INTUBATION.

INCLUDING A REPORT OF SOME UNUSUAL CASES.*

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Notwithstanding the active opposition of many prominent British and continental specialists, the administration of large doses of antidiphtheritic serum and intubation have become generally recognized as among the most successful life-saving methods in the hands of the pediatricist or laryngologist. This treatment, however, of laryngeal diphtheria in private practice has not attained the wide field of usefulness which it deserves. The larger and earlier doses of antitoxin have developed new indications for the treatment of tube cases, and greatly reduced the mortality.

In an experience with over 350 intubations with antitoxins in private practice some peculiar difficulties have been encountered which I have not observed to have been recorded in our literature, except meagerly. The usual technic of intubation may be necessarily modified in a hurried introduction of the tube. When the handle of the introducer can not be pressed well down against the chest wall, the tube may be passed in a horizontal, lateral position into the pharynx, and then tipped to the vertical, engaging the left index finger when in position; or the index finger and the tube resting against it in proper position may be passed simultaneously to the opening of the larynx.

A study of the various modifications of the O'Dwyer instruments made by Collin, Baer, Tsakeris, Egide, Rabot, Bauer, Fisher, Trumpp, Bayeau and others is exceedingly interesting. We are led to the conclusion that the European surgeon is endeavoring to avoid the use of our perfect American instruments, but with more expensive results. Let us join with Waxham, Nicoll, McCollom, McNaughton and others in a plea for the ideal instruments and tubes of O'Dwyer. Let them remain in their perfection as a fitting monument to the genius of the master who presented them. Two or more sets of seven tubes are essential for careful work.

The operation should not be attempted without practice on the phantom, anesthetized dogs, or the cadaver. Traumatism, followed by superficial and deep ulceration, retained tubes, or the spasmodic ulcerous condition, characterized by frequent autoextubations, result in many cases when an ill-fitting tube is worn. The selection of a proper tube for each patient deserves the most careful consideration. The great value of experience in technic and the dangers and accidents of intubation have been pointed out by the numerous writers.

Variations in the size of the lumen of the larynx are found in different races. An Italian child of three years frequently requires a two-year tube, while those of Polish or Bohemian parentage, for example, will frequently wear a tube a size larger than the American subject. The presence of adenoids and other nasal obstructions so common in children who develop severe laryngeal diphtheria are also important factors in the development of malformations. These patients often require smaller tubes than the age would indicate. The peculiar abnormal topography of the larynx, as a high or low variety, may be noted as a family anomaly, where two or more intubations are required in the same household. The expert sense of touch alone can reveal the peculiar deviation from the normal larynx in the living child. A

plea is made for an accurate interpretation of abnormalities or pathologic conditions by digital examination of the larynx. This is not attained without considerable practice.

The laryngologist who is not an intubationist does not frequently resort to digital examination of the larynx. As the late Dr. O'Dwyer has said, little is known about malformation of the larynx in children. A considerable number of infants undoubtedly die of undetected congenital stenosis of the syphilitic, vestibular, web or pouch varieties. The diagnosis must be carefully made before operation. I have been called to intubate cases of asthma, pneumonia, acute laryngitis, laryngismus stridulus, retropharyngeal abscess, foreign body in the trachea, laryngitis of measles, and edema, which were mistaken for the stenosis of diphtheritic laryngitis.

Intubation is usually considered an easy operation, especially in a child from 3 to 4 years of age. In point of fact, it may be exceedingly difficult or impossible. Ingals and Abt of Chicago and Ranke of Munich report impossible cases. My experience will add one case to the list. Operation was attempted many times by my colleague, Dr. P. M. Hickey, and myself in a child 1½ years of age, suffering from laryngeal diphtheria until tracheotomy was necessary. The right arytenoid region was infiltrated and firm under the finger. The one-year tube was used and engaged the laryngeal opening perfectly. With gentle pressure it could be advanced about one-half inch, only to meet with a firm obstruction. Intubation was attempted after tracheotomy, with the same result. When the child died some days later of bronchopneumonia, a postmortem was refused. The patient apparently had a congenital stenosis just below the right arytenoid.

