INTUBATION OF THE LARYNX: A SUMMARY.

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The modern method of intubation of the larynx is due to Dr. J. O'Dwyer, of New York. As this author points out in his first paper (*New York Medical Journal*, August 8th, 1885), Bouchut, so long ago as 1858, had used short tubes in cases of diphtheria, at the time when Trousseau was advocating tracheotomy. His success, however, was not sufficient to encourage further trial, and the method was condemned by a committee, of which Trousseau formed a member, in favour of tracheotomy. In the paper above referred to, O'Dwyer says that he had been experimenting since 1880, that is, for five years, before he published his results. He mentions three cases of recovery, and modestly concludes: "I leave all considerations as to the value of this method of treating croup and other stenoses of the larynx to be determined by a more extended trial in the future." He believed the method would be found valuable in chronic stenosis of the larynx, and to facilitate the removal of the tube after tracheotomy. Dr. O'Dwyer's method was taken up at once by Drs. Waxham and Ingals, both of whom have written several papers on the subject. The most important of the former will be found in the *Journal of the American Medical Association* for July 23rd, 1887, and earlier communications in the *Chicago Medical Journal*, March, 1886, and *Journal of the American Medical Association*, October 24th, 1885. The leading paper by Dr. Ingals will be found in the *New York Medical Journal*, July 2nd and 9th, 1887; and in an earlier paper, published in the *Journal of the American Medical Association*, February 6th, 1886, the author gives illustrations of the various instruments employed. The set of instruments consists of five laryngeal tubes, an introducer, extractor, and a gauge. The tubes vary in length from $1\frac{1}{2}$ in. to $2\frac{1}{2}$ ins., the calibre of the largest being about $\frac{1}{2}$ in. by $\frac{1}{4}$ in., that of the smallest about half that size. At the upper end of the tube is a diamond-shaped head with rounded angles, which rests upon the ventricular bands and prevents the tube from slipping into the trachea. The anterior aspect of the head is bevelled off where it rests against the base of the epiglottis, and at its anterior part is a small eye through which a double thread is passed. Below the neck is a fusiform enlargement to make the tube self-retaining. Each tube is fitted with a jointed obturator, in the upper end of which is an aperture to receive the introducer. The stem of the introducer is fitted with a sliding tube, which may be pushed forward by a thumb-piece to release the obturator from the laryngeal tube when the latter is in position in the glottis. The extractor is constructed on the principle of a dilator. When used the closed blades are passed into the end of the laryngeal tube; a lever in the handle is then pressed down to open the blades, which impinge against the inner aspect of the tube and hold it firmly so that it may be withdrawn. Dr. Ingals and others recommend that those not familiar with laryngology will find it profitable to practise on the cadaver.

The Operation.—The child is wrapped in a shawl and held in the nurse's arms; a gag is inserted on the left side. The left index finger is passed over the tongue behind the epiglottis, the arytenoid recognised; then the tube is passed under the forefinger and directed into the larynx, and, when through, the glottis is held by the index finger while the obturator is disengaged. The thread attached to the tube is allowed to remain till the child has cleared the trachea and got over the dyspnoea caused by the introduction; the finger is then once more placed upon the head of the tube, the thread divided and withdrawn. The object of the silk is to enable the tube to be withdrawn should it have been passed into the pharynx. No anæsthetic is used, nor does the child complain of pain. Should any difficulty be experienced in the first attempt, the apparatus should be withdrawn to give the child air.

Besides the difficulty of finding the glottis, the introduction of the tube is attended with another danger, and that is the pushing down of the membrane into the trachea and the closure of the lumen. This is the more likely to occur if the operation be undertaken late in the disease, at a time when the membrane is beginning to separate. In such a case tracheotomy would probably become necessary. Though such skilled operators as O'Dwyer, Ingals, and Waxham appear to find no difficulty attending the insertion of these tubes, a perusal of the discussion on their papers shows that such is not the experience of all, and one can understand that the movements of the larynx and the struggles of the child render it by no means easy to find the

glottis. There can be no doubt, therefore, of the wisdom of the advice to practise the procedure on the cadaver. Indeed, so difficult has the introduction been found by some American practitioners that they have condemned the tubes on this account.

