

PLATE LVI.

BRONCHOTOMY.

Figs. 1, 2, 3.—Surgical anatomy of the front of the neck.

*Fig. 1.—Subcutaneous layer offront of the neck.—*a, a, lower jaw; B, hyoid bone; C, thyroid cartilage; d, d, carotid vessels; e, e, infra-hyoid muscles; g, g, external jugular veins; f, f, anterior jugular veins; h, sterno-mastoid muscles.

The larynx and trachea are covered in front by skin and superficial fascia enveloping the platysma. Some anastomosing branches of the anterior jugular vein are found here. The sterno-hyoid and sterno-thyroid muscles, sometimes meeting in the middle line, hide the larynx and trachea under a thin muscular layer; lastly, deeper and at the level of the cricoid cartilage is the thyroid body, whose size and position are variable.

*Fig. 2.—*Below this superficial layer we find the hyoid bone, A, the thyro-hyoid muscles, C, C, separated in the middle line, and exposing the thyro-hyoid membrane, and the thyroid cartilage, B, the crico-thyroid muscles, d, the thyroid gland, E, and the trachea, F. A dotted line, g, g shows the upper edge of the sternum and clavicles. By the sides of the larynx and trachea are the carotid vessels: h, h, the common carotid; i, superior thyroid artery; j, inferior thyroid vessels; k, k, internal jugular veins; l, innominate vein; m, inferior thyroid veins; n, innominate artery. The thyroid veins when divided in tracheotomy often bleed severely. The incision must not be carried too low, lest the innominate veins be wounded; the finger-tip in the wound will perceive the pulsations of the large arteries. In describing the operation we shall have to insist on the importance of these anatomical data.

*Fig. 3.—Anatomy of the larynx.—*a, hyoid bone; b, thyro-hyoid membrane; c, thyroid cartilage; d, crico-thyroid membrane; e, e, cricoid cartilage; f, trachea; g, g, internal jugular veins; h, innominate vein; i, j, j, thyroid veins.

*Fig. 4.—Operation of tracheotomy.—*a, a, incision in the middle line in front of the trachea; b, b, tape to keep the canula in the trachea. Under the generic name *brochotomy* are included those operations which are intended to obtain an artifi-

cial passage into the larynx or trachea, to extract foreign bodies or to admit air when the upper part of the larynx is obstructed,

The incision may be made (1) *into the larynx by the thyro-hyoid membrane* (sub-hyoid bronchotomy); (2) *through the hyoid cartilage* (laryngotomy); (3) *into the larynx and upper rings of the trachea* (laryngo-tracheotomy); (4) *into the trachea* (tracheotomy).

OPERATIONS, ETC.

Bronchotomy ought to be used in all cases where the life of a patient is threatened by a mechanical obstacle to respiration.

The obstacle may arise from the presence of a foreign body, or from disease of the air passages.

1. *Foreign bodies.*—The accidental entrance of foreign substances is the most common case which may call for bronchotomy. Not only can such bodies produce suffocation, but they may set up ulcerations in the larynx and trachea, perforate their walls, and cause the most alarming accidents; there is, therefore, double reason for operation when the body is not soon expelled by the cough.

Foreign bodies in the œsophagus, about the level of the larynx or trachea, may so compress those organs, and produce such a degree of apnoea as to demand immediate bronchotomy.

2. *Organic lesions of the air passages.*—*Tonsillar affections.*—Flajani performed tracheotomy for inflammatory enlargement of the tonsils. But his example is not to be followed; oedema can usually be controlled by free scarification. And this mode of treatment should be employed before having recourse to the more dangerous measure.

The tumefaction of *Glossitis* is usually rapidly relieved by deep incisions, and the opinion of Richter and Bell, who advised tracheotomy, has not received the sanction of surgeons.

Oedematous Angina.—The glottis may be scarified with the point of a curved bistoury conducted by the finger; but the punctures thus made on the oedematous enlargement do not always permit sufficient serum to escape; it then becomes urgent to perform bronchotomy. Since the time of Bayle, who first

proposed tracheotomy for cases of œdema of the glottis, it has been successfully practised by a great number of surgeons. And laryngotomy is better than passing a tube through the mouth.

Laryngeal diseases, as chronic inflammation, tuberculosis, or wounds, may produce suffocation by causing contraction of the calibre of that organ, through cicatrisation. In these cases bronchotomy has been successfully employed by numerous surgeons.

Tumours.—Bronchotomy may be called for when asphyxia is threatened by the pressure of tumours in parts adjoining the larynx.

Croup.—Others had successfully used bronchotomy in croup but Bretonneau regularly adopted this mode of treatment, and gave indications demanding its use.

Not only does bronchotomy, by enabling the false membranes to be removed, snatch the patient from imminent death; but prolonging life, the diseased parts have a better chance of regaining a healthy condition.

The greatest probability of success is when tracheotomy is performed on an infant suffocated by croup in the *larynx*. When the false membranes extend into the trachea the operation succeeds in fewer cases, and is almost useless when the disease extends to the bronchi. Nevertheless, the precise seat of croup being difficult to ascertain, we should, in all circumstances when asphyxia is threatened, decide on performance of the operation.

INFRA-HYOID BRONCHOTOMY.

This operation has been proposed by Malgaigne in cases where foreign bodies or grave disease are seated in the larynx.

In this operation (*not yet performed on a living subject!*) we divide the fibrous membrane, *b* (Plate LVI., fig. 3), which extends from the hyoid bone, *a*, to the thyroid cartilage, *c*, and thus descend directly upon the upper orifice of the larynx.

Malgaigne's operation.—A transverse incision two inches long is made directly below the hyoid bone, along its lower edge. The second step is to divide the platysma and the inner half of each of the sterno-hyoïd muscles; then directing the point of the bistoury backwards and upwards, the thyro-hyoïd

membrane and its fibrous extension to the epiglottis are cut through transversely. We thus reach the mucous membrane, which is protruded at each expiration. It is held with forceps and divided with the bistoury or with scissors ; the epiglottis then appears, driven into the wound by expiration ; it is held out of the way with forceps or a hook, and the whole larynx is exposed to view, so that instruments are easily guided.

THYRO-LARYNGOTOMY.

The superficial position of the thyroid cartilage renders this operation very easy. The thyro-arytenoid muscles and the vocal cords which are attached to its posterior surface, in the lower third of the median line of the cartilage, alone demand the consideration of the surgeon.

Operation.—An incision is made extending from the hyoid bone to the cricoid cartilage ; if the isthmus of the thyroid body interferes with reaching the crico-thyroid membrane, it is to be pulled down ; the infra-hyoid muscles are separated, and after having determined the exact position of the crico-thyroid artery, the bistoury is passed through the membrane which unites the two cartilages. This puncture permits the employment of a probe-pointed bistoury or strong scissors to divide the thyroid cartilage from below upwards. This division must be made exactly in the middle line, not to interfere with the insertion of the vocal cords. In the adult the cartilage is very hard, and the left thumb will be needed to assist the passage of the blade. In the aged the cartilage, being bony, will need, perhaps, to be sawn.

The foreign body is to be cautiously seized, lest the attempt to extract it send it down into the trachea.

LARYNGOTOMY.

An incision is made through the integument commencing at the prominence of the thyroid cartilage and extending below the lower margin of the cricoid cartilage. The cervical fascia is then divided, and the infra-hyoid muscles separated from each other in the middle line, together with any veins which may there appear ; next the tissue beneath the muscles is separated

and the isthmus of the thyroid gland pushed downwards, if in the way of the operator, and the crico-thyroid membrane is thus exposed. If the crico-thyroid artery is large, it is seen crossing the membrane, and must be avoided in opening the larynx. Some surgeons advise that the membrane shall be opened by a longitudinal incision, and enlarged if necessary by a crucial incision. The author makes only a horizontal incision, and of sufficient size to enable the tube to be inserted without inconvenience.

LARYNGO-TRACHEOTOMY.

This operation was performed successfully by Boyer. The incision extends from the lower edge of the thyroid cartilage to the first three rings of the trachea (inclusive). The muscles are separated, the thyroid gland and the crico-thyroid artery pulled upwards, and the bistoury, passed in just below the artery successively divides the crico-thyroid membrane, the cricoid cartilage, and the first rings of the trachea.

The divided cricoid turns forcibly inwards, and it is difficult to separate the edges. The passage of a canula is almost impossible, except through the rings of the trachea.

TRACHEOTOMY.

In some cases, for this operation, trocars of various sizes, straight or curved, have been used ; they are passed at once into the trachea. This mode of operation and these instruments are now abandoned, and it is preferred to freely open the trachea in the middle line, in order to easily introduce canulæ, which answer the purpose to be attained better than those used with the trocar.

Anatomy (Plate LII. and explanation).—It is only necessary here to remark that the lower we go the deeper is the trachea, and that it is crossed at the level of the sternum by the innominate artery, and that in the case of croup or impaction of foreign bodies the soft parts may be infiltrated with serum or gas.

The instruments (supposing the case to be one of croup) needed are :—(1). A straight bistoury. (2). Dissecting forceps. (3). Blunt hooks or retractors, with which the assistants are to separate the edges of the wound. (4). Dilating forceps, or a dilator. 5. Single or double canulæ ; a hair probang to clean the

canulae, and sponge probangs to clean the trachea. In extracting foreign bodies long curved forceps are needed, in order to reach a substance impacted above or below the point of the incision.

Operation.—We here insert the description given by Troussseau :—

“The child lies on a table, a rolled pillow under the nape of the neck, to make the front of the neck curve well forward—an important condition ; the surgeon (having at least three assistants) cuts quickly through the skin, then more carefully penetrates to the trachea, until the tracheal rings are exposed. The trachea is then sufficiently opened. If possible the venous trunks should be avoided ; if they *cannot* be avoided, cut them through without stopping to tie them, as the bleeding will stop directly the tube is placed in the trachea.

“When the trachea has been opened, the branches of a dilating instrument must be passed between its edges ; lift the child, and wait for a few moments until breathing has become regular and the bleeding has stopped.

“If, in spite of the opening, the child remains in a state of partial asphyxia or syncope, cold water must be thrown on the child’s face, and the plumed end of a pen must be passed down the trachea to excite contraction of the inspiratory muscles.

“Should there be orthopnoea, some drops of cold water are thrown into the trachea, or the latter is cleared with a probang, which consists of a small sponge fixed to the end of a flexible whalebone stem. This will help to clear the windpipe of blood or false membranes, which may be present in it or in the bronchi.

“I advised above that wounded veins are not always to be tied. This precept is supported by the experience of Bretonneau and myself.

“If we slowly and successively cut through the tissues between the skin and trachea, we see in each inspiratory movement the expansion of the thyroid veins in the wound.

“When they are situate on the sides of the opening made by the bistoury, cut above them ; but if they are just under the edge of the instrument they may be separated by blunt hooks, which can be done without difficulty.

“However, the thyroid veins of the two sides sometimes

anastomose across the trachea, in which case they must be cut. Much blood flows, which can usually be stopped by pressure with the tip of the finger by the surgeon on one side or by an assistant on the other side. In the meantime the incision is continued, guiding the knife along the finger nail (deep in the wound), and taking care to sponge often, until the trachea is seen, when it is quickly opened, and the dilator inserted ; the bleeding then stops at once.

"I advise, then, that the veins be not tied, because, having now (June 1, 1842) performed the operation 121 times, I have never found the need of doing so. Besides which, the ligature may prove hazardous, partly by inducing phlebitis, which is particularly dangerous in this region, and partly by protracting an operation which is often done under circumstances when it is most important not to lose any time.

"*Accidents during operation.*—One of these is hæmorrhage. We have seen how rare and how very seldom this is serious. But if we are obliged to cut several thyroid veins, and the blood pours out in a stream, the trachea must be taken between the ulnar edge of the first finger and the radial edge of the middle finger (passed deeply into the wound till the spine is touched), then cut the trachea open quickly from below upwards, and at the same instant pass in the dilator, and the bleeding will stop. I do not speak of hæmorrhage from the thyroid artery or the innominate ; it is clear that such vessels must be tied at once to save the patient's life. I don't know that such an accident has ever happened ; but I have many times felt under my finger the beating of the innominate artery, which I should certainly have cut if I had moved my bistoury carelessly in the lower end of the wound.

"I have many times seen asphyxia arise and breathing stop during the operation ; the patient was in a state of apparent death. I finished the incision as quickly as possible, passed the canula in ; then, the patient being placed on his side (if blood has run down the trachea, or on his back if not), I made alternate pressure on the stomach and chest, which initiated respiratory movements, and all my patients have returned to life.

"Syncope is a more common accident, appearing usually just

after the operation, at the moment when, the breathing becoming easy, cerebral congestion ceases suddenly. I once saw it last nearly an hour ; still it was not fatal. I merely throw cold water on the face, and some drops into the trachea, mopping it out briskly ; and I keep the patient lying flat.

" As to the passage of blood into the trachea, much has been said about it, but I have never seen serious results from it, provided that the dilator is used at once, and the lips of the tracheal wound are kept open ; or that, by some means or other, a good sized canula is promptly put in ; for if after having made the opening the surgeon fumbles, and cannot introduce the canula, a lot of blood passes into the trachea at every inspiration ; and the air not being able to enter asphyxia may be the immediate result ; the haemorrhage is also kept up by the continued obstruction to the breathing.

" If, on the other hand, the dilator keeps the tracheal wound open, the air passes in easily, and blows out the small quantity of blood which has entered, and the return of normal breathing checking the haemorrhage, there is no longer any influx of blood ; if by chance some blood finds its way down into the bronchi, the patient can usually expel it himself ; if there be any difficulty in the matter, the use of the probang will generally effectually clear the passage.

" The respiration is usually relieved directly after the operation. If it continues embarrassed, then there are some clots of blood, or false membranes, in the chief bronchi. When we are concerned alone with blood clots, it suffices, the trachea being kept open by the dilator, or by the canula already in position, to throw a few drops of cold water into the passage, and sponge it out.

" When there are false membranes in the trachea, it is convenient to leave the dilator in the wound till they are expelled, which is assisted by dropping cold water into the trachea, and then by repeatedly using the little probang. Yet, in spite of these measures, sometimes the false membranes remain fixed by the attachments they have formed to prolongations into the bronchi, while the upper part is broken and movable. Then one can, in some cases, seize them with forceps passed through the opening, and by gentle traction remove them.

" If the child is strong, and has energetically expelled the false membranes from the air passages, and if after the operation the breathing is easy, then, before introducing the canula, fifteen or twenty drops of a solution of nitrate of silver (five grains to the ounce) are to be dropped into the trachea in two portions ; or if there is reason to suppose that the larynx alone has been invaded by the diphtheria, then a probang soaked in a strong solution of nitrate of silver (eighty grains to the ounce) is passed along the trachea.

" The canula is then introduced ; but this should take place immediately in the case of children operated on in the last stage of croup. And a few drops of cold water in the trachea, followed by sponging out, will be the only measure practicable.

" *Canulæ.*—The canula should be of such length that at the moment it is introduced into the trachea, it passes along the canal to a distance of nearly an inch. This is indispensable, for the day after the operation the skin and adjacent tissues will be swollen to such a degree that the canula will not penetrate more than $\frac{1}{2}$ of an inch. If the canula is not long enough, it starts from the trachea in the attacks of cough, and the child may be suffocated.

" If it is essential to have a canula of good length, it is still more important to have it large enough. For infants from six months to two years old the tracheal opening of the canula should be $\frac{1}{8}$ inch in diameter ; for those of two to four years old $\frac{1}{4}$ inch ; for youths $\frac{1}{3}$ inch ; for people of great stature $\frac{1}{2}$ inch.

" The canula must be withdrawn whenever the respiration is embarrassed, if there is reason to think that the obstruction is in the artificial air passage. In general it is enough to change the canula twice in twenty-four hours. The expulsion of false membranes, which would obstruct the passage, and abundance of mucus would demand more frequent attention.

" When, instead of the single canula, a double one is used, the inner one must be withdrawn every three hours and replaced at once ; this is done without the patient's perceiving it, and renders the blocking of the tubes almost impossible.

" During the first two or three days, when the canula is withdrawn, the tracheal wound closes directly, and to such an extent

as to cause symptoms of asphyxia ; therefore another canula or a dilator must be passed in at once, and the dilator is very useful when the canulæ are changed, preventing a great deal of suffering on the patient's part.

"The moment when the canula is removed, or the wound is held open by means of the dilator, is that which should be chosen for touching the mucous membrane with solutions, or sponging out the trachea with a probang.

"At the end of two or three days the wound in the trachea remains open for some minutes after the removal of the tube, which can then be easily replaced without the aid of the dilator. On about the eighth day the tracheal wound will keep open for nearly an hour ; later on the patency will last through a whole day, or even longer.

"When, about four or five days after the operation, the patient seems to be going on well, the tube should be allowed to remain out for a short time, that the air going into the larynx may displace the mucous and false membranes, and clear its way through the organ. The permeability of this air passage may be measured in this way. This is so much the more important, as it is considered the first rule in tracheotomy to withdraw the tube as soon as possible.

"If the air has appeared to pass through the larynx, a perforated canula should be introduced, and the orifice should be stopped with a cork.

"For some minutes the breathing seems to be easy, though perhaps the amount of air passing is insufficient ; but gradually the respiration becomes excited, and the child would die of suffocation if the obstacle were not taken away. But if there is little trouble in the breathing, the cork may be left in, and some coughing efforts drives the air with any false membranes through the larynx, and the passage becomes more clear. From day to day the size of the canulæ may be gradually lessened, and the instruments are finally abandoned when the patient can breathe with the orifice closed.

"When the canula is taken away, the edges of the wound are to be drawn together with court plaster. This dressing, renewed two or three times a day, is sufficient in most cases. In a very

short time usually the trachea closes completely ; the wound in the other soft parts also soon closes, and the cicatrix is not important.

"On one occasion I was able to remove the canula finally at the end of four days ; sometimes it has been from the sixth to the eighth, *usually* from the sixth to the thirteenth ; once on the forty-second day ; once on the fifty-third. When no accident arises, then the larynx clears itself in from four to thirteen days. I have never yet seen an "aerial fistula" after tracheotomy.

"*Treatment after operation.*—When a child has reached the extreme stage of croup, some physicians consider that there is only one treatment indicated—do tracheotomy and put in a canula. For my part, tracheotomy appears to be the means to ward off asphyxia, which will kill the patient, and afterwards to convey to the mucous membrane of the trachea and bronchi applications capable of stopping the reproduction or extension of false membranes. I know that many of my *confrères* have been successful while they have been satisfied with frequently changing the canulæ, and sponging from time to time, but I have preferred to keep up local medication. I tracheotomised in succession twenty children, and applied no lotions to the mucous membranes, and the results were so unfavourable that I returned to the topical medication which had been so beneficial previously in my hands.

"The topical treatment which I have adopted is the following it is that of Bretonneau :—

"As has been said before, if the child is strong, if he has forcibly expelled the false membranes from the air passages, and if after the operation the breathing is good, then, before introducing the canula, at two or three times the following solution is dropped into the trachea : fifteen or twenty drops of a solution of nitrate of silver, five grains to the ounce. This application is to be made four times the first day, three times the second and third day, once or twice the third day, and then it is given up. At the same time a probang is used in the trachea, consisting of a very small sponge fixed to the end of a very flexible whalebone stem, and soaked in a strong solution (one part in five of water) of nitrate of silver.

"This last manœuvre is enough, if there is reason to believe

that the larynx alone is affected. Cauterisation in this manner is to be repeated as often and for the same length of time as the probang application above mentioned. The use of the probang alone and the dropping in of water are important additions to the above treatment.

"If the cough is loose and the expectoration free there will be no need of the water. On the other hand, eight or ten drops of lukewarm water dropped in once or twice every hour will mix with the mucus, soften it, and assist its ejection.

"Water should always be injected or dropped into the canula after using caustic solution to break up the coagulated mucous and help its expulsion. The use of water should be many times in an hour ; and if the respirations are rapid and "serratic," that is, if they resemble the sound of a saw cutting stone, every use of the probang should be followed by dropping in water.

"The canula and trachea must be sponged whenever respiration appears embarrassed ; and the operation will be more efficacious if preceded by the use of water. If a sound of a clackvalve is heard in the trachea, or a peculiar whistling gives reason for thinking that there are movable false membranes, then frequent use of the probang must be made until the membranes are detached and expelled, and the most important time for using the sponge is when the canula has been removed, the lips of the trachea being separated by the dilator. It is all the more needed when the progress of the patient is not favourable. It never causes any harm, and is always followed by easier breathing, even when the child is at his last gasp, and possibly there are no membranes nor mucus to be removed.

"With this mode of treatment, carefully employed by Bretonneau and myself, success has not been very striking ; but lately Bretonneau has saved six out of twenty children operated on, and I have had twenty-seven recoveries out of 112 cases. Leclerc has successfully operated on two children, treating them in the same manner. Velpau, a pupil like myself of Bretonneau, has saved two children out of ten. Petel, following the same course of treatment, has had three recoveries after six operations. Thus out of 150 cases there have been thirty-nine recoveries, that is to say, rather more than one-fourth. I should

Fig. 1.

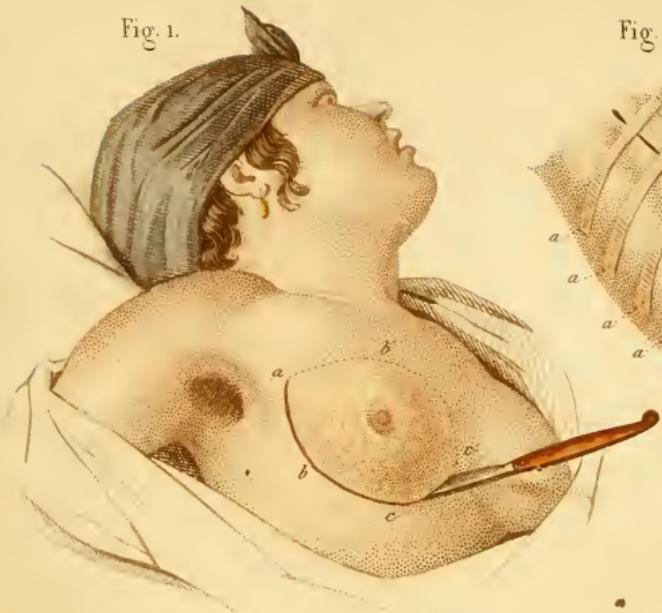


Fig. 2.

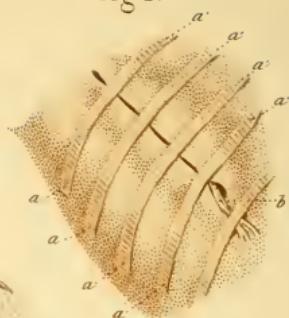


Fig. 3.

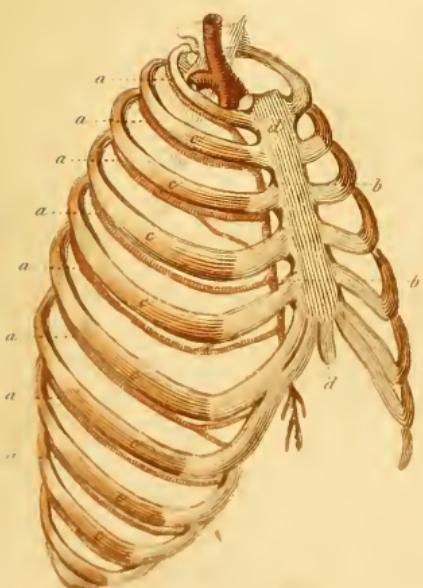


Fig. 4



like to have been able to compare the cases whose after treatment was according to my method with those treated more simply. But we know that there are now living in Paris nearly fifteen children tracheotomised in the last stage of croup, and in whom our method was not followed."

PLATE LVII.

EXTIRPATION OF THE BREAST.—EMPYEMA.

Fig. 1.—Amputation of the breast.—*a, b, c*, first curved incision made at the base of a cancerous mamma; *c', b', a*, second incision, which with the first includes the breast in an elliptic flap.

Fig. 2.—Dressing after operation.—*a, a', a, a'*, etc., adhesive strips keeping the edges of the wound together. A strip of lint, *b*, is fastened in the angle of the wound for drainage.

Fig. 3.—Anatomy of the chest walls and intercostal arteries.—These arteries divide into two branches about the posterior third of the rib. The upper branch (which is the larger) runs in the groove on the under side of the rib above, and leaves it about the anterior third. The inferior branch runs along the upper edge of the rib below.

Fig. 4.—Operation for empyema.—*Sédillot's operation.*

EXTIRPATION OF THE BREAST.

The scirrhou or encephaloid tumours, which are developed in the breast, most commonly call for this operation. Many surgeons have objected to the operation on account of the tendency to recurrence of the tumour.

In the meantime, all tumours of the breast not being liable to recurrence, and numerous malignant tumours never recurring, most practitioners prefer to operate if the patient presents conditions favourable to success: these are mobility of the tumour, with well marked outline, and the age, strength, and health of the patient. Large size of tumours, adherence to the ribs and processes in the axilla, affections of the axillary and cervical

glands, pale yellow colour of the skin, characteristic of the cancerous cachexia, the presence of tumours in other parts of the body, revealing general affection of the system—all these are contra-indications. Yet adhesion to the ribs, without further unfavourable conditions (such as those above-mentioned), is not enough to forbid an operation. Operation is not likely to lead to permanent cure unless there is good reason to suppose that the disease is purely local.

OPERATIONS.

Compression, condemned by C. Bell, but supported by Récamier, is now rejected by surgeons as useless in the case of cancerous tumours ; its successes were probably attributable to errors in diagnosis.

Ordinary method.—The instruments needed are, straight and curved bistouries, dissecting forceps, hooks, artery forceps, waxed thread, rugines, resection saws. Hot irons may be useful if the disease has attacked the ribs.

The patient lies on the table, the body turned to the side opposite to that affected, the arm held away from the chest, so as to stretch the fibres of the Pectoralis Major. The surgeon stands on the side he is going to operate upon ; many assistants are arranged round the patient so as to lend intelligent help to the operator.

Two semi-elliptic incisions, one below, with the concavity upwards, the other above, with the concavity inferior, will comprise in an elliptic flap all the diseased parts and some healthy tissue. The incisions should be made obliquely from above downwards, from without inwards, in the line of the long diameter of the gland and fibres of the Pectoralis Major.

This direction, which allows the incision to be prolonged towards the axilla, renders more easy any investigations in that region. Beside which, it enables the dissection of the tumour to be made in the line of the fibres of the muscles ; and after the edges of the wound are drawn together fluids can run freely from the lower angle.

The tumour is held with the fingers, or with a hook which is to be held by an assistant if the growth is of large size ; and the

operator first dissects from below upwards, then from above downwards, taking care to remove a layer of sound tissue. Commencing the dissection at the lower part of the tumour, we are not troubled by the blood which would run over the parts to be cut if the operation began above. Yet some operators prefer dissecting downwards, not to catch the bistoury under the Pectoralis. When the tumour is very large, it is to be raised by strokes of the knife made alternately above and below, so as to gradually isolate the mass from the periphery towards the centre.

When the tumour has been removed, the arteries tied, the wound sponged, we proceed to examine the subjacent tissues. All the parts which appear changed should be taken away, either with the knife or with the curved scissors. Suspected glands must be exposed to view by lengthening the incision, and as it might be dangerous to dissect in the axillary region, and neighbourhood of large vessels, it is more prudent to unseat them and twist them out with the fingers. It is generally at the level of the thoracic vessels—below, on the Serratus Magnus, and above, under the Pectoralis Minor—that affected glands are found. (The anatomy of the axilla is given at page 22, Plate IX.)

The operation ended, it is necessary to dress the wound at once; some surgeons wait some hours before closing it, in order to watch the arterioles which could not be tied, and to be able to close the wound without fearing ulterior haemorrhage. The edges are then brought together by twisted sutures (page 7, Plate II., fig. 6). If the wound is of small extent, and the edges are capable of easy extension, they may be brought together by means of very long adhesive strips, $\frac{1}{2}$ an inch, crossing at right angles to the line of the wound (Plate LVII., fig. 2). In cases, on the other hand, where the approximation of the edges is difficult, the edges must be dissected up to a movable distance to separate them from the subjacent parts. The cicatrix of the wound will be watched carefully, and if any buds of malignant growth appear they must be at once destroyed with the knife, the hot iron, or some kind of caustic.

EMPYEMA (Figs. 3, 4).

Pus, serum, or blood contained in the thoracic cavity may require removal. In the normal state the lungs fill the chest, but when there is a collection of fluid in the cavity of the pleura, it presses upon the lungs from without inwards. The effusion may be so great as to compress the lung, and thus to obstruct respiration. We have already remarked that blood, pus, serum, and even gas may collect in the pleura, and necessitate an operation ; and the nature of the effused fluid, its quantity, its situation, the different complications to which it gives rise, constitute so many indications for the operation, either at any spot which the operator chooses to select, or at some particular spot where the operation is alone feasible.

Effusion of blood.—If the effusion of blood is the result of an injury, the surgeon should not be in a hurry to evacuate the fluid, the presence of which tends to close the ruptured vessel, and to arrest the haemorrhage. Care must be taken to place the patient in a proper position, to close the wound which has given rise to the haemorrhage, and to moderate the flow of blood by appropriate general treatment. Several days should elapse before any attempt is made to give vent to the effused fluid by a counter opening. Nevertheless, the operation should not be deferred when the effusion of blood has taken place so suddenly and is so great as to threaten suffocation.

Effusion of pus.—The operation is only justifiable when the effusion is the result of an acute or chronic affection of the lungs or pleura. It should not be undertaken if the lungs are the seat of tubercles or of cavities, or if the great debility of the patient, or the nature of the disease which has given rise to the effusion, leave little hope of a cure being effected.

Purulent effusions may terminate : (1) by resolution ; (2) by ulceration of the parenchyma of the lung, and evacuation of the matters through the bronchi, trachea, and mouth ; (3) the pus may escape externally by ulceration through the parietes of the chest.

Effusion of serum.—It is only when the effusion results from acute pleurisy, or when it continues until suffocation is

threatened, notwithstanding the absence of inflammatory symptoms, that an operation is likely to be successful. Surgical interference is uncalled for at the beginning of pleurisy, and when the inflammation is still in its acute stage, unless a fatal issue from compression is feared. Nor should an operation be ventured upon in those chronic pleurisies where the effusion continues long after the attack, and where the lung, driven back upon itself, is no longer able to exert its elasticity, unless at least a month has passed away and the health of the patient does not progress.

Effusion of gas.—Air or gas effused in the pleura is so quickly reabsorbed when the cause of the effusion is slight, that it is quite unnecessary to resort to an operation.

OPERATIONS.

According to Galen the Greeks perforated the chest with a red-hot iron; a method which was adopted by Paulus *Oeginita*. The operation for empyema—sometimes practised in the form of cauterisation, at other times by an incision into the intercostal spaces, or trephining the ribs themselves—has been attended at various times by very different results. After having been more than once abandoned and again revived, it was finally established as a legitimate operation by Dionis, Ledran, Foubert, and Morand.

Numerous facts furnished by the practice of contemporary surgeons show that they are successful in about five out of ten operations; a success which is quite sufficient to justify the practice in those cases in which this operation is imperatively called for.

Is it necessary to draw off the whole of the fluid at once, by a free and rapid evacuation, or is it better to remove the fluid slowly and gradually by means of repeated tappings by the aspirator? There is no occasion to enter upon the discussions and the differences of opinion to which this question for a long time gave rise. Modern surgeons, and chiefly M. Reybard, whose operation will be presently described in detail, have sufficiently demonstrated the advantages of the latter plan.

1. Where the spot to be selected for the operation is optional.

—As a rule the opening is best made at some dependent spot in the lower part of the chest, and where there are no adhesions. The ninth or tenth intercostal space should be preferred, as lower down the diaphragm might be wounded. In thin subjects it is always easy to mark with precision the place where the opening is to be made, as the ribs can be felt and counted. If the obesity of the patient does not admit of the intercostal space being exactly determined, the puncture can be made about five fingers' breadth below the inferior angle of the scapula, or about the breadth of three fingers above the cartilaginous border of the ribs. The puncture should be made more behind than in front, close to the union of the posterior third with the two anterior thirds of the circumference of the thorax.

2. When the place chosen is not optional.—This is indicated by the seat of the effusion. Generally the adhesion can be best avoided by performing the operation about the centre of the effusion.

M. Sédillot's operation.—M. Sédillot objects to all methods which entail two or more successive openings with immediate closing of the wound. He recommends an opening large enough to allow of a free discharge of the fluid, that the wound should be kept open by the introduction of some foreign body.

With this view he makes through the skin an incision about an inch in length at the place chosen for the operation. The deep parts are cut to a less extent, and layer by layer. When the effusion is not considerable, or when it is circumscribed by adhesions, or when the walls of the sac can be easily approximated and brought into contact, the complete evacuation of the pus is not attended with any danger. But where the empyema occupies the whole pleura, and is very abundant, it is advisable to arrest the discharge of the fluid directly the jet fails at each inspiration, and there is risk of air entering the chest. This fact shows that the pus is not sufficient to fill the cavity of the chest during its expansion, and that a vacuum may be formed. The surgeon should then place

in the wound the middle of a piece of lint, in the cul-de-sac of which some pellets of charpie should be inserted, while some cotton wool and a thick compress and a bandage nicely adjusted to the body complete the dressings.

Two hours afterwards the pus may be again discharged, and the operation repeated at the same intervals. A little air often penetrates the chest when the dressings are removed; but this accident need not create any uneasiness, provided that it does not again take place during their re-application. Where, either from want of care or from some other cause, the collection of pus discharges itself and is replaced by air, the air may be removed with M. Stanski's air-pump, or some other aspirator, and the chest injected with an antiseptic fluid.

M. Velpeau's operation.—In the case of sanguineous effusion, or when the fluid penetrates beneath the intercostal integuments, M. Valpeau boldly plunges in a bistoury as far as the pleural cavity, enlarging the wound as he withdraws the instrument. When the diagnosis is not doubtful, this proceeding has this advantage, that a large opening gives free vent to the effusion, whilst a very small one may admit of the entrance of air without allowing the complete evacuation of the pleural cavity.

M. Vidal de Cassis' operation.—M. Vidal proposes to perform the operation several times. In the first operation he advises an incision to be first made through the skin, the subjacent cellular tissue, and the muscles, including the external intercostal muscle. As soon as the internal intercostal muscle is exposed, the operation is stopped, and the wound is filled with charpie, with the view of setting up suppuration. A piece of caustic potash, as large as that employed in making a pea-issue, is then placed in the wound. This gives rise to an eschar of the size of a sixpence, which is gradually thrown off; while during its separation there is established around the borders of the mortified disc first an oozing, then a discharge which takes place so gradually as to give the lungs time to dilate to the walls of the chest, and the latter to close upon the substance of the lungs. The inspiration of air into the

lung takes place gradually, and but a very minute quantity can enter the pleural cavity by the external opening.

M. Reybard's operation.—This operation, which is both simple and ingenious, permits of the continual discharge of the effused fluid without allowing the air to enter the pleural cavity. M. Reybard perforates a rib with a trocar, and he allows a canula, or the barrel of a quill-pen, to remain in the wound. The free extremity of the canula consists of catgut, or of a tube made of gold-beater's skin, which can be made soft, and the advantage of which is that the fluid in the pleura easily escapes externally at each inspiration, while the air is prevented from entering the chest by the soft walls of the skin tube collapsing one against the other and closing up the end of the canula. M. Rousseau plunges the free extremity of this instrument into a vessel full of water, a proceeding which makes the introduction of air an impossibility.

M. Stanski's operation.—According to M. Stanski, the most essential indication is to fill up and to obliterate the sac, to prevent the entrance of air into the thorax, and to exhaust the source of the secretions. To attain these objects he makes use of a complex instrument consisting of a cupping-glass fitted to a trocar, and in which a vacuum can be formed by means of a pump, which completes the apparatus. By this method of aspiration the fluid can be easily removed from the cavity of the pleura. The air, on entering the lungs, now no longer compressed, dilates them, and approximates the visceral and parietal sides of the pleura. M. Stanski, however, has only tried his operation on the dead body (1849).

Remarks.—The pathological considerations above mentioned sufficiently indicate the relative value of the operations that have just been described. Serous effusions will require small tappings with the aspirator, so as to favour the slow and progressive discharges of the fluid, great care being taken not to allow air to enter the chest, or suppuration will follow. Collections of coagulated blood, or of pus, necessitate larger openings. Lastly, the abundance of the effusions, the general condition of the patient, the occurrence of suffocative

symptoms, etc., will guide the operator as to whether he should have recourse to a slow or to a quick method of emptying the chest.

PARACENTESIS OF THE PERICARDIUM.

A dangerous operation ; which is not very often necessary. When, however, the operation is deemed to be justifiable, the pericardium may be opened in three situations : (1) between the fifth and sixth intercostal space ; (2) through the sternum ; and (3) through the space which lies between the xiphoid cartilage and the cartilage of the seventh rib.

1. *Desault's operation*.—This surgeon made an incision between the sixth and seventh left ribs, on a level with the apex of the heart. The muscular structures were divided layer by layer, until his finger, plunged into the wound, felt a pouch full of fluid. This Desault opened ; but the autopsy made four days afterwards showed that he had only opened a cyst, beneath which he found the pericardium.

2. *Skiederup's operation*.—This consists in trepanning the sternum in a line with the mediastinum. By this means a triangular space is reached, the base of which is formed by the diaphragm, and whose summit is on a level with the fifth rib. There is not much resistance met with in trepanning the bone until the internal periosteum is reached. This is very hard, and therefore the surgeon should proceed carefully for fear of wounding the pleura. The opening being effected, the patient should be made to lean forward, so that the pericardium may come within reach of the finger of the operator. A straight bistoury guided by the finger will serve to open the sac.

3. *Larrey's operation*.—In passing through, from below upwards, the space which separates the left border of the xiphoid cartilage from the cartilage of the last true rib, we come upon the most depending part of the pericardium. By this method, which is preferable to those described above, it is easy to avoid the pleura, the peritoneum, the diaphragm, and the internal mammary artery.

LESIONS OF THE INTERCOSTAL ARTERIES.

The only wounds that can do much injury to the intercostal arteries are those which are seated in the posterior third of the chest. When the wounded vessel is visible it must be tied. The operations which, independently of the ligature, have been undertaken with the view of arresting the haemorrhage are even more numerous than the recorded observations of these wounds. Before operating it is necessary to discover the source of the haemorrhage. It has been proposed to introduce into the wound a card bent into the form of a gutter.

If the blood escapes beneath the card, it proceeds from some injury to the lung; if above the card, an intercostal artery is the source of the haemorrhage.

In cases where the wound of the artery is easily recognized, the finger, covered with a fine compress, like the finger of a glove, should be inserted into the wound. Then the cul-de-sac of this compress is to be filled with charpie so as to form a kind of cushion to the pleura. Lastly, by drawing out the compress, not only can pressure be made upon the thoracic borders of the wound, but the intercostal artery will also be compressed against the groove of the rib.

It is not necessary to describe here the different instruments that have been contrived for the treatment of these wounds. They all have the disadvantage of being little or not at all applicable to the cases; and they always irritate the pleura.

pl. 58

Fig. 1.



Fig. 2

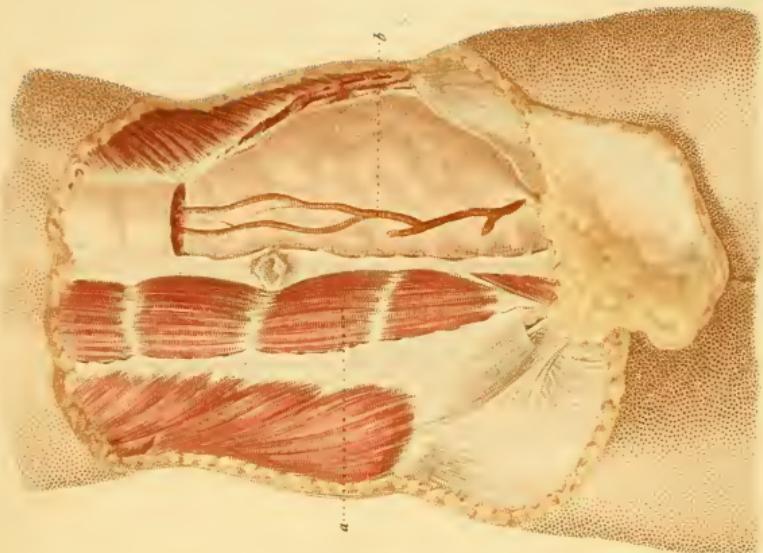


PLATE LVIII.

OPERATIONS WHICH ARE PERFORMED ON THE ABDOMEN.

PARACENTESIS OF THE ABDOMEN.—ANATOMY.

Figs. 1 & 2).—It is generally over the middle of a line (*a, c*, fig. 1), extending from the umbilicus to the left anterior superior spinous process of the ilium, that French surgeons plunge their trocar in the operation of paracentesis. By this means it is easy to avoid the fleshy parts of the abdominal wall, or any injury to the deep epigastric artery (*b*, fig. 2) which courses beneath the rectus muscle.

In England this operation is performed in the course of the linea alba (*a, b*, fig. 1).

The object of abdominal paracentesis is the evacuating of a collection of fluid in the peritoneum. Ascites is the disease in which it is usually practised; but this affection may be complicated (1) with pregnancy; (2) with an ovarian cyst; (3) by partitions constituting encysted dropsy; (4) with a congenital hydrocele. These various complications will indicate the place where the operation should be performed. In the case of pregnancy care must be taken to avoid the uterus. It is under this latter circumstance that Scarpa proposed to make the puncture in the left hypochondrium, a little below the third false rib. The umbilicus was selected by Ollivier d'Angers. M. Velpeau thought the puncture might be made without any risk in any part of the left flank. With regard to the best method to be adopted, the surgeon should likewise take into consideration the stage of pregnancy, the situation of the uterus, etc. In the case of congenital hydrocele, Morand and Ledran tapped the hydrocele. In encysted dropsies, and in doubtful cases, fluctuation and the swelling formed by the fluid will indicate the spot where the operation should be performed.

The ordinary operation.—Puncture with the trocar.—The instruments required for this operation consist of a trocar, a

bandage for the body, and a bandage, by means of which pressure is made upon the abdomen while the fluid is being drawn off.

The patient lies upon the edge of the bed, and the operator finds out, by percussion, the level and the extent of the effusion in order that he may not plunge the trocar into that part of the abdominal wall which lies over the coils of intestine. An incision $\frac{1}{3}$ of an inch long is made through the integument to assist the passage of the trocar. An assistant makes with both hands methodical pressure on the opposite parts to that operated upon.

Taking, then, a good hold of the handle of the trocar, with his forefinger so placed on it as to limit the length of the instrument which is to enter the abdomen, the surgeon, with one thrust, plunges it into the peritoneal cavity. The canula is then held in its place with one hand, while the trocar is withdrawn with the other. Flocculi floating in the serous effusion, or even a coil of intestine, may close the internal aperture of the canula, and thus obstruct the evacuation of the fluid; but this obstacle may be overcome by inserting a probe into the canula, or by turning the latter about in different directions. The evacuation of the fluid should be effected slowly, while an assistant at the same time maintains a progressive pressure with the bandage. The object of this pressure is to prevent the too-rapid dilatation of the mesenteric vessel, and to avoid the syncope which might result from the too-sudden depletion of another part of the vascular system.

When enough fluid has been drawn off, the canula is removed, and a small compress is applied over the wound, and is kept in position by the bandage round the body.

M. Fleury's (of Val-de-Grâce) operation.—This consists in introducing into the canula a gum-elastic catheter, and then withdrawing the canula while the catheter is maintained *in situ*. It is said that the catheter follows better the retraction of the abdominal walls, and can be inserted farther into the cavity than the canula, an advantage which permits of its being allowed to remain several hours.

If haemorrhage should occur, which very rarely happens,

the canula should be left in the wound, or it should be replaced by a piece of wax or gum-elastic bougie. The wound may also be raised into a fold of skin, on which pressure is maintained.

M. Baudens' operation.—It sometimes happens that the effusion, having distended and ulcerated the skin, makes for itself an opening on a level with the umbilicus. This accidental and fistulous opening allows the fluid to escape continuously. With the view of imitating this accident, M. Baudens designed a canula which, being allowed to remain in the side, and having a self-closing action, permits of the patient drawing off the fluid as fast as it collects. The umbilicus is the place selected by M. Baudens for the application of his canula. This method, which necessitates the use of a special instrument, is an ingenious modification of that adopted by M. Fleury, but is not unaccompanied by danger.

We shall not here dwell upon the different plans, injections, foreign bodies, etc., that have been proposed for the radical cure of ascites. They are all attended with danger, and it is better to resort to the operation of paracentesis as often as the disease requires it.

GASTROTOMY.

Gastrotomy signifies cutting into the belly, but the term is generally applied to the operation of cutting into the stomach.

This operation is justifiable when a foreign body is present in the stomach, but only when the foreign body, not being able to pass through the pylorus, gives rise to some serious mischief, or threatens to make its way out externally. The operation in these cases has been particularly successful. An incision should be made over the tumour or over the abscess that has been formed. But if there are no external signs of the presence of a foreign body, an incision of three inches in length may be made in the epigastric region, over the middle line. The peritoneum should be cautiously divided, the transverse colon drawn to one side, and the anterior surface of the stomach, being drawn out and exposed, should be opened in such a situation that there can be no risk of wounding the coronary arteries.

It is quite unnecessary to insist upon the dangers inseparable from so serious an operation. Before it is determined upon surgeons would do well to make a trial of the lithotrite instrument, which may be easily passed down the cesophagus.

Sédillot's operation.—This surgeon makes crucial incisions three inches in length, the vertical arm of which is on the left side of the middle line of the body, two fingers' breadth from the costal cartilage, and commencing immediately below the level of the ensiform cartilage. The muscular fibres are cut through by these incisions. On opening the peritoneum, the border of the left lobe of the liver is sought for, and the stomach, which lies below it, can be seized and drawn forward by means of the thumb and finger.

Mr. Bryant, in two operations, made the incision from the linea semilunaris, near the xiphoid cartilage, obliquely downwards and outwards, parallel with the line of the ribs.

GASTROSTOMY.

This term, which signifies a stomach mouth, is applied to the operation for cutting into the stomach with a view to retain a fistulous orifice in that organ for the introduction of food. It is performed in cases of obliteration of the cesophageal passage by cancerous and other growths. After adopting one of the above methods of reaching the stomach, the organ is drawn forwards and fixed by wire sutures to the lips of the wound. An opening is then made into it, the greatest care being taken to prevent any of its contents from entering the abdominal cavity. This operation has been, hitherto, almost invariably fatal.

ABSCESS OF THE LIVER, TUMOURS FROM BILIARY CALCULI, AND HYDATID CYSTS.

When the abscess points externally, and when there is distinct fluctuation, the visceral and parietal layers of peritoneum are probably adherent, so that an opening may be made into the abdomen without fear of any escape taking place into the peritoneal cavity. An incision of small extent,

so as not to exceed the area of adhesion, should be cautiously made, when, if the diagnosis is correct, immediate exit will be given to the pus. When the diagnosis is doubtful, and the existence of adhesions uncertain, it is advisable to employ the aspirator.

Graves's operation.—The tissues are divided layer by layer as far as the peritoneum. The wound is then filled with charpie, and the resulting inflammation gives rise to adhesions, and lays open the abscess.

M. Begin's method.—The tissues are divided as far as the peritoneum, in the same manner as in Graves's operation, and the wound dressed. But on the third day, when adhesions have been established, the abscess is opened with a bistoury.

M. Récamier's operation.—M. Récamier reaches the peritoneum by repeatedly cauterising the parts with caustic potash. The sloughing sets up the adhesive inflammation, and the tumour can be opened with the bistoury or trocar. The walls of an abscess in a parenchymatous organ like the liver cannot become approximated, and a cavity remains behind in which air may collect. It has therefore been proposed to substitute for the pus an injection of some emollient fluid.

The possibility of opening *the gall-bladder*, if necessary, in the same manner as abscesses of the liver may be easily conceived; but the danger of an incorrect diagnosis will make surgeons hesitate before performing such an operation. *Hydatid cysts* may be opened by simple puncture, in like manner, or they may be evacuated by the aspirator.

OVARIAN CYSTS.

Ovarian cysts vary much in size, in form, in consistence, and in the nature of their contents. Some—the *dermoid* class—consist of a mass of fatty matter, in the midst of which are to be found teeth, hair, fragments of bone, etc.

Serous cysts contain fluid, which varies much in consistence. Sometimes they form one large sac completely filling the abdomen, and sometimes they are composed of a variable

number of cysts full of fluid, and without any communication between them. The relations of these kind of tumours to other organs are equally variable. At one time they contract adhesion with the large omentum and other parts of the peritoneum, while at another time the tumour is isolated and pedunculated.

Operations.—*Tapping.*—Tapping is only applicable to cases of dropsical cysts, and is, moreover, merely palliative. It may be performed either at the most prominent part of the tumour or *per vaginam*. Tapping the abdomen is preferable to puncturing the vagina, as there is less risk of peritonitis. To obtain a radical cure it has been proposed to conjoin with the tapping compression, and the use of irritant injections. But experience has not yet shown that there is anything to be gained by this plan, and it is best to confine the operation to simple tapping, with the view of guarding the patient as much as possible from any accidents that may arise.

Incision, recommended by Ledran, is chiefly indicated when the cysts are multilocular, and contain fluid of some consistence. A longitudinal incision is made over the most depending part of the tumour, or over the linea alba, or outside the recti muscles. The tumour is then evacuated by a trocar, care being taken not to permit the contents to enter the peritoneal cavity. It is then opened in the same direction, sufficiently to admit the hand, and the partitions are destroyed as far as they can be reached. A drainage tube is then retained in the wound, and the suppuration which is set up may complete a cure.

Extirpation, proposed and described by Theden, was practised by McDowell.

McDowell's operation.—An incision is made in the middle line from above downwards, commencing at the umbilicus, extending as far as within one inch of the pubis, and passing through the skin and the linea alba. The peritoneum, which is not touched in the first part of the operation, is then seized with forceps and opened to a small extent, either with scissors or with a bistoury. A director is passed beneath the membrane, in order to isolate it from the subjacent parts, and

to facilitate an incision being made through it as large as that through the integuments. The tumour can then be explored with the view of seeing whether it has contracted any adhesions. If these are slight they may be divided or torn asunder, so that the base of the tumour may be more easily examined. But when they are both strong and numerous, it is better to let them alone, and to merely empty the cyst.

When the pedicle is fully exposed it should be surrounded by a strong ligature. If it be large it should be transfixated with a needle armed with a double thread, and in this way several ligatures can be easily applied. The tumour may then be cut off within $\frac{3}{4}$ of an inch of the ligatures. When the operation is over the external wound should be closed with the interrupted suture. In some cases an incision extending from the umbilicus to the pubis is not long enough; and it may be necessary to make an incision from the xiphoid cartilage to the symphysis pubis.

There are two other methods of dealing with the pedicle : the clamp and actual cautery.

There are several varieties of clamps in use, the object of all of them being to hold the pedicle firmly, so that no haemorrhage can take place from the divided vessels, and to retain it external to the abdominal walls.

In using the cautery the pedicle is first clamped, and the tumour cut away about an inch from the clamp ; an iron, heated only to black heat, is then applied until the mass is cut off on a level with the clamp. With this method of treating the pedicle there is great danger of fatal secondary haemorrhage.

WOUNDS OF THE ABDOMEN.

Simple penetrating wounds.

When these wounds exceed an inch or so in length they are almost invariably followed by a hernia of the intestines, or of the great omentum. If the protruding parts are not injured, it will be sufficient to wash them with a little tepid water and to return them. It is sometimes necessary to

unravel them before their reduction can be effected. The edges of the abdominal wound may be then accurately brought together, either with the twisted or the interrupted silver wire suture, and a bandage applied round the body.

Wounds attended with strangulation of the viscera.

The protruding parts may be strangulated by the wound, the result of which may be so serious as to call for the prompt assistance of the surgeon. The nature of the parts implicated and the severity of the injuries inflicted will indicate what course should be pursued.

STRANGULATION OF THE GREAT OMENTUM.

SIMPLE STRANGULATION.

The exposed portion of omentum should be unfolded in case it should enclose a small portion of bowel. When only the omentum is engaged in the wound, and when the patient feels no dragging pain in turning round, it is better not to disturb it. Adhesions form on a level with the wound, the external portion of omentum sloughs and falls off, and the wound itself cicatrizes. If, however, the hernia is so large as to be exposed to injury, or to prevent the patient standing upright or turning round, it must be set free and returned. The omentum, being directed from above downwards, the rule is to disconnect it towards the inferior angle of the wound (see below).

When the protruding omentum is gangrenous, it will be prudent to ligature it and cut the slough away from below, leaving the pedicle in the wound.

STRANGULATION OF THE INTESTINES.

The first thing to be done is to diminish the volume of the protruded bowel by gentle methodical pressure, or by cold applications. Ambrose Paré proposed to prick the intestine in order to let out the gas. When these means fail the wound must be divided before the reduction is attempted.

The patient being placed on his back, with his thighs flexed

so as to relax the abdominal muscles, the operator presses down the hernia with his left hand, while with the right he introduces a hernia director into the upper part of the wound. The director is then passed beneath the peritoneum, and guides the blade of the hernia knife in the division of the stricture. The operator should take care that the protruding bowel does not overlap the groove of the director, and that the knife does not wound the non-protruding portion of bowel. The left index finger may serve as a guide to the knife instead of a director.

When the director cannot be introduced, the integument should be divided layer by layer as far as the peritoneum. The surgeon, pressing the bowel down with his left hand, passes the finger of the same hand up to the superior angle of the wound, and by careful and repeated incisions reaches the peritoneum, which is then divided with the help of a director.

WOUNDS OF THE INTESTINES.

(See Plate LIX.)

