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Intubation in Chronic Stenosis
of the Larynx, with a
Report of Five Cases.

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INTUBATION IN CHRONIC STENOSIS OF THE LARYNX,

*WITH A REPORT OF FIVE CASES.**

BY JOSEPH O'DWYER, M. D.

HAD intubation of the larynx proved a complete failure in the treatment of croup, I should still feel amply repaid for the time and expense consumed in developing it, for I believe that it offers the most rational and practical method yet devised for the dilatation of chronic stricture of the glottis.

I have records of five such cases treated by intubation, three of them by myself and two by other physicians.

Of the first case I will give only an abstract, as it has already been published in the "Medical Record" of June 5, 1886 :

CASE I.—This patient was a woman, forty years of age, who came under my treatment December 5, 1885. Twelve years previous to this time she had contracted syphilis, which manifested itself chiefly by ulcerations in the pharynx, and for the last two years had also involved the larynx, but without producing any serious interference with respiration until within two

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months. The immediate performance of tracheotomy had been recommended by a leading laryngologist a short time before I saw her. The soft palate was adherent to the posterior wall of the pharynx on both sides, and a small ulcer still existed on the left side. A cicatricial band encircled the left half of the larynx and crossed to the right over the posterior portion of the chink, leaving only a very small breathing space between it and the right cord. The epiglottis was also deformed on its posterior surface by cicatricial contraction.

On the date above given I attempted to insert the smallest tube I then had for adult cases, but failed after several attempts, and was obliged to fall back on the largest of the croup tubes, that intended for children from eight to twelve years of age, which I succeeded in passing by using a great deal of force. She could breathe through this small tube with perfect comfort in a state of rest, and with it obtained her first night's comfortable sleep in the recumbent posture in two months. Tubes of larger size were used in rapid succession as the smaller ones were coughed out, and she returned home at the end of eighteen days with ample breathing room in the larynx. During this time the tubes were inserted nine times and retained an aggregate of one hundred and seventy-three hours. She reported occasionally for observation, and while there was no return of the cicatricial band, which had disappeared apparently by ulceration, and there was ample breathing room in the chink of the glottis, there was a gradual return of the dyspnoea, due, undoubtedly, to subglottic obstruction. Almost from the beginning I was convinced that there was considerable thickening on the right side below the cords, from the fact that the lower extremity of the tube was deflected sharply to the patient's left as it passed below the rima, and also because the force required to overcome the resistance was greater than could be offered by the cicatricial tissue in the glottis.

After an interval of about two months and a half I was obliged to resort to dilatation again, and found it necessary to begin with the smallest tube and use almost as much force as on the first occasion, although there was very little recontraction in the glottis. This time the patient was under treat-

ment twenty-seven days, as I used still larger tubes, which were inserted thirteen times and retained two hundred and four hours.

I was now thoroughly convinced that the only means of preventing a return of the stricture was continuing dilatation by the occasional introduction of a tube. I therefore began by using it once a week, leaving it in the larynx from twelve to twenty-four hours at a time and gradually increasing the interval until it amounted to six weeks, but I found that this was too long, and was obliged to reduce it to one month, and sometimes five weeks. I still continue to insert this hard-rubber tube, which is the largest I have used, once a month, and leave it in from two to three days.

It is now one year and nine months since I began the dilatation of this patient's larynx, and there is scarcely any doubt that it will be necessary to continue it during the rest of her life. I am therefore beginning to teach her to insert the tube herself, which I do not think will be very difficult, as she possesses an unusual amount of pluck.

If this patient omits her iodide, of which she was taking sixty grains daily when she came to me and which I increased to ninety, for any length of time, points of ulceration appear in the larynx and on the posterior wall of the pharynx. The metal tube always produced some ulceration where it exerted the most pressure, especially on the anterior surface of the arytenoids, but this has not occurred to any extent with the light vulcanite tube. I have used the latter several times in this case, and while the patient does not swallow nearly as well with it as with the metallic tube, she is convinced that it causes less irritation, and that expectoration of the tenacious mucus is much easier. Although swallowing of both solids and liquids was very imperfect, this patient found no difficulty in taking an ample supply of nourishment. Liquids were swallowed better while she was lying on the back.

