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IN THE  
Treatment of Croup.

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## THE COMPARATIVE MERITS OF TRACHEOT- OMY AND INTUBATION IN THE TREAT- MENT OF CROUP.<sup>1</sup>

BY GEORGE W. GAY, M.D.,  
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DR. JOSEPH O'DWYER'S method of intubing the larynx for croup, which has engaged the attention of the profession for the past few years, is slowly but surely crystalizing into its proper place as an important adjuvant to tracheotomy. The novelty and boldness of the method are so striking, that many surgeons whose experience had made them familiar with the old operation hesitated, and very properly hesitated, to accept the new one, until careful and repeated trials had demonstrated its value to a reasonable extent. That stage in its career has now been reached. There can be no doubt that it relieves dyspnœa; that it saves life; that it is a reasonably safe operation to do; and that in the majority of instances, it is more easily performed than tracheotomy. Hundreds of cases of intubation have now been put upon record, and the results are fairly satisfactory. The immediate relief to the dyspnœa may not, in the severe cases be as complete, as it is after the old operation, yet it is usually sufficient for all practical purposes. Intubation has met with opposition, but in spite of its dangers and inconveniences, from which no method of treating these affections is free, its advantages are gradually forcing themselves upon the profession, as experience becomes more extensive. The operation calls for much patience and perseverance in the after-treat-

<sup>1</sup>Read before the American Surgical Association, at the Congress of American Physicians and Surgeons, Washington, D.C., September 20, 1888.



ment, more especially in the feeding of the child, and for this reason, if for no other, the surgeon should hesitate to pass a final opinion upon its merits, until he has seen a goodly number of cases. It will be the object of this brief paper to set before you, as clearly as I am able, the advantages and disadvantages of the two methods of relieving the dyspnœa arising from acute membranous laryngitis.

In considering this subject the first point to engage our attention is the comparative results of the different modes of treatment. Which operation saves the more lives? All other questions are secondary to this one. If it appears from experience, that intubation saves as many, or about as many patients, as tracheotomy, then, whatever may be its dangers or its disadvantages, it justly claims a careful and thorough trial at the hands of all, who are called upon to treat this most serious affection.

Statistics are proverbially unsatisfactory, and at times they are positively misleading; yet in trying to decide the question at issue more or less dependence must necessarily be placed upon them. Agnew, Lovett and Munro, Mastin, Stern, and others have given us the results of many thousands of cases of tracheotomy, and while the rate of recovery varies greatly in the different groups, yet a fair average may be put at about twenty-eight per cent. One of the latest, as well as the largest collection of statistics of this operation was very carefully made last year (1887) by Drs. R. W. Lovett, and John C. Munro,<sup>2</sup> formerly house-surgeons at the Boston City Hospital. They collated nearly 22,000 cases from every available source, taking especial care to avoid duplication. As a rule they rejected all groups of cases under five, and mostly those under ten, "for the reason," as they say, "that

<sup>2</sup> American Journal Medical Sciences, July, 1887.

recoveries predominate enormously in the very small groups." "It was considered that to count such groups would be misleading, and they were all rejected, whether favorable or not, because they were not considered representative." Twenty-eight per cent. of these cases resulted in recovery. The percentage of recoveries in Agnew's<sup>3</sup> cases was 26%, as was also that in Monti's collection. Dr. Wm. M. Masten has gathered 860 operations from American sources. Of these 195 were saved (22%). The following American statistics are not included in Masten's tables. H. Z. Gill,<sup>4</sup> reports 151 tracheotomies performed in Illinois, with 38 recoveries (25%). In over 100 tracheotomies Dr. John H. Ripley, of New York, saved 33%. Dr. C. G. Jennings, of Detroit, has had 18 successful cases in 37 operations, Dr. C. T. Parkes,<sup>5</sup> has had 18 recoveries in 31 cases. My own cases of tracheotomy for croup amount to 103. Of these 35 recovered, (33%).

Previous to January, 1887, which was about the time of the introduction of intubation into our city, 327 tracheotomies had been performed at the Boston City Hospital.<sup>6</sup> Most of these cases had occurred since 1880. 95 patients recovered, making the rate 29%. Since intubation has come into vogue in that institution, 57 patients have been tracheotomized, but only 7 have recovered. This high death-rate is due to the fact, that as a rule, only the severest cases, or those in which the new operation failed to give relief, were subjected to the old method. Of these 57 patients 27 were under 3 years of age; 25 died.

It is a well-known fact that children suffering from croup are seldom sent to a hospital, until all measures,

<sup>3</sup> Max. J. Stern, M.D., Medical Register, November 12, 1887.

<sup>4</sup> Annals of Surgery, April, 1881.