If the wounded bowel remain within the abdominal cavity, it will be only necessary to prevent the occurrence of inflammation by antiphlogistic measures. But when the abdominal wound is large and permits of the coils of intestine being easily drawn out, there is nothing to prevent a search being made for the wound in the bowel, which, if more than $\frac{1}{3}$ of an inch in length, may be closed with a suture.

Hereafter a description will be given of the operations by means of which an artificial anus may be established. At present it will suffice to mention those measures which are usually adopted to obtain an immediate cure by bringing together the edges of the wound, without interfering with the intestinal tube.

These measures will vary according as the wounds are longitudinal or transverse.

1. *Longitudinal wounds.*

Palfyn's method.—This consists in fastening the lips of the intestinal wound to the peritoneal surface of the abdominal

wound. For this purpose a silk thread passed through the edges of the wound keeps them in apposition, while the ends of the thread fastened outside support the bowel against the external wound. This plan, though easily carried out, may lead to the formation of an artificial anus.

Ledran's operation.—More complicated than the preceding, it involves the same principle. Several pieces of thread, about $\frac{1}{2}$ of an inch apart, are passed in the same manner as in Palfyn's operation. The ends of the thread are then united, and twisted in such a manner as to ensure the approximation of the edges of the wound, the contraction of the intestinal wall, and the ultimate closure of the wound. The bundle formed by the ends of the threads is fixed outside the abdomen.

Operation of M. Reybard (fig. 2, Plate LIX.).—This operation has also for its object the adhesion of the visceral to the parietal peritoneum. A small longitudinal piece of wood, rounded at its angles, is taken, and a thread passed through two holes made in its centre about $\frac{1}{6}$ of an inch apart. This little plate thus suspended by the thread is introduced into the wound of the bowel, like a button through a button-hole. The two ends of the thread are outside the intestine. Each is then passed through a needle, and one lip of the intestinal wound is to be perforated from within outwards with one of the needles, while the other needle is to be passed through the other lip. The coil of thread thus includes the plate and the two edges of the wound in the bowel. The threads are then carried through the edges of the abdominal wound, from within outwards, in the same manner as they were passed through the intestinal wound. The bowel is then reduced, and in tying the threads externally the wooden plate keeps the external surface of the bowel closely applied to the abdominal peritoneum.

M. Reybard cuts the thread two days after the operation. The plate of wood, being released, passes along the bowel and is rejected *per anum*.

Fig. 2 represents a transverse section of the bowel applied against the parietal peritoneum by M. Reybard's plate : *b, b, b,*

bowel; *c*, wooden plate; *d*, coil of thread; *d, d*, external knot of the thread which passes through the abdominal wall, *a, a*.

A. Cooper's operation.—When the intestinal lesion is very slight, it may be seized with a pair of forceps, and a ligature applied to it as if it were a blood vessel.

M. Jobert's method.—The edges of the wound are perforated by several pieces of thread, then reversed in such a manner that by tying them the serous surfaces are kept in apposition.

M. Moreau Boutard's operation.—The mucous membrane of the bowel being everted is excised, and interrupted sutures are applied so as to keep in contact the cut surfaces. One end of each thread is cut near the knot, while the other end should be passed through the abdominal wall in order to ensure the immediate union of the edges of the wound and their adhesion to the wall of the abdomen.

The continued suture, described at page 7, is applicable to wounds of the intestine. The thread serves the purpose of fixing the bowel to the external wound, and at the end of five or six days it can be gently withdrawn.

The operation of M. Reybard.—This is a modification of the continued suture. A sewing needle is used, with a double thread, to the free loop of which is fixed a small plug of lint. The operation is commenced by piercing the parts from within outwards near the angle of the wound. The small plug fixes one end of the thread, and afterwards serves the purpose of drawing the thread along with it in the motions. When the continued suture has been applied the whole length of the wound, the doubled thread is separated, the free ends of the threads are tied, and are then cut close to the knot. The bowel is then returned and the thread cuts its way through the parts to which it is applied, and falls into the bowel, where it is expelled with the stools.

M. Gély's operation.—*The quilted suture* (Pl. LIX, fig. 1). In order to understand this operation the reader should refer to the description of the above plate. A waxed thread is armed at each end with an ordinary needle. One of them is thrust into the bowel parallel to the wound outside

and behind one of its angles, and about $\frac{1}{6}$ of an inch from it. The other needle is applied in the same manner to the opposite edge of the wound. The threads are then crossed; the needle on the left side passing over to the right, and *vice versa*. With each thread another stitch is made exactly like the first, taking care to enter each needle at the point from which the other escapes. This manœuvre is afterwards repeated as many times as the extent of the wound renders necessary. That being done, each stitch should be properly tightened before the threads are tied. This may be done by seizing with a pair of dissecting forceps each transverse stitch and even each of the two threads which compose it, making slight traction, and at the same time pressing down the edges of the wound. There is nothing to prevent their being so exactly adjusted that it is impossible to perceive externally any trace of the threads by means of which the union has been accomplished. When the operation is over, it only remains to tie the two threads, and to cut them close to the knot. The needles used should be a little larger than the thread, so that the latter may easily follow the needle. The bowel, on each side, should be perforated at least $\frac{1}{6}$ of an inch outside the wound, that is to say, at such a distance that the two lines formed by the lateral stitches should be $\frac{1}{3}$ of an inch apart. The distance between the apertures where the needle respectively enters and leaves the bowel should be at the most $\frac{1}{4}$ of an inch. M. Gély recommends the suture to be tightened as soon as two stitches have been made on each side, and at once to fasten them off with a small knot. Sewing silk of moderate thickness is what M. Gély chooses for this purpose.

2. Transverse wounds.—Inragination.—The approximation of serous, and mucous surfaces.

Ramdohr's plan.—This consists in introducing the upper margin within the lower margin of the wound, and keeping them in contact by means of a few sutures. This plan has been modified by Hermans, Sermale, and Richter.

Direct union of the edges of the wound.—Duverger's operation.

—Duverger made use of a portion of a bullock's trachea, furnished with pieces of thread disposed at equal distances, each end of which was provided with a curved needle. The trachea was introduced into the two ends of the bowel, and the needles, passing through the intestinal tube from within outwards, ensured the edges of the divided bowel being fixed and approximated over the trachea, while the fastening of the threads preserved the union.

M. Jobert's operation.—When the omentum gets in front of the wounded bowel a fold of it may, as M. Jobert recommends, be interposed between the approximated edges of the bowel and united by a few sutures applied in the manner adopted by Ledran.

Union of the serous surfaces.—Adhesion between serous membranes is readily affected provided the surfaces are kept sufficiently long in contact. Mucous membranes, on the other hand, unite with more difficulty, and the adhesion of mucous and serous membranes cannot be directly accomplished. These facts, which are demonstrated by Richat and Richeraud, led to further researches, and gave origin to the following operations.

M. Jobert's operation (fig. 3).—The two ends of the bowel are separated from the mesentery for the space of $\frac{1}{2}$ an inch in order to facilitate the invagination of the upper within the lower portion of the bowel. The haemorrhage resulting from the cut mesentery, if slight, need not be interfered with, and at all events a temporary ligature will be sufficient to arrest it. The surgeon then seizes with his left hand the upper portion of the wounded bowel, while with his right hand he passes from within outwards a needle (bearing a thread of sufficient length) through the wall of the intestine about $\frac{1}{4}$ of an inch from the wound. The thread thus passed through the upper portion of the bowel is held by an assistant. A second thread is passed in the same manner into the upper portion of the bowel, at a point exactly opposite the first.

The surgeon then turns in the border or edge of the lower portion of the bowel, the result of which is to turn inwards

the serous surface. Each of the two ends of the threads held by the assistant is passed through a needle which the operator using his finger as a guide, introduces into the bowel in such a manner as to perforate from within outwards the double or inverted edge of the lower portion. The other end of the same thread is passed through the gut in the same manner, about $\frac{1}{6}$ of an inch from the first end (fig. 3 *a*).

The same operation is gone through with the free extremities of the second thread, *b*, and then all that is necessary to secure the invagination of the bowel is to make slight and methodical traction upon the threads. The latter drag the upper portion of the bowel within the lower one, and the invagination being completed, the threads may be fastened off, or a few sutures may be applied. Finally the bowel is returned into the abdominal cavity, and the threads, brought together in the lower angle of the wound, are kept externally in position by means of a small piece of diachylon.

M. Lembert's operation (fig. 4 & 4 *bis*; see description of Pl. LIX).—This operation allows of the serous surfaces being approximated by means of a corrugation and inversion of the edges of the wound. For this purpose as many threads should be taken as the number of sutures required, and each thread should be provided with a needle. The latter, having been inserted from without inwards, about $\frac{1}{3}$ of an inch from the wound, should make its exit about $\frac{1}{6}$ or of $\frac{1}{4}$ an inch above the wound, and then, having again entered the bowel $\frac{1}{6}$ of an inch below the wound, should be brought out $\frac{1}{6}$ of an inch further down. The figs. 4 & 4 *bis* show the course of the thread. The edges of the wound should then be turned in, the thread tied, its ends cut off near the knot, and the bowel returned.

M. Denan's operation (fig 6).—The adhesion of the serous surfaces is here secured through the medium of a foreign body. M. Denan provides himself with three silver or silver plated collars. One, the central collar, is about $\frac{4}{5}$ of an inch in depth and the same in width. The two others are scarcely $\frac{2}{5}$ of an inch in depth; but their diameter is greater than that of the first, so that the bowel can be inter-

posed and kept in position between the central collar and the two others.

The two ends of the bowel are separated from the mesentery to the extent of $\frac{1}{2}$ an inch. The two narrow collars, the diameter of which is the largest, *b*, *b*, are separately introduced within each end of the bowel, the free border of which is turned over the collar, *b*, *b*. Whilst one of the collars is thus covered all round by the borders of the bowel, the collar, *a*, is inserted, which keeps the bowel turned inwards, and by its pressure prevents the border of the intestine slipping out of place. The collar, *a*, which is only introduced in its half, is then engaged in the other collar, *b*, where it also keeps the bowel inverted.

In order to fix this apparatus and keep the collars in position, an intestinal suture must be applied. The surgeon above mentioned uses a needle and silk thread. He passes the needle above the collars, and brings it out below them, *f*, having passed it beneath the central collar, *a*. In the next place the needle re-enters its point of exit, *f*, is passed between the bowel and the external collars, *f*, and brought out at *g*. Fig. 6 represents the course of the thread, *d*, *d*, *d'*, *d'*, *f*, *f'*, *g*. The two ends are then tied, cut off short, and the bowel returned. This proceeding leads to the mortification and separation of the two inverted edges, the serous surfaces of which adhere between the outside collars. The latter are set free within the bowel and are passed *per anum*. The central collar may consist of a spring of elastic steel, which can be taken hold of with a pair of forceps, and easily introduced within the silver collars.

M. Amussat's operation (fig. 5).—M. Amussat introduced into the bowel a cork, *a*, *a*, enlarged at each end, and having a hole through its centre. He then invaginated the two ends of the bowel, and tied them over the cork with the thread, *b*, *b*. The foreign body sets up inflammation and subsequent adhesion of the serous surfaces. The ligature, after cutting its way through the tissues which cicatrise over it, falls into the bowel, from whence it is expelled along with the piece of cork.

Remarks.—The operations that have just been described

have not been all performed. To judge of their relative value we must study the conditions on which the success of the operation essentially depends. On one hand, the facility with which serous surfaces unite when brought into contact, on the other hand, the impossibility of securing the direct adhesion of two membranes that differ in their nature, permit of our drawing a well-marked line between the value of one operation and that of another, and all we have to do is to consider which kind of operation offers the most chance of success. The great point is to bring into apposition the serous surfaces of the edges of the wound. Moreover, the surfaces must be brought into exact contact throughout the whole extent of the wound, and the contact should be maintained in such a manner as not to allow of any matter escaping into the abdomen. The diameter of the bowel must at the same time be diminished as little as possible, and no projection of the parts should offer any obstacle to the passage of its contents. Lastly, the fewer the sutures the less constriction there will be, and the less chance of any accidents occurring afterwards.

M. Gély's operation, applied to longitudinal wounds, fulfils better than any other operation the conditions which are so essential to the exact closure of the wound ; the only drawback to it being that it exposes the bowel to the accidents which a number of stitches frequently entails. The simple suture and M. Reybard's operation (a modification of the glover's suture), are perhaps exempt from the inconvenience of the quilted suture.

The same principles are applicable to transverse wounds. The operation of M. Gély may be recommended ; and that of M. Lembert has been performed on the living subject by M. J. Cloquet.

M. Denan's operation, which is easy of execution, has been performed on the living subject by M. Guersant. The autopsy showed that the most perfect cicatrization of the bowel without any constriction had taken place. The inconvenience which may result from the pressure of metallic bodies in the bowel has induced M. Bourgery to use collars made with some substance of sufficient consistence or solidity to remain in its

Fig. 1.

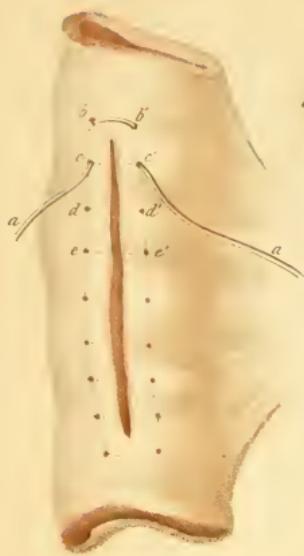


Fig. 2.

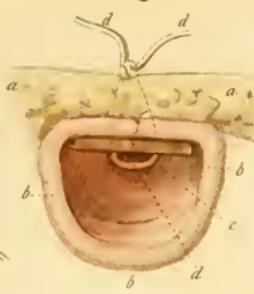


Fig. 3.



Fig. 4.

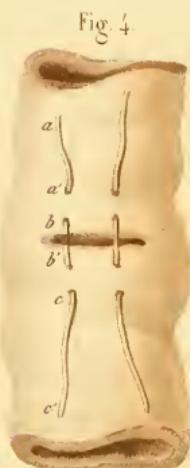


Fig. 5.

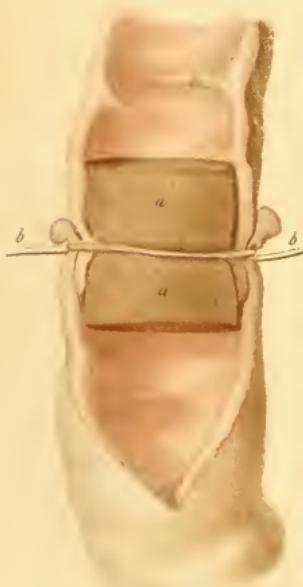
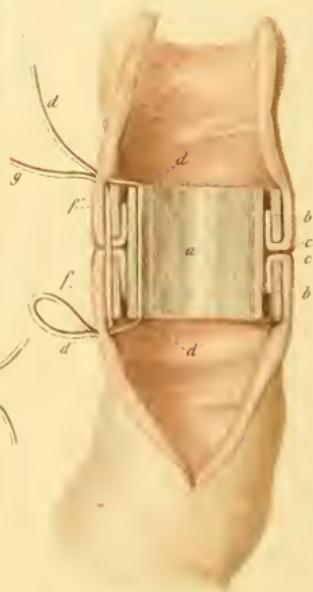
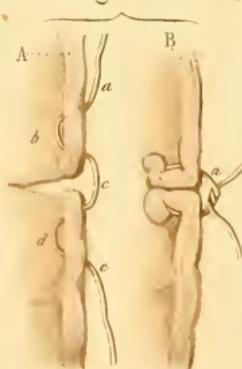


Fig. 4 bis.



place just so long as to secure the formation of peritoneal adhesions, and, on the other hand, sufficiently changeable and hygrometric as to become afterwards much softened, and even to be converted into a paste that can be easily expelled by the bowel. Collars of gelatine that have been hardened by means of a coating of some sedative oil answer the purpose very well.

PLATE LIX.

WOUNDS OF THE INTESTINE.

Fig. 1.—M. Gély's quilted suture.—The surgeon takes a silk thread that is well waxed and armed with a needle at each end. One of the needles is passed through point *b*, above, and $\frac{1}{8}$ of an inch external to the upper angle of the wound, and is brought out, from within outwards, at point *c*, a $\frac{1}{4}$ of an inch below. The second needle enters at point *b'*, and comes out at point *c'*. The figure illustrates this first step of the operation. The ends, *a*, *a*, of the thread are then crossed in front of the wound in such a manner that the thread from point *c'* re-enters at *c*, and the thread from point *c* re-enters at *c'*. The needles then make their exit at *d* and *d'*. Another crossing of the threads is made; that issuing from *d'* re-enters the bowel at *d*, as was done above at *c'* and *e*. This proceeding is continued as far as $\frac{1}{8}$ of an inch below the wound, where the threads are tied in a knot. Externally, the closure of the wound is secured by a double thread, which crosses it in the direction of *b*, *b'*, *c*, *c'*, *d*, *d'*, *e*, *e'*, and approximates the serous surface of its edges; internally, two threads run parallel with the direction of the wound, *b*, *c*, *d*, *e*, and *b'*, *c'*, *d'*, *e'*, thus making the union still more secure.

Fig. 2.—M. Reybard's operation.—The illustration shows a transverse section of the bowel and of the abdominal wall on a level with the wound: *a*, *a*, wall of the abdomen; *b*, *b*, *b*, bowel; *c*, tablet introduced into the bowel; *d*, *d*, *d*, suture of thread passing through and keeping in apposition the tablet, the bowel, and the abdominal wall.

Fig. 3.—Transverse wound of the bowel.—M. Jobert's operation.—Apposition of the serous surfaces.—Two silk threads,

a, *a*, and *b*, perforate the upper end of the bowel. At the lower end the edge of the bowel has been turned inwards, while the thread, provided with a needle at each end, passes through this inverted edge, and maintains the inversions. When traction is made upon the threads, *a* and *b*, the upper end of the bowel is invaginated within the lower portions, and by this means the serous surfaces are brought into contact.

Fig. 4 & 4 bis.—M. Lembert's operation.—The number of needles and thread required in this operation must be in proportion to the number of sutures to be applied. One thread, *a*, is inserted at *a'*, and drawn out at *b*; it then passes over the transverse wound, re-enters the bowel at *b'*, and again makes its exit at *c*. The other threads are applied in the same manner.

Fig. 4 bis. represents the course of the thread, *a*, *b*, *c*, *d*, *e*, through the wall of the abdomen, *A*. It is only necessary to pull the thread and to tie it in order to bring the serous surface of the edges of the wound into contact with each other, *B*.

Fig. 5.—M. Amussat's operation.—Longitudinal section of the bowel, showing the cork, *a*, *a*, over which the two ends of the bowel are bound by the thread, *b*, *b*, the mucous surface of one end being brought into contact with the serous surface of the other.

Fig. 6.—Denan's operation.—Longitudinal section of the bowel and of the collars or rings, showing the disposition of the apparatus employed: *a*, central collar; *b*, *b*, the two eccentric collars, less deep, but broader than the central one, *a*. One thread, *d*, *d*, *d'*, *d'*, *f*, *f'*, *g*, keeps it all in position.

The edge of the upper portion of bowel, *c'*, is folded round the upper collar, *b*, and that of the lower portion, *c'*, is folded in the same manner over the other collar, *b'*.

The central collar, *a*, keeps the edges of the wound inverted and presses them against the internal surface of the two collars, *b*, *b'*. By this means the serous surfaces of the intestinal wall are brought into contact. The thread, *d*, *d'*, *f*, *f'*, *g*, keeps the collars in place.

Fig. 1.

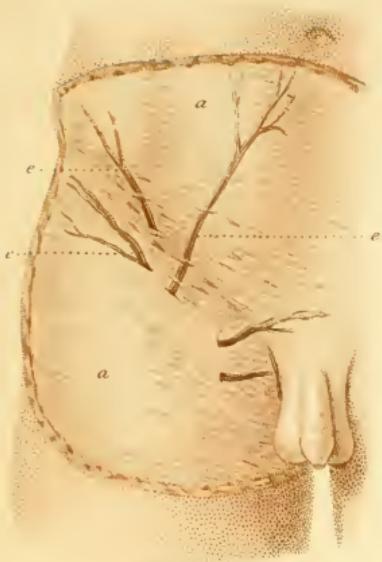


Fig. 2.

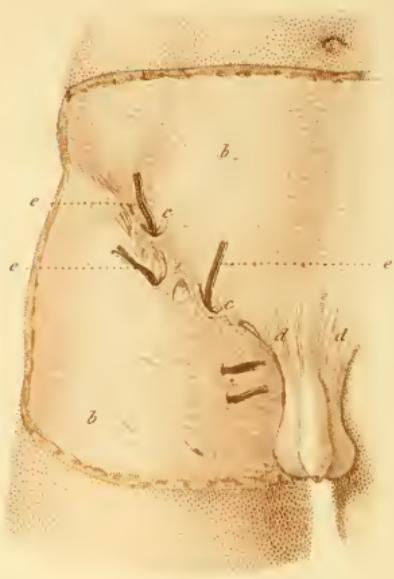


Fig. 3.



Fig. 4.



PLATE LX.

HERNIA.

SURGICAL ANATOMY OF THE INGUINAL REGION.

Fig. 1.—The skin and the subcutaneous cellular tissue have been raised throughout the whole extent of the region : *a, a*, the superficial layer of the subcutaneous fascia. Superficial vessels, *e, e*, perforate the meshes, *i*, of the fascia.

Fig. 2.—Deep layer of the superficial fascia ; the meshes, *b, b*, are large ; *d, d*, fibres of the dartos ; *e, e, e*, superficial vessels converging towards the crural arch, and passing through the apertures with which the superficial fascia is riddled.

Fig. 3.—The superficial fascia is removed. Below this layer is seen, in the abdominal region, the external oblique, *a*, and its aponeurosis, *b* ; and in the crural region, the fascia-lata, *c, c*. The cribriform fascia still remains ; numerous glands, *e, f*, are scattered over this layer, which covers, moreover, the femoral sheath. The subcutaneous fascia of the thigh, *d, d*, has been turned back. It covers the ganglions, and becomes united at the crural arch with the subcutaneous fascia of the abdomen. The cribriform layer of cellular tissue, which joins externally the aponeurosis of the fascia-lata, *c*, is a part of the deep layer of the superficial fascia.

Fig. 4.—The cribriform layer is separated from the fascia-lata, *c*, and raised with a tenaculum, *d*. Beneath this layer lie the femoral vessels : the vein, *f*, and artery, *g*, enclosed in a cellular sheath of funnel shape, *e, e*. The cavity of the funnel-shaped sheath is divided into three compartments by partitions which separate the artery from the vein. The internal compartment containing a femoral gland is that which is the seat of crural hernia.

PLATE LXI.

CONTINUATION OF THE SURGICAL ANATOMY OF
THE INGUINAL REGION.

Fig. 1.—A part of the external oblique, with its aponeurosis, *a*, is removed. Beneath is seen the internal oblique, *b*. The aponeurosis of the external oblique, *c*, detached from its upper part, *a*, is turned down over the thigh. This portion of the aponeurosis is inserted at Poupart's ligament, or the crural arch, which will be described presently (figs. 5 & 6).

Fig. 2.—After the removal of the external and internal oblique muscles, the transversalis muscle, *a*, is exposed ; and the inguinal canal, *b*, commences beneath the inferior fibres of this muscle ; *d*, spermatic cord seen in the inguinal canal. The aponeurosis of the external oblique, which contributes to the formation of the inguinal canal, being removed, the relations of the cord with the inferior fibres of the transversalis muscle are brought into view. The femoral vessels, *c*, leave the iliac fossa below the fibres of the transversalis, and enter the crural region after they have passed beneath Poupart's ligament (see fig. 5).

Fig. 3.—All the muscles of the abdominal wall are removed, and the aponeurosis of the external oblique, *a*, as shown in figs. 1 & 2, is turned down over the thigh. The transversalis fascia, *b*, is next exposed, and on removing the lower portions of this, the peritoneum, *c*, will be seen covering the coils of intestine. The spermatic vessels and the vasa deferentia unite to form the spermatic cord, *d*. Fibres of the transversalis fascia are prolonged over the cord, and form one of its coverings, the proper fibrous tunic of the cord ; *e*, the track of the epigastric artery (see Pl. XVII., fig. 1).

Fig. 4.—This represents the posterior or peritoneal surface of the abdominal wall, the anterior surface of which has, from before backward, been described above (figs. 1, 2, & 3), layer by layer. This surface of the peritoneum shows the small fossæ which are produced by the projection of the viscera

Fig. 1.

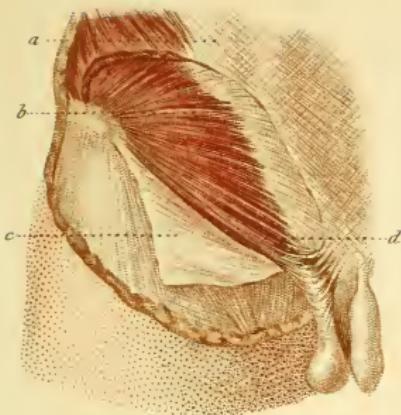


Fig. 2.

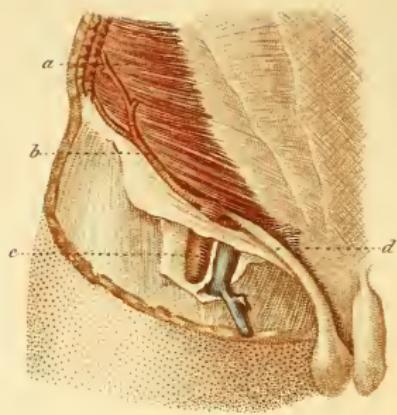


Fig. 4.

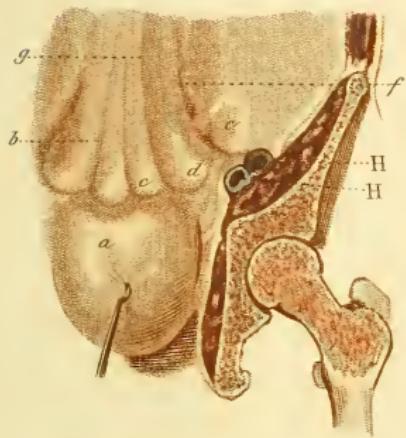


Fig. 5.

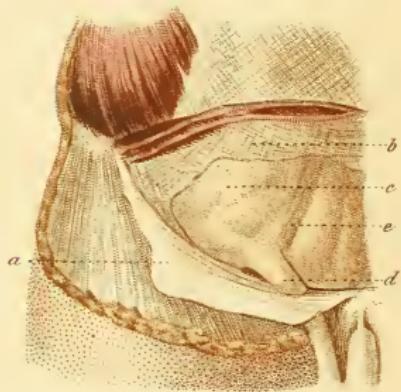


Fig. 3.

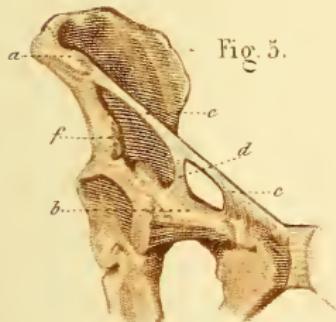
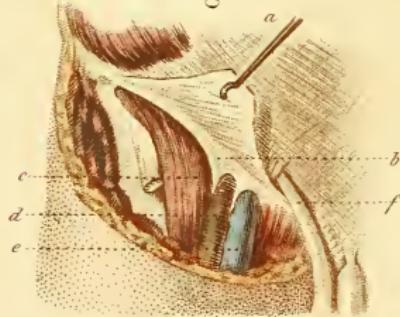


Fig. 6.



beneath it.—*a*, the bladder drawn down with a tenaculum ; *H, H*, cut vessels.

The *external inguinal fossa*, *e*, corresponds to the abdominal ring, or to the abdominal orifice of the inguinal canal through which passes the spermatic cord. Internally this fossa is bounded by the epigastric artery, which courses between the peritoneum and the abdominal muscles. This artery (see Pl. XVII.) passes beneath the cord, and is consequently found internal to the hernias which commence at the external fossa (External or Oblique Inguinal Hernias, see Pl. LXIV. fig. 1).

The *internal inguinal fossa*, *d*, is situated between the projection of the epigastric artery, *f*, and the projection formed by the obliterated umbilical artery, *g*. This fossa corresponds to the inguinal canal, and *internal inguinal hernias* (see Pl. LXIV., fig. 2), which, pushing the peritoneum in this direction, appear internal to the epigastric artery.

A ; third fossa, or *vesico-inguinal* fossa, formed by the projection of the umbilical artery and the projection of the external border of the rectus muscle, corresponds to the external ring or orifice of the inguinal canal. Hernias which commence at this fossa are *direct*. *H, H*, crural vessels.

Fig. 5—Poupart's ligament, or the crural arch.—Gimbernat's ligament.—*a*, anterior-superior spinous process ; *b*, horizontal ramus of the pubis ; *c, c*, Poupart's ligament, or the crural arch ; *f*, anterior-inferior spine of the ilium.

Poupart's ligament, or the crural arch, is formed by a strong aponeurotic bridle extending from the spine of the ilium, *a*, to the spine of the pubis.

Gimbernat's ligament, *c*, is formed by the lowest fibres of the crural arch, which are reflected from before backwards, and are inserted close to the pectineal line, *b*. This ligament, the aponeurotic expansion of the crural arch, by its reflected direction from before backwards, forms a sort of partition which separates the fossæ, described above, from the crural canal. Another ligament, *d*, associated with the crural arch, becomes separated from it, and is inserted upon the ileo-pectineal line. This ligament, the *ileo-pectineal band*, bounds on the outside an orifice that is bounded above by the

crural arch, inside by Gimbernat's ligament, *c*, and below by the ramus of the pubis, *b*. This opening gives passage to vessels, and nerves, and crural hernia begins at this spot. If the reader bears in mind that crural hernia always follows the internal compartment of the femoral sheath, he will understand its relations to Gimbernat's ligament, relations of which we shall have more to say hereafter.

Fig. 6.—A tenaculum, *a*, raises the crural fascia; *b*, Poupart's ligament, or the crural arch. The anterior wall of the crural canal is removed, by which the crural artery, *d*, on the outside, and the crural vein, *e*, on the inside, are brought into view; *f*, the spermatic cord coming out of the external ring of the inguinal canal. The explanation of Plates LX. and LXI. will make the following description of the inguinal and crural canals more intelligible.

The inguinal canal.—This canal is a hollow passage through the substance of the abdominal wall, and gives passage to the spermatic cord in the male, and to the round ligament in the female. Its direction is oblique from above downwards, from without inwards, and from before backwards. In it are to be seen two openings: one internal and above, the *abdominal* or *internal ring*; the other external and below, the *external ring*.

The internal ring is formed by an opening in the transversalis fascia for the passage of the cord. We have seen that this fascia is prolonged upon the cord, and forms one of its coverings (Pl. LXIV., fig. 2; and Pl. LXI., fig. 3). It is in the external inguinal fossa of the peritoneum (Fig. 4, *c*, Pl. LXI.) that this passage lies.

After the transversalis fascia has given passage to the cord by the internal ring, it is connected with the crural arch, where is likewise attached the aponeurosis of the external oblique, which, in its turn, gives passage to the cord by the external ring. It follows, therefore, that the inguinal canal lies between these two membranes, the fascia and aponeurosis, and in the furrow formed by their union at the crural arch. This furrow, indeed, constitutes its lower wall or floor. The upper wall is formed by the lower fibres of the internal oblique and

transversalis. The external ring is formed by the separation of the fibres of the aponeurosis of the external oblique. It is between the *pillars* formed by the separation of these fibres that the spermatic cord escapes.

The external pillar is inserted into the spine of the pubis, and the internal pillar into the symphysis pubis. The separation of these pillars is bridled over above and below by transverse fibres, the *intercolumnar fibres* arising from a prolongation of the aponeurotic fibres of the external oblique of the opposite side. The result is that the positions of the body in which the abdominal muscles are contracted tighten the external ring by the tension of the aponeurotic pillars.

The length of the inguinal canal varies from one and a half to two inches. Its direction is parallel to that of the crural arch, which forms its lower wall, and from which it is about half an inch distant. The orifice where the external ring is situated is about an inch external to the symphysis pubis.

In the infant the two rings are closer together, and almost in juxtaposition; and, further, the peritoneum often communicates with the tunica vaginalis. Hernias may in that case commence in the canal, and descend into the scrotum without having a proper sac. This anatomical disposition of the peritoneum always places hernias external to the epigastric artery.

In females the inguinal canal only contains the round ligament of the uterus and a few vessels. Its abdominal opening is reduced to a simple cleft, a circumstance which explains the rarity of inguinal hernia in this class of patients, and the frequency of crural hernia.

PLATE LXII.

SURGICAL ANATOMY OF THE SCROTUM, AND OF
THE SPERMATIC CORD.

Fig. 1—*a*, penis drawn to the left; *b, b, b*, skin of the scrotum; *c, c, c, c*, the superficial fascia lining the skin; *d*, the dartos; *e*, the fibrous tunic or intercolumnar fascia; *f*, the aponeurotic fibres of the external oblique; *g*, the fibrous or proper covering of the cord; *g*, the spermatic cord cut close to its exit from the ring.

Fig. 2.—*Anatomy of the spermatic cord*.—*a*, aponeurotic fibres of the external oblique; *b, b*, the intercolumnar fascia arising from the circumference of the inguinal ring; *c, e*, cremaster muscle; *d, d*, the proper fibrous covering of the cord derived from the cremasteric fascia; *e*, a sound passed beneath the spermatic vessels; *f*, vas deferens.

Fig. 3.—*a*, the testicle; *b, b, b, b*, the tunica vaginalis; *c, c*, the fibrous covering of the cord.

The dissection of the scrotum from without inwards exposes the coverings of the testicle in the following order:—

The *skin of the scrotum* (*fig. 1, b, b, b*) is thin, elastic, susceptible of being relaxed under the influence of heat, and of contracting itself under the influence of cold. It is lined with a layer of cellular tissue, forming a superficial fascia, *c, c*, which is continuous with the superficial fascia of the abdomen. The skin, and the fascia which lines it, form one pouch for the two testicles. This pouch is grooved externally, and in the middle line by a well-marked raphe.

The *dartos*, *d*, then forms two distinct pouches, composed of reddish and very contractile fibres. These fibres appear to arise from the circumference of the ring over the fibrous tunic.

The *fibrous tunic*, or intercolumnar fascia, *e*, is an expansion of the aponeurosis of the external oblique. It quits the tendinous fibres of that muscle at the margin of the external inguinal ring, and provides the cord and the testicle with a strong covering.

The *cremaster* (*fig. 2, c, c*) is situated beneath the fibrous tunic.

Fig. 1.

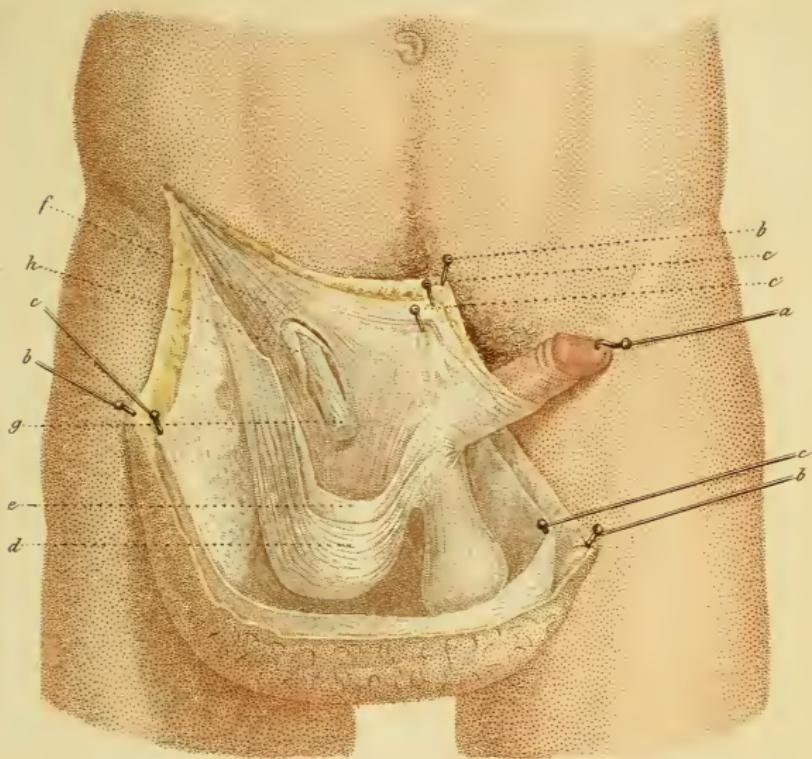


Fig. 2

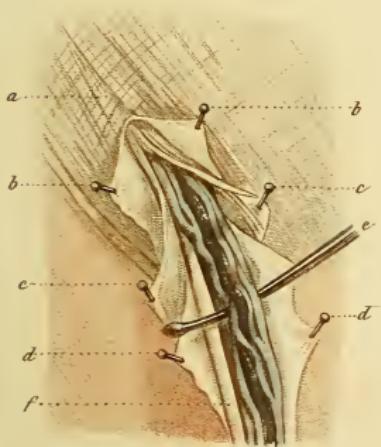
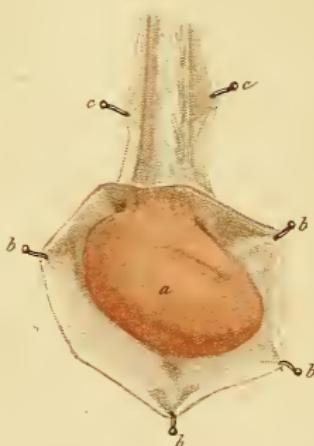


Fig. 3



This muscle, which is very thin, and which is formed, according to M. J. Cloquet, of the lower fibres of the internal oblique dragged down by the descent of the testicle, forms for the spermatic cord a covering composed of muscular loops, with their concavity above, commencing with a fasiculus of fibres at the circumference of the ring, and joining another fasiculus which is inserted into the pubis.

The *proper fibrous coat* (fig. 1, *h*, and fig. 2, *d*) follows next. It is a prolongation of the fascia transversalis and sub-peritoneal tissue.

In the midst of these coverings are situated the *spermatic vessels* and the *vas deferens*. The vessels are in front of the *vas deferens*. The walls of the latter are strong, thick, and resisting. In the operations that are performed with the view of tying the vessels it is necessary to recognise this duct, and to carefully isolate it.

The *tunica vaginalis* (fig. 3, *b*, *b*) covers the whole testicle except above and behind. Sometimes this pouch, as it may be called, communicates with the peritoneum, of which it is a prolongation. It is often the seat of a considerable effusion of serum (hydrocele), and when there is a communication with the peritoneum, by making pressure upon the swelling the fluid can be made to flow back into the abdomen. The surgeon should always make sure that there is no such communication before he injects any irritant fluids into the tunica vaginalis for the purpose of radically curing the hydrocele.

PLATE LXIII.

A THEORETICAL EXPLANATION OF THE FORMATION
OF HERNIAS.

The drawings represent a section passing through an opening in the abdomen, and also hernias of the bowel.

Fig. 1.—*a*, abdominal opening; *b, b, b*, the bowels pushing before them the peritoneum, *c, c, c, c, c*, and having a tendency to enter the opening, *a*. Only the peritoneum has commenced to enter the opening, *a*; it is the first step in the formation of the sac.

Fig. 2.—The bowel, *b, b, b*, and the peritoneum, *c*, have cleared the opening, *a, a*. Here the process is more advanced than in the first figure; but the sac, *c, c, c, c, c*, has not yet become narrow or contracted at the opening; its neck is not yet formed.

Fig. 3.—*b, b*, the *herniated coil of intestine* enclosed in the *peritoneal sac*, *c*. The sac is dilated into a pouch or bladder, *c*, and is narrowed on a level with the opening, *a, a*. This contracted part of the sac is called its *neck*.

Fig. 4.—*Formation of the sac by the peritoneum.*—On a level with the opening, *a, a*, the walls of the sac, *d*, forming its neck, become considerably thickened. *e, e, e*, the body of the sac.

Fig. 5.—Sometimes there is more than one sac, one above the other, *e* and *d*. When the sac has been pushed down along with its organised and thickened neck, a second sac, situated above the other, may be formed with a neck equally organised. The peritoneum forming the sac is thickened all round the necks.

Fig. 6.—But when the first neck is not completely detached from the abdominal opening, *a, a*, a second sac, *d*, may form by the side of the first, *d*.

Fig. 7.—*a, a*, the opening in the abdomen completely strangulating a coil of intestine, *b*.

Fig. 8.—The abdominal opening strangulating only a portion of the bowel.

Fig. 1.

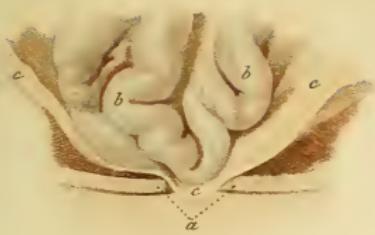


Fig. 2.

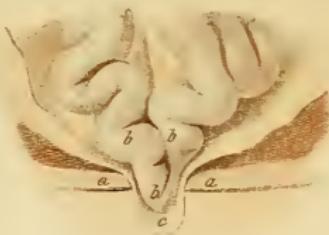


Fig. 3.

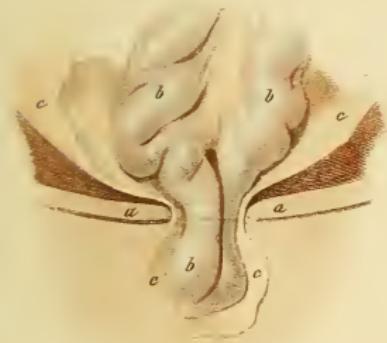


Fig. 4.



Fig. 5.

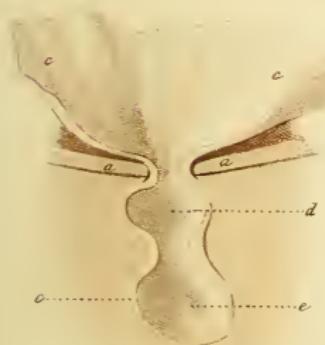


Fig. 6.



Fig. 7.



Fig. 8.



Pl. 64

Fig. 1.

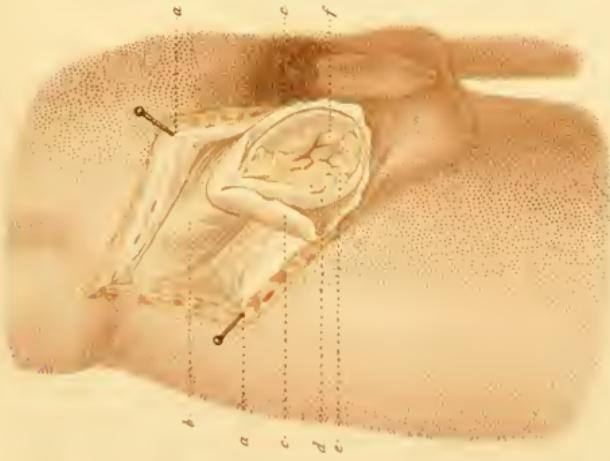


Fig. 2

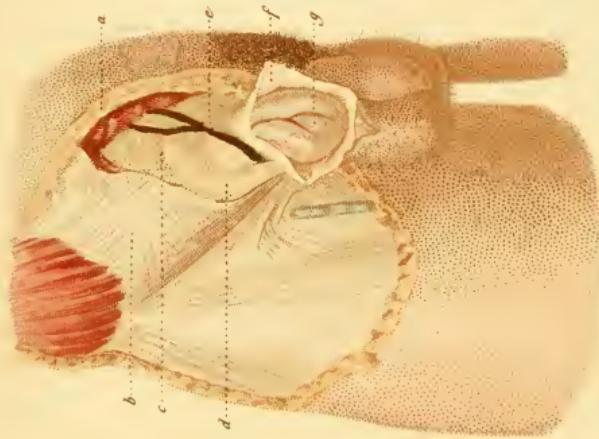


Fig. 3.

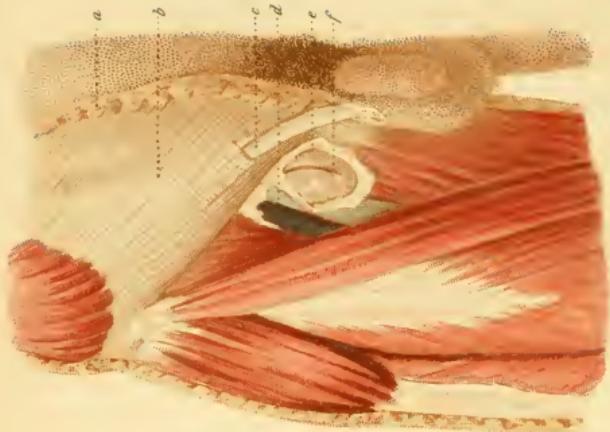


PLATE LXIV.

SURGICAL ANATOMY OF HERNIAS.

Fig. 1.—External inguinal hernia and its coverings.—The incision through the skin, the subcutaneous cellular tissue, and the superficial coverings, *a, a*, bring into view the aponeurosis of the external oblique, *b*; the fibrous coat, *c*, covered by the origin of the fibres of the cremaster. Below is the hernial sac, *d*, formed by a portion of peritoneum, in which is seen the epiploon, *e*, with a coil of intestine, *f*.

Fig. 2.—Internal inguinal hernia.—The skin and the subcutaneous cellular tissue has been removed, *a*; along with a portion of the aponeurosis of the external oblique, *b*, the peritoneum, *c*, is exposed; the commencement of the spermatic cord, *d*; the epigastric artery, *e*, passing beneath the cord; a hernial sac laid open, *f*, situated inside of the artery, and enclosing a coil of intestine, *g*.

Fig. 3.—Crural hernia.—The skin of the abdomen, *a*, being to a great extent removed, the aponeurosis of the external oblique, *b*, is exposed, as well as the spermatic cord, *c*. Below the crural arch will be seen the femoral vessels, *d*; and internal to these vessels a hernial sac, *e*, laid open, and containing a coil of intestine, *f*. To complete the anatomical description of the inguinal region, see Plates XVI. and XVII.

PLATE LXV.

RADICAL CURE OF HERNIA.

Figs. 1, 2, & 3.—M. Gerdy's operation.

Fig. 1.—The operator introduces the index finger of his left hand into the inguinal canal, and folds back the skin of the scrotum. A needle-carrier, *a*, passed over the finger as far as the bottom of the cul-de-sac, perforates, from within outwards, both it and the anterior wall of the inguinal canal, and at the same time carries outwards the first loop of thread, *b*.

Fig. 2.—Having passed the first double thread, *a*, the needle-carrier, *b*, is inserted in another direction, carrying the same thread through a little lower down, *c*.

Fig. 3.—The threads are tied over two quills, *a* and *b*, and the loop which they form maintains in the inguinal canal the organic plug produced by the skin of the scrotum, folded back like the finger of a glove.

Figs. 4, 5, & 6.—The operation of Bonnet, of Lyons.

Fig. 4.—One pin, *a*, passed beneath the spermatic cord, pierces the hernial sac.

Fig. 5.—Two pins, *a*, *b*, passed through the sac, one beneath, and the other above the cord.

Fig. 6.—The skin has been raised, in order to show the position of the pins, *b*, *c*, with respect to the cord, *a*.

THE OPERATIONS.

Compression.—This should only be practised by means of a bandage, which the patient attends to day and night. It is capable of producing a progressive contraction of the neck of the sac, and of the hernial opening, so as to prevent the reproduction of the hernia. It is chiefly when the patient is young that we can expect this practice to be successful.

The treatment should be persevered in for at least a year ; and sometimes it will take two or three years to obtain a good result. The surgeon should give particular attention to the

Fig. 1.

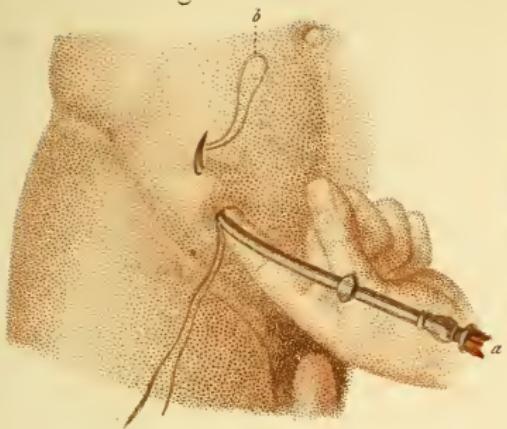


Fig. 2.



Fig. 3.

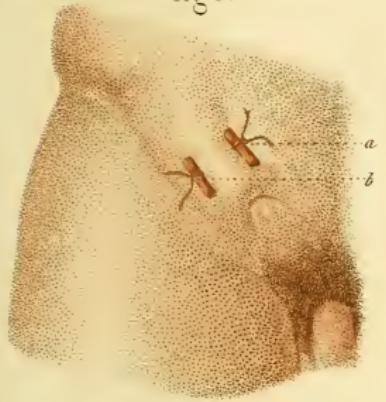


Fig. 4

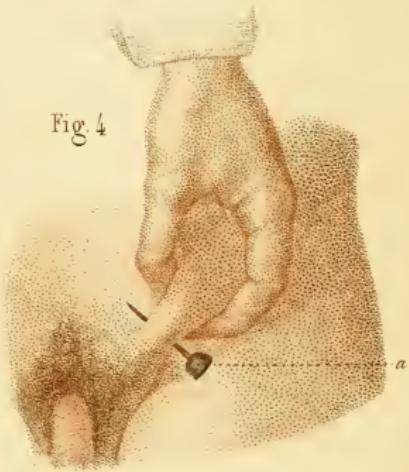


Fig. 5.

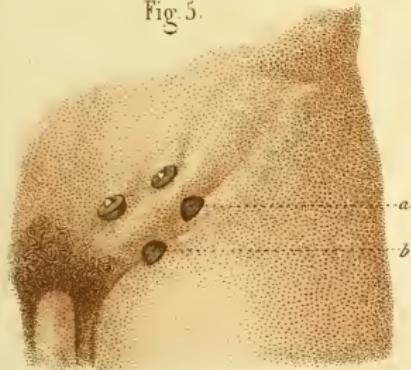
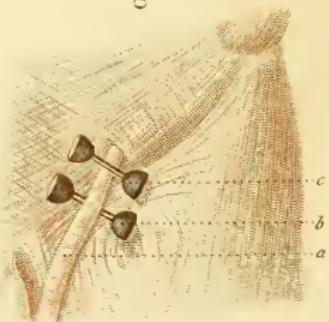


Fig. 6.



choice of the bandage and the form of the cushion. It is an essential point to close the hernial orifice exactly, but without forcing it in, and without pressing too much upon the skin.

It may be worth while here to mention *cauterization* of the neck of the sac, as formerly practised by the Arabian surgeons; *incision* of the sac, condemned by J. L. Petit and by Potts; *incision* of the sac described by Celsus; *ligature of the neck* of the sac in order to produce the mortification and separation of the covering of the hernia, etc. These operations, however, have been long abandoned ; in this place only the more modern methods will be described.

M. Belmas' operation.—The object of the operation proposed by M. Belmas is to obliterate the hernial opening by setting up inflammation of the walls of the sac through the introduction of a foreign body within its cavity.

The first method adopted by M. Belmas consisted in introducing into the interior of the sac, by means of particular instruments, a small pouch of gold-beater's skin, which he inflated. This pouch, by filling up the sac, kept the hernia reduced, and set up adhesive inflammation, which was followed by the complete obliteration of the hernial opening. For this operation, which is rather difficult of execution, M. Belmas substituted an analogous but much more simple one. He used gelatine threads in place of the pouch of gold-beater's skin, the presence of which suffices to inflame the sac ; the threads then become absorbed, and the adhesions remaining, the obliteration was complete. Out of ten operations, five were successful, three were partially successful, and two were failures.

M. Gerdy's operation (Pl. LXV., figs. 1, 2, & 3).—This operation is only applicable to inguinal hernia. It consists in obliterating the opening with an organic plug formed out of the skin which covers the hernia, and fixed with sutures. The operator pushes up the skin of the scrotum into the ring and into the inguinal canal with the index finger of his left hand (fig. 1) ; while, with his right hand, he takes a particular kind of needle-carrier, and passes it over the finger which keeps the

skin pushed up into the inguinal canal. The point of the needle is carried up as far as the bottom of the cul-de-sac, and then a see-saw movement is given to the instrument in order to make it appear through the skin of the abdomen. The loop is entrusted to an assistant, and the needle is then withdrawn. A second puncture is now made below the first (fig. 2), and the second head of the coil of thread, *c*, is disengaged from the needle, which is withdrawn.

A double thread fixes in the highest part of the inguinal canal the organic plug formed by the skin of the scrotum pushed up, like the finger of a glove, into the hernial opening. The whole is fastened by tying the heads of the double thread over the ends of a gum elastic sound (fig. 3).

In order to effect the obliteration of the cutaneous sac, pushed up into the inguinal canal, M. Gerdy introduces into it a pencil dipped in ammonia, so as to inflame and produce adhesion of the epidermic walls of the cul-de-sac. Simple dressing is then applied, and the patient keeps his bed for two or three months. One of the dangers of this operation is the wounding of the peritoneum. Some patients have died from the operation.

