of the same percentage in the two groups, which indicates that treatment does not affect the pupillary anomalies. In nine cases of visual and perimetric defects, four patients became progressively worse, two improved considerably, and three had no change of the vision or perimetric fields during arsphenamin treatment.

In thirteen of the 114 cases, there were visual disturbances during treatment with tryparsamide. In four cases, the vision and fields definitely decreased, and in nine cases no visual or perimetric field changes could be demonstrated. In one case (Case 12), the vision in one eye improved during treatment with tryparsamide.

As soon as any change in the vision or fields could be demonstrated, treatment was stopped; the end-results cannot, therefore, be determined. However, a definite toxic effect of the drug was not demonstrated, as a central scotoma was not found in any case during the treatment with tryparsamide. In two cases (2 per cent.), definite central scotoma developed during treatment with arsphenamin (Cases 7 and 15). In one case (6 per cent.), definite central scotoma developed without treatment for syphilis.

The treatment did not seem to influence the pathologic changes observed in the fundus. Visual and perimetric field changes occurred as often during treatment in cases in which the fundi were normal as in those in which they were not.

CONCLUSIONS

1. Changes in vision, fundi and perimetric fields are much greater in cases of untreated syphilis of the central nervous system than in treated cases.
2. Pupillary and reflex changes are practically the same in treated and untreated cases of syphilis of the central nervous system.
3. Ocular changes occurred as often with arsphenamin treatment as with tryparsamide treatment.
4. The use of tryparsamide is not contraindicated by pathologic changes in the fundus.
5. The arsenicals are apparently efficient in decreasing ocular changes in syphilis of the central nervous system.
6. In this select series of cases, tryparsamide was not more harmful to the eyes than any form of arsenic used in the treatment of syphilis of the central nervous system.

Sparganum Prolifer Infection.—R. M. Marjoribanks and Elizabeth J. O. Le Sueur report what they believe to be the third case on record. The symptoms, consisting of cough commencing with irritation on the left side of the throat, had been present three months. Attacks appeared on alternate days; during each, two or three "worms" were coughed up. The patient, a Chinese student, aged 22, was found to be well nourished. There was a slight bulging of the left sternomastoid muscle, below which a deeply lying tumor, about twice the size of the thumb, could be palpated. It extended from below the angle of the jaw to the larynx. Laryngoscopically the larynx was normal, but a spongy patch could be detected below the left tonsil. This could be palpated with the forefinger, and bits removed were found to contain small *Sparganum* bodies. According to the patient's statement, he had coughed up in all about 150 worms. These were found to vary in size from that of a pin's head to bodies measuring 8 by 6.5 mm. They were mostly bean shaped, with prominences on one side. Some had distinct heads and tails, and centrally situated prominences. A thin membrane limited the contents. When fresh, the bodies were cream colored and of the consistency of soft cheese. Microscopically, the contents were found to consist of a white, granular material with food vacuoles and oily globules.—*Tr. Royal Soc. Med. & Trop. Hyg.* **18:70 (March-May) 1924.**

CERTAIN PROBLEMS IN THE TREATMENT OF DISEASES OF THE THYROID GLAND*

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The possibility and efficiency of the practical application of the administration of iodin for the prevention of goiter as a public health measure were definitely established by Marine and Kimball in their classical experiment in the public schools of Akron, Ohio, in 1917. As the result of that study, the application of this principle of goiter prevention has been extended to various endemic goiter districts in this country and abroad, so that today children in various parts of the world are being benefited by prophylactic treatment, and the incidence of goiter is by so much diminishing.

For a practical consideration of the problems of goiter, we may consider three abnormal states of the thyroid gland—hypothyroidism, malignancy and hyperthyroidism.

HYPOTHYROIDISM (SIMPLE GOITER)

The problems presented by simple goiter are comparatively easy of solution.

1. *Prevention.*—I have already referred to the possibility and duty of preventing the incidence of simple goiter in the present generation by the administration of iodin throughout adolescence: in the coming generation, by giving iodin to expectant mothers throughout the periods of pregnancy and lactation.

2. *Functional Deficiency.*—In cases of functional deficiency in adults, the condition may be controlled by the supervised administration of some form of iodin, thyroxin or thyroid extract.

