THE TREATMENT OF GRAVES'S DISEASE BY LIGATION.

BY

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EARLY in the course of acute Graves's disease efforts should be made to abolish, or at least reduce, the thyrotoxicosis, prolonged exposure to which has been shown to result in definite myocardial degeneration. If after fair trial medical measures prove ineffective, more radical means should be adopted.

In my opinion both x-ray and radium therapy are undesirable, and the method of choice is partial extirpation of the overactive gland. The Mayos have emphasized the importance of performing this operation during one of the periods of remission, to which these patients are subject, but even then, in very severe cases, primary resection may prove a formidable and dangerous operation involving an unjustifiable risk, because the reaction may be great. However, by gradually cutting off the blood supply to the gland by ligation of its vessels, the degree of intoxication may be gradually reduced with but little reaction. It may then be advisable to perform partial thyroidectomy.

When the goitre is small, diffuse, very vascular and exceedingly toxic, primary extirpation may be very dangerous, particularly in the presence of marked cardio-vascular disturbances. In such cases especially ligation appears to be the procedure of choice, and may be performed under local analgesia, which should be by novocain only, adrenaline being contraindicated.

Professor John Rogers of New York has recently advocated quadruple ligation in these cases, and in many has found it unnecessary to perform resection of gland substance later. Kocher pointed out the necessity of absolute haemostasis in operations on exophthalmic goitre. Strict asepsis and rapidity of operating also largely contribute to success. With Crile of Cleveland, Ohio, the ligation of the superior thyroid artery is a most remarkable surgical feat, being at times accomplished in forty seconds, through an incision about one inch in length.

While some authorities maintain that the superior thyroid arteries are the more important, and from the point of view of comparative anatomy this may appear to be so, yet, as de Quervain points out, in goitre the changes in the thyroid occur principally in the middle and lower parts of the lateral lobes and are associated with increase in calibre of the inferior thyroid arteries, which form the principal blood supply to these areas. For this reason, and because the inferior vessels can be tied very easily in the way subsequently described, without handling or in any way disturbing the gland itself, which the surgeon should strive to avoid in highly toxic cases, it is often advisable in these bad cases to begin with ligation of one of the inferior thyroid arteries. However, it is undesirable to be dogmatic on this point; in one of my cases the largest vessel was the left superior thyroid, which was almost as large as the internal carotid. Moreover, it is only fair to point out that some authorities maintain that more good is done by ligation of the superior vessels because of the interference with the secretory nerve fibres which are said to enter the gland with these vessels.

Whichever vessel is first tied it is probably advisable next to ligate the other artery of the same side, because the anastomosis across the middle line has been shown to be less free than that between the upper and lower arteries of each lobe.

Most of the textbooks advocate tying the inferior thyroid artery through an incision which exposes the anterior border of the sterno-mastoid, but from first experimenting on the cadaver and subsequently from experience gained in practice I have found that a slight modification of the posterior route, popular with some Continental surgeons and recently advocated by Professor John Rogers, greatly facilitates the procedure. An incision about $1\frac{1}{2}$ inches long is made along the posterior border of the sterno-mastoid just above the clavicle. The muscle is retracted forwards, and on dissecting through the fasciae the tendon of the

omo-hyoid is defined and pulled down downwards and forwards. In the angle between its upper margin and the inner border of the anterior scalene muscle, and behind and slightly external to the carotid sheath, the thyroid axis will be found, and from its direction upwards, inwards, and forwards towards the lower pole of the gland, the inferior thyroid artery is easily identified. The vessel is divided between ligatures. At this point it is the main trunk which is divided, and the division is well outside the recurrent nerve. There may appear to be a slight danger of wounding the cervical sympathetic, but this has not been found to occur in practice. No harm results from any damage, and, in fact, some authorities deliberately sever any fibres that appear in the wound.

The advantages of ligation of the inferior thyroid near its origin are that here one is well away from the recurrent nerve, and that there is little danger of either wounding the thyroid veins or of producing tetany by damaging branches to the parathyroids and so interfering with the collateral circulation to these bodies. The phrenic nerve lying on the scalenus anticus is not injured, as it is displaced laterally with the muscle.