<sup>5</sup> American Lancet, November, 1886.

<sup>6</sup> Lovett and Munro, op. cit.

other than surgical have been fairly tried. The hospital being the last resort, the patients are often in a most deplorable condition upon their arrival, and are very unpromising subjects to undergo any sort of treatment. It has always been the rule in the City Hospital to insert a tube, or at least to make the attempt, in every instance however desperate the condition of the patient might be. Such being the fact the results of the operation as given above are reasonably satisfactory.

Dr. O'Dwyer thinks that the published records of the results of tracheotomy are too highly colored; that the operation is not as successful as the literature upon the subject would lead one to suppose. He says "that, with rare exceptions, only the few operators who have good results publish their cases, which is a mere bagatelle compared with the whole number operated on."<sup>7</sup> If this be true in relation to tracheotomy, it is difficult to understand why the same statement may not be made in regard to intubation. Both operations are resorted to for the same affection, oftentimes under similar conditions and by the same operators, and, so far as experience has taught us, the results of intubation are not so uniformly successful as to preclude the possibility of silence on the part of timid or sensitive practitioners.

From careful inquiries, and from my personal knowledge of the matter, I feel justified in stating that from one-fourth to one-third of the tracheotomized patients in Boston and vicinity recover. Applying this statement to the subject at large, I think that reliable statistics will warrant us in accepting it as a fair conclusion of this part of our inquiry.

Such being the record of tracheotomy, what is the verdict of about three years' experience with intuba-

<sup>7</sup> Medical Record, Oct. 29, 1887.

tion? Dr. O'Dwyer,<sup>8</sup> whose skill in inventing, and whose perseverance in developing and perfecting the operation are worthy of all praise, has performed it 205 times. Forty-seven patients got well. It is but fair to state that 65 of these operations were done during the experimental stage of the method with various kinds of tubes, and upon foundlings, who were in a very unfavorable condition to withstand the disease. Omitting these cases, and his record stands thus: operations, 140; recoveries, 38 (27%). Dr. Dillon Brown writes me that he has performed the operation 190 times, and has had 51 recoveries (26%). He operates late, when the symptoms are severe, and only after a thorough trial of other measures has been made. Dr. F. E. Waxham<sup>9</sup> has operated upon 150 patients, 41 of whom recovered (27%). He has collected 1,072 cases of intubation, showing a rate of recovery of 27%. Dr. Frank Huber<sup>10</sup> has intubed 94 patients; 37 were saved (39%).

Dr. Stern<sup>11</sup> has collected 953 cases, of which 252 (26%) recovered. Dr. E. Fletcher Ingals<sup>12</sup> has brought together 514 cases, most of which had never been published; 134 were successful (26%). Intubation was first done at the Boston City Hospital in December, 1886. With varying results, it has grown in favor, and is now the accepted mode of treatment for the majority of cases of croup. It has been performed in that institution 107 times for this affection; 26 patients recovered (24%). The ages ranged from seven months to fourteen years. The youngest, who recovered, was nineteen months old; she wore the tube more or less for sixteen days. The oldest was

<sup>8</sup> Correspondence.

<sup>9</sup> Intubation of the Larynx, p. 105.

<sup>10</sup> Correspondence.

<sup>11</sup> Op. cit.

<sup>12</sup> N. Y. Medical Journal, July 2 and 9, 1887.

ten years, but, as she wore the tube only one day, the case must be considered a light one. Another patient, aged twelve years, was relieved for a short time by the laryngeal operation, but tracheotomy was finally necessitated to ease the dyspnoea. She died in a week from bronchial croup and septicæmia. In ten instances both operations were performed; all were fatal. They were desperate cases, accompanied with a good deal of exudation and sepsis.

The ages of 92 cases of intubation at the City Hospital were as follows:

	Number,	Recovered.	Per cent.
Under one year, . . . . .	1	0	..
1 to 2 years . . . . .	12	1	8
2 to 3 " . . . . .	13	3	23
3 to 5 " . . . . .	35	10	28
5 to 7 " . . . . .	20	8	40
7 to 14 " . . . . .	11	4	36

Total Number 92, with 26 Recoveries.

In 15 cases the age was not given, but the patients were all young; they were in the last stages of the disease when admitted, and they all died. It will be noticed that the ratio of recoveries gradually increased with the age of the child up to seven or eight years, when it began to diminish. Such was the fact in 1,600 cases of tracheotomy collected by Lovett and Monro<sup>13</sup> from Cohen, Masten, and others. From 20% in children under two, the percentage ran up to 40% at eight years of age. A similar result obtains in the 327 tracheotomies at the City Hospital.