In endeavoring to teach students the proper technic serious difficulties are presented, which are given meager consideration in the various books on the subject. Some men never can learn to intubate. The prominent difficulties, briefly stated, are: Large or clumsy fingers, imperfect tactile sensibility, insufficient attention to detail, poor knowledge of the anatomy of the larynx and adjacent structures, the use of too much force or tendency to carry the tube too far posteriorly into the esophagus. A considerable number of cases have come under my observation recently where the former operator had failed to intubate. The causes of failure have been carefully studied. They are exceedingly interesting and instructive. An intubationist can not be considered an expert until he has performed the operation on at least 25 cases. The usual difficulties are then overcome and confidence is established.

CAUSES OF FAILURE TO INTUBATE.

The most common causes of failure are, first, the faulty position of the patient. With the head thrown well back, we have a direct route into the esophagus. With the patient "held as if hung from the head," the larynx is readily entered.

Second, proper technic is dependent on drawing the tongue well forward. We frequently note the effort of patients who have been previously intubated to resist the introduction of the tube by forcing the root of the tongue backward and holding the epiglottis well over the opening of the larynx.

Third, spasm of the glottis may cause the tube to slip over into the esophagus or engage the folds of mucous membrane on either side. This is easily prevented by holding the tube in place until the patient takes a deep inspiration.

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Fourth, peculiarities of structure or conditions about the epiglottis may interfere with the operation. In children from 6 months to 2 years, the flexible epiglottis may curl downward and posteriorly under the index finger, making it difficult to restrain the normal function of the cartilage. Edema may make the operation difficult.

Fifth, the cause of failure is frequently due to the use of a larger tube than necessary.

Sixth, hypertrophy or edematous arytenoids, a large leathery diphtheritic exudate, a sharp lateral or anterior curve of the laryngeal bands or tumors greatly increase the difficulties.

Seventh, the use of force is only mentioned to be condemned.

The resulting hemorrhages, syncope, false passages and other traumatisms are unnecessary.

Gentle, firm pressure may be required to force the tube through a subglottic obstruction into position after the obturator has been removed. A deep inspiration offers a favorable moment to exercise this steady pressure.

OBSTRUCTION OF TUBE WITH MEMBRANE.

The use of large doses of antitoxin has increased the so-called danger of pushing down the diphtheritic membrane ahead of the tube. The exudate separates more rapidly and easily from the mucous membrane under the action of the serum, and this accident occurs frequently. It is usually to the advantage of the patient, however. The sudden withdrawal of the tube immediately during the paroxysm of coughing may be attended by the expulsion of a cast of membrane. Where difficulty is experienced in dislodging the detached membrane from the larynx or trachea, mechanical emesis produced by placing the handle of a spoon against the base of the tongue and pharyngeal wall is usually sufficient. This may be followed by several teaspoonful doses of spts. frumenti until coughing is produced. Repeated intubations may succeed if these measures fail. Severe hemorrhage and syncope during a skillful operation are extremely rare.

Obstruction of the tube with loose membrane is much more frequent when antitoxin is given 12 to 24 hours before operation. Casts of the larynx and bronchi are frequently expelled as such in these cases at the time of intubation, or they may be pushed below the tube. When the familiar valve-like sound is heard with each expiration it denotes the danger of obstruction.

CARE AND EXTRACTION OF TUBE.

