

125 millions, increased by 25 or 30 millions at each injection administered weekly.

The diet is an important feature in some cases; meats should be partaken of sparingly owing to their tendency to raise the blood-pressure in some cases, and in others totally omitted if the case be one due to autointoxication of intestinal origin. Violent physical exercise produces the same effect as meats by increasing abnormally the average of wastes.

HYPERTHYROID OR TOXIC GOITER.

In the group of parenchymatous or simple goiters it is now customary to include—though injudiciously, since they thus tend to be overlooked, to the detriment of the patient—the considerable number of cases in which certain symptoms of thyrotoxicosis, in particular those relating to the heart, occur, nearly always, however, in the absence of exophthalmos. In my opinion, most if not all these cases are instances of larval exophthalmic goiter—this being sustained by the fact that the usual treatment for their condition is alone beneficial.

According to Brenizer, hyperthyroidia or thyroid toxemia is observed in 20 to 25 per cent. of all cases of simple goiter. The condition occurs most frequently in cases of diffuse or encapsulated adenoma of the thyroid of several years' standing. The toxic symptoms may arise either gradually or suddenly. The entire group of these cases has been termed by Plummer "toxic non-hyperplastic goiter," thus emphasizing the need of considering separately from simple goiter. Moreover, experienced clinicians are in accord that the state of the patient approximates more and more that of exophthalmic goiter, and the same preliminary measures and precautions as are necessary in the latter condition are indicated in *bona fide* cases.

TREATMENT.—When a goiter is showing a tendency to assume the Graves syndrome, Fowler's solution, 2 to 3 minims (0.12 to 0.18 c.c.), three times daily in half-glassful of water, or the bromides to reduce the sensitiveness of the centers, and cold compresses over the gland are useful. But if tachycardia, tremors, etc., persist, the treatment for Graves's disease (*q. v.*) should be employed. Thyroidectomy or at least ligation of some

of the arteries of the thyroid should be performed if the less radical measures which usually succeed in Graves's disease fail.

L. F. Watson,⁶⁶ of Oklahoma City, obtained good results by injecting 10 to 40 c.c. (15 to 60 minims) of a sterilized 30 to 50 per cent. solution of quinine and urea hydrochloride into the growth, in fifty cases of hyperthyroidia. He recommended the method only to relieve the latter condition and not to remove the goiter, though the latter may disappear, when small. The injection must be used with discretion; its indiscriminate use by an inexperienced person might have bad results. The use of local anesthesia cannot be too much emphasized, and he precedes it in all toxic cases with preliminary injections, into the most prominent parts of the goiter, of a few minims of sterile salt solution, followed by sterile water injections. Two to four preliminary injections will accustom the patient so that the quinine and urea can be safely given with slight discomfort. As soon as no hyperthyroidal reaction follows the water injections their usefulness is over. After the usual aseptic precaution and the anesthetization of the site of the injection with a 0.1 per cent. cocaine, or a 0.25 novocaine solution, the needle is carried down to the body of the goiter, repeating the injections every third day, according to the progress of the patient. From 8 to 15 injections are usually necessary to bring about marked improvement. In cases of recent cystic goiter with moderate hyperthyroidism he aspirates the fluid and makes from 1 to 3 injections. In his conclusions he says the injection will not relieve advanced cases when the vascular and nervous systems have been permanently damaged, and, while the method is harmless in experienced hands, it should be used only in a hospital.

HYPOTHYROID DEGENERATIVE GOITER.

This type of goiter may occur as a morbid development of the simple or parenchymatous form reviewed above, but it does not, as is the case with the latter, represent a uniform pathological entity. The characteristic alteration may occur in one or several parts of the gland, thus giving it in most instances an irregular or nodular surface. The affected areas may be the

⁶⁶ Watson: Jour. Am. Med. Assoc., Jan. 10, 1914, and Sept. 25, 1915.

seat either of an increase of follicles, vessels, etc., a true hypertrophy, or of accumulations of more or less thick and tenacious colloid, which dilates one or more follicles. These areas, especially when a single nodule is present, tend to degenerate owing to the influence of the proliferated tissues upon the neighboring structures and upon the local vascular supply, and to become the seat of hemorrhages. Nodule of the isthmus is relatively frequent, the mass projecting from the middle of the neck.