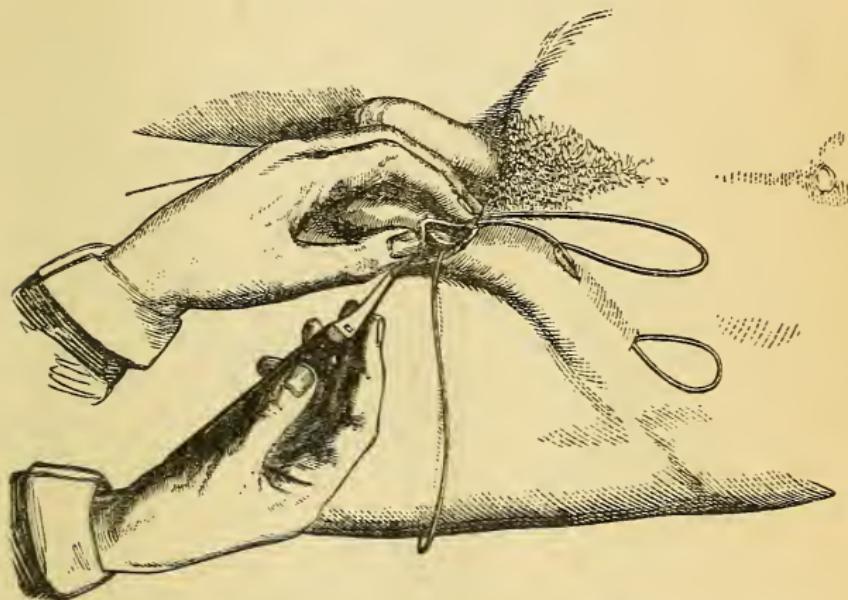
The operation performed by M. Bonnet, of Lyons (Pl. LXV. figs. 4, 5, & 6).—The obliteration of the sac is effected by passing pins through its walls. Having reduced the hernia, he seizes the root of the sac, and raises the spermatic cord between his two fingers. One pin, provided with a small cork head or button, is passed beneath the cord. The point of the pin is then furnished with another cork head, and is bent round so as to hold the parts tight between the two cork buttons. A second pin is passed in the same manner above the cord. Inflammation is set up in about four hours' time. The pins are withdrawn on the sixth or twelfth day, and the obliteration of the sac is effected in the course of two or four months.

Injections of iodine have been tried by M. Velpeau, as well as scarifications of the sac.

*Wood's operation.**—An incision is made in the skin of the

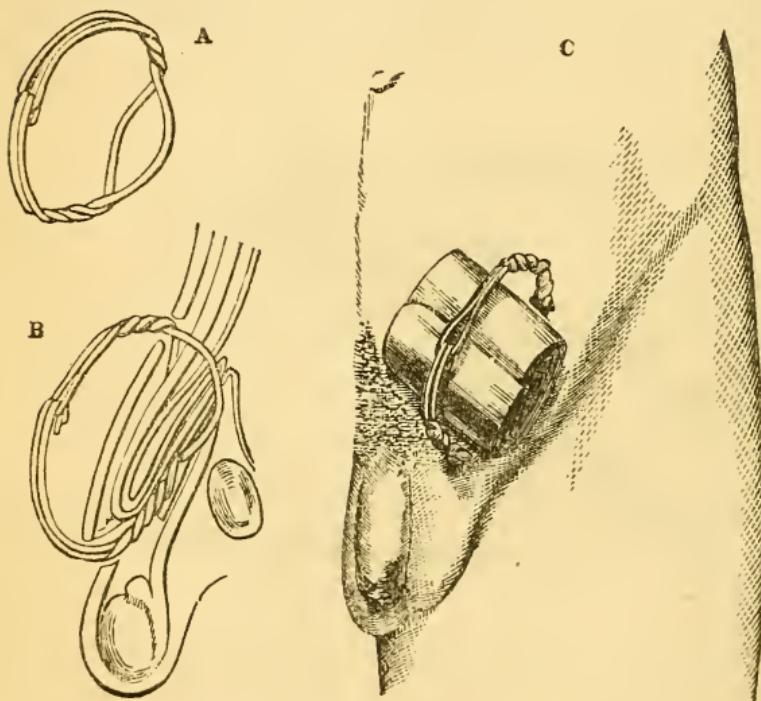
* Plates from the Jacksonian Prize Essay on Rupture. By John Wood, F.R.S., Professor of Clinical Surgery, King's College.

scrotum, about $1\frac{1}{2}$ inch in length obliquely downwards and outwards over the fundus of the sac. The integument is then raised from the subjacent fascia, for an area of about two inches in diameter. The detached fascia is now invaginated in the inguinal canal, as high up as the internal abdominal ring, by means of the forefinger of the operator. The forefinger which is supporting the invaginated fascia raises the lower border of the internal oblique muscle and conjoined tendon, and in front of them the inner pillar of the superficial ring; the needle being passed along the finger behind and



through the conjoined tendon and internal pillar, the skin is next drawn inwards, and the needle pushed through it, so that the aperture in the skin is somewhat external to that in the conjoined tendon. One end of a piece of stout *copper wire, silvered*, about two feet in length, is then engaged in the needle and drawn through to the scrotal wound. The needle being disengaged from the wire, is passed along the outer side of the forefinger, nearly as high up as the internal abdominal ring; it is then pushed through the external pillar of the external ring, that is to say, through the aponeurosis, close to Poupart's ligament, and, by drawing the skin outwards to

meet it, brought out through the same cutaneous opening. Here the other end of the wire is engaged, and the needle again withdrawn, so that a loop of the wire then appears in the single cutaneous aperture, and the two ends of the wire in the scrotal wound, one perforating the conjoined tendon, the inner pillar of the ring, and the invaginated fascia, the other perforating the external pillar of the ring and the invaginated fascia.



The sac of the hernia and the fascia covering it opposite the scrotal aperture is now to be pinched up between the finger and thumb, and the spermatic cord is slipped back from their grasp. The needle is then passed from without inwards, and a little upwards in front of the spermatic cord, so as to include the sac, and all structures in front of the cord (fig., p. 279). Either end of the wire is then engaged in the needle and drawn

through, either puncturing the sac, or, if possible, passing altogether behind it. The loop above should be twisted, and the two free ends below should be twisted several times, so as to contract the space enclosed within the wires, *A* and *B*; (fig., p. 280); and lastly, a pad of bandage being placed over the spot, the twisted ends are passed through the loop and drawn over the pad, and a spica bandage is applied over all, so as to press firmly upon the wire, *C*.

Mr. Wood records 235 cases operated upon, of which sixty-five per cent were radically cured. Of the earlier cases three died from hospital causes, pyæmia and erysipelas, but since adopting the use of wire no deaths have resulted.

Remarks.—All the operations that have been tried up to the present day, with the view of radically curing hernias, are far from being free from danger; the advantages to be gained do not compensate for the risk and the dangers incurred in performing them. Further, they aim at obliterating the sac without strengthening the abdominal wall, and therefore, if successful, they effect only a temporary cure. Now considering that an indolent hernia is not attended with any imminent peril, the prudent surgeon will decline performing operations that are frequently unsuccessful, and often fatal. On the other hand, experience shows that compression, practised in a methodical manner by means of a bandage, in many cases effects a radical cure. M. Malgaignie has seen an inguinal hernia cured in an old man of seventy-six years of age, by completely obliterating the inguinal canal by means of simple compression alone. The records of this kind of cure are sufficiently numerous to encourage the exclusive adoption of a method which is not attended with any inconveniences.

GENERAL STUDY OF HERNIAS.

The following remarks apply to inguinal, crural, and umbilical hernias only:—

Every hernia presents for consideration : (1) the protruding parts; and (2) the coverings of these parts or hernial sac.

The *omentum* and the *small intestine* form the majority of

hernias which enter the inguinal canal, the crural canal, or the umbilicus.

If the bowel alone is displaced (*enterocele*), the hernia forms a rounded tumour of variable consistence, according as the bowel is full or empty. It is elastic, tympanitic on percussion when the gut is full of gas, more or less soft when it is full of fecal matter.

When the hernial tumour is composed of the omentum (*epiplocele*) alone, it is soft, doughy, and unequal on pressure. This kind of hernia is not often attended with symptoms in the region of the digestive passages as is the case in hernias of the bowel. Lastly, the tumour sometimes consists of both bowel and omentum (*entero-epiplocele*).

We have already noticed (Plates LXIII. and LXIV.) the formation of hernias and the different anatomical layers that form its envelope.

The true *sac* then consists of those layers folded over the displaced parts. The number and nature of the different coverings vary according to the seat of the hernia; while the whole of the sac undergoes certain structural changes according as the hernia is recent or old. The various layers which constitute the whole of a hernial sac have been already described seriatim; but it is of some importance to recognize them when the hernia has lasted for a considerable time. The different parts are glued together by the inflammatory process, and form one dense hard whole, in which two parts only can be distinguished—the *neck of the sac*, or the portion embraced by the abdominal opening, and the body of the sac, which constitutes its most developed portion. Inside the sac is formed by a serous membrane, the peritoneum, which is smooth in appearance, and is sometimes filled with serum. Externally the sac is more or less confounded with the subcutaneous cellular tissue. In time hernial sacs may undergo changes of such a nature as to embarrass the operator. They may be thickened, ruptured, and full of serum; they may be adherent to surrounding parts; and their walls may be the seat of cysts.

Hernias are *reducible* or *irreducible* and *strangulated* with

or without adhesions. A hernia is reducible when it is easy to push the displaced organs back into the abdomen. In this case the neck of the hernial sac is sufficiently large to admit of the return of either the bowel or the omentum, which do not then contract any adhesions either with the neck or with the bottom of the sac. Hereafter we shall study the operative measures (*taxis*) by which hernias are reduced.

Irreducible hernia is that in which the sac or the neck of the sac have contracted adhesion with the protruded organs.

OBSTRUCTION.

When fecal matters collect in a coil of protruded bowel and distend it, the hernia is said to be *obstructed*. Obstruction is very apt to occur in old men, and when hernias are old and much dilated. Obstructed hernias are very painful; and to the touch they closely resemble a fatty tumour. The *taxis* will generally succeed in reducing them; but when the obstruction is persistent, and the hernia remains for a long time irreducible, it may then end in actual strangulation.

STRANGULATION.

A hernia is said to be strangulated when the opening through which it passes is too tight or narrow to admit of its reduction, and when the protruded part is inflamed. This inflammation, which is the result of the strangulation, becomes itself a cause of constriction by increasing the volume of the parts involved in the hernia. Then follows a secretion of fluid, with adhesion to the neck and in the interior of the sac. The inflammatory process may take its usual course, and may terminate in mortification of the hernia. Before, however, this takes place, the surface of the bowel always presents a smooth appearance, with a violet tint occasioned by a stagnation of venous blood. Later on, this colour turns blackish, and, when the mortification has commenced, of a grey ashy colour, with fibrinous deposits.

SEAT OF THE STRANGULATION.

Richter thought that the seat of the strangulation was always

at the aponeurotic rings, and that a spasmodic contraction prevented the return of the parts concerned into the cavity of the abdomen. But since then a more attentive study of the morbid anatomy of hernias has shown that in the great majority of cases strangulation takes place at the neck of the sac. This last opinion is adopted by M. Malgaigne to the exclusion of any other. According to this surgeon, when actual strangulation has taken place, it is always found to be at the neck of the sac. Nevertheless, the aponeurotic rings are also a cause of strangulated hernias, a cause which does not exclude the constriction occasioned by the neck of the sac, except in recently-formed hernias, where the neck of the sac is not thickened.

It may happen that the neck causing the strangulation is free in the abdominal opening; and in that case, if the hernia is reducible, the strangulation may continue after the hernia has been returned into the cavity of the abdomen.

The neck of the sac and the aponeurotic rings are not the only causes of the strangulation. Bridles may be present in the interior of the sac, omental adhesions, etc., which may be of such a nature as to form constricting bands and to interrupt the passage of the contents of the bowel.

Diagnosis.—As strangulated hernia may necessitate the performance of a very serious operation, we shall briefly notice the principal symptoms that characterize the three periods of this accident.

1st period.—An irreducible swelling, not very large, and painful to the touch. Colicky pains radiate from the swelling to the abdomen. Emetation and vomiting of the contents of the stomach take place first, then vomiting of bilious, and, lastly, of fecal matter. Constipation, meteorism, and borborygmi, are also observed.

The duration of these symptoms may vary from an hour to several days.

2nd period.—A more or less abundant effusion of serum into the interior of the sac; inflammation, and more acute pain. The abdomen is painful on pressure, and flatulent croakings are more audible. Nausea and vomiting continue to increase;

the pulse is small and frequent; and the pinched appearance of the features indicate the extreme uneasiness of the patient.

3rd period.—The inflammation is at this stage succeeded by gangrene. The pain now ceases; the vomiting is replaced by hiccoughs; the body is covered with a cold perspiration, and the temperature declines to about 96°; the features undergo a change, and the face becomes livid; the pulse becomes small, thready, and intermittent; the voice is trembling; and the swelling assumes a reddish appearance, and often crepitates under the finger. The bowel may then return into the abdomen, and a rapid and fatal effusion of fluid takes place in the peritoneal cavity. At other times, the swelling ulcerates and bursts externally; in this case the open bowel remaining adherent to the external wound may give rise to an *accidental artificial anus*.

The symptoms above mentioned will enable us to form a differential diagnosis between a hernia that is simply obstructed and one that is strangulated. Whatever may happen, the surgeon should always try the *taxis* before resorting to the division of the stricture, especially if the strangulation is recent. But if the hernia is old and very painful, it is better not to increase the inflammation by unseasonable manœuvres, but to resort at once to an operation which, if put off, may be no longer serviceable.

TREATMENT OF HERNIAS.

The treatment of simple hernia is either palliative or curative.

The palliative treatment consists in preventing any accidents occurring, by keeping the hernia reduced by means of a bandage.

The object of the curative treatment is to radically remove the condition.

Another chapter will be devoted to the consideration of the different plans and operations (*taxis* and *kelotomy*) which are called for by the accidents to which hernias are exposed.

Trusses.—The application of a truss keeps the parts reduced, and thus prevents the accidents with which hernias may be

complicated, such as irreducibility, obstruction, strangulation, etc. Trusses may also, under certain conditions with regard to the age of the patient and the character of the hernia, be the means of effecting a radical cure.

It is therefore of importance to duly recognize what their size and form should be, in order to derive the greatest possible benefit from them. The only trusses now used consist of a steel band, well lined, covered with wash-leather, and terminating in a fixed or movable cushion, and of a shape that is most suited to the nature of the case. Formerly a soft kind of truss was in use, made of leather, cloth, or some other non-metallic substance. These trusses were fixed on by a soft girdle, while a spring fastened to the cushion kept up the necessary degree of pressure.

The cushion of the truss should be made of rather soft material; but sometimes it is made of wood, ivory, india-rubber, spring-pads, water-pads, air-pads, etc. The union of the spring or the body of the truss to the cushion is called its neck. On the plate which supports the cushion there are hooks or buttons, to which is fixed the leather strap which completes the girdle. A strap, made of leather or cloth, is fixed to the posterior part of the truss, and runs from behind forwards, along the fold of the thigh, to be attached to one of the hooks belonging to the cushion-plate. This strap keeps the truss in position, and prevents it mounting up. There are also double hernial trusses of different shapes.

The conditions of a good truss are: that it is fitted to the stature of the patient; that it keeps up a gentle and constant pressure upon the aponeurotic opening without causing any inconvenience.

Application of the truss.—Make the patient lie on his back and pass the truss round his pelvis. Then, having reduced the hernia, keep up the reduction by applying one hand over the inguinal or crural ring, while the cushion of the truss is adjusted to this spot, and fixed there by fastening the strap, which is continuous with the spring, to the hook or button that is fixed to the plate of the cushion. Lastly, pass under and fix the thigh-piece. The patient should then stand up,

walk a few paces, and move the body in different positions, so as to see whether the truss fits well to the hernia.

When the truss is applied to a crural hernia, the cushion should be carried below Poupart's ligament. M. Malgaigne thinks that movable cushions have, in a certain number of cases, an advantage over fixed cushions; that in oblique inguinal hernia the cushion should press over the course of the canal and over the internal opening, resting very little or not at all upon the pubis, according to the nature of the case; that in direct hernias the cushion should be more voluminous, fixed, and adjusted to the pubis; and that hard cushions are more useful for maintaining pressure upon the canal, and soft cushions for direct hernias.

REDUCTION OF HERNIAS.

Taxis.—By *taxis* is meant a series of manœuvres by which the surgeon is enabled to return the displaced parts into the cavity of the abdomen. It is by manual assistance, applied directly to the swelling, that the reduction of the hernia is effected by means of this operation.

Position of the Patient.—The best position is that in which the abdominal muscles are completely relaxed. Let the patient, therefore, lie on his back with his head and shoulders raised on pillows. The pelvis should also be raised in such a manner that the patient's back, being in a declivitous position, the swelling is a little above the level of the abdominal cavity. In this position, the bowels will not exert any pressure upon the ring through which the hernia has to pass. Lastly, raise the thighs and flex the legs upon them.

General rules.—Before describing the different manœuvres especially adapted to this reduction of particular hernias, the attention of the reader may be drawn to the general rules which, according to M. Malgaigne, it is necessary to observe in the great majority of cases—1. Draw off the urine in order to increase by so much the capacity of the abdominal cavity. 2. Make the patient breathe freely without screaming or moving his head—a movement which he is very apt to make for the sake of watching the operation—in short, he must

make no effort of any kind. 3. Make at first gentle pressure so as to be able to increase it gradually, and to continue it for a long time without bruising the hernia. 4. Return those parts first which were the first to be protruded. 5. Take care that the protruded parts are returned by the same channel as that through which they were protruded. Thus, in recent inguinal hernias, the bowel should be at first pressed directly backwards in order to pass the first ring, then backwards, upwards, and especially outwards, in accordance with the course of the canal ; and, lastly, from before backwards again, when it may be presumed to have arrived at the second ring. In congenital or old hernias it is enough to press the parts backwards and a little upwards. 6. And lastly, in certain exceptional cases, these rules do not hold good; and patients have themselves a method of procedure which it is as well to follow.

OPERATION.

The surgeon places himself on the right of the patient, and takes hold of the base of the tumour in such a manner as to distribute equally the fecal or gaseous contents of the hernia. This manœuvre, by making gentle pressure over the abdominal ring, should have the effect of pushing *en masse* the contents of the bowel towards the seat of strangulation ; but the reduction would be impossible if the operator did not at the same time take care to seize the pedicle of the hernia with the view of concentrating and contracting the passage of the contents of the hernia in the direction of the ring. This last manœuvre, by preventing the hernia being crushed against the ring, allows of its being drawn outwards, and of its being gradually returned by the channel through which it passed.

Equal pressure should be made upon all points of the swelling by applying the fingers uniformly over its surface.

With the view of assisting the reduction, the patient may be recommended not to breathe so as to paralyse the action of the diaphragm upon the viscera. The application of cupping glasses to the abdomen has also been suggested for the purpose of dragging up the protruded bowel.

It is very difficult in an operation of this kind to adopt one method exclusively. The attempts that are made to reduce a hernia always admit of the simultaneous or successive adoption of the different methods of reduction described by authors. The great point is to return the hernia by the same channel through which it was protruded. When the reduction takes place, the hernia may gradually diminish in volume and in hardness, and then pass back all at once. Sudden reduction, which is usually accompanied by a gurgling noise, is a sign of an intestinal hernia. A hernia of the omentum is generally reduced without any noise, and in a more gradual manner.

DURATION OF THE TAXIS.

If the taxis be too prolonged, it may compromise the success of the operation for the division of the stricture which may be rendered necessary in consequence of the failure of the attempts made to reduce the hernia. M. Amussat, on the other hand, is in favour of the taxis being prolonged and complete. This question, however, cannot be absolutely decided from *à priori* consideration. The surgeon, therefore, must draw from the peculiar circumstance of each case the indications which should regulate his conduct in this respect.

PLATE LXVI.

OPERATION FOR DIVISION OF THE STRICTURE
(KELOTOMY).

Fig. 1.—A fold of skin is raised over the tumour, transversely to the axis of the groin. This fold of skin is held on the inside by an assistant, and on the outside by the left hand of the operator, who, with his right hand, cautiously makes an incision into the fold. The incision may be made from within outwards, by plunging the instrument, with its sharp edge upwards, into the base of the fold.

Fig. 2.—The above incision (fig. 1) has merely involved the skin and the subcutaneous cellular tissue. When the edges of the wound are separated, the swelling, *a*, is exposed enveloped in its several coverings, which are next divided layer by layer with the bistoury, *b*, guided over a director, *c*.

Fig. 3.—Having divided in succession all the coverings of the hernia, the operator raises a fold of the hernial sac with a pair of forceps, *a*, and lays it open with the bistoury, *b*.

Fig. 4.—The hernia, *a*, is now exposed; *b*, omentum. A director, *c*, is inserted between the hernia and the seat stricture.

Fig. 5.—Division of the stricture.—The surgeon passes over a finger of his left hand either a hernia knife or a blunt-pointed bistoury, the blade of which has been partially covered with lint, and then proceeds to divide the stricture upwards and outwards.

Fig. 6.—M. Vidal's plan.—According to this method the operator presses the bistoury over a fluted spatula, *a*.

DIVISION OF THE STRICTURE IN INGUNIAL
HERNIA.

The operation for division of the stricture in cases of strangled hernia was first proposed and described by Franco in 1561. Adopted and practised at a later period by Ambrose Paré, it was perfected and described as an established operation by Dionis.

Fig. 1.

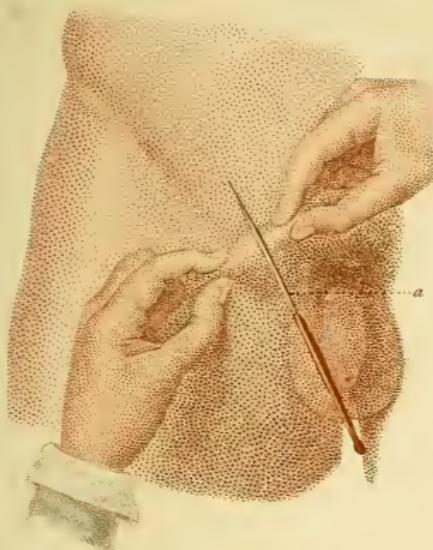


Fig. 2.

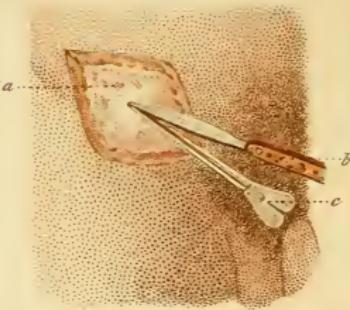


Fig. 3.



Fig. 5.

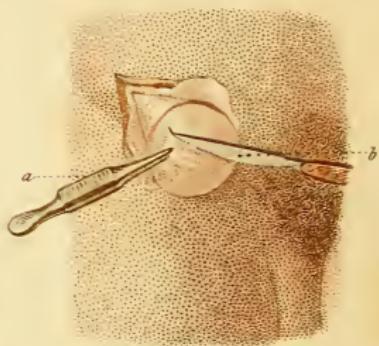


Fig. 6.

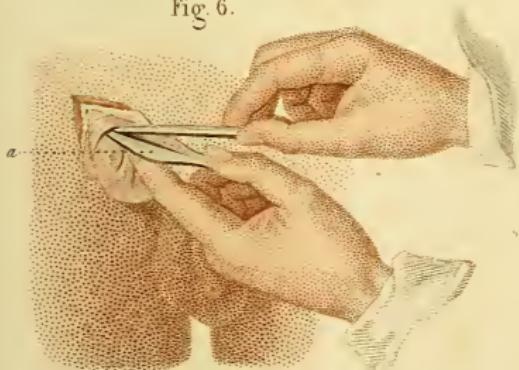
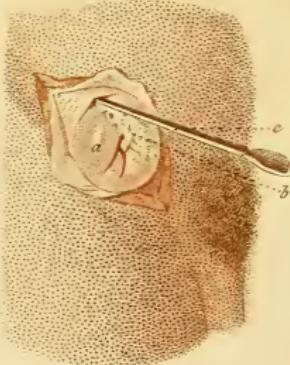


Fig. 4.



The *instruments* required for this operation are—an ordinary straight bistoury or scalpel, the hernial knife of Pott or A. Cooper, also a director, a pair of scissors, a pair of mouse-toothed forceps, and one or two pairs of dissecting forceps. Several fine sponges should likewise be at hand to absorb the blood during the operation. Lastly, several pieces of dressing, lint, bandages, etc., should be provided.

The *position of the patient* should be such as to completely relax the abdominal muscles. He should, therefore, be placed horizontally on a couch, with his thighs half flexed, his legs flexed upon the thighs, and his shoulders slightly raised upon a pillow. The part to be operated upon should be shaved if necessary. The operator should stand on the hernia side of the patient, with his assistants near him on the opposite side, to hand the instruments, stanch the blood with sponges, and take any other part in the operation that circumstances may render desirable.

As the object of this operation is to remove the strangulation by dividing the stricture which causes it, it naturally consists of several principal steps in which the surgeon divides in succession first, the skin; second, the subcutaneous coverings of the hernia; third, the hernial sac; fourth, the stricture itself; while the reduction of the bowel constitutes the fifth and last step in the operation.

First Step.—Incision of the skin (Plate LXVI., fig. 1).—The incision should be made in the long axis of the tumour, and to an extent proportionate to the size of the hernia. It may be made from within outwards, or from without inwards; and when the skin is intimately connected with the coverings of the hernia, and cannot be raised into a fold between the fingers, the incision should be made very cautiously. The essential point is not to wound the bowel. When the skin is soft, not much adherent to the subjacent parts, it is best to raise up a fold of skin over the tumour. The operator, holding one end of this fold, while an assistant holds the other, makes an incision into it from within outwards, or *vice versa*, by plunging into its base a bistoury with the blade held upwards. This incision divides the skin only; it should extend nearly $\frac{1}{2}$ an

inch above the swelling. It is sometimes advisable to make a crucial or T-shaped incision.

This first step in the operation is generally followed by a little haemorrhage from some of the superficial vessels, which it is as well to arrest before continuing the operation by torsion of the bleeding vessels, or the application of cold water.

Second Step.—Division of the subcutaneous coverings of the sac.—This step of the operation must be performed with great caution. Some surgeons make a direct incision from without inwards by passing over the surface of the tumour the sharp edge of a bistoury held like a fiddle-stick. The safer method, however, is to raise with a pair of forceps the membranous coverings of the hernia, and then to perforate separately each fold seized by the forceps. Through the small opening thus made a director should be inserted beneath the layer as far as each extremity of the tumour, while with a bistoury guided by the director, and with its sharp edge upwards, the surgeon divides one by one the coverings of the hernia as far as the sac. The number of the coverings of the sac is variable, and we have already enumerated and described them when treating of the surgical anatomy of inguinal and crural hernia. But the age of a hernia, the duration of the strangulation, so much modify its relations to the parts around and the nature of its coverings, that its normal anatomy is no guide in cases of this kind, while it is often extremely difficult to recognize the sac in the midst of the abnormal structures produced by the disease. Serous cysts, lumps of fat, suppurating glands, an old sac, etc., may obscure the operation and make the most experienced hand perilously uncertain.

Nevertheless, there are some signs by which the sac may be recognized. These are, a smooth and glistening surface, a spherical shape, fluctuation from the presence of serum, the omentum or the bowel seen through its transparency, etc.

Third Step.—Opening of the sac (fig. 3).—The sac when once recognized should be cautiously opened so as not to wound the bowel. A fold of the sac should therefore be taken up with a pair of mouse-toothed forceps between the convolutions

of the bowel if seen through the transparent sac—an operation which is generally facilitated by the presence of the serum which bathes and distends the inside of the sac. An incision should then be made into the fold close to the forceps in order to make an opening into which a director can be inserted. Guided by the director, the sac is then to be opened both above and below to a sufficient extent, but it is an object to expose the bowel as little as possible. This opening of the sac should be effected as much as possible in front of it, and a little to the outside. It is of the utmost importance to make certain that the sac is really entered. The escape of a certain quantity of serum after the sac has been opened; the facility with which the interior of the sac can be explored, either with the finger or the director (provided, of course, there are no adhesions between it and the bowel); the fact of the bowel or the omentum freely floating, and not being adherent to anything except the seat of the stricture,—all these signs combined will scarcely leave any doubt as to the nature of the pouch or sac which has been opened. We may add, however, that some hernias (hernia of the cæcum, for example) have no sac. Should this embarrassing peculiarity present itself, which is very rarely the case, the bowel may always be readily recognized by the structure of its coats.

Generally speaking, the bowel appears of a variable colour, according to the time that has elapsed since the commencement of the strangulation. Its surface is vascular, of a more or less deep, reddish-brown, or even black colour, and perhaps masked in some places by a layer of plastic lymph. The omentum may be easily unfolded when there are no adhesions. Figs. 4, 5, & 6 represent a coil of protruded bowel after the opening of the sac.

Fourth Step.—The division of the stricture.—Before proceeding to divide the stricture, the neck of the sac should be explored with the finger, and gentle traction made upon the protruded bowel, with the view of reducing it, if possible, without dividing the stricture.

Having discovered the seat of strangulation, and that the

stricture must be divided, the operation may be accomplished in two ways: first, by dividing the stricture to a sufficient extent, and on the side where there is no occasion to fear the presence of any blood-vessels; second, by making several incisions at different points of the seat of stricture,—a mode of procedure that has been methodized by M. Vidal.

The division should be made with a hernia knife; the sharp edge of the instrument should be inserted beneath the stricture, being passed along the index finger, or over a director (figs. 5 & 6). When there is no room for the insertion of the finger, the director must be used; but if the nail can be introduced beneath the constricting band, the bistoury should be passed over the finger, first in a flat or horizontal position, and then by raising the sharp edge upwards, and at the same time pushing the back of the instrument with the finger on which it rests, the division of the stricture is accomplished. Afterwards the index finger may be passed in more deeply, so that it may be possible to carry the division a little further. During the operation the assistants should not only keep the edges of the wound apart, but keep the viscera out of the way, as by getting over the blade of the instrument they may be wounded, or obstruct the operation.

M. Vidal has proposed the use of a fluted spatula instead of an ordinary director, and which is particularly useful when it is impossible to follow with the eye the track of the bistoury. The end of the spatula is first passed between the protruded part and the part strangulating it. The fluted surface is turned upwards, or looks towards the point that is to be divided. Along this surface the bistoury is passed in a flat or horizontal position, so that its edge can do no harm. To make the division, the bistoury must be turned on its axis in such a manner as to raise upwards the sharp edge, which should divide the stricture as much by scraping as by cutting it. The spatula protects the bowel from the edge of the knife, and keeps it out of the way.

In England a hernia director is employed having the form of a spatula, and the breadth of nearly $\frac{1}{2}$ an inch.

We have already remarked that an attempt at reduction

should be made before resorting to an operation for the division of the stricture ; but it should not be forgotten that the seat of strangulation is more often at the neck of the sac than at the aponeurotic ring. In certain cases, therefore, the hernia may be returned along with the sac, reduced *en masse*, a circumstance which would of course involve the continuance of the strangulation after the reduction of the hernia. Consequently, the surgeon should be sure about the precise seat of the stricture. Nor should it be forgotten that some hernial sacs have multiple necks, and that the seat of strangulation may be very extensive, and may reach as far as the upper ring of the inguinal canal. It is only by repeated explorations and divisions of strictures that the operator will be able to discover the difficulties that may be encountered in operations of this kind.

There is a difference of opinion amongst authors as to the direction, and the extent to which the division should be carried. When the seat of the strangulation is at the external ring, and when the neck of the sac can be drawn out of the canal, the division is easy of execution, and there is no risk of wounding the epigastric artery. But when the stricture is more deeply situated, the impossibility of knowing whether the hernia is internal or external should induce the surgeon to act cautiously.

The reader should refer back to Plates LV., LVI., & LIX., for a description of the more important anatomical relations of the parts concerned in the production of hernias. The division of the stricture in an upward direction is less dangerous as respects the viscera that have to be avoided : and by not carrying the incision beyond $\frac{1}{6}$ of an inch in extent, there is no risk of wounding the artery. In the case of external hernias, the division outwards allows of its being safely carried to a greater extent, and in proportion to the volume of the displaced viscera. For this reason it will be often advisable to have recourse to the multiple division recommended by M. Vidal.

Multiple division.—Where it is necessary to enlarge the abdominal opening, and with the view of avoiding such an

extensive incision as would incur the risk of haemorrhage, M. Vidal proposes three, four, or even a greater number of incisions of $\frac{1}{2}$ to $\frac{1}{3}$ of an inch in length.

M. Malgaigne's operation.—M. Malgaigne does not make the first incision over the sac and the scrotum, but over the apparent seat of strangulation, prolonging the incision upwards and downwards to such an extent as the obesity of the patient and the volume of the hernia may render advisable. All the tissues are divided as far as the peritoneum, and in this way he has nothing to fear from the presence of blood-vessels, which are kept under the eye, or removed out of the way. If the strangulation is found to arise from the constriction of a fibrous aperture, the sac itself is not touched, and the hernia is reduced. Otherwise he divides the neck by small incisions from without inwards; or if the stricture appears very tight, he makes a small incision in the peritoneum, either above or below the neck of the sac, and raises the latter with a director on which the neck is divided.

According to M. Malgaigne, the advantage of this plan over all others is, that the operator can see what he is doing; in the second place, the seat of strangulation is reached by the shortest route, and by the fewest possible incisions; and thirdly, the scrotum and the sac are more protected, and the surgeon has not afterwards to trouble himself about the suppuration and cicatrization of a wound that has been more or less useless. In illustration of his method, M. Malgaigne cites a case of scrotal hernia of large size. Its neck was situated on a level with the abdominal ring; the neck of the sac was opened; the sac for a few days became full of fluid, the absorption of which took place as fast as the inflammation of the wound above subsided; and a cure was effected without any accidents (*Malgaigne Medecine Operatoire*).

Fifth step.—Reduction.—In the case of an intestinal hernia, and when the bowel is sound, draw the latter out a little, divide any slight adhesions that may be present, raise the buttock so as to allow the intestines to drag back from the sac, press gently inwards the gas distending the bowel, and finally reduce it bit by bit, returning first the parts that are nearest the ring.

When the bowel is also accompanied by a portion of omentum, the latter should be returned last of all. When a part of the bowel has become gangrenous, the indications for treatment will vary according to the extent of the mischief. If there is any doubt as to the existence of gangrene, M. Vidal recommends a very slight and superficial incision to be made over the diseased portion of bowel. If the circulation is still active, a large drop of blood collects on the little wound, if on the other hand the bowel is gangrenous, the surface of the wound remains dry : in the first case the part may be reduced, in the second it should not. Where there is any doubt, the diseased part should be kept on a level with the ring ; and should it be gangrenous, the fecal matters will find their way through the abdominal opening.

It sometimes happens that in making the small incisions above mentioned, the bowel is perforated by the bistoury. In that case the surgeon must have recourse to one of the operations already described (*Wounds of the Bowels*), according to the nature and extent of the wound. Lastly, when the bowel is gangrenous to a great extent, the two sound portions or ends of the bowel must be fastened to the ring, to facilitate the passage of the faeces through the upper end and through the abdominal opening, by which means an artificial anus will be established, and slowly heal. Perhaps, too, it might be possible to excise the gangrenous part, to unite the sound parts by suture, by one of the operations described, and then to reduce the bowel.

Whenever it is necessary to establish an artificial anus great care must be taken to preserve the adhesions which unite the end of the bowel to the neck of the sac. The destruction of these adhesions will expose the bowel to the accident of returning into the cavity of the abdomen. If the stricture should prevent the fecal matters from freely escaping outside, a small female speculum might be introduced into the upper end of the bowel, and if this procedure is impossible, or attended with too much danger as respects the integrity of the adhesions, the sac may be cautiously divided on the outside.

The treatment of a gangrenous condition of the omentum

depends upon its extent and volume. When the gangrenous portion is pretty extensive, unfold the omentum, cut off all the diseased portion, tie one by one the bleeding vessels, and confine the sound parts, tied as above, to the opening of the ring.

Dressings.—Having well cleaned the depths and the edges of the wound, the latter should be approximated by sutures, and an antiseptic dressing, with a pad of lint and a spica bandage, applied; but if it has been found necessary to establish an artificial anus, the wound must be left open, and a charcoal poultice applied.

CRURAL HERNIA.

The detailed description (pp. 267, *et seq.*), and the illustrations (Plates LX., LXI., & LXIV.) that have been given of crural hernia will be sufficient to show its anatomical relations. When the extra-peritoneal portion of the cæcum and the sigmoid flexure of the colon is the part protruded, the hernia so formed has no sac. But not counting these exceptional cases, crural hernia is composed of much the same elements as inguinal hernia. The direction it takes is, first, downwards into the sheath of the femoral vessels, then through the layer of cribriform fascia; afterwards it takes another direction, and ascends towards the abdomen, under the skin, and the layers of subcutaneous cellular tissue. If the hernia be of large size, it is on a level with the opening of the cribriform fascia that the neck of the sac is formed; and there also is the seat of strangulation, which takes place at the aponeurotic ring of the cribriform fascia. But usually the stricture is situated at the upper opening of the canal, the crural ring, or in the canal, the neck itself being in the latter case the seat of strangulation.

The remarks that have been made on the taxis in cases of inguinal hernia are also applicable to the hernias now under consideration. It will be sufficient to observe that in returning the protruded parts they should be made to follow, inversely, the circuitous course above described.

OPERATION.

One great aim of the operator is to reduce the hernia without opening the sac. This can only be accomplished when the constriction is not constituted by the neck of the sac. If, therefore, the hernia has not descended on any previous occasion, the neck of the sac will assuredly not be the constriction. And again, if the knuckle of intestine constricted is small, which is the case in the majority of femoral hernias, it is not likely to be the neck of the sac which prevents its return. In all such cases an attempt to reduce the hernia without opening the sac should be made, unless the length of time since the strangulation took place or the symptoms shown by the patient give rise to the opinion that the bowel is gangrenous, and not in a fit state to be returned into the abdomen.

The most convenient incision is one commencing about $\frac{1}{2}$ an inch above the spine of the pubes and carried downwards, in the course of the tumour—somewhat on its inner side—to a sufficient length, according to its size. As the different coverings of the hernia are by no means thick, they must be cautiously divided; and it is often impossible to raise a fold of skin from the tumour. The *fascia propria* enveloping the sac is very thin, and may be mistaken for the sac itself—an error easy to fall into, from the fact that fatty masses folded over the sac, and seen through the transparent fascia, may be mistaken for the omentum, whilst the fascia itself is easily separated from the tissue around, and when so separated presents a ball-like appearance, much in character like the hernial sac. Having determined that the layer under observation is the fascia propria, it should not be separated from the tissue around, for by so doing it is rendered liable to slough; but it should be laid open on a director throughout its length, and thus the subperitoneal fat and cellular tissue is brought into view. The subperitoneal layer is often a mere film of connective tissue; but in fat persons, and in persons in whom the hernia has long existed, it presents important and often perplexing variations. If this covering be simply a connecting lamina, the sac is plainly visible; but if

containing fat, it may have increased to a thickness of a quarter or half an inch, or even more, and may possibly also contain a number of small serous cysts, each one of which may, when first seen, present the appearance of the sac containing fluid. This loose tissue should be cautiously divided until the sac of the hernia is exposed.

The rest of the operation differs only as to whether or not it has been determined to open the sac. If not, then the finger nail may be carried along the inner side of the sac to Gimbernat's ligament, beneath which it may be pushed to serve as a guide for the hernia knife. Gimbernat's ligament is then to be incised, together with the fibres of fascia propria, by cutting directly inwards, or inwards and upwards, from the hernia, one or two notches being made according to requirement. Now the hernia may be pressed upwards from the sac into the abdominal cavity, the sac itself being retained in its original position. Should it not be possible to empty the sac of the hernia, the rest of the operation may be proceeded with. The sac is to be cautiously raised by a pair of mouse-tooth forceps, and incised by the scalpel to an extent only sufficient to admit the director. The director then being inserted, the sac is to be laid open. Now in the same manner the index finger is to be passed along the inner side of the gut to the crural ring, and the hernia knife carried along the finger, or—if necessitated by the tightness of the constriction—along a hernia director, to incise the neck of the sac, together with the fascia propria and Gimbernat's ligament, as before described.

UMBILICAL HERNIA (OMPHALOCELE OR EXOMPHALUS).

Taxis and bandages.—These hernias may be easily reduced by taxis; and they are kept in place by particular kinds of bandages. In children it is usual to apply some discs of cork which are fastened by a bandage round the body.

A radical cure may be easily effected in young patients by means of simple compressions. Ligature of the sac has been also proposed. Practised with success by Desault and Dupuy-

tren, this plan has been condemned by Sabatier, Scarpa, and A. Cooper, who have taxed it with the production of convulsions in children and inflammation of the sac.

Kelotomy.—Umbilical hernia may be obstructed or strangulated, so that an operation is imperative. It must not be forgotten that the coverings of this hernia are very thin, and that the sac contains little or no fluid. The operation, therefore, is rather a delicate one. A + or T-shaped incision should be cautiously made; and as, in this kind of hernia, the neck of the sac is very rarely the seat of strangulation, some authors advise only the fibrous ring to be divided, without touching the sac, so as not to expose the peritoneum to subsequent inflammation. This recommendation is a good one, and should be followed when the hernia is large and when it is not necessary to examine the viscera. A longitudinal incision should be made in the median line, commencing an inch or more above the tumour; the nail may then be inserted between the tumour and the ring, the tumour being drawn well downwards, and the linea alba may be cautiously cut through towards the finger nail. Multiple division is preferable to a single division of the stricture; but if only one is made, its direction should be upwards and to the left, in order to avoid the remains of the urachus and the umbilical vessels.

PLATE LXVII.

ACCIDENTAL ARTIFICIAL ANUS.

Fig. 1.—Artificial anus opening inside by two orifices.—The upper end of the bowel, *a*, and the lower end, *b*, open into the bend of the groin, each by a cutaneous orifice, *d* and *e*; *c*, mesentery.

Fig. 2.—Artificial anus opening outside by one orifice.—*a*, upper end of the bowel; *b*, the lower end, terminating in a cul-de-sac; *c*, partition formed by the approximation of the walls of the two ends; *d*, external orifice of the upper end.

Fig. 3.—Diagrams showing the formation of the spur or partition.—*a*, the upper, and *b*, the lower end of the bowel; *c*, the partition or spur formed by the juxtaposition of the walls of the two ends; *e*, mesentery; *d*, external orifice of the upper end.

In this figure, the partition, *c*, descends as far as the external orifice, *d*, and prevents the faeces from passing into the lower end, *b*, directing them outside, as shown by the arrow.

Fig. 3 bis.—Diagram showing the formation of the membranous funnel.—The mesentery, by drawing inwards the spur or partition, *c*, leaves the passage from the upper to the lower end perfectly free. The space, *d*, intervening between the spur and the external orifice, has been described by Scarpa under the name of the *membranous funnel*.

Fig. 4.—The membranous funnel, after Scarpa.—*a*, peritoneum; *b*, upper end of the bowel; *c*, lower end; *d*, mesentery; *e*, partition; a probe, *g*, inserted through the cutaneous orifice into the membranous funnel; *f*, external wall of the funnel; *h*, *h*, anterior-superior spines of the ilium.

Fig. 5.—Application of Dupuytren's enterotrite.—The instrument, *a*, is introduced through the external wound and the partition or spur is seized between the teeth of the instrument.

Fig. 6.—Application of a circular enterotrite, a.

Fig. 1.



Fig. 5.

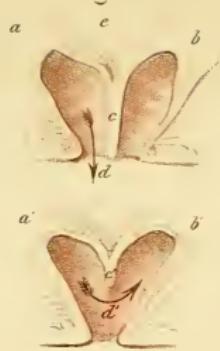


Fig. 2.



Fig. 4

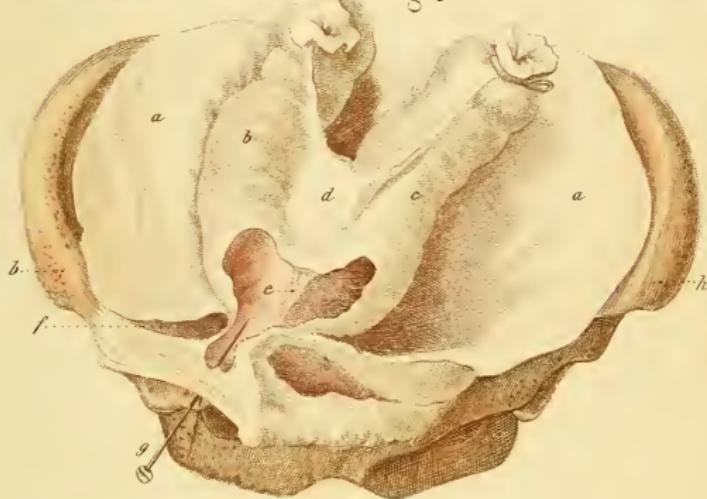


Fig. 5

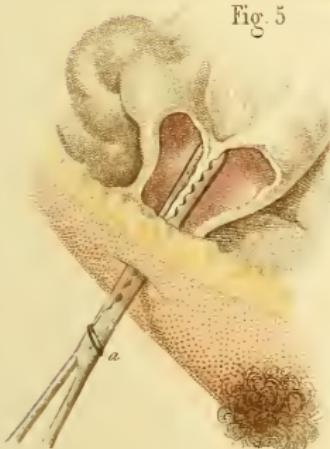
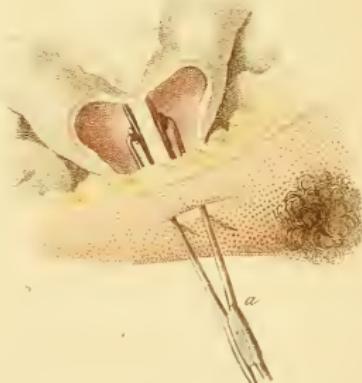


Fig. 6.



ACCIDENTAL ARTIFICIAL ANUS.

PATHOLOGICAL ANATOMY (Pl. LXVII.).

When treating of the accidents incidental to strangulated hernia, we stated that it may terminate in gangrene of the bowel, and the external discharge of the faeces through a fistulous wound situated within the fold of the groin. This solution of continuity gives rise to a permanent communication between the bowel and the outside of the body, giving passage to the contents of the bowel by another opening besides the natural one, and constituting an infirmity which is called an *accidental artificial anus*. We shall now notice the surgical operations which have been resorted to with the view of combating this infirmity, reserving for future consideration the operation for *artificial anus*.

It is of the greatest importance to understand the disposition of the ends of the bowel above and below the solutions of continuity ; as upon this disposition the curability of the affection depends. Sometimes the accidental anus is formed by a number of small openings more or less distant from the bowel ; sometimes the upper and lower ends of the bowel are supported one against the other, like the barrels of a double-barrelled gun, having a parallel direction, and opening externally by two separate apertures. Fig. 1 of Pl. LXVII. shows this disposition of the parts : *a*, the upper, and *b*, the lower end, *d* and *e*, the two external openings corresponding to the two ends of the bowel.

The upper end of the bowel may open externally by only one aperture (fig. 2, *d*), and the lower end may be supported by it, and at the same time be separated from it by the partition, *c*.

The partition or spur.—This disposition of the parts is brought about by the peculiar adjustment of the two ends of the bowel (fig. 3). Their walls, *e*, supported one against another, constitute a sort of valvular partition, which prevents the free passage of their contents from the upper, *a*, into the lower end, *b*. This partition has received the name of the spur.

Further on will be described the operations performed for the purpose of destroying this partition, and re-establishing a communication between one portion of the bowel and the other.

The membranous funnel.—The mesentery, in consequence of the tractions which it makes upon the bowel, has a constant tendency to drag it back into the abdomen, and to separate it from the abdominal wall. The spur, obeying this retrograde movement of the bowel, gets removed from the abdominal opening. The cellular tissue uniting the bowel to this opening gives way a little, and then there is formed beneath the spur a sort of hollow space (fig. 3 d'), through which the faeces pass, without being discharged externally, and without meeting with any obstacle from the presence of the spur. In this way the contents of the bowel have a free passage from the upper end, a', to the lower end, b', and the accidental anus undergoes a spontaneous cure.

Scarpa has given the name *membranous funnel* to this passage, which, being formed little by little, naturally and gradually effects the cure of these accidental anuses. Fig. 4 is a drawing after Scarpa of this membranous funnel.

It may happen also that the bowel is parallel to the abdominal wall, and that the wound in it is in juxtaposition with the abdominal wound, so that there is neither a spur nor a membranous funnel.

It will be seen from the above how important it is to recognize the dispositions of the two ends of the bowel. In fact this disposition must be the basis on which the surgeon should make his choice of the operation to be performed.

OPERATIONS.

Palliative treatment.—The object of this treatment is to regulate the evacuation of fecal matters, and to prevent any accidents arising from the obliteration of the abdominal opening. The dilatation of the opening and of the upper end of the bowel may be attained by means of charpie tents, seaweed susceptible of dilatation, fragments of prepared sponge, etc. Obturators

have also been designed, the form of which must vary according to circumstances. A plate of ivory or of wood may be used to support the edges of the wound, and may be pierced in its centre with an aperture which can be opened or closed at pleasure.

A communication may also be maintained between the two ends of the bowel by means of a large gum-elastic tube, one extremity of which is inserted in the upper end of the bowel, and the other in the lower end ; so that the fecal matters can pass through the tube from one end of the bowel to the other. It will be unnecessary to describe in detail all the apparatus that have been designed in order to lessen the inconvenience resulting from an artificial anus. All these half-measures but badly fulfil the object we have in view, and the distressing infirmity which they still leave exposed to serious dangers calls for operative measures of a curative nature.

Curative treatment.—Before attempting the obliteration of artificial anus, the surgeon should remove the complications by which this affection is frequently accompanied.

When the skin is riddled with holes they may at once be thrown into one. Sometimes there is prolapse of the bowel, and inversion of the mucous membrane, in which case the taxis should be applied, and the reduction effected by making methodical pressure from the summit to the base of the extrusion. Should the reduction of the bowel be impossible, an operation must be resorted to, dividing the abdominal opening by small multiple incisions from the skin towards the peritoneum.

When this first step in the treatment has been accomplished, the spur or partition above mentioned must be destroyed, with the view of facilitating the passage of the fæces from one end of the bowel to the other, as well as the obliteration of the external wound.

Destruction of the spur—Desault's operation.—This surgeon began the operation by dilating the two ends of the bowel with charpie tents, the size of which was gradually increased ; five days often elapsed before the dilatation was complete. He then introduced into the wound a conical plug, which, pushing back the spur in the direction of the abdominal

cavity, left the two ends of the bowel facing each other. When the fecal matters were able to pass freely from one end of the bowel to the other, gentle pressure, made over the external wound only, prevented the escape of the faeces externally, and gradually led to the cicatrization of the parts.

Desault also used an ebony holder to push back the spur. Both these proceedings may give rise to flatulence, colicky pains, the retention of the faeces, and other inconvenience.

With the view of not interrupting the passage of the contents of the bowel, M. Fayet, and afterwards M. Colombe, proposed to replace the plug and the ebony holder by a gum-elastic tube of large calibre. The body of the tube compresses the spur, while its extremities engaged within each end of the bowel allow of the free passage of the faeces. This operation was performed by M. Velpeau, but the patient died three days after from peritonitis.

Compression, however, is generally insufficient. It cannot be made in a methodical manner, for there is no power of support on the part of the abdominal wall, and as the spur is not placed between a medium of pressure and one of resistance, there is really no compression, and the spur is merely pushed back. If the pressure is increased, it then becomes dangerous, for the adhesions may be disturbed and even destroyed.

Enterotomy.—The object of this operation is to remove the spur altogether. Schmalkalden was the first to describe it in 1798. He passed a needle and thread through the base of the spur, and joining the two ends of the thread, he thus divided the spur by ligature.

Afterwards (in 1809), this operation was successfully performed by Physick.

M. Dupuytren's operation.—This surgeon made enterotomy an established operation. The danger of perforating the bowel with the needle induced him to bring about adhesion between the walls which by their approximation constituted the spur.

He made use of a particular kind of forceps called the enterotrite. He seized the spur between the teeth of the instru-

ment, and gradually compressed it, so as to make it mortify and fall off from the wall of the bowel.

The enterotrite is composed of two blades, which can be introduced separately, one into the upper, and the other into lower end of the bowel. The blades are then joined together, as in the case of the midwifery forceps. A screw serves to close the blades. The pressure made by the instrument secures in the first instance the adhesion of the adjoining walls of the bowel, and subsequently the division and separation of the compressed parts. The instrument is fixed by bandages to prevent its moving about or making painful traction upon the bowel. At the end of the seventh or eighth day the division is complete, and the enterotrite falls off of itself.

Delpech has proposed an enterotrite the ends of which are terminated by enlargements resembling one-half of a nut-shell. These forceps, much larger at their extremity than those of Dupuytren, are not easily applied.

M. Liotard has designed an enterotrite terminated by two oval rings, $1\frac{1}{2}$ inch in length by $\frac{3}{4}$ inch in width, and one of which, hollowed out by a fluting, receives a corresponding projection of the other. The two blades only meeting at their rings, the latter can be applied over the spur, and thus give passage to the faeces at a distance from the abdominal opening.

M. Jobert thinks the enterotrite should only be used for the purpose of securing adhesions. After forty-eight hours, by which time the adhesions have taken place, the instrument should be withdrawn, and when, in the course of a day or two, the adhesions have become more organized, the partition may be cut off with a pair of scissors without disturbing them.

Cauterization.—M. Vidal proposes to use caustics in place of the enterotrite. Each end of the forceps should contain a small hollow space which can be charged with the nitrate of silver, or, what is better, the Vienna paste. In this way the caustic cannot spread far; its action can be limited, and, at the same time, rapid, and nothing remains in the wound after the operation. The slough is gradually thrown off, and the ulceration left behind allows of the passage of fecal matter.

OBLITERATION OF THE EXTERNAL OPENING IN CASES OF ARTIFICIAL ANUS.

The spur or partition being destroyed, and a free communication between the two ends of the bowel having been established, the opening in the abdominal wall must be next obliterated. This obliteration is very difficult to accomplish.

Autoplastie has been tried by many surgeons, but without success. M. Velpeau practised excision, followed by sutures, upon a patient in 1835.

He thus describes the operation : " I included all the fistula in an ellipsis, with the view of excising it by a double half-moon-shaped incision, and so as not to interfere with the bowel, or, at least, its mucous membrane. I then put in four stitches, about two lines from each other, at the same time taking care that the middle portion of them did not reach as far as the cavity of the abdomen or the bowel. In the next place an incision, about two inches in length, and extending through the skin, the subcutaneous cellular tissue, and the aponeurosis of the external oblique, was made on each side from twelve to fifteen lines away from the wound. After the parts were well washed, I tied the threads, and placed a fold of lint in the lateral wounds."

