SOME POINTS IN TRACHEOTOMY.

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WHEN my friend Dr. Carr requested me to read a paper here, it occurred to me that there were one or two points in connection with the operation of tracheotomy which might fairly be discussed by the Society. The members are familiar with the description of it given in books, and many of those present have no doubt performed this operation repeatedly. It would be superfluous therefore for me to attempt to recapitulate the whole *modus operandi* in this place, but it may perhaps be permitted to me to refer to some of the difficulties which I have myself met with, and to invite an expression of opinion on those points where improvement appears possible.

In the course of my practice, I have had occasion to open the air tube twenty-three times for very varied diseases; but I will restrict my remarks here to those cases in which the *trachea* was the seat of the incision, and leave out of account nine cases in which the opening was purposely made above the cricoid cartilage. This leaves fourteen cases of tracheotomy.

First then, as to the fatality of the operation. I may say that in no case could death be traced to the operation. Six of the cases were for diphtheria; one for laryngeal phthisis; three for acute inflammation and swelling of the mucous membrane lining the larynx; three for extreme stenosis, owing to old standing laryngeal inflammation; and one for almost complete closure of the larynx by intralaryngeal papillomata in a child 2½ years old. Four of the cases of diphtheria died of the disease at varying periods, but with the breathing relieved and death rendered more peaceful. Another case recovered from the immediate danger of the diphtheritic attack, so far as to permit of the removal of the tube and the closure of the wound, but sank two months after the operation from cardiac syncope, probably one of the paralytic after effects of the disease. The last of the six cases of diphtheria made a perfect recovery, the tube being removed in a fortnight. The case of laryngeal phthisis was tided over the immediate danger of suffocation, and only ended fatally a year after the operation from extension of the disease. The three cases of acute inflammation and swelling of the mucous membrane of the larynx made excellent recoveries, and were able to dispense with the tube within a month after the operation. The three

cases of chronic thickening were in elderly people, and they, too, rallied well after the tracheotomy, but in them the tube continued to be worn. One of them succumbed to diabetes several months after the tracheotomy; the other two are alive and in comfort as regards the breathing. Lastly, the little boy whose larynx was occupied by intralaryngeal growths is well and strong, and though the tube is still in (one year after the operation), I have been able to remove a number of the papillomata from the larynx, and there is a fair prospect of our being able to dispense with the tube soon.

I have thought it right to mention briefly the cases which, owing to the kindness of medical friends, have been sent to me; but of course I do not bring forward the statistics of so small a number of cases from any belief in their novelty or importance, but rather to show that my remarks have at all events a certain basis of observation.

