ON THYROTOMY

FOR THE

REMOVAL OF FOREIGN BODIES IMPACTED IN THE INTERIOR OF THE THYROID CARTILAGE.

BY

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ALL operations for the removal of foreign bodies from the air-passages are matters of interest to the practical surgeon, and any experience which has been obtained of comparatively new proceedings is valuable as guiding our course in these grave and sometimes very difficult emergencies. Now, the operation of thyrotomy, as it is called, or, as it may possibly be better termed, "total laryngotomy" or "chondro-laryngotomy," is a comparatively modern proceeding. All these operations through the thyroid cartilage,¹ as far as I know, have been performed within living memory. Gibb, in 1865, spoke of his case² as being the first operation of thyrotomy ever performed in England. Since then no doubt the operation has

¹ A case is erroneously ascribed by Planchon to Pelletan, but the original clearly states that the incision was made through the cricoid cartilage, not the thyroid.

² 'Brit. Med. Journ.,' September 30th, 1865.

become common, but it is practised usually for the removal of tumours; and both in this class of cases and in those of foreign bodies lodged above the glottis its application is now much restricted by the use of the laryngeal forceps and snare.

I propose in this paper to discuss the operation only so far as it is applicable to the removal of foreign bodies. I will first give short notes of a case which lately occurred in my own practice, and which was interesting as enabling us to see the condition of the parts subsequent to the operation after nearly complete union had taken place, and I will then discuss the indications for the operation, the best method of performing it, and its results so far as I have been able to discover them.

CASE.—Bernard M—, æt. 30, a large, muscular man, was admitted on November 3rd, 1881, with a foreign body impacted in the larynx. About two hours before, he was eating some rabbit soup, when some one made him laugh and a piece of bone which was in the soup got into his windpipe. He had violent dyspnoea for a few seconds, but coughing seemed to displace the foreign body, and he was somewhat relieved. When admitted, he was breathing quite freely, the voice was a husky whisper, and he pointed to the left side of the thyroid cartilage as the seat of his trouble. Laryngoscopic examination was quite easy, and showed a piece of bone lying parallel to the left vocal cord. The bone was judged to be in the ventricle of the larynx. An attempt was made by the house surgeon to remove it with laryngeal forceps, and these attempts were repeated during the next few days by Dr. Whipham with forceps and bent probes of various forms; but though the bone could be touched, and though a small piece was on one occasion broken off, it could not be moved. Meanwhile the man was getting more distressed. There was a copious secretion of frothy sputa even from the day after the accident, and this became more abundant. The mucous membrane above the cord became much swollen, especially on the left side, and patches of white

fur began to appear on the base of the tongue and on the laryngeal mucous membrane.

As it was clear that the foreign substance could not be successfully dealt with without tracheotomy, I performed that operation on November 8th, making a free incision through the cricoid and upper rings of the trachea. As considerable hæmorrhage took place from a large vein, which ceased on the insertion of the laryngeal tampon, it was decided to leave the case for a time, hoping that the foreign substance might now become less firmly impacted or might be pushed up from the wound. Dr. Whipham examined the patient next day, and reported that the bone was in the same place, and so firmly impacted and buried in the swollen mucous membrane that its removal from the mouth was impossible.

On November 10th (a week after the accident), I performed thyrotomy. After making an unsuccessful attempt to seize or to displace the bone from the tracheal wound, the parts were carefully dissected off the thyroid cartilage, and the middle line of the *pomum Adami* carefully followed from the top to the bottom, till the knife touched the tracheal canula. Then the lips of the wound were held open, and the finger at once came down on the bone, which was extracted without the least difficulty. It is seen to be of large size (about $\frac{3}{4}$ of an inch square), bent at right angles, and with a very sharp spine projecting from one corner. It looks like part of the base of the rabbit's skull. The operation was greatly facilitated by the use of Dr. Semon's modification of Trendlenburg's tampon, which prevented the entrance of any blood into the trachea. The bleeding, however, was not at all formidable. After renewed search with the finger had proved that there were no fragments left behind, the soft parts were brought together with silver sutures. Two hours after the operation the air was let out of the tampon, and on the following morning the tracheal tube was altogether removed in order to free the windpipe from all irritation of foreign bodies. The man slept well, his breathing was unem-

barrassed, and he was free from pain. Still there was very profuse expectoration, obviously from tracheitis, for there were no bronchial sounds. It was not till a week after the operation that the vocal cords could be seen from the mouth, and then only indistinctly, on account of the swollen membrane above them. The patient, however, seemed going on well. All the portion of the wound above the passage of the tracheal canula healed very rapidly, and the lower part of it slowly contracted.