The results of intubation in the experience of different operators presents as great a variation as do those in tracheotomy. While O'Dwyer, Brown, and Waxham save about 1 in 4, Huber and Montgomery<sup>14</sup> save 1 in 2; O'Shea and Van Fleet save 1 in 3; Northrup

<sup>13</sup> Op.cit.

<sup>14</sup> Stern, op. cit.

and Denhard 1 in 5, Jennings 1 in 10, Cheatham 1 in 15, and A. B. Strong 1 in 31.

If the statistics of either operation prove anything, it is that the type of the disease determines to a great degree the result of treatment. The light cases will get well, and the worst cases will die after either operation.

It is claimed that more patients under three years of age recover after intubation than after tracheotomy. Waxham gives 52 cases, with 13 recoveries (25%); Huber<sup>16</sup> 49 cases, of which 17 were successful (34%). In Dr. O'Dwyer's 100 cases in private practice, 35 were under three, and 5 recovered (14%). Stern has analyzed 519 cases of intubation under three and one-half years of age, and finds that 23% recovered. Comparing these results with 1,300 tracheotomies reported by Bourdillat, he finds that intubation gives more recoveries under four and a half years, after which period the old operations appear to be more successful.

Twenty-nine of the 107 City Hospital cases of intubation were under three years of age. Of this number, 4 recovered (13%)—an experience which corresponds very closely with O'Dwyer's. It is a singular fact that in 83 tracheotomies under three performed in this institution, the ratio of recovery was nearly the same; namely, 12%, there being 10 successful terminations. Masten reports 32 tracheotomies under three years, with 5 recoveries (16%). While the weight of evidence at present tends to substantiate the claim of the superiority of intubation in young children, further experience is desirable before the question can be considered as definitely settled.

To recapitulate: Dr. O'Dwyer with a modesty and scientific candor worthy of emulation gives us his ex-

<sup>16</sup> Correspondence.

perience with the new operation, (would that he had given us his results with the old one), and wisely awaits the verdict, which time and further trial will surely render. Waxham thinks that more young children, and as many older ones recover after the new method. Stern reports the percentage of success as about the same from both operations; namely, 26%. Sajons<sup>16</sup> thinks that the old method is the more successful. "Skilled tracheotomy will, I believe, save more cases than intubation, but the operators seem to be few who can obtain the best results." "I think tracheotomy will save every case that intubation can, and a great many more."<sup>17</sup>

Three hundred and twenty-seven cases of tracheotomy, and one hundred and seven cases of intubation performed at the Boston City Hospital, show but a small difference in the results, (five per cent.). So far, the old method has the larger ratio of success, but the number of intubations is not yet large enough to definitely determine the relative value of the two operations in saving life. I trust that I may be pardoned for quoting the following remarks from one of Dr. O'Dwyer's letters in relation to this matter: "From the large number of cases of croup treated at the Boston City Hospital, it certainly affords the best opportunity for the study of this disease to be found anywhere in this country. When you shall have accumulated the same number of intubations, that you have had tracheotomies, it will settle the question of the comparative methods of the two operations in saving life, better than thousands of cases collected from various sources."

It may appear to some that sufficient evidence has not yet been accumulated to definitely settle the point at issue, but I think that after making due allowance

<sup>16</sup> New York Med. Journ., July 23, 1887.

<sup>17</sup> C. G. Jennings. Trans. Mich. Med. Soc., 1887.

for that enthusiasm, which naturally attends a new and important surgical procedure, the facts available at present go to show, that nearly, if not quite, as many patients recover after intubation as after tracheotomy. This is a triumph for the new method which ought to please even its most ardent admirers.

It having been shown by the most reliable facts and figures at hand that intubation is reasonably efficient in relieving dyspnoea, and in saving life, several other points now present themselves for consideration, and among them is the comparative ease and facility of performing the operation itself. It is undoubtedly true that as the new method does not require the knife, nor an anæsthetic, permission to do it is more readily given. For these reasons an earlier interference is practicable, thereby conserving the strength of the child. It is difficult to understand the assertion made by some writers, that it is an easy operation to perform. "You will find no difficulty in doing intubation," says one. "The child is swathed, the gag is in, the tube is in, the thread is out, the gag is out, and the relieved and bewildered child is looking about, coughing, and quite unable to comprehend the surroundings."<sup>18</sup> This is a brilliant picture, and while it may be true in numerous instances in the hands of an expert, yet very many physicians, who will be called upon to do the operation, are not experts, and to them the above assertions will be misleading. O'Dwyer's remarks upon this point would seem to be more in accordance with common experience. "Nothing could be more erroneous than the prevalent opinion, that it is an easy matter to place a tube in the larynx or remove it, but I am satisfied that a single trial will serve to convince most persons of this fact."<sup>19</sup> Hence the importance of practising the method upon the cadaver.

