

TRACHEOTOMY.*

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The operation of tracheotomy occupies a most anomalous position. There is no other justifiable life-saving operation whose reign of usefulness has not been extended by modern methods. This is in part due to the introduction of intubation, but there are several classes of cases in which intubation does not meet the indication and there are frequent individual cases where, for some special reason, the cutting operation is easier, safer and more efficient. Yet even here, the profession hesitates longer to advise tracheotomy than it did fifty years ago. The principal reason for this is probably the introduction of general anesthesia, which in this single instance was a distinct step backward. The cough reflex is the watch-dog of the lung, and when the trachea is to be opened should be preserved or stimulated, rather than drugged asleep. Aside from this, general anesthesia has, strange as it may seem, rendered our technic more hasty and careless than previously. When tracheotomy is decided on, there is usually sufficient dyspnoea to demand some voluntary use of the extraordinary muscles of respiration. As complete anesthesia approaches, this voluntary action ceases, cyanosis increases until the respiratory center is paralyzed from over-stimulation, and the patient makes no further breathing effort. He never will make another breathing effort unless the trachea is opened widely and on the instant. For with an obstructed larynx, artificial respiration is never efficient for complete oxygenation of the blood. The trachea under these circumstances is opened by a stab, rather than an incision, and it is small wonder if the percentage of mortality is almost as high as of stab wounds, inflicted with homicidal intent. In the hands of the most skillful and experienced, the incision is usually badly placed; in the hands of the unskilled or the excitable, serious accidents have occurred, such as the opening of the esophagus or a large vessel. A collection of tracheotomy specimens shows incisions at all sorts of positions and angles. One specimen shows a slicing off of the side of the trachea like a slab from a log. There is no time for asepsis or hemostasis; the opening is made at the bottom of a pool of blood, and the first inspiration necessarily pumps clots, and possibly pus,

*Read at the meeting of the Eastern Section of the American Laryngological, Rhinological and Otological Society, January 9th, 1909.

into the bronchioles, where it remains, because the cough reflex is absolutely abolished by the cumulative action of general anesthesia, deep cyanosis, and shock. We have therefore a large mortality from shock, hemorrhage, sepsis, and broncho-pneumonia.

How prone the profession is to under-rate the dangers of general anesthesia is shown by a case of my own. In a child of four, papillomata of the larynx were readily removed after a tracheotomy under infiltration anesthesia and the administration of chloroform, through the tube. Nothing could have been easier, simpler or more satisfactory. Operation for a slight recurrence of the growth became necessary, and general anesthesia was suggested. In the light of the satisfactory previous experience, it is difficult to say why, as a precautionary measure, I called a consultant, choosing a man who prefers the safe side always, who has a strong bias in favor of local anesthesia, and with whom I had frequently discussed this very point. He noted that stridor was not extreme; dyspnoea, as evidenced by action of the extrinsic muscles, moderate; and that there was not the slightest hint of cyanosis. He gave a positive and clean-cut opinion that general anesthesia in this case would not be especially dangerous. Nevertheless, before anesthesia was complete, the child stopped breathing, and the life-saving tracheotomy looked more like assassination than operation.

Our general conception of the operation is a composite picture of many such instances, and we are therefore disposed to defer it until dyspnoea and cyanosis are extreme, or to omit it altogether, if the condition of the patient appears hopeless. These accidents should, however, teach exactly the opposite lesson. For we frequently save life when the patient is in coma, limp, and relaxed, with the respiration entirely abolished, and the pulse nearly or quite imperceptible. In the experience of all of us, many times has the result of quick work seemed like quickening the dead. In one of my own cases the heart, as well as the lungs, had ceased to act, according to Dr. Clarence Ingram and Dr. Thomas T. Kirk. It is hard to understand how a patient's condition can be too bad for operation. Under local anesthesia and at the proper time, tracheotomy should be free from dangers of shock, hemorrhage, or consecutive broncho-pneumonia. Between the skin and the trachea, in the middle line, there is no large vessel, and no important structure. There should be no more mortality from the operation, *per se*, than from the opening of superficial abscesses by an incision of equal length. Wider employment of tracheotomy in the more favorable classes of cases than is now usual, besides reducing its