On November 23rd (thirteen days after operation) he had a rigor, and the temperature, which had been normal, rose to 103° F., but fell again to the normal next day. It seemed that he had had ague previously, and it was doubted whether this was some irregular aguish symptom. It was also discovered that some food had been smuggled in by his friends. At any rate, there was not at first any cause for serious alarm, but the persistence of the frothy expectoration was disappointing. The throat was sprayed with carbolic acid and then with alum, but with little result. The voice, meanwhile, was improving, and the wound had contracted to a very small chink, through which, however, the air still passed. No morbid sounds were detected in the lungs, forty-eight days after the operation.

Things went on in this way till December 28th, when he had a severe rigor while sitting before the fire, followed by a second in the middle of the night; and now evidences of consolidation were found in the right lung, and of congestion in the left, and he complained of pain in the right side of the chest. The temperature would rise usually to about 100° at night, and the cough was very troublesome. On January 11th he brought up a considerable amount of blood, and now the sputa were observed to be extremely offensive. The hæmoptysis recurred on the evening of the 14th, followed by the expectoration of a quantity of foul pus, and soon after this he quietly expired, rather more than nine weeks after the operation.

The larynx was removed from the body, and is now

exhibited to the Society. The only thing noticeable in it is that the left vocal cord is slightly ulcerated. The line of incision on the inside of the larynx is so perfectly united as to be hardly perceptible, except at a point about the centre of the thyroid cartilage, where there is a minute opening. The external wound was also quite closed, except one small granulation, the position of which did not correspond to the unhealed part of the thyroid cartilage. The vocal cords are on the same level, in fact, it is hardly possible to see that they have been ever disturbed. The incision reached from the upper border of the thyroid to the first or second ring of the trachea, but the lower part of it was so perfectly healed that it is hardly possible to be sure whether these smaller cartilages had been divided.

The trachea and bronchi were much congested. The base of the right lung was occupied by a large foul-smelling gangrenous abscess. The left lung was greatly congested.

The liver weighed six pounds, and was cirrhotic to a great extent. The spleen was soft and large, the kidneys much congested, but not showing any evidence of structural change. The other organs were healthy.

The issue of this case was very disappointing, and it is still to me difficult of explanation. No doubt the man was unhealthy, and his liver bore evidence to his having been of intemperate habits. Yet this seems of itself rather an inadequate reason for death ensuing on so comparatively trivial a lesion as the lodgment during seven days of a foreign substance outside the true larynx. It will be noticed that except at the first moment of the accident, when the bone no doubt passed down to the glottis, and probably one of its pointed edges excited the cords to spasm, he had never suffered from any urgent dyspnoea, and therefore it seemed wrong to be in a hurry to open the windpipe so long as there seemed the least chance of extracting the foreign substance through the mouth; and equally wrong, after the tracheotomy, to be

in a hurry to divide the thyroid cartilage until it had been rendered certain that the bone could neither be extracted nor dislodged through the tracheal wound. I may also observe that the view obtained through the laryngoscope did not lead us to think that the bone was either so large or so irregular as it proved to be. Only one edge of it was seen, and it was believed to be a mere spine stuck across the orifice parallel to and above the left true cord. In reality, however, there was a very large mass buried in the ventricle and in the swollen mucous membrane, and it seemed strange afterwards that the distress was not much greater. The comparative slightness of the symptoms and the assumed probability of removing the foreign body by milder means justified, I think, the delay which took place in performing thyrotomy. Yet, nevertheless, that delay was, I doubt not, the cause of death, by setting up a diffuse or spreading inflammation of the respiratory mucous membrane, which the man's constitutional weakness rendered him unable to throw off.