<sup>18</sup> W. P. Northrup, M.D. Medical Record, December 11, 1886.

<sup>19</sup> O'Dwyer. Medical Record, December 11, 1886.

Intubation is often a difficult operation to perform upon patients under three, or over twelve or fourteen years of age, and at any age if the epiglottis and neighboring structures are much swollen and infiltrated. In young children the space in which the necessary manipulations take place is limited, the larynx is small, deep and movable, and made more so by the struggles of the patient. In adults it is difficult to reach the top of the larynx with the forefinger, except when they try to vomit or cough or swallow. During these efforts the larynx is raised sufficiently to be felt, and a quick, dextrous motion will usually carry the tube to its destination. If the parts are extensively infiltrated and thickened, it is by no means easy to determine the different structures by the touch, while the exhausted condition of the patient often demands, that the least possible amount of time shall be consumed in placing the tube. Several fatalities have occurred under these circumstances, and unless one is reasonably familiar with the operation, and can do it quickly without using force, a careful tracheotomy would probably be a safer procedure. A moderate experience will enable most surgeons to do the operation with comparative ease and facility, except under the conditions above mentioned, but whoever thinks that intubation consists in simply sliding a tube down the throat, as he would a sponge probang, will probably have ample reason to change his mind before he has operated upon many young, or upon many very sick children.

In doing this operation one fact should always be borne in mind, and that is, that no force is required to enter the larynx. If the tube does not pass along easily, then the direction is wrong. O'Dwyer mentions two cases in which the autopsy revealed a perforation of the walls of the larynx from too great force. A

cool head, steady nerves, and gentle manipulations are essential to a proper performance of this operation.

It is often more difficult to remove than to introduce the O'Dwyer tube: The calibre is small, the inner surface coated with secretion, making it slippery and difficult to hold, the larynx is deep and movable, which added to the struggles of the child, make the manipulation anything but easy. Care is to be taken that the forceps be not opened till they have entered the tube, as the larynx is liable to be lacerated.

Tracheotomy, like intubation, may be easy or difficult according to circumstances. Every one knows how difficult it is to do in young and fat children, as the trachea lies deep in the neck, is small, soft and movable, the veins are large and tortuous, and hæmorrhage is likely to be free, thus obscuring the parts and delaying the surgeon. Under these circumstances intubation is undoubtedly the better procedure in a majority of cases. Should the patient be greatly prostrated from sepsis or other cause, both operations are attended with danger, and the physician would do well to select the one with which he is the most familiar.

For several years I have discarded sulphuric ether as an anæsthetic in tracheotomy. It produces congestion of the mucous membrane and an increased secretion to such an extent as to increase the dyspnœa in many instances to a dangerous degree; spasm of the glottis is also likely to follow, thus adding another element of embarrassment to a condition already sufficiently grave. Chloroform usually acts very kindly in these cases, and unless the child is unconscious, or partly so, it is my custom to give a few whiffs — just enough to benumb the incision in the skin. After that is divided, this operation is attended with little pain, and is better completed without further anæ-

thetia, thereby lessening or entirely avoiding shock. With plenty of assistance, the operation can be satisfactorily done without any anæsthetic.

Tracheotomy can be done with the aid of one good assistant. Intubation requires, at least, two. If the operator cares for the integrity of his left forefinger, he will see to it that the gag is intrusted to a reliable person, to one who will not allow it to be displaced by the tongue, or in the struggles during the brief period of suffocation while the tube is being placed. Ingals mentions a case of diphtheria in a physician contracted from a bite, which proved fatal. A patient can be quieted with chloroform during tracheotomy, but, in doing the new operation, reliance must be placed upon the strength and steadiness of the assistants. In an emergency, the old operation can be done with less aid than the new, but to do either comfortably, the same help is required in the one as in the other.

As time goes on, it will probably be found that as many patients perish while undergoing the new operation as the old. The dangers in tracheotomy are collapse and hæmorrhage, and yet the deaths which occur upon the table are not common. Ten of the City Hospital cases proved fatal in that manner. "Two of these evidently died of heart-failure, for they stopped breathing before the trachea was opened, and had but slight hæmorrhage. Four had profuse hæmorrhage, and two died of shock some little time after the tube was put in place and everything seemed favorable. In the remaining two cases the records are not full."<sup>20</sup>

The most serious accident liable to occur during intubation is the obstruction of the tube or trachea by dislodged membrane or other secretion. Fortunately, it is not a common occurrence, but it calls for prompt action to save the patient. The tube is to be removed,

<sup>20</sup> Lovett and Monro. *Op. Cit.*

and unless the efforts of nature are sufficient to clear the air-passages, the trachea should be opened at once and artificial respiration resorted to if necessary. In fact, the new operation should not be undertaken in severe cases of membranous croup without having the facilities for tracheotomy at hand for an emergency.