As goitrous masses may develop anywhere in the gland, and simultaneously in several parts of the organ, while varying greatly in shape and size, the pressure effects they produce vary greatly with each case. The trachea may be displaced from side to side, twisted, or compressed against the spine, thus producing dyspnea; the cervical vessels and the vagus may also be pressed upon, causing congestive disorders of the brain, syncope, slowing of the pulse and dyspnea. Hoarseness and aphonia may occur, if the recurrent laryngeal is pressed upon. Occasionally sympathetic nerves are compressed, thus giving rise to vascular phenomena or paralysis in the parts which these nerves supply.

The progress of recent years in the treatment of degenerative goiter renders it necessary to identify its various forms, some being amenable to measures which cannot be used in others. Thus, while aspiration is sometimes possible in cystic goiter, it is of course unavailable in fibrous goiter, etc. The various types are as follows:—

Colloid Goiter.—This form of goiter, which is often met with in practice, is thus termed because its main characteristic is an accumulation of thick, tenacious colloid in follicles of the organ, in isolated lobules, lymph-spaces, and even the whole organ. In the average case the gelatinous colloid (the growth being termed *struma gelatinosum* by some authors) so overfills the follicles that the goiter is lobulated and hard. It is probably an advanced stage of the softer goiters, both diffuse and nodular, and may be distinguished from them through their relative hardness and the fact that they do not become reduced under pressure with the hand, owing to escape of a part of the fluids in the neighboring tissues, as do some of the softer growths. This form of goiter is not influenced by internal medication, iodine, thyroid, etc.

Cystic Goiter.—This form may develop from a colloid goiter or from an *adenomatous goiter*, a form in which the glandular epithelium is embryonic and produces but little colloid. It may be composed of retention cysts or of *hemorrhagic cysts* due to rupture of some dilated vessels in the growth. This constitutes a special form of goiter.

Cystic goiter is lobular, sometimes oval, at others circular, but always circumscribed. It is elastic, and usually soft and smooth. Fluctuation may sometimes be elicited. Hence the fact that it may be aspirated and successfully treated without resorting to surgical removal.

Fibrous goiter differs entirely from the foregoing pathologically in that it is due to the development of fibrous tissue, a result of local inflammation in various parts of the organ. It is, therefore, hard under pressure and nodular. The glandular elements being more or less compressed by the fibrous tissue, their functional power is inhibited, causing a corresponding degree of hypothyroidia, which, when advanced, may reach the stage of true myxedema. In rare cases the goiter becomes as hard as wood; hence the terms ligneous goiter and Riedel's disease sometimes attributed to it. A distinctive feature of the latter is its rapid evolution—a few months or even weeks, serious pressure effects (described below) developing promptly.

Any one of the above types of goiter may, through projection of one or more parts of the gland, awaken a special group of phenomena most of which are serious.

Intrathoracic Goiter.—This type, which is by no means rare, is the result of a downward development of a nodule from either inferior horn of the thyroid. At first remaining above the suprasternal notch it finally passes down into the thorax, behind the sternum, being aided in doing so by the downward movement of the thyroid and the suction of the enlarged organ into the chest, which occur during inspiration. It is apt to be met in subjects who, owing to their occupation, are obliged to bend the head forward, as in writing, during prolonged periods each day, and in short-necked individuals.

As the intrathoracic goiter develops, tending as it does to become very large, the resistance of the sternum causes it to compress quite markedly the structures on either side of the

trachea and the latter itself, and may become a cause of sudden death.

The diagnosis of intrathoracic goiter is very difficult without the aid of X-rays. The most striking symptoms are dyspnea, dysphagia, hoarseness, cough, redness or suffusion of the face, cyanosis of the lips, dilatation of cervical veins and of those of the upper part of the chest. Cardiac symptoms, "palpitations," are usually complained of. Dullness over the manubrium sterni is also suggestive.

Constrictive Goiter.—In this form the nodular mass has grown in such a way as to pass behind the trachea and thus encircle or constrict it. It may also be due to embryonal malformation of the thyroid, both superior horns of which may encircle the trachea or esophagus. Dyspnea and dysphagia are the main symptoms. Deep laryngoscopy, esophagoscopy and the X-rays are of material help for the recognition of this condition—a very distressing one in most instances.

Lingual goiter is an interesting, though rare, form of goiter which is more frequent in women than in men, though in the latter accessory thyroids are more common. When these accessory structures become goitrous this occurs with relative suddenness, the growth showing great vascularity. Lingual thyroids are situated upon the dorsum of the tongue behind and below the foramen cecum and are sometimes very large. They cause prolonged fits of coughing, deglutition, spasms, and hoarseness.

Lingual goiter may be confused with malignant growths of the same structures. While lingual goiter is painless, however, malignant growths are painful and are usually accompanied by swelling of the neighboring lymphatic glands. They are apt moreover to grow more rapidly. The lingual gland at the base of the tongue may also be the seat of benign growths: dermoid cysts, calcareous deposits, etc., and gummata.