It is surprising how rapidly in cases of lodgment of bones, or similar pointed substances, the inflammation will spread along the mucous surface. A child was brought to St. George's Hospital under my care some years since, whose case exactly resembled the present one, so far as the accident went, though the result was more fortunate. He had got a piece of rabbit bone into the larynx while eating some soup. When admitted, only a few hours after the accident, there were loud fluid râles over both sides, and when the bone was extracted (which was done with forceps from the mouth under chloroform) in the evening, the râles had spread quite to base of both lungs. In that case a large prong was found sticking out of the chief mass of the bone, and probably projecting through the glottis and irritating the mucous membrane. In all such cases the removal of the foreign substance is urgent. But in my patient we could not hear any morbid sounds in the thorax, and therefore thought ourselves justified in waiting. And no doubt,

when the foreign body can be seen and touched, and when there are no serious spasms, it can usually be extracted from the mouth. Examples of this kind are found in the works of Mackenzie. As a good example of success in a case very similar to the above I would refer to that recorded by Dr. Morell Mackenzie,¹ where a piece of bone was impacted transversely in the larynx above the vocal cords, and where, after fruitless attempts to remove it, tracheotomy was performed three days after the accident. Various fresh attempts were then made, and thyrotomy was contemplated, but at length, on the fifteenth day after the accident, the bone was broken with the laryngeal probe, and soon afterwards the rest of it was coughed up, and the man at once recovered.

This is by no means the longest period that a piece of bone has remained innocuously in the larynx. Planchon² quotes a case from the '*Gaz. Med.*,' 1868, in which tracheotomy was practised seven days after the accident. It was not till the nineteenth day that the surgeon was able to assure himself of the position of the foreign body, and it was not till seven weeks after this that he decided to open the larynx, "fearing," as the report says, "that the vocal cords might become ulcerated." Notwithstanding that the bone had thus remained in close proximity to the vocal cords for nearly ten weeks, the patient recovered entirely and regained his voice.

Still more remarkable is the following :

In the '*New York Med. Rev.*,' Aug. 15th, 1870, Dr. Gurdon Buck relates the case of a lady, æt. 25, in whom a fishbone had been lodged somewhere near the ventricle of the larynx for about two years and a half, causing great distress and constant cough. The diagnosis was long doubtful, but at length it was decided to lay open the larynx. This was done by first incising the crico-thyroid membrane, in the middle line, then continuing the incision through the lower half of the thyroid cartilage,

¹ '*Diseases of the Throat and Nose*,' i, p. 417.

² '*Faits cliniques de Laryngotomie*,' p. 68.

and as soon as respiration was established freely through this wound, completing the division of the thyroid cartilage. As no foreign body could be found the wound was extended through the two upper rings of the trachea and a tube introduced, for which purpose it was thought necessary to cut away part of the tracheal cartilages. It is not necessary to follow this interesting case in all its details. Suffice it to say that repeated examinations failed to detect the bone, though it was believed that there was an ulcerated patch of membrane on the interior of the cricoid cartilage. The patient had to wear a tube permanently, and it was not till twelve years afterwards, *i.e.* more than fourteen years after the accident, that the fishbone presented itself in the fenestra of the tracheotomy tube, and it was not till a year after this that she would consent to the removal of the tube, after which a plastic operation was necessary to close the wound. She recovered completely, but unfortunately no exact details are given of the final condition of the voice. Even before the removal of the tube, however, "all that was noticeable was a slight huskiness of the voice, and that by no means conspicuous."

In the face of cases such as these we can hardly say that the removal of a foreign body impacted above the vocal cords is a matter of immediate urgency unless it is exciting spasm of the glottis or giving rise to spreading bronchitis.

The next point is this: having made up his mind that operation is necessary, should the surgeon divide the thyroid cartilage at once, or should a preliminary laryngotomy or laryngo-tracheotomy be performed? Here we must distinguish between the cases in which the position of the body is known and those in which it is only suspected. In the latter there can be no doubt that an opening below the thyroid cartilage is the most prudent course. And for many reasons I think that even if the foreign substance is known to be lodged between the two alæ of the thyroid cartilage, it is better to make the

incision below it. However carefully performed, the division of the thyroid cartilage cannot but entail some risks to the voice. What those risks are will be discussed in the sequel, but I think every one will admit that there must be some danger to the integrity of the voice.