To one not familiar with the new method, the rapid respiration, 60 to 80 per minute, sometimes present might seem to be due to the small calibre of the tube. Such, however, is not the fact in my experience, as I have done tracheotomy under these circumstances without making the slightest difference in the rapidity of the breathing. This symptom means bronchial croup or pneumonia, and is not due to lack of space in the tube of either kind.

Some difference of opinion exists in the profession as to the amount of care and skill required in the after-treatment of intubed patients. I suppose no one will question the desirability of having skilled assistance at hand for three or four days after both operations, but in very many instances this is impossible. The points to be decided are, what operation should be done in cases where the after-treatment must be left principally to a nurse or to persons with ordinary tact and ability, and what one is to be chosen when the tube can receive no attention of consequence. In well-appointed hospitals, where reliable aid is always available, these questions are of less importance than in sparsely settled districts, or when the patient lives miles away from a physician or other competent assistance. The tracheotomy tube always requires more or less care to keep it clear, but any one of ordinary tact can soon learn to do it by means of feathers, steam, instillations, and so on. In an emergency, the string may be cut, both tubes removed, and the wound kept patent by means of a dilator until the obstruction is relieved.

On the other hand, while the O'Dwyer tube is much less liable to become filled up, yet it does "gum," or it is suddenly occluded in some cases, and, unless it is coughed out, it must be removed and cleaned. Of course, no one can do this unless he has had some training and experience. Herein lies one of the dangers of this method. If the patient cannot relieve the dyspnoea by ejecting the tube, he must bear it as best he can till help arrives. Death occasionally takes place under these circumstances. Whether the obstruction be slow or sudden, an ordinary attendant can take care of a tracheal tube, but not of the laryngeal.

The testimony of one of our best nurses, who has had a good deal of experience in taking care of both classes of cases, is interesting in this connection. She says: "In a hospital, or wherever a physician is within easy call, I had rather take care of intubations. Under the opposite conditions, I should feel safer with tracheotomy." The reason for this is that it is sometimes necessary to replace the O'Dwyer tube immediately to prevent suffocation. This is especially true in septic children.

In cases where the tube can receive no attention whatever, as among the very poor, etc., intubation is probably the better procedure. Some risk must be taken under these circumstances, and as the danger from sudden or gradual obstruction is not very great after the new method, this would seem to be the best one for the occasion.

As to the relative amount of work and care involved in the after-treatment of the two operations, it may be said that a good nurse will find plenty to do after both. "The time we used to spend in taking care of the tracheal tube is now occupied in feeding the children; but, on the whole, it is less work and more agreeable

to take care of intubations." So says the nurse above referred to, and the testimony of the house-surgeons is all in the same direction.

In many instances it requires great tact, patience, and perseverance to give intubed children sufficient nourishment. Liquids choke them more or less, and too often they have no appetite for solids. Occasionally a child gets frightened, and refuses to make an effort to take anything, in which case tracheotomy is advisable. Soft solids, like ice cream, mush, eggs, etc., are valuable articles of diet under these circumstances, and something can be done by means of nutritive enemata.

Rarely is there any difficulty met with in feeding tracheotomized children. In the very sick there may be a total want of appetite for even liquids. The power to swallow is also occasionally impaired by paralysis of the muscles of deglutition, which allows the fluids to return from the nose, or even to enter the trachea, and find exit through the tube. This seldom occurs except in very septic cases, and even then it is far from common. As a rule the power to swallow is not interfered with by tracheotomy.

A great deal has been said and written about "food pneumonia," and other affections caused by the entrance of food to the lungs, via the laryngeal tube. It is true that patients cough and choke a good deal while taking liquids, but at the autopsies pathologists do not find any evidence of food in the finer bronchi. Dr. Northrup,<sup>21</sup> has reported 107 autopsies made at the New York Foundling Asylum, in which special attention was paid to this point, and no evidence whatever was found to show that the extension of the disease was due to the presence of a foreign body, such as milk or other food. Surely if a hundred post-mor-

<sup>21</sup> Medical Record, December 11, 1886.

tem examinations made with reasonable care and intelligence do not reveal the existence of this alleged condition, that question may be considered settled for the present.

