

before the fracture. 4. To do this by a method of fixation which will last for an indefinite time, and does not depend upon the frictional grip of nails and screws upon the bone. 5. To restore the limb to a condition in which it can be freely moved as soon as the skin wound has healed—i.e., in 7 to 14 days, and used for its full natural function in a period of 3 weeks to 3 months according to the bone involved. I am keenly alive to the fact that at present these ideals have not been fully attained, but I believe that there is nothing impossible in their attainment, and whilst these ideals remain unfulfilled, they provide both stimulus and goal for future work.

THE THYREOGLOSSAL TRACT.*

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In the treatment by operation of the abnormalities which occur in the course of the thyreoglossal tract there is a tendency to excess on the one hand, by which essential thyroid gland tissue is removed under the mistaken idea that a new growth must be taken away, with the result that operative myxoedema, cachexia strumipriva, has followed; on the other hand, owing to limited operations on cysts, a sinus opening upon the neck is set up which persists, or is only cured after several operations.

The observations which have been made upon the development of the thyroid gland subsequent to the description given by His have shown that the thyroid gland is chiefly developed from the median thyroid rudiment.¹ This rudiment, in the human embryo during the third week, grows out below the floor of the primitive mouth in intimate relation to the developing hyoid bone. As the neck of the embryo elongates, it is carried backwards as a pedunculated mass. Then the enlarged end becomes bilobed and forms the isthmus and major part of the lateral lobes of the normal thyroid gland, whilst the pedicle under normal conditions to a large extent disappears or portions become constricted off and isolated in the line from the pyramidal lobe to the foramen cæcum.

Persistence of thyroid gland tissue in the course of the thyreoglossal tract stands in an inverse relation to the normal development of the thyroid gland. In vertebrates below mammals the median thyroid rudiment is the only source of thyroid gland tissue as distinguished by alveoli containing colloid. The dog-fish has simply a median thyroid which is continued forwards through the hyoid cartilage to end beneath the skin of the tongue. But in higher forms behind the last branchial pouches, or from a freely developed fifth branchial pouch, there arises a pair of outgrowths, the ultimobranchial (post-branchial, teleobranchial) bodies, which in mammals take some share in the formation of the lateral lobes of the thyroid gland.² Below mammals these ultimobranchial bodies, although of an epithelial structure, do not exhibit follicles containing colloid. In echidna the lateral thyroid masses contain colloid but do not unite with the median thyroid process. In higher mammals this union occurs whenever normal thyroid gland is developed, but none the less the median thyroid rudiment has the largest share in

its formation. Under normal conditions some thyroid gland alveoli containing colloid are generally found in the position of the pyramidal lobe. Also, but not so generally, as first discovered by Verneuil,³ particles of thyroid gland tissue may be found at the root of the tongue.

From the clinical standpoint, however, no thyroid gland masses are noticeable in the course of the thyreoglossal tract under normal conditions; and, on the other hand, whenever such masses are met with the presumption should be that they are compensatory to some arrest in the development of the normal thyroid gland. More important still, when no proper thyroid gland is developed in the neck, then all the actively functional thyroid gland tissue is placed in the line of the thyreoglossal tract. If this suffices for the patient's needs the absence of the thyroid gland from its proper position passes unnoticed. When about puberty, especially in females, the thyroid gland tissue becomes temporarily more active and vascular, it is then that the existence of a mass at the base of the tongue, or about the hyoid bone in the neck, may present itself. Far from being a new growth or of recent formation, this ought to be considered a temporary parenchymatous enlargement of the patient's real thyroid gland, although it is not in the usual situation.

