LOVETT (R. W.)

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Being a Study of 858 Cases Operated On at the Boston City Hospital.

BY

ROBERT W. LOVETT, M.D.,

OF BOSTON;

OUT-PATIENT SURGEON TO THE BOSTON CITY HOSPITAL; ASSISTANT SURGEON TO OUT-PATIENTS AT THE CHILDREN'S HOSPITAL, AND SURGEON TO THE INFANTS' HOSPITAL.

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THE operation of intubation for the relief of croup is one that has excited the deepest interest in the last few years, and its merit is a question of the greatest practical value. It comes into competition, of course, with the older operation of tracheotomy, and the question of the comparative merits of the two is one that has been the subject of many articles. At the end of six years of trial, during which time the operation has been performed upon thousands of cases, intubation stands in a position to be judged on its merits, and to be compared with the operation of tracheotomy as a life-saving measure.

There are two methods of presenting this comparison to the reader: (1) By the relation of personal experience and by weight of authority[1]; (2) by the statistical method, which is open to the objection pertaining to all statistical inquiries in medicine,

[1] Faulkner: THE MEDICAL NEWS, April 9, 1892.

but which, upon the whole, seems to me to be a more scientific and satisfactory mode of procedure.

The objection to any method that collects reported cases of the two operations from literature and endeavors to draw conclusions in this way as to the comparative merit of the two lies in the fact that the statistics of either operation greatly vary according to locality and the individual reporter, so that in this way they lose much of their value from their lack of uniformity.

When groups of cases of tracheotomy, for instance, are collected from literature, the variation in the recovery percentage is a most striking one. For example: in 9242 cases collected from French authors the recovery percentage was 24, while in a group of 400 cases reported by Wauscher, of Copenhagen, the recovery percentage was 42. It is manifest that if any practical conclusions are to be drawn from the comparison of tracheotomy and intubation statistics, the two classes of cases should have been, to a certain extent, under like conditions. It is for this reason that I venture to call attention to two groups of cases, taken from the records of the Boston City Hospital, which seem to have more than a passing interest in determining the relative value of these two operations. I have nothing new to present in a statistical way, and merely desire to call attention to certain obvious deductions that seem warranted from the two groups of cases already reported from the Hospital. These deductions are, however, necessarily colored by my personal views and experience.

With regard to the opportunities afforded at this

Hospital for such observation, it may, perhaps, be permissible to quote the remarks of Dr. O'Dwyer, in a letter to Dr. G. W. Gay:[1] "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 as 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."

Up to the year 1887 the operation of tracheotomy was the only one performed at the Hospital. The cases from 1864 to January, 1887, were collected and analyzed.[2] Of these cases there were 327. Excepting in 30 cases, all of the operations were done between 1880 and 1887. The first intubation was done at the City Hospital, December 31, 1886, and from that time to January, 1891, the operation was performed 392 times.[3] It seems perfectly fair to contrast these two groups of cases as bearing upon the merits of the two operations, because they were performed under like conditions, upon the same class of cases, and, for the most part, by the same surgeons. The operation of intubation was taken up with interest, and was most carefully watched.

[1] G. W. Gay: Boston Medical and Surgical Journal, October 11, 1888.

[2] Lovett and Munro: The American Journal of the Medical Sciences, July, 1887.

[3] Prescott and Goldthwaite: Boston Medical and Surgical Journal, December 31, 1891.

It should be borne in mind that the cases included in these two groups are, for the most part, severe cases. The Hospital is particularly well equipped for the care of these cases of diphtheria, and, in general, cases are sent to the Hospital in preference to being operated upon at home. At the same time it is easy to see that the cases are sent to the Hospital generally as a last resort, after the expectant treatment has been pursued in most cases too long, and the children who are admitted to the surgical department of the Hospital are only too often in a hopeless condition. As mentioned by Dr. Gay, it has always been the policy of the Hospital to perform the operation, even in manifestly hopeless cases, in the hope of affording relief. It cannot, therefore, be expected that the mortality percentage will be a low one when such a class of cases is taken for analysis; nor, as a rule, would the results be nearly as favorable as in private practice, where cases are likely to be seen earlier, and where mild cases would be seen. The proportion of cases developing laryngeal symptoms in the Hospital is a small one, and most of the cases are admitted in a state of urgent dyspnea.

For the most part, the conditions from 1880 to the present time have been constant. If there has been any change, it has been since February, 1888, when a new diphtheria-ward was opened, which is particularly well equipped and well ventilated, so that it would seem probable that any change in the conditions would tell in favor of the later operation of intubation. Since July, 1890, two house-officers have been detailed for exclusive duty in the con-

tagious service, serving two months, and living in the ward. If there is any fault to be found with the results of either operation at this Hospital, it is not to be ascribed to unfavorable conditions or inefficient nursing. The conditions are as favorable as possible.