mortality almost to nil, will give us a better conception of its usefulness. The wonderful general therapeutic effect of better oxygenation and the local improvement from putting the larynx at rest can be seen even in such serious conditions as typhoid perichondritis and laryngeal tuberculosis. Yet it is, I think, unknown to the general practitioner, and under-appreciated by the laryngologist. In giving the statistics of my cases of tracheotomy to date, I do not overlook the fact that the slight mortality is to some extent a matter of good fortune. It is beyond hope that my next one hundred cases will show a similar happy result. But that even as a matter of fortune such a series of cases is possible, shows that the operation is much less dangerous than is generally supposed. It is to be noted that in the majority of cases the technic was deficient in some or many important points, and if the series had shown even a ten or fifteen percent mortality, it would not have changed my opinion that the operation is an entirely safe one when performed with the care and precision that modern surgery demands in every other locality, and done at the first indication, not after carbonic poisoning has made recovery impossible.

Technic.

The different points necessary to put our technic on a plane with the other departments of modern surgery may be arranged as follows, in my opinion, in the order of their importance:

First.—Preservation of cough reflex by the omission of chloroform, ether, morphine, codein and other sedatives, and the avoidance of marked cyanosis by early operation. I have a standing order in all the hospitals where I work that under no circumstances is any sedative to be given in any laryngeal or tracheal case.

Second.—Deliberate work, careful dissection exactly in the middle line until the wind-pipe is laid bare, and absolute hemostasis before it is opened are desirable. When the operation is done as a matter of election at an early period, and without extreme cyanosis, there is no reason why we should not wait until the wound is not only dry, but glazed, before the wind-pipe is opened.

Third.—Careful after-treatment—good ventilation, uniform temperature, moist atmosphere, frequent dressings of the wound, preservation of the patient's vitality by all temporary and permanent means—reduces mortality. To trust to routine surgical hospital nursing is to court disaster. It is imperative that the case shall be in the care of a nurse trained in tracheal work. She must know by the sound when the canula is even slightly obstructed, and

must distinguish between this sound and the usual stridor serraticus. No one can describe this or any other sound so that another may know it. It must be heard many times to educate the ear to niceties of distinction. The nurse must be trained to dress the wound, for the dressing must be done very frequently, even every half-hour, if secretions are abundant. The old surgical rule to disturb the wound by dressing as seldom as possible, is one of the causes of the high mortality of tracheotomy under routine surgical regime. Conditions here are entirely different from anywhere else in the body. The secretions and discharges must be absorbed and removed by very frequent dressings. Gauze wrung out of mercuric chloride, 1 : 10,000, is used in three pieces.

a. To pack around the canula.

b. A bibb piece on the surface surrounding the stem of the canula under the tape-holders.

c. A filter piece to lay over the entire front of the neck.

This latter piece should be changed as often as soiled, even if every ten minutes. Both the filter and bibb pieces should be fastened by small safety pins at the side of the neck to the tapes which hold the canula. Thus no bandage is needed.

The inner canula should be cleaned by the nurse as often as necessary, boiling it after cleaning it with a pistol-cleaning bristle brush bent to shape. The outer canula is to be removed only by the surgeon or his assistant, though the nurse must know how to find and dilate the tracheal incision in the depths of the wound, should the canula accidentally be withdrawn or be coughed out, owing to the breaking of the tapes.

Fourth.—Asepsis. The technic of the operation and of the dressings should be as nearly perfect asepsis as it is possible to be. The tracheal secretions will unavoidably infect our wound, but we must not add any infection. The patient is usually immune against the organisms he himself harbors.