The median thyroid process in developing below the floor of the primitive mouth does so around a median ventral epithelial pouch. In the amphioxus this pouch is formed without any thyroid gland tissue around and, according to Wiedersheim, secretes mucus which sticks together entering food particles and so prevents them from being washed out again through the gills. In higher forms the epithelial sinus develops in the middle of the median thyroid rudiment, but the thyroid gland tissue always consists of closed alveoli containing colloid which do not open at any stage into the epithelial sinus. The glands which are formed by outgrowths from the epithelial sinus are similar to buccal glands; therefore this epithelial sinus is at no stage a duct of a thyroid gland. In man it forms the foramen cæcum, a blind pouch about 1 cm. deep into which open the mucous glands, to which it therefore forms a short common duct, and only in this limited sense can it be called the "lingual duct." Kanthack,⁴ examining 100 adult cadavers, found the foramen cæcum absent in many cases and never any long sinus: the longest canal in a new-born child measured 5 cm. This epithelial sinus was called the "lingual duct" by Vater,⁵ who by a forced injection made out a connexion between the foramen cæcum and the thyroid gland, a mistake repeated by others since Vater's time.

Whilst the normal condition in man is for a sinus lined by stratified epithelium to extend from the foramen cæcum a few millimetres backwards under the surface epithelium, and into which mucous glands open, it is subject to abnormalities of two kinds, a prolongation in the line of the median thyroid process, and a lateral branching. These persisting extensions may be lined either by squamous or by ciliated columnar epithelium, indicating that the sinus is developed at the junction of the primitive mouth with its covering of squamous epithelium and of the primitive pharynx lined by ciliated epithelium. But neither the squamous epithelium nor the ciliated columnar epithelium has any essential connexion with the thyroid gland.

When the prolongation of this epithelial sinus in

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the line of the median thyroid process is cut off from its connexion with the foramen cæcum, there is developed a cyst, which is usually seen in the neck just below the hyoid bone, less commonly underneath the position of the foramen cæcum. Therefore, although the median thyroid process is developed around this epithelial sinus, the two should be regarded as having no physiological connexion. Stillborn and non-viable myxœdematous infants such as are not uncommon in goitrous districts may present no development of thyroid tissue at all. The epithelial sinus and its outgrowths then exist alone. Thus in the case of a female child aged 3 months, 50 cm. in length and markedly myxœdematous, there was a complete absence of the thyroid gland, but in the position of the foramen cæcum an irregular epithelial cystic mass (Dieterlé⁶). Among a collection of 25, eight such cases were described by Ungermann.⁷

In a myxœdematous infant a small, although insufficient, mass of thyroid tissue may be found. Thus a myxœdematous infant aged 6 months, 53 cm. in length, with short thick extremities, was noted post mortem to have no sign of a normal thyroid; there was an enlargement of the pituitary body and at the base of the tongue a cyst of the size of a pea with some thyroid gland follicles containing colloid in its wall (Ashoff⁸). Even if lateral thyroid or parathyroid masses exist in the neck, yet, if there has been a deficiency in the development of the median thyroid rudiment, myxœdema results. Hence, if on clinical examination no isthmus can be felt in front of the trachea, gland-like swellings alongside the trachea should be considered parathyroid, and not assumed to be true functional thyroid gland tissue.

Thus in a boy aged 3 months, 46 cm. long and markedly myxœdematous, along with a complete absence of the normal thyroid gland, there was found an epithelial cystic tumour at the base of the tongue, and in the neck on either side of the trachea four normal and eight accessory parathyroids. In the case of a girl aged 8 months with marked myxœdema there was an absence of a normal thyroid gland. At the foramen cæcum there was a sinus with branching tubes ending in an epithelial cyst, and around this a very little thyroid gland tissue. In the neck on either side of the trachea were altogether eight parathyroid masses (Erdheim⁹).

There may, however, be sufficient thyroid gland tissue developed at the base of the tongue. Thus, a man aged 30 died after excision of the lip for tuberculous disease. During life there had been no sign of any thyroid insufficiency nor of any swelling at the base of the tongue. Post mortem there was found lying under the foramen cæcum a mass of thyroid gland tissue the size of a chestnut, the alveoli containing colloid. There was no sign of a normal thyroid gland, but by the side of the trachea below the thyroid cartilage were on the right side two masses and on the left one, the size of peas, embedded in fatty and fibrous tissue. On microscopic examination these masses were found to resemble in structure the normal thyroid gland, but the alveoli did not contain colloid. The lingual mass had therefore been the only actively secreting thyroid gland, and the bodies beside his trachea were probably destitute of any such function (Ungermann).