After-Treatment.—The tube, it is stated, is cleared by the ordinary respiratory efforts, membrane being as freely expelled as through a tracheotomy tube. If the tube becomes blocked, it will be expelled, a result which Dr. Ingals states occurs in about one-fourth the cases. Its immediate reintroduction is necessary in most cases when expelled on the first or second day, and here is no doubt one of the great dangers of the method; for while a nurse can insert a tracheotomy tube, a skilled hand is necessary to replace the laryngeal tube, and in the meantime the child may be asphyxiated. In one case the tube was expelled in an hour, and though the child was almost moribund at the time of its introduction, a rapid recovery ensued without the further use of the tube.

The authors recommend that the tube be removed in all cases from the fourth to the sixth day, to avoid the dangers of undue pressure. The necessity for its reinsertion will depend upon the dyspnoea. O'Dwyer mentions two cases in which the tube was retained ten days, and Dr. Waxham one of fourteen days, without evil result. In removing the tube it seems best to give an anæsthetic, for the difficulty of guiding the extractor into the small orifice can easily be imagined.

The greatest difficulty as well as danger is the administration of food. The head of the tube interferes with the movement of the epiglottis, and the child is unable to swallow fluids without coughing, and, in consequence, suffers terribly from thirst. Dr. Ingals states that most will swallow half a teaspoonful at a time if the head be well bent forward and to one side, while some will swallow without difficulty. So great, however, is the danger of pneumonia, from the entrance of even small quantities of food into the trachea, that it is necessary to prohibit fluids, and to feed the child on soft solids, giving the fluid by enemata. The distress from thirst is described as being very great, and one speaker (Dr. Strong) condemned the method on this ground, believing that he had lost many of his cases from the traumatic pneumonia set up by the entrance of food, thirty-one out of thirty-two cases having died.

As to remedies, the writers referred to recommend in all cases of diphtheria small but frequent doses of mercury, gr. $\frac{1}{2}$, of perchloride every half hour, or half-grain doses of calomel every three or four hours; attention at the same time being given to the condition of the heart and lungs. Dr. Ingals recommends the following mixture every two hours, alternately with $\frac{1}{2}$ gr. to 1 gr. of calomel, namely, tr. nuc. vom. $\mathfrak{m}$ i; amm. carb. gr. i; syr. ipecac. $\mathfrak{m}$ xii; pot. acet. gr. iv in syrup of liquorice.

Dangers.—There seem to be several dangers special to this method, which it is well to enumerate.

1. The tube may be coughed out, and before skilled assistance arrives the child may die.

2. The tube may slip into the trachea. At first sight this would appear to be a frequent danger, but the accident does not often appear to have occurred. One fatal case is mentioned, while others have been saved by extracting through the glottis. It must be stated, however, that the tube used in the fatal case was not O'Dwyer's pattern, but a smaller form.

3. The tube may be plugged with membrane, and, not being expelled, fatal stenosis occurs. One such case is recorded.

4. The membrane, as mentioned above, may be pushed down by the tube, "crowded down," and give rise to increasing dyspnoea.

5. The great danger is the entry of food into the trachea, and the consequent pneumonia.

From this it will be seen that the after-treatment is by no means free from danger, and would appear, in some cases at least, to be attended with as much trouble, and to require even more skill than after tracheotomy.

RESULTS.—Dr. Ingals has collected 514 cases, with 134 recoveries, or 26.7 per cent. The greater number of these occurred in his own practice and in that of O'Dwyer and Waxham, all skilled operators. Dr. Waxham reports 136 cases of his own, with 37 recoveries, or 27.2 per cent.; and of these 72 were three years of age or under, with 16 recoveries, or 22 per cent., the youngest to recover being nine months; 64 were over three years, and of these 21 recovered, or 32.8 per cent. It is stated that in every case membrane was observed before operation, and it is clear from the reports of the cases that in the vast majority death would have speedily occurred had not the operation been performed. The suggestion, therefore, that the success is due to early operation must, in the face of the reports, be silenced. Dr. Waxham concludes that 25 per cent. will be saved, and that, for his part, he will never perform tracheotomy again. So great a measure of success