By adopting this plan, and by paring down the fistula, M. Velpeau transforms it into a deep funnel-shaped aperture, the widest part of which is outside. By bringing together the edges of this opening, the bottom of it, which is the narrowest part, necessarily closes up before the edges of the external wound can be united. Such is really the case, and the closure of the wound in the bowel is rapidly effected. The lateral incisions maintain the skin in a relaxed state and permit of the lips of the wound being easily brought together.

M. Malgaigne's operation.—M. Malgaigne thinks that surgeons have not clearly recognized the chief cause of difficulty met with in closing certain abnormal anuses, while others become spontaneously obliterated. In the first case the bowel reaches as far as the cutaneous opening, its valves direct its fecal contents towards this opening, and the condition almost indispensable to the success of the cure is to

interrupt this communication
contrary direction. Her
M. Malgaigne has already
subject.

The operator begins
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—ING IN CASES

ANUS.

ed, and a free communication between the bowel having been made, the anal wall must be next closed, which is difficult to accomplish. It can be done by surgeons, but without difficulty, followed by suture,

which included all the fistulae. I then closed it by a double half-hitch, so as not to interfere with the rectal lumen. I then put in four other, at the same time, but none of them did not reach the rectal lumen or the bowel. In the

—d extend-

Fig. 2.



Fig. 7.



interrupt this continuity and to carry back the valves in a contrary direction. Hence the following operation, which M. Malgaigne has already successfully performed on the living subject.

The operator begins by paring the abnormal channel throughout its whole extent as far as the bowel, carefully separating the latter from its external adhesions, and remembering that these adhesions are very slight, and that by dividing them beyond a $\frac{1}{2}$ of an inch in extent there would be the risk of opening the peritoneum. He then, without paring them, turns the two edges of the bowel inwards, and unites them by suture, so as to bring them together by their external surface. In addition to this suture he closes up the soft parts of the skin with the twisted or quilled suture, at the same time taking great care to avoid any forcible traction of the parts. If he meets with a loss of substance he would have recourse to autoplastie. In short, the essential point consists in isolating the bowel, to fold inwards its two edges or lips, and to close the external wound over it.

PLATE LXVIII.

OPERATION FOR ARTIFICIAL ANUS.

ANATOMY.

Fig. 1.—The anterior abdominal wall and the bulk of the small intestine have been removed; the large intestine has been preserved, in order to show the disposition of the different parts of the colon: *a*, transverse colon; *b*, ascending colon; *c*, cæcum; *d*, descending colon.

Fig. 2.—The back of the body.—The posterior abdominal wall has been removed: *f, f*, the vertebral column; *a*, the left kidney, covered by a layer of aponeurotic fascia; *b*, the arteries coming out of the lumbar vertebræ. A portion of the peritoneum being removed, the small intestines, *c*, are exposed; *d*, right kidney; *e*, right colon.

This figure shows the general disposition of the viscera in the lumbar region.

PLATE LXIX.

OPERATION FOR ARTIFICIAL ANUS.

Fig. 1.—The operation performed on the cæcum, according to the plan adopted by Littré.—a, a, dotted line showing the course of the ascending colon and of the cæcum ; b, b, incision made into the right iliac fossa through the abdominal wall ; c, c, blunt hooks separating the edges of the wound, at the bottom of which is seen the cæcum, d.

Fig. 2.—Callisen's method—Amussat's operation.—a, a, dotted line showing the course of the left colon ; b, b, transverse incision of the subcutaneous layers ; c, c, hooks separating the lips of the wound ; d, d, coils of thread passed into the extra-peritoneal portion of the left colon.

Fig. 3 & 4.—Junction of the edges of the wound in the bowel to the edges of the abdominal wound by means of sutures.

ARTIFICIAL ANUS.—OPERATION.

The subject of *accidental anus* has already received full consideration, and the different plans adopted for its cure have likewise been described.

The formation of an *artificial anus* constitutes a regular operation, by means of which the surgeon proposes to make in a particular part of the bowel, and in the abdominal wall corresponding to it, an aperture of exit for fecal matter, which, in certain pathological conditions, cannot be evacuated by the natural passage.

According to M. Amussat, the following are the affections for which this operation may be performed :—

1. Stercoraceous tympanites, occasioned by obstruction of the rectum or colon, provided that the obstacle cannot be overcome lower down, and the patient's life is in danger.

2. Scirrous affections of the rectum or of the large bowel when they give rise to great pain and inconvenience in defecations.

FIG. 2

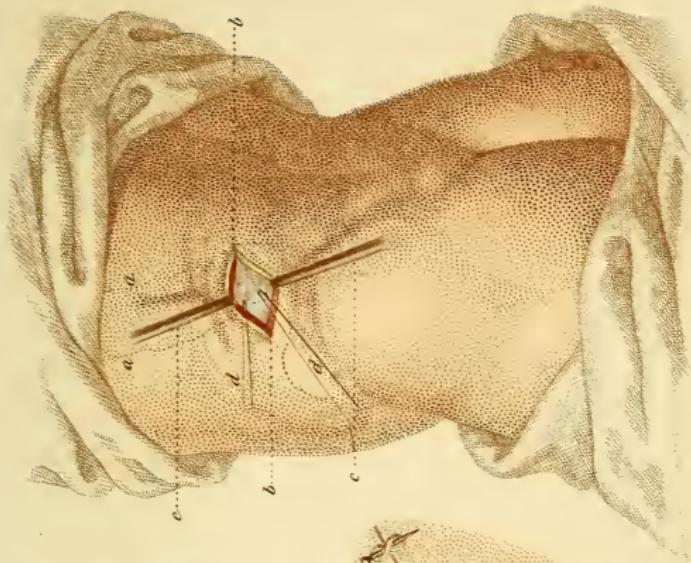


FIG. 3

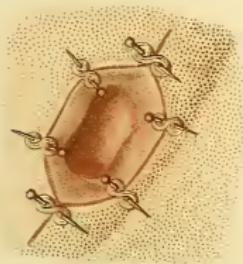


FIG. 4

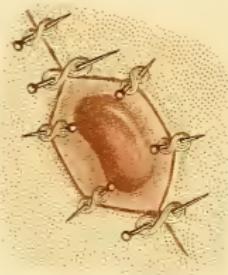
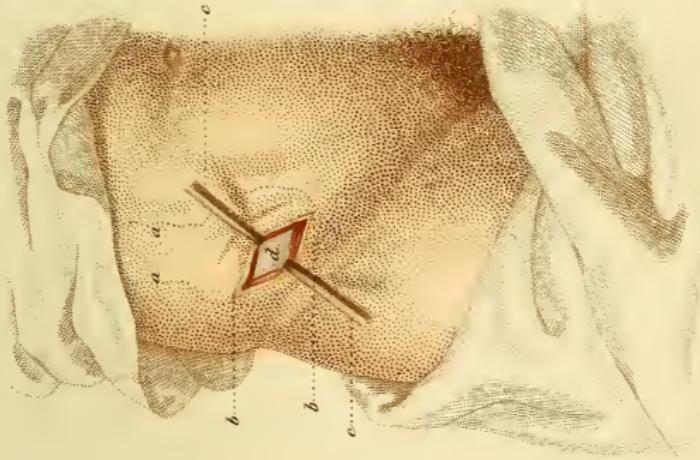


FIG. 5



3. Imperforate rectum, or an absence of a portion of the bowel, and when a passage cannot be established lower down.

Two methods of operating are practised at the present day. The first is that of Littre, who, having noticed an imperforate rectum in an infant that died at the age of six days, conceived the possibility of establishing an artificial anus by an opening through the abdominal wall and the sigmoid flexure of the colon. The second method was proposed by Callisen, of Copenhagen, and consists in opening the ascending colon in the right lumbar region.

Littre's operation (Plate LXIX).—The instruments required are: an ordinary scalpel, a director, forceps, scissors, needles, and wire sutures. The infant being placed upon his back, and brought under the influence of chloroform, an incision about two inches long, and starting from midway between the umbilicus and the anterior superior spine of the ilium, is continued down the left flank toward's Poupart's ligament. The various layers of the abdominal wall are divided on a director; and on the peritoneum being opened, the sigmoid flexure is readily found, being recognized by its thick and knotted appearance. This piece of the bowel is then brought up to the wound, opened longitudinally, and the edges fixed to the wound in the abdomen by wire sutures. Plastic effusion, should the child survive, will quickly cause the edges of the gut to become adherent to the lips of the wound. The best dressing will consist in oiled lint.

Mr. Edmund Owen, who has lately had a successful case of this nature, is of opinion that, for imperforate rectum where no anus can be established after careful dissection in the perineum, the colon should be at once opened from the left flank; and, further, that on account of the large intestines in the infant being very tortuous, and floating in a mesentery, the surgeon should never attempt the extra-peritoneal (Amussat's) operation. At the same time, or on a future occasion, a flexible gum-elastic catheter might be passed through the lower piece of the large intestine towards the perineum. With this aid, Mr. Owen believes the blind end of the bowel might be

discovered from the incision in the perineum, and there be opened and secured.

Callisen's operation (fig. 2).—To avoid injuring the peritoneum, a result inseparable from Littre's operation, Callisen proposed opening the descending colon in the loins, between the last rib and the crest of the ilium. In this part of its course the left colon can be reached without wounding the peritoneum (at least in the adult). But Callisen's proposal did not meet with a favourable reception at the hands of contemporary surgeons.

In 1830 Amussat was occupied with the study of Callisen's proposal, and framed the rule for the operation which we now describe.

Amussat's operation.—Anatomy.—The relationship existing between the peritoneum and the lumbar colon must be well understood. If this piece of the gut is examined on its posterior aspect, after the removal of the mass of muscles which covers it, it is seen that the posterior third is uncovered by the peritoneum. This posterior part of the intestine rests upon the wall of the abdomen without the intervention of a serous layer, so that the bowel can be opened without opening the peritoneum. But this extra-peritoneal part varies in extent. Sometimes the peritoneum only just faces the anterior aspect of the colon, whilst at other times its folds almost meet round the gut.

The lumbar colon can only be reached between the kidney and the iliac crest. Its direction corresponds pretty nearly to the interval between the quadratus lumborum and the transversalis abdominis,—the interval corresponding to the outer border of the erector spinae. Sometimes, however, the colon lies in front of the quadratus lumborum, that is, nearer the vertebral column.

The colour of the colon is dusky green ; and it is well to bear this in mind, so that, in certain cases, the small intestine, which is yellowish, may never be mistaken for it. To render the extra-peritoneal part of the colon more accessible, a few syringefuls of warm water may be injected from the anus.

The operation.—The patient must be placed with his face downwards, and the body rolled somewhat on to the right side. It is generally advised that a pillow be placed under the right side; but, as is pointed out by Mr. James Lane, such an arrangement tends to push the coils of small intestines over to the neighbourhood of the left colon. An incision, three or four inches in length, is then made horizontally, outwards, from the outer border of the erector spinæ, midway between the last rib and the iliac crest. (It might be necessary, in a very fat subject, to make the incision in the skin cruciform.) Beneath the skin and fat the outer border of the latissimus dorsi is seen at the spinal end of the wound. This must be divided, as must also the posterior part of the external oblique, which lies at the anterior extremity of the wound. Afterwards the internal oblique, the transversalis, and the transversalis fascia are divided, layer by layer. The last-named structure may be divided more vertically than the others.

Beneath these layers lies the colon, which is somewhat masked by layers of connective tissue and fat that must be manipulated with great care. The difficult part of the operation consists in recognizing and properly opening the gut. Before incising the gut it is well to lay bare the two sides without using any roughness. On the dead subject the colon is more readily recognized by its colour than it is in the living; the colour is due to the presence of fecal matter. The thick and "resisting" feel of the large intestine is a useful help. Should the intestine be contracted it will be found further back upon the quadratus lumborum, which muscle must be notched, if, indeed, it have not been so treated already. The bowel should not be opened without due consideration. On the contrary, it is well to give it time to become inflated and bulge out of the external wound.

The colon being recognized, two strong sutures, distant about an inch, are passed through its walls and are given to an assistant. It is then opened by the scalpel, and an escape of ill-smelling gas and liquid follows. The opening thus made may be increased to any extent desirable by a blunt-pointed bistoury. A free escape of pent-up material then takes place.

If thought advisable, an injection of warm water, above and below, through the wound, will do much to clear the canal. When further escape of faeces seems unlikely, the wound in the bowel is fixed to that in the skin by twisted wire sutures (figs. 3 & 4). The ends of the wound may also be closed, and joined to the intestine by carefully arranged sutures.

Having twice performed this operation, M. Malgaigne does not consider it necessary to divide the muscular layers by a cruciform incision, as the fibres contract so as to expose the bottom of the wound.

Relative merits.—Callisen's operation has a real advantage over that of Littré, in that it exposes the peritoneum to less interference, whilst the artificial anus placed behind it, in certain circumstances, less in the way than the anus in the front of the abdomen.

Fig. 1.



Fig. 3.



Fig. 2.



Fig. 4

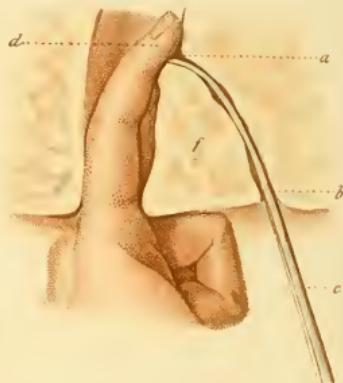


Fig. 5

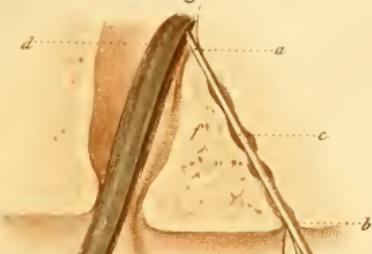


Fig. 6.

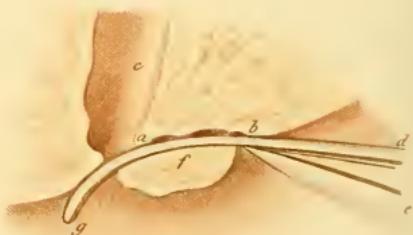


Fig. 8.

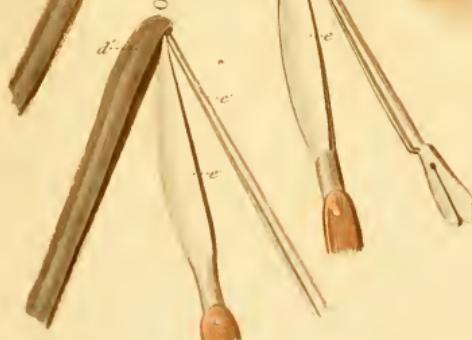


Fig. 7

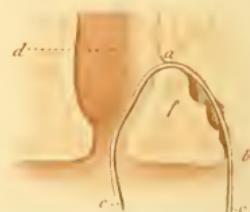


PLATE LXX.

OPERATIVE SURGERY OF THE ANUS AND RECTUM.

All the figures in this plate represent the rectum in vertical section, and the course of a fistula.

Fig. 1.—Blind internal fistula.—a, b, fistula; a, internal orifice communicating with the interior of the bowel, d; b, blind end of the fistula; c, anus; f, section of tissues between the fistula and the bowel.

Fig. 2.—Complete simple fistula.—a, b', b, fistulous tract opening at a, in the intestine, d, and at b, near the anus c; f, section of intervening tissues.

Fig. 3.—Blind external fistula.—a, external orifice of fistula; b, fistula and off-shoots; d, intestine; c, anus.

Figs. 4 & 6.—Incision.—Ordinary method.

Fig. 4—First step of the operation.—c, a grooved director is passed through the fistula, a, b; the index finger, d, of the operator catches the end of the instrument in the intestine at the inner end of the fistula to hook it outside the anus.

Fig. 6—Second step of the operation.—Incision.—The end of the director, g, has been brought out; a, b, the fistula; e, the blade of the bistoury lodged in the groove of the director, g, d; this blade travelling along the director will divide the bridge of tissues, f.

Fig. 5 & 8.—Desault's method.

Fig. 5.—A grooved director, a, c, b, passed through the fistula is caught by an instrument, d, introduced into the intestine. A bistoury, e, is started in the groove of the director to divide the bridge of tissues, f.

Fig. 8.—The same operation.—The bistoury, e, meets the instrument, d'. These two instruments will be drawn out together to divide the soft parts in the angle made by the instruments. c', the grooved director.

Fig. 7.—Ligature.—A thread of silk introduced into the fistula, b, a, reaches the intestine, d, and passing out by the anus, includes in a loop, c, a, c', the organic bridle, f.

FISTULA IN ANO.—OPERATIONS.

Fistula in ano is of several varieties ; some *complete* (fig. 2), consisting of a course communicating with the intestine by an *internal orifice*, and in the neighbourhood of the anus by an *external orifice*. The others, *incomplete* or *blind*, have but one opening, their other end being a *cul-de-sac*. The *blind external* fistula has an opening on the exterior only, the track does not communicate with the bowel. The *blind internal* fistula opens into the rectum, but not on to the exterior. Fistulæ are said to be *complicated* when their course branches off into sinuses, and they are often accompanied by much induration of the surrounding tissues. Such complications may require modifications in the operation ; but the chief point to be borne in mind is to hunt out and open up all offshoots, and to freely incise indurated walls.

To learn the nature and extent of a fistula, it is necessary to explore with a blunt-pointed flexible probe introduced by one of the openings, and it is only after careful examination in this way—occasionally once or twice repeated—that a true knowledge of the condition of the parts can be arrived at.

It is easy enough to find the external orifice ; it is generally found to one side of the anus, rarely in front of, or behind, it. The opening is not always solitary ; sometimes the surface of the integument is riddled by holes, like a colander. These multiple and branched sinuses may undermine the skin through a great extent, but they generally open into the bowel by a single fistula. The internal opening is found with greater difficulty. Generally it is found near the anus, just above the internal sphincter.

The surgeon, having first smeared his left index finger with simple ointment, introduces it into the rectum, and there discovers either a hard ridge, a depression, or some irregularity of the mucous membrane in which is situated the internal orifice. Towards this spot the probe must be directed, and often it travels on to the end of the finger most readily. Fig. 4 shows this exploratory manœuvre. The surgeon's finger, *d*, is introduced into the rectum ; a grooved director, *c*, enters by

the external orifice, *b*, passes along the fistula, and impinges by the opening, *a*, on the pulp of the finger, *d*. Important evidence of the presence of a fistula in ano is the thickening about the anus—a thickening due to chronic inflammatory deposit ; before searching for an opening it is well to feel carefully around the anus for the hard and rigid course of the burrow. From the time of Hippocrates practisers of the healing art have endeavoured to cure fistulæ in ano by cauterization and by injection of caustic or irritant fluids ; but such methods generally end in failure and disappointment—occasionally in inflammation and haemorrhage.

Ligature.—For surgeons or patients who have an antipathy to the knife in the treatment of fistulæ in ano, a ligature of silk, wire, or hemp has suggested itself. This method of treatment is unattended by loss of blood, which in some cases may be a matter of importance, and in uncomplicated cases may be successful ; but where there are branching sinuses and much induration of the parts nothing short of free incision should be attempted. For ligature with wire a small canula is first introduced by the fistula, and the wire is passed through it into the rectum and drawn out through the anus ; the canula is then withdrawn and the knot tied. Five or six weeks may be required for the ligature to cut its way out. Much pain is experienced on the knot being from time to time tightened up, and, perhaps, after all, the surgeon is forced to complete the tedious cure by the bistoury. Free incision is evidently to be preferred to such half measures.

Incision.—A purgative should be administered on the evening before the day of operation, and an enema should be administered in the morning, so that there may be but a small chance of evacuation taking place upon the operating-table, and that there may be no need for the bowels being disturbed for some days subsequently. The instruments that will be required will be probes, a grooved steel director, a scalpel, curved bistoury, straight blunt-pointed bistoury, a pair of spring scissors to cut off angles of thickened tissue, and cotton wool for the after dressing.

The patient should be placed upon the affected side, and

the upper thigh, flexed upon the abdomen, should be fixed by an assistant. The same assistant should with the other hand drag up the fold of the buttock. Another assistant should take charge of the lower leg, whilst a third steadies the affected buttock and looks after instruments.

Ordinary method (Fig. 4 & 6).—The grooved steel director having been introduced through the fistula, and having been caught by the pulp of the index finger introduced into the rectum (fig. 4), is thus hooked down out of the anus, and the end is drawn out over the opposite buttock (fig. 6). The curved bistoury travelling down the groove effects the section of the intervening tissues.

The straight bistoury will be then found of great use in dividing hard and thickened bands and tissues generally.

Fig. 5 & 8 show Desault's method of operating on fistulæ, which open high up into the rectum ; but with a finger of average length such modifications as he suggests are quite superfluous ; the secret of success in all operations for fistula lying in free and thorough divisions of sphincter, sinuses, and indurated tissues. It is, moreover, advisable to let the wound taper off into the buttock ; it heals much more satisfactorily than a deep and hidden incision. It is never necessary to stay to tie twigs of the inferior haemorrhoidal vessels ; all bleeding will cease when the wound is lightly filled with fine cotton wool, and when the thighs are brought down and finally approximated.

FISSURE OF THE ANUS.

By *fissure of the anus* one means the narrow and elongated painful ulcer which is found between the muco-cutaneous folds of the lower end of the rectum. If the fissure is merely a superficial chap at the exterior of the anus it may be cured by application of nitrate of silver or by a forcible dilatation of the anus ; but when it is of greater extent, and is accompanied by painful spasms of sphincter, these means may be insufficient, and more severe treatment is necessary.

Dilatation by sponge tents introduced into the rectum have been advised. The introduction of the first tents is very

painful, but the fourth or fifth creates much less trouble. M. Vidal (de Cassis) speaks highly of tents prepared with mercurial ointment and belladonna.

It has been advised to commence the gradual dilatation with full-sized tents, so that the painful treatment may be rendered as short as possible, the sphincter being quickly and thoroughly stretched. The tent may be left in a day or two ; and after its removal an enema may be given. Dilatation may be associated with cauterization.

M. Récamier's treatment.—In 1838 Récamier showed the possibility of curing fissures by *extension* and *dilatation*.

The patient having been placed upon his side, and brought to the edge of the bed, the legs are flexed upon the thighs and the thighs upon the trunk. The surgeon's right index and middle fingers, having been smeared with ointment, are introduced into the anus, first the index, then the middle finger, and by this means the anus is well and steadily dilated. The pain is acute, but of short duration, and Récamier did not find it necessary to administer a narcotic. To make the dilatation more complete, Récamier used often to introduce the left index finger as well as the two mentioned (*Journal des Connaissances Médico-Chirurgicales*, 1852). This gradual dilatation is unattended by danger, and is certainly to be preferred to M. Velpeau's method of *excision*. Indeed, twice in six cases did this excision fail in M. Velpeau's hands.

Boyer's method of *division of the sphincter* is applicable to all fissures which do not get well under other treatment : by its means all spasm and pain cease, and the fissure granulates to the surface.

The patient having been prepared for the operation (as for the operation for fistula), is brought to the edge of the bed, and a straight bistoury with a blunt end is laid flat upon the left index finger and introduced into the rectum. The edge is then turned towards the fissure, and the sphincter incised as the knife is withdrawn. A pyramidal wound results, the apex being above, the base at the anus. It is well to let the incision through the fissure be free. A light dressing of cotton wool is applied to the wound ; the bowels are kept from acting for

three days; and at the end of five or six weeks all is soundly healed.

Slight but painful ulcers, hidden beneath the anal folds, may be cured by drawing the edge of the knife gently down their course, without dividing the sphincter.

Other methods of treatment have from time to time been introduced, but as ordinary fissure—we do not speak of syphilitic fissure, which, of course, requires no operation—can be cured by dilatation or by division of the sphincter, it is quite unnecessary to describe them.

PLATE LXXI.

CONTINUATION OF OPERATIONS UPON THE RECTUM AND ANUS.

Fig. 1.—Removal of piles.—The piles are held by ligatures at *a* and *b*, and are removed by scissors, *c*, curved on the flat; an ordinary vulsellum will act as well as, or better than, a ligature in holding the tumour.

Fig. 2.—Excision of redundant folds of skin about the anus.—A fold of skin, *a*, held by the forceps, is excised by the scissors, *b*.

Fig. 3.—Imperforate anus.—Removal of small flaps of skin to establish an outlet.

HÆMORRHOIDAL TUMOURS, OR PILES.

Piles should only be operated on when, from their volume, they obstruct the fecal evacuations; when they are inflamed or tender; or when, from the loss of blood which they occasion, the patient is becoming weak; or when they cause straining at stool and prolapse of the rectum.

Incision, cauterization, ligature, and excision comprise the chief methods of operating.

Incision is only suited for small external tumours. The hæmorrhage causes diminution of bulk and temporary loss of pain. The incision can be made with a bistoury or lancet, but is an unsatisfactory method of treatment.

Cauterization is only employed to prevent bleeding after

Fig. 1.

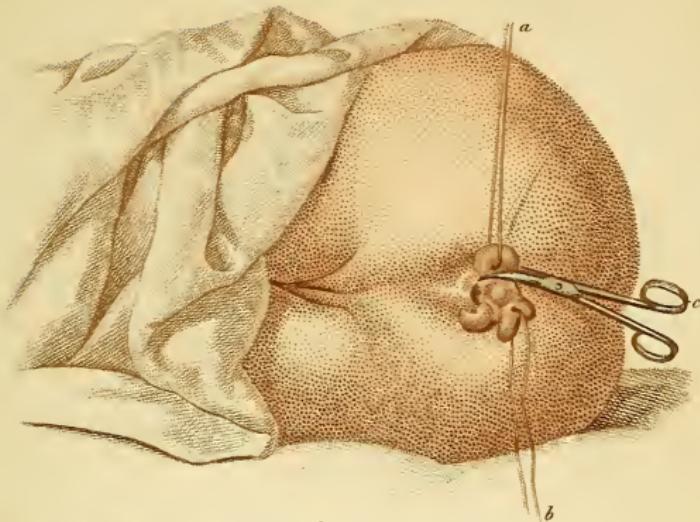


Fig. 2

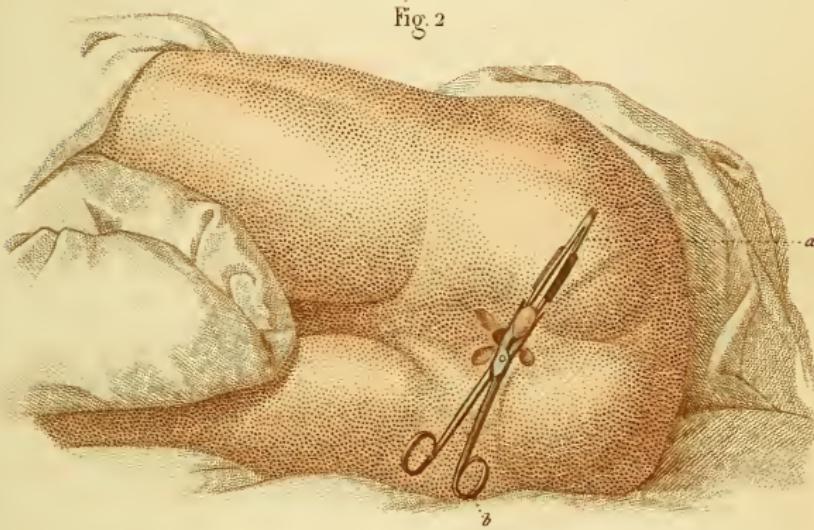
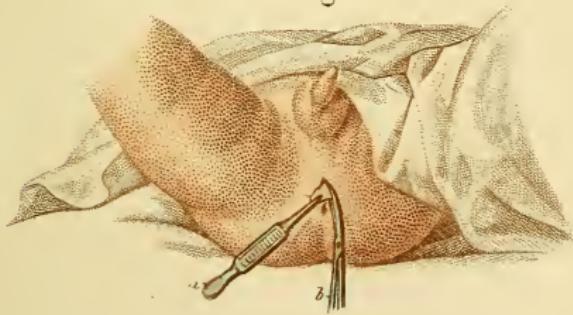


Fig. 3.



excision. But strong nitric acid may be applied with advantage to a general and relaxed condition of the mucous lining of the rectum.

Treatment by ligature.—For this process the tumour must be drawn well out of the rectum by a vulsellum, and there held by an assistant. The blade of strong scissors, passed up between the broad root of the pile and the wall of the rectum on the side to which it is attached, incises the mucous membrane, and diminishes the amount of tissue to be inclosed in the ligature. As the hæmorrhoidal vessels pass vertically downwards into the pile, there is but little or no danger of their being divided in the cut. The ends of the ligatures, which should be of strong hemp, well waxed, are left out of the rectum. The tumours slough off in about ten days. Should the mass of prolapsed membrane appear as a large pad extending in a circular manner around the bowel, it will be necessary to tie it in separate portions. Before tying the ligature the pile must be drawn well out and away from the wall of the rectum, and by the aid of the tips of the index fingers the noose must be pushed high up round the pedicle. No dressing other than by cotton wool will be required. An opium suppository may be administered at the end of the operation if it is thought desirable. Action of the bowels should be prevented for three or four days lest hæmorrhage should occur.

Mr. Henry Smith has identified himself with the treatment of internal piles by the clamp and the actual cautery. An incision is made as for ligation, the clamp is applied, and the tissue cut off to a level with the clamp; actual cautery is then applied to the stump.

External piles, which are small knots of varicose vein, often with effused blood in hardened skin, may be cut off with curved scissors, and the small wounds dressed with cotton-wool.

M. Velpeau has advised that, after excision of a pile, the edges of the wound should be brought together by suture.

VENEREAL EXCRESENCES.

Condylomata are distinguished from piles by their flat and

button-like appearance, by their being covered with moisture, and by their presence on the scrotum, as well as around the anus. They generally disappear under proper constitutional treatment.

POLYPI OF RECTUM.

Polypi are treated as internal or external piles, according to their situation.

CANCER OF RECTUM—ANATOMY.

The following data have been given by Lisfranc : The antero-posterior diameter of the female perineum is rather more than an inch ; in both sexes the distance from the anus to the tip of the coccyx is rather more than an inch and a half.

In the female the front of the rectum lies in close proximity to the vagina, and higher up it is separated from the uterus by a *cul-de-sac* of peritoneum. This *cul-de-sac* also comes down between the vagina and the rectum. Posteriorly the rectum lies upon the sacrum, and having reached the tip of the coccyx, it turns to end at the anus. It should be remembered that the rectum does not take the straight course which its name seems to imply, but curves laterally as well as in the antero-posterior direction. In introducing a long enema tube no force must be used.

The upper part of the rectum is supplied by the superior haemorrhoidal arteries, the terminal branches of the inferior mesenteric. The next part is supplied by branches of the anterior trunk of the internal iliac. The lowest part is supplied by the inferior haemorrhoidal branches of the internal pudic, and by twigs from the superficial and transverse peritoneal.

OPERATIVE SURGERY.

Dilatation.—In certain cases of stricture of the rectum dilatation may be advisable. (See below, *Stricture of Rectum.*)

Lisfranc's operation of excision.—The patient must be placed upon his side and brought over to the edge of the bed or table. The thighs are half flexed upon the abdomen, and

there fixed by assistants. One of these assistants stretches the integument around the anus, whilst the other hands the instruments to the surgeon, who makes, with a sharp bistoury, two bold semicircular sweeps around the anus. The incisions meet in front of and behind the anus. If malignant growths or ulcerations are found in the integument the incisions must be kept well to their outside. The skin is then freely dissected up by directing the bistoury towards the rectum. The left index finger is then introduced into the bowel, and the whole mass is drawn firmly down through the wound. When the malignant disease is limited to the mucous membrane, and at the same time does not extend far up the bowel, the wall of the rectum may be turned almost inside out, and the morbid growth shaved off or removed by curved scissors.

2nd. But where, as is too often the case, the disease has spread for some inches up the bowel, and has invaded the external coat, the operation just described would be of no use ; a more complicated one is required. The first part of the operation must be performed as before, and, in addition, the fibrous tissue around the rectum must be divided by a strong pair of scissors directed up into the pelvis parallel to the axis of the rectum. This incision must be kept as much as possible to the back of the bowel, so that the peritoneum which slopes downwards and forwards into the sides of the bladder may not be wounded. The incision must, however, pass well beyond the limits of the disease. The bleeding may be checked by pausing for a few moments, and stuffing the wound with sponges soaked in ice-cold water. After this, one can obtain a good idea of the extent of the disease, and Lisfranc assures us the wound does not give out more blood than if it were upon the dead subject. The lower end of the rectum can be drawn well out of the wound, and there held by a strong vulsellum.

When the operation is to be performed upon a female, the fingers of an assistant should be introduced into the vagina to push down the recto-vaginal wall ; and in this region the dissection must be conducted with the greatest delicacy. If the

subject be a male, a staff should be passed into the bladder to demonstrate the course of the urethra, and to save it from injury when the front of the rectum is being dissected. The assistant who holds this staff should warn the operator each time the bistoury comes near it. And from time to time the surgeon himself should take hold of the staff to reassure himself of the relations of the parts.

After the diseased part has been removed, a careful exploration by means of the finger will be necessary. A large drainage tube may be left in the rectum. With women it may be necessary to draw off the urine, so that the wound may not be irritated during micturition.

Velpeau's operation.—When the stricture lies within easy reach of the finger, M. Velpeau recommends that it be divided posteriorly, and that the mass be treated by ligature, like an internal pile. (See page 321).

Remarks.—M. Vidal has collected statistics of this operation which give reflections that must not be lightly passed over.

"The operation can rarely remove all the disease; then it will do harm and hasten death. Out of nine cases Lisfranc confesses to have lost three; Velpeau lost three out of six patients operated on. Only two of M. Velpeau's were completely cured. The sixth could not hold his faeces. Here is, then, an operation which by no means always frees the patient of his disease, which may possibly give an imperfect relief, and which may kill in twelve hours.

"But whereas patients with cancer of the rectum are inevitably destined to die of the disease, and as it is possible that the operation may greatly improve their condition, the surgeon may in some cases feel justified in trying it."*

According to M. Vidal, the cancer in the form of small tumours is of a most malignant type, and more than likely to return, and if it spreads any distance up the rectum it is probably beyond the reach of the knife. In the male it is very difficult to separate the rectum from the prostate; and the prostate from its colour and consistence may well be confounded

* Vidal (de Cassis), "Traité de Pathologie externe," vol. iv., 3rd ed. Paris, 1851. J. Baillière.

with the scirrhus. In the female the operation should never be attempted when the finger introduced into the vagina finds the partition invaded.

PLUGGING THE RECTUM.

Severe haemorrhage, after operations such as we have just described, may render this process necessary. A *cul-de-sac* of strong linen may be introduced into the rectum by the finger, and then packed tightly with small pieces of sponge or of dry lint.

FOREIGN BODIES IN THE RECTUM.

Much will depend upon the nature of the material introduced as to what process be adopted. If the body be angular the mucous membrane must be well protected by the finger, and pressed out of the way, as the material is withdrawn. Or a speculum may be inserted, and the body withdrawn through it. Section of the sphincter might be necessary.

STRICTURE OF THE ANUS AND RECTUM.

This affection may be dealt with by dilatation or by incision.

Dilatation.—Desault dilated the rectum with greased tents, gradually increasing the size. Gum-elastic bougies might be employed in the same conditions.

M. Costollat introduced a small linen bag by the aid of a bougie, and then stuffed it with cotton-wool. But the best means of dilatation is afforded by Todd's double-bladed dilator. A thin capsule of india-rubber covers the blades, which are gradually separated by a screw. The india-rubber cap prevents the mucous membrane being injured when the blades are approximated previous to the withdrawal of the instrument from the rectum.

Incision is specially applicable to fibrous stricture where no malignant disease exists. It is effected by a long blunt-ended bistoury introduced flat on the finger. When the stricture has been entered and passed, the edge is turned to the stricture, and the incision is performed as the instrument is withdrawn. The nicks into the stricture should be made at

the back and sides of the bowel, as the vagina, or bladder, lies close to the front. Dilatation may afterwards be indicated.

PROLAPSE OF THE RECTUM.

Sometimes the mucous membrane, but loosely connected to the other tunics of the rectum, descends externally for an inch or so. Sometimes the prolapsed part consists of the whole thickness of the bowel with some peritoneum.

For the cure of this condition several operations have obtained,—reduction, excision, cauterization, and excision of folds at the anus. In children no active treatment of the bowel itself is required, as the prolapse is probably due to calculus, worms, phimosis, or to some disturbing element. The child so affected should never be allowed to pass his motions *sitting*. Should the prolapse be due to a general feeble condition, all that will be required is reduction, and an occasional astringent enema; the affection will disappear with the return of health. The rectal tumour should be washed and then oiled. Gentle compression with the fingers applied in the centre of the mass, so as to cause diminution of bulk, will be followed by ascent of the prolapsed part. The thighs should then be fixed together, and a perineal bandage applied.

In the adult, the prolapsed mucous membrane may be removed by treatment such as that recommended above for internal piles.

Dupuytren recommended excision of some of the mucocutaneous folds at the anus, so that the cicatrization which follows would cause a permanent narrowing of the opening. Actual cautery and the application of nitric acid have been employed with good results.

IMPERFORATE ANUS.

This abnormal condition may exist in the newly born, and the septum may be superficial or deep. If the former, it is composed of skin. This condition is readily distinguished by the violet tint of the skin, and by the bulging at the spot when the infant cries. On plunging a bistoury into the swelling a flow

of meconium escapes. A crucial incision is then made in the septum, and the corners are cut off by scissors. Pieces of oiled lint are then inserted, and are kept there until cicatrization has advanced (Plate LXXI., fig. 3).

Should the septum exist higher up, it may not be possible to reach it satisfactorily with the knife. Should it be beyond reach, an artificial anus must be made. This high imperforation may be diagnosed by the absence of evacuation of meconium, by the general symptoms and discomfort of the unhappy infant, and by constant efforts at vomiting. The confirmation is obtained by a flexible bougie introduced into the rectum, meeting the obstruction.

Should the septum be within reach, the treatment by the guarded scalpel and by dilatation is indicated and is easily performed. Meconium at once escapes. A piece of oiled lint may then be passed through the opening.

Malgaigne gained easier access to the partition by dividing the sphincters of the anus.

In a case under the care of Mr. A. T. Norton the anus was formed; but a septum *more than an inch* in thickness existed between the anus and the bowel. A fine trocar and canula was cautiously introduced, with an aspirator attached. As soon as the bowel was reached a small quantity of meconium was at once aspirated from the canula, and a sharp-pointed straight bistoury was then carried along the canula, to enlarge the opening to a sufficient extent by means of a crucial incision.

ABNORMAL ANUS.

The inferior extremity of the rectum may be wanting, and the bowel may open into the bladder, urethra, or may end in any part of the pelvis. When the rectum opens into the vagina, two methods of treatment have been proposed. The first is the division of the perineum and the partition up to the abnormal anus. A tube is placed in the bottom of the wound, and the edges united in front of the tube, so that the tube continues the course of the bowel. The other operation consists in puncturing the bowel from the proper site of the anus, and

treating the abnormal anus like a recto-vaginal fistula. Should there be absence of the lower end of the rectum, a dissection may be attempted from the perineum with the view of finding the blind end. Should this process fail, an artificial anus would be necessitated, and would be performed as described a few pages back. Generally the rectum ends in a *cul-de-sac*, filled with meconium. The knife must be directed towards this pouch from the perineum, layer by layer. Should the operator be fortunate enough to meet with the pouch, the treatment is simple enough.

Should the rectum open into the bladder one will operate as for imperforate rectum, directing the knife in the dissection well up the front of the sacrum, so as to avoid injuring the bladder, or, in the female, the vagina.

PLATE LXXII.

OPERATIONS PERFORMED UPON THE PENIS.

Fig. 1.—Division of the frænum.—A bistoury, *a*, transfixes the frænum to divide it from below upwards.

Fig. 2.—Phimosis.—A grooved director, *b*, is inserted between the glans and the prepuce; a bistoury, *a*, slid along the groove, pierces the prepuce and divides it from behind forwards.

Fig. 3.—The operator seizes the flaps with the forceps, *a*, and cuts them off with the scissors, *b*.

Fig. 4.—Circumcision.—First step.—The prepuce is drawn forward from the glans and fixed in the grip of the fenestrated forceps, *a*; sutures, *b*, *b*, are passed through the fenestrae and through the prepuce.

Fig. 4, bis.—Second step.—Amputation of the prepuce in front of the glans by the bistoury, *a*.

Fig. 5.—The prepuce released, the retraction of the skin is greater than that of the mucous membrane: *a*, *a*, *b*, *b*, sutures.

*Fig. 5, bis.—Skin brought to the mucous membrane by a suture, *a*.*

Fig. 6.—Operation for paraphimosis.—Reduction.

Fig. 1.

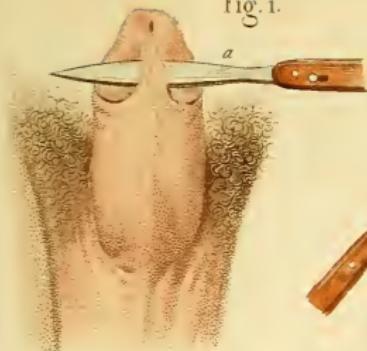


Fig. 2.

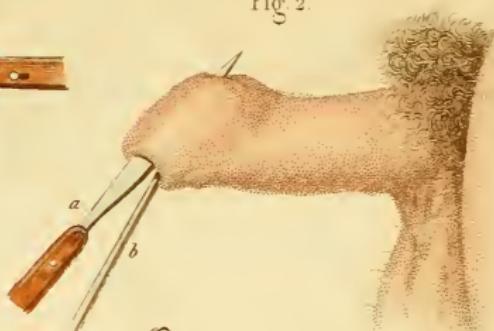


Fig. 3.

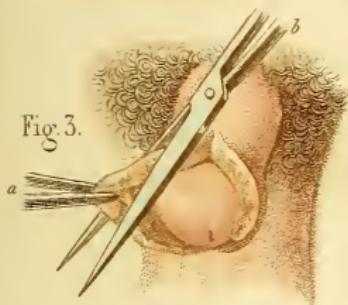


Fig. 4.

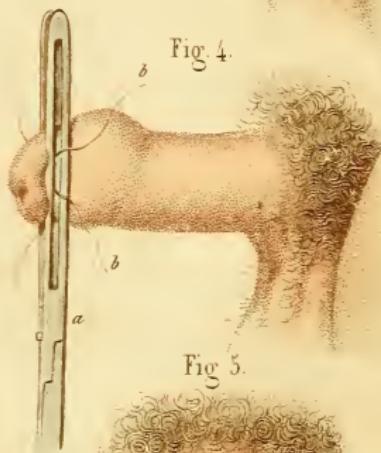


Fig. 5.

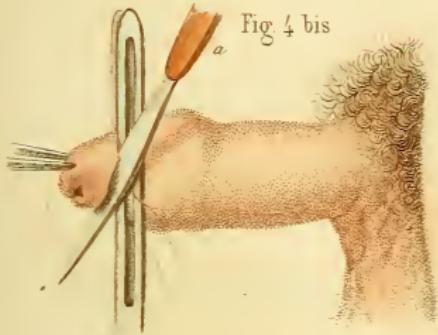


Fig. 5 bis



Fig. 6.



DIVISION OF THE FRÆNUM (Fig. 1).

The operation may be performed with the scissors or bistoury. An assistant holds the glans; the operator pulls forward the fold of skin containing the band. A snip of the scissors, or a stroke of the bistoury which has transfixed the frænum, completes the operation. The best dressing is a small piece of dry lint.

PHIMOSIS (figs. 2 to 5, *bis*).

Phimosis may be operated on by incision, excision, or circumcision.

1. *Incision.*—Incision consists in setting free the prepuce. M. Cloquet advises that the incision be made at the lowest part; but here lies the artery of the frænum, the division of which may give rise to troublesome hæmorrhage. The prepuce is best incised above, and from behind forwards, a grooved director having first been introduced (fig. 2) between the foreskin and the glans. It is well to have the skin made tense during the cutting part of the operation.

2. *Excision.*—Excision often follows as the second step, after incision, for when two long flaps hang down on either side of the cut, it is necessary to snip off their corners, as is shown in fig. 3. The flaps may be removed by scissors or by knife.

3. *Circumcision.*—In this operation the whole free end of the prepuce is taken away. The prepuce is drawn forwards, and all the redundant skin is caught between the blades of forceps, as shown in fig. 4. Fig. 4, *bis*, shows the section with the bistoury, and fig. 5 the relation of mucous membrane and integument after section. It will be necessary to excise the mucous membrane, as it is sure to be less affected by the section than the skin. The glans must be completely uncovered after the operation, the mucous membrane being turned well back, and, when adherent, peeled from off the glans.

It is advisable that sutures be introduced to keep the edges of the skin and mucous membrane in apposition, so that the process of cicatrization may be accelerated.

PARAPHIMOSIS (Fig. 6).

For paraphimosis reduction by careful compression should be attempted. Should this fail, it may be necessary to divide the constricting band, which is usually found at some distance behind the oedematous prepuce.

1. Reduction.—The operator seizes the penis, as is shown in fig. 6. With his thumbs he pushes back the glans, which has been previously smeared with oil, whilst with the index and middle fingers of each hand he drags forward the oedematous prepuce.

Compression exercised by a narrow bandage may succeed, after several hours, in restoring the parts to their proper condition when the ordinary method proves inefficient. In troublesome cases, punctures to allow of the escape of the serum will aid in the reduction.

2. Section.—When the parts are much inflamed, and the pad of mucous membrane is much strangulated, it may be necessary to divide the constricting band.

The surgeon seizes the penis in the left hand, placing the thumb upon the glans and the fingers beneath it. He then passes a sharp-pointed bistoury up under the constriction and divides it from behind forwards, and then attempts its reduction in the ordinary way.

CANCER OF THE PENIS.

Lisfranc has called attention to the true origin and seat of this disease. It may begin at the prepuce, or in the skin of the body of the penis, and completely surround it. An incision made along the dorsum of the organ often shows the cavernous structure to be completely free of disease, although situated in the middle of a cancerous mass. All the diseased parts must be carefully removed by the bistoury or scissors.

Fig. 1



Fig. 2

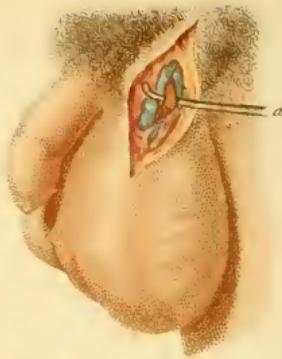


Fig. 3



Fig. 1 bis



Fig. 4



PLATE LXXIII.

OPERATIONS UPON THE PENIS AND SCRÖTUM.

Fig. 1.—Operation for hydrocele.—The operator takes the tumour in the left hand, *a*, and punctures with a canula and trocar held in the right hand (fig. 1 *bis*).

Fig. 2.—Operation for sárcocele.—Ligature and excision of the arteries of the cord. The cord is laid bare by an incision along its course ; the spermatic artery is separated by a director, *a*, from the other constituents of the cord.

*Fig. 3.—Dissection of the tumour with a bistoury, *a*.*

Fig. 4.—Amputation of the penis.—The surgeon holds with one hand, *a*, the extremity of the penis wrapped in a piece of lint ; an assistant, *b*, holds back the integument at the root ; *c*, the knife amputating the organ.

HYDROCELE (Fig. 1 & 1 *bis*).

Tumours composed of a collection of serum are called hydroceles. When it collects in a sac such as the tunica vaginalis, it constitutes an ordinary hydrocele. œdema of the scrotum is often due to general causes, and may be relieved by punctures. *Hydrocele* may occupy the tunica vaginalis or the spermatic cord. A *congenital* hydrocele is one in which the fluid collects in the tunica vaginalis, and filling the funicular process of peritoneum, passes up into the general peritoneal cavity. In such a case the scrotal tumour can be emptied into the abdomen ; at any rate, the swelling diminishes when the patient lies on his back, and has his pelvis raised. The constant pressure of a truss is generally sufficient to effect a cure ; no operation should be undertaken. Hydrocele of the cord may be treated as a hydrocele of the tunica vaginalis ; but the surgeon, remembering the close proximity of the structures of the cord, and of the peritoneal cavity, should be cautious in the employment of injections. The treatment of hydrocele may be palliative or radical. The former consists in drawing off the fluid by puncture. But after this simple operation the fluid

may collect again and the affection return. For the radical cure the nature of the secreting surface of the serous membrane must be altered so as to prevent the recurrence of the affection. To obtain this condition recourse has been had to puncture, incision, excision, cauterization, seton, suture, and injection.

Puncture is best performed by a small canular trocar. The patient lying down, the scrotum is taken in the palm of the left hand, and so held as to render tense the integument, and the front and lower part of the tumour should project between the thumb and index finger. Having first made out the exact situation of the testis, by the aid of a strong light, the instrument is suddenly plunged into the fluid, the depth of the puncture being limited by the right index finger, which is held firmly against the canula. The trocar is then withdrawn and the canula held in position, whilst the serum flows away.

Incision.—The scrotum is held as for puncture (*vid. sup.*), and the tissues are divided layer by layer down to the tunica vaginalis; an incision through this structure is made of sufficient length to allow the cavity to be stuffed with oiled lint.

Excision, as recommended by Boyer, consists in laying bare the tunica vaginalis, and in removing as much of it as possible. This may be advisable when the wall is very thick, but for most cases the previous operation suffices.

Cauterization by caustic potash is an obsolete operation for hydrocele.

A *seton* passed through the cavity and the ends tied together on the front of the scrotum may effect a cure.

Injection is the method of treatment most often adopted. The puncture is first made by a good-sized canula and trocar, and some port wine, tincture of iodine, or solution of sulphate of zinc is thrown up into the sac. Some surgeons inject a large quantity of a weak solution (grs. iv. to $\frac{5}{3}$ j.), which they afterwards withdraw; others prefer a little strong solution, which they allow to remain in the sac. The syringe must have a nozzle which exactly fits the canula. Should a large quantity be injected, it should be allowed to remain in the sac until the patient experiences severe pain up the spermatic

cord and in the loins. The fluid can be then pressed out through the canula.

As the injection is being performed, it is very necessary that the end of the canula be free in the sac, lest some of the fluid be thrown up amongst the tissues of the scrotum. Should such a mishap occur, free incisions must be made for the escape of the irritating fluid, lest gangrene supervene.

After the use of the seton, or of the injection, the parts become very red and inflamed, hard and painful; then absorption commences, and at the end of a fortnight the patient is probably cured. Should suppuration follow, the certainty of cure becomes absolute.

TUMOURS OF THE TESTIS (figs. 2 & 3).

Malignant tumours of the scrotum may be treated by ligature of the spermatic vessels, or by castration.

1. *Ligature* (fig. 2).—The cord is laid bare by a free incision along its course, the vessels are raised, tied in two places, and are divided between the two ligatures.

Preferable to such interference is castration.

2. *Castration* (fig. 3).—The first step consists in laying bare the cord; the second in its division, and in the removal of the gland itself.

First step.—An incision is made down the front of the cord from the external abdominal ring; and when the gland is not adherent to the integument, it can be easily turned out by the handle of the scalpel and by the finger. But if it is adherent a careful process of dissection may be required. All the diseased skin must be removed.

Second step.—The tumour forced from its coverings, and now only attached by the spermatic cord, is supported by an assistant. The cord may be divided by a single cut, and the arteries may be secured when the testicle is taken away. But, perhaps, it is preferable to tie the cord in one ligature before dividing it, as all risk and trouble of haemorrhage is then at an end. Moreover, there will be no danger of any divided arteries being drawn, by the elastic cord, up into the abdomen and bleeding there.

AMPUTATION OF THE PENIS.

When cancer has spread into the depths of the penis nothing short of amputation will be of use. The penis is held at the root by an assistant, and the surgeon, drawing it well forward, severs it with one sweep. It must be remembered that the corpora cavernosa retract more than the skin. The assistant must not pull too much upon the skin lest such redundancy at the end result that the aperture becomes interfered with. As the corpus cavernosum contracts in proportion to its length the nearer the amputation is performed to the scrotum the more skin may be left.

After the amputation a catheter is fixed in the urethra, and though it is removed from time to time, still its use must be continued until cicatrization is complete.

PLATE LXXIV.

OPERATION FOR VARICOCELE.

Fig. 1.—Compression of the varicocele by the aid of Breschet's apparatus, *a, a*.

Fig. 2.—*Velpeau's twisted suture.*—A pin, *a*, is passed beneath the dilated veins, and a string, *b, b*, is twisted in a figure of 8 around it.

Figs. 3 & 4 bis.—*Ligature.—Ricord's method.*

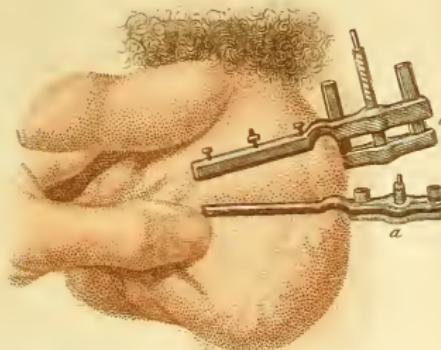
Fig. 3.—A loop, *a*, passed under the veins.

Fig. 4.—A second loop, passed by the holes which the introduction and exit of the other has made, lies in front of the veins. The ends, *a* and *c*, are caught in the loops; *a*, veins; *b*, vas deferens.

Fig. 4, bis.—Subcutaneous strangulation of the veins by the loops.

Fig. 5.—*M. Vidal's method of treatment by twisting.*—*a, a'*, needles represented in natural size; they are pointed at one end and hollowed out at the other, so as to receive the worm of a silver wire, *b, b'*. The stronger needle, *a*, should be the posterior one.

Fig. 1.