3. *Colloid Goiters and Diffuse Adenomas Causing Pressure Symptoms.*—These should be excised. It should be emphasized that the administration of iodin to either adults or children will not remove fetal adenomas, but may produce hyperthyroidism—a condition identical with that associated with the so-called toxic adenoma, which I regard, not as a clinical entity, but as one form of hyperthyroidism. This tendency of adenomas to produce hyperthyroidism, myocarditis and high blood pressure supplies a second reason for their removal.

Another reason for excising fetal adenomas is found in the results of studies by Allen Graham, who has found that in more than 90 per cent. of cases of malignant tumors of the thyroid, the growths arose in fetal adenomas, and that in a microscopic examination of all the fetal adenomas removed by my associates and me, whether or not malignancy was suspected, one in eight was found to be cancer

My personal surgical experience, on which this discussion is based, includes 7,617 operations on the thyroid gland, this number including 2,809 thyroidectomies for hyperthyroidism, and 1,922 ligations.

MALIGNANT TUMORS OF THE THYROID

We have dealt surgically with 107 cases of malignant tumors of the thyroid gland. In 102 cases, thyroidectomy was performed for cure; in five cases, decompression only. Eighty-two of these patients have been traced, twenty-three of whom are living, five or more years after operation.

*Read before the Section on Surgery, General and Abdominal, at the Seventy-Fifth Annual Session of the American Medical Association, Chicago, June, 1924.

The prevention of cancer by the routine removal of fetal adenomas is on a par with the prevention of cancer by the removal of moles, scars, irritations and ulcer, and the repair of lacerations of the cervix. But even more brilliant than the prevention of cancer is the prevention of the fetal adenoma in the child by giving the mother iodin during pregnancy. That is, as has already been stated but should be emphasized again, cancer of the thyroid in the next generation can be prevented by giving iodin in this generation.

HYPERTHYROIDISM

At the outset, let us admit that we know of no specific pathologic basis for the syndrome that we designate as "hyperthyroidism." We have not sufficient information regarding the mechanism of the disease to argue regarding its pathology. We admit that there is no specific criterion whereby to establish the diagnosis in the borderline cases; that is, to determine at what stage altered function on the outer boundaries of normality ends and hyperthyroidism begins. Although we must admit these uncertainties, on the other hand in our series we have found no case of hyperthyroidism associated with a normal thyroid. We know that hyperfunction of the thyroid gland is an essential factor in the disease, and that, therefore, to secure maximum results in the treatment of hyperthyroidism, a sufficient amount of the gland must be resected at an early stage in the disease.

We believe that we now have sufficient data on which to base the judgment that, important as is the partial rôle of a rest cure, roentgen ray, radium, any form of iodin, thyroid extract, general medication, general hygienic regulation, the overcoming of autointoxication, the removal of focal infections, or dietary control in the treatment of this disease, no one of these measures, and not all combined, approach the certainty and efficiency of surgical treatment as the primary mode of attack, supplemented by the measures mentioned above. This conclusion is based not only on the immediate but also on the remote mortality, that is, on the expectancy of life no less than on the conservation of organic function and the general well-being of the individual. Surgical treatment, supplemented by whatever lesser means of attack are indicated in the individual case, not only conserves life and function but is of economic value also; viz., it is the shortest road to recovery.

The problem presented by the patient with hyperthyroidism is precisely the same as that which would be presented by a patient—and right now there are many such patients—who is taking thyroid extract or iodin in such amounts as to cause definite symptoms of hyperthyroidism. In the latter case, would it be best to control the racing heart and overworked myocardium by a rest cure, sedatives, digitalis, bromids, irradiation of the gland, diet, change of scene—by any or all of these lesser expedients—or would it be best first to stop the taking of the drug itself and then supplement the restoration by these valuable adjuncts?

In hyperthyroidism, the thyroid gland is the druggist, an extraordinary druggist, a tireless druggist, who day and night is manufacturing and turning into the circulation the exciting hormone.

To justify our conviction that surgical treatment is the central, the primary mode of attack against hyperthyroidism, it is essential to show that the immediate mortality is less than from the nonsurgical treatment, that the end-results are better. The mild cases may be excluded, for in these there is a negligible surgical risk. The crucial test is presented by the fully developed case, which has reached the terminal stage characterized by emaciation, cardiac decompensation, swollen extremities, ascites, vomiting, acidosis and prostration—the case that is nearing final dissolution, or that shows repeated periods of, or continuous, delirium.