has not attended the practice of others. Thus Dr. Strong, in the discussion on Dr. Waxham's paper, reported 32 cases, with 31 deaths, the fatal issue being attributed to traumatic pneumonia, extension of membrane, and actual starvation. Another speaker, Dr. Hatfield, recorded 10 cases, all fatal. If the results obtained by Ingals and Waxham be contrasted with tracheotomy, the new operation stands first as a means of saving life. Tracheotomy under four is admitted to be, on the whole, unsuccessful. Dr. Ingals estimates the recoveries at 15 to 20 per cent.; Trouseau for all cases, 20 per cent., or 1 in 5. Individual operators can, no doubt, show better results than these; thus Dr. Mudd, in contrasting intubation and tracheotomy, gives as occurring in his own practice and in that of his firm 171 cases, with 46 recoveries, or 26.9 per cent. His later cases did better, for out of the last 32 no fewer than 16 recovered. This success he attributes to the milder character of the disease, and to the fact that the operation was performed earlier. Those who see much of tracheotomy know well how the results vary with the character of the disease, and the same influences act, of course, for or against intubation. I remember a series of 19 tracheotomies at Guy's with 1 death, followed by another series in which nearly all died.

Amongst the special advantages claimed for intubation are the rapidity with which it is performed, and the ready consent of friends; the after-treatment is less tedious, and the results are as good as tracheotomy. It is, moreover, urged that expectoration occurs more readily than through the tracheal tube—a result one would scarcely have anticipated. Again, it may be performed at a time when tracheotomy could not be urged.

Many of these points place intubation for general purposes before tracheotomy, but a perusal of the dangers above enumerated will qualify this conclusion to some extent, and leave us with the impression that the new operation will require as much skill, both in its performance and in the after-treatment, as tracheotomy. As has been pointed out by the authors alluded to, and from whose writings, as will be understood, all these facts have been taken, intubation, besides giving relief and saving life in diphtheritic laryngitis—in which disease it should be performed early—is also specially of value in spasmodic croup, oedema of the larynx and in chronic stenosis. It has, I think, been proved that these tubes can be worn for ten to fourteen days without injury, a fact which leads me to hope that for laryngeal stenosis due to catarrh, the operation may be performed early without any injurious effect, and at a time when we should not recommend tracheotomy, on account of the dangers which we know to be inherent in that operation itself. These tubes have also been of great value in aiding the removal of the tracheotomy tubes in cases where difficulty arises. In scald, again these tubes may be useful. Not having had any experience with this method of intubation, it would be unwise for me theoretically to compare it with tracheotomy; this has been done, however, by two American practitioners, Drs. Strong and Mudd, who claim for the latter operation greater or equal success with less difficulty. To all, the difficulty of applying antiseptic remedies, and of treating the trachea locally, will be apparent, and we must wait for personal experience before being convinced of the ease with which membrane is expelled, or with which it may be removed by tracheal forceps through the tube. The method certainly commends itself at once in those cases where we stand hesitating whether to perform tracheotomy to-night or wait till to-morrow; and in all cases where the parents refuse their consent to tracheotomy, we must feel it our duty to employ this method, to which approval seems generally given. In face of the difficulty of introducing the tube, it would seem always wise to be prepared to tracheotomise the patient (when consent has been obtained), more especially should the membrane be pushed before the tube, and the dyspnoea thereby increased. Therefore, should anyone be about to perform intubation without the alternative of tracheotomy being granted him, he will have to prepare the friends of his patient for a possible speedy termination of the case. Such a result is exceptional, even rare, according to the record of cases. Our greatest difficulty will be with the feeding. The use of a stomach tube has been tried, but found to give so much distress as to be abandoned; still, with older children it may be successful.

As showing the tolerance of the larynx of mechanical interference, I may refer to two cases of chronic stenosis, in one of which complete recovery ensued, and in the other great improvement. The first was a child, aged 3, whose thyroid cartilage, with probably the cords, had been wounded in tracheotomy. The case was severe diphtheria, and the wound became very unhealthy. A catheter was first passed by the mouth on a stylet, under the finger, as described under intubation, but was soon expelled. Later, dilatation was effected by Mackenzie's dilator at frequent intervals, the tracheotomy wound was allowed to close, and the boy recovered the partial use of his voice.