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Fig. 3

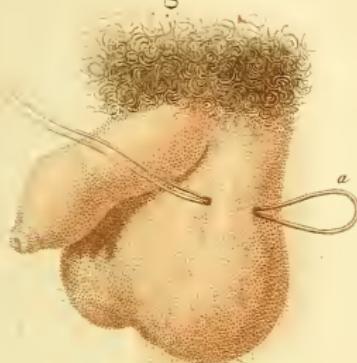


Fig. 4

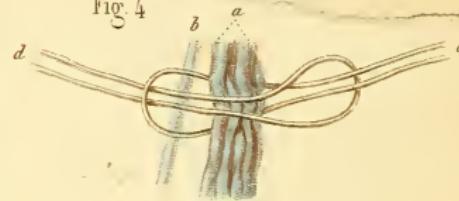


Fig. 4 bis



Fig. 5

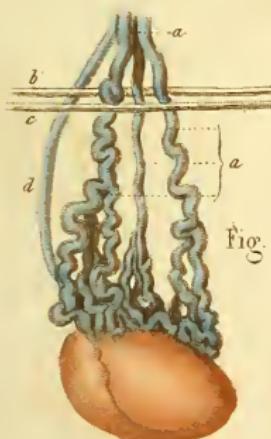
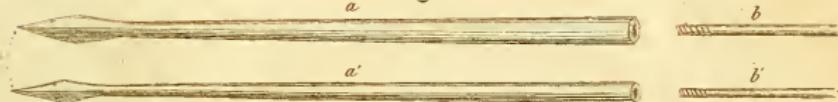


Fig. 6

Fig. 7

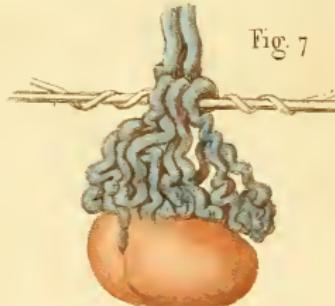


Fig. 8.



AMPUTATION

When cancer has spread nothing short of amputation at the root by an assistant, a forward, severs it with one s that the corpora cavernosa . assistant must not pull + redundancy at the en³

farmer assistant

Fig. 6.—The varicose veins, *a*, *a*, are strangled between the two wires, *b* and *c*. The vas deferens, *d*, is to the outside of the veins.

Fig. 7.—The veins puckered up by the twisting of the wires.

Fig. 8.—The wires slightly twisted.

VARICOCELE.

Varicocele may be radically treated by compression, twisting, or ligature.

1. *Compression.*—*Breschet's method* (fig. 1).—This method consists in compressing the varicose veins by the blades of forceps, which nip the included tissues, and are fixed by screws. A slow section of the veins results from the pressure.

Before applying the blades the veins should be well distended by a hot bath. The vas deferens and the artery should be carefully separated from the varicose veins, so as to escape strangulation. The former structure can be recognized by its whipcord-like feel. All the veins should be compressed. The blades have been modified by M. Landouzy, so that the border of the fold of skin is not damaged.

2. *Suture.*—*Velpeau's method* (fig. 2) may be performed in two ways: by passing a pin under the veins, and twisting a ligature tightly around in figure of 8; or the veins may be compressed by two pins placed, one in front and one behind the cluster, the ends of the pins being firmly secured by ligatures.

Ligature.—By a curved needle a strong ligature is passed through the scrotum, around the veins, and out near to the point of entrance. The two ends are then tied tightly around a roll of lint, so that the skin suffers but little. In about a fortnight the vessels are divided. Or the two ends may be brought out of the same opening, and the veins tied subcutaneously.

Ricord's method (fig. 3, 4, & 4 bis).—The varicose veins are isolated in a fold of scrotum, and a loop is passed behind them through the scrotum (fig. 3, *a*). Another loop is passed through the same holes in front of the cord, but in the opposite direction to the first loop, so that the cord lies, *a* (fig. 4),

between two double ligatures. Then, as represented in fig. 4, the ends are passed through the loops, and on drawing them tightly in opposite directions (fig. 4 *bis*), the vessels are thoroughly strangulated. The free ends may be tied to the extremities of a piece of metal of horse-shoe shape.

M. Vidal (1844) twists up the veins (figs. 5, 6, 7, & 8), passing a needle, *a* (fig. 5), armed with a wire, *b*, between the veins and the vas deferens, and then another, *a'*, with a finer wire, *b'*, in front. The same openings serve for the two wires. By bending the first wire with the concavity slightly forward, the finer wire lies like a bow-string in front of the veins.

Fig. 6 shows the varicose veins, *a, a*; the testicle and vas deferens, *d*; the latter being kept out of the way. The wires, *b* and *c*, include the veins. On twisting the wires round and round the veins are entangled and wound up also (fig. 7): the vas deferens is not interfered with.

As the veins have a fixed point above (in the abdomen), and are movable below, the act of winding causes the testis to ascend towards the inguinal canal.

Fig. 8 shows the wires slightly twisted, with the thinner wire winding around the thicker. Afterwards the ends of the wires are brought round to the front of the scrotum and fixed together, and a pad of lint is placed between the skin and the point of junction of the wires. Thus the veins of the cord become obliterated in several places, and if the veins of the scrotum become divided from pressure of the wires, or, indeed, if they be cut with the knife, the chance of return of the malady is diminished. In the twisting many small veins are implicated which might have escaped the influence of the ordinary ligatures. If the varicocele be of long standing, there may be many veins in the scrotum which will require division.

FIG. 1



FIG. 2

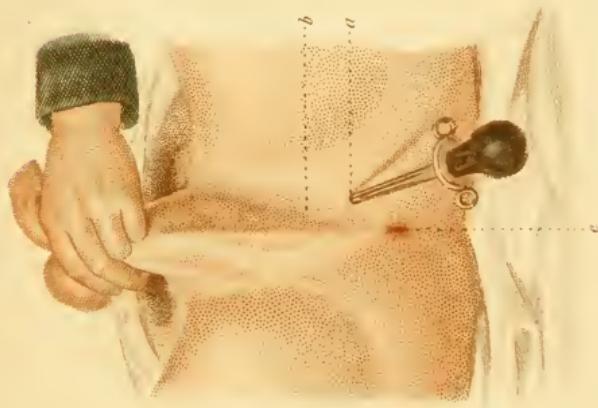


FIG. 3

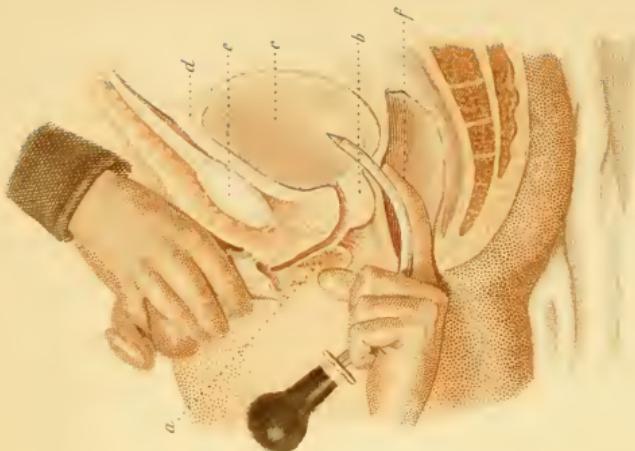


PLATE LXXV.

OPERATIONS ON THE BLADDER AND URETHRA.

Fig. 1.—Supra-pubic puncture of the bladder.—This diagram gives a vertical section of pelvis, and shows the relations of bladder to neighbouring viscera. *a*, meatus urinarius; *b*, neck of bladder; *c*, interior of bladder; *d*, symphysis pubis; *e*, connective tissue between pubes and prostate; *f*, section of bulb; *g*, septum scroti; *h*, prostate; *i*, rectum; *k*, deflection of peritoneum from summit of bladder on to abdominal wall; *l*, trocar and canula passing over pubes into bladder.

Fig. 2.—Perineal puncture of bladder.—The body is placed in the lithotomy position; *a*, spot at which puncture is performed between the anus and front of ischial tuberosity; *b*, projection of bulb beneath the skin; *c*, anus.

Fig. 3.—Puncture through the rectum.—The median section shows the relations between bladder and rectum. *a*, bulb in median section; *b*, posterior lobe of prostate; *c*, interior of bladder; *d*, summit of bladder; *e*, symphysis; *f*, left index finger of operator introduced into rectum to guide the instrument in effecting puncture through base of bladder.

PUNCTURE OF BLADDER.

Now that the treatment of stricture is better understood, the operation of puncture of the bladder is becoming a rare operation, and is only had recourse to when every other means of relieving the retention has failed. The aspirator is now used in preference to the trocar. Let the operator be absolutely sure of the need of this operation before he performs it. Much may be learnt from the introduction of the finger into the rectum. When the performance of the operation becomes imperative, delay may be attended by rupture of the viscus.

1. *Supra-pubic puncture* (fig. 1).—When the bladder is much distended it rises nearly to the umbilicus, carrying the peritoneum up in front of it; the anterior surface—base of serous covering—lies close behind the front of the abdomen.

To perform this operation the patient must be brought to

the edge of the bed, and his head and shoulders raised; the canula and trocar are then forced with a sharp and sudden plunge down into the interior of the bladder, the point entering the abdomen in the middle line and close above the pubes, *b.* It is advisable to puncture the skin with a knife before thrusting in the trocar. The canula is then steadied, and the trocar withdrawn. When the urine is withdrawn, the end of the canula is fixed to tapes passing around the pelvis and thighs, and a small plug of wood stops up the opening of the instrument. If the instrument is too long, and the end be not guarded during the puncture, the posterior wall of the bladder might possibly be wounded; but if the instrument is too short the bladder will slip away from the end as it contracts. When the distress is relieved the stricture becomes less obstinate, and allows the passage of a catheter; but until this happy result is brought about the canula must be kept in the bladder.

2. *Puncture by the perineum* (fig. 2).—The patient is placed in the lithotomy position, and the straight canula and trocar is plunged into the bladder through a spot lying between the anus and the front of the left ischial tuberosity. The instrument passes through the skin and connective tissue, and the levator ani, entering the bladder close behind the neck. As soon as it travels freely in the deep part the surgeon knows that the vesical cavity has been penetrated; the trocar is therefore withdrawn, the urine voided, and the canula fixed in position by a T-bandage.

3. *Puncture by the rectum* (fig. 3).—The patient being placed upon his back, and the thighs and legs flexed, the surgeon passes his left index finger, well anointed, into the rectum, and then he feels the prostate gland and the base of the bladder bulging on to the anterior wall of the bowel. The well-curved canula and trocar are then passed up in front of the finger, the point of the trocar being withdrawn into, and concealed by, the end of the canula. When the end of the canula reaches the base of the bladder, the trocar is suddenly forced out of the canula, and with the canula enters the distended viscus. The instrument enters between the *vasa deferentia*, behind and above the prostate, and below the recto-

Fig. 2.

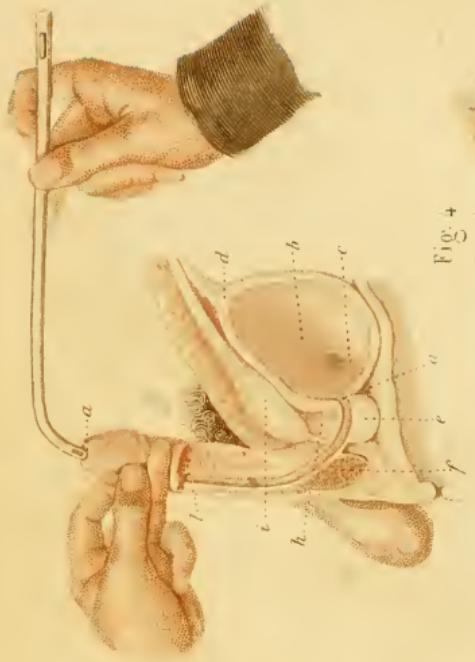


Fig. 1.

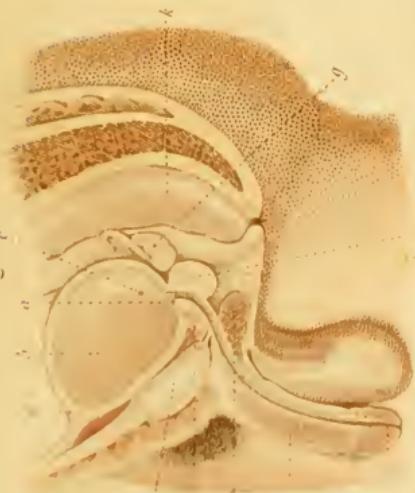
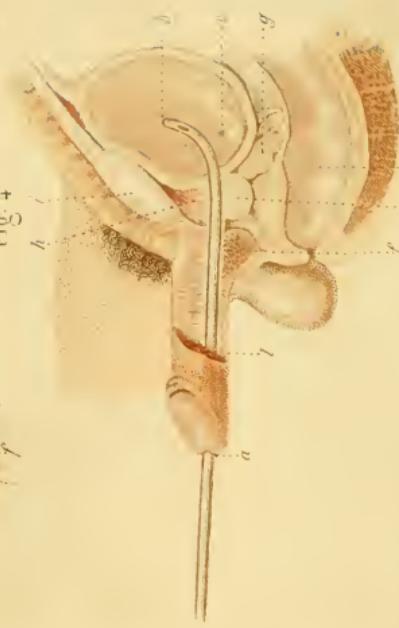


Fig. 3.



Fig. 4.



vesical fold of peritoneum. When the bladder has been evacuated, the canula is fixed to a spica of tape; the urine may be allowed to pass, as quickly as it flows into the bladder, out by the canula into a carefully-arranged receptacle.

These situations have been chosen for tapping the bladder on account of their being free of important connections and on account of their being easy of access. The perineal puncture offers no special advantage. The rectal puncture has hitherto been most frequently performed; but should the prostate be much increased in size it may become necessary to have recourse to the supra-pubic puncture. But, as we have said above, the operation is now rarely required because the simple and frequent use of the aspirator gives all that can be desired, and is almost free from danger. The site for puncture by the aspirator needle is an inch or so above the symphysis pubis.

PLATE LXXVI.

CONTINUATION OF OPERATIONS UPON THE BLADDER AND URETHRA.

Fig. 1.—Vertical section shewing the direction of the urethra, and the position of pelvic viscera, etc. *a'*, neck of bladder; *b*, cavity of same; *c*, opening of ureter; *d*, summit of bladder; *a*, glans penis; *l*, corpora cavernosa; *e*, prostate; *f*, bulb; *g*, vesicula seminalis; *h*, front of prostate; *i*, symphysis; *k*, rectum.

Fig. 2.—Catheterization.—Introducing the instrument into the meatus urinarius, *a*; *b*, bladder; *c*, opening of ureter; *d*, summit of bladder, and, *a'*, neck; *e*, prostate; *f*, bulb; *h*, front of prostate; *i*, symphysis; *l*, floor of urethra:

Fig. 3.—Catheter, reaching to the prostate.—*a*, meatus; *b*, bladder; *c*, ureter; *d*, summit of bladder; *a'*, beak of catheter; *e*, prostate; *f*, bulb; *i*, symphysis; *l*, catheter in the spongy part of the urethra.

Fig. 4.—The catheter entering the bladder as the penis is depressed. *b*, beak of catheter in the bladder; *e*, *h*, prostate; *g*, vesicula seminalis; *k*, rectum.

SURGICAL ANATOMY OF THE URETHRA.

The urethra in the female is the conduit for the urine only, in the male it conveys also the semen.

The male urethra is divided into three parts for description. 1. The prostatic part, about an inch and a quarter in length, and extending from the neck of the bladder to the posterior layer of the triangular ligament. 2. The membranous part measures about $\frac{3}{4}$ inch in length, and, lying between the two layers of the triangular ligament, is curved, with its concavity directed to the under part of the symphysis pubis. This part is surrounded by the compressor urethræ. The bulb projecting backwards overlaps the floor of the membranous part of the urethra. 3. The spongy part of the urethra measures six or seven inches, but its length varies with the condition of the penis. It extends from the membranous part behind to the meatus urinarius in front. It must be borne in mind that the canal takes a bold sweep under the pubes to reach the neck of the bladder, and that when the prostate is much hypertrophied the neck of the bladder becomes pushed up behind the pubes, and that the length of the urethra may be thus increased from about seven or eight inches to ten or eleven. When the penis is flaccid, the urethra curves like the italic *f*. When the penis is drawn out for catheterization but one curve remains, and this is between the layers of the triangular ligament—this curve, then, is permanent.

Calibre.—The calibre of the urethra varies in different people, and at different times in the same person. But when one sees a No. 14 English catheter enter the bladder without trouble, the capacity of the canal and its readiness to adapt itself to circumstances becomes evident.

The prostatic portion of the urethra is large and somewhat dilatable. The membranous portion is girt by the compressor urethræ, and becomes small towards the bulb; whilst the meatus is the narrowest part of the canal. Behind the meatus is a dilatation, the navicular fossa. Occasionally the meatus is very small, and requires forcible dilatation or incision before

an ordinary sized catheter can be introduced (Pl. LXXVII., fig. 9 *bis*).

Structure and relations.—The mucous membrane is thin and elastic, and darkens in colour towards the meatus; there it becomes continuous with the delicate covering of the glans penis. When the canal is distended the longitudinal folds which are found in the flaccid urethra become effaced.

In the prostatic urethra the mucous membrane and erectile tissue are raised in a permanent ridge called the veru montanum, and burrowing backwards beneath it is the depression known as the sinus pocularis. On either side of the ridge lies a groove, the prostatic sinus, which receives the openings of the prostatic follicles. Into the sinus pocularis open the two common ejaculatory ducts.

The lining of the urethra is studded with the small openings of the mucous crypts of Littré; these are apt to become the seat of abscess in connection with urethritis, and to open externally; much more rarely still do they intercept the beak of a small catheter in its passage towards the bladder (Pl. LXXVII., fig. 1 *a*). The mucous membrane of the urethra is covered externally by a layer of fibrous and non-striated muscular tissue, and it is in this bed that the inflammatory products contract in organic stricture. In the spongy part of the canal this submucous layer is composed chiefly of vascular and erectile tissue. It is perhaps on account of its great vascularity that the mucous lining of the spongy urethra is so prone to the absorption of irritating and morbid products. Outside this layer is the general fibrous investment, and over all is the muscular expansion from the accelerator urinæ.

Around the membranous part of the urethra is a considerable quantity of fibrous tissue, and at the narrowing anterior end of this part of the canal the careless introduction of a small catheter may do great damage. In front of the triangular ligament the spongy portion of the urethra is expanded (in a bulb), especially at the floor, and unless the beak of the instrument be kept carefully along the roof of the canal it is very apt to pass out and run up between the prostate and rectum. Hence the advisability of introducing the left index

finger into, and keeping it in, the rectum in dealing with a troublesome stricture. In all probability the compressor urethræ does not by "spasmodic contraction" offer such a great bar to the passage of a catheter as it is generally represented to do. Muscular fibres have, indeed, been described by Wilson, which have as their office the widening of the urethra in this neighbourhood. The membranous portion of the urethra is in relation with the veins of Santorini, and with the connective tissue below the pubic symphysis. Behind and below it is overlapped by the bulb. It really belongs to the perineal region, being situated between the two layers of the deep perineal fascia (or triangular ligament).

In the prostatic part the urethra is enclosed by friable muscular and glandular tissue.

In old men the prostate is often found to be much increased in size, firm and lobulated, encroaching on the trigone and neck of the bladder and on the outer wall of the rectum, and this, by altering the length and curve of the urethra, gives rise to conditions which are so important that we must not attempt to enter on the subject in this small work.

CATHETERIZATION OF THE URETHRA.

The operation of passing an instrument into the bladder may be required for drawing off the urine, for crushing a stone, for dilating a stricture, for searching for a foreign body, and for obtaining a guide in certain operations (*vide*, Imperforate Rectum).

The operation of passing an instrument through the urethra will vary as we deal with a man, a woman, a child, or with any subject with an altered condition of the parts. We shall speak farther on of catheterism in the female; but we must refer our readers to special treatises for an account of the diseases in which it may be required. The instruments may be curved or straight; if the former the curvature may be permanent as in the case of silver catheters and metallic sounds; the curvature may be altered by having the instrument made in gum-elastic with a flexible wire in the interior.

Every one knows the curve of the ordinary sound, and the

proportion between the straight and curved parts. If the patient is young the curve will be less pronounced ; for old men, on the contrary, and in cases of disease of the prostate or neck of the bladder, it is better to employ an instrument with a sudden curve. Before passing an instrument it should be warmed and oiled.

A catheter may be passed in the ordinary way, or by the "tour de maître."

1. *In the ordinary way, or from over the abdomen* (Pl. LXXVI., figs. 2, 3, 4).—*Position of the patient.*—The patient may be placed upright, with his back against a wall, or he may lie upon his back at the left edge of his bed.

Position of the surgeon.—The surgeon will find it most convenient to stand at the left of the patient, so that he may pass the instrument with his right hand, introducing the left index finger, if necessary, into the rectum to give him his bearings. The end of the penis is taken between the fingers and thumb of the left hand and drawn up towards the abdomen so as to straighten the spongy part of the urethra. (See Anatomy of the Urethra, and Pl. LXXVI., figs. 2 & 3.) The prepuce may require drawing back, and before introducing the instrument it may be well to draw the penis over toward the left groin. The catheter is taken in the right hand and held like a pen, the convexity being directed upwards. Introduced into the meatus, it must be pressed onwards with great care and gentleness, any roughness giving rise to pain and spasm. Thus the beak of the instrument reaches the level of the symphysis, and then the fingers of the left hand are glided down beneath the penis, and are placed in the perineum, feeling the instrument in the urethra ; the handle by this time is raised perpendicular to the abdomen, and by gentle depression of the right hand the beak passes through the membranous part of the urethra and through the prostate into the bladder ; and in depressing the handle the instrument sweeps up under the pubes. It is very necessary to keep the beak close under and along the roof of the canal.

The surgeon recognizes the instant that the instrument enters the bladder, and keeping his thumb or index finger

over the opening of the catheter, directs it so that the urine may flow into the vessel prepared for it.

2. "*Tour de maître.*"—This showy way of passing a catheter was much in vogue with the surgeons of the last century; it may be useful when the abdomen is large and pendulous. It is practised thus:—

Position of the patient.—He may be standing, sitting, or lying on his back, the last position being the best. The pelvis is brought to the edge of the bed, and the legs and thighs flexed and separated.

Position of the surgeon.—At the right side, or kneeling, or stooping between the thighs of the patient, the surgeon takes the end of the penis between his fingers and thumb, drawing it but slightly towards the abdomen. The catheter held in the right hand, with beak directed towards the perineum, the concavity looking downwards and backwards, is introduced into the meatus and passed down to the triangular ligament. The left fingers now embrace the root of the penis, and by giving the handle of the catheter a bold and rapid sweep from right to left, it is brought up in front of the abdomen as in the ordinary way, but at the same time the beak travels on into the bladder.

The introduction of flexible instruments rendered rigid by a stylet of wire is performed as in the case of the metallic, but the operation is more difficult; but if the urethra is well accustomed to the passage of instruments, the soft catheter will find its own way into the bladder without force or trouble. The stylet is only useful for introduction of the catheter as far as the triangular ligament, and when this part is reached, it should be withdrawn; if it be left in until the catheter has reached the bladder its withdrawal will be attended with pain; or one can, following the advice of Hey, fix the stylet and push on the catheter the rest of the way by itself.

Catheterism by straight instruments.—When we consider how elastic the urethra is, and how its walls are capable of depression, one understands how it is possible to pass a straight catheter into the bladder.

M. Amussat has occupied himself much with this subject, and

has had a considerable influence in directing the surgery of the urethra and bladder, especially as regards lithotrity.

Position of the patient.—He may be standing, sitting, or lying.

Position of the surgeon.—He places himself in front of the patient, and pulls out the penis with his left hand until it is at a right angle with the trunk. The instrument passed straight from before backwards passes beneath the pubes to the level of the bulb. Then the penis is drawn on the instrument and the handle firmly depressed so as to make the beak ride into the prostatic part of the canal and into the bladder (Pl. LXXVIII., fig. 1). If the first attempt fail, the instrument must be withdrawn a little and again pushed on. The penis must not be stretched until the symphysis is passed.

Obstacles to catheterization.—Accidents.—Remedies.—The various manœuvres that we have just described do not always succeed at the first attempt, and we will show in what the failure may consist and how it may be overcome. We must also point out the accidents which may arise in catheterization and how they are to be avoided, and the precautions which must be taken in passing a cathether in a wounded urethra. The difficulties may be due either to clumsy handling of the instrument, or to deviations in the direction of the urethra ; from either cause a false passage may result.

False passages.—The beak of the catheter may be caught in one of the large follicular depressions so frequently found on the roof of the canal near the meatus ; to avoid it the beak of the catheter must be withdrawn and then passed on along the floor of the urethra. Or the catheter may be stopped beneath the pubes, where the bulbous part joins the membranous, perhaps because the instrument is too much curved, perhaps because the handle has been depressed too soon ; the instrument must be slightly withdrawn and then passed along nearer the floor of the urethra.

A common cause of difficulty is the catching of the beak in the bulbous enlargement of the urethra against the front of the triangular ligament. To avoid this the handle must be gently depressed ; nothing is easier than to force the beak of

the catheter through the pouch and up between the rectum and prostate.

Another obstacle may be found at the junction of the membranous and prostatic portions of the canal ; and yet another at the neck of the bladder, where a wall of mucous membrane may be developed.

These obstacles may be overcome by passing the beak of the instrument along the roof of the urethra. From this short account it is evident that a correct knowledge of the length, shape, and size of the various parts of the canal must be obtained.

Lesions of the canal.—In this category must be placed the numerous causes of obstacle to the passage of the catheter, but all are not of equal importance. The instrument may be intercepted by one of the lacunæ (Plate LXXVII., fig. 1*a*), by a dilated prostatic duct, or by the opening of the common ejaculatory duct ; but such an accident can only happen to a fine instrument. When one is passing a full-sized catheter such a cause for failure is out of the question. But when a stricture exists, or when enlargement of one lobe of the prostate has altered the direction of the urethra, catheterization is not a simple matter, nor is it when a spasmodic contraction supervenes in the muscles about the urethra, which we have described above. It is impossible to say how each case is to be dealt with, but some useful hints will be found in the article on stricture of the urethra.

The most serious accident that can happen is the perforation of the wall of the urethra, and this may readily occur where the canal is narrowed or diseased, especially if the catheter be roughly or carelessly handled. A bridle of mucous membrane in the urethra, or at the neck of the bladder, may thus be tunnelled, and, more likely still, the middle part of the prostate (Plate LXXVII., fig. 1).

This is not, however, a very grave accident, for the beak regains the canal and enters the bladder. But of great gravity is the perforation of the wall of the urethra, as the instrument may travel on amongst the neighbouring tissues almost indefinitely.

Fig. 1

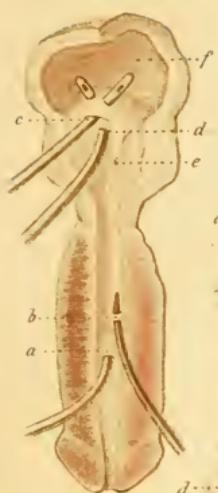


Fig. 4

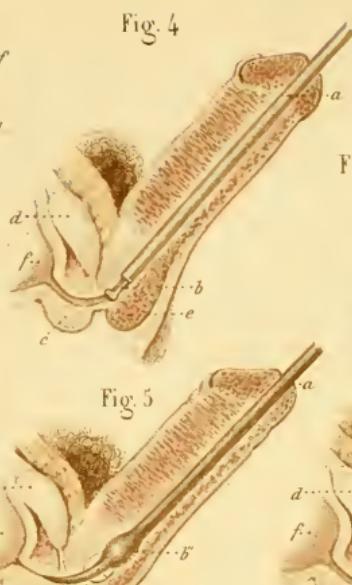


Fig. 2

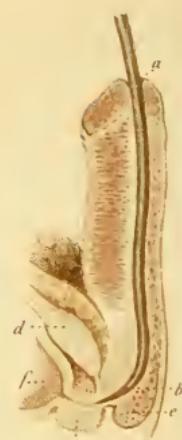


Fig. 3

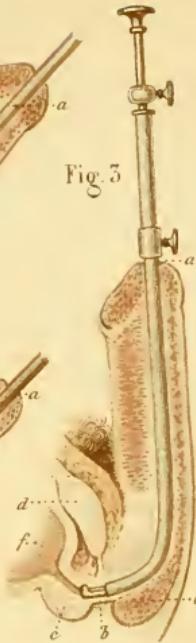


Fig. 6

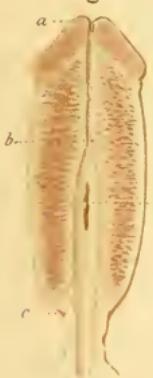


Fig. 7

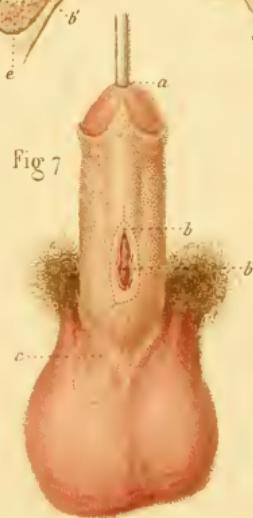


Fig. 8

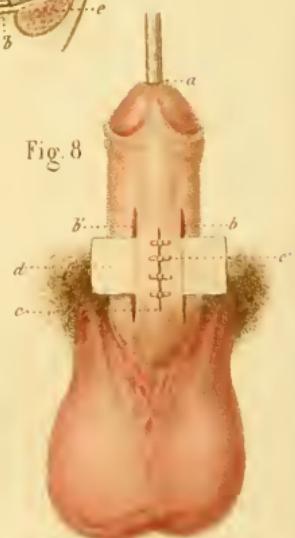


Fig. 9 bis



Fig. 9

Fig. 10



False passages are generally formed in the floor of the urethra near the bulb, and may give rise to haemorrhages and the infiltration of urine. Their presence may be suspected when free bleeding occurs, or when the handle wanders away from the median line ; the left index finger should at once be introduced into the rectum, where the beak may be found lying in front of the muscular wall of the bowel, and in dangerous proximity to it. The prostate gland ought to be felt between the catheter and the rectum.

Often false passages exist when the surgeon is called in to relieve a case of retention of urine, or to dilate a stricture. If he find out their situation he must carefully avoid them, keeping his finger in the rectum ; and it must be confessed that the operation in these cases is one requiring the greatest skill and patience.

PLATE LXXVII.

FALSE PASSAGES.—STRICTURE OF URETHRA.—
PLASTIC OPERATIONS.—ENLARGEMENT OF
MEATUS.—FIXING INSTRUMENTS IN URETHRA.

Fig. 1.—Accidents of catheterization.—*a*, beak of instrument caught in a lacuna ; *b*, the same having traversed the mucous membrane and re-entering the canal ; *c, d*, catheters caught in old false passages in the prostate, tunnelling its tissue ; *e*, urethral crest ; *f*, bladder with thickened walls.

Fig. 2.—Passage of bougies through stricture.—*a*, meatus ; *b*, conical extremity of a bougie caught in the stricture ; *c*, bulb ; *d*, symphysis of pubes ; *e*, prostate ; *f*, cavity of bladder.

Fig. 3.—Cauterization of the prostatic part of the urethra, with M. Lallemand's instrument.—*a*, meatus ; *b*, membranous portion with the instrument carrying the caustic ; *c*, prostate ; *d*, symphysis ; *e*, bulb ; *f*, bladder.

Fig. 4.—Cauterization of the membranous part of the urethra with the straight instrument.—*a*, canula of the *porte-caustique* ; *b*, part of the instrument armed with caustic ; *c*, prostate ; *d*, symphysis ; *e*, bulb ; *f*, bladder.

Fig. 5.—Division of stricture.—*a*, meatus ; *b*, conical point of scarifier in the membranous part of the canal ; *b''*, enlargement of scarifier ; *b, b, b'*, blade protruded from the protecting enlargement by a movement of the handle ; *c*, prostate ; *d*, symphysis ; *e*, bulb ; *f*, bladder,

Fig. 6.—Antero-posterior section showing a stricture of urethra.—*a*, meatus ; *b*, stricture with dilatation behind it, whilst the urethra in front of it (from *a* to *b*) is narrowed ; *c*, commencement of the membranous part of the canal ; *e*, internal orifice of an antero-posterior fissure situated on the floor of the spongy portion.

Fig. 7.—Plastic operation.—*a*, a sound ; *b'*, the same seen through the urethral fistula ; *b*, penile fistula. A dotted line shows the extent to which the surfaces have to be vivified around the opening ; *c*, a flap to be raised from the root of the penis and scrotum. This flap must be rather larger than the gap on to which it will afterwards fall.

Fig. 8.—Operation by lateral incision.—*a*, sound in urethra ; *c*, fistula whose vivified edges have been brought together by sutures, *c'* ; *b, b'*, lateral incisions made at a distance from the fistula ; *d*, a thin sheet of india-rubber, placed so as to protect the sutured part from contact with urine, and to prevent the lateral incisions healing too quickly.

Fig. 9.—Enlargement of meatus.—A sickle-shaped bistoury, entering at *b'* and emerging at *a* ; *b''* shows the point guarded by a small button of wax.

Fig. 9 bis.—Urethra ending in two apertures on the glans, *a* and *a'*. The intervening bridge of skin requires division.

Fig. 10.—A catheter fixed in urethra by a piece of darning cotton tied around the penis behind the corona.

STRUCTURES OF URETHRA.

Stricture is the narrowing of the canal from some pathological condition. Most authors admit three kinds of stricture.

1st. Inflammatory or congestive.—This is noticed when an acute urethritis causes the mucous membrane to swell into the canal and diminish its calibre.

2nd. Spasmodic.—Sir Henry Thompson thus writes of

"spasmodic stricture," "I will tell you what spasmodic stricture often is. It is an exceedingly useful excuse for the failure of instruments. It is a 'refuge for incompetence.'"

Spasmodic stricture should be called urethral spasm, being simply a spasmodic contraction of the muscular fibres surrounding the urethra.

3rd. Organic.—These are the most common, and follow on injuries to the urethra, and as the result of chronic urethritis. They are the most obstinate as regards treatment, and when a man is once the subject of one he can never be *cured*. The bad effects may be kept under control; but so surely as the patient and surgeon leave off attending to the stricture, so surely does a relapse take place—it is only a question of time.

There may be one or many strictures in the same urethra; they may appear as small or large cicatrices, fibrous rings surrounding the canal, bridles, or as a general thickening all around a certain part of the canal.

The narrowness of the aperture will vary with the degree of thickening in the sub-mucous coat. As a rule, the older the stricture the smaller the opening. The mucous membrane in the neighbourhood of the stricture becomes altered in appearance, so that the terms *indurated* and *fibrous* are often employed in describing the parts; they mean this,—that the chronic inflammation has given rise to a considerable amount of plastic deposit in and beneath the mucous membrane, a deposit which has become organized into thick fibrous tissue.

Traumatic strictures may be found anywhere along the urethra. Organic contraction following gleet generally occurs in the neighbourhood of the bulbous end of the spongy portion. An enlargement of the prostate, blocking up the canal, cannot properly be included amongst the strictures.

The surgical therapeutics comprise preliminary explorations, palliative and radical treatment. We avoid the word *cure*.

Preliminary operations are to give information concerning the number, size, and situation of the stricture.

The introduction of ordinary catheters of different sizes is generally sufficient to give the surgeon every information that he requires for undertaking the treatment of a stricture; but

when about to operate, one must be careful and precise in making the preliminary examination. Ducamp used to employ what he called his *exploratory sound*, but the instrument has properly fallen into disuse. The simpler the instruments the better.

The instrument à boule in gum-elastic renders service in measuring the length of a stricture; but when the thickening in the sub-mucous coat exists in the spongy portion only, the surgeon can obtain a good idea of its extent by gently pinching it between his finger and thumb.

TREATMENT.

Dilatation.—Dilatation is the method to be preferred in the treatment of most tight organic strictures. The best way of performing it is to employ the No. 1 (English scale), for instance, on the first occasion, and having ascertained by the finger in the rectum that it is in the proper course for the bladder, to urge it gently onwards; when it has reached the bladder, urine having flowed, it should be withdrawn. On the third or fourth day, supposing that no harm have followed on the introduction, No. 2 will probably be introduced, and so on until No. 12 finds its way in easily. But this is a method which requires much time and patience, both on the part of the surgeon and of the subject. When No. 12 can be passed the patient should be instructed in the art of catheterization, and should, at first every week, introduce No. 10 for himself. He will never be *cured* whatever the treatment adopted be; but, as we have said above, he may be able to keep the stricture under control.

Continuous dilatation.—Sir H. Thompson has shown that if No. 1 be introduced into a stricture and left in—just within the bladder—for a few days, a process of softening takes place at the seat of stricture, so that when the small instrument is withdrawn No. 9 or 10 may be easily passed.

Forcible dilatation.—When a stricture allows the passage of No. 2 or 3, Mr. Holt's instrument for bursting the fibrous ring may be employed. The instrument consists of a small

catheter split down the middle, the halves being joined by a hinge near what would be the eye of an ordinary catheter. Running between the halves and fixed to the hinge is a slender wire stylet, over which a large hollow style, of the size of a No. 8 or 9, is passed. In its passage over the stylet it separates the halves of the instrument and so bursts up the fibrous constriction.

The instrument has met with little approval in the hands of some surgeons, and condemnation from others, but a fair trial of its merits in unprejudiced hands shows that most organic strictures can be quickly and effectually treated by its means.

Simple division.—In this operation a cutting instrument is passed through the stricture dividing some of the constricting tissue. The instruments are called *urethrotomes*. They vary much in form. They may be straight or curved, and cutting from behind forwards, when passed through the narrow track. For the most part they consist of canulae, varying in size, and are armed with a stylet, which has a hidden blade at its vesical end. Sometimes the blades are terminal, at others they start out through a lateral slit in the instrument on pressure being made through some arrangement of screw or lever. When the urethrotome is curved, the blade is situated at the convexity. The blade may be single or multiple. Some of the instruments cut their way through the stricture in passing through towards the bladder; but generally the cutting is effected with the withdrawal.

The instruments are used thus. When the stricture has been somewhat dilated, and a good knowledge of its extent and condition has been obtained, the urethrotome is introduced with the blade hidden; the beak is then passed beyond the narrowing, so that when the blade is made to start out it is on the bladder side of the stricture. The blade is then made to cut its way forward through the tight band, without wounding the healthy part. If advisable, the band may be divided in more points than one; the blade must be made to return under cover again ere the instrument is withdrawn. Some bleeding may follow the operation. From time to time

a full-sized catheter must be introduced to prevent the return of the contraction.

M. Reybard, not satisfied with division of the fibrous ring of the stricture, proposed to divide, in addition, the healthy tissues of the urethra right through the copus spongiosum to the skin, the section being effected by a blade like that of a penknife. We only mention the operation to condemn it.

M. Wertember has employed electricity in the treatment of stricture.

Some have tried to force a passage through the narrowed part of the canal by cauteries; whilst others have endeavoured to effect a cure by excision of the morbid tissue.

M. Amussat has sometimes succeeded in introducing a catheter through an obstinate stricture by forcibly distending the urethra with warm water, and for this he has a small catheter with an india-rubber ball at one end, which, filled with water, can be forcibly emptied by the hand into the urethra, the other end of the catheter being passed down to the stricture. By gently forcing on the catheter after the injection the stricture has been penetrated. Whilst the injection is being made the penis is tightly pressed around the instrument by the finger and thumb.

When dealing with a narrow stricture it is well to inject a small quantity of oil into the urethra before introducing an instrument.

OPERATIONS ON URINARY FISTULÆ.

(Plate LXXVII., figs. 6, 7, & 8.)

Urinary fistulæ may be the result of injury or of abscesses, and may give rise to a communication between the urethra and skin, bladder and vagina or rectum, bladder and uterus.

Urethral fistulae are named from their seat penile, anterescrotal, scrotal, and perineal; they may have followed on stricture with abscess, or on injury. They may be short and uncomplicated or burrowing, tortuous, and multiple.

As regards curability, we may say briefly that the anterescrotal fistulæ are very difficult of treatment, and that the larger the fistula the less the success.

Should the fistula be associated with stricture, the latter must be dealt with before the former is touched. The great difficulty of obtaining a complete success is due to the union of the vivified surfaces being hindered or prevented by contact with urine. Often one sees a perineal fistula heal spontaneously on a stricture being dilated.

Indirect treatment.—Old plan.—A catheter is introduced into and fixed in the bladder, and the small plug of wood is removed each time that the patient desires to pass water. The urine, however, sometimes finds its way to the wound by passing between the catheter and the walls of the urethra. To prevent this some surgeons have left the catheter without the plug of wood, so that the urine might flow away as it is secreted. Simple fistulæ in the perineum occasionally heal under such methods of treatment. On account of the severe inconveniences resulting from the catheter being allowed to remain in the bladder, Ducamp has proposed to draw off the urine by passing a catheter each time the patient has the desire; but the irritation set up by urine collecting in the bladder is occasionally so severe that the patient cannot wait to have the instrument passed, so that no good result can be anticipated with certainty from this method of treatment.

Direct treatment.—Perineal fistulæ often require free divisions ere they can be obliterated, but no excision of the tracts need be practised.

A plastic operation may be required when there has been a loss of tissue at the floor of the urethra in the spongy portion of the penis, but it is very apt to fail. The edges of the fistula are pared and brought together by wire sutures over a gum-elastic catheter introduced into the urethra; but M. Malgaigne considers that its presence in the canal is productive of harm, and that repeated catheterizations are to be preferred.

Perhaps when the nature and use of Mr. Napier's self-retaining convolvulus catheters are better understood, the treatment of penile fistula may be more satisfactory. In most cases it is well to make an opening into the urethra in the

perineum, and allow the urine to escape by it whilst the wound at the front of the scrotum heals.

When the gap in the floor is extensive it will be necessary to make use of a flap cut from one side of the thin penile covering, and, bringing it across the opening, to let it fall into a space which has already been excavated for it on the opposite side.

Partial successes are by no means uncommon in these cases, and it is often only after repeated attempts that the opening is entirely closed.

Imperforation of the glans.—Enlarging the meatus (Plate LXXVII., figs. 9 & 9 bis.).—Should the imperforation of the glans be congenital, the aid of the surgeon is at once required. Generally in these cases the urethra is distended behind the obstruction, so that a simple incision, or an excision combined with puncture, will be all that is necessary.

After the operation care must be employed lest the new passage be again blocked up by cicatrization.

Should there be congenital narrowing of the meatus, oft-repeated and gradual dilatation will alone be required. The separation of the ends of the blades of small dressing forceps introduced into the meatus will effect a sudden and complete dilatation.

A catheter may be fixed in the urethra by a loop of worsted tied from the handle of the instrument around the neck of the glans (Plate LXXVII., fig. 10); or, if preferred, the instrument may be secured by small tapes to a spika bandage around the trunk.

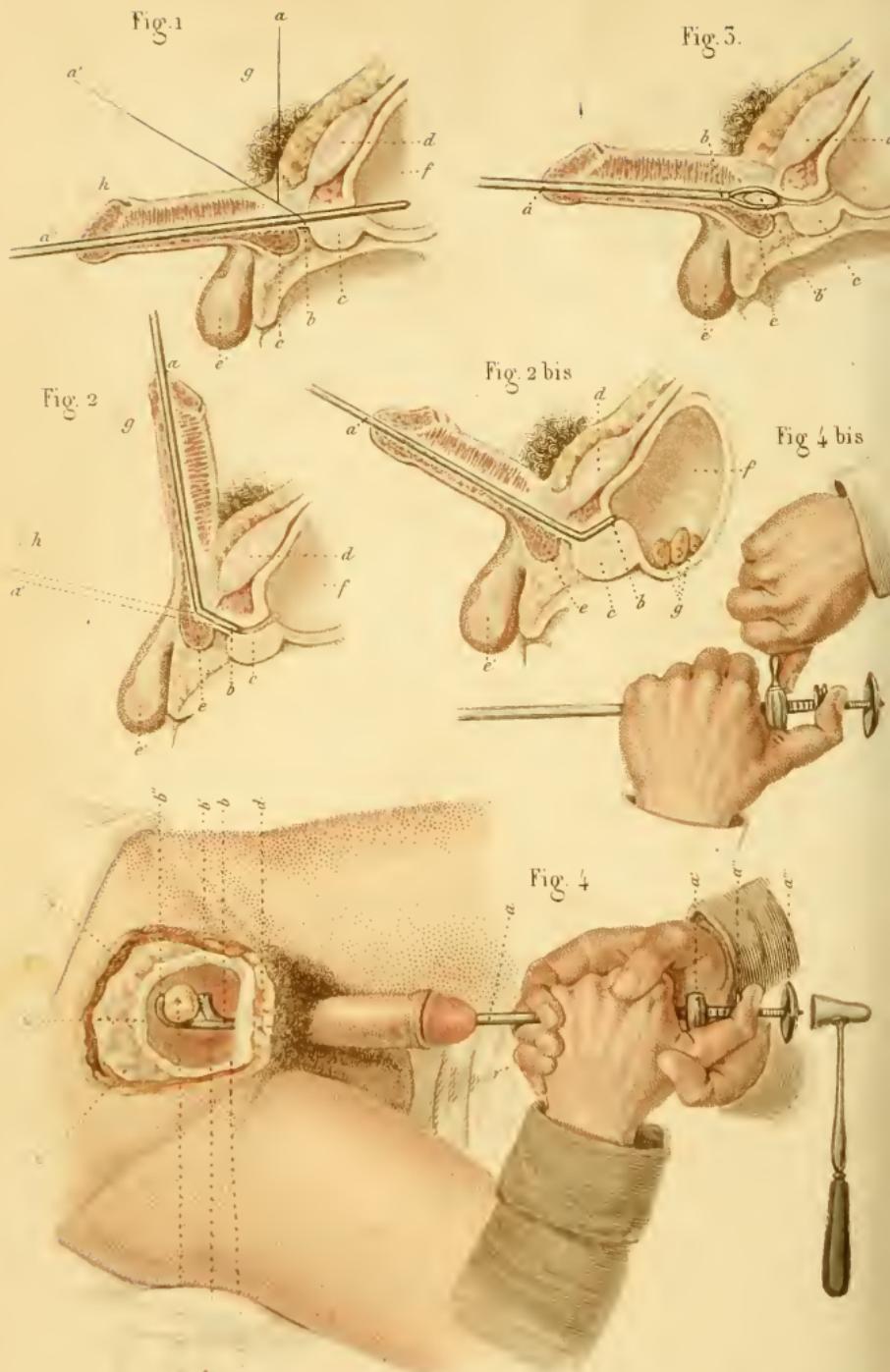


PLATE LXXVIII.

CATHETERISM AND LITHOTRITY.

Fig. 1.—Rectilinear catheterism.—*a*, position of the instrument at the start; *a'*, position showing the inclination necessary to pass the (*b*) triangular ligament; *a''*, the instrument entering the bladder, the handle having passed through the quarter of a circle, *g h*; *c*, prostate; *d*, symphysis; *e*, bulb; *e'*, testicle; *f*, bladder.

Fig. 2.—Passage of a metallic sound.—*a*, first position; *a'*, when introduced into the bladder; *b*, the beak passing through the prostate, *c*; *d*, symphysis; *e*, bulb; *f*, bladder.

Fig. 2 bis.—Sounding for stone.—*a*, sound entering bladder, *f*; *c*, prostate; *d*, symphysis, *e*, bulb; *e'*, testicle; *g*, stone lying at base of bladder behind prostate. This diagram shows how necessary it is to employ a sound with a short and sudden curve, and also how much assistance may be occasionally obtained by pushing up the base of the bladder by the left index finger in the rectum.

Fig. 3.—Extraction of a urethral calculus.—*a*, *b*, small straight forceps introduced into the membranous part of the urethra; *b'*, the fragments seized in its bite; *c*, prostate.

Fig. 4.—Crushing a stone by percussion.—*a*, lithotrite; *a'*, female blade, which allows the toothed male blade to play in it, so that the stone may be readily fixed in the bite; *a''*, circular plate on the male blade for manipulation by the finger; *a'''*, disc-like head of male blade for receiving the strokes of the hammer. The lithotrite is firmly held between the two hands of an assistant, and steadied by the operator's left hand whilst he uses the hammer with the right. *b*, end of lithotrite in bladder, *f*; *b'*, male blade; *b''*, female blade; *c*, stone. A window has been cut through the hypogastric region of abdomen. This instrument is now superseded by a stop screw.

Fig. 4 bis shows the way in which the stone is caught and held by the blades being approximated by manipulation with the male blade.

LITHOTRITY.

Lithotripsy has for its end the removal of the crushed fragments of a stone from the bladder without a cutting operation.

The idea of the operation is of ancient origin, being alluded to in terms more or less clear by Azzarhavi, A. Benedictus Sanctorius, Fabrice de Hilden. Everywhere one hears of the Monks of Cîteaux, and of one, Martin by name, who removed stones from bladders by ingenious methods. Of more importance were the endeavours of the Bavarian surgeon, Gruithuisen (1812), to perforate a calculus, and of Elgerton, who invented an ingenious rasp for the destruction of a stone. Then came (1818-22) the reports of the cases of Civiale, Amussat, and Leroy d'Etioles, which did so much to improve the operation; and later, still further advance has been made by Wm. Coulson and Sir Henry Thompson.

Lithotripsy is not performed on calculous male children, for the reasons that the urethra is not large enough to admit a trustworthy instrument into the bladder, and because the child is intolerant of prolonged or frequently repeated interference. Moreover, the lateral lithotomy in children is so safe and satisfactory an operation that no improvement on it is to be obtained.

Nor should the operation of crushing be undertaken in the adult male subject when the bladder is over-sensitive or small, callous and thickened, for there must be room for the free movement of the end of the instrument around the stone. When the kidneys are in all probability the seat of abscess, when the stone is large or hard (oxalate of lime), when there are more stones than one, or when the stone is lodged in a hernial pouch of the mucous membrane, cutting is preferable to crushing.

For the most part, in the female, crushing is not to be chosen unless the stone be small, for should the urethra be paralyzed from over dilatation, no subsequent operation can repair it; whereas if vagino-vesical lithotomy be undertaken any fistula that may result can subsequently be closed. In the female

child, then, unless the stone be small, lithotomy is the operation to be selected ; in the male child there is, as we have shown above, no alternative on lithotomy.

Briefly, then, lithotrity is to be performed on the healthy adult male when the stone is small and not too hard. In all probability these patients would do equally well under lithotomy ; in fact, they would be, after children, the very patients selected by the lithotomist. So the lithotritist picks his patients, and is wise in his choice ; but it is questionable to compare the happy results of such operations with those of the lithotomist, who has had to undertake the treatment of the most unpromising cases.

Nor is this all. When the lithotritist commences the comparison, he objects to the children being counted by the lithotomist.

Sometimes, after a patient has failed to be relieved, he is submitted to, and succumbs under, the cutting operation. Therefore, if there be any doubt about which method of treatment should be employed, the preference should at once be given to the cutting operation. Should any urethral stricture exist in a patient who might have his stone crushed, the treatment of the former must be first undertaken.

Should a patient be the unfortunate subject of cancer of the bladder, as well as of stone, no operation would appear advisable.

THE OPERATION AND INSTRUMENTS FOR CRUSHING A STONE IN THE BLADDER.

The patient should retain his water for some few hours before the operation.

At the first attack upon the stone—the sitting, as it is generally called—the surgeon may content himself with breaking it into two or three large pieces ; or he may, if he think fit, continue the operation to breaking up each separate fragment into powder, or into pieces small enough to pass readily by the urethra. It is by no means necessary that the patient be put under the influence of an anaesthetic. If he seems to suffer little or no pain or inconvenience from the

first breaking of the stone, the operator may go on crushing the various fragments. But the patient should not be allowed to pass his water for some days, except in the recumbent posture, for, as Sir H. Thompson has shown, if the angular fragments are allowed to remain for a few days in the bladder they become "water-worn," and injure the mucous membrane much less when they are subsequently allowed to pass. If, after the first crushing, acute cystitis follow, the fragments must be attacked without delay, and be powdered as fully as possible. In such cases as this an anaesthetic may be administered and the bladder washed out by Mr. Clover's valuable bottle-syphon. In this way many of the fragments may be removed.

The lithotrite consists, as is well known, of two blades, a male and female. The latter may be "fenestrated" or not, as is thought advisable, but the male blade should not have too much the form (in section) of a wedge, lest the stone be splintered with violence, and the mucous lining of the bladder injured. The borders of the blades, moreover, should not meet with absolute exactness, and each should be somewhat bevelled, so that the folds of mucous membrane may run little risk of being pinched.

Number of stones.—The number of "cliks," or the presence of hard bodies in several parts of the bladder, leads one to diagnose several stones; but an ordinary sound, used with great care and method, will enable the surgeon to arrive at very exact conclusions on this subject, and, moreover, if the stem near the handle be marked in a scale, the measure of the calculi may be ascertained with great precision, the beak of the instrument being made to travel over the stone in its different diameters. In this way the surgeon can almost as well picture to himself the condition of the interior of the viscera and the nature of the foreign bodies as if his finger itself were introduced.

Position of the patient and of the surgeon.—The patient may be placed supine on a hard bed or on the table, his pelvis being raised on a small and fine pillow, so that the stone may be tilted from off the delicate mucous membrane of the trigone.

The surgeon should stand on the right side of the patient, so that his right hand may be in a convenient position for manipulating the handle of the lithotrite. If there be not a sufficient number of assistants it will be advisable to fix the patient's wrists to the ankles, the thighs and legs being flexed after the introduction of the instrument.