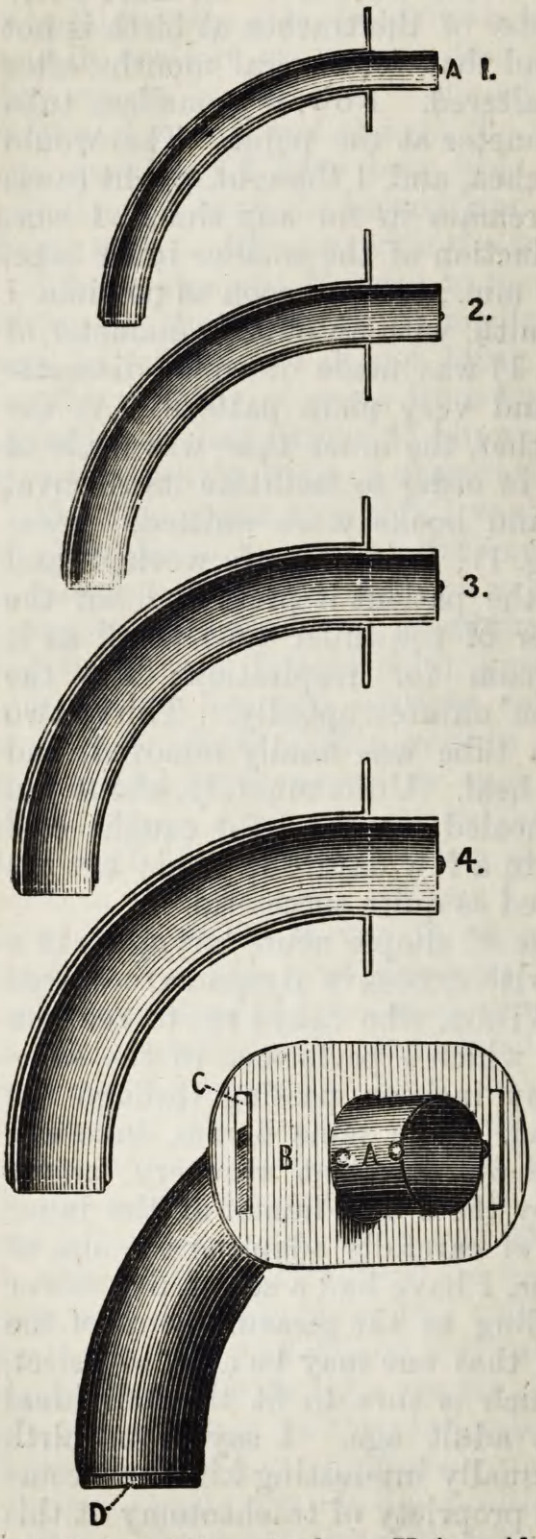
The first point to which I would draw attention is the size of the tube to be used at different ages. This is particularly important in the operation on very young children, but is not beneath attention even in adults. The youngest patient on my list was a female child, aged 6 months, who, four days before I saw her, had "caught cold." The symptoms at first were very slight, but a certain amount of dyspnœa set in, and gradually increased to such an extent as to alarm her attendants. Active treatment by calomel and tartar emetic and local blood-letting failing to give relief, I was asked to perform tracheotomy. When I saw the child (10 P.M., 11th November, 1879), it was in an agonizing state of dyspnœa; the skin was pale and clammy, the lips pale blue in tint; at each inspiration the eyebrows rose and the forehead wrinkled, and the supraclavicular and lateral costal regions sank in; while the noisy inspiration and expiration indicated advanced stenosis of the larynx. There was no membrane on the fauces, nor any suspicion of diphtheria; and the diagnosis of simple acute laryngitis appeared to be quite clear. No time was to be lost, as the child was fast becoming exhausted, and, therefore, Dr. Lothian put her under the influence of chloroform, and I cut down on the trachea. At this early age the trachea is a very small and soft tube, not easily distinguishable by the finger, so delicate are its rings; and the larynx, too, is soft and yielding. I therefore selected the most resistant point of the air tube as my guide—namely, the cricoid ring, which gave me a clear clue to the position of the upper end of the trachea. Exposing this, I divided the first four rings, and, of course, the isthmus of the thyroid gland. Then arose the

doubt as to the propriety of putting in the smallest tracheal tube which I had been able to procure. Some observations of my own,* and the published measurements of M. Marc Sée,† had taught me that the diameter of the trachea at birth is not more than 4 mm. or 5 mm., and that for several months after birth this size is not much altered. Now, my smallest tube measured 5 mm. external diameter at the point. This would have completely filled the trachea, and, I thought, might cause erosion if the tube were to remain in for any time. I contented myself with the introduction of the smaller inner tube, the diameter of which was 4 mm.; and, as soon as possible, I had a tube made by a silversmith, with an outside diameter of 4 mm. This new tube (Fig. 1) was made of equal diameter throughout, of solid silver, and very plain pattern. At the suggestion of the patient's father, the inner tube was made to project a little at the front, in order to facilitate its removal for cleaning; and all loops and hooks were omitted. I was delighted with this tube (Fig. 1); it was easily worked, and to the nurse and mother of the patient it presented not the least difficulty. The diameter of the inner tube, small as it was—3 mm.—gave ample room for respiration; and the recovery of the child went on uninterruptedly. Thirty-two days after the operation the tube was finally removed, and the small wound allowed to heal. Unfortunately, about ten days after the wound had healed up, the baby caught cold again, pneumonia set in, and, in a few days, she died; but the operation may be fairly claimed as quite successful.