Hemorrhagic Goiter.—Although the thyroid gland is sometimes the seat of hemorrhagic foci in the course of certain infections, diphtheria in particular, the term "hemorrhagic goiter" is usually given to hemorrhage occurring more or less suddenly in a goiter. The minor vessels of these growths being delicate, a blow, a severe strain, violent coughing, playing wind

instruments, glass-blowing, a fall, etc., cause them readily to tear. The resulting symptoms depend in intensity upon the size and location of the hemorrhagic focus, but as a rule they are severe, sufficiently so in some instances to end in almost immediate death. Swelling, tenderness, and pain due to distention, increasing dyspnea, cyanosis, asphyxia and other pressure symptoms follow in more or less rapid succession according to the location of the pressure and its degree and direction.

SYMPTOMS OF DEGENERATIVE GOITER.—Patients may be unaware of the existence of a goiter until some pressure symptoms among those described below, causes them to seek medical advice. Others complain of the necessity of increasing the size of their collarband; of disappearance of the normal circular creases of the neck; of stiffness about the front of the neck; of dyspnea on inclining the head forward, etc. The goiter being connected through the posterior capsule of the thyroid with the trachea and esophagus, deep respiration and deglutition cause the growth to move up and down, a fact which greatly facilitates its detection by inspection and palpation. Cough accentuates the movement and is especially helpful in the diagnosis of intrathoracic goiters. Detection of the latter is further facilitated by percussion over the upper part of the sternum, when marked dullness is obtained. If the goiter is sufficiently large to cause pressure on the trachea, a sibilant or whistling râle may be heard on auscultation. This is apt to be mistaken for asthma in cases of intrathoracic goiter occurring in short-necked individuals.

The diagnosis of a degenerative goiter is a relatively simple matter, even in their incipiency, when the measures described above are carried out. From the diffuse, simple, non-toxic growths, they are readily distinguished in most instances by the fact that they are nodular. While the former are, as a rule, diminished in size through pressure upon them, owing to the vascular depletion produced, nodular goiters yield but little, if at all, to pressure. Fluctuation may sometimes be discerned in large colloid or cystic growths.

Pressure symptoms are far more likely to occur in degenerative goiters than in simple goiters, because of their tendency, in addition to their general growth, to project nodules which directly or indirectly produce compression of some neighboring

structure, the trachea, esophagus, blood-vessels and nerves in particular. They may occur early or late in the history of the case, or suddenly where, as we have seen, interstitial hemorrhage is caused in the growth by a blow, violent effort, etc.

Hoarseness is frequently observed in goiters that are sufficiently large to cause distortion of the trachea, compression upon the cricoid and thyroid cartilages, thus interfering with the proper anatomical relations. Hoarseness may also be caused by pressure upon the recurrent laryngeal nerve, and by a chronic catarrhal process of the laryngotracheal mucous membrane, due in turn to the pressure and the interference with the functions of the epithelium through which the membrane is kept free of foreign substances, mucus, etc.

Dyspnea, sometimes termed "goiter asthma," is a common and prominent symptom of goiters that have reached sufficient size to compress either the trachea, and thus interfere directly with respiration, or the blood-vessels of the neck and neighboring structures, thus disturbing the circulation and the equable return of blood to the heart and lung; or it may compress the recurrent laryngeal nerve. The dyspnea is increased by temporary hyperemia of the goiter or hemorrhage therein, by conditions which increase the demand of air, such as exertion, and by local catarrhal inflammation due to the pressure. When the trachea is markedly compressed, tracheal stridor, a loud, whistling sound may be heard during both inspiration and expiration. Paralysis of the vocal cords is frequent. J. Matthews⁶⁷ found in a laryngoscopic examination of 1000 cases, before and after removal of the goiter, 289 instances of partial paralysis and 272 of complete paralysis. Recovery of the vocal disability occurred only where the paralysis had been of short duration.

Asphyxia may readily be produced in such cases by sudden violent exertion, bending the head in such a way as to increase pressure of the growth on the trachea, sudden pressure on the growth, constriction of the neck, violent cough; hemorrhage into the goiter, thus suddenly increasing its dimensions; swallowing the wrong way, anger, by causing turgescence of the cervical vessels, etc. Cyanosis is not necessarily a symptom of threaten-

⁶⁷ Matthews: Jour. Am. Med. Assoc., Sept. 3, 1910.

ing asphyxia, since it may also occur when the veins which drain the head, neck, and arms are compressed by the growth. The latter form may occur irrespective of dyspnea; it is apt to be especially marked during exertion. It affects chiefly the cheeks, lips, and tongue, and also the arms when the innominate veins are compressed.