Large doses of antidiphtheritic serum have made possible a procedure that obviates the danger of sudden death from obstruction of the tube, facilitates the extraction, and in private practice has been found entirely practicable, especially among children over three years of age. Where this method has been followed of leaving the string fastened with adhesive plaster across the left cheek, no prolonged or retained tubes have been necessary. Where antitoxin has been given in large doses, 24 hours or more before the operation, the tube is usually worn from two to three days. It is possible during so brief a period to allow the string to remain in place. Under these conditions the nurse can easily remove the tube in case of danger, and the anxiety of the parents is greatly relieved when prepared for this emergency. In some cases among ungovernable children and unreliable parents this method is not a success. Leaving the string is obviously not necessary in hospital practice, where the services of a trained nurse and expert intubator are always on call; but in private city practice it is convenient, simple, practicable in older children, and also in

many selected cases under three years of age. The technic, accidents and dangers of extraction are eliminated. It is a well-known fact that edema of the tissues in the region of the epiglottis and arytenoids often follows the most careful manipulation, and a slight swelling about the entrance of the larynx may result in obstruction enough to require reintubation. Gentle removal of the tube with the string has been followed by no obstructive edema in my series of cases. In a few cases the string seemed to increase the difficulty in taking nourishment, but post-pharyngeal paralysis also existed in several as the explanation of the trouble. When genuine interference with swallowing is encountered, the string or tube may be removed.

A case which illustrates one of the unusual accidents of extraction came under my observation some months ago. A previously healthy child, 4½ years of age, was intubated with a three-year tube for the relief of stenosis due to laryngeal diphtheria of the descending type. Three thousand units of antitoxin as an initial dose were administered, and the child placed in an improvised croup tent. Although the sepsis was extensive from an infected area involving the tonsils, both pillars and a portion of the pharyngeal wall, the child made an uninterrupted recovery until the morning of the fourth day, when extraction was attempted. As the closed jaw of the extractor was resting against the head of the tube, with a deep inspiration the child raised up suddenly and the head of the tube was pressed below the cords. An effort to remove it by the method known as enucleation proved unsuccessful, as the cartilaginous rings of the trachea were exceedingly firm at this age. Five possible methods may be available in these cases. First, evulsion or enucleation; second, a specially modified slender extractor with a long curve and sharply pointed beak; third, the use of a general anesthetic and the extractor; fourth, the extractor and x-ray; fifth, tracheotomy as a last resort. In this case the special extractor was inserted below the cords, while the left hand held the larynx from the exterior. The instrument could be felt to come in contact with the head of the tube, and gentle pressure with a delicate side-to-side motion was sufficient to engage the proper opening and remove the tube.

INTUBATION FOR OTHER CONDITIONS.

Intubation for the relief of dyspnea due to multiple papillomata in children is successful as a measure of temporary relief. The theory of producing sufficient pressure by the tube to produce absorption of the growth has not received the practical verification expected. A case that illustrates the limitations of the operation in this condition came under my observation.

CASE 1.—H. L., a boy aged 4 years, was referred to me by Dr. E. L. Shurly. He was suffering from a slowly progressive difficulty in respiration, with complete aphonia.

Symptoms.—The dyspnea became so great at times that danger of asphyxia was imminent. The attacks of laryngeal spasm with great cyanosis increased and surgical interference was demanded.

Treatment and Result.—He was sent to Harper Hospital and intubation was performed with complete relief. The tube was worn for some months, during which time it was removed each week and reinserted after some hours of natural respiration. Persistent treatment by this method resulted in normal respiration without the tube for an interval of three to four days. The patient returned to his home in a neighboring city and instructed to have intubation performed at home. A week later he was returned in a serious condition, with the information that no physician in the city was able to intubate.

Subsequent Treatment.—Tracheotomy was performed and the

larynx put at rest for over a month. Subsequent operations were also performed by Dr. E. L. Shurly during my extended absence from the city, when portions of the papillomata were removed through the tracheotomy wound and finally a thyrotomy was performed, with almost complete restoration of voice.

Intubation for papillomata can be classified as a temporary measure of relief only, and when performed tracheotomy instruments should always be at hand. It is possible that gelatin alum or other astringents or medicaments, when applied as a coating about the tube, might be useful in these conditions.

INTUBATION IN THE ADULT.