The other was the case of a woman, about 60, admitted for laryngeal dyspnoea, for which tracheotomy became necessary. For many months she lost all power of phonation, and was never able to dispense with the tube. Under chloroform the tracheal wound was enlarged, some granulation tissue removed, and a rubber tube passed from the wound through the glottis, and retained by a thread. This was changed from time to time by passing a loop of silk through the rubber tube and the end of the catheter; the catheter was passed up into the mouth, and the tube drawn through the glottis; the loop was cut and the silk withdrawn, the short piece of tube remaining in the trachea and glottis, and retained by a piece of silk tied round its centre, brought out of the wound, and tied round the neck. Through this she was able to breathe and to speak, and, finally, by wearing a tube with an opening in its upper surface, regained her voice. She was not, however, able to dispense with the tube. O'Dwyer's tubes would have been useful in both these cases.

CASE OF PARTIAL EXCISION OF THE LARYNX, PHARYNX, ETC., FOR EPITHELIOMA: EVENTUAL DEATH.

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A GROCER, aged 39, was visited by me in Widnes on February 22nd, 1887, in order to have tracheotomy performed. He was under the care of Dr. McCambridge, and suffered dyspnoea and much loss of voice from laryngeal obstruction, suspected to be due to malignant growth in that passage. Dr. Glynn had been consulted, the growth had been seen with a laryngoscope, and early operation advised, for fear of total obstruction and asphyxia.

The patient was laid on a table and put under chloroform by Dr. Mangan, of Runcorn, other assistance being given by Dr. McCambridge and Dr. Nealon. During the progress to anaesthesia the patient became cyanosed, and it was soon evident that complete respiratory obstruction had occurred. The pulse having ceased to be felt, the chloroform was discontinued, yet every breathing effort intensified the cyanosis, and with it the anaesthesia, which soon became complete; but when respiration faded and actually stopped, the presumption that he was merely dying gave place to the fear that he was actually dead. Tracheotomy was now performed above the thyroid isthmus, and some difficulty experienced in puncturing the windpipe from calcareous hardening of its rings. For this eventuality I was prepared with a pair of cutting forceps; but, after an effort, the knife was forced through the upper rings, and the requisite section made upwards, on which the patient immediately breathed. Before the tube was inserted it was evident that he was safe, and shortly afterwards he was lying comfortably in bed, with a good colour and pulse, ignorant of the peril he had been in. The wound was treated with iodoform gauze slipped under the plate of the tube.

An inspection of the glottis with a laryngoscope just before tracheotomy had given me a view of an intralaryngeal growth having a papillary look suggestive of epithelioma, according to what I had been told. The tumour then appeared to me to be confined to the larynx, where by digital examination it could be felt, while the tongue and epiglottis seemed unaffected. I accordingly offered to attempt excision should the patient care to accept it. This he afterwards eagerly agreed to, but a little time was allowed him to get over any ill effects that might result from tracheotomy, to get accustomed to the tube, and to permit a more generous diet than he had been previously able to take owing to distress from coughing, dyspnoea, and other discomforts. Though he had to live on milk and soup, he took more of them. The trachea tube answered its purpose thoroughly, and his health improved at once. No febrile reaction or a single symptom of illness occurred, and he began to feel comparatively well and strong.

Three weeks elapsed after tracheotomy before excision was attempted. On inspecting the patient, it was noticed that the laryngeal region of the neck was swollen, and the skin over it was red and oedematous. This had only appeared a day or two and was not at first explained, but the cause became evident during the next operation.

On March 15th, 1887, the same gentlemen assisting me, chloroform was given by Dr. Mangan, on a sponge at the end of a bent piece of leaden gas-pipe inserted into the tracheal opening. This being about a foot in length, was intended to permit the chloroformist to work without impeding the operator, while the bleeding caused by the latter was kept out of the windpipe by a small plug of sponge. The long pipe, however, had to be abandoned in favour of the tracheotomy