After this prelude, it may be permissible to examine in detail what the results of the two operations have been, as exemplified by the figures taken from the books of the Hospital. Up to 1887, tracheotomy had been performed in 327 cases for croup. Of these cases, 232 died, and 95 recovered, making a recovery percentage of 29.05 ; ten cases died during or soon after operation, but only four of these from hemorrhage. It was manifest from a study of these cases that the tracheotomy death-rate at the Hospital continued for months in closest correspondence with the mortality percentage of diphtheria in the whole city of Boston. In short, when diphtheria was most fatal in the city tracheotomy was most fatal at the Hospital. It is presumable that the same conditions could be applied to intubation, although it has not been possible to analyze the cases in this regard. It must, however, be evident to anyone who sees many of these operations that it is the severity of the disease that kills in most cases rather than any influence related to the operation itself.

In the 327 cases of tracheotomy there were four in which it was difficult to remove the tube. Several months elapsed before it could be permanently taken out. All of these cases completely recovered.

In short, tracheotomy was performed 327 times, with 29.05 per cent. of recoveries; ten cases died

immediately, presumably as the result of the operation, and in four cases there was difficulty in removing the tube.

The first intubation at the Hospital was performed on December 31, 1886, and from that time until January 1, 1891, this operation had been done 392 times. During this time 139 tracheotomies were performed. It is manifestly unfair to consider these tracheotomies as having any bearing upon the question at all, because, in those four years the operation of intubation was adopted as a routine procedure, so that tracheotomy was reserved for the most part for the severest and most desperate of the cases, in which it seemed hopeless to do intubation, so that these 139 operations, in which the recovery percentage was only 11½, cannot be taken into account in any way. It is not by this meant that the cases of intubation were selected, but that, naturally, tracheotomy, as the old and more tried operation, was adopted as a last resort in the severest cases. When it is noted that nineteen of these tracheotomy cases were moribund at the time of operation it can, perhaps, be better understood how desperate the majority of them were.

Of the 392 cases of intubation, 312 died, and eighty recovered, making a recovery percentage of 20.41. The accidents occurring in connection with tracheotomy have been mentioned, so that it seems perfectly fair to speak of the more numerous accidents in connection with the operation of intubation. Twenty-one times intubation was attempted, and immediate tracheotomy was necessitated by the cessation of breathing. Of these cases only two

recovered. In three cases death occurred during the attempt to insert the tube. Two children died during the choking-spells. In two cases the tube was drawn into a bronchus, and death of course resulted. In two the insertion of the tube was followed by convulsions. In two the introducer broke during the operation. This list of accidents, all necessitating tracheotomy, it seems to me, is a serious commentary upon the operation of intubation.

It is no easy matter to do an instantaneous tracheotomy when an intubation tube has been introduced and has failed to give relief, or when the attempt at intubation has caused sudden choking. The child is generally lying in bed, the cessation of breathing is instantaneous and very threatening, and the conditions are not favorable for the careful and successful performance of tracheotomy. The fact that only two of twenty-one cases of this sort recovered is not encouraging for the performance of such operations. The operations were performed with care, and under otherwise favorable conditions, inasmuch as they were undertaken in a well-equipped hospital, so that the liability to accident should have been certainly no larger than in private practice.

In two respects, then, intubation does not compare favorably with tracheotomy in the study of these two series of cases: 1. The death-rate of intubation is 9 per cent. higher; 2. Accidents during intubation are much more common.

It is of especial interest to consider the merits of the two operations with regard to children under three years of age. The outlook could hardly be

worse than it is in tracheotomy. Of forty-two patients under two years of age, on whom tracheotomy was done, only three recovered, while, of 123 cases in which intubation was performed on children under three years of age, 14.63 per cent. recovered. Although these two groups of cases cannot be very well compared on account of the differences in age, yet if an operation is so nearly hopeless as is tracheotomy, it seems wiser to perform the milder operation of intubation. Again, tracheotomy in these very young children is likely to be a difficult operation, and, although intubation is by no means easy in these small mouths, it seems to me to be a more acceptable operation than tracheotomy in children under two years of age. In children between two and three the question would be debatable. With regard, however, to the choice between the two operations in general, the question is often evaded by the performance of intubation, to be followed by tracheotomy. Should the case progress badly, it is against this secondary tracheotomy that I would particularly protest. I would plead for the early performance of tracheotomy if it is to be done at all.