Intubation in the adult for the relief of acute stenosis is not attended by the successful results obtained by the intubation of the child, although Casselberry reported six cases, with five recoveries. While operation with the use of a laryngoscopic mirror is the method generally indicated in chronic stenosis, cases of acute obstruction in private practice present conditions which demand hurried intubations with the index finger as a guide. The adult cases that require intubation for acute conditions are, fortunately, very rare. Three cases have come under my observation. They are two cases of acute secondary edema, both of which were fatal, and one of diphtheria, as follows:

CASE 2.—Mrs. F. B., age 29 years, was seen in consultation with Dr. Burgess Dec. 19, 1903, on the sixth day of the disease, and sent at once to Harper Hospital.

Examination.—Examination revealed a diphtheritic exudate over the tonsils, pillars, pharynx, uvula and epiglottis. Laryngoscopy showed the extension of the pseudo-membrane over the arytenoids and downward, apparently completely obstructing the lumen. Respirations were thirty and very labored.

Treatment.—Four thousand units of antitoxin were administered, and intubation, with the index finger as a guide, was performed at once. The tube was immediately expelled with a complete cast of the larynx, and the trachea beyond the bifurcation, followed by perfectly easy respiration. Three subsequent intubations were necessary (two performed by Dr. P. M. Hickey in my absence), and a thick leathery cast of the larynx was expelled at each operation, although 12,000 units of diphtheritic antitoxin and 20 c.c. of antistreptococcus serum were administered during the forty-eight-hour interval. Although the laryngeal dyspnea was entirely relieved, the patient died on the ninth day of anuria and septicemia of the streptococcus and Klebs-Loeffler varieties. In this case it was unnecessary to leave the tube in place.

The adult larynx is extremely irritable in this condition, as reported by Dr. Casselberry in his paper, "Intubation in Acute Stenosis."

CONCLUSIONS.

1. O'Dwyer tubes and instruments are generally satisfactory. No cheap modifications or substitutes are required.
2. Digital exploration of structures about the entrance of the larynx are as relatively important in diagnosis as examination of the nasopharynx.
3. Failure to intubate is due to the operator, except in very rare cases, in which it is impossible to intubate.
4. Obstruction of the tube is more frequent after large doses of antitoxin. Therefore, the string should be left when indicated.
5. Early intubation is advocated in private practice and removal of the tube at the beginning of the fourth day.
6. Early removal of the tube and large doses of antitoxin before operation are in direct ratio.
7. Intubation is usually indicated as the primary operation in papillomata of children and acute stenosis in adults.

DISCUSSION.

DR. GEORGE F. COTT, Buffalo, N. Y.—We are all aware that intubation is becoming a lost art, now relegated to the surgeon. I have been wondering why laryngologists do not practice it more, and have been told it is because they are afraid of carrying infection from diphtheritic patients. I do not believe that, for these same men take care of tubercular and syphilitic throats. I have also been told that probably some of the younger men do not practice intubation because they are afraid of carrying the infection to their babies. I said that I did not believe that either. I have never had any trouble, nor have I taken any precautions except as to my hands. It is difficult to teach intubation. I have tried it on the adult cadaver in the dissecting room and found that a poor practice. It is difficult to get bodies of young children for intubation purposes. I mentioned these difficulties to a class, and one of the young physicians, taking a post-graduate course, offered himself as a volunteer, and I intubated him twice. He never volunteered again, however. Intubation puts the larynx into an irritated condition for from twenty-four to forty-eight hours. The young man wrote up his experience, and I read it to one of the societies. It is important to know when to intubate and what result to expect. Dr. Shurly has intubated 350 cases; I have intubated 109, and have had almost every accident except a false passage. I have been called to cases a number of times where the child was turning blue, the reflexes were abolished and it was gasping for breath, but pulse quite full and normal. The tube may be put in in half a second, and the child will live in every instance. Here you have a peculiar condition, want of oxygen, with a normal pulse. When you have poisoning from the Klebs-Loeffler bacillus you have a very rapid and compressible pulse, an indication of acute fatty degeneration. In that case the child will die every time, with or without intubation. It does not die from suffocation, but from the bacillary alkaloidal absorption. In the course of the next few years students will probably know very little of the art of intubation. Since the advent of antitoxin, it is almost impossible to get a good intubator. When you have a membrane in the throat and nose, it is also in the trachea, and the string must be left on the tube, or the child will be suffocated by the membrane occluding the tube. When you are sure the trachea, nose and throat are free of membrane, then you can take the string out. If a man is not expert enough to remove the tube, it is well to leave the string in and tie the child's hands so that it can not possibly pull out the tube. The tube may be left in indefinitely. I have intubated one child as many as fifty or a hundred times in six months. It is as well to-day as ever and has a perfect voice. A healthy larynx can not stand much irritation, but a diseased larynx can stand anything.