From the standpoint of a clinical examination, then, it is of primary importance to recognise the

presence of the isthmus of the thyroid gland or the reverse. When the isthmus is absent so that the tracheal rings from the cricoid cartilage downwards can be felt it should be assumed that the patient's actively secreting thyroid may have been developed in the course of the thyreoglossal tract, and although there may be a fulness on either side of the trachea suggesting the existence of lateral lobes, yet these may be parathyroids destitute of any true thyroid function.

This precaution has been ignored and cases of operative myxœdema following the removal of thyroid gland tissue in the course of the thyreoglossal tract have frequently occurred, and it has been estimated in a district where disease of the thyroid is frequent that it occurs in 1 out of 7 cases (W. H. Mayo¹⁰). But it is the individual cases which have to be carefully examined before deciding whether there are sufficient indications for the operation. A large number of the recorded cases show that lingual thyroids have been removed without taking note as to the proper development of the thyroid gland, and when they have been reported directly after the operation without waiting to see the result it is much to be feared that in some of the cases myxœdema supervened later. At any rate, there are a number of cases recorded in which myxœdema did subsequently arise and a review of them sufficiently explains the reason of its occurrence.

A tumour was removed from the base of the tongue of a girl, aged 14, after it had been noted for some months. It consisted of thyroid gland tissue with the alveoli containing colloid. A normal thyroid gland could not be felt. Some time later the patient died with symptoms of cachexia strumipriva (Seldowitsch¹¹).

A cretin, aged 37, had a tumour the size of a walnut at the base of the tongue. When performing tracheotomy preliminary to excision no normal thyroid gland could be made out. The tumour removed showed thyroid gland tissue, partly normal, partly embryonic. The patient returned five months later suffering from cachexia strumipriva (v. Chamisso¹²).

A girl, aged 20, had no isthmus nor left lateral lobe, but there was a fulness supposed to indicate a right lateral lobe. A tumour the size of half a nut, consisting of thyroid gland tissue, was removed from the base of the tongue. Five months later a letter from the patient reported signs of myxœdema (Meixner¹³).

At the age of 7 a girl was noted to have an elastic swelling the size of a marble in the middle line of the neck at the level of the thyroid cartilage. It was removed and found to consist of thyroid gland tissue. Three weeks after the operation she began to show signs of myxœdema and continued under active medical treatment for ten years by thyroid extract, but remained at the time of the report in a state of chronic myxœdema (Morley Fletcher¹⁴).

On the other hand, many cases of lingual thyroid have been seen where the thyroid gland has been noted as absent, and then no operation of removal has been done. Since the two cases recorded by Butlin,¹⁵ one of which afterwards showed signs of myxœdema, I have recognised the functional importance of a lingual thyroid. In three recent cases, all very similar, of girls about 20, with an absence of a thyroid isthmus and a swelling characteristic of a lingual thyroid at the base of the tongue, advice had been previously

given that the swelling should be removed, whereas, on the other hand, I advised against any such procedure. I have lost sight of the first two; in a third case she had been to a throat hospital and given a card of admission for operation. I gave her a certificate stating that myxœdema would result if the swelling were removed. All three were suffering from a temporary vascular hypertrophy of the only thyroid gland they possessed. Painting with iodine, the administration of iodide of potassium, perhaps a careful exposure to X rays, should be the treatment.

Where the swelling at the base of the tongue has become so prominent as to impair the breathing or has ulcerated and hæmorrhage has followed, then the removal of a small wedge and suture, or a limited application of the cautery is all that is indicated. An extensive submaxillary operation may not only be excessive but, when a normal thyroid gland is absent, a serious blunder. Fortunately some of the extensive removals have been probably incomplete in spite of the statements of the operators that they had shelled out the tumours. These thyroid masses at the base of the tongue are not circumscribed, but have branches or semi-detached portions so that the patients have been saved from myxœdema in spite of the objective of the surgeon. Hickman¹⁶ described an extreme case of the kind forming a tumour extending from the circumvallate papillæ to the epiglottis and deep into the tongue which caused the death of the infant 16 hours after birth.