The showing for this secondary tracheotomy is exceedingly bad when the figures are considered. In the City Hospital figures there were 57 secondary tracheotomies, with 5 recoveries. Ganghofner[1] has reported 21 late tracheotomies in 42 cases of intubation, all of which were fatal. Urban[2] lost all of 18

[1] Jahresbericht f. Kinderheilkunde, 1889, xxx, 3.
[2] Deutsche Zeitschrift f. Chirurg., 1890, xxxi.

secondary tracheotomies done after 32 intubations. Jakubowski did 27 secondary tracheotomies in 64 intubations, and 25 died. Mudd[1] saved 3 out of 4 secondary tracheotomies.

These are all the reported groups of secondary tracheotomies that I have been able to find, but as a collection they afford very little encouragement for secondary tracheotomy, whatever the cause may be of this great fatality:

	Secondary Tracheotomy.	
	No. of cases.	Recoveries.
City Hospital	57	5
Ganghofner	21	0
Urban	18	0
Jakubowski	27	2
Mudd	4	3
Total	127	10

The recovery percentage was 7 8, and without Mudd's very exceptional group only 5.8 per cent. recovered.

To commit oneself to a method of procedure of which the recovery percentage in cases of average severity ranges from 6 to 8 seems unjustifiable. In view of these figures the conclusion that I would present is that intubation is not so favorable an operation as tracheotomy for the saving of life in severe laryngeal diphtheria. The chief reason for this appears to me to be twofold: intubation does not afford such good drainage to the trachea, and only a limited amount of nourishment can be taken by the intubated patient.

[1] Medical Mirror, January, 1890.

First, as to drainage. A child on whom tracheotomy has been performed expels through the tube large quantities of detritus, consisting of mucus, pus, and diphtheritic membrane. The metallic expulsive sound with which this is ejected is familiar in every tracheotomy room. The stuff comes out, often a teaspoonful at a time, for two or three days, and the larger the amount of discharge the more favorable the outlook for recovery.[1]

In intubation cases this does not occur. Whatever becomes of this mass of material, it is certainly not expelled from the mouth. It may be swallowed or it may be inhaled, but it is not often expectorated. To my mind this is a great disadvantage, in comparison with which the occasional accidents associated with intubation are of little account. The material is highly septic, and its retention in the body cannot be otherwise than harmful. This is a matter that has been largely overlooked, but which is certainly of consequence in severe diphtheria.

The limited amount of food that most cases of intubation are able to take is also to my mind a decided objection to the operation in severe diphtheria. In the tracheotomy series the children took from twenty to forty ounces of milk a day. Thirty ounces constituted a fair amount, and when a child took less than twenty-five ounces it was noted as an unfavorable symptom. In the intubation cases the diet was retricted to soft solids, which are inferior to milk in their sustaining power, and a much less quantity was generally taken than was the case in the tracheotomy series. A diet of soft boiled eggs,

[1] The American Journal of the Medical Sciences, July, 1887.

milk-toast, ice-cream, and oatmeal, is not a stimulating one, nor is it one very well suited to maintain the strength throughout an intensely septic and prostrating disease. Rectal injections can of course be used to supplement feeding by the mouth, but only a limited amount of food can be taken in that way, and often none at all is retained. It has been said that it is the severity of the disease that kills in most cases, whatever the operation, and the free stimulation possible in tracheotomy cases is often a powerful aid in withstanding the great prostration and sepsis. To give up the hourly stimulation of concentrated food and alcohol, pushed to its utmost, is to my mind to give up a very important means of doing good in these desperate cases.

Most of the objections so often urged against intubation seem trivial in the extreme. The fact that the lumen of the tube is smaller than the normal trachea, that tubes are occasionally coughed out or swallowed, the fact that food is occasionally drawn into the trachea, are matters of small moment. Intubation tubes become stopped with membrane often, but so do tracheotomy tubes. These are comparatively trifling matters.

When, however, an operation shows a recovery percentage of nine less than the operation that it is intended to supersede, in presumably the same class of cases, it becomes time to criticise it, and, if possible, to find the source of the greater fatality.

In conclusion, I would again call attention to the lamentably small recovery percentage in cases in which tracheotomy has been performed after a preceding intubation. Again, accidents, and especially

hurried tracheotomy, occur often during attempted intubation. In most cases these eventuate fatally.

Finally, I would suggest that the cause of this increased fatality after intubation in severe diphtheria lies in the imperfect drainage and the limited amount of nourishment that it is possible to give.

The performance of any operation as a routine practice is of course unfortunate, and individual cases should be treated according to their especial features, but in general I would be glad to advocate the performance of tracheotomy instead of intubation in most cases of severe laryngeal diphtheria, except in the cases of children under two years, when intubation is to be preferred.