In such cases, the surgical problem is this: Is the state one of hopeless dissolution in which, even were it possible by a miracle to wish out the thyroid, death still would be inevitable? Can we differentiate between the quick or the dead? This, we have found, can be done almost with certainty by the application of a biologic test consisting in the following measures:

1. Restoration of the water equilibrium to the desiccated cells, by subcutaneous infusions of from 2,000 to 4,000 c.c. of one-third per cent. procain solution in twenty-four hours, after Bartlett's method.

2. Digitalization of the failing myocardium, whose feeble effort is not sufficient to assure the circulation of the blood in the essential organs—the myocardium, the brain, the liver, etc.—leaving these organs at this critical time in a state of relative anemia.

3. Increasing the blood volume—and oxygen carriers—by means of blood transfusion.

4. Modifying and controlling the ceaseless, exhausting restlessness and tension—physical and mental—by sedatives, and especially by the service of nurses fitted by natural endowment and by special training to assuage, cajole and quiet.

If, after this biologic test, consisting in these measures, has been applied, the downward course of the patient continues unchecked, as happens only in about one in 500 cases, then inevitable dissolution and death are before us.

On the other hand, and happily this is almost always the case, if the vomiting ceases and the delirium grows less and clears, then the patient is viable, and just as soon as the utmost value of the restorative program has been achieved—usually within a few days—a ligation of one pole is done in the patient's room, under local anesthesia alone or, in occasional cases, supplemented by nitrous-oxid analgesia. Usually, on the third day thereafter, the other pole is ligated and, a few days later, the patient is sent home for a period of hygienic control, the routine of which has been carefully prepared and written out for his daily guidance.

After from ten to twelve weeks, the margin of safety will be widened sufficiently to permit the resection of one or, usually, both lobes, after which the patient is again sent home to repeat the same hygienic program for a prolonged period.

By thus seizing and holding the initiative, the average length of time in the hospital before the ligations or thyroidectomy has been reduced to three and one-half days. In a recent analysis of the histories of 1,200 consecutive thyroidectomies, the average hospital preoperative and postoperative periods covered six days.

In actual experience, we have found that in 1,415 consecutive ligations, the mortality has been 0.63 per cent., and the average reaction has been just a little less than that occasioned by the entrance to the hospital—thus, the mortality of ligations is almost exactly the same as the mortality attending admission to the hospital. That is to say, in general, whoever is able to go to the hospital at all survives the ligation. If he survives the first ligation, he the more certainly survives the second. If he survives both ligations, he almost certainly improves enough for a safe thyroidectomy. In other words, no diagnostic tests such as metabolism measurements are required; only sound judgment, biologic measures of

protection, and controlled technic are necessary for survival.

After operation, every resource at our command is required to build up the final end-result.

SUMMARY

Since the present plan of management has been carried out, there have been no deaths from so-called hyperthyroidism; the occasional death—approximately one in 100—is due to some complication, e g., heart failure, cerebral hemorrhage or pneumonia.

Goiter is among the most preventable of diseases; its treatment, in whatever form it presents itself, is accurately defined.

1. Prevention is achieved by the administration of iodin throughout adolescence and pregnancy.
2. Simple goiters should be excised if they cause pressure or are adenomatous.
3. Malignant goiters should be excised if possible; or they should be decompressed, followed by radiation.
4. For hypofunction, the essential product that is lacking should be added.
5. For hyperfunction, the essential product that is overabundant should be diminished.

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CERTAIN BLOOD DYSCRASIAS DEPENDENT ON PATHOLOGIC CONDITIONS OF THE SPLEEN *

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The blood may be considered an organ consisting of cellular, colloid and crystalloid substances in a liquid medium, and the vascular system a means of transportation which carries these various substances to the tissues of the body and removes waste products. The total volume of blood in the body of the average person is estimated by Mann [1] at from one thirteenth to one tenth of the body weight. Krogh and Haldane [2] have shown that, in man at rest, each cavity of the heart expels about 4 liters of blood a minute. During violent exertion, to supply the necessary amount of oxygen to the tissues, the entire volume of blood passes through the heart and around the body every ten seconds, and the amount expelled by the heart each minute is increased from 4 to 24 liters.