It is a well-established fact, that in a large proportion of the fatal cases of croup, death is due to an extension of the disease to the deeper air passages producing bronchial croup or pneumonia. It has been claimed that intubation would prevent this complication to a great extent, for the reason that the air thus gains entrance to the lungs through the natural channels. Experience does not, as yet, seem to substantiate that assertion. In 50 of O'Dwyer's 73 fatalities death was due to an extension of the disease. Of the 109 deaths reported by Waxham, 69 perished in this manner. The cause of death in the majority of fatal cases of intubation at the City Hospital was bronchial extension. In fact they died from the same causes, in the same manner, and in about the same time after the new operation as they formerly did after the old one of tracheal section.

Dr. O'Dwyer uses the following language in relation to this subject: "Although pneumonia is not an uncommon sequel of intubation of the larynx and of tracheotomy, I believe the principal factor in its causation after both operations is the impairment of the expulsive power of the cough from the inability to close the glottis, and the consequent retention of the irritating substances in the bronchi, and not the entrance of extraneous substances through the tube."<sup>22</sup> Others ascribe the frequency of these affections in thacheotomized patients to the fact, that the air enters the lungs directly, without having been warmed and moistened by passing through the normal channels.

I venture to express my doubts as to the soundness

<sup>22</sup> O'Dwyer, *op. cit.*

of either of the above opinions. So far as we know at present bronchial croup is just as frequent, and just as fatal in cases which have received no surgical treatment whatever, and in which the power to cough and expectorate has not been interfered with. The only difference to be noticed is, that the patients live longer in consequence of the operation, thus allowing the secondary affections to reach a greater degree of development. It is the natural tendency of the exudation process to extend in all directions, downwards to the bronchi and smaller tubes, as well as upwards to the nares and so on, in spite of any and all methods of treatment. Speaking in general terms we can neither prevent it, nor cure it. Such being the facts as is conclusively shown by the experience of a multitude of observers, it is unnecessary to ascribe the causation of these secondary affections to any mode of treatment, until a reasonable array of facts can be brought forward to substantiate the assertion.

While it is always desirable on general principles to avoid a wound in the skin, yet that made in doing tracheotomy seldom gives much trouble, or does much harm. "Diphtheria of the wound was noted in only 6 of the 327 cases; 3 of these recovered."<sup>28</sup>

The septic material or poison does not enter the system in that way. It has gained admission, as a rule, long before there is any occasion to make a wound; and moreover, the septic cases pursue the same course whether an incision has been made or not. It is rare for the tissues to slough or abscesses to form, or other untoward local event to occur in these cases. This objection to tracheotomy is more theoretical than practical.

The tracheotomy tube occasionally irritates the trachea, and produces exuberant granulations. So

<sup>28</sup> Lovett and Munro, *op. cit.*

likewise does the laryngeal tube. Northrup found ulceration in five autopsies caused by the irritation of the lower end of the tube upon the anterior wall of the wind-pipe. These complications are not common, however, and they need not deter us from choosing either method in accordance with the other conditions present in the case.

A final word as to the after-effects of each operation upon the voice and general health. Drs. Lovett and Munro,<sup>24</sup> personally investigated 56 cases of tracheotomy with these two objects in view. The operation in every case had been done at least a year previous to the examination. "Fifteen cases were seen from one to two years after operation; 16 cases in three years; 12 cases in four years; 2 cases in five years; 6 cases in six years; 4 cases in seven years; and 1 case in twenty-one years." There had been no deaths in this number of cases (56), and 53 were found to be in good general health. None of them had had a second attack severe enough to call for surgical interference, only 6 were liable to sore throats, a remarkably small proportion.

The voice was clear in all but 4 cases; and in these the impairment was not grave. One could not sing as high as she could before the operation, but laryngitis without operation produces the effect upon the voice at times, so that all the trouble cannot be fairly laid to the treatment.

The residences of seventeen children, who were intubed at the City Hospital, have been visited by Dr. C. M. Whitney, formerly house surgeon, at periods varying from two to fourteen months after the operation. One child had died a month after the onset of the disease from some cerebral affection, probably the result of sepsis. All the other children were well.

<sup>24</sup>Op. cit.

Every one of them had been hoarse for a term ranging from two to twelve weeks. One had aphonia for two weeks. The voice in the fatal case mentioned above, never returned after the operation. So far as can be known at present, every one who survived eventually regained the voice in its natural degree. One had had a return of "croup" in eight months, but it was not membranous. All of these children swallowed without any difficulty. I have not been able to gather any evidence showing that the O'Dwyer tube produces permanent impairment of the voice, or of the power of deglutition.

