INTUBATION OF THE LARYNX.

REPORT OF 100 CASES: 38 PER CENT. RECOVERIES, WITH A RUN OF SEVEN CONSECUTIVE SUCCESSFUL CASES.

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THE following is a report of 100 cases of intubation of the larynx for diphtheritic croup, with 38 per cent. recoveries, with a run of seven consecutive successful cases. I will not present all the cases in detail, but desire to make mention of certain cases which demand special notice owing to some unusual and interesting feature in connection with them. I have found, then, that the introduction of the tube is usually accomplished without much difficulty, and one becomes accustomed to perform it with ease and confidence. The extraction of the tube is also usually very readily and easily done; but occasionally considerable trouble is experienced owing to the head of the tube being partially covered by swollen membrane, etc.; obstinate resistance on the part of patients, etc. I am usually a little anxious about the extraction of the tube, but never have failed in getting it out, and now, after an experience of 100 cases, I find extraction almost as easy as introduction.

CASE V. Difficult Extraction.—M. H., aged 2 years; diphtheritic patches upon tonsils and pharynx; duration of disease, three days; marked stenosis and recession of sternum, with cyanosis. Respirations, 45 per minute; pulse, 145. I intubated; dyspnoea entirely relieved, but patient continued restless and feverish; used rectal alimentation and fed by the use of the oesophageal tube. On the fourth day patient's symptoms became quite comfortable, but she was very weak. On the fifth day attempted to remove the tube, but after several trials failed; I could not succeed in uncovering the head of the tube on account of the swelling of the mucous membrane of the epiglottis and ary-epiglottic folds.

Thinking best not to try any more that day we desisted, and attempted its removal on the sixth day, with no better success than before. The child had such great power in the muscles of the tongue and constrictors of the larynx that every time an attempt was made to extract she would resist most stubbornly, preventing my reaching the head of the tube even with my finger. The little patient struggled and choked until she became markedly cyanosed; then followed a series of marked convulsions. We were obliged to stop. The child had ceased to breathe, and we inverted her, used artificial respiration, etc., and after very anxious moments she slowly recovered, and began to breathe regularly again, and we wisely concluded to allow the tube to remain at least for another day. I never had had such serious trouble before in extracting, and began to feel very anxious, although the tube could do no harm if it remained for weeks *in situ*. The parents were unreasonable, and said, "You put it in, take it out now." On the seventh day the last and successful attempt was made. Patient was chloroformed, and a double ligature was passed on each side of the frænum linguæ. In order to draw the tongue well forward and assist in lifting up the larynx a finger was applied to each side of the larynx to raise it still higher, and after repeated efforts we finally succeeded in extracting the tube. The patient made a good recovery, but the voice remained imperfect for several months, but is now normal. She passed through an attack of chicken-pox, and is now well.

CASE X. Recovery: Intubated Five Times in same Case on Second, Third, Fourth, Fifth, and Sixth Days.—B. L. T., female, 5½ years, duration before intubation seven days; had great recession of sternum, cyanotic and restless. Intubated easily, with great relief of symptoms, but upon the second day the tube became plugged with membrane and mucus, and strangulation appeared imminent, when the child expelled the tube. The croupy respiration returned immediately, and I was again summoned. Thinking that we could delay with safety, I waited several hours. All urgent symptoms returned, and I was obliged to intubate to save the child's life. She immediately became comfortable, but fourteen hours later the tube became plugged with membranes and secretions, and was expelled again, and so repeatedly on the fourth, fifth, and sixth days. Each time I waited until urgency of symptoms demanded intubation and would brook no delay, the parents beseeching its performance. On the seventh day after the last expulsion she still had stridulous respiration, and it continued for more than a week afterwards, but not so as to demand intubation. All bad symptoms slowly disappeared, and she made an excellent recovery. This case

demonstrates clearly the duration of stenosis during the attack, and the wonderful efficiency of the tube, and shows conclusively to how great a degree we are dependent upon the instruments and methods devised and perfected by the inventive genius and delicate skill of Dr. Joseph O'Dwyer in the treatment of these difficult and desperate cases.