Now, it is clear from Mackenzie's and other cases where patience and perseverance succeeded in removing the foreign body without thyrotomy, that there is a fair prospect of the expulsion or removal of the foreign body by renewed attempts either from the mouth or the tracheal wound without any such dangerous interference with the framework of the glottis. Again, is it not possible that by making the incision directly on the foreign body through the thyroid cartilage the surgeon might displace it and drive it down below the wound, necessitating a further extensive incision into the windpipe under disadvantageous circumstances? The tampon in the trachea affords also an absolute security against hæmorrhage, and although the thyroid cartilage has been divided, without any preliminary opening below, and without any bad consequences, in several cases for the extraction of foreign bodies¹ as well as for the removal of tumours, yet I cannot but think the other course the safer, and the only argument against it is that a more extensive wound gives more freedom of motion for the two halves of the thyroid cartilage, and so renders the displacement of the vocal cords from each other more probable.

Another question of some interest relates to the possibility of extracting the foreign body by a partial division of the thyroid cartilage. This was successfully effected by Dr. E. H. Bennett, of Dublin,² in the case of a boy, æt. 8. Half a plumstone had lodged in or near the glottis. Tracheotomy was performed on the day after the accident, and many attempts were made to seize or dislodge the foreign body. This being found impossible,

¹ See Marjolin's, Maisonneuve's, Vidal's, and Blandin's cases as quoted by Planchon, *lib. cit.*

² 'Dublin Quarterly Journal,' August, 1870, p. 29.

partial thyrotomy was performed nineteen days after the accident, the lower part only of the cartilage being divided. This was completely successful, and in a fortnight the voice had entirely returned.

No doubt this partial division of the cartilage is less liable to be followed by displacement of the vocal cords, and in such a case as the above it may be well to follow Dr. Bennett's course. But where, as in my case, the foreign body is quite inaccessible from the crico-thyroid opening, and is known to be firmly impacted in the ventricle and buried in the swollen mucous membrane, it is hopeless to attempt its removal without dividing the entire cartilage, and thus attaining a free access to the parts above the glottis.

With regard to the results of the operation, I believe that the case which forms the text of this paper is the first in which death has followed the operation, unless we are to reckon as a fatal case one in which Marjolin operated¹ under a mistaken diagnosis. The foreign body (a bean) was really in the right bronchus, but the surgeon thinking that it was in the larynx laid open the thyroid cartilage. Death took place next day, but it does not appear from the report to have been due to the operation.

Mr. Durham, in a work on 'Injuries of the Air-passages,' not yet published, says that "in at least eighteen cases it has proved successful, and that he does not find on record a single case in which death has resulted," reckoning Marjolin's case, no doubt, as one of death not from the operation, but from the unrelieved impaction of the foreign body.

I believe that this statement is essentially correct, though possibly the number may be open to question, since I find that Planchon, who is one of the authorities on this subject, has admitted as instances of thyrotomy at least two cases in which the incision was made entirely below that cartilage. As far as I can discover, mine is the first case

¹ Planchon, Case 4.

in which death has followed after the operation of thyrotomy when performed for the removal of a foreign body, and even here it may very fairly be argued that it was not so much the operation as the delay of the operation which caused the man's death. He would doubtless have had a better chance of surviving had the operation been performed on the day of the accident.

The results as to the preservation of the voice seem in general to be very good. The dangers which threaten the integrity of the voice are two-fold, viz. from the ulceration of the vocal cords which the foreign body may produce, and from the irregularity of the cords which may follow on the operation.

As an instance of the former danger, and as a motive for speedy interference, I may refer to a case published by Dr. Stone in the 'Med. Times and Gaz.,' November 6th, 1880, and in which Mr. Croft operated. This case presents several points of interest. One very singular peculiarity was that though the foreign body (a piece of walnut shell which had been drawn into the larynx in a fit of epilepsy) could be easily touched with a probe from the laryngotomy wound, it could not be seen with the laryngoscope. In fact, laryngoscopic examination shortly after the accident showed the cords white and quite normal. Thyrotomy was not performed till twenty-six days after the occurrence, and then the piece of shell was easily extracted, but the boy has never been able to dispense with the tube, and (as Mr. Croft informs me) is still wearing one of india rubber. The strong probability in this case is that the cords were more or less ulcerated from the contact of the rough shell, which seems to have been buried in the ventricle.