I have thus in a very imperfect way, endeavored to show that, while intubation is a most valuable operation, it is not as free from objections and complications, and is not so far superior to the old and time-honored operation of tracheotomy as some of its advocates would lead us to suppose. The method has great advantages. In favorable cases it is easily and quickly performed; there is no cutting, and hence no hæmorrhage; no anæsthetic is required: as it is not looked upon by the laity in the same light as an ordinary surgical operation, consent for its performance is more readily granted; it can thus be done earlier in the disease; many practitioners will undertake the new method who would shrink from the old one; the tube takes care of itself; it is often coughed out when no longer required; it is especially adapted to young children.

But on the other hand, the operation may be difficult and even dangerous to perform; it may not relieve the dyspnœa; the tube may be repeatedly coughed out or it may be swallowed; it may "gum" thus requiring frequent removals; it may become suddenly occluded, and unless quickly ejected or removed, death will ensue; and there may be great difficulty in feeding the patient.

Both operations are often attended with difficulties, and occasionally with danger; both are liable to complications; the mortality attending each is about the same; the fatal results in a majority of instances are due to the extension of the disease to the lungs, and this occurs as frequently after one operation as after the other; in neither case is the treatment the cause of the complication, nor does it prevent, or cure it.

In conclusion, I would say, that in a majority of cases of membranous laryngitis intubation may be done with a fair prospect, that it will effectually relieve the dyspnœa for the time being.

That it is to be preferred in young children and in all cases living at a distance from skilled aid, where the tube must be allowed to take care of itself.

That it may be resorted to preliminary to tracheotomy.

That it may be done for euthanasia providing the operator is reasonably expert and can do it quickly without producing collapse.

Tracheotomy is indicated in those cases in which intubation cannot be done, or in which it fails to give relief to the dyspnœa.

In severe cases situated at such distances, or under circumstances in which only ordinary and not skilled assistance can be obtained in an emergency, tracheotomy is the safer method.

It is also to be preferred in those cases of intubation which cannot be fairly nourished either in the natural way or by enemata, etc.

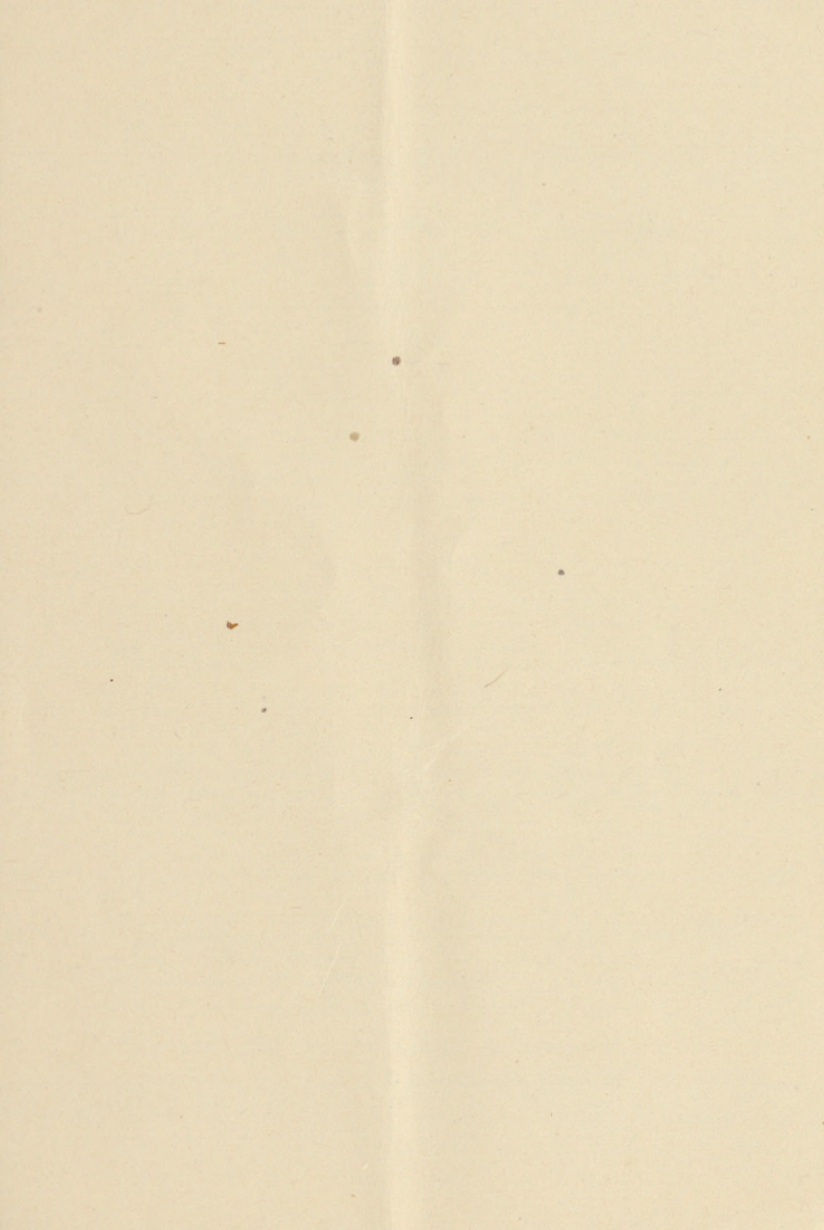
It may be resorted to when the O'Dwyer tube is frequently ejected, or when it requires frequent removal to prevent obstruction.