CASE VI. Recovery; was the Most Convincing of All, and Serves as a Type.—B. A., aged 4½, had been complaining of croup for four days, and had gradually grown more and more croupy; greyish white patches were on the tonsils, palate, and pharynx. This case was extremely urgent in every particular—great restlessness and imminent suffocation. Intubated at once. Prognosis most unfavourable. The breathing was relieved immediately. The respirations fell from 45 to 20, and the patient slept with mouth closed, but continued restless and feverish for several days, when she gradually became comfortable, taking interest in objects about her, at the close of the fifth day, when all danger seemed to have passed, and she suffered very little inconvenience from the presence of the tube, swallowing very well. The tube was removed without any trouble whatever upon the first introduction of the extractor. The difficulty in breathing returned directly, and the little girl cried out: "Oh, doctor, put it back again, I can't breathe!" We soothed and watched her, and the temporary spasm of the glottis, which had been making the trouble, passed away. She was then able to "eat, drink, and be merry," and is now perfectly recovered.

CASES IX, XI, XIV, XVI, XX, XV were apparently hopeless, being called in consultation too late. They were cyanotic, with feeble and irregular pulse, pulmonary complication, and septic poisoning, and even unconscious—yes moribund—and I simply intubated to satisfy the frantic parents, and left the string fastened to the ear. The helpless infants revived, became quite comfortable, partook of nourishment, and seemed to be on the way toward recovery, but died from pulmonary complications, some of them living four days and a half after intubation.

CASE XXXV. Triple Cast of Larynx and Trachea down to Bifurcation, with Intubation and Recovery.—C. T., aged 5½. Consultation with Dr. Ullman. Showed croupy symptoms October 22nd, became rapidly worse, and was intubated on October 24th. She coughed up a cast of the trachea through the tube (Fig. I, 1). It came up in two pieces, and caused considerable dyspnoea and

FIG. I.—Triple Cast of Larynx and Trachea in Case of Membranous Croup.

symptoms of strangulation. Patient did not breathe well, and tube was removed by extractor. Symptoms of stenosis returned immediately, and after a few hours was reintubated. Patient continued restless and feverish, pulse ranging from 150 to 120; temperature $103\frac{1}{2}^{\circ}$ to $101\frac{1}{2}^{\circ}$; respirations 55 to 35. Casts and albumen in urine, and foul patches on tonsils, pharynx, and palate.

October 25th. Respiration became laboured and rapid, and a second cast of trachea (Fig. I, 2) was coughed up through the tube. Patient was nearly asphyxiated, but succeeded in coughing up

the membrane and clearing her larynx. Patient still restless and feverish; temperature 103° ; respirations 45.

On Saturday, October 27th, at 1 A.M., the tube again became obstructed by a third cast of the trachea (Fig. 1, 3). This effectually blocked up the tube, and the patient became cyanotic and in the last stages of strangulation, when the mother of the child inverted the patient, and by means of her finger hooked out the tube from the larynx, by getting her finger-tip under the head of the tube and starting it out of its place. The pressure of imprisoned air behind it forced it up into the pharynx, and the brave mother grasped it and flung it upon the floor. Stenosis of larynx still present, rapid respiration, etc., but did not find it necessary to intubate again.

The after-history of this unusual case is interesting. A severe bronchitis, catarrhal and septic, supervened, and her course toward recovery was slow, complicated by a desquamative nephritis, with casts and albumen in urine, and anasarca of both extremities. She had paralysis of the muscles of deglutition; food, both solids and fluids, came through the nose. She also had strabismus for several weeks. Almost complete aphonia was present.

She finally made a very good recovery; her voice is returning, her strabismus has disappeared, she swallows well, and her urine no longer contains albumen nor casts, and, under tonics, etc., she is in good condition, considering the severity of the ordeal through which she has passed.

This is the only case of membranous croup in which I have ever seen or heard of the membrane forming three times, and it is curious to note that the period of re-formation of the membrane was about forty-eight hours; the last cast of trachea (Fig. 1, 3) being more firm in consistency, it rolled up into a solid plug (see Fig. 1, 3, middle fragment), and it was this piece which came so nearly causing the death of the little patient by strangulation.