The introduction will be effected as we have described further back (see *Catheterization*), and it may be necessary to divide slightly the meatus urinarius. As soon as the calculus is felt the blades are separated by a sliding movement at the handle (not by the aid of the screw), and the opened blades are then turned round to where the stone is supposed to lie. The male blade is then slid down on to the stone and the screw put into gear. The wheel at the handle is then turned forcibly and steadily so as to crush the stone. Supposing the stone is not caught the first time, the blades must be again separated and turned to the other side, and, if necessary, must be made to dip down behind the prostate, when useful aid may be afforded by the left index finger introduced into the rectum or vagina. Supposing that the stone slips suddenly from the bite, it must be searched for again. In any case, when it is fairly caught it will be well to give the instrument a turn or two on its long axis so as to make sure that the mucous membrane is not by any chance caught; and this and every other movement must be executed with the greatest delicacy; for it must be remembered that the patient will not be able to inform the surgeon if a fold is included or not. Should the stone be small and not too hard, it may be pulverized there and then, at the first attack; but should it be otherwise, the surgeon must rest content with knowing that he has broken it into fragments, and has, in addition, crushed some of those fragments. The "sittings" should be short and oft-repeated, rather than prolonged. Two minutes should be sufficient time for the purpose. Fragments should not be withdrawn with the lithotrite, but should be crushed. Nothing more than powder should be removed between the blades, and it is very necessary to see, by inspecting the handle, that the male blade is well home before an attempt is made to withdraw the

instrument. Two or three days should intervene between the sittings.

The *débris* of the stone is passed, as we have said above, as the patient is lying down; but should an angular fragment become impacted in the urethra it must be removed by the long and slender scissor-forceps. Rarely will it be necessary to extract it by an incision. Should the bladder have lost all power of evacuation, Clover's syphon will be of great service in getting rid of the powder and small fragments.

Accidents.—Attention to the precautions which we have just given will avoid injury to the bladder and urethra; but it occasionally happens that the male blade snaps off at its angle. The fragment may be removed by the aid of another lithotrite; but if this appear impracticable, the patient must be submitted to the operation of lithotomy. Cystitis, nephritis, peritonitis, or retention of urine, may follow on lithotripsy, and so also orchitis and prostatitis. Slight or severe febrile symptoms are by no means uncommon. Inflammation of the plexus of veins about the neck of the bladder is a very grave sequel and may be fatal. To insure a good result in a case of lithotripsy, the patient must be first carefully prepared as regards regime and diet; the sittings should be of short duration; and, lastly, the greatest care and supervision of the patient must be exercised during and after the time that he is under operative treatment.

Relapse.—Should a small fragment of stone be left in the bladder, it will probably form the nucleus of another calculus, so that the surgeon must make sure that all is removed before the patient leaves his care.

Fig 1.



Fig 2

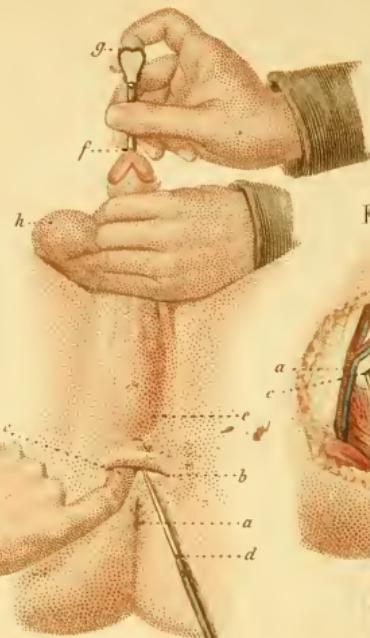


Fig 5

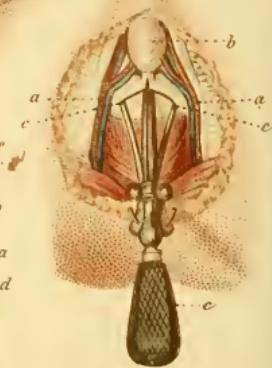


Fig 5 bis

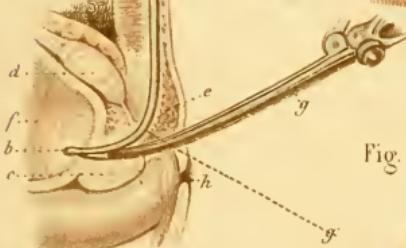


Fig 4

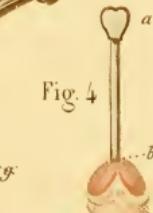


Fig 6 bis

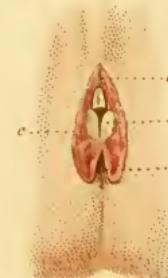


Fig 6

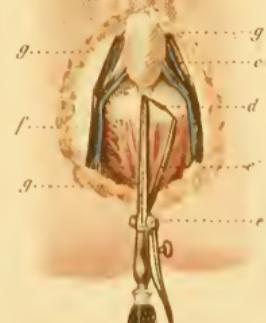
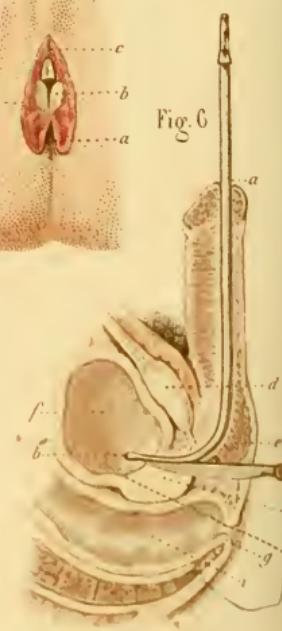


PLATE LXXIX.

SURGICAL ANATOMY OF THE PERINEUM.

Fig. 1.—The perineum.—The left half of the figure represents the superficial layers; the right half the deep structures, the superficial fascia being preserved on the left half: *a*, the anus with the external sphincter, half dissected; *b*, the bulb of the urethra covered by the accelerator urinæ; *c*, the internal pudic vessels, the artery being superficial and external to the vein. These vessels, traced backwards over the spine of the ischium, enter the pelvis below the pyriformis; but traced forwards, under the protection of the tuberosity and ramus of ischium and pubes, they lie between the two layers of the triangular ligament, giving off branches in their course; these are, *f*, the superficial perineal, for the supply of the scrotum, and *f'*, the inferior hemorrhoidal which passes inwards towards the anus.

The most important branches are the artery to the bulb, which runs from the front of the ischial tuberosity forwards and inwards, and the transverse perineal, which courses along the posterior border of the transversus perinei. These are accompanied by corresponding veins. The internal pudic artery ends in the artery for the corpus cavernosum and the dorsal artery of the penis; *e*, section of glutæus maximus; *g, g*, skin. The origin of the adductors and the fascia lata, the coccygeus and levator ani, and the coccyx are also seen; *h, h*, testicles; *i*, the penis.

Fig. 2.—Bilateral lithotomy.—Introduction of the staff and incisions in the skin.—*a*, anus; *b*, transverse incision across perineum between anus and bulb; *c*, the index finger feeling for the groove in the staff; *d*, bistoury; *e*, bulb; *f*, meatus; *g*, the staff held vertically in the middle line; *h*, testicles drawn up by the assistant who holds the staff.

Fig. 3.—Incision through prostate in the bilateral section.—The coverings have been removed to show, *a*, the internal pudic vessels; the bulb, *b*, covered by the accelerator urinæ; the inferior surface of the prostate, in which is noticed the

crescentic incision made by the withdrawal of the separated blades of the lithotome, *c. c.* At the middle of this incision is seen a small notch, which passes into the membranous part of the urethra to give greater room; more posteriorly is shown the levator ani.

Fig. 3 bis shows the way in which the double lithotome is introduced, the blade being hidden in the stem.

Fig. 4 shows the way in which the left side of the prostate is cut by the single lithotome. The line of incision, *d*, is also followed by the lithotomy knife of the English surgeon in the second part of the lateral operation. The incision passes backwards and outwards between the median line and the internal pudic vessels.

Fig. 5.—Extraction of the stone by the forceps.—a, held in the right hand, the blades being steadied on the stone by the left hand.

Fig. 6 shows a modified operation for stone, the incision passing backwards in the middle line through the prostate and front of the rectum. (*Median Recto-prostatic.*)

Fig. 6 bis shows the result of the section.

LITHOTOMY.

Lithotomy is the operation in which a passage is cut through into the bladder for the extraction of calculi or foreign bodies generally. Every variety of operation which the ingenuity of surgeons could conceive for reaching the bladder has been attempted; but we shall content ourselves here with describing the methods of operating employed in England. A special article will treat of lithotomy in the female.

SURGICAL ANATOMY OF THE PERINEUM.

By the perineum is meant the layers of muscular and fibrous tissues which fill in the triangular interval between the rami of pubes and ischium and the anus; further back, and on either side of the anus, is the ischio-rectal fossa. Beneath the perineum, and partly in its substance, are the urethra, the bulbous and membranous portions, the prostate and neck of

the bladder, and, further out, the trunks of the internal pudic vessels and nerve.

The surface markings are, in the middle line, the urethra with the bulb; behind this a slight depression can be made out which corresponds to the central tendon of the perineum, and further back still is the anus. In front is the root of the scrotum, with its median raphé. The fossa at the side of the urethral tube is limited externally by the rami of the pubes and ischium. Behind it loses itself in the ischio-rectal fossa.

The skin is thin, brownish, and elastic, being covered with scattered hairs and sebaceous follicles. Beneath the skin is the superficial fascia disposed in two layers, of which the superficial contains non-striated muscular fibres and becomes continuous with the fatty layer on the thighs and in the ischio-rectal fossæ. The deeper layer of the superficial fascia is thin and membranous; it is attached externally to the rami of pubes and ischium, posteriorly to the base of the triangular ligament, and looping around the scrotum in a wide sheet passes up to the abdomen and around the penis. On the abdomen it is attached to Poupart's ligament and to the outer lips of the crest of the ilium. This deeper layer of the superficial fascia plays a most important part in cases of ruptured urethra, for, whilst preventing the urine from passing down the thighs or into the ischio-rectal fossæ, it guides it up on to the abdomen by way of the scrotum and penis, and in the direction of the spermatic cord. This layer of fascia covers in an important triangular space, limited by the following muscles: externally by the erector penis, posteriorly by the transversus perinei, and in the middle line by the accelerator urinæ. Under this fascia are found the superficial perineal branches of the internal pudic vessels and nerve, and, probably, the small transverse perineal branch of artery. In the depths of the space is seen the triangular ligament of the urethra, or the true deep perineal fascia. Into this triangle the surgeon plunges the knife in the beginning of the lateral operation of lithotomy to reach the groove in the staff between the two layers of the triangular ligament, and, cutting backwards and outwards to the interval between the anus and the ischial

tuberosity, divides perhaps the superficial perineal branches of vessel and nerve, the transverse perineal muscle and vessels, the inferior haemorrhoidal vessels and nerve, the base of the triangular ligament, the compressor urethræ, and the wall of the urethra itself.

The central tendon of the perineum is the spot in front of the anus in which the posterior fibres of the accelerator urinæ and the anterior fibres of the levator ani join with the insertion of the transverse muscle of the perineum.

The triangular ligament or deep perineal fascia is a double fibrous layer which fills up the anterior part of the pelvic outlet, and steadies the urethra in its course beneath the pubic symphysis, between the prostate and the bulb of the urethra.

The superficial layer of the ligament covers the compressor urethræ, the internal pudic vessels and nerve, the branches to the bulb and to Cowper's gland. It is lost externally on the rami of the pubes and ischium ; in front it is attached to the pubic symphysis ; and posteriorly it is joined to the base of the deep layer of the triangular ligament, and is in connection with the deep layer of the superficial fascia which has dipped down behind the transverse muscle.

The deep layer of the triangular ligament is a fascia stretched across the pubic arch. Posteriorly it is in connection with the capsule of the prostate and the pelvic fascia. It is separated from the superficial layer by the internal pudic vessels and nerve, the compressor of the membranous part of the urethra, and the artery of the bulb.

If the knife is brought too far forward in the lateral operation the artery to the bulb would be in danger of being divided.

Both the layers of the triangular ligament are pierced, at about an inch below the symphysis, by the urethra, and higher up by the dorsal vein of the penis in its course to the prostatic plexus.

The neck of the bladder is partly behind the prostate gland, partly surrounded by it. It is steadied in its position by the wings of the pelvic (recto-vesical) fascia passing inwards under the name of the lateral true vesical ligament. This same fascia surrounding the prostate is also connected

with the back of the pubes and the bladder under the puboprostatic or anterior true ligaments of the bladder. Passing down to the side of the prostate are the anterior fibres of the levator ani.

After the knife has reached the groove in the staff it is made to travel on from the membranous part of the urethra through the side (left) of the prostate and the neck of the bladder, dividing in its course a few fibres of the levator ani.

Position and course of incisions in the lateral operation.—The superficial incision should not be started too far forwards lest the bulb of the urethra or its artery be injured. The surgeon must feel for the prominence of the bulb at about an inch and a half in front of the anus of the adult, and should plunge his knife boldly in towards the membranous part of the urethra behind the bulb and close to the left side of the median line. Nothing is gained by keeping the point of the knife well forward at the commencement of the operation; the ripping up of so much of the canal is undesirable. This incision must extend to a point between the tuberosity and the anus, and a little nearer to the former, well back into the ischio-rectal fossa, so that the inferior extremity of the passage cut into the bladder may be the most capacious part, and so that urine may have no impediment in its flow to the exterior of the perineum. It is well also that the operator endeavour to hit the staff in the first plunge of the operation; if this be effected the following parts will have been divided by the time that the knife has emerged from the ischio-rectal fossa: skin and superficial fascia, branches of the superficial perineal vessels and nerves, the transverse perineal vessels and muscle, the base of the triangular ligament, the membranous part of the urethra with the compressor urethræ, the inferior haemorrhoidal vessels and nerves, and the fat in the ischio-rectal fossa.

Now, before this incision is made, the surgeon must have obtained a thorough knowledge of the anatomical position of the tuberosity and the ramus of the ischium, the anus, and the rectum. He must assure himself, by introducing his finger into the bowel, that the rectum is not distended with fæces

and bulging into the ischio-rectal fossa, for if this be the case it will stand in great danger of being wounded as the knife passes backwards through the fat in the fossa. While the left index finger is in the rectum it will be well to feel by it the staff in the bladder and urethra, and, possibly, the calculus.

If the incision be taken too far outwards and the point of the knife be allowed to travel up under the ischium, the internal pudic vessels would be in peril. The dangers in connection with the last part of this incision will be the wounding of the rectum or the internal pudic artery.

Second incision.—Although we are in the habit of speaking of the first and second incisions in lateral lithotomy, it must not be supposed that the operator is to make only two with his knife. On the contrary, he may have to draw his knife several times from before backwards in making the opening into the perineum and ischio-rectal fossa according to his experience. By the second incision one means the deepest part of the cutting operation by means of which the groove of the staff is laid bare, and the prostate and neck of the bladder are incised. The surgeon introduces his left index finger into the front of the wound and feels the grooved staff in the membranous part of the urethra. He then makes the nail of the finger a guide for the knife to reach the groove. The point of the knife being thus engaged in the groove, the surgeon feels with certainty that all is going well, and he makes the knife to travel on in the groove until a rush of bloody urine informs him that he has reached the bladder. The back of the point of the knife must be made to rub firmly along the groove in all the way, lest it wander out between the bladder and rectum and fail to enter the bladder. The knife must be then withdrawn, with the handle depressed, so as to enlarge the bladder opening.

The parts which are necessarily divided are, the base of the triangular ligament, and perhaps a few fibres of the accelerator urinæ, the urethra between the layers of the ligament, and the compressor urethræ. Then the prostate, and its capsule derived from the pelvic fascia, and the neck of the bladder. In the adult this incision is best limited to the prostatic

part of the bladder, lest, the pelvic fascia being freely divided, urine find its way into the loose tissue in the floor of the pelvis, and infiltration ensue. But in the child it is impossible to keep the incision in such narrow limits, on account of the exceedingly small dimensions of that gland.

The incision, however, must not be too cramped, especially in the child, lest, on account of the slender connections of the neck of the bladder, the whole viscus be pushed up into the pelvis by the finger which seeks the stone. No doubt many of the cases in which no stone has been found at the time of the operation have been consequent upon the incision into the bladder not being properly made.

Knowing, then, that he has opened the neck of the bladder, the surgeon passes the left index finger on to the groove in the staff and works it over the concavity of the staff into the bladder, hooking down, as it were, the staff in the endeavour to reach the interior of the bladder. Then he feels for the stone, and having his finger against it, he requests his assistant to withdraw the staff. The finger thus introduced dilates the wound, and over it is passed the forceps; the stone is seized and worked out by lateral movements. It must not be pulled straight out, lest damage be done by laceration. If the stone is very large, a nick may be made into the right side of the prostate, or if it proves to be a calculus of enormous size it must be crushed, or the supra-pubic operation must be at once performed. A "petticoated" tube may be introduced into the bladder, and there left if there seems to be much haemorrhage; a syringeful or two of cold water will generally be enough to check oozing.

The following rules deserve the attention of the young lithotomist. Never cut a patient unless you can strike the stone when you are about to operate. Let your first incision be free, so as to get plenty of room for the second, which should not be made too far forwards nor of too limited an extent. Be sure to lay the staff well bare before running the knife towards the bladder. Never allow the staff to be withdrawn until you have touched the stone with your index finger. Take no thought of dash, display, time, or lookers-on,

but proceed step by step with care and certainty. If the rectum is prolapsed as you are about to commence, do not diminish the space required for your incisions by returning the protruded part.

The Median Operation.—By the “Median Operation” is meant the removal of a stone from the bladder by an incision through the middle line of the perineum. This method of procedure was, in late years, revived by Allerton, who was of opinion that the bladder could by its means be opened with a much less injury to tissues, especially as regards the pelvic fascia, and with less risk of damaging important arterial branches, such as the artery of the bulb and irregular trunks from the internal pudic.

A full-sized staff, with a groove running along the convexity, having been introduced into the bladder, the patient is tied up in the usual way. The surgeon then introduces his left index finger into the rectum, and, feeling the staff in the urethra, keeps the end of the finger against the apex of the prostate gland. The point of the knife is now plunged into the perineum about half an inch in front of the anus, the back of the knife being directed towards the rectum. The incision is then carried forward in the middle line of the perineum for about an inch. The urethra having been opened at the triangular ligament, a button-ended probe is pushed along the groove of the staff into the bladder; the staff is then withdrawn. The finger, then following the track in which the probe lies, makes its way into the bladder and feels the stone. The finger being kept against the stone, and dilating the wound the while, prepares the way for the forceps, and the stone is extracted.

Remarks.—This operation answers well for the extraction of a small stone or of a small foreign body; but these are just the cases in which lithotrity can usually be employed with advantage. Moreover, small bodies can well be removed by the lateral method; for it is not, as a rule, the incision into the bladder which, in fatal cases, causes the unfortunate result, but the laceration of the parts which is necessitated by the removal of a large stone. The larger the stone the more

unfavourable the prognosis. Certainly there is less risk of haemorrhage following on the median than on the lateral operation, and less risk of opening up the reflections of pelvic fascia, and of death occurring from urinary infiltration into the connective tissue of the pelvis. But as the incision lies so far to the front of the pelvic outlet, there is, evidently, little chance of being able to remove a large stone by the median operation. If, to obtain greater space, the incision is taken far forward, the bulb would be cut ; if taken backward the rectum would be opened.

The "medio-lateral" operation is performed much in the same manner as the median, but in order to obtain more room for reaching and extracting the stone, the incision is carried backwards and outwards from the membranous part of the urethra into the ischio-rectal fossa.

By the use of Buchanan's rectangular staff, the angle of which is made to project well into the perineum, the bladder is reached with great ease.

Dupuytren's bilateral operation was introduced with a view to obviate the risk of wounding the bladder unnecessarily, or of cutting beyond the limits of the pelvic fascia, as it surrounds the prostate. Both lobes of the prostate being divided, it is held that ample room is obtained without further cutting or rough dilatation. The operation is rarely performed in England because, since the days of Cheselden and Liston, the simple lateral operation has been found to fulfil almost every requirement.

The staff, which has a wide median groove in its convexity, is passed and held in the usual way, and the surgeon, with his left forefinger introduced into the rectum, makes a crescentic incision just in front of the anus, the convexity being directed forwards. The ends of the incision are carried round into each ischio-rectal fossa. Cutting down, layer by layer, and guarding well the rectum, the surgeon at last exposes the staff as it lies in the membranous part of the urethra (Pl. LXXIX., fig. 2). Guided by the groove on the staff, the *lithotome caché* is then introduced into the bladder, the concavity being turned upwards (fig. 3 bis). The staff is now withdrawn and the

lithotome turned with the concavity directed downwards. The surgeon then presses a button on the handle so that the hidden blades start out of the lithotome and effect the section of the two sides of the prostate as the instrument is withdrawn. The amount of separation of the blades and consequent section of the lobes of the prostate can be arranged beforehand by the adjustment of a screw (fig. 3). The lithotome having been withdrawn, the calculus is extracted in the usual manner.

Surgeons have occasionally removed stones from the bladder by cutting through the anterior wall of the rectum ; but it is not necessary to more than allude to this operation.

PLATE LXXX.

SUPRA-PUBIC OR "HIGH" OPERATION.

Fig. 1.—Antero-posterior median section, showing the thickness of the perineum and the position of bladder and rectum, and a sound, *a*, with a hidden blade, *b*, which is made to travel from the interior of the bladder through the abdominal wall in the supra-pubic region. *c*, prostate; *c'*, seminal vesicle; *c''*, recto-vesical pouch; *d*, symphysis; *e*, bulb; *e'*, testis; *f*, bladder distended by fluid.

Fig. 2.—High operation.—Section in linea alba.—*a*, bistoury, plunged into the small wound made by the sharp guide, *b*; *b'*, point of guide passing through thickness of abdominal wall. The distended bladder, the rectum and the prostate are also shown.

Fig. 3.—Incision into the bladder, *f*, previously distended, the bistoury, *a*, the edge being directed towards the pubes, the back resting upon the curved index finger of the left hand.

Fig. 4.—Dilatation of the wound.—Extraction of the stone.—*a*, hook or elevator raising the stone, *c*. The wound is dilated by a gorget held by an assistant, and by the operator's left index finger.

Fig. 5.—Extraction of calculus, *c*, by the forceps, *b*, the

Fig. 1.

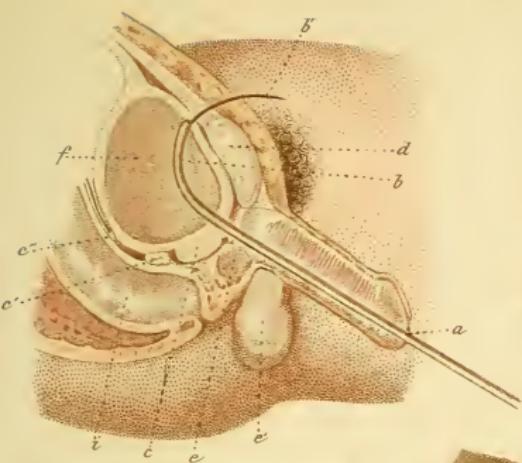


Fig. 2.

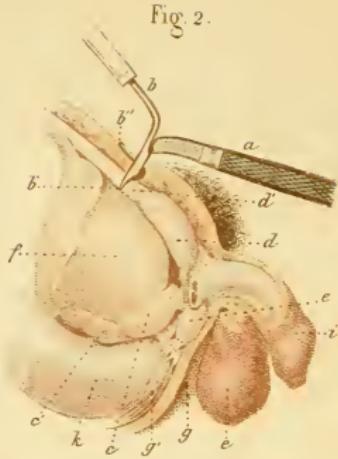


Fig. 3



Fig. 4



Fig. 5

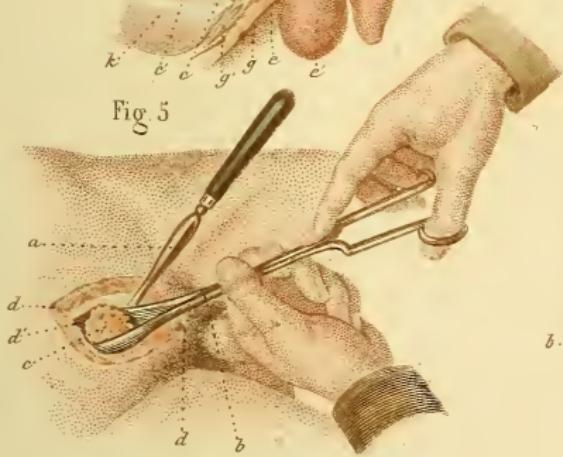
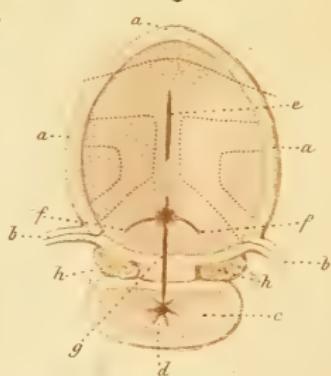


Fig. 6.



thumb and fourth finger being passed through the rings of the forceps. The left hand steadies the forceps nearer the wound, and helps in traction; *d* and *d'*, edges of wounds.

Fig. 6.—View of the interior of the bladder, the upper and back parts having been removed, so as to show the line, *e*, of the hypogastric section; *g*, the incision for the median operation; *f, f*, shows the bilateral section of Dupuytren,—the half on the left side would pretty nearly indicate the line of incision in the English operation; *b*, ureters; *h*, seminal vesicles. The body and rami of the pubes are marked in dotted outline.

SURGICAL ANATOMY OF THE SUPRA-PUBIC REGION.

When the bladder of the adult is empty it lies deeply in the pelvis, hidden behind by the pubes; but when distended it rises high up, nearly to the umbilicus, and pushes up with it the peritoneum, leaving always the surface of the bladder behind the anterior abdominal wall bare of serous coat. Of this fact the surgeon takes advantage in certain operations. The skin of this part of the abdominal wall is thickened above the pubes by a considerable addition of fat, constituting in the female the mons veneris. The region in the middle line, corresponding to the linea alba beneath, is covered by a longitudinal streak of hairs. The skin in this line is a little darkened, and beneath may be made out the furrow between the recti abdominis; but in a very fat subject the situation of the linea alba can only be distinguished by drawing a line on the surface from the symphysis pubis to the ensiform cartilage. The amount of fat in the superficial fascia varies; it is as a rule more abundant in women than in men, and may increase to such an extent in either case as to render the wound in the high operation for stone excessively deep.

On either side of the linea alba is the rectus abdominis in its sheath; the muscle is narrower near the pubes than elsewhere. In front of the rectus in this neighbourhood is the pyramidalis, an accessory muscle, which is inserted into the linea alba. The rectus arises from the crest and symphysis of the pubes, and passing straight upwards is inserted into

the cartilages of the lower *true* ribs. The borders of the muscle are thinner than the middle portion, and along the outer edge is seen a somewhat crescentic marking, corresponding to the border of the rectus and the ending of the fleshy fibres of the oblique muscles in the aponeurosis; this is called the linea semilunaris. The deep epigastric artery, a branch of the external iliac, lies so far away from the inner border of the rectus that it is in no danger of being wounded in suprapubic lithotomy.

Behind the lowest part of the rectus no sheath is found, but the muscle lies upon a layer of condensed connective tissue known as the transversalis fascia, which varies much in character, being sometimes thick and strong, at others loose and lax, or impregnated with fat. It separates the posterior surface of the anterior wall of the abdomen from the peritoneum and the distended bladder, and is often firmly attached to the linea alba.

The remains of the urachus and of the two hypogastric arteries are found between the peritoneum and the recti.

When the bladder is distended this layer of connective tissue becomes thinned; but it is nevertheless somewhat tough, like the sheath of an artery, and may require to be cautiously divided by a crucial incision. It is quite possible to reach the bladder from above the pubes without having distended the viscous with water; but in doing this care must be taken not to wound the fascial layer unnecessarily. If the bladder be previously distended the operation is facilitated by the easy recognition; to strip up the serous pouch is an easy task. The catheter introduced into the bladder by the urethra is useful as a guide. If the coats are hypertrophied there may be some trouble in extracting the stone, but the incision in the front of the viscous must not be taken down too far lest the veins of the neck be injured.

OPERATION.

The high operation is performed in England when the stone is too large to be extracted by the perineum. Mr. Holden says (Landmarks) that Jean de Dot, a smith at Amsterdam, cut

himself in the linea alba, above the pubes, and took out of his bladder a stone as large as a hen's egg. "The stone, the knife and the portrait of the operator, may be seen to this day in the Museum at Leyden."

The operation is unsatisfactory on account of the frequency of injury to the peritoneum, and also on account of the danger of urinary infiltration. About one in three is the proportion of success.

The operation is thus performed : the patient is placed on his back, and an incision three or four inches in length is made in the middle line down to the pubic symphysis. A catheter introduced by the urethra is steadily held by an assistant, the handle being well depressed so as to make the beak approach the hypogastric region in the middle line. This will be a sufficient guide to the surgeon without injection of the bladder. The operator will work through the lower part of his incision, keeping close towards the pubes, cutting through the fibrous structures of the linea alba. Having divided the transversalis fascia, he will strip up the peritoneum with his fingers, and feel down behind the pubes for the end of the catheter, over which he will make an incision. A soft gum-elastic catheter will be allowed to remain in the bladder for a few days, so as to keep urine from the wound.

Though this operation is performed but rarely in the present day, nevertheless a deformed pelvic outlet, or ankylosed femora will occasionally render its selection imperative. There are several methods of performing it described ; but the simple one to which we have just called attention is to be preferred. A scalpel, scissors, director, dissecting forceps, catheters, calculus forceps, retractors, needles and sutures will be all the instruments that are required.

PLATE LXXXI.

OPERATIONS PRACTISED ON THE GENITAL ORGANS OF WOMEN.

CUTTING FOR STONE IN WOMEN.

Fig. 1.—Anatomy of the perineal region in women.—*C*, anal sphincter; *C'*, constrictor vaginae; *P*, anus; *V*, vagina; *s*, clitoris; *u*, meatus urinarius; *m, m*, superficial branch of the internal pudic artery; *b*, clitoric, or deep branch; *l, l*, transverse muscle; *i, i*, middle aponeurosis; *a, a*, internal pudic artery; *f, f*, gluteus maximus; *r*, levator ani.

Fig. 2.—The vestibular operation in women.—*Method of Lisfranc.*—*First step of the operation.*—*A*, curvilinear incision practised in the vestibule, and designed to give exit to the calculus; at the same time the vestibular space is enlarged by lowering the urethra, *u*, by means of the catheter, *S*. *b, b*, fingers of assistants keeping the labia majora apart; *V*, external orifice of the vagina; *l, l*, labia minora.

Fig. 3.—Urethral operation in women, seen in profile section of the perineum, so as to show the relation of the different organs in the operation.

Method of Laurent Colot.—*P*, anus; *S*, grooved sound introduced into the urethra and bladder; *V*, vagina; *a*, uterus; *a'*, orifice of the cervix uteri; *a''*, vesico-uterine fold of peritoneum; *b*, bladder; *c*, vesico-vaginal septum; *d*, recto-vaginal septum; *e*, lower part of the rectum not invested with peritoneum; *e'*, upper part of the rectum; *l*, middle haemorrhoidal artery; *t*, straight bistoury, the end of which *u*, is engaged in the grooved sound (see Operative Procedures).

SURGICAL ANATOMY OF THE FEMALE PERINEUM.

In women, as in men, the ano-perineal region may be considered in its entirety as a musculo-fibrous floor, designed to close the lower part of the abdominal cavity. This floor is, pretty nearly, formed in the two sexes by the same planes, disposed in the same order. The modifications affect only the organs which traverse this floor. Thus it always presents

Fig. 1

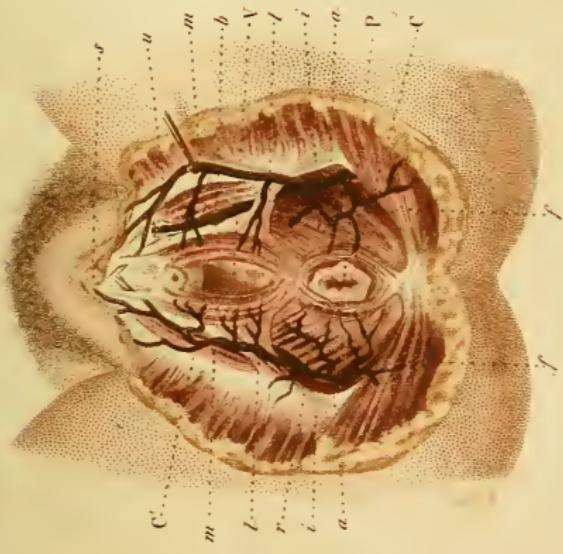


Fig. 2

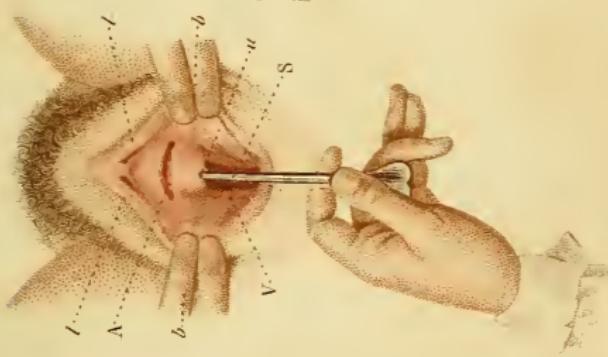
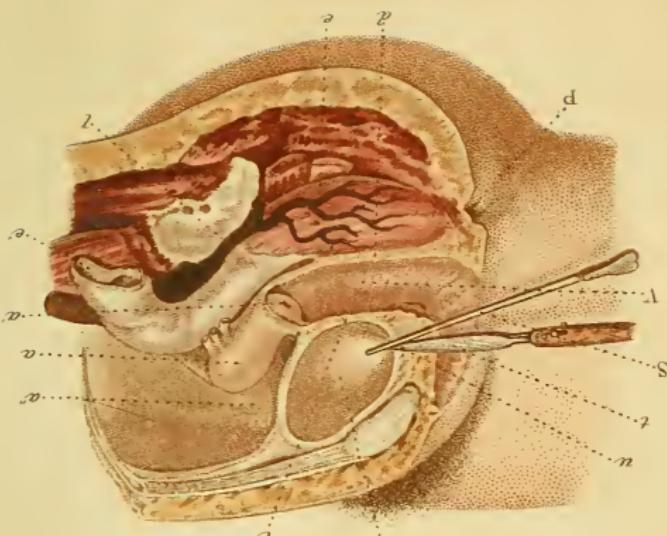


Fig. 3



two regions—the one posterior, or anal ; the other anterior, urethral or perineal, properly so called.

There is nothing to add respecting the first, in which the same elements are met with : in the centre is the rectum, which descends surrounded and supported by the levator ani, ending below in the anal orifice (*P*, fig. 1), itself surrounded by the anal sphincter, *C*, and presenting right and left the ischio-rectal space bounded by the obturator internus and levator ani, and their aponeuroses. This space, filled with fat in the recent state, is traversed by the internal pudic artery, *a*. It is less deep in women than in men ; but it is more extended transversely, which is explained by the greater separation of the two ischial tuberosities, which diverge obliquely outwards, and are less prominent.

The result is that the anus is not so deep, and it is found on nearly the same plane as the two tuberosities, without the great quantity of cellulo-adipose tissue with which the skin is thickened at the level of these prominences.

In front, on the contrary—that is to say, in the perineal region properly so called—we have to point out notable differences, which do not affect the disposition of the superposed layers or planes, but the organs which traverse these layers. Thus this portion of the perineum is, like the preceding, traversed through the centre by a membranous canal (the vagina, *V*, fig. 3), situate between the rectum and the bladder, surmounted by the uterus, the neck of which it embraces, and of which it may be considered the excretory duct. This canal ends below at the vulva. In front it is in immediate relation with the urethra.

The vagina and urethra traverse the perineal aponeuroses, the disposition of which is the same as in man.

The vulva, or the whole of the external parts of generation, presents itself externally in the form of an elongated fissure from the mons veneris to one inch in front of the anus.

The fissure is bordered on each side by two more or less projecting cutaneous folds, which are the labia majora. These, opposed to each other by the internal surface, are free, and covered by hairs on their external or cutaneous surface.

The internal surface is mucous, and one finds here, as at the level of nearly all the orifices where internal and external integuments are continuous, the almost insensible transition between skin and mucous membrane, marked only by the change in colour.

By their posterior extremity they are joined to one another to form a membranous fold, the posterior commissure or fourchette, which is nearly always torn in delivery.

One finds in their thickness dartos tissue, hairy and sebaceous follicles, an expansion of the *fascia superficialis*, and the superficial aponeurosis.

On separating the labia majora, two other folds appear, formed by erectile tissue and covered by a mucous fold, which is here abundantly endowed with sebaceous follicles. These folds, the labia minora, less developed than the preceding, commence internal to the labia majora, at the level of the posterior third of the vulva, by a thinned extremity, and end in front by uniting together.

Here they cover a small rounded eminence, the clitoris, more or less prominent, and formed of abundant erectile tissue, or rather of a cavernous body springing from two roots, very rich in nerves, and surrounded by a fine fibrous layer, which lines the mucous membrane.

a, a, internal pudic artery.

Behind the posterior border of the transverse muscle, *l, l*, this artery divides into two branches: the one superficial, *m, m*, which is destined to the labia majora and mons veneris; the other deep, or clitoric artery, which goes to the clitoris.

Veins accompany the arteries. A certain number of those which come from the clitoris always communicate with the vaginal veins.

The lymphatics go to the inguinal glands; the nerves come from the internal pudic and the inguinal branches of the lumbar plexus.

About half an inch behind the clitoris, *s*, the external orifice of the urethra, or meatus urinarinus, *u*, is seen, and a quarter of an inch behind the meatus another small nipple, less prominent than the clitoris, exists, named the urethral tubercle.

It is the anterior part, the termination of the column or anterior longitudinal crest of the vagina, slightly enlarged in the form of a tubercle.

The space which separates the clitoris from the meatus urinarius, and which is bounded on each side by the angular opening of the two labia minora, has received the name of vestibule, and is of some interest to the surgeon on account of its great dilatability, which allows him to obtain a space more than double (one inch or more) when the urethra is depressed backwards, or when, after labour, or from any other cause, the meatus urinarius, carried upwards, rises to behind the symphysis pubis.

Below the vestibule, and at the level of the urethral tubercle, begins the vaginal orifice, which occupies all the posterior part of the vulva nearly to the fourchette, from which it is only separated by a small triangular space, the fossa navicularis. This orifice is, in virgins, more or less closed by a thin membrane, somewhat disposed in the form of a diaphragm, with a central aperture, sometimes like a crescent, of which the free concave border looks forwards. It is this membrane, known as the hymen, which is torn during coitus, and is represented by little tubercles called carunculae myrtiformes.

Outside these caruncles the excretory canal of the vulvo-vaginal gland opens.

The vagina, V, a short distance from its external orifice, is embraced by the spongy body which has received the name of Bulb of the Vagina.

The walls of this membranous canal are constituted by a layer of erectile tissue, by fibres of dartoid tissue, of which one set, longitudinal, arranged on the anterior and posterior aspects, form within the vagina two projections, which have received the name of Columns of the Vagina, and of which the others, circular or curvilinear, extended from one column to the other, and forming within a great number of transverse folds, raise the mucous membrane, which covers or invests the internal surface of the organ. Lastly, at the level of the external orifice there is a veritable ring of muscular fibres, the sphincter or constrictor vaginæ, *C'*. The mucous membrane

contains a great number of follicles and glands; the vulvo-vaginal gland, situate without the vagina, through the walls of which its excretory duct passes, seems to be one of the most developed of these glands. The arteries come from the internal iliac, the veins, frequently anastomosing with each other and with those of the clitoris, empty into the vesical vein. The nerves come from the hypogastric plexus.

The anus, *P*, is surrounded by the sphincter, *C*; *r*, levator ani; *i*, ischial tuberosity; *S*, clitoris; *f, f*, glutei maximi.

The female urethra, much shorter and less complicated than that of man, begins at the meatus urinarius, is directed obliquely upwards and backwards, presents a slight curve with the concavity upward, which follows the symphysis pubis, and ends at the neck of the bladder. Wanting a prostate, it widens, and is placed near the lowest part of the body of the bladder. The length of the urethra is rather more than an inch. In front, it is within a third of an inch of the pubic symphysis; posteriorly it is at first in immediate relation with the anterior wall of the vagina, which is grooved by a canal to receive it, then it deviates from it a little above, and is separated by a cellular space a quarter of an inch in extent. This canal, larger than that of man, is besides eminently dilatable. In other respects it has the same structure as that of man.

The bladder, *b*, presents nothing particular in women; it rises forwards and a little above behind the pubic symphysis; behind it is in relation, not with the rectum, but with the vagina and uterus, *a*. The vagina, *V*, is four to five inches long from the cervix uteri to its external orifice. In the normal condition it has a diameter of about an inch and a half; but by forcible extension it may attain to double that, especially in its middle and upper parts; for at its orifice it resists dilatation much more. Like the urethra, it describes a curve with the concavity forward; its axis, oblique from above downward, and from behind forward, falls in front of that of the outlet of the pelvis.

The vagina is in relation, in front, with the base of the bladder, which, in the extent of that position corresponding to the vesical trigone, is united with it by a filamentous cellular

tissue in such a manner that the peritoneum, which is reflected over the posterior surface of the bladder, does not descend to the vagina. The arrangement is not the same behind, where the vagina, immediately connected with the rectum, in its middle part, is separated above by the peritoneum reflected from the anterior aspect of the rectum to the posterior aspect of the vagina, forming the recto-vaginal cul de sac, of which the bottom is rather more than an inch from the surface of the perineum. Below, the vagina, on account of its curve, deviates from the rectum, and is separated from it by a cellular tissue; *c*, vesico-vaginal septum; *d*, recto-vaginal septum.

Situate in the pelvic cavity between the bladder and the rectum is the uterus, *a*, of an ovoid shape of which the larger end is upwards. The two upper thirds form the body of the organ; the lower third constitutes its neck.

The uterine axis is generally considered as oblique from above downwards, and from before backwards. But from recent researches it is found that in the foetus, the child, the young girl, in a word, up to the epoch of the first pregnancy, the axis of the body of the uterus forms with that of the neck an obtuse angle, an angle which may sometimes be even acute; so that these two parts, the body and the cervix, are flexed on each other.

In all cases the body and cervix are separated by a constriction; the anterior and posterior surfaces are convex; the upper and lateral borders, convex, unite by two rounded angles, which give attachment to the Fallopian tubes, the round ligaments, and the ligaments of the ovary.

The cervix uteri projects half an inch into the vagina, the walls of which are inserted around it. This projection presents in the middle the uterine orifice, the os tincae. The form of the cavity of the uterus is elliptic at the level of the cervix, and triangular in the body, the two superior angles being continuous by a very narrow orifice with the cavity of the Fallopian tubes. The cavity of the cervix and that of the body are separated by a marked narrowing which can seldom be passed by the sound without difficulty, and without causing rather sharp pain.

The uterine walls are very thick and covered by peritoneum, which in front is reflected from the posterior wall of the bladder to invest the anterior surface of the uterus, and behind covers the posterior surface in its reflection from the rectum to the uterus. Of these two folds, or *culs de sac*, in which loops of intestine may lie, the posterior descends lower than the anterior, the bottom of which is half to two-thirds of an inch from the insertion of the vagina. This serous investment and the folds to which it gives rise, and which form the broad ligaments, are, with the vagina and the round ligaments, nearly the only means of fixing the uterus. Accordingly this organ is exceedingly mobile and exposed to deviations and displacements.

It is susceptible of great development in spite of the resistance of its walls, to such an extent that, barely reaching the level of the superior pelvic opening in the normal condition, it sometimes rises to above the umbilicus during pregnancy.

Besides the serous tunic, the uterine walls present a very thick layer of muscular tissue, which, but little apparent in the empty state, acquires a very great development during pregnancy. These fibres constitute almost by themselves the whole thickness of the organ; they are covered on their internal aspect by a mucous membrane closely attached. The mucous membrane of the cervix presents a great number of muciparous follicles, which are the seat of a secretion the product of which has received the name of *Ovula Nabothi*.

The arteries of the uterus come from the ovarian and internal iliac arteries. The veins (which in the thickness of the uterine tissue present only their internal membrane and the dilatations of which during pregnancy form the uterine sinuses) outside the organ follow the same direction as the arteries. The nerves emanate from the hypogastric plexus; few in number, they go to the body and cervix.

The broad ligaments formed by two serous folds extend transversely outwards, being prolonged to the superior extremity of the vagina. Subdivided into three secondary folds or wings, they are lined by some muscular fibres, prolongations from the uterine fibres. The three folds contain, the round

ligament which ends in an expansion in the cellular tissue of the mons veneris; the Fallopian tube, a slightly flexuous narrow tube, opening into the abdominal cavity by a fringed orifice; and lastly, the ovary and the ovarian ligament.

The *ovary* is the essential organ of generation in women, is united to the uterus by a fibro-muscular ligament, and has an ovoid shape flattened from before backwards.

In childhood, and up to the epoch of the first menstruation, the surface of the organ is smooth; then in proportion as the woman advances in age, this surface becomes uneven and fretted by the formation of numerous cicatrices which correspond to the evolution of ova.

The ovary is formed by a very dense fibrous membrane covered by the peritoneum of the posterior wing of the broad ligament, and constituting, by the prolongations which emanate from its interior surface, the stroma of the ovary, a species of fibrous mesh where the ovules form, or rather the Graafian vesicles, to which the corpora lutea succeed.

The ovarian arteries come from the aorta, the veins accompany the arteries. It is the same with the nerves which come from the renal plexus.

OPERATIVE PROCEDURES.

ON CATHETERISM AND CUTTING FOR STONE IN WOMEN.

A. Catheterism.—Catheterism may be practised with the patient lying down or sitting on the edge of a bed, the parts being covered or uncovered.

The catheter ordinarily used is the female one, generally carried in every pocket-case; it is usually made of silver and is short, its length being from six to seven inches. Slightly curved and designed to traverse a short and but slightly curved canal, it generally enters the bladder very easily. The only difficulty, if ever there is any, is to find the meatus urinarius. If the parts are uncovered, this difficulty does not occur. In the first case the patient lies on the back, the legs

and thighs separated and slightly flexed, the pelvis a little raised. The operation may be made by the right or left hand, the position of the surgeon being considered indifferent; but, generally, it is easier to stand on the right of the bed.

Carrying the left hand pronated on the pubes, the surgeon separates the labia majora and minora with the thumb and index finger of that hand, and uncovers the vestibule and meatus. Then, taking in the right hand the catheter, previously oiled, he holds it almost like a pen. It is sometimes useful to close the catheter with the index finger, in order to avoid soiling the clothes by the first jet of urine.

The direction of the catheter is such that the concavity looks upwards. The beak is applied to the urethral orifice; and, as soon as the instrument is engaged, it is lowered to free it from the symphysis pubis; then it is raised a little, and pushing it forwards in the direction of the urethra, it is introduced at once into the bladder.

Sometimes, as in cases where the pelvis is deep in the bed, in old age, during pregnancy, or after delivery, it happens that the urethra, rising with the bladder towards the pelvis, becomes very oblique, or even rises entirely behind the symphysis pubis.

In such circumstances M. Velpeau advises the separation of the nymphæ by the thumb and middle finger of the left hand, and with the index finger of the same hand forcibly lifting the clitoris and vestibule, so as to lower the meatus urinarius and bring it forward; then to pass the hand with the catheter, not directly between the patient's limbs, but below the ham which corresponds to the side occupied by the surgeon.

Should this not be sufficient a more curved catheter, or even a male catheter, would be required.

In these difficult cases one has not often a choice of means, and it is necessary to catheterize the patient uncovered; but generally it is not so; and as feminine modesty ordinarily revolts at being thus exposed, the surgeon is obliged to catheterize guided only by touch, and without the aid of the eye. Search may be made for the urethral orifice by proceeding from before backwards, or the reverse.

In the former case, M. Velpeau advises, as previously, the

separation of the labia minora with the left thumb and middle finger, and raising the clitoris with the index finger, the nail of which remains turned towards the meatus urinarius ; then carrying the point of the catheter on this nail, it is made to glide gently along the middle line from above downwards on the vestibule, and it then almost necessarily enters the urethral orifice

In the second case, which is the preferable, inasmuch as many women have great objection to manipulation of the clitoris, the surgeon, standing on the left, carries the index finger of the left hand, the pulp being directed forwards, towards the posterior part of the vulva. The finger meets successively with the fourchette, the vaginal orifice, and the urethral tubercle, $\frac{1}{6}$ of an inch from which is the orifice of the urethra ; the finger thus serves to conduct the catheter, held in the right hand, which is directed along it to the urethra.

In performing the operation of catheterism in women it will be found much more convenient for all purposes to use a gum-elastic male catheter than the silver instrument advocated in the text. A good size is the No. 8 English, but other smaller sizes should be at hand. When the urethra is tortuous compressed, or elongated, the flexible instrument adapts itself readily to the distorted canal, and renders this sometimes troublesome operation much more easy to the surgeon, as well as less painful to the patient.

B. Cutting for stone.—This operation is but rarely practised on women, and it may be given as a precept, and before all indication of procedures, that it should not be resorted to without absolute necessity. Many reasons concur to render this operation infrequent. These reasons are the consequence of the fortunate anatomical disposition of the female urethra ; its shortness, its want of curvature, and, above all, its great dilatability, which, joined to the declivity of the neck of the bladder, and the absence of the prostate, render easy the emission of calculi, when of small volume ; or allow of their being easily seized and extracted when they have not acquired a very notable size.

Nevertheless, sometimes we are obliged to have recourse to this operation. As in man, it may be practised above or below the pubis, by the perineum or high operation.

The perineal operation consists of three methods: in the first the bladder is penetrated through the vestibule; in the second the vagina is involved; in the third the urethra is engaged, a method which we reserve to the last, to incorporate dilatation and lithotomy.

Vestibular operation (see Pl. LXXXI., fig. 2).—The patient being placed, as directed by Ledran, on the edge of a table or bed, is to be turned on her back in such a way that the body occupies a line between perpendicular and horizontal, the thighs and legs being separated and flexed. One or more assistants, *b*, *b*, are charged with keeping the labia majora and minora, *l*, *l*, apart. The surgeon, standing between the patient's legs, introduces into the urethra an ordinary catheter, *S*, and turns it downwards so as to depress the urethra and vagina, *V*. The surgeon then, recognizing the pubic arch, and holding a bistoury in the right hand like a pen, makes a curvilinear incision, *A*, about $\frac{1}{2}$ of an inch below it, the convexity being directed upwards.

The incision should begin at the level of the right lateral aspect of the meatus urinarius, and finish diametrically opposite on the other side. The tissues are then severed layer by layer to the bladder, care being taken to hold the handle of the bistoury a little lower than the point. Having reached the bladder, the bistoury is either plunged in by puncture, or the walls are incised on the catheter, or, lastly, according to Lisfranc, the left thumb is introduced into the vagina, and the index finger into the wound; and, exercising slight traction on the tissues, the bladder walls are stretched and the incision made surer. In all cases, the bladder wall being cut above the neck, the left index finger is introduced into the wound and the wound enlarged.

The wound should be $\frac{3}{4}$ to $1\frac{1}{2}$ inch in length. The forceps are then to be introduced and the stone extracted.

Vesico-vaginal operation.—This operation, first performed by Rousset, consists in making an incision one inch or more in

length into the vesico-vaginal wall. It has been practised by Fabrice de Hilden, Méry, Ruysch, and in latter times by MM. Faure, Clémot de Rochefort, Flaubert, and Rigal.

The process is very simple. Introduce an ordinary catheter into the urethra, the convexity looking downwards, and depress the vesical wall; a straight bistoury is then to be carried into the vagina, an incision made upon the instrument and enlarged to the desired length, care being taken to avoid the urethra.

M. Velpeau proposed a slight modification, which consists in placing the woman not in the ordinary position for vestibular lithotomy, but lying on the abdomen, the thighs and legs being opened and flexed.

Urethral operation (see Pl. LXXXI., fig. 3).—The different procedures of urethral lithotomy may be ranged under two principal heads: sometimes one or two lateral incisions are made into the urethra; sometimes the urethra is incised directly upwards or directly downwards.

If it is intended, after Fleurant and Louis, to incise the urethra bilaterally, the surgeon employs either the instrument of the latter, which is composed of a flattened sheath furnished with two lateral openings, into which a double-edged blade is introduced, and which cuts both ways, or, preferably, the double lithotome of Fleurant or Dupuytren, which are very analogous. If, on the contrary, a unilateral incision is preferred, for which M. Klein invented the name of *cystenchenotomy*, the section of the urethra is made obliquely from above downward and from right to left, by the aid of a grooved sound, which serves to conduct either a long straight bistoury, or, what is simpler, the lithotome of F. Côme. Lateral incisions are at present completely abandoned; meanwhile Dupuytren believed, and M. Velpeau inclines to the opinion, that the bilateral incisions may offer some advantage.

In the second method, the incision of the posterior wall of the urethra directly downwards has been proposed by M. Malgaigne, resembling a little vesico-vaginal lithotomy: this may be termed urethro-vaginal lithotomy.

Incision of the upper wall of the urethra directly upwards,

attributed to A. Dubois, belongs, according to A. Paré, to Laurent Collot. The operation is very simple: a grooved sound (see Pl. LXXXI, fig. 3), is introduced into the urethra, the groove directed to the symphysis. This instrument, when the end is pressed upon, serves on the one hand to depress the vaginal wall; on the other to introduce a straight bistoury, or a lithotome caché, by means of which the urethra is incised throughout its length, and the surrounding tissue to the sub-pubic ligament. This incision gives an opening of nearly $\frac{1}{5}$ of an inch, a small opening which barely permits the extraction of small calculi. The forceps being introduced, and the stone seized, a recommendation of M. Velpeau's should be remembered, especially useful in this case, and which may moreover be equally so in all sub-pubic lithotomies. The handles of the forceps must be raised in such a way that they are applied to the inferior wall of the urethra, and that the instrument, being directed in the lower axis, does not impinge the stone against the symphysis.

Supra-pubic operation.—Concerning the operation nothing need be added to what has been said respecting hypogastric lithotomy in man.

Lithotripsy.—The same may be said of lithotripsy.