DR. W. E. CASSELBERRY, Chicago—Intubation is becoming a lost art, not for the reasons mentioned, but because antitoxin cut short the stage of constriction of the larynx. When I heard Dr. Shurly refer to 350 cases of intubation since the introduction of antitoxin, I confess that I was surprised, and can only infer that for some reason, in certain districts in Detroit, the diagnosis of diphtheria is not made sufficiently early. I have had very few cases of intubation since the advent of antitoxin. This reason for the decline of intubation is supplemented by the other, that more physicians are capable to-day of making intubation than formerly. I have not found it difficult to teach intubation. I have taught one hundred men annually the initial steps, and many of these students subsequently perfected themselves in practice. The instruction is on young cadavers which are accumulated by the institution for this purpose. The class is divided into sections, and each member is compelled first to make a digital examination for study of the pharynx and larynx, then to make an intubation and extubation. Pediatricists and general surgeons also are conversant with the art. Fewer cases and more operators may mean diminished skill with which to meet complications, but the general good has been subserved. As to the absolute inability to make an intubation in any given case, the unexpected is especially liable to happen with this procedure. I recall a case of Dr. Plummer's which came to autopsy, at which it was demon-

strated that the inner caliber of the cricoid cartilage would not permit the passage of the smallest tube of the O'Dwyer set. In a case of my own, a partial ankylosis of the jaw precluded a proper manipulation of the instruments. A sphincter-like spasmodic closure of the larynx interrupting the passage of the tube is a real possibility. I have seen this happen in laryngeal diphtheria in a girl of twenty years of age on whom I was making intubation under laryngoscopic observation. With two phases of this subject I have been especially interested—the posture method of feeding, and intubation in the adult. Intubation in the adult is a good procedure when you can perform it under laryngoscopic observation, but I have warned the profession against it when the patient is moribund or recumbent, usually on a slouchy bed and unable to sit up, and when the diagnosis is not accurately made. In such emergency cases, usually of erysipelatous or infectious edema of the larynx or those with an underlying syphilitic or tuberculous stenosis, tracheotomy is much the safer and more satisfactory operation. One's index finger is too short to guide the tube in most adults, and, moreover, the mere insertion of the finger into the throat when the patient is already *in extremis* may cause immediate death. The so-called posture method of feeding after intubation of the larynx, which originated, and which was instrumental in popularizing the operation by satisfying the distressing thirst of patients without the danger of "swallowing pneumonia," consists in feeding while the head and chest are inclined downward, at such an angle as to preclude liquids from gravitating through the tube into the lungs, the ability in this position to "swallow upward" being, of course, retained. I wish to report continued success and satisfaction with this method of feeding with the head and chest on a downwardly inclined plane.

DR. KATE W. BALDWIN, Philadelphia—I will say for the benefit of those teaching on the cadaver, that it is of advantage to do a preliminary tracheotomy and thereby control the tube with the finger from below. It adds very much to the facility with which the tube is introduced and also in the removal.