Dr. Joseph O'Dwyer is at work devising a certain improvement in his tubes (Fig. II), which is designed to render extraction easy;

Fig. II.—Improved intubation tubes.

it consists of a hinged top with little sharp projections upon the under side, in which to engage the finger-tip, so that the nurse or attendant can remove it by the hand alone, and without the use of the extractor, in cases of sudden obstruction. He has also constructed a set of tubes with no swelling in the centre, of three times the usual calibre, by using thinner material. This set is for use in cases where loose membrane is present below the tube. The membrane can either be more easily expectorated by reason of the larger passage, or having become plugged—the tube may be readily expelled. Though it be rejected every few hours, no harm will be done provided the operator be within reach; for a frequent cause of death is detachment of membrane and sudden suffocation from obstruction below the tube.

A run of Seven Consecutive Successful Cases of Intubation of the Larynx for Diphtheritic Croup.—I will report each of these cases in detail, so that an opinion can be formed as to the severity of the cases, and the necessity for immediate instrumental assistance. I have never intubated unless there existed a most urgent demand for it, nor have I ever refused to operate in cases of advanced laryngeal obstruction, no matter how hopeless it might seem—all these cases were seen in consultation with other physicians.

CASE I.—T. G., aged 3 years, male, seen in consultation with Dr. T. K. Perry, who informed me that for three days and a half the little patient had suffered from diphtheritic croup, with patches upon tonsils, pharynx, etc. Patient was restless and anxious, with marked stenosis of larynx and recession of sternum. The case demanded immediate intubation. This was followed by great relief and profuse expectoration. He slept, and also partook freely of food, swallowing fairly well. On the fifth day I removed the tube with

the extractor, all urgent symptoms having disappeared, but was obliged to reintubate, on account of recurrence of stenosis, but took out the tube on the eighth day, followed by complete recovery.

CASE II.—W. C., male, aged $3\frac{1}{2}$ years; consultation with Dr. Stillman. I had intubated a sister of the patient several weeks before for diphtheritic croup; she unfortunately died from sepsis on the fourth day. Owing to the death of this first child, when the second child was taken ill they very naturally sought other advice. Dr. H. Hun was called. The case progressed under their treatment in much the same manner as the other one, and on the afternoon of the third day Dr. Hun advised immediate tracheotomy. Dr. Balch was asked to perform the operation, but refused to operate on so marked a septic case, and advised them to come to me and ask for intubation. This occurred upon the morning of the third day. Not having very much confidence in intubation, they permitted the patient to become worse, and only upon the urgent solicitation of Dr. Stillman they consented to it as the very last resource. The doctor awakened me at 4 A.M. by telephone, and asked me to come down and do what seemed to me under the circumstances a death-bed intubation. I at first refused, because I supposed that the case was really past all help. The symptoms were all extremely urgent by this time, for the patient had been labouring for twenty-four hours with stenosis, recession of sternum, marked cyanosis, and imminent suffocation, and was rapidly becoming moribund, and I feared oedema of the lungs or an acute bronchopneumonia. The father was persistent in his demands, and I intubated; this was followed by immediate amelioration of all urgent symptoms. Dr. Hun visited the patient at 10 A.M. the following morning. He gave an unfavourable prognosis. He feared a food pneumonia, as the little patient did not swallow very well. The patient progressed very satisfactorily, partaking of food, both solids, semi-solids, and fluids freely; and on the fifth day, all unfavourable symptoms having disappeared, I removed the tube, but the croup was still present; and, after waiting for an hour or so, I was obliged to reintubate, on account of return of all the urgent symptoms, and in reality to save life. I removed the tube again on the eighth day, but was again obliged to reintubate, and allow the tube to remain two days longer; it remained out permanently on the tenth day, but the child continued croupy and partly aphonic for several weeks afterwards. Patient continued to improve, and made a complete recovery. He ate chicken, soup, sausage—in fact, anything and everything that he asked for, and in direct disobedience to my commands, but it did not seem to make any material difference in the result. He is now perfectly well.

CASE III.—T. S., male, aged 3 years 2 months. Seen in consultation with Dr. Lee More. Patient had exhibited croupy symptoms for several days, with patches upon tonsils and pharynx. There were marked stenosis of larynx and recession of sternum. Intubation gave immediate relief, and after profuse expectoration the child slept for four hours without awakening. This was the first good sleep that he had had for several days, he having had to stay awake to keep himself alive. The temperature was 103° , pulse 150. He progressed favourably, and on the fifth day I removed the tube, but was obliged to reinsert it until the eighth day, also until the twelfth day, the disease prevailing with marked severity through the whole of that time, and demanding the presence of the tube the whole of the twelve days. The patient made a good recovery, excepting that he could only speak in a whisper for several weeks afterwards, but he slowly regained his voice, and is to-day perfectly well.