Remarks.—This résumé of the different operations for stone in women appears to condemn nearly all of them. The calculi which it is possible to extract through an incision not an inch in length are all or nearly all small enough to be removed by lithotripsy, especially aided by an operation which it remains for us to speak of, careful dilatation of the urethra.

Thus reduced to the exceptional cases of large calculi, which we cannot usefully crush, lithotomy may be practised by the vagina or by the high operation.

DILATATION OF THE URETHRA.

The idea of extracting foreign bodies or calculi by the urethra naturally occurred to the minds of surgeons, as is shown by many examples, in which the canal was sufficiently distended for bodies as large as hen's eggs or goose eggs, if we may believe Heister, Collot, Plangue, and others, to have

passed. Dilatation may be performed suddenly, as suggested by Tolet, or slowly, as first suggested by Douglas. First suddenly. The urethra may be dilated by introducing a grooved sound or a gorget, in the groove of which the finger is forcibly thrust, or by a bivalve or trivalve speculum. Secondly, slowly, by daily introducing into the urethra a tent of prepared sponge or gentian root, the size of which is progressively increased. The first process is frequently so painful that women cannot bear it; the second is therefore preferable, but it should not be pushed too far, for laceration of the urethra or permanent incontinence of urine may be produced. It should not be forgotten that the dilatability of the urethra diminishes with increasing age.

PLATE LXXXII.

OPERATIONS INVOLVING THE GENITAL APPARATUS
PROPERLY SO CALLED.OPERATIONS APPLICABLE TO RUPTURE AND FISTULÆ OF
THE VAGINA.

Fig. 1.—This figure shows the state of the parts after perinæorrhaphy by Dieffenbach's method, modified by the substitution of the quilled suture for the twisted suture. *P*, anus; *u*, urethra; *v*, vagina; *i, i*, semilunar lateral incisions; *d, d, d*, threads tied around a quill; *e, c, c*, loops of thread round the opposite quill.

Fig. 2 represents the operation to remedy vesico-vaginal fistulae; it shows the fistula after paring the edges and while the sutures are being passed. *A*, cervix uteri depressed by tenacula, *t, t*; *B*, vesico-vaginal fistula, with the edges pared, and through which the end of a female catheter, *S*, introduced through the bladder by the urethra, *u*, is passed; *P*, anus; *b, b*, fingers of assistants separating the labia; *d, d, d*, sutures passed through the lips of the fistula; *c*, curved needle carrying a suture through the edges.

Fig. 3.—Operation for vesico-vaginal fistula by adapat-

tion of the edges of the fistula.—*Desault's method.*—*S*, a support to bring nearer the edges of the fistula; *l, l*, labia minora separated by the fingers of assistants, *b, b*; *u*, meatus urinarius; *a'*, edges of the fistula, one of which is partly pared; *a*, shred detached by the bistouri, *c*, held by forceps.

Fig. 4.—Antero-posterior section.—To show the relation of the parts concerned in the operation for recto-vaginal fistula.—*Method of M. Jobert.*—*V*, vagina; *b*, bladder, *c*, vesico-vaginal wall; *e*, rectum; *l*, upper lip of the fistula drawn upon by a thread, *l'*, the descent of which is facilitated by lateral incisions; *u*, meatus urinarius.

Fig. 4 bis.—*The same operation completed seen from the front.*—*l, l*, labia minora separated by the fingers of assistants, *b, b*; *u*, meatus urinarius; *a*, fistula; *e, c*, points of interrupted suture; *d, d, d*, threads of three other points of suture; *l*, upper lip of the fistula drawn down; *P*, anus.

Fig. 5.—Operations for vesico-vaginal fistula by elytroplasty.—*Method of M. Jobert.*—*P*, anus; *u*, meatus; *b, b*, fingers of assistants separating the labia; *a*, vesico-vaginal fistula; *l*, flap for closing it, taken from the skin of the buttock which shows a wound, *i*, of the form of the flap; *l'*, pedicle of the flap.

OPERATIONS ON THE VULVA.

1. Many of these operations differ scarcely at all from those of the same kind which may be practised elsewhere.

Thus the labia majora are frequently the seat of abscesses which are important, on account of the rapidity with which they develop, the frequency of vulvar fistulæ which follow them, and the foetid odour prevailing in the pus of these abscesses, as in all collections which form near the orifices of natural openings. The operation is a suitable incision. There is a precept which should always be taken into account in making the incision: that is, as far as possible, to make it in the cutaneous aspect of the abscess. In this way the cavity is preserved from contact with the fluids which may flow from the vagina.

It is unnecessary to insist upon certain other operations which are not of great interest; thus the amputation of a

hypertrophied clitoris, or one which has become the seat of any morbid growth, may be made by bistoury or scissors, the ligature may be rejected; the labia minora may be removed by excision or ligature. Excision by knife or scissors, or ligature of the clitoris or labia minora, is, ordinarily, not so satisfactory as removal by actual cautery, for in the case of excision bleeding is apt to be very troublesome, and with the ligature the tediousness and pain are both objectionable. Removal by *écraseur* does not altogether prevent haemorrhage; and, all things considered, the actual cautery is decidedly preferable.

Lastly, more deeply situated tumours, vaginal tumours, require great precautions, and demand much attention on the part of the surgeon. Minute dissection is necessary in order to avoid, with certainty, wounding the walls of the canal in which he operates. If he has to do with a tumour situated in the recto-vaginal or vesico-vaginal walls, he should assist himself by rectal examination or catheterism. If a foreign body is introduced into the vagina, he must conform to the precepts given for extracting foreign bodies from the rectum, unless he prefers, where the foreign body is very large, dividing it, like Dupuytren, by introducing a small saw into the vagina, or, like Lisfranc, incising the perineum.

2. *Imperforate vagina*.—The vaginal orifice, in part normally closed by the hymen, is sometimes completely closed by this membrane. A small crucial incision with removal of the flaps suffices; or, in default of instruments, when there is accumulation of menses behind the obstacle, with thinning of the partition, he may do as Malgaigne did, burst it by forcible pressure with the finger. If the partition is double, the operation may be repeated. But imperforation of the vagina may be due to congenital absence of a part of the canal, or to morbid adhesions. In the latter case generally the occlusion is incomplete, and well directed dilatation with sponge tents, aided, if necessary, by incisions, will be sufficient. In the former case, on the contrary, the canal may be wanting for a small portion of its length, and at the epoch of puberty, when the menstrual blood, accumulating at the bottom of the

sac, gives rise to a fluctuating tumour, one may, aided by rectal touch and catheterism, puncture the tumour by a trocar and afterwards enlarge the artificial passage by a bistoury. Lastly, when one has to do with one of those cases in which the vulva barely presents more than the urethral orifice, remembering the example of M. Amussat, a kind of vagina may be made by simple pressure with the finger, aided by dilatation by means of sponge tents, in order to get near enough to the existing vagina, or rather vaginal cul-de-sac, to give exit to the accumulated fluid by puncture. This was done to a girl of fifteen and a half years by M. Amussat, who began by forcibly depressing the mucous membrane by a large sound, then he used the finger, carrying it immediately below the urethra to the point where the vaginal orifice should be found. In the depression which ensued he placed and kept forcibly applied a piece of sponge tent. Three days afterwards fresh attempts were made to break down this wall ; followed by slight tearing of the mucous membrane, and the application of sponge tents. Lastly, at the end of five or six attempts a conduit measuring $2\frac{1}{2}$ inches was formed. Fluctuation was easily felt. The index finger, passed into the bottom of the canal, served to guide a trocar, by means of which the tumour, having been separated by a layer of tissue an inch thick, was penetrated.

The opening was enlarged by a blunt-pointed bistoury, covered by lint for $\frac{5}{6}$ of its blade, and was kept open by means of a large sound.

3. *Perineorrhaphy* (PL. LXXXII., fig. 1).—This is the name given to the operation by which it is proposed to remedy a more or less complete laceration of the perineum, and even of the recto-vaginal septum.

Rupture of the perineum, a very common accident after parturition, may, especially when it is recent and not so extensive as to transform the vaginal and anal orifices into a cloacæ, be cured by the recumbent position, and by the thighs being kept closed, extended, and immobile.

But when the tear is old, extensive, and especially when it involves a part of the recto-vaginal septum, it is necessary,

after having pared the edges with scissors or a bistoury, to keep them in apposition, either by suture a points passés, or better, by quilled sutures; or still better, the common interrupted suture; the patient is then placed on her back, the thighs are brought together immovably, and must not be disturbed except to draw the urine which the patient may not pass naturally, or for motions, which one should endeavour as far as possible to render easy and infrequent. If the sutures are found to drag too much on the edges of the wound, semi-lunar incisions, with the convexity outwards, may be made in the skin to the right and left of the sutures, after Dieffenbach's method.

Each incision should commence $\frac{1}{2}$ an inch outside the posterior border of the labia majora, widening at its greatest convexity to $\frac{3}{4}$ of an inch, and finishing less than $\frac{1}{2}$ an inch from the anus.

Deep sutures should be removed in fifty-six hours, but superficial stitches may be left in place until cicatrization is perfect; for the success of operation is likely to be lost by precipitation, or the rent may be replaced by a small fistula, which disappears with difficulty. One may often count on union by the first intention.

An operation for the restoration of the functional integrity of the anal sphincter in cases of rupture of the perineum into the bowel, suggested and practised by Dr. Wiltshire, deserves mention here. In addition to the ordinary operation of paring the edges of the ruptured parts, Dr. Wiltshire cuts down upon the retracted ends or stumps of the sphincter, the remains of which can be felt like a crescentic cord at the posterior margin of the anus, and in inserting the sutures he is careful to add an additional one, which picks up and reunites the separate ends of the torn sphincter, so as to restore the integrity of the lacerated ring.

A similar plan has been since advocated in a recent edition of Dr. Gaillard Thomas's work on the Diseases of Women.

As regards the material of which the suture is composed, opinions vary. The twisted silver wire suture is very manageable and quite reliable. To prevent the ends irritating the

skin, a knot of gutta percha, softened by hot water, should be applied to each.

Pure silk, carbolized cat-gut, or silkworm-gut may be used.

OPERATIONS ON THE VAGINA.

1. *Vesico-vaginal fistulae*.—This is not the place to enunciate at length the series of procedures which have been successively proposed to remedy a lesion which involves so painful and disgusting an infirmity. This useless trouble would only be, as usual, an indication of the poverty of sufficient means, or an indication of a great number of operations, all more or less inefficient, among which one may almost choose at hazard.

A lucky idea, ably put into practice by M. Jobert, allows us nowadays to do justice to old procedures, to relegate to the surgical arsenal numerous and varied instruments that henceforth can be of no service, as also to bear witness to the incessant efforts of modern surgery, to solace a misery formerly considered as beyond remedy, until J. L. Petit, and afterwards Desault, soon followed by the German surgeons, fixed attention to the subject.

It is therefore useless to recall that J. L. Petit confined himself to a simple attack by means of a tampon in the vagina, a tampon much more frequently troublesome than useful, especially when complicated with the bandage added by Desault; that MM. Malagodi, Roux, Lallemand, and Nagelé pared the edges of the fistula, and then re-united them by interrupted sutures, the quilled, or looped suture; that MM. Lallemand, Caubet, Langier, etc., successively invented an infinite variety of forceps and hooks.

A single word will suffice for all these procedures and instruments: they are all equally imperfect, all leave the condition persisting when they do not augment it, or transpose the infirmity into another nearly analogous. Among this number is the cauterization and obliteration of the vagina proposed by M. Vidal.

To cauterize the edges of the fistula, one introduces into the vagina a univalve speculum, or the duck-bill speculum, then

an actual cautery, or caustic (nitrate of silver generally) is applied to the edges of the fistula thus exposed. The caustic is either fixed in a straight caustic holder, or perpendicularly at the end of a long forceps. If the fistula is very small, it may sometimes be closed ; generally it fails, and it may happen that, far from determining adhesive inflammation, an eschar is produced, which transforms a small canal into a large opening.

M. Vidal employed a sort of perinæorrhaphy ; he proposed to close the vaginal orifice by paring the periphery of it and uniting it by suture ; but as M. Sedillot stated, the vagina became an appendage of the bladder ; and, admitting a complete success, the genital functions were abolished, and the woman exposed to other accidents, for the menstrual blood must of necessity arrive first in the vagina, and then rise up, after a longer or shorter sojourn, into the bladder, to be expelled by the urethra, the only possible issue of a cloacus which can never be completely emptied. Attempted twice, the operation has not been judged by its results, for in the first case it failed, and in the second the patient died. In judging it, then, even favourably, in admitting the complete obliteration of the vagina as possible, such an operation must be performed as a last resource, applicable only to cases of very considerable loss of structure, and in women who have passed the critical age.

There remain the method, or methods, of M. Jobert de Lamballe : elytroplasty, and cystoplasty by flaps.

Elytroplasty.—The first and oldest is an autoplasic procedure, which consists in closing the fistula by a cutaneous flap taken at the expense of the labia majora or the buttocks (see Pl. LXXXII., fig. 5).

The edges of the fistula, having been previously pared, are made tense, stretching the labium majus of the side from which it is proposed to cut the flap ; then by two connected incisions an angular, or semi-lunar, flap of suitable size and especially long enough not only to close the fistula, but to resist retraction, is circumscribed. This flap should be cut so that the base or pedicle is as near as possible to the vagina. Sometimes the extent of the fistula may oblige the surgeon to

prolong his incisions to the buttocks, so that the flap may be long enough ; nevertheless it should be made with extreme reserve, especially in fat women, for the cutaneous flap lined with cellulo-adipose tissue may be too thick and difficult of introduction ; while deprived of this tissue it becomes exposed to gangrene.

The flap is afterwards dissected from the summit towards the pedicle, which is left broad and thick enough for the skin to preserve its vitality. Then the snmmit of the flap being traversed by a waxed thread, its introduction is proceeded with, and it is fixed by two sutures. These two steps present certain difficulties, especially if the fistula is rather high in the vagina.

The operator begins by folding the flap, rolling it on itself, then, introducing a female catheter by the urethra, and bringing the end out by the fistula, the two ends of the waxed thread are passed through the eye of the catheter, which is then withdrawn, bringing with it the ends of the thread. The threads are then to be moderately drawn upon, the other hand at the same time gently pushing the flap through the vaginal orifice, within the vagina, until it is engaged in the fistula. To fix it there the index finger of the left hand is carried up to one of the angles of the fistula ; on this finger, serving as a conductor, a curved needle, or needle in a holder, armed with thread, is slid up ; with one thrust the vesico-vaginal wall and the flap are traversed ; then with forceps the needle is brought out. It is then armed again with thread, and in the same way a similar suture is put in the other angle of the fistula. The indispensable necessity of including each of the two angles in one suture will readily be conceived if one wishes the flap to be opposed to the vivified edges of the fistula. A double knot generally suffices ; or a perforated shot may be used to finish the ligature.

The patient is then removed to her bed ; a catheter, introduced with care so as not to disturb the flap, is left in the urethra. The catheter requires constant watching for fear it should be shifted or get stopped.

Six or seven days afterwards the sutures, the ends of which

have been left in the vagina so that they may be more easily found, begin to loosen; little by little the flap adheres more intimately to the lips of the fistula; but to avoid the chance of gangrene, M. Jobert advises that the pedicle be not cut before about the fourteenth day.

Side by side with this autoplasic procedure may be placed that of M. Gerdy, apparently much more simple, but difficult of execution, as are all the procedures of anterior sutures in cystoplasty. M. Gerdy dissects the vaginal mucous membrane of each lip of the fistula, then he brings the pared edges together and unites them by suture. In case of too great tension one may, as in perinæorrhaphy or hare-lip operations, make incisions in the mucous membrane a short distance from the flaps.

Cystoplasty.—The second method of M. Jobert rests essentially on the anatomical disposition already indicated, that is to say, on the relations which exist between the uterus, bladder, and peritoneum. It will be remembered that the vesico-uterine peritoneal cul-de-sac is shallower than the recto-uterine cul-de-sac, and that in consequence the cervix uteri and the posterior wall of the bladder are in immediate connection, and are united by lax cellular tissue, which allows of isolation of the two organs one from another to the extent of more than an inch. It is precisely that which has allowed M. Jobert to obviate the traction which causes cutting of the lips of the fistula by the sutures.

This operation necessitates a pretty complete list of instruments: thus a univalve speculum, tenaculum forceps, blunt-pointed and sharp bistouries, curved scissors, straight scissors, long and strong forceps, curved needles, the dart-shaped catheter of Lewinsky or Deyber, sutures, a female catheter, one or more syringes filled with water, and sponges fixed on holders.

The instruments being arranged, the operation is begun. The patient is placed on her back with the legs separated. The surgeon depresses the lower wall of the vagina with the speculum so as to show the cervix uteri; and, directed by the index finger of the left hand, which he slides along the anterior

wall of the vagina, he seizes the *cervix uteri* with the tenaculum forceps, sideways if the fistula is longitudinal; and in the contrary way if it is transverse, but always in such a manner as to leave the anterior insertion of the vagina on the cervix free. The forceps being fixed, the speculum is withdrawn and moderate traction is made on the cervix so as to bring it down as much as possible. Is it necessary to add that if the first pair of forceps do not suffice more may be used? When the *cervix uteri* is brought down it is well, before going further, to proceed to a last exploration of the fistula, either by introducing a sound through the urethra into the mouth of the fistula, or by injecting fluid through the urethra.

The great advantage of the last step of the operation is the bringing of the fistula almost under the operator's eyes. To obtain this result more completely, which is frequently wanting when the uterus resists the attempts to bring it lower, and especially to prevent the dragging which usually occurs on the upper lip of the fistula when the operation is finished, the vagina is detached from its insertion to the uterus by a semi-lunar incision made transversely; the cellular space which separates the bladder and *cervix uteri* is thus penetrated, and the two organs are isolated by slow and careful dissection, grazing the anterior aspect of the cervix, the most superficial fibres of which are incised, if necessary. M. Malgaigne prefers generally to reserve this part of the operation to the end, because it is only at this time that one can appreciate the traction, and one may thus apportion more suitably the extent of the incision and dissection.

There are different advantages in the two cases: the incision done at this time facilitates the lowering of the uterus; done later it is perhaps better proportioned, although, in truth, the traction, the effects of which are feared, are not immediately produced, but according as inflammation develops after the operation; it appears then, preferable, especially when the uterus offers much resistance, to terminate this dissection early. This being done, the blood is sponged away, or it is stopped by a current of cold water; then seizing the edges of the fistula one after another with toothed forceps, they are pared

by the blunt-pointed bistoury. If the fistula is transverse one must begin at the posterior border, which, by reason of its position being lower, would be masked by the blood which would flow from the anterior lip. The paring should be through the whole thickness of the vesico-vaginal wall ; and in cases when one meets with indurated tissues the operator must not be content with simply paring, but should remove them entirely.

The next process is to apply the sutures. To pass them M. Jobert often uses the barbed catheter of Deyber. But the management of this instrument is somewhat complicated and it is not indispensable. When the fistula is pared the wound is generally large enough to allow the finger being passed into the bladder and guiding the needle. The operator should always prefer this method, which has the advantage of greater simplicity, and, above all, allows him to assure himself that the needle has traversed the whole thickness of the wall, which is sometimes great. The needle then, armed with the suture, is introduced into the bladder, then it is brought through the other lip, from the bladder to the vagina ; and the same manœuvre is repeated as many times as it is judged necessary to insert sutures. If too great obstacles compel the operator to use the barbed catheter, he introduces it through the urethra into the bladder so as to bring the end to one of the lips of the wound, then, pushing the barb armed with the suture, he traverses this lip, disengages one of the ends of the suture, and retiring the barb in its sheath, he does the same to the other lip, and thus has the two ends of the suture hanging outwards. In these two cases the two lips of the fistula are comprised in the loops, the number of which is proportional to the extent of the fistula. The two ends of the suture are lightly drawn to approximate the two lips of the wound, then they are only lightly tied, so as not to cut the flesh, for fear of exciting too sharp inflammatory reaction. It may happen that the anterior lip is the seat of some dragging ; it is good in that case to combat its effects, to practise some small incisions in the vaginal mucous membrane parallel to the lips of the fistula. If the operation has been well done, if the lips of

the wound are well adapted, the fistulous orifice should be sufficiently well closed to prevent an injection passed into the bladder penetrating into the vagina. One of the two ends of the sutures may be cut, the other being left in the vagina, which will be an easy means of finding the loop when it becomes time to remove the sutures; then the forceps are withdrawn, a catheter is placed in the urethra, and the patient is removed to her bed. It is not necessary to follow M. Jobert's example of placing a tampon of agaric in the vagina: there is no fear of haemorrhage, and if a little blood should flow, the means which serve to remove the clots from the vagina will always suffice: it is only an oozing which is easily overcome by injections of cold water.

At the end of eight or ten days, in general, the process of cicatrization is sufficiently advanced to allow the removal of the sutures: the uterus is lowered, and, guided by the ends which hang in the vagina, the loops are cut and withdrawn.

When the sutures are removed the fistula may be only diminished, and not cured. In this case, sometimes cauterization, or better, a fresh suture, completely cures, or it may be necessary to operate more than once.

The vagina may be the seat of two other kinds of fistula which operative surgery proposes to remedy. It may happen that a more or less extensive solution of continuity of the recto-vaginal septum constitutes a recto-vaginal fistula; or sometimes one sees a communication established between a portion of the intestinal tube, above the rectum, and the vagina: an entero-vaginal fistula.

(a) *Recto-vaginal fistula*.—What has been said of vesico-vaginal fistulae applies to recto-vaginal fistulae: paring and adaptation of the edges, cauterization, and sutures may be employed. One may also have recourse to a kind of suture exactly comparable to cystoplasty: the edges of the fistula being pared and united by some points of interrupted suture, incisions parallel to the great axis of the fistula are practised on each side. This is a new application of the precept of Celsus, Franco, and Dieffenbach (Pl. LXXXII., fig. 4 and 4 bis).

Lastly, as a last resource in cases of failure, one may still

imitate Saucerotte, who, having failed by the suture, transformed the fistula into a rupture of the perineum and septum by an incision of the lower part of the recto-vaginal septum and had recourse to perineorrhaphy.

(b) *Enterovaginal fistula*.—As regards the treatment of entero-vaginal fistulæ, in which the continuation of the intestinal channel becomes more or less obliterated, surgery offers but few resources. Two operations of this kind have been attempted by two different processes; in both cases the patients died. In the first M. Roux incised the abdominal wall, and after having attempted to separate from the vagina the portion of intestine which communicated with it, he wished to invaginate it in a loop of intestine which he believed to be below the fistula. At the autopsy it was found that instead of invaginating the portion of intestine, which was the seat of the fistula, in the lower end of the colon, it had been made to communicate with the gut above the level of the fistula. In the other case, M. Casamayor devised the following much more simple and also less dangerous process.

The operation was performed with the aid of a particular apparatus, a kind of enterotome, composed, like that of Dupuytren, of two stems articulated like forceps, eight inches long, each furnished with an oval plate, $\frac{3}{4}$ inch long and half that breadth. One of these two stems introduced into the vagina was carried through the fistula to the upper end of the intestine; the other was conducted through the rectum to the level of the first. The two plates were then only separated from one another by the thickness of the opposed walls of the intestine and rectum. By the two faces, which should correspond, the plates offer some indentations designed to maintain its relations more securely. Then, the two branches being approximated, the intestinal walls are strongly compressed. By the aid of this constriction it is sought to produce a loss of substance, which, putting in communication the two portions of intestine, allows the faeces to follow the new passage. It is to be regretted that pneumonia carried off the patient, and rendered useless a well-conceived operation.

PLATE LXXXIII.

OPERATIONS APPLICABLE TO THE TREATMENT OF UTERINE POLYPI AND PROLAPSE OF THE WOMB.

Fig. 1.—Ligature of a polypus.—*A*, polypus; *b*, gorget held by an assistant to separate the polypus from the vaginal wall and help the action of vulsellum forceps, *d*, and at the same time to facilitate the passage of the ligature, carried round the pedicle, *c'*, by the knot fastener; *u*, the meatus urinarius; *b'*, fingers of an assistant; *P*, anus.

Fig. 2.—Torsion of a polypus.—*A*, polypus; *B*, bivalve embracing the pedicle of the polypus; *P*, anus; *u*, meatus; *c*, torsion forceps.

Fig. 3.—Excision of a polypus.—*A*, polypus; *P*, anus; *l*, *l*, labia separated by the fingers of assistants, *b*, *b'*; *u*, meatus; *t*, *t*, tenaculum forceps, which draw upon the polypus, the pedicle of which is partly cut through by strong scissors.

Fig. 4 bis.—Prolapse of the uterus and vagina.—*u*, meatus; *l*, *l*, labia majora; *A*, vagina drawn outwards by the uterus between the labia majora, the neck of which, *b*, is seen externally; *P*, anus.

Fig. 4.—Obliteration of the vagina.—*A*, vagina prolapsed; *b*, cervix uteri; *P*, anus; *l*, *l*, labia; *u*, meatus; *s*, *s*, internal surface of the labia majora pared at the level of the vaginal orifice; *c*, *c*, *c*, loops of suture which traverse the labia majora at the level of the pared portion, and of which the ends, *d*, *d*, *d*, are seen on the opposite side.

Fig. 4 ter.—Procedure of Fricke of Hamburg (episiorrhaphy).—*Operation completed.*—*l*, *l*, anterior portion of the labia majora; *P*, anus; *B*, *B*, quills engaged on the one side in the loops of the sutures, *c*, *c*, *c*, and over which on the other side the ends, *d*, *d*, *d*, are tied.

Fig. 5.—Antero-posterior median section, to show the application of an air pessary.—*A*, uterus pushed up by the ball, *B* introduced into the vagina; *e*, rectum; *d*, recto-vaginal wall; *u*, meatus; *c*, vagino-vesical wall; *b*, bladder; *x*, tap which

Fig. 1

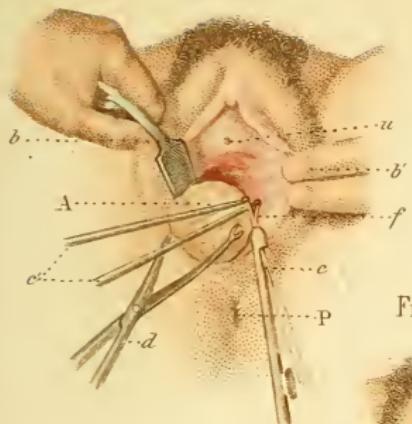


Fig. 2

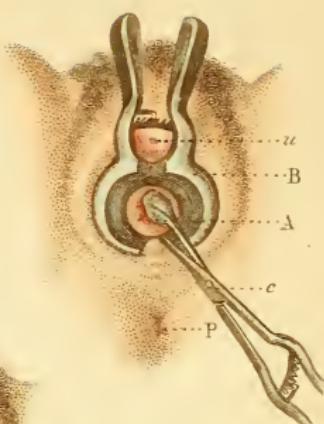


Fig. 3

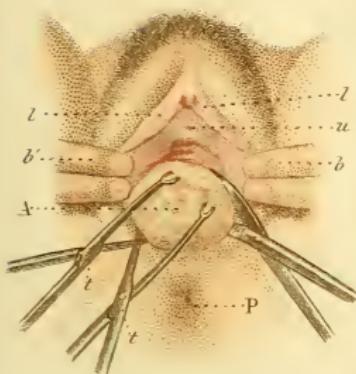


Fig. 4

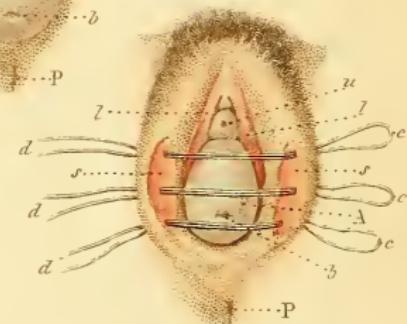
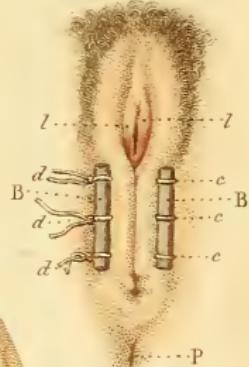
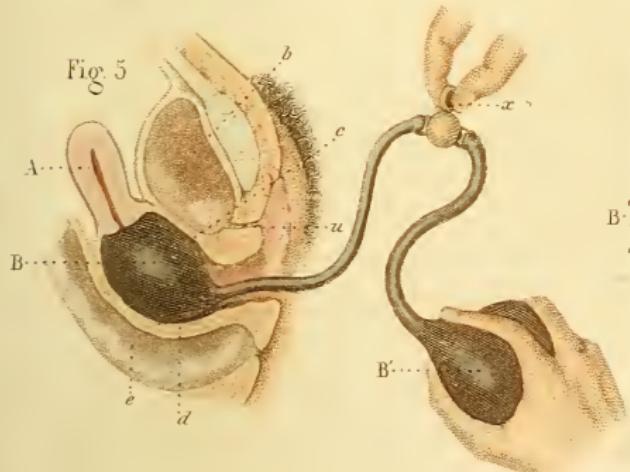


Fig. 4 ter.



controls the communication between the vaginal ball, *B*, and the external ball, *B'*, which is emptied on being compressed to distend the other.

OPERATIONS UPON THE UTERUS.

Operations applicable to uterine polypi.—This is not the place to enter upon extended anatomico-pathological considerations of uterine polypi; these do not in effect decide the surgeon in preferring one method over another; he relies more upon the indications furnished by the consistence and volume of the morbid product, and, above all, he is careful to ascertain if it is pedunculated or not.

OPERATIVE PROCEDURES.

There are at least six methods of operation which have been proposed for the cure of uterine polypi. Of these six methods three are very seldom employed; they are cauterization, crushing, and torsion. The other methods—avulsion, ligature, and incision—are more important.

(a) *Cauterization* was known to the ancients; it is nowadays nearly abandoned. The operative procedure is the same as that which will be described *apropos* of cauterization of the cervix uteri; it is done with the actual cautery or caustics.

(b) *Crushing*.—Having to do with a small polypus of soft consistence, Récamiér introduced the finger into the cavity of the cervix uteri, and it was sufficient to press the polypus between the cervical wall and the bulb of the finger to break up and extract it. In a similar case this example might be imitated. One may also, if the polypus is very voluminous, but appears soft, have recourse, not to a real crushing, but to a strong compression with forceps to diminish the volume somewhat, as Dupuytren and Récamiér once did, causing almost complete disappearance by combining pressure, crushing, and avulsion. It was a large polypus, consistent, which could not be lowered by any means. These surgeons broke it up several times with tenaculum forceps and the fingers, so as to make it a pulp, which suppuration was left to eliminate.

(c) *Torsion*.—Like crushing, torsion is hardly anything else

than undisguised avulsion. The polypus being seized and forcibly drawn upon by forceps, an effort is made to twist the pedicle, as in the treatment of nasal polypi. If the polypus is soft it yields more to the efforts at traction than those of torsion; if it is hard, at least when the pedicle is not very small, it resists, and it is not only the polypus which is twisted, but the whole uterus.

(d) *Avulsion*.—Avulsion is still an imperfect method; it is reserved for polypi which are not very firm. The index finger is passed into the vagina, the polypus is recognised, and the polypus forceps are slid along the finger and the growth seized, and partly by traction and partly by torsion it is sometimes entirely torn away, generally only partially. In the latter case the forceps are again introduced, and the attempts are renewed until it is all extracted.

M. Malgaigne indicates another procedure, applicable to multiple polypi, viz., drawing down the uterus with tenaculum forceps, then, with a curette introduced into the uterine cavity, scraping all the internal surface. This is also a procedure which partakes of crushing; it has, according to its author, the advantage of not being followed by haemorrhage.

(e) *Ligature* (Pl. LXXXIII., fig 1).—The polypus may be tied outside the vulva, in the vagina, or in the uterine cavity.

1. If the tumour appears outside the vulva with its pedicle, the operation is very simple, and consists in surrounding the pedicle with a strong waxed thread, which one ties with a double knot. If the pedicle does not appear, the polypus is drawn down by tenaculum forceps. Lastly, if the pedicle is too large for a simple ligature to suffice to grasp it, it is to be transfixed with a needle carrying a double thread, the four ends of which are to be subsequently separated and tied, two and two, on each side.

2. When the polypus, although already low down and escaped from the uterine cavity, is still retained in the vagina, one may either attempt to draw it externally with tenaculum forceps and deal with it as above, or put on a ligature with the fingers if they can reach high enough, or with one or two knot fasteners, that is to say, two metallic stems pierced with

a hole at one end, or ending, as proposed by Mayor, in crabs, claws, to receive the thread, or two metallic tubes which carry a thread. The patient is placed as for the operation for stone or vesico-vaginal fistula; an assistant presses on the hypogastrium, the surgeon explores the vagina with the two first fingers of the left hand, feels the polypus again, then, applying these two fingers to the posterior wall of the vagina, they serve as conductors to guide the knot fasteners and place the ligature round the pedicle. The fingers are withdrawn, and a knot fastener is grasped by each hand; they are made to describe a half-circle from behind forwards, and the pedicle is surrounded by a loop of ligature. One may equally well, like Desault, engage the two knot fasteners in front, and, while one remains immobile, manage the other so as to surround the polypus. In these two cases, the instruments, being carried in front, are crossed, and thereby the two ends of the ligature are crossed; then, after having withdrawn the instruments, recourse is had to a knot holder (that of Græfe or Sauter), which twists the ligature on itself several times so as to strangle the pedicle.

3. Lastly, if the polypus is retained within the uterine cavity, recourse is had to the process of ligature with knot fasteners. But a difficulty here presents itself: in carrying a ligature around a polypus within the uterus, there is danger of tying the cervix uteri itself. This operation is often accompanied by sharp pains and accidents which oblige one to relax the ligature, and even to renounce it.

Instead of making use of silk for a ligature, silver wire may be employed, which, being readily twisted, avoids the necessity of tying a knot, a proceeding always accompanied with considerable difficulty.

(f) *Excision.*—Like the ligature, excision of uterine polypi may be practised in the vagina or in the uterus. For the rest, whatever the place where the operation is performed, the process varies but little. The patient is always placed as in the preceding cases, and the surgeon introduces into the vagina either a bivalve speculum, or rather the index finger of the left hand, to serve as a guide for seizing the polypus

with tenaculum forceps, by the aid of which he draws it down as low as possible, facilitating the lowering if necessary by the use of other forceps placed higher up. The polypus having descended, the pedicle is apparent, and it is then cut with a bistouri or with strong scissors curved on the flat (Pl. LXXXIII., fig. 3).

If the polypus offers too great resistance to efforts at traction, and cannot be brought down, a long blunt-pointed bistoury curved on the flat is to be slid along the finger, and the pedicle cut in the vagina. It is scarcely necessary to remark that this process is only applicable to polypi already large, fibrous polypi; for if we have to do with a small polypus, it suffices to dilate the vagina by a speculum, discover the tumour, and apply the bistoury or scissors to its root.

When the polypus is retained within the womb, it must be brought down in the same way; or better, the uterus may be drawn down by forceps placed in the cervix, and then the polypus itself dealt with. Sometimes the polypus is too voluminous to pass the cervix uteri or vagina, it is then necessary to incise the cervix and perineum, or, like Chassaignac, to diminish the volume of the polypus by two deep incisions which circumscribe a wedge-shaped fragment: inasmuch, when dealing with non-pediculated polypi, it often suffices to incise the superficial layer, which forms a sort of envelope, to enucleate the tumour. By the rapidity of its execution, excision merits the preference which has been accorded to it since Dupuytren brought it into honour. Haemorrhage is the only complication to be feared, and it always yields to the simplest haemostatics or at least to plugging. Ligature, on the contrary, is a longer operation, which exposes to more dangers, and involves graver inconveniences, among which may be named the slowness of its action, the pains which are the consequence of it, the hindrance occasioned by the flow of foetid discharges, the presence of knot holders, etc., and the obligation of repeating the constriction several times.

The best method of excising polypi is that by the ecraseur, an instrument which excels all others for this purpose in the

great majority of cases. The wire écraseur is very convenient and can be applied without difficulty, even to large polypi. That form of wire écraseur should be used which allows of the adaptation of the wire around the polypus before it is attached to the rest of the instrument. In this way a loop of wire of moderate length may be made to encircle the base of a polypus or sessile growth. When the pedicle is properly encircled by the loop of wire, the ends are to be attached to the handle of the instrument and the screw put into motion. In this way the wire is caused to embrace the pedicle so tightly that by slow turns of the screw the tissues are gradually cut through quite cleanly, and that without loss of blood. Hæmorrhage from the pedicle is thus prevented, and the risk from that source is accordingly almost entirely excluded. The process is quick, clean, simple and safe. The instrument can be applied to polypi even high up in the uterus.

The application of the écraseur will be facilitated by first seizing the polypus by polypus forceps, or, if the growth be too large for that, by toothed forceps. The handles of both these instruments should lock, so that a firm grip may be obtained with them without the necessity of maintaining constant pressure by the hand. Downward traction to a sufficient extent may be made by the forceps, and the wire, rope, or chain of the écraseur, can then be readily applied around the pedicle or base of the growth.

OPERATIONS THE OBJECT OF WHICH IS TO REMEDY PROLAPSE OF THE UTERUS AND VAGINA, VAGINAL CYSTOCELE AND RECTOCELE.

These operations are of two kinds—palliative and radical. The palliative treatment is the application of pessaries. There are many kinds: bung-shaped, hour glass-shaped, ring-shaped, cup-shaped, etc., etc., the form of which varies not only according as one proposes to combat prolapse of the vagina, vaginal herniæ, falling, or the various displacements of the uterus, but also as the inventors of the different instruments were moved by such or such principles; one proposes to

act on the cervix uteri, another on the body of the uterus, another solely on the vagina, which he proposes to stretch, etc. For the rest one can readily conceive that the size of the vagina, or still more the nature of the lesion, must singularly modify the form of pessary. One can therefore frequently employ with great advantage indiarubber air pessaries, which by their small volume are very easy of introduction, and which are moreover much more capable of filling the vaginal cavity in dilating and unfolding the folds of the vagina, or the organs which tend to escape from that canal, without causing discomfort comparable with that almost inevitably caused by all others, their size and consistence being augmented, but not their weight. Their action is double: they keep up the organs by direct pressure, they dilate the vagina, causing its folds to disappear, which causes the organs to rise, obliging them to resume a normal position (Pl. LXXXIII., fig. 5).

Whatever may be the pessary chosen, it is first oiled and then is carried to the entrance of the vagina and is introduced from before backwards, and from below upwards. If the pessary is larger one way than another, it is to be presented so that its larger diameter corresponds with that of the vulva; it will then depress the posterior part of the vaginal orifice and the perineum so as to facilitate its passage below the pubic arch.

Once introduced, the pessary is to be placed in a suitable position; thus those which present a concavity on one of their faces—being designed to correspond with the projection of the symphysis—must be directed forwards. Those which are cylindrical, or bung-shaped, are placed according to the axis of the vagina; those which are furnished with a cup are so disposed as to receive the cervix uteri into the cup; if they are flat (ring-shaped), an oblique position is given to them in the vagina, so that one face looks forwards and the other backwards, and the upper border is behind the cervix, etc. It is impossible to enumerate the different positions to give to pessaries, but they present no difficulty. It is less easy to obtain the immobility of these pessaries, which shift with

disheartening facility in spite of all the more or less troublesome means with which they are complicated to obviate the defect. In this relation, too, pessaries of caoutchouc, funnel-shaped, and especially air pessaries, have a great advantage, for they keep themselves in position.

The *radical cure*, like the palliative treatment, is also encumbered with far too great a number of processes, the efficacy of which is no more demonstrated than that of different pessaries. Thus Dieffenbach proposed the excision of some folds of the vaginal orifice; Marshall, Ireland, Hemming, and Velpeau that of a longitudinal or quadrilateral flap of vaginal mucous membrane; M. Langier prefers to cauterise it; then M. Malgaigne thought to obtain good results by excising the demi-circumference of the vaginal orifice, before and behind, and reuniting them by suture. Fricke (of Hamburg) indicated, under the name of episiorrhaphy, vivification of the labia majora, and then reunion by suture. Lastly, M. Romain Gérardin had recourse to the extreme process applied by M. Vidal (de Cassis) to vesico-vaginal fistulæ, obliteration of the vagina.

All these processes are so simple as to render a description of them useless; but, unfortunately, they offer the common inconvenience of being inadequate.

All fail against an obstacle which is almost insurmountable: and, even when they seem to be followed by complete success, one is often deceived, for the malady is not slow of reproduction.

In cases where pessaries have to be applied to combat falling of the vagina, or womb, or displacement, it is evident that the application of the pessary must be preceded by another little operation, the reduction of the fallen or displaced organ.

To reduce displacement of the vagina, the plan is the same as for prolapse of the rectum: the surface of the projection is covered with a napkin smeared with grease, and then gently pressed with the fingers from the circumference towards the centre. It is the same for the reduction of the uterus: the organ is enveloped in greased linen, and then pushed back by compressing the fundus so as to lessen its size; if the organ

is inverted like the finger of a glove, one places the finger on the lowest part and pushes it in the direction of the vagina.

If there be deviation of the uterus, it is recognised by the help of touch, or the application of a speculum, or the use of the sound ; then, having reduced it, it is opposed by the employment of an appropriate pessary, or by the use of Simpson's sound.

Serious difficulty may be encountered in restoring an inverted uterus to its proper position : indeed, reduction may be impossible, and then, if haemorrhage threaten the life of the patient, amputation of the inverted organ may become necessary. Success will often attend patient efforts. Continuous elastic pressure should be kept up against the centre of the fundus uteri, with slight deviation to one or other side. Compression of the organ by an elastic bandage with a view to driving as much of the blood as possible out of the organ in order to reduce the bulk of the body and fundus will facilitate all efforts at restoration. Incisions into the cervical tissues have been practised by some in order to favour dilatation of the neck. These should be carefully done, if employed, so as to avoid undue laceration, or penetration into the peritoneal cavity or adjoining viscera, *e.g.*, bladder or rectum. A much more serious measure has been adopted, viz., opening the abdominal cavity, dilatation of the cervix on its peritoneal aspect, and subsequent reinversion of the organ.

This is so grave an operation that its adoption must always be guarded by great circumspection.

All attempts at reduction are more likely to be attended by success if they are made a week or more after the cessation of a catamenial period rather than near that epoch. Pressure upon the inverted organ should not be too long continued for fear that sloughing may ensue.

Fig. 1

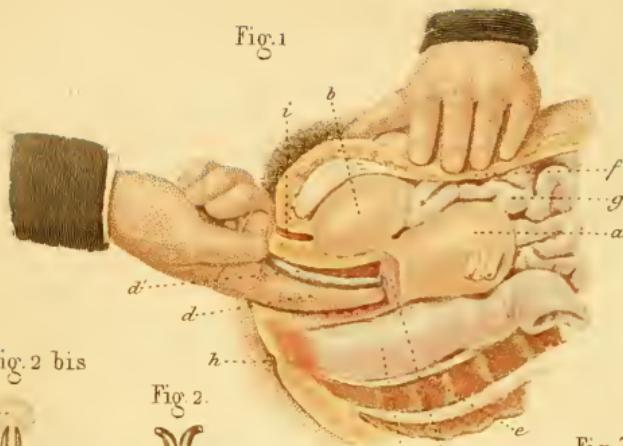


Fig. 2 bis

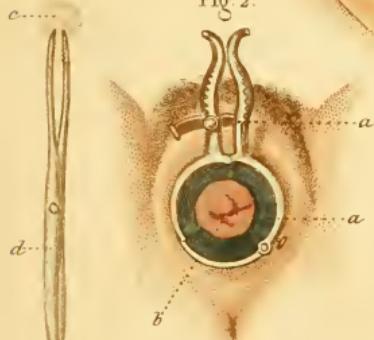


Fig. 2.



Fig. 4

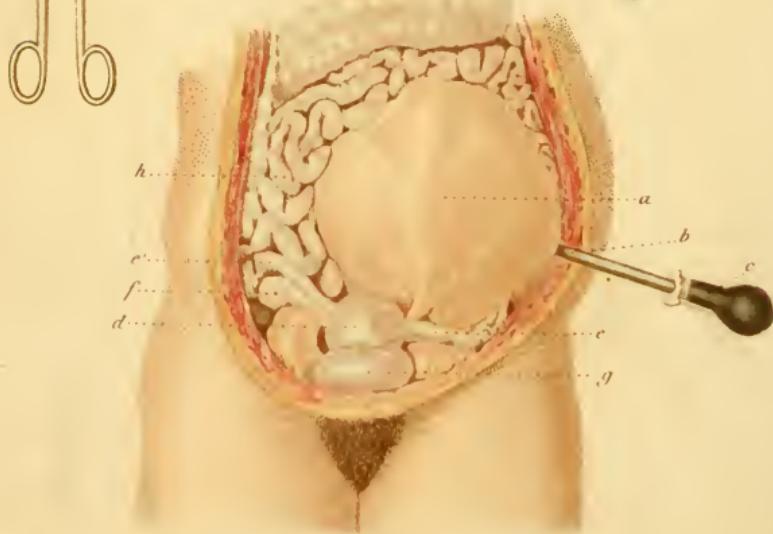


PLATE LXXXIV.

OPERATIONS ON THE CERVIX UTERI AND OVARIES.

Fig. 1.—Tapping the uterus.—*a*, uterus; *b*, bladder; *c*, rectum; *d*, index finger of the surgeon introduced into the vagina, and serving as a conductor of a trocar, *d'*; *e*, sacrum; *f*, abdominal wall depressed; *g*, loops of intestines; *h*, anus; *i*, urethra; *l*, orifice of the uterus.

Fig. 2.—Application of the speculum.—*a*, *a*, trivalve speculum; *b*, cervix uteri.

Fig. 2 bis.—*d*, long forceps, with cotton wool, *c*, to cleanse the cervix.

Fig. 3.—Cauterization of the cervix uteri.—*a*, ivory speculum; *a'*, its handle; *b*, cervix uteri; *c*, actual cautery; *c'*, its handle; *d*, *d'*, labia majora.

Fig. 4.—Puncture of an ovarian cyst.—*a*, cyst; *b*, canula of trocar, the handle of which is seen at *c*; *d*, uterus; *e*, *e'*, Fallopian tubes; *f*, healthy ovary; *g*, bladder; *h*, coils of intestine.

EXPLORATION OF THE CERVIX UTERI.

Of the touch.—Besides palpation and mediate auscultation through the abdominal parietes, the surgeon has at his disposal two modes of direct exploration to discover the different physiological and pathological conditions which the uterus and vagina may present. By touch he acquires a number of ideas respecting the consistence, volume, etc., of the cervix and body of the uterus, and by the application of the speculum he completes it by bringing in the aid of vision.

Vaginal examination may be made in two ways, the patient standing or lying down.

1. If the woman who is to be examined is standing, she is to be placed with her back against a firm substance; the surgeon sits or kneels before her; kneeling on the left knee, if he uses the right hand, and *vice versa*.

The index finger is to be oiled, the thighs are to be separated, and the hand passed to the parts. The index finger and thumb are to be kept extended, and the others flexed on the palm of the hand; the forefinger, being carried to the perineum, recognises the vulvar opening, which is then to be penetrated gently and without violence. If any obstacle is encountered, its nature is to be investigated.

It is always to be understood that if the woman is a virgin, the integrity of the hymeneal membrane is to be respected, unless there be urgent indications to the contrary,

The vagina having been explored, the finger reaches the cervix uteri, and glides gently around it, explores the os and surrounding parts—in a word, it is carried in every possible direction, examines the uterus so as to appreciate its sensibility, consistence, temperature, weight, etc. Lastly, to complete the investigation, the surgeon places his left hand on the hypogastrium and depresses the abdominal wall, while he fixes the uterus with the finger which is in the vagina, so as to compress the organ between the two hands, and estimate with the greatest certitude its form and volume.

This last stage of the examination can be most easily practised when the patient is lying down. The examination being completed, the nature of the liquid adhering to the finger should be carefully examined.

2. The patient lying on the back, the head, shoulders, and pelvis being somewhat raised and supported, so as to put the abdominal walls in the greatest state of relaxation possible, the surgeon places himself as near as he can on the right side, and passes his hand under the coverlit, and proceeds as above. It frequently happens, when the patient is lying down, that the finger cannot reach the cervix uteri; the pelvis should then be raised, either by the patient's own efforts, or by placing a cushion under the loins. Should this not be sufficient, either the flexed fingers may press back the perineum, the thumb being fixed against the pubic bone, or the middle as well as index finger may be introduced.

The foregoing is the position generally adopted by continental practitioners, both for obstetrical as well as gynaeco-

logical practice. In England the patient is usually placed on her left side for both purposes.

Application of the speculum.—Before proceeding to the application of the speculum, the surgeon always finds it a great advantage to make a digital examination. He learns by this means the exact position of the cervix uteri, and thus avoids a number of searchings which render the operation fatiguing, difficult, and sometimes even nearly impossible.

It is unnecessary to insist on the different form of instruments which may be used; the operative procedure varies but little whatever be the speculum preferred.

It is, however, worthy of remark that the smaller the inferior extremity of the speculum, the easier it is of introduction; and in this respect the bivalve speculum apparently offers the greatest advantage by its conical shape; when introduced, the examination is often difficult, the separation of the two valves permitting the folds of the vagina to project into the cavity of the speculum, and to mask the parts which one would examine at the top of the vagina. In this respect it is more convenient for the examination of the vaginal wall.

The quadrivalve speculum is very rarely employed; those which are preferable are the full speculum, that is to say, the slightly conical metal tube of Récamier, furnished at the end with the ebony of Galezowski, or Mélier, or the trivalve speculum.

The patient is placed on the edge of a bed, the lower limbs separated, bent, and supported by assistants, or on chairs; the surgeon places himself in front, either seated or kneeling on one knee, takes the speculum, previously greased, and, separating the labia with the fingers and thumb of the left hand, presents the end of the speculum to the vaginal orifice, and gently introduces it. The instrument ought in the first place to be directed from before backwards, and but little from below upwards, so as to avoid the fourchette, which if pressed upon causes much pain. The orifice passed, the hand is lowered, and the instrument is introduced in the direction of the vaginal axis. The plug is then to be withdrawn, and the introduction is to be continued with much gentleness,

guiding the speculum to the position of the cervix uteri, which has already been recognised by touch. At the same time the operator examines the state of the vaginal walls, against which he must exercise a certain amount of force to overcome their resistance. In effect the patient involuntarily makes efforts, the vagina contracts and presents a rose form at the extremity of the instrument, which may often be taken by the surgeon for the cervix uteri, but it has not the smooth aspect of the cervix ; on the contrary, the surface is furrowed with corrugations somewhat redder than the cervix in the normal state, or paler in case of inflammation of the cervix. Lastly, it does not offer the resistance of the cervix on pressure, either by the speculum or sound.

As soon as the cervix appears endeavours should be made to engage it in the orifice of the speculum ; if it is too large, the different parts should be examined by inclining the speculum from side to side, the parts successively discovered being wiped by lint or cotton wool, held by long forceps (see Pl. LXXXIV., fig. 2 and 2 *bis*).

When once the speculum is introduced, nothing is easier than to apply topical remedies, whatever one may have recourse to, even the actual cautery ; only in that case an ivory speculum should be used instead of a metallic one (Pl. LXXXIV., fig. 3).

One may add to the employment of the ordinary speculum the use of a similar but much smaller instrument, viz., that of a small speculum fixed to the end of long forceps, whereby one can examine the uterine cavity. The use of this instrument, which necessitates the employment of artificial light, has been much simplified by the mode of illumination adopted by M. Langier.

The speculum may also be used for the introduction of the uterine sound ; but generally touch suffices. Once the os uteri is recognised, the finger is used to conduct the sound. It is the same for the application of the uterine adjuster, on the use of which it is the less necessary to insist, as the application is easy, and, moreover, the importance of the general employment of it has probably been much exaggerated.

In the case of pronounced uterine deviation, anteversion, or retroversion, the first thing is to reduce it. Reduction is ordinarily easy; but the displacement may be reproduced directly. It may be done by the vagina, or by the rectum. The patient lying down, and the abdominal walls in a state of relaxation, the surgeon introduces one, or, if required, two fingers, by means of which he first pushes up the body of the uterus, and then hooking the end of the finger on the cervix, he tries to bring it downwards.

If that be not sufficient, the body of the uterus may be pushed up through the rectum, either by the fingers, or, rather, after Evrat, by means of a stem nine or ten inches long, having at its end a greased plug, whilst attempts are made by the vagina to hook down the cervix.

Lastly, when these attempts have failed, and the displaced uterus is distended by the product of conception, a last resource is puncture of the organ.

Puncture of the uterus.—Puncture of the uterus is done in cases of congenital or accidental obliteration of the cervix, either to give exit to the menstrual blood accumulated in the uterine cavity, or when the gravid organ is in a state of retroversion which cannot be modified. In the first case the puncture is made per vaginam; in the second it may also be made by the rectum.

1. By the vagina (Pl. LXXXIV., fig. 1), the finger in the canal serves the surgeon to recognise the point where the os and cervix should be. Should this search be fruitless, it at least serves to guide a slightly curved trocar, so disposed that when the handle of the trocar is held in the palm of the hand, the point is within and masked by the canula.

When the end of this reaches the point which it is judged suitable to traverse, the instrument is thrust through, being stopped as soon as resistance is no longer met with. The trocar is then withdrawn, and the liquid evacuated through the canula, or, if desired, a sound may be inserted to keep open the orifice made or to inject into the uterine cavity.

2. By the rectum the process is the same; instead of introducing the trocar by the vagina, it is conducted through the

rectum; and as, in this case, the object is especially to determine the escape of the liquor amnii, should it not flow, a stylet may be passed through the canula, so as to ascertain the nature of the obstacle, and to learn whether or no a second puncture should be made.

Puncture of a retroflexed or verted gravid uterus is rarely, if ever, necessary. Evacuation of the bladder and rectum, the prone, or genu-pectoral position, and chloroform will always, or nearly so, enable the surgeon to restore the displaced organ.