Dietrich and Langenbeck, who, according to Crotti, were the first to advocate tying the vessel on the inner border of the scalene muscle, approached the artery between the two heads of the sterno-mastoid, while Drobnik, Rudiger, and Wölfler made their incision entirely behind the muscle. Alamartine says that ligation of the trunk of the inferior thyroid artery by the retro-sterno-mastoid route at the internal border of the scalenus anticus is the method of choice. Most of the ligations described, however, have been carried out below the tendon of the omo-hyoid; my slight modification is in approaching the vessel above the tendon.

The superior thyroid artery is exposed through the usual transverse incision at the level of the middle of the thyroid cartilage, and may be identified by tracing the vessel from one of its branches at the upper pole of the gland. The large veins leaving the upper pole may obscure the field and render ligation difficult. The loop of the artery should be looked for, as it lies on the inferior constrictor below the superior laryngeal nerve, but, as Kocher pointed out, it is sometimes necessary to free the external carotid and identify the artery by its origin.

Care should be taken to include in the ligature the posterior branch of the vessel, which sometimes arises high up and courses down the back of the gland. Severing what appears to be the main vessel between ligatures will enable the surgeon to see whether the posterior branch has been included or not.

The following is a brief history of a case of quadruple ligation.

The patient, a man aged 52, suffered from acute Graves's disease. Stellwag's and von Graefe's signs were positive. The pulse was 140 to 180, with occasional attacks of auricular fibrillation. Tremors were marked. The goitre was small, diffuse, and highly vascular. The patient was very emaciated and short of breath, and had been an invalid for many weeks. Three months before he had had to give up his work as a railway signalman.

Quadruple ligation was performed, one vessel at a time being tied under novocain analgesia; an interval of from ten to thirty days elapsed between each operation.

Subsequently there was great improvement. Ten weeks after the last ligation he had gained 29 lb. in weight, the pulse rate had fallen to 80, and there were no longer any tremors, but slight exophthalmos remained. He has since gained still more weight and returned to work, pulling heavy levers all day without discomfort. It is now nearly a year since his discharge from treatment; he has reported from time to time, and there have been no signs of tetany or cachexia strumipriva.

From such simple operative procedures involving little risk to the patient results of this type are very gratifying.

Quadruple ligation has now been performed very many times, and, contrary to what might be expected, deficiency symptoms following it are almost unknown. It is apparently very rare to meet with either tetany or myxoedema, and the explanation no doubt is that it is the trunks of the main thyroid arteries which are ligated, and that Neubauer's artery (the thyroidea ima) is a fairly constant vessel.

It is true that Kocher did not consider it permissible to tie all four arteries, because on one occasion on which this operation was performed by him his patient subsequently suffered from tetany; but this is probably accounted for

by the fact that his procedure was to tie the inferior thyroids close to or within the capsule of the gland. In 22 cases in which De Quervain tied the trunks of all four arteries no sign of tetany occurred subsequently.

At a later date it is hoped to supplement this paper with a detailed record of cases, but the object here has been to draw attention to the benefit of quadruple ligation in certain bad cases of exophthalmic goitre, and to put forward one or two points in technique with the hope that they may prove useful.

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DENTAL SEPSIS AND SEPTICAEMIA.*

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ILLNESSES secondary to foci of infection situated about the roots of the teeth are known to be very common, but are apt to be overlooked. The infection may arise from: (1) An abscess at the roots of crowned or filled teeth which apparently are perfectly sound and causing no trouble whatever. (2) Nodular collections of organisms on the roots of the teeth. (3) Absorption of the alveolar process of the jaws, generally associated with more or less visible pyorrhoea, which leads to retraction of the gums and greater or less exposure of the roots of the teeth. (4) Tartar on the teeth.

Whenever a person is suffering from some illness of painful, debilitating, or infective nature for which no other cause can be found the teeth should be carefully examined. Visible pyorrhoea in small or profuse amount may be present, and swelling and inflammation of the gums and interdental papillae; or retraction of the gums may be very obvious. On the other hand, the teeth may be a picture of excellent crowning, bridging, or conservative filling work with healthy gums and yet harbour septic organisms.

It is therefore advisable to have all filled and crowned teeth or protruding teeth examined by x rays, because frequently it is by this means alone that serious septic lesions can be found. The films must be taken by an expert dentist or x-ray specialist used to dental film work; otherwise it is difficult to interpret the results accurately and unnecessary extraction may be done. Ill informed and inexperienced interpretation of x-ray films is responsible for much unnecessary extraction of teeth and disappointing after-results on the one hand, and for the overlooking of septic foci on the other.