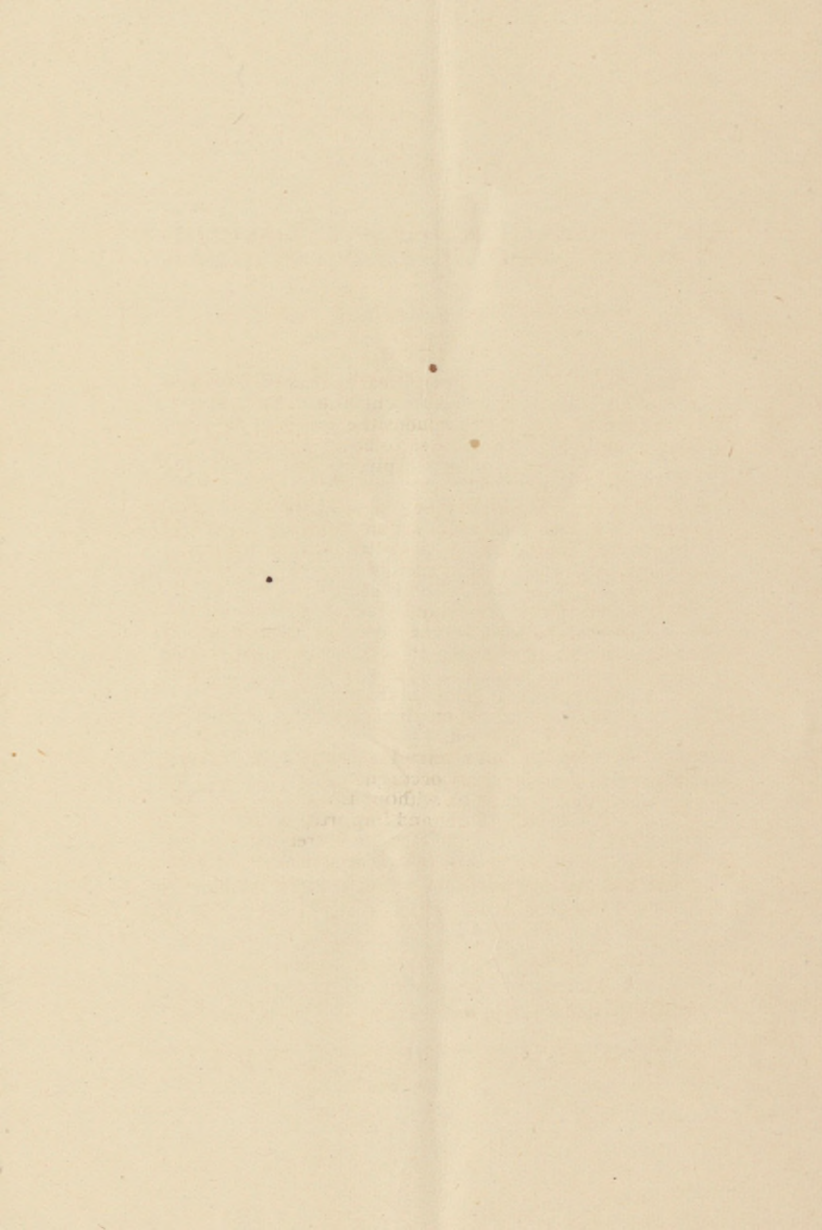
I would repeat that as regards patients residing at a distance, if competent aid is to be at hand during the convalescence, intubation is advisable as it is if no

care whatever is to be given to the tube. But if ordinary care and no other in case of accident can be commanded, and I mean by that, a fairly good nurse, or any clever person, then tracheotomy is the better procedure.

Each operation supplements, but neither supplants the other. The old one should ever be held ready to come to the aid of its young and vigorous rival. That Dr. O'Dwyer's method is a most valuable one, is amply shown by the fact, that it is surely growing in favor, and that new evidence in that direction is constantly being presented. As it has been before the profession but a few years, there is reason to hope that some means will be found to overcome its disadvantages, and thus make it a more complete substitute for the older, more serious, and more difficult operation. It marks a real advance in the art of surgery; and it is an honor alike to its ingenious inventor, and to American skill and perseverance.







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