Cardiac phenomena are frequent in goiter, as previously stated. The dyspnea is often increased by dilatation of the heart, due to the interference with the respiration. The heart should always be examined in these cases, since appropriate treatment is very helpful. Dilatation of the heart may also be due to pressure exerted by the goiter on the blood-vessels, and to the effects of defective nutrition incident upon the hypothyroidia upon its muscular elements.

Paralysis of various muscles of the arm, and numbness of the fingers, occasionally met with, are due to pressure upon the brachial plexus. These symptoms are mainly observed in intrathoracic goiter. Irritability, nervousness, restlessness, and other nervous phenomena may also be witnessed when hyperthyroidia is a feature of the case. Insanity is more frequent in goitrous than in normal individuals.

Myxedema may supervene when the functions of the thyroid have been sufficiently inhibited by fibrous and other degenerative changes, practically to arrest its functions. This complication is seldom witnessed until very late in the history of the case, unless the injudicious use of X-rays has totally inhibited its function, however, owing to the fact that a small portion of normal gland suffices to carry on its functions.

TREATMENT.—Under appropriate treatment, provided the causative intoxication be removed, good results are obtained in some cases of degenerative goiter—exclusive of course of the malignant types—especially when in young subjects, by the measures indicated for the simple form. The use of iodine requires, however, considerable care and should only be resorted to tentatively. In some types, the colloid for instance, any halogen or thyroid may give rise to untoward effects, owing to inability of the diseased gland to assimilate iodine. Cases of long standing, even though the goiter be small, are those most likely to react unfavorably to this form of treatment. All the other

remedial agents described—injections of boiling water, electricity, galvanic or static; the X-rays, etc.—may be tried. In cystic goiters the aspiration of the contents of cysts can be resorted to and the reduction of growth thus greatly hastened. Removal of the causative intoxication, whatever that be, is essential, however, and sometimes affords surprising results. Especially is this the case when the source of intoxication is a focus of infection, such as chronic tonsillitis, or alimentary auto-intoxication, etc., which can be eliminated.

When the various measures indicated in simple goiter have been given fair trial and no result is obtained, surgical measures are indicated.

SURGICAL TREATMENT.*—The advisability of surgical treatment in goiter depends not only upon the type of goiter present, but upon the stage the disease has attained, the results which may be expected or have already been secured by medical treatment, the extent to which operation might reduce thyroid function below that required by the organism, and various other factors.

In simple goiter surgical treatment is occasionally demanded: (1) owing to the disfigurement, where the swelling is large; (2) because of symptoms due to pressure on the trachea, esophagus, larynx, or other structures in the neck or upper part of the thorax; (3) when enlargement of the goiter is rapid and a malignant nature is suspected; (4) when symptoms of hyperthyroidism appear; (5) when infection of the goiter occurs. Many patients come to the surgeon for cosmetic reasons alone. The risk attending operation in simple goiter being slight, radical treatment, *provided medical measures have proven ineffectual*, may be looked upon with favor in cases requesting it, especially since a considerable proportion of simple goiters may subsequently undergo changes resulting in injury to the heart, kidneys, and liver, and possibly become cancerous in later life.

In the presence of mechanical symptoms, the patient is again often the best judge as to the time when the discomfort experienced is such as to require operation. Pain due to pres-

* This sub-section has been written by the author's son, Dr. Louis T. de M. Sajous.

sure, sometimes occasioned by hemorrhage within the gland, may be the chief symptoms indicating intervention. In the various types of non-exophthalmic, *i.e.*, non-toxic goiter, including colloid, parenchymatous, cystic, and general adenomatous conditions of the gland, definite indication for operation is afforded less by the size than by the location of the goiter tissue. At times a swelling not exceeding a cherry in size may cause urgent discomfort, whilst in other cases even a large goiter occasions no distress other than that of unsightliness.

Among the advantages of operation, where a definite indication for it exists, are its effect in preserving residual healthy thyroid tissue from destruction by pressure necrosis and the frequent resulting improvement in the heart action, even simple goiter being capable at times, we have seen, of inducing the well-known "goiter heart"—an effect usually attributed, though apparently often without justification, to pressure of the growth on blood-vessels in the neck.

Colloid and adenomatous goiters are, as a rule, but slightly responsive to medical treatment, and where pressure symptoms exist should be operated, the diseased part of the gland being removed and its better portions preserved.