In March, 1880, another case of simple acute laryngitis in a female child, æt. 17 months, with excessive dyspnœa, occurred in the practice of Dr. John Wilson, who asked me to see her. We decided on tracheotomy, which I performed in the same way as in the other case, my incision passing through the isthmus of the thyroid gland. The same 4 mm. tube was used, and the patient made an excellent recovery, ample breathing space being given by the 3 mm. lumen of the inner tube. Following up the idea of carefully adapting the size of the tube to the individual case, I have had a set of five silver tubes made, graduated according to the measurements of the trachea at different ages, so that one may be able to select, without hesitation, a tube which is sure to fit the individual case, from birth onwards to adult age. I say from birth onwards, for a case of an unusually interesting kind has come under my notice, in which the propriety of tracheotomy at this

* See Paper by Dr. Miller, in *British Medical Journal*, 17th Nov., 1877.
† See *Lancet*, 13th July, 1878, page 58.

early age has been seriously discussed. This was the case of a newly born male child, which succumbed to laryngismus a few



I. Diam. 4 mm., for patients under 18 months of age.

II. Diam. 6 mm., 18 months to 2½ years.

III. Diam. 8 mm., 2½ to 10 years.

IV. Diam. 10 mm., 10 to 20 years.

V. Diam. 12 mm., large—males.

Full size outlines of tubes. V. is a side profile view of the largest tube to show plate, &c. A is placed between two knobs which check the inner tube and permit it to be grasped. D shows the lower end.

hours after birth.* Every sort of sedative treatment was tried, and failed; and the question of tracheotomy was raised only to be negatived. But, bearing in view the facts that three children of the same parents had previously succumbed to laryngismus shortly after birth, and that a *post-mortem* examination of the child which I attended failed to reveal any disease or abnormality of the larynx, we have agreed that, in the event of another delivery being followed by laryngismus in the child, the apparently severe measure of tracheotomy is not to be shirked, and to this the parents have given their approval. The success of the operation in the child æt. 6 months (above detailed) leads me to think that a favourable result may be got even in the newly born.

The curve of the tubes is a wide one, in order to avoid that ulceration of the anterior wall of the trachea which often follows the use of the ordinary over-curved tubes. These tubes are sold by W. B. Hilliard & Sons, 65 Renfield Street.

Another interesting detail in performing tracheotomy is the exact seat of election for the opening in the windpipe. In books we have a tradition handed down informing us that the windpipe may be opened either *above* or *below* the isthmus of the thyroid gland; and hæmorrhage is alluded to as an event to be dreaded if the isthmus be cut. But some of the best authorities (Erichsen, Bryant, and others), while still advising us to leave the isthmus alone if possible, say that it may be cut without scruple when necessary. And it is not difficult to understand why this should be done; for in the isthmus in the middle line there are no blood-vessels, just as in the tongue or in the perineum the middle line is devoid of vessels of more than capillary size. Hyrtl failed to inject the one side of the thyroid from the other through the isthmus. It is quite true, indeed, that the thyroid arteries, ramifying outside the capsule of the thyroid body send small branches across the trachea to anastomose with those of the opposite side, but these vessels are quite outside of the isthmus, and do not belong to it. In many cases, especially in young children, and people with short necks, the space between the cricoid and the isthmus is so very small that no tube could be got in without dislodging the isthmus or incising the cricoid, and as a matter of fact, I believe the isthmus is often cut unawares in children. But in the fear of the isthmus, which young and even more experienced surgeons are imbued with, serious mistakes are made. I have been called twice to make *post-mortem* examinations of children dying of diphtheria, in whom the so-called