The vital constituent of the blood is oxygen. The supply of oxygen to the extremities can be cut off safely for several hours, but if the circulation of the blood through the central nervous system is stopped for more than from seven to ten minutes, death ensues. If there is shortage of oxygen from actual hemorrhage, the blood pressure drops, and the efforts of the heart and the respiratory system are increased in order to hasten oxygen to the tissues. The rapid action of the circulatory and respiratory systems throws out the carbonates from the blood as in normal respiration, and the rapidity of respiration tends to exhaust them. Seventy-five per cent. of the body is composed of water. Filling the veins with sodium chlorid solution to increase the blood pressure in case of shortage of oxygen from hemorrhage is of no benefit, for the red cell oxygen carriers are not increased, although their medium is diluted; nor is the blood volume materially increased, because the water will not stay in the blood vessels. Transfusion of blood, which adds to the oxygen-carrying capacity, is indicated for serious hemorrhage and for anemia. Just how much a single transfusion of blood will raise lowered blood pressure is still under discussion. Taking the hemoglobin as an index, a reasonable transfusion of from 500 to 600 c.c. cannot be expected to raise the hemoglobin index more than from ten to twenty points. Repeated small transfusions, on the whole, give better results than a single large one, provided the first transfusion is sufficient to maintain life.

If the cause of oxygen shortage is overexertion, the sudden failure of the mechanisms of circulation and respiration, as in acute dilatation of the heart, and the rapid elimination of the carbonates which accompanies fatigue, tend to produce acute acidosis and failure to eliminate the products of combustion. In such cases there are plenty of oxygen carriers but, temporarily, too little oxygen and too little carbonate, which prevents the transformation of the accumulated waste into carbon dioxid. Transfusions of blood would be harmful, but phlebotomy may be indicated to relieve the circulation and prevent a breakdown of the transportation system.

Forty-seven per cent. of the known earth, including atmosphere and water, is composed of oxygen. Considering how vital and immediately necessary oxygen is to animal life, it is surprising that there is no storage capacity in the body, either for oxygen or for substances which, under stress, would produce it.

If the process of circulation is studied in detail, it is apparent that the red cell transports oxygen from the lungs to the tissues of the body, and on its return for a fresh supply of oxygen aids the blood plasma in carrying carbon dioxid to the lungs for exhalation. The red cells also act as carriers of vital molecular substances to the tissues. Hemoglobin is the most important of these substances, containing one atom of iron to the molecule. Anything which reduces the number of the red cells, whether actual blood loss or those various agents, infectious and otherwise, which produce secondary types of anemia, either through destruction of red cells or the production of toxic substances which prevent their formation or their function, is a serious menace to life and health.

SPLENIC ANEMIA

The spleen, in the adult, like other organs of the reticulo-endothelial system, has for one of its proper functions the destruction of deteriorated red cells. When the spleen is enlarged, as from splenic anemia or hemolytic icterus, this destruction may become excessive and produce the chronic anemia that leads to death, directly, or indirectly through intercurrent disease.

The term "splenic anemia" in itself indicates a syndrome of many causes, and not an entity. In the ninety-eight cases in the Mayo Clinic in which the spleen was removed for splenic anemia, micro-organisms were not secured on culture; yet the spleen, revealing interiorly the enormous development of a protective type of fibrous tissue, thrombophlebitis, and atrophy of the pulp cells, and exteriorly the adhesions that bind it to the surrounding organs, gave the impression that the disease is the result of infection by bacteria which are short-lived and have disappeared or, one might better say, have been destroyed. Experience leads us to believe that when a pathologic process in the spleen is once set

* Read before the Section on Surgery, General and Abdominal, at the Seventy-Fifth Annual Session of the American Medical Association, Chicago, June, 1924.

1. Mann, F. G.: Shock and Hemorrhage: An Experimental Study, Surg., Gynec. & Obst. 21: 430-441, 1915.
2. Krogh and Haldane, quoted by Starling, E. H.: The Wisdom of the Body, Lancet 2: 865 (Oct. 20) 1923.