In intrathoracic goiter with pressure symptoms, early intervention is indicated. Such a goiter, extending from either thyroid lobe, two or more inches beneath the sternum and into the thorax, particularly demands prompt operation, but is sometimes entirely overlooked or not detected until it is too late for operation.

The period of life at which a goiter appears has a distinct bearing on the operative indications. In particular, in the simple goiter met with in adolescents, a somewhat edematous type of colloid enlargement of the gland, operation is rarely indicated, as the goiter will often subside either with or without medical treatment. Severe dyspnea in goiter at puberty, however, is an indication for operation (Legg).

Most substantial goiters, however, cause cough, hoarseness, and suffocative attacks which lead eventually to their discovery through percussion and X-ray examination. Prominent veins extending from the neck down on the chest may also be noted.

Rapid enlargement of the thyroid in the form of an irregu-

lar, hard growth may occur, we have seen, because of hemorrhage, in a simple benign goiter, but is more generally indicative of carcinomatous or sarcomatous degeneration of the gland. Early operation is then required, as will be shown under the succeeding heading.

According to most surgeons, all goiters should be operated on when they are nodular, cystic, or beginning to adhere to neighboring structures, especially in adults. Removal of both lobes of the thyroid is, however, not required in innocent goiters. If both are enlarged, that which is the larger and extends lower and more deeply into the neck is the one to be removed. At times the lobe which is the cause of the symptoms, while extending lower in the neck, is the less enlarged of the two; this is, nevertheless, the one to be selected for removal. Where the trachea is displaced, that lobe which is the cause of the distortion should be removed.

In diffuse colloid and general adenomatous goiter, the removal of one lobe and of the isthmus is generally the procedure of choice, though in some instances removal of a portion of each lobe, as advised and practised by Mikulicz, is required. After the unilateral operation the remaining lobe generally undergoes later a reduction in size. Since, moreover, the extirpated lobe is that which is the most diseased, or exclusively diseased, the greater part of the enlargement can generally be removed without serious reduction of the properly functioning parenchyma.

In rapidly growing parenchymatous goiter in young individuals arterial ligation has been advised for the purpose of causing atrophy of the goiter tissue.

Encapsulated thyroid tumors may be removed by perforation of the gland substance and enucleation with the finger or a blunt instrument. This is generally the case in the largest substernal goiters. Encapsulated thyroid adenomata are apt to become cystic. Enucleation is, here again, the procedure of choice, tapping or injection, which might suggest themselves as simpler expedients, being inadvisable. Tapping may, however, be resorted to in the course of removal of a cystic substernal goiter, to facilitate its extraction from beneath the sternum. Even in freely movable goiters, provided they can be pushed

down behind the sternum or clavicle, removal is considered advisable, as a prophylactic measure.

In large adenomata in which there is only a thin layer of thyroid tissue over an extensive area of the tumor the procedure known as "resection-enucleation" may be carried out, the portion of thyroid tissue over the tumor being left attached to and removed with it, and the cut edges of the gland then united with sutures.

Operative Risks and Results.—The mortality in operations in uncomplicated simple goiter is only a fraction of 1 per cent. The safest type of all cases for operation is that where the tumor is rounded and rather even in outline, *i.e.*, typically where it is cystic in nature. Firmness of the thyroid enlargement is a favorable feature, meaning that the gland has a strong capsule and that the removal can be effected easily.

Risk increases, on the other hand, where the trachea has been compressed for some time, with resulting bronchitis, emphysema, poor oxygenation, and impairment of cardiac action. The latter unfavorable condition may also be a result of marked interference with venous return through pressure on large vessels at the thoracic inlet, particularly if thrombosis has occurred, or of disorders such as atheroma of the coronary vessels or fatty heart. In all these cases cyanosis and puffiness of the face manifestly more pronounced than would reasonably be expected in view of the size and situation of the existing thyroid tumor are likely to be met with.

The danger of operation on the thyroid is also increased when the organ is in a condition of diffuse follicular colloid degeneration, the proportion of normal glandular tissue being greatly reduced. These are often large, nodulated goiters, pressing on the trachea and only slightly movable. Vascular ligation followed by unilateral excision is the best procedure in these cases to minimize danger.

According to Mayo, hemorrhage, either primary or delayed, with the efforts made to control it, constitutes the most important cause of death in operations for adenomatous goiters. Inclusion of some muscle tissue in ligation of the superior thyroid artery seems to have been usually responsible for delayed hemorrhage. Fortunately, patients with adenomatous goiters