CASE IV.—M. W., female, aged 3 years. Had been treated by five physicians. The croup had prevailed for about three days, and the father of the child, becoming frantic, had gone out into the street in a chance search for help; he hailed Dr. Boyd, who was driving by, and begged him to come and see his child. Dr. Boyd followed the father, and when he saw the child he said that he thought it was past all human help, but that there was one chance in a thousand that its life could be saved, and sent the father in search of me. Dr. Boyd saw the patient about 12 o'clock noon, and I did not see the case until 2.30 P.M. I found the patient in a dying condition, and suffering from extreme carbonic acid poisoning. She was blue, perfectly limp and insensible, with very laboured and shallow and feeble respirations. I informed the parents that I considered the case a perfectly hopeless one and beyond assistance. The respirations were growing perceptibly shorter every minute, and the patient was practically dead. The father pleaded with me to intubate, and at least save his child

from suffocation. I had previously explained to him the danger of oedema of the lungs, etc., or of the almost positive occurrence of a bronchopneumonia, which, after such harsh experience of the lungs in so extreme a case as this one had been, would be almost certainly fatal, but he still persisted. I had taken several of the members of my laboratory class over with me from the medical college, and thinking that perhaps they might be instructed by witnessing an intubation of the larynx, I consented to put in a tube. The patient was perfectly insensible and limp, and she was held in position for intubation by many hands, but the depression of the lower jaw by means of the gag proved sufficient to obstruct the feeble respirations, and the patient ceased to breathe while I was in the act of intubation. This accident had never happened to me before, and fearing unjust censure I quickly removed the gag, laid the child in a horizontal position, used restoratives and artificial respiration. After prolonged and continuous efforts we succeeded in re-establishing the feeble breathing. I was making preparations to quit the house, being content to leave matters at least no worse than I had found them, when the father again begged as before to do what I could to save his child, so I put the child in position once more and intubated as quickly as I could, and left the thread attached to the tube, and fastened to the ear of the child. She brightened up a little before my departure, and I returned in several hours, found her quite comfortable and breathing naturally. She had, however, bitten the thread in two, and had thrown part of it upon the floor, and had evidently swallowed the other portion, and as there was no unusual irritation in the throat, I did not attempt to ascertain exactly just where the remainder of the string had gone. The case progressed in the usual way, and I removed the tube upon the fifth day, and found several inches of the string still attached to the tube; it had been hanging down in the oesophagus, where it had done no harm. The case continued to progress, and made a perfect recovery.

This is the most extreme case that I have ever had or heard of in which complete recovery occurred, and I think all will agree with me in crediting to Dr. Joseph O'Dwyer's ingenuity the salvation of this case.

I have had somewhat similar cases, but with fatal results, one in which I was called, but found that the patient had actually ceased to breathe. The candles had been lit and the prayers were being said for the dead. I noticed, however, that the platysma myoides had not ceased its spasmodic contractions. Despatching the father hastily to my carriage at the door for my intubation case I hastily intubated. I employed artificial respiration, and succeeded in recalling the almost extinguished respiratory centres, and the little fellow returned to consciousness, and appeared to be out of danger. He partook of nourishment, talked, laughed, and expressed himself as being desirous of going for a drive, etc., but died of pulmonary complications thirty hours afterwards, to the extreme disappointment of his parents, but in strict accordance with my prophecy, which proved alas! too true.

CASE V.—T. B., male, aged 3 years, seen in consultation with Dr. Cook. Had had diphtheritic croup for three days and a half previously; had been in a regular croup-camp, with atomiser, steam, etc., but all the usual urgent symptoms prevailed without abatement. I intubated, and this was followed by marked relief and copious expectoration, and several hours of peaceful sleep. He partook of nourishment well, and on the sixth day, all signs being most favourable, I removed the tube, and pronounced the patient convalescent.