The results of absorption of poison from infective teeth vary in an extraordinary way, and are in no way related to the extent of the dental sepsis. Some of the worst cases arise from small foci revealed only by x-ray examination; on the other hand, a marked degree of chronic purulent inflammation of the alveolar process of the jaws may be present, with visible pyorrhoea, teeth covered with tartar, and with foul breath, and yet the subjects enjoy rude health. Either these people's powers of resistance are perfect or the absorption of toxins is not so great where there is free escape of pus.

When septic absorption takes place the metastatic infection, whatever its nature, may run a definite course for a week or a few weeks and then clear up, Nature having produced efficient antibodies to neutralize the invading

toxins. There may be no return of bodily trouble for months or years. Then another outbreak of similar or different nature may occur. For instance, in one patient there was a violent painful inflammation of the tonsil like diphtheria which lasted ten days. Recovery took place, but in a year or so a severe acute painful neuritis and cramp affecting the nerves and muscles of the legs, especially of the feet, developed and lasted three weeks. X-ray examination showed extensive infection of the roots of the teeth, and wholesale removal has resulted in good health.

It is because of the use of x rays in investigating the condition of the teeth that more attention is being paid to general illnesses which can arise from dental sepsis than was paid ten years ago. I remember patients in private practice in my past experience, who had acute illnesses or who died, and in whom no satisfactory explanation of the toxic process was ever given. I often think of one man especially who had a virulent infection with a rash, which I took a fever specialist to see, and which was not scarlet fever. He died. I do remember that he had very bad teeth, but it was many years before the days of dental x-ray work. I do not refer to hospital cases in this paper.

There are two broad types of affections caused by sepsis of the teeth: one unaccompanied, and one accompanied by a rise of temperature.

1. *Apyrexial Affections*.—The common illnesses arising in this way are generally painful, such as myositis, fibrositis, neuritis, arthritis, or phlebitis. Affections of the stomach simulating ulceration and malignancy may, in my opinion, be caused by dental sepsis, and probably biliary infections as well. I always have the teeth of cases of indefinite gastric nature examined, and in many instances removal of septic teeth has relieved the complaint of the patient. A common type of apyrexial complication is an adult of 40 or more who has attacks of rheumatism or neuritis which affect any part of the body, come on at any time without exposure to wet or cold, but especially if the person is run down or overworked. The pain and stiffness may be very great, allowing lying down in only one stiff position to avoid pressure on the affected muscle or nerve, and causing a very crippled gait. Sleep without anodynes is impossible. If such a person has any septic teeth they are almost certain to be the cause of the trouble, and their removal will result in cessation of the pains, though, it may be, only after some months in long-standing cases. One interesting case I am watching now is a young gentleman farmer, aged 25, who has had three attacks of painful myositis, etc., affecting the neck and back, for which there was no cause like exposure to weather. He had an excellent set of his own teeth with only one filled molar. This we had x-rayed. The roots were not clear like those of the other teeth, and as it was a dead tooth it was removed, and definite evidence of sepsis about the roots was found. It is at present too early to say whether we have removed the cause of the "rheumatism."

2. *Pyrexial Affections*.—Among affections accompanied by a rise of temperature are inflammation of the throat, acute tonsillitis, arthritis, phlebitis, bronchopneumonia, and septicaemic conditions generally, including septic endocarditis. The temperature varies from a simple septic evening rise and morning fall lasting weeks or months to daily rigors of severe type lasting days or weeks or longer. In one case I will refer to it was more like rat-bite fever than any other condition I know of. In some cases it simulates that of irregular typhoid or paratyphoid infection, and Widal tests should be done to check diagnosis. Death has occurred in two cases in private practice under my observation.

PHYSICAL SIGNS AND SYMPTOMS.

Myasthenia Cordis.—One of the most important and commonest symptoms of dental toxæmia even in apyrexial cases is shortness of breath on slight effort—what I may call myasthenia cordis. This was the only complaint of one patient, and it had troubled him for many months. It may persist for several months after the offending teeth have been removed and the acute symptoms have passed off. There may be no evidence of dilated heart in these cases unless there is some associated anaemia; merely some inability on the part of the heart muscle to carry on the

* A paper read in opening a discussion on focal sepsis at the Manchester Pathological Society, December 9th, 1925.