* *British Medical Journal, op. cit.*

high operation has been done by surgeons who certainly could not be called quite inexperienced. In one of these cases the tube was pushed into the larynx at the base of the epiglottis; and in the other it had gone into the pouch of Morgagni. On the other hand, by going too low down, we come into serious dangers. The thick plexus of thyroid veins; the occasional thyroidea ima; and even the innominate itself may give trouble: while the bulky thymus in children, though not dangerous to cut, comes more or less in the way. It occurred to me, therefore, after doing one or two tracheotomies, and after carefully dissecting the parts in a number of bodies at various ages, both injected and uninjected, to *select the isthmus* as the safest seat of the incision. To this I was the more impelled by watching the results of cutting the cricoid cartilage. It does not answer to cut the cricoid, for there is so much spring in the ring of the cricoid that the tube cannot be worn without a constant irritation, it may be unfelt, but steadily leading to perichondritis and necrosis of parts of the cartilage. Twice I have tried to obviate this by *removing* a piece of the cricoid in cases where it was intended to wear the tube permanently: and this proved very successful. But, in merely splitting the cricoid, the result is not good if a tube is to be worn even for a week or two. In another case, that of a female, æt. 34, with acute infraglottic œdema, under the care of Dr. Sloan, I performed the low operation, but during it I had so much profuse hæmorrhage from the thyroid plexus of veins that I resolved to go higher up, and incised through the isthmus, with the best results. In the last five or six cases I have cut through the isthmus with the knife, and have had reason to be well satisfied with the easy access to the trachea and absence of hæmorrhage during the operation. Any hæmorrhage which is met with at this part of the air tube is from small arterial vessels which are readily secured by ligature or pressure forceps, and that gushing of blood from large and swollen veins in the thyroid plexus is avoided. The trachea is near the surface, and we have the useful guide of the firm resistant ring of the cricoid at the upper end of our incision, which, in very young children especially, is of considerable value.

The incision in the skin may reach from the level of the cricothyroid membrane to a point half way towards the suprasternal notch; and, in dissecting deeper, it is wise to use two pairs of dissecting forceps, one of which is held by the operator, and the other by the assistant; so that, with these, the tissue to be cut is steadily held on both sides before each

cut is made. Vessels are secured as they appear. Keeping in the middle line, the isthmus may be cut and the trachea exposed and, all bleeding being stopped, incised either with or without the aid of a hook to steady it. In inserting the tube, the point of the dissecting forceps is placed in the cut in the trachea, and the tube pushed along between the blades which open the trachea as the tube advances. No complicated instruments are needed, nor split tubes. A thin tenotomy knife, several artery compressors, a sharp hook, and two pairs of dissecting forceps are all the necessary instruments.

The tube once in, the after treatment is easy. No steaming is needed. If a single layer of dry gauze is loosely thrown over the face and neck, the air will be kept warm and moist enough for all purposes. It cannot be a good thing for a patient to have a chill fog playing over an open tracheotomy wound; and this is what happens when steam is blown even out of a hot kettle into the air over the patient. I prefer to have the patient near the fire, out of draughts, but with abundance of fresh air; and, therefore, without any tent of blankets over the bed.

One other detail I may mention, rather in explanation than as belonging to the operative procedure.

It may perhaps have been remarked that I have not used the word *croup* as applying to any of my cases. I have avoided it purposely; for it appears to me that the word croup is applicable to a symptom rather than to a disease or a pathological condition. Croup, so far as I can discover, means a hoarse cough with difficulty of respiration; and as this symptom may be caused by a variety of pathological conditions, I have preferred to state what in my opinion was the disease in each case. It seems to me to resemble very much the use of the word *cough*, which may be a symptom of several diseases; and just as we talk of pneumonia, bronchitis, &c., &c., all of which may cause cough, so we may talk of diphtheria, acute simple laryngitis, &c., &c., which may give rise to croup. That there is any one distinct disease to which the word croup can be fairly limited I do not believe; for, on the *post-mortem* table, according to my experience and reading, it always resolves itself into one or other of well recognised pathological conditions of the air tube. It is a useful word in a *clinical* sense, however, just as the word cough is also.