A word may be added respecting the reduction of displacements of the non-gravid uterus.

When reduction cannot be effected by the fingers, the careful use of the uterine sound will usually accomplish it: that is to say, if there be no morbid adhesions of the uterus to surrounding parts. In a case of retroflexion, for example, the sound should be bent to a curve, corresponding, as nearly as the operator can judge by digital examination, to the bend in the uterus. The sound being then introduced into the uterine cavity, careful and gentle attempts at rotation are to be made by causing the extremity of the handle of the sound to describe a large circle, so as not to press upon or injure the interior of the uterus. On no account is the handle of the sound to be rotated on its own axis: this would cause the uterine end of the sound to describe as large a circle as possible, which would be injurious, while by causing the handle end to describe as large a circle as possible, injury to the uterus is avoided, and the fundus of the retroflexed organ is brought forwards.

If a pessary be applied, it should be inserted while the sound keeps the womb in the normal position, so that the organ may be kept up and prevented falling again into its abnormal location.

OPERATIONS APPLICABLE TO CANCER OF THE CERVIX UTERI.

Several kinds of operations have been proposed for cancer of the cervix uteri: cauterization, ligature, and excision or

amputation. Ligature, being frequently followed by very grave accidents, is completely abandoned. Excision, extolled by Récamiér and Lisfranc, is, like all other operations for cancer, followed by such numerous relapses that, conjoined with the series of primary accidents which may accompany it, it is nowadays almost abandoned. Cauterization justly merits to be reserved.

Cauterization of the cervix uteri, which is also practised for several other lesions besides cancer of the cervix, is a very simple operation.

Apply the speculum, cleanse the cervix, place between the posterior lip and the wall of the speculum a dossil of dry lint, so as to absorb such portions of the caustic as, failing to act on the cervix, may involve the vagina ; then, by means of forceps or caustic holder, apply the caustic, solid or liquid, to the cervix, and let it remain there a longer or shorter time, according as it is desired to affect the tissues slightly or deeply ; lastly, apply some cooling lotion : this is the whole procedure.

If, on the other hand, the actual cautery is preferred, and this is a procedure one need not fear to recommend, several lenticular cauteries are heated to a white heat, so as to act as deeply as may be desirable ; then an ivory speculum is to be applied, in order to avoid burning the vagina and causing pain ; or even a tin speculum, after M. Malgaigne's example.

Cauterization, and especially with the actual cautery, is an excellent operation ; generally but slightly painful, it permits of the destruction, if not by one by several applications, of the deep ulcerations, which at first sight one might have felt obliged to regard as of a nature to yield only to a cutting instrument.

Amputation of the cervix uteri.—This is performed in two ways, according as the womb can be lowered or not.

1. Two fingers in the vagina serve to implant and keep in place tenaculum forceps, by means of which the uterus can be brought down to the level of the vulva ; then, with a blunt-pointed curved bistoury, protected with lint up to near the end, section of the tissues is made, care being taken always to keep above the diseased portion, and to trench on the sound parts.

2. If traction will not produce the desired effect of lowering the womb, scissors, curved on the flat, may be advantageously used, or Dupuytren's curette, which should be introduced into the cervix, guided by the two fingers.

The operation is generally done without the patient having felt much pain, except perhaps during efforts at traction, which should always be done with extreme gentleness and slowness; blood will flow freely, but it need not occupy the attention much, plugging being called for only when the flow is very abundant and the patient is sensibly weakened by it.

Dr. Marion Sims has lately practised an operation similar to the second of the above. He cuts widely into the sound tissues and plugs the resulting cavity with a styptic preparation of iron—the persulphate by preference, or the perchloride. Care should always be taken in these operations not to invade or encroach too nearly upon the peritoneal cavity or the bladder or rectum.

The cervix may also be removed by means of the écraseur.

Extirpation of the womb.—Extirpation of the womb is, even more than amputation of the cervix, an objectionable operation, that should be abandoned.

When the prolapsed womb hangs outside the vulva, and circumstances necessitate its removal, it may be ligatured, but it should not be immediately followed by excision.

DISEASES OF THE OVARY..

Ovarian cysts.—Operative surgery is not concerned in the different kinds of cysts which occur in the ovary: hairy, fatty and other cysts. In effect there is but one which has demanded its help, for until recently all cysts have been designated under the name of dropsical cysts, or encysted dropsy of the ovary.

These cysts generally acquire a considerable volume, pushing aside the viscera, and ending by filling the abdominal cavity; the walls of which they distend. Sometimes they are formed by a single fibrous sac, filled by perfectly limpid citrine coloured serous fluid; sometimes they are divided into a great number of cysts, which have only an external envelope in com-

mon, and do not communicate with each other. This variety in the disposition of the cyst has real interest for the surgeon : though it is not always possible to know whether the cyst is uni- or multi-locular. Sometimes the cyst contracts intimate adhesions with the neighbouring organs ; at others it is found to be retained only by a pedicle formed by the Fallopian tube and the broad ligament in which arteries, and notably the ovarian artery, are found, the development of which has followed that of the tumour.

OPERATIVE PROCEDURES.

For this lesion a simple operation is generally adopted, but one which is incomplete in its results, for it only affords temporary relief, and generally does not prevent the reproduction of the disease. This operation is *puncture* of the cyst (Pl. LXXXIV., fig. 4.) Puncture, like that which is made in dropsical ascites, is made with a trocar through the abdominal wall, care being taken to carry the instrument through the most prominent part of the tumour, generally in the median line. Puncture has also been made through the vagina, but the results of such attempts are not such as to encourage a repetition. Purely palliative, puncture is only useful in uni-locular cysts ; it may, however, be repeated many times. It may even sometimes, according to Ledran, cure radically, a result the rarity of which is much to be regretted when one compares the freedom from danger of the process with the dangers presented by all the other curative measures of which we shall have to speak.

It is not on account of the smallness of their number that one may reproach these methods : in effect there are many but all so inefficient or dangerous that the palliative cure is, and perhaps long will be, the only treatment a really prudent surgeon will first think of. Accordingly we shall be brief respecting these different methods.

We shall, therefore, merely refer to the compression of M. Bricheteau, by means of a tightly laced bandage ; puncture with a small knife, proposed by M. Maisonneuve, with a view to the escape of the fluid into the peritoneal cavity, a method

which may well bring about a fatal peritonitis; puncture with a canula, which is left in to allow of the continuous escape of the liquid, a practice which has succeeded in South Carolina, but which in the hands of M. Robert, less fortunate than the American surgeon, Douglas, caused hectic fever and endangered the life of the patient.

As regards the tapping of cysts, experience shows that when judiciously done it is usually harmless. This simple operation is moreover often of great aid in diagnosis, the microscopical and chemical characters of the fluids withdrawn frequently affording conclusive evidence of the nature of a given case. Again, cysts of the parovarium, which are usually single and contain limpid fluid of low specific gravity, are commonly cured by a single tapping. On the other hand, true single ovarian cysts generally refill, but immense relief may be gained by a simple tapping, which may, in some cases, be repeated scores of times.

Tapping followed by the injection of iodine has long since been discarded by the most experienced and enlightened ovariotomists. The results are generally most unsatisfactory in every way.

Incision, practised by Ledran and Galenzowski, counts some cures. Nothing is simpler than this operation, which consists in a large longitudinal incision of the integuments and the cyst walls, either in the middle line or outside the recti muscles. Issue is given by it to the fluid, and then a roll of linen, a tent, or canula, is placed in the wound; or the cyst wall is stitched to the external wound, the rest being left to suppuration; or, lastly, a greater or less part of the cyst wall is excised.

From this to the complete extirpation of the tumour is but a step.

Ovariotomy.—MacDowell made an incision from the umbilicus to the pubis. The incision penetrates to the peritoneum; this membrane is seized with forceps and so raised that a small opening can be made into it through which the finger is introduced, in order to push aside and protect the neighbouring organs and to serve as a conductor to a blunt-pointed bistoury,

with which the incision can be enlarged. The surgeon introduces one or two fingers, or even the whole hand, through the wound, to recognise the nature and number of adhesions, and (it is to be regretted) it may happen that after having produced a large separation, he may be obliged to give up the operation when the adhesions are so strong that he could not think of destroying them. In this case the cyst is emptied and becomes one of simple incision. When the adhesions are few a ligature is put around them and they are cut. The cyst, being isolated, is incised or punctured to give exit to the fluid ; then the pedicle is included in a strong ligature, and the tumour can be removed.

Modern surgery deals almost as, if not equally, successfully with dermoid as with simple cysts of the ovary. Any competent ovariotomist can ordinarily diagnose the character of the tumour, whether mono- or poly-cystic. Indeed much more than this is requisite, and can be done ; for before operative measures of so grave a character are undertaken it is usual, in this country at least, to make a differential diagnosis between the various forms of abdominal tumour ; at any rate such as may, or do, simulate ovarian tumours.

The brilliant results of ovariotomy in England and America show that it is an operation more successful than almost any other capital operation in surgery. The mortality in the hands of Wells, Keith, Atlee, Peaslee, Wiltshire, and other operators is now less than twenty per cent : indeed the most recent statistics would make it only ten per cent ! Great improvements have been made in the manner of operating, and especially in the after treatment of the patients. Scrupulous cleanliness is observed, all possible sources of infection are avoided, the peritoneal cavity is carefully freed from all clots of blood or other discharges, and the pedicle is more judiciously managed than formerly, being more frequently clamped than it used to be. Coincidently with these improvements the mortality has fallen to the remarkably low figures already mentioned.

In performing the operation of ovariotomy the best operators are careful not to make a larger incision into the abdominal

parietes than is requisite ; but they do not hesitate to make it free enough for convenience of manipulation, nor to enlarge it if judged necessary, for it is found that mere length of incision alone does not unfavourably influence the results of the operation. Care is taken to arrest bleeding step by step ; adhesions being ligatured when necessary with pure silk or carbolized catgut. The cyst or cysts are tapped to reduce their bulk before withdrawing the tumour through the abdominal incision ; and the pedicle is dealt with according to the indications : *e.g.*, if it be long enough the most experienced operators, as Wells, put a clamp upon it ; if short it may be tied in one or more portions ; but it is always important that the ligatures should transfix the pedicle so that slipping may be avoided. Care should of course be taken not to wound large blood-vessels when transfixing the tissues. Some operators prefer searing off the pedicle with the hot iron, the tissues being held meanwhile by a suitable clamp. However the pedicle may be secured, care should be taken to prevent the occurrence of hæmorrhage from it, cases having terminated fatally from this cause. The peritoneal cavity having been scrupulously cleansed, the wound in the abdominal parietes should be brought together by sutures of pure silk, silver, or carbolized catgut, care being taken to include the peritoneum in the stitches. Simple dressings suffice, with a light cotton wool compress ; union of the wound, by first intention, usually taking place.

PLATE LXXXV.

OBSTETRICAL OPERATIONS.—PREMATURE ARTIFICIAL DELIVERY.

Fig. 1.—Dilatation of the cervix uteri.—Ordinary process.—Anatomy.—*A*, uterus ; *A'*, cervix uteri into which the end of a catheter, containing a sponge tent, *B*, is introduced ; *D*, finger of the operator introduced into the vagina ; *b*, bladder ; *c*, vesico-vaginal septum ; *d*, recto-vaginal septum ; *e*, rectum.

The right hand of the operator, *G*, slides into the interior of the catheter, *C*, a stilette, *C'*, *F*, the end of which pushes the

Fig. 1 bis



Fig. 1

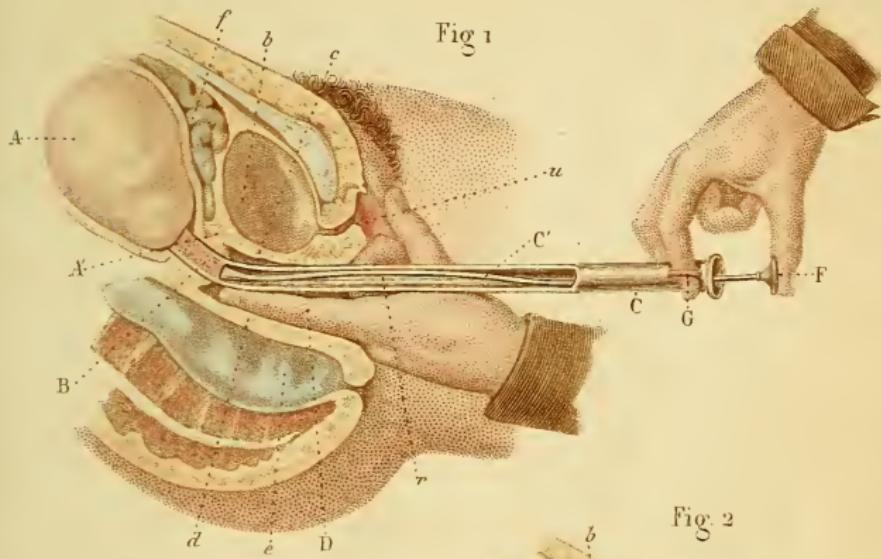
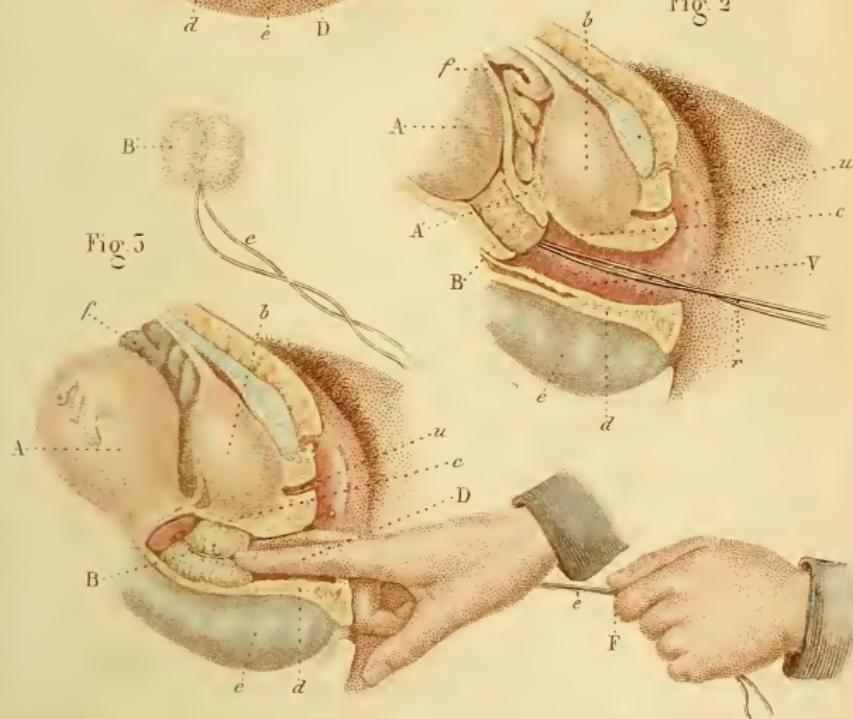


Fig. 2



tent, *B*, into the cervix uteri; *u*, meatus; *f*, intestinal loops; *r*, cavity of the catheter.

Fig. 1 bis.—The catheter and the stilette.

Fig. 2.—A, uterus; *A'*, vesico-vaginal septum. The sponge tent, *B*, has swollen and dilated the cervix; *r*, double thread serving to withdraw the tent; *f*, loops of intestine; *b*, bladder; *u*, meatus; *c*, vesico-vaginal septum; *V*, vagina.

Fig. 3.—Plugging.—A, uterus; *B*, plug of lint introduced into the vagina, and pushed up to the cervix by two fingers of the operator's right hand, *D*; the left hand, *F*, retains externally a double thread, *e*, attached to the plug; *f*, loops of intestine; *b*, bladder; *u*, meatus; *c*, vesico-vaginal septum; *d*, recto-vaginal septum; *e*, rectum.

OPERATIVE PROCEDURES.

Perforation of the membranes.—Practised by Macaulay in 1756, this operation may be done either with a straight or curved trocar, but it should be long enough to penetrate into the interior of the cervix and reach the inferior segment of the membranes. The instrument should be so directed as not to wound either the mother or the foetus.

After the puncture the rapid flow of fluid is followed by contractions and expulsive pains.

The method may prove dangerous both to mother and foetus. After the complete escape of the fluid, labour may begin late and proceed slowly. The uterine walls then compress the foetus and cause its death.

A much more safe and satisfactory method of inducing labour is that which consists in merely introducing a clean (new, preferably) gum-elastic catheter into the cavity of the uterus, where it is to be allowed to remain until regular contractions are established. The instrument should be gently passed up, *without the stilette*, between the membranes and the uterine wall, the whole being introduced into the uterine cavity, with the exception of about a couple of inches which should be coiled up in the vagina. All things considered, this is probably the safest method of inducing labour prematurely.

Meissner's process.—With the view of moderating the flow

of the amniotic fluid, and to prevent unfortunate consequences, Meissner (of Leipsic) has proposed the perforation of the membranes at the highest part of the ovum. For that purpose a silver canula 13 inches long, of which the curve represents an arch of 8 inches radius, is armed with two stilettes : one, ending in an ivory button, facilitates the introduction of the instrument ; the other, ending in a trocar, serves to make the puncture. The canula is introduced between the posterior wall of the uterus and the membranes. When it has reached some height above the cervix, the bulbed stilette is replaced by the trocar and the puncture is made. The flow of the fluid then slowly occurs ; the pains have time to come on ; dilatation begins before the foetus is compressed by the uterus, and delivery may take place in thirty-six or forty-eight hours.

Plugging (Pl. LXXXV., fig. 3).—Schoeller, of Berlin, has practised plugging of the vagina with the view of provoking premature delivery. Whatever the object for which plugging is had recourse to the method of its performance is the same.

The rectum and bladder are first emptied, then a plug composed of several balls of lint anointed with oil or cerate is introduced into the vagina close to the uterus ; the first ball being furnished with a double thread to facilitate extraction. It is not necessary to fill the whole vagina ; there are indeed inconveniences in doing this, for the excretion of urine and faeces may be hindered. The effect of this method is soon apparent by pains in the abdomen and back, and by a certain bearing down in the womb. When the plug has aroused uterine contractions and the os is open, it may be withdrawn. If the labour is not real, or if the pains become weaker and slower, the plug may be reapplied. The pain may also be roused by dilating the os with the finger. Care should always be taken to avoid rupturing the membranes before dilatation is nearly complete.

Dilatation of the cervix.—Kluge was the first to suggest the induction of premature labour by the introduction into the cervix of a foreign body acting at once as a mechanical dilator and irritant ; and with the object of determining expulsive contractions he used a cone of prepared sponge, which he

ntroduced into the cervix with long forceps, and then applied a plug to keep the tent in place, which, in dilating, brought on contraction.

Ordinary process (Pl. LXXXV., figs. 1 & 2).—A small cylinder of prepared sponge, traversed by a loop of thread, is placed in a canula (fig. 1 bis.) ; the two forefingers of the left hand are then introduced into the vagina, and feel the position of the cervix ; the canula is then slid along the palmar aspect of the fingers to the os uteri, in which the end of the instrument should be engaged, when, the stilette being pushed, the sponge slides into the cervix, and the canula is withdrawn.

The first sponge determines, by its dilatation, pains which soon cease ; the dilated cervix will then easily receive a second tent larger than the first ; fresh pains occur, and the dilatation of the cervix increases, and if labour does not progress regularly, a third tent may be inserted, and the cervix still more dilated, so as definitely to bring on labour.

It is important that only such tents be used as have been fully disinfected by steeping them in thymol, carbolic acid, or some other powerful disinfectant. No tent should be allowed to remain *in situ* over twelve hours, and disinfecting injections should be used before another tent is inserted. Barnes's bags may be substituted for tents when the cervix uteri is large enough to admit the smallest size.

Process of uterine injection.—M. Cahen describes this process as follows :—

To practise the injection use is made of a small syringe, generally of tin, containing from forty-eight to sixty grammes of starch water. The canula is about 9 inches long, $\frac{1}{8}$ to $\frac{1}{6}$ in diameter at its extremity, and presents a curve similar to that of a female catheter. The patient should lie on her back with the pelvis raised ; two fingers should be passed to the posterior lip of the os, and along them should be slid the canula, which should be introduced between the anterior wall of the uterus and the ovum to the extent of 2 inches within the uterine cavity. The injection is then to be begun, being thrown in gently and slowly, care being taken to raise the syringe a little, to avoid

the opening being applied to the uterine wall, and to vary, if desired, the direction of the instrument, whenever there is any obstacle to the escape of the liquid. The syringe is withdrawn gradually; ten minutes after the patient may get up and walk about; if at the end of six hours there are no signs of labour, the injection may be repeated.

PLATE LXXXVI.

CÆSARIAN SECTION.—SYMPHYSEOTOMY.

Fig. 1.—Body of a pregnant woman.—a, a', line indicating the lateral incision; b, b', line indicating the median incision.

Fig. 2.—Cæsarian section practised in the linea alba.—a, head of the child; b, b', incision; c, c', operator's hands; d, flap of membranes.

Fig. 3.—Lateral incision.—Extraction of the child by the feet.—a, body of the child; a, a', incision; c, hand of an assistant separating the lips of the wound; d, c', hands of the operator.

Fig. 4.—Dotted lines indicating the direction of the pubic bones; a, incision made at the level of the symphysis pubis; b, b', labia majora.

CÆSARIAN SECTION (Figs. 1, 2, & 3).

When the passages are too narrow to allow of the application of the forceps, or the operation of symphyseotomy, recourse must be had to Cæsarian section, which consists in making an incision through the abdominal and uterine walls for the extraction of the child.

This operation may be practised on the dead woman, from five to twenty minutes after the last breath, after the seventh month of pregnancy, with a chance of saving the child.

The operation of Cæsarian section is considered indispensable in the living woman, whenever the pelvis measures only 2 inches. The most favourable time for operating is that which immediately precedes or follows the rupture of the membranes.

Fig. 1

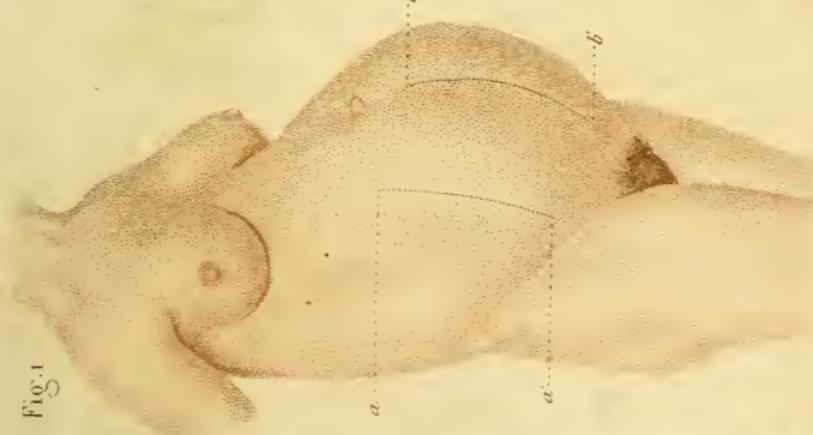


Fig. 2

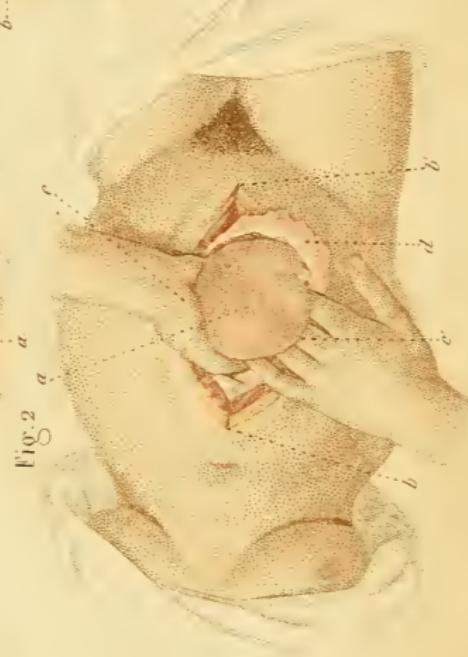


Fig. 2

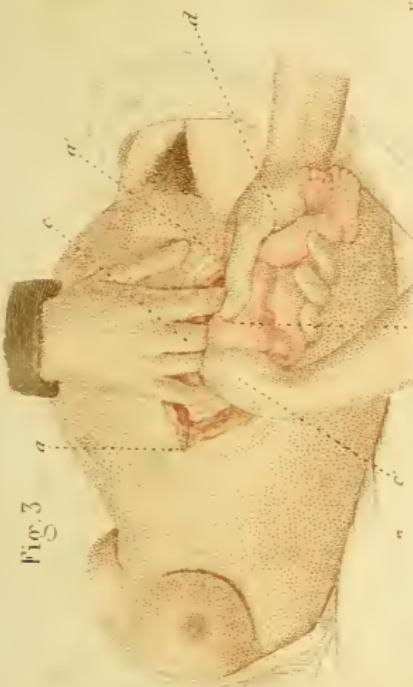


Fig. 3

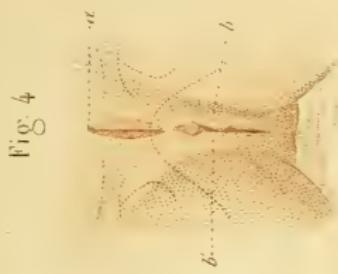


Fig. 4



OPERATIVE PROCEDURES.

The incision may be made laterally, α, α' , fig. 1, on the right side following a line springing upwards from the anterior superior iliac spine to the last rib. The incision thus practised has been recommended by some authors with the object of avoiding the recti muscles.

But M. Malgaigne has justly remarked that authors have confounded the disposition of the abdominal walls in pregnancy at term with that of the non-pregnant condition.

In women at term the linea alba is generally from 3 to 4 inches broad at the level of the umbilicus; the lateral muscles contribute least to the amplification of the abdomen. Consequently the longitudinal incision into the linea alba is preferable.

If an oblique incision is made, M. Malgaigne advises that it should be made 2 inches outside, but at the level of, the umbilicus, terminating below in the middle line.

The incision in the linea alba should begin a little below the umbilicus, and end from $1\frac{1}{2}$ to 2 inches above the pubis. Before it is made, the bladder and rectum should be emptied. The patient is held on a bed by assistants, one assistant fixing the womb with two hands applied to the sides of the abdomen. The surgeon then makes an incision which should be at least 5 to 7 inches long, and which should involve only the skin and subcutaneous cellular tissue; the aponeuroses are then to be divided layer by layer to the peritoneum; the peritoneum is at first to be carefully opened in such a way that a finger may be introduced, on the palmar aspect of which a blunt-pointed bistoury may be slid so as to enlarge the incision.

The womb is then incised layer by layer; the membranes are incised with the blunt-pointed bistoury like the peritoneum. The assistant whose duty it is to keep open the lips of the wound keeps those of the abdominal wound in relation with the lips of the uterine wound; the child is then extracted by the part which presents (Pl. LXXXVI., figs. 2 & 3), together with the placenta.

The transverse incision is made between the linea alba and the vertebral column at the level of the fundus uteri.

A second method has been proposed with the view of avoiding lesion of the peritoneum. Physick recommended a transverse incision above the pubis, stripping off the peritoneum, and incision of the uterus to the level of the stripped peritoneum. This process has been variously modified. Experience has not yet appraised the value of the second method ; and incision in the linea alba is generally preferred.

The operation should not be undertaken without having at hand an electrical apparatus to excite contraction of the uterus, should other measures fail to secure it. After the uterus has been emptied of its contents a clean probang, carrying a sponge as large as a walnut, or a disk of soft caoutchouc an inch and a half in diameter, should be passed through the cervix uteri and out at the vagina, so as to secure a free exit for lochial or other discharges. The probang should be from eight to twelve inches long, and the handle should be passed first through the cervix from above downwards, so that the larger end following may carry down any clots or other debris, and thus prove that a free channel exists.

Some doubt exists as to the desirability or the reverse of stitching together the edges of the uterine wound. Cases have done well without being so treated; but probably on the whole it would be better to bring the edges together carefully with pure silk sutures. Catgut sutures should be avoided, as they are apt to become untied when soaked in discharges, and fatal haemorrhage has been known to occur from this cause.

The incision into the abdominal walls made in the middle line, just as in ovariotomy, is to be preferred, and the after treatment of the cases should be similar to the after-treatment of ovariotomy.

SYMPHYSEOTOMY.

Proposed and practised in 1768 by Sigault, symphyseotomy has for its result an increase of about $\frac{1}{2}$ an inch in the extent of the antero-posterior diameter of the brim, and allows of a separation of about one inch between the pubic bones. This operation may, therefore, be indicated where the pelvic

diameters are not large enough for the passage of the foetal head.

Nevertheless, in the present state of science, it cannot be considered as a regular and practicable operation ; the indications are vague and uncertain, the operation is dangerous, and premature delivery is, happily, applicable in cases which demand symphyseotomy. In forty operations Baudelocque found fourteen deaths ; thirteen children only were living, and most of the patients operated upon who recovered remained infirm.

Although these results are but little encouraging, we shall describe the operation.

Ordinary procedure (fig. 4).—An incision beginning a little above the pubis is practised in front of the symphysis, and is prolonged to the clitoris, inclining a little to one side so as to avoid one of the branches of the clitoris. This first incision comprises all the soft parts. The inter-pubic ligament is then carefully incised, so as to avoid wounding the bladder; as soon as the section is completed the bones immediately separate. Delivery then takes place naturally or by means of the forceps, according to the case.

MM. Imbert and Stoltz have proposed a subcutaneous method : the first with the bistoury passed under the skin near the clitoris, and cutting the symphysis from before backwards, the second with the chain saw acting on the side of the symphysis on the bone itself.

M. Gabbiati has also proposed and practised the double section of the pubis.

We cannot advise this operation, the indications for which, as we have already said, are not clearly laid down, and the results of which are most uncertain.

PLATE LXXXVII.

TENOTOMY.

TORTICOLLIS OR WRYNECK—SECTION OF THE STERNO-CLEIDO-MASTOID MUSCLE—CLUB-HAND—PERMANENT CONTRACTION OF THE FINGERS.

Fig. 1.—Torticollis of the right side, and contraction of the sterno-mastoid.—*a*, cord-like prominence, caused by the shortening of the muscle.

Fig. 2.—Torticollis of the left side, and subcutaneous division of the muscle.—*a*, the sternal fasciculus contracted; *b*, puncture made by the tenotome at the external border of the fasciculus.

Fig. 3.—Tenotomes, or tenotomy knives, employed by Jules Guerin, but in England discarded.

Fig. 4.—Operation for a torticollis due to contraction of both the sternal and the clavicular fasciculi of the muscle.—The plate represents an assistant rotating the head in order to increase the tension and the prominence of the contracted muscle.—*a*, point at which the extremity of the knife should be felt beneath the skin, which, however, it should not penetrate; *c*, point at which the puncture is made by the knife.

Fig. 5.—Same operation.—This figure does not represent the operation as now performed. This peculiar double-bellied knife is now never employed, nor is the point of the present tenotome allowed to make its appearance from beneath the skin. The whole operation should be *subcutaneous*.

Fig. 6.—Permanent contraction of the fingers with palmar club-hand.

TORTICOLLIS—SECTION OF THE STERNO-MASTOID.

We recognise by the name of torticollis a lateral deviation of the head and neck, more or less marked, with an inclination towards one shoulder. The face is turned to the side opposite to the lesion; the mastoid apophysis approaches the clavicle, and is drawn forwards; the cervical region of the vertebral column is flexed laterally. This deformity may be tem-

Fig. 1.

Fig. 2



Fig. 3



Fig. 4



Fig. 5



Fig. 6



porary or permanent. Numerous *causes* are recognised. It may be the result of a traumatic or organic disease of the cervical vertebræ, or it may be due to the presence of a large tumour, or of bands or cicatrices, etc. It most commonly originates in contraction of the lateral muscles of the neck—the scaleni, platysma, and sterno-cleido-mastoid. This last being almost always the seat of origin of permanent torticollis, or, at any rate, the locality of the only form of the disease capable of cure by operation, will be the only muscle with which we shall concern ourselves.

For a long time attempts have been made to cure this disease by means of various forms of apparatus; but now section of the contracted muscle is regarded as the most efficacious procedure; bandages and other contrivances are only introduced as aids, although they are indispensable for securing a good result after treatment.

Anatomy.—Bouvier, Malgaigne, and other surgeons have proposed various positions for the point of section of the sterno-mastoid, but the division is usually made in the lower third, the tendinous portion being preferred.

The muscle in its lower portion consists of two distinct fasciculi: the inner one very firm—half an inch wide—fibrous the length of an inch or more. It is inserted into the upper anterior surface of the manubrium sterni, in front of the sterno-clavicular joint; its more internal fibres often touch those of the other side. The second and outer fasciculus, larger, broader, and thinner than the first, with very short tendinous fibres at its lower extremity, is connected with the inner third of the clavicle. Though sometimes the two tendons are in contact and almost united, yet in other cases, especially in thin subjects, they are quite distinct, as can be made out by sight and touch; a depression marks the cellular inter-space between them.

Jules Guerin, who has clearly shown the functional independence of the two heads of the muscle under consideration, showed that the sternal origin of the muscle is the part usually affected; contraction of the clavicular portion, which is much rarer, producing inclination of the head to one shoulder,

or elevation of the latter without rotation. The result has been that surgeons have proposed to limit the incision to the inner fasciculus alone, a precept too exclusive.

The relations of the tendons are as follows. They are subcutaneous, and when the muscle is contracted form an immovable projection, like a hard cord ; there is no important structure between the tendons and the skin, on which account some of the old surgeons made the section in an open wound. Behind the tendons is the deep fascia which alone separates them from the carotid and internal jugular, whose course is indicated by the cellular interval between the sternal and clavicular origins. Tension of the muscle separates it from the large vessels, which fact adds greatly to their safety in the operation. The inferior thyroid and anterior jugular veins run along the inner edge of the sternal origin ; but the first is separated from it by the sterno-hyoid and thyroid muscles, and the second, when present, is superficial and easily avoided. As regards the external jugular, it is generally far enough from the outer edge of the clavicular origin not to be in the way. The nearer we approach the bony origins of the muscle, the less the risk of wounding the vessels, so that in a doubtful case it is best to cut the tendons close to the bones.

No important nerve is met with in these parts ; the muscle is enclosed in a sheath derived from the cervical fascia, which will be treated according to circumstances.

OPERATIONS.

The necessary apparatus consists of tenotomes of different shapes : sharp-pointed for puncture, straight or convex for the section.

Dupuytren was the first to subcutaneously divide the sterno-mastoid ; he was followed by Stromeyer and Bouvier. Guerin modified their operation, and to him we owe the rules of the procedure now generally adopted.

The patient is seated, or lying on his back, with the trunk half raised ; an assistant sitting behind fixes the head, and rotates it to the side opposite to the morbid condition, so as to

put the affected muscle more than ever on the stretch. It then forms so marked a projection that it can be held by the fingers of the left hand. This circumstance is of real help in making the section. The surgeon, standing in front of the patient, takes up a vertical fold of the skin, parallel to the axis of the muscle, its base corresponding with the outer edge of the muscle (when the skin is naturally loose): the surgeon then pierces the skin with his knife, at a point answering to the outer edge of the muscle, and $\frac{3}{4}$ of an inch above the clavicle or sternum, using for this purpose a sharp-pointed convex tenotome, whose blade is $\frac{1}{8}$ of an inch broad. The instrument is passed from without inwards, between the skin and muscle, the back turned downwards, the edge upwards, until it reaches and passes the inner edge of the sternal origin of the muscle, carefully avoiding any perforation of the skin; then the surgeon gives a quarter rotation to the knife, so that the edge touches the anterior surface of the tendon. The skin is now held no longer, and the knife is drawn slowly backwards and forwards across the tendon, until a peculiar sound—a kind of cracking—shows that the tissue is divided, when the knife is withdrawn through the passage by which it was introduced. If the two portions of the muscle are both contracted, the clavicular origin is to be attacked at the same time as the sternal, and without making fresh wounds; the muscle is put on the stretch by binding the head over to the opposite side, and the tenotome is passed again through the same wound, but from within outwards, following the same rules as before; but the knife must not go far beyond the outer edge of the muscle lest the external jugular be wounded.

Surgeons are not afraid as to the direction of the incision. Cutting from before backwards is safer as regards the vein, but, on the other hand, the fibres are more likely to be left undivided in this procedure. Malgaigne recommends cutting the clavicular portion from before backwards, on account of the jugular vein, and, because of its greater ease, he would divide the sternal origin from behind forwards. But M. Guerin is diametrically opposed to him on this last point.

The muscle can be cut just as well, in either way; but if the

surgeon fears wounding the vessels, he may use a blunt-pointed knife after making the skin incision.

M. Guerin's operation with a double-edged knife.—Having placed the patient as in the last operation, the surgeon puts the middle finger of the left hand on the inner edge of the sternal origin and endeavours to insinuate it beneath the tendon, in order to separate this latter from the subjacent parts, and to direct the point of the knife with more certainty ; the tenotome, with the two distinct cutting blades held in the right hand like a pen, is passed through the skin on the outer edge of the clavicular origin (fig. 4), and is slipped behind the muscle until it touches the tip of the left middle finger, which is then used to guide the knife while it pierces the skin from within outwards. When transfixion is finished, the second blade is brought to the margin of the fasciculus about to be divided, a quarter rotation of the knife on its axis brings the edge against the muscle, and section is effected by pressing from behind forwards; the instrument is then removed from within outwards. Both origins of the muscle can thus be divided successively, and, if more fibres have escaped, the second blade divides them as it is withdrawn.

The drawback to this method is the production of two wounds ; it is not often employed, and the ordinary operation is usually preferred.

PERMANENT CONTRACTION OF THE FINGERS.—CLUBBED HAND, SECTION OF PALMAR APONEUROSIS, AND OF THE FLEXOR TENDONS.

Permanent contraction of the fingers may be congenital or accidental. It arises from burns, from wounds, or from disease peculiar to the fascia itself. In all cases the lesions may be simple, and limited to the superficial parts, or else accompanied by general deformity of the hand (as is the case in clubbed hand), or complicated with contractions or cicatrices of the tendons of the muscles of the forearm. There are many modes of treating contractions of the skin and of the palmar fascia.

Astley Cooper was the first to apply subcutaneous surgery

to these cases. The fibrous band was put on the stretch by forcible extension of the finger, a straight-bladed bistoury was passed under the skin and made to divide the contraction without cutting the integument. If then extension could not be properly effected, the incision was repeated in another place. The fingers had to be kept straight by suitable apparatus.

Dupuytren operated by open incision. The hand being supinated, and the fingers extended as far as possible, he cut down upon the contracted band at its most prominent part, somewhere near the metacarpo-plalangeal joints. The skin being cut through transversely to the extent of an inch, the fibrous band was laid open and cut completely through. A second incision was made higher up or lower down; if the hand could not be easily extended, the fingers were bandaged to a digitate splint, applied to the dorsal surface; and the wounds, dressed with lint, slowly cicatrised; but the deformity often reappeared after a shorter or longer interval.

Goyrand cuts through the skin longitudinally at the most prominent part of the band, and dissects aside the integuments on each side, thus laying the contraction bare throughout, which is then divided at one or two points and removed; the lips of the wound are then brought together.

When contraction of the fingers is due to the flexor tendons, division has been proposed at the level of the first phalanx, in the palm, or near the wrist even. This matter has been the subject of most lively controversy, and is not yet settled.

Most surgeons have declined the operation because tendons divided in their synovial sheaths seldom reunite: the fingers can be straightened, but afterwards can rarely be flexed properly. Hence tenotomy of the fingers is only to be performed in very rare cases. Contraction of the flexors and other forearm muscles, is the most common cause of clubbed hand. Subcutaneous division of the tendons is evidently indicated, and rarely presents any great difficulty.

PLATE LXXXVIII.

CLUBFOOT—SECTION OF TENDO-ACHILLIS.

Fig. 1.—Tenotomes—*a*, tenotome with concave cutting edge; *b*, tenotome cutting on its convexity; *c*, lancet-shaped tenotome for puncturing the skin.

Fig. 2.—Division of tendo-Achillis.—Surgical anatomy.—*a*, *a'*, the two ends of the tendon separated after division; *b*, the sheath of the tendon formed in front by the muscular aponeurosis which separates the superficial from the deep muscles; *c*, the crural aponeurosis which forms the posterior layer of the sheath of the tendo-Achillis; *d*, skin removed to let the dissection be seen.

Fig. 3.—Talipes equinus.—The foot is in the same line as the leg, and only rests on the ground by the toes. The heel is raised by the contraction of the tendo-Achillis; *a*, point of puncture of the skin, where the tendon is to be cut.

Fig. 4.—Operation of dividing the tendo-Achillis.—Position of the surgeon and his assistant.—The tenotome, *b*, introduced by the wound, *a*, dividing the tendon from behind forwards.

Fig. 5.—Talipes calcaneus.—The foot is forcibly flexed upon the leg, the heel alone resting on the ground, which the toes do not touch at all.—*a*, *a'*, point in the skin where the tenotome ought to be introduced to cut the tendon of the extensor digitorum.

Fig. 6.—Talipes valgus.—The foot rests on its inner edge, the outer edge is raised from the ground, and the sole looks outwards.

Fig. 7.—Talipes varus.—The sole is turned inwards, and is concave from behind forwards, the foot resting on its outer edge, the inner edge being turned upwards.

CLUBFOOT.—DIVISION OF TENDONS OF THE LEG AND FOOT.

All deviations of the foot termed *clubfoot*, whether congenital or acquired, are associated with contraction of certain muscles,

Fig. 1

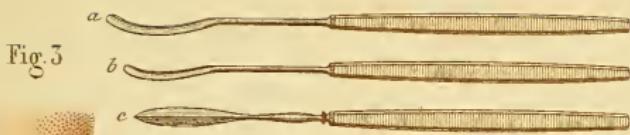


Fig. 3



Fig. 2

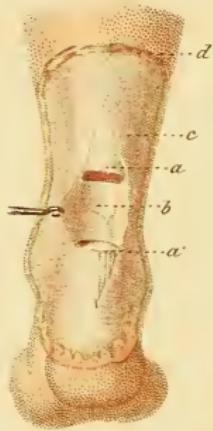


Fig. 5.



Fig. 4

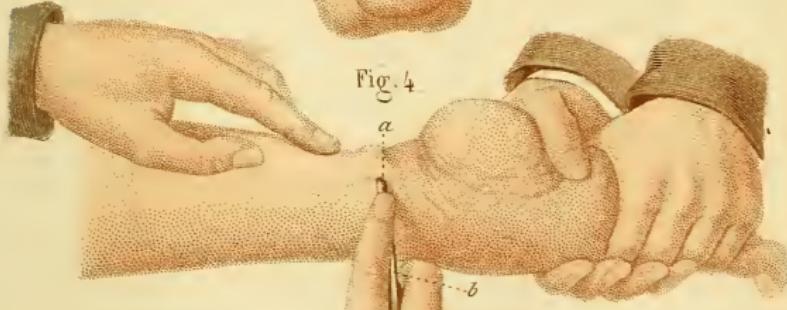


Fig. 6



Fig. 7



tendons, or aponeuroses. Subcutaneous tenotomy is successfully employed in the cure of these deviations.

There are many varieties of clubfoot, but they are always in some way related to the normal movements of the sound foot, of which they seem to be merely exaggerations, as is well seen in cases where the deformity is simple and at an early stage; while, on the other hand, in extreme cases, the deformity is so great that the foot may take any strange forms.

Extension of the foot causes *talipes equinus*, in which the heel is strongly raised, and the foot, placed in a line with the leg, only rests on the ground by the toes or ends of the metatarsus. *Talipes equinus* is caused by contraction of the tendo-Achillis, and of the common flexor of the toes.

Flexion of the foot causes *talipes calcaneus*, which is just the reverse of the preceding. The heel alone rests on the ground, the plantar surface of the foot being directed forwards; the toes which cannot touch the ground are more or less drawn upwards, and towards the crest of the tibia. This variety, the rarest of all, is due to contraction of the anterior tibial and peroneal muscles, and of the common extensor of the toes.

Adduction of the foot is found in *talipes varus*, the commonest form of all. The foot touches the ground on its outer edge, the inner is turned up, the sole looks inwards, the toes are almost always flexed, and the heel raised from the ground. This kind, especially when of long standing, is almost always associated with *talipes equinus*. The cause of *talipes varus* is contraction of the tibial muscles, the tendo-Achillis and plantar fascia.

Abduction is represented by *talipes valgus*, which is the reverse of the last kind. The foot rests on its inner edge, from which the concavity is gone, the outer edge and sole of the foot no longer rest on the ground, and the latter looks outwards. This kind is usually combined with *talipes calcaneus*, and is the result of contraction of the peronei; the deformity known as *flatfoot* is a mild form of *valgus*.

If the malformation is originally due to muscular contraction, there soon arise other causes for its perpetuation, in gradual involvement of the fibrous tissues, the articular ligaments, the

aponeuroses, and the tendinous sheaths. The bones subluxated, and deformed by abnormal pressure, lose their shape and relations to such a degree as to remove all hope of restoration, so that tenotomy is useless in extreme degrees of clubfoot, especially when the patient is fifteen or eighteen years old. In some very severe cases of deformity of the bones with talipes excision of the deformed bones of the tarsus has been recently practised.

Cases are not altogether hopeless at a later date if the deformity is simple and not excessive, and improvement may be looked for. Tenotomy, which is so valuable in the treatment of clubfoot, should always be associated with the use of suitable apparatus designed to restore and preserve the normal position of the limb. The simultaneous use of shampooing or of galvanism is often very useful. Section of the contracted muscles is performed according to the general principles of tenotomy. We are about to recall these principles, referring first to the class of cases in which the tendon is free, and capable of making a distinct prominence under the skin, and to a second class of cases where it is bound down to the bones by a fibrous sheath, and surrounded by a synovial membrane. In the first category are the tendo-Achillis and tendon of the tibialis anticus, common extensor of the toes, superficial tendons and muscles of the sole, and bands formed by the plantar fascia. In the second class are the tendons of the tibialis posticus, long flexor of the toes, and peronei.

Section of the tendons of the first kind is performed as follows. Only one opening is made in the skin, as small as possible, the size not exceeding that of the instrument, which is to be no larger than is required for proper strength.

The opening must be at such a distance from the tendon that its course can be oblique, thus to prevent admission of air, and to obtain this result it is a good plan to pinch up a fold of skin and puncture it near its base.

When the tenotome reaches the tendon, the section may be effected either from the deeper side outward or in the other direction. Selecting the latter mode, the tenotome is slipped under the skin flat, and as soon as the middle of the blade

is opposite the tendon, the knife is to be turned through a quarter rotation, so that the edge presses against the tendon, and the back is in contact with the deep surface of the skin. Convex tenotomes are preferable to those which are straight or concave, or two may be used, one pointed and straight, the other blunt and convex. While the knife is being introduced, the tendon is to be relaxed that the blade may glide between it and the skin; but it must be stretched during section, an assistant keeping the limb in the requisite position.

When selecting the method of cutting the tendon from its deeper surface, the tendon should be relaxed, and if possible raised by the thumb and index finger of the left hand, when the knife can be easily inserted beneath it. The tendon is then put firmly on the stretch whilst the section is being made.

The surgeon knows when the section is complete by a slight shock accompanied with a peculiar sound, by the disappearance of the prominent cord, and sometimes by the perceptible interval between the cut ends.

These general principles being given, we proceed to examine the division of special tendons separately.

Section of tendo-Achillis.—This operation is undertaken for the cure of talipes equinus, but it is often required for equino-varus, and even for simple varus in young children. It has been employed in a variety of cases, as, for instance, in the retraction of the tendo-Achillis, after Chopart's amputation, and in some cases of irreducible fractures of the leg it has proved most efficacious.

Surgical anatomy.—The tendo-Achillis consists of the combined insertions of the muscles of the calf. Wide above, the tendon converges its fibres in descending, so as to form a vertical cord, which makes a well marked prominence, capable of being embraced by the fingers for a length of 2 inches or more.

The height above the os calcis at which the fleshy fibres end varies, but is seldom less than two inches. The tendon at its lower end widens for insertion into the tuberosity of the calcaneum, from which it is separated by a bursa. As it is necessary to avoid the bursa below, and the muscular fibres

above, the point preferred for the division of the tendon is about $1\frac{1}{4}$ inch above its insertion into the bone. In infants the distance should be about $\frac{3}{5}$ of an inch. This point is chosen for another anatomical reason: the tendon is covered behind by the skin alone, while in front it is in relation with the deep muscles, and especially with the tibial vessels and nerves, from which it is only separated by the fascia. Near the heel, the tendon is at some distance from these deeper parts, a thick layer of fat and cellular tissue intervening; but above and below the point indicated above as the selected point, there is more risk of wounding the vessels and nerves; this is further lessened by introducing the knife on the inner side of the tendon.

The tendo-Achillis is surrounded by a firm and resisting fibrous sheath, in which the two ends retract after division, and which plays an important part in the cicatrization of the divided tendon. Fig. 2 shows the relations of the tendon and the separation of the cut ends.

OPERATION.

The patient lies on his face, an assistant holds the leg about its centre, and the foot about the middle of the sole. In the first stage, the foot is extended to relax the tendon, while the knife slips under the skin; in the second stage, the tendon is made very tense to assist its division. The surgeon, standing on the inner side of the leg, perforates the skin with a lancet, or the sharp tenotome, at the inner edge of the tendon at the point selected as referred to above. The instrument is introduced on the flat between the deep surface of the skin and the prominent tendon, or, on the other hand, beneath the deep surface of the tendon, then, having made a quarter rotation, its edge is brought against the tendon when direct pressure, aided by a slight movement backwards and forwards, divides the tendon with a slight noise. This sound, a sudden shock, and the yielding of the tendon show that the section is complete. Usually a deep groove can be felt between the separating ends of the tendon; the knife is withdrawn with great care, and two or three drops of blood follow.

A pad of lint and a piece of plaster is applied over the wound, and the foot retained in its original position by a flexible metal splint. The scarpa's shoe may be applied two or three days later.

Division of the tibialis anticus.—This is practised in the treatment of talipes calcaneus, and in talipes varus, though Bonnet considers that it may be dispensed with in the latter affection. It is performed at the point where the tendon makes its prominence under the skin most evident ; that is, about the level of the tibio-tarsal joint. This tendon should certainly not be cut from the surface downwards, for fear of injuring the joint and the dorsal artery of the foot. The knife should be entered on its outer side and slipped beneath the tendon cutting towards the surface.

Division of the extensor pollicis, extensor communis digitorum, and peroneus tertius.—This operation may be called for in talipes calcaneus, valgus or varus. The prominence of these tendons under the skin renders their division easy. They can be reached by one or more incisions made in front of the malleoli, above the level of the tibio-tarsal articulation (fig. 5, a, a). Bonnet prefers to operate at the level of the metatarso-phalangeal articulations ; there is less risk in that proceeding of wounding the nerves and the vessels of the dorsum of the foot. The section of all the tendons is effected at the same operation.

Section of the plantar fascia.—Contraction of this structure is very common in talipes. It is usually about the level of the joints, between the first and second row of tarsal bones, that the prominences of the fibrous bands are most marked ; they may be cut from the surface downwards. The numerous processes of tissue to the sides and into the depth of the sole render complete division of the plantar fascia very difficult ; in fact, the result seldom appears at once. The methods of operating on the palmar fascia are equally applicable to these cases.

Section of the muscles of the thenar and hypothenar eminences is seldom effectually performed, and no clear rules can be laid down.

The *peronei* and *tibialis posticus* form another class of

muscles which, closely attached to the bones and contained in firm fibrous sheaths, make no prominence under the skin until they are contracted. Division is never here effected by cutting from the surface ; it is best, having made the skin-puncture as before described, to slip the pointed convex tenotome under the tendon and cut it from below towards the surface. Cutting from the surface downwards, as recommended for the preceding muscles, would risk opening the joints and wounding the vessels of the foot.

Section of the peronei.—This may be done in three places.

(1) Behind the fibula, $\frac{3}{4}$ of an inch above the external malleolus, it is possible to make the section quite safely from the surface downwards ; but as fleshy fibres pass very low down the tendon the division must be made freely.

(2) These tendons may also be cut $\frac{1}{2}$ an inch below the outer malleolus, near the point where they turn forwards. There is, however, greater risk of opening the ankle joint, on which account the first operation is preferable.

(3) Lastly, the operation may be performed behind the malleolus, but the manœuvre is impeded by the bony edge of the groove in which the tendons run. Division of these tendons is employed in cases of valgus, and has been of much use in the relief of flat foot (Bonnet).

Section of tibialis posticus.—In talipes equinus and in cases of varus in adults this tendon may need to be cut, the operation varying according to the degree of deformity. In talipes equinus the tendon is divided behind the malleolus. It may also be cut below the ankle as follows. Define exactly the prominence of the scaphoid ; let the tenotome perforate the skin $\frac{1}{2}$ of an inch above and a little in front of this eminence, until the knife reaches the astragalus ; then slip it along the bone until the point passes $\frac{1}{6}$ of an inch below the scaphoid eminence ; then raise the edge and turn it forwards until it comes just under the skin. The tendon cannot fail to be divided, and the flexor communis is generally involved in the section (Bonnet). When in very bad cases of varus the scaphoid touches the malleolus, there is then no other part of the muscle available for operation in the foot, and the tendon

must be divided behind the malleolus; but the result is less certain; if the instrument is carried too deep there is much risk of wounding the artery. M. Bonnet thinks this has often happened, but rarely with any great injury.

Section of the tendons of the flexor longus pollicis and flexor communis digitorum.—The deep position of these tendons prevents their being divided with certainty near the malleoli or in the sole; the operation must, therefore, be performed near the first phalanges of the toes. The methods applicable to the muscles of the first category are used here: puncture of the skin and division of the tendon must be performed in each toe, the chief inconvenience being the length of the operation. The same remarks are applicable to the flexor brevis digitorum. It usually happens that the tendons of the long and short flexors are cut at the same time, as is shown by the simultaneous retraction of the two muscles.

THE END.



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