CASE VI.—W. D., male, aged 3 years 3 months, seen in consultation with Dr. Brown. Patient had shown croupy symptoms for several days, and became very markedly croupy, with restlessness, stenosis, and recession. I intubated, and obtained the usual relief. The patient at first swallowed badly, but soon learned to drink in the bent-forward position, and the case proceeded uninterruptedly for five days and a half. Upon removal of the tube by the extractor he, after a few minutes, quieted down, and made a perfect recovery, making a sort of typical case in every particular.

CASE VII.—F. B., male, aged 5 years 4 months, seen in consultation with Dr. Reynolds. He had previously been under the care of Dr. Dhevlín (uncle to the patient). He had gradually reached a most desperate condition. He was cyanotic, and his countenance expressive of great anxiety. He was restless, and had recession of sternum and marked stenosis. I visited him in the afternoon and advised intubation, but the parents would not consent. About 10 P.M. all symptoms were much more urgent, and the little fellow

was dying fast; then the parents desired that I should intubate. I did so, and he wore the tube for five days. His temperature (104° F.) and pulse (140) were high, and he emaciated rapidly. He was suffering from sepsis. He partook freely of stimulants, quinine, etc.; was treated by corrosive sublimate internally, and locally by atomiser. After removal of the tube he was very weak; he could not stand alone, and had a catarrhal or septic bronchitis, for which we were obliged to treat him for several weeks with tonics, cod-liver oil emulsions, and wheat phosphates. His convalescence was slow, but he is now in very good condition considering his recent severe illness.

In the narration of the above cases it will be observed that they were for the most part exceedingly severe in their character, and it would seem like folly even to hope to save them all. In fact, my experience has been more often the other way. Once I was so unfortunate as to lose seven consecutive cases.

The one factor of the greatest success in the remarkable group of cases just related was the comparative slowness, notwithstanding the severe and threatening nature, of the malady. It afforded time in which to do good work. It will be noted that they were not proceeding with that frightful degree of rapidity with which some cases manifest themselves, for within a few days I have been called by two of our most experienced physicians to intubate for croup, and before I could reach them, even when responding within an hour and a half, both cases had terminated fatally.

Intubation is of great assistance in the treatment of diphtheritic croup, but it cannot be expected to save more than a certain percentage of cases; all that intubation does is to keep the glottis open, so that respiration can continue, and it is only an aid in the battle against sepsis, bronchopneumonia, etc. Some cases are from the very inception doomed, either from the rapidity with which they are progressing, or the intensity of the morbid processes at work—dying within twenty-four or thirty-six hours, and with the tube perfectly free; while, on the other hand, I have had cases in which it was necessary to keep the tube in the larynx twenty-three days, the stenosis continuing during the whole of that time, and demanding the presence of the tube to prevent suffocation, and yet the patient was finally saved.

The operation of intubation requires from three to eight seconds for its performance; and so accustomed may one become as to be able to intubate without the introducer. On one occasion I had simply a tube with me, and as the case was very urgent, I intubated simply with my hands.

A word as to general results. In 100 consecutive cases of diphtheritic laryngeal croup it has been my good fortune to have saved 38 per cent.

INTUBATION OF THE LARYNX.

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THE comparative study of intubation of the larynx on the one hand, and of tracheotomy and laryngotomy on the other, by those who have had experience of these operations, shows that the former has both advantages and disadvantages over the latter. It will probably be found that, especially in young children, the advantages predominate and the results are better.

After intubation in membranous croup (diphtheria of the larynx), I have seen bad results ensue from extension of the membrane beyond the range of the tube—an occurrence which might, of course, also follow tracheotomy. This is indicated by the usual signs of cyanosis, and in addition by a peculiar, laboured "wheezy" expiration of gradual onset. It is of importance to recognise the signs of this extension, as one might otherwise be apt to infer that the tube was at fault, and so have recourse to a fruitless tracheotomy; for intubation does not necessarily preclude a subsequent tracheotomy. Certain disadvantages which appertain more particularly to the operation of intubation are illustrated by the following cases:

1. At the beginning of February of 1889 I intubated, at the request of a practitioner, in the case of a child, aged 21 months, for "membranous croup." The insertion of the tube was followed by marked relief of the breathing, and all went well until about six hours afterwards, when, in my absence, profuse bleeding from the mouth and nose set in. The child died almost immediately.