Turning to patients possessing a normal thyroid gland it is from the median thyroid rudiment that accessory thyroids so-called arise. The explanation is that they are lateral buds from this tract which are displaced as the embryo grows. Thus they may be found in the floor of the mouth above the mylohyoid to one side or the other. The position of such accessory thyroids corresponds with that of the frog's thyroid gland, in which there is a mass on each side at the tip of the lesser cornu of the hyoid bone, dorsal to the sternohyoid muscles.

In Paton's¹⁷ case an accessory thyroid mass about the size of a walnut was situated underneath the right sublingual salivary gland, which he removed from under the jaw. I removed from the same situation the tumour¹⁸ exhibited which measures $2\frac{1}{2}$ by $1\frac{1}{2}$ by 1 inches; a male child, aged 3 weeks, was suffering from dyspnoea, it had apparently a normal thyroid gland, and I saw it some time after healing in good health. The tumour has the usual naked-eye and microscopic appearances of a fibrocystic thyroid adenoma, and in addition there are islands of hyalin cartilage which came from the region of the cornu of the hyoid bone.

A review of the cases where there has been an accessory thyroid to one or the other side of the true line of the thyreoglossal tract shows that where the normal thyroid gland has been developed their removal is sufficiently indicated; it is when the swelling is situated in the middle line that it may represent the true thyroid gland.

When there is a question in a doubtful case as to the necessity for operation, then it will be generally wise to treat the case expectantly. The only case which tended to become malignant that I can find recorded is the following. A woman, aged 42, with an apparently quite normal thyroid, had had a small tumour removed from the base of the tongue nine years before, when it was stated that not all had been removed. Two years later some enlarged

glands were excised from the right submaxillary region; later there was a recurrence of the growth at the root of the tongue and in the right submaxillary region, and in addition an enlargement of the glands on the left side of the neck. At the first operation a mass of glands the size of the doubled fist was removed from the left side of the neck; at the second operation two enlarged glands the size of hazel nuts were removed from the right side, and a nodule the size of a small walnut from the base of the tongue. All showed thyroid gland tissue. The patient was exhibited six months later in good health without recurrence (Brentano¹⁹).

Thyreoglossal cyst.—The thyreoglossal cyst is generally situated in the neck, protruding just below the hyoid bone, forming whilst small a tense swelling as distinguished from a soft vascular thyroid tumour. It is, as explained above, the blind end of an epithelial sinus which has no functional importance. The cyst lies beneath the median raphe and the adjacent margins of the sternohyoid muscles; it is quite free from any connexion with the thyrohyoid membrane, but at the upper part of the cyst it is closely attached to the hyoid bone. If punctured it continues to discharge mucus, especially during deglutition; this mucus is derived from the mucous glands opening into the sinus especially near the foramen cæcum and from degeneration of the epithelium, but has no relation to thyroid secretion.

If the hyoid bone is hooked upwards, it may be possible to remove the cyst completely from behind the hyoid bone. But when the cyst extends up to the foramen cæcum and is of long standing, it has proved impossible to remove the whole of the cyst without dividing the hyoid bone.

I have thus divided the hyoid bone in the middle line when operating for the first time; but more especially when a fistula has persisted after a previously incomplete operation is this step necessary. In one case the patient had been operated upon elsewhere three times, in another case eight times before coming under my care. The excision of the cyst together with half an inch of the middle of the body of the hyoid bone was followed in both by permanent healing; the division of the hyoid bone is not followed by any disability. The latter case was exhibited at a meeting of the Clinical Section of the Royal Society of Medicine in May, 1913.²⁰

In conclusion, I wish to express my thanks to the Royal College of Surgeons of England for permission to exhibit eight specimens from their museum.

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