DR. B. R. SHURLY—I should like to see the day when we can have an expert intubator in every large city. There are a great many practitioners in our city who have returned from courses in the east without being able to do an intubation, and I can not agree with Dr. Casselberry that intubation is easily learned, even with courses of instruction. I have trained my students carefully with the phantom, the cadaver and on the dog, and by the time they were through they were able to perform the manipulations. Yet I am often called in by some of these very men for cases of not unusual difficulty. There are new indications which have developed since we began to use large doses of antitoxin. The tube can be removed much earlier, especially when the string is left on. The fact that I have had so many cases under my observation in Detroit is due to the large Polish settlement there. They are densely ignorant, live in unhygienic conditions, disease thrives among them, and they will not call in a physician until after the disease is under way three or four days. This makes intubation necessary in a great many cases.

Graduates of Medical Schools.—In THE JOURNAL, Aug. 13, 1904, we published a table showing the results of state board examinations in 1903 and remarked that many deductions might be made from the tabulated facts, but that we left it to others to make them. In a letter to the editor of the *New York Medical Journal* a correspondent has made certain deductions from the standpoint of a Philadelphian. He shows that graduates of the Philadelphia schools give a smaller percentage of failures than the graduates of schools in other cities and that the proportion of failures by graduates of Washington schools was more than three times that of the graduates from Philadelphia, and of those from Baltimore, Louisville, and St. Louis, respectively, it was over *four, five* and *six* times that of the Philadelphia candidates.

A CHIEF PREDISPOSING CAUSE OF APPENDICITIS.

A PRELIMINARY NOTE WITH A FEW LABORATORY EXPERIMENTS.*

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CHICAGO.

One evening in the fall of last year I was called to the bedside of a man who had suddenly become ill with symptoms typical of acute appendicitis, viz., chills, nausea and vomiting, general abdominal pain and local tenderness over the ileocecal region. The patient's history was as follows:

An American, of German extraction, 40 years of age, unmarried, stenographer, almost a total abstainer, and of excellent habits in general. Family history excellent. He has always been well, with the exception of a diarrhea several months ago, of a few weeks' duration, from which he made a complete recovery. For a week or so preceding his last illness he was troubled with flatulency, though it caused him slight inconvenience.

After remaining in bed for ten days, and with appropriate medical treatment, the patient made an uneventful recovery from appendicitis.

In considering the case in all its bearings, but especially with regard to the intestinal flatus preceding his attack, the following questions arose: Why is appendicitis rare in infancy and early childhood and also in persons of advanced years? If, according to some authors, who claim that appendicitis is due principally and primarily to infection or to an extension of infection from the bowel, then the disease ought to be by far more common during the early years of childhood. The susceptibility at this time to infection in general, and especially to intestinal infection, is well known; at least there are no *a priori* reasons for believing that infection of the appendix from the bowel or through other channels, e. g., lymphatic or blood system, might not occur as readily in infants as in adults. We might assume from this that infection occurs at a later stage in the evolution of appendicitis.

The etiologic connection between appendicitis and fecal concretion, though not emphasized as much at present as formerly—in many text-books, however, still occupies a conspicuous position. If this were an important factor in the production of appendicitis, the disease would surely be more common in persons advanced in years, owing to their greater liability to formation of concretions and calculi generally. If the same conditions govern the development of concretions or calculi in various parts of the body, then we might also rightfully expect women to have appendicitis more frequently than is the case, judging from their marked predisposition to gall-stone disease.

Constipation is, according to a number of authors, a condition that favors the development of appendicitis. But such a view becomes untenable in considering the great disproportion of appendicitis in the sexes. If constipation really played an important rôle in predisposing to this disease, instead of having one female to about three males, the converse would surely be the case.

The occurrence of appendicitis in about three-fourths of all cases between the ages of 10 and 30, also appears enigmatic from the point of view of infection as the primary cause, considering the greater resistance possessed at such a time than by children under 10 years of age.

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