Again, in the case related by Mackenzie,¹ in which Dr. S. Johnson extracted a "toy engine" which had been buried in the larynx for several months, the voice remained hoarse at the date of the report, three years after the operation. Such cases as these seem to show the

¹ 'Dis. of Nose and Throat,' i, 412.

necessity for prompt interference in cases where the foreign body is known to be voluminous and rough, or where there is any good reason to think that it may be so. In my case it will be noticed that one of the vocal cords still showed distinct traces of ulceration, though the operation was performed only a week after the accident.

The dangers to the voice from the operation itself I cannot but think have been over-estimated. No doubt it is possible that the two halves of the thyroid cartilage may unite on different levels, so that the two cords would no longer meet quite evenly, and it is possible that the incision may deviate from the middle line, and that one of the cords may be wounded, and it is possible that the incision through the cartilage may not wholly unite, so that a fistulous opening may be left, or that a portion of the cartilage may die.

All these things are possible, but I see no evidence that any of them have ever taken place. I have not succeeded in finding any description of the appearances on dissection in any case where thyrotomy has been performed, and am inclined to believe that the preparation which I exhibit to-day is in that respect unique. It shows really no deviation from the natural condition of the vocal cords depending on the operation, and without a somewhat close inspection there would be some difficulty in seeing that the larynx had ever been opened, so exact is the apposition of the parts, and so minute the perforation which remains in the thyroid cartilage. Clearly in this case the vocal cords are on the same level, and have not been interfered with by the incision, and though the wound has not entirely healed, there could be no doubt that it would soon have done so had the patient survived. Yet here the halves of the cartilage were not brought together with sutures, as is sometimes recommended (though, as I think, very erroneously), and the incision was to the greatest extent which is probably ever practised, viz. from the upper margin of the thyroid cartilage down to about the second ring of the trachea. The

patient had not entirely recovered his voice, but he could speak plainly and loudly, though somewhat huskily. This defect, however, depended, I have no doubt, on the irregularity of the left vocal cord caused by the impacted foreign body, and not on any result of the operation.

In numerous other cases the voice is reported as being perfect. Sometimes, as in Maisonneuve's, Vidal's, Coates's, Berr's,¹ the voice is only said in general terms to have been "restored" or "normal." In other cases, such as Mr. Durham's,² it is expressly stated that the patient "could laugh, talk, or sing, almost as well as ever;" and such, I think, we may fairly say will be the general result when thyrotomy is performed before the injury has produced ulceration of the vocal cords.

The conclusions, then, to which our present experience of thyrotomy for the removal of foreign bodies point, seem to me to be the following :

1. Very large substances may be impacted either in the ventricle of the larynx or between the two *alæ* of the thyroid cartilage, without causing any symptoms of immediate urgency.

2. When such foreign substances are rough or pointed they sometimes give rise to a spreading inflammation of the mucous membrane, and in such cases should be removed as soon as possible.

3. If they can be seen and touched they can usually be removed, either whole or piecemeal, with the laryngeal forceps.

4. When this is found impossible without tracheotomy, an opening should be made through the crico-thyroid membrane and upper rings of the trachea.

5. After this operation it is quite possible that the spasmodic condition of the parts about the glottis may subside, and a renewed attempt at extraction be successful.

6. If this is impossible the foreign body may be

¹ All these cases are to be found in Planchon's monograph.

² 'Guy's Hosp. Reports,' 1866.

either extracted or displaced from the tracheal wound, so that a preliminary tracheotomy is always advisable.

7. On the failure of such attempts the thyroid cartilage is to be laid open in the middle line partially, from below upwards, if the body is small and can be felt lying near the wound, entirely (and better from above downwards) if the body is large, firmly impacted, and lying altogether out of reach from the tracheotomy wound.

8. The operation of thyrotomy involves little danger to life, and not much to the integrity of the voice; at least, the risk of damage to the vocal cords is much greater from the protracted irritation of the foreign body than from the sequelæ of the operation.