Fifth.—Trendelenburg-Roser position at the moment the trachea is opened is an advantage. The tracheal mucous membrane will bleed slightly, and with a diseased larynx infected secretions may be aspirated in at the first deep inspiration. We should aid cough all we can by the influence of gravity. None of these points is hard to secure except the avoidance of general anesthesia. As the virtues of the infiltration method of Schleich become more familiar to us, this will be easier than general anesthesia and a great time-saver, requiring but a minute. Infiltration of the skin is easy

and renders the first incision absolutely painless. The deeper tissues are not so easy to infiltrate. Brown-Sequard's statement that the first incision, when made exactly in the middle line, anesthetizes the deeper tissues, is erroneous. But the sensation in the underlying parts is slight. The incision may be carried through them, even in a child, with less distress and struggle than is involved in the administration of a general anesthetic.

Sixth.—The canula must be of proper size and length. Nearly all the canulae in the shops are worthless, being both too short and of too short radius. Most of them will not reach the trachea after the neck has swelled in the reaction. I have been unable to find in stock a canula which could be with safety trusted to leave in the wound over night. I know personally of three cases seen in consultation where death, said to be due to gradually increasing stenosis, was really due to the shortness of the canula, which was withdrawn by the swelling until the inner end slipped out of the trachea. Air still passed in and out through the approximated lips of the incision, but in insufficient quantity, and it became less and less. The carbonic acid narcosis, together with the residue of the chloroform narcosis, and the weak toxemic conditions (due to febrile disease) of the patients, with the assistance of anodynes,—these things enable the patients to sleep away. The death was ascribed to increasing stenosis, and in one instance to this combined with edema of the lungs. In some cases the stenosis in the trachea was not reached by the canula when first inserted, and the diagnosis was "edema of the lungs" or "intra-thoracic conditions too deep to reach." In such instances the long tracheal canulae devised by me to reach to the bifurcation of the trachea are needed.*

In one patient recurrence of endothelioma, following laryngectomy, had extended down the trachea until but a fistulous tract leading to a stump of the two main bronchi remained. The patient has been thus kept alive for four months, and an ample passage for air can and will be maintained until the patient succumbs to exhaustion, hemorrhage, or some of the other termini of such cases. He will not die for want of an air passage to his bronchi.

In regard to the execution of the operation in the urgent cases, two incisions are better than one. The first should penetrate to the trachea, which is then felt like a wash-board under the left fore-finger. This finger acts as a guide for the second incision which should follow the first in a second's time. With the wound a well of blood, there is little need for a light until the vessels are to be

*Journal American Med. Assn., May 25th, 1907.

caught up, which should not be attempted until the respiration has been started and the patient is able to do his own breathing.

In looking over the statistics of my cases I find it impossible to accurately figure out the percentage of mortality. Two patients whose larynx was removed died (two deaths in eleven laryngectomies) within ten days of the operation. Neither died of lung complication, and in any event it would be, and is, impossible to say that the tracheotomy could not have been a factor, but in these and other cases where major operations followed the tracheotomy, it is much more reasonable to suppose that it was the major operation.

Of the one hundred tracheotomies done up to the time this paper is being prepared, eighty-six patients are now living, or were so when discharged from further treatment. In ten other cases death resulted from the conditions that required tracheotomy, or from the major operation which followed the tracheotomy. In one case it is impossible to deny that the tracheal incision may have had a fractional share in inducing the shock that finally caused death thirty hours later, and in three cases death was certainly due to tracheotomy. The author is aware of the fallacies arising from an analysis of his own statistics; but an analysis is necessary for the reasons given. He can only give the opinion of others concerned in the cases that in the ten fatal cases alluded to, the tracheotomy could not have acted even as a predisposing cause, and there seemed to all of us no doubt that in all of them it prolonged life by prevention of cyanosis and facilitation of other necessary and more serious operative interference.

No claim is made for priority in the advocacy of local anesthesia for tracheotomy, for Theisen, Root, and many others have urged it; but the statistics of hospitals all over the United States show that it is almost never used. From a complex solution the author has come to use a solution of one grain of cocaine hydrochlorate and one drop of carbolic acid to the ounce of sterile water, allowing the solution to stand long enough for chemical sterilization to take place. To boil a cocaine solution is to destroy its anesthetic powers. Intradermatic, not hypodermatic, injection is the procedure, the needle following the blanched track it makes ahead of itself.

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