Notwithstanding the free use of cocaine, very sharp pain was complained of just after the introduction of the tube, which usually required a hypodermic injection of morphine for its relief. Tolerance was soon established, and a repetition of the

dose was seldom required unless the tube was allowed to remain in the larynx for about a week, when the pain would again become severe.

In order to render possible the introduction of the small tubes used in the early treatment of this case it was necessary to reduce the retaining swell to almost nothing, which rendered their rejection certain as soon as the stricture became somewhat relaxed. They were consequently often expelled in less than twelve hours.

To avoid the pain and irritation necessarily produced by the frequent forcing of a tube through the larynx, I would in another case, if reasonably certain that the stricture were confined to the chink of the glottis, produce sufficient divulsion under ether to admit a large or medium-sized tube that would be retained as long as desired—a week, a month, or longer, according to the pain and irritation excited. It would be a much more rapid and less painful method. In this case it would have accomplished nothing, as no amount of divulsion short of rupturing the cricoid cartilage could affect the subglottic stenosis.

I have here a set of ten laryngeal stricture-tubes made by Tiemann & Co., of New York. The retaining swell is left greater on the smaller sizes than it was on those used in the case just reported, because I believe the force required to pass the tubes was due in great measure to the fact that the subglottic thickening was confined principally to one side, which rendered the canal tortuous.

The larger of these tubes is constructed of hard rubber, the medium sizes of metal—brass, gold-plated—with vulcanite heads to diminish the weight, and the smaller of metal only. The heads of the latter are left comparatively small, so that they can also be used in acute stenosis of the larynx in the years immediately following puberty, for which no provision has been made in the set of croup instruments.

The largest of them, in which the transverse diameter of the head is seven eighths of an inch, can be used in any form of acute stenosis in the large adult male, and the medium sizes in the female and small adult male.

In the largest larynx that I have yet examined the antero-posterior diameter of the chink, which is the same as that of the trachea, measured only seven eighths of an inch, and the transverse five eighths.

The diameter of the subglottic division of the larynx varies from one eighth to three sixteenths of an inch less than that of the trachea.

CASE II.—Louise M., aged thirty-five, married, was sent to me in April, 1886, by Dr. J. J. Reid from the throat wards of Charity Hospital, where she had remained since the performance of tracheotomy two years before. For seven months of this time she was under the care of the late Dr. Elsberg, and came to me with the diagnosis of incurable bilateral paralysis of the abductor muscles of the cords. Electricity and other methods of treatment had been tried in vain, and her case was regarded as hopeless so far as the functions of the larynx were concerned.

The history that I obtained as to the beginning of her ailment, and which I do not consider reliable, is as follows: During one of her periodical sprees with a number of boon companions, who were trying to make as much noise as possible by singing or screaming, in a desperate effort to outdo the rest she suddenly lost her voice. Her throat swelled and she soon began to suffer from dyspnœa, and was ordered to a hospital by a physician who was called to attend her. She had no recollection of reaching the hospital or of the tracheotomy that followed, and I could form no estimate of the time intervening between the first symptoms and the operation; she placed it at a few days.

The introduction of a laryngeal tube, with the vocal bands lying in apposition and their abductor muscles incurably paralyzed, I regarded as useless, and did not contemplate it for a

moment. My intention was first to remove the vocal cords, or a portion of them, and make a cylindrical opening where before there was none, and then insert a tube until the healing process was accomplished.

When I came to investigate the case I found there was not the least power to whisper. She was obliged to communicate her thoughts altogether in writing. I already knew from my experience with intubation in children that with a very small volume of air passing through the larynx the ability to whisper distinctly is retained.

I found, further, that no air could be driven through the larynx by stopping the tracheal cannula and directing the patient to make a forced expiration, and was led to the only conclusion that could be drawn from these facts—viz., that the larynx was completely occluded, or that, if any opening existed, it was a mere pin-hole.

In the mirror the vocal cords could be seen closely approximated but normal in appearance. No adhesions were visible, and during all attempts at phonation or inspiration the arytenoids remained motionless. I now interpreted the case differently. This patient had undoubted symptoms of syphilis when I first saw her, which soon disappeared under the influence of the iodide. I believed that the first trouble was an acute laryngitis aggravated by the constitutional disease, and attended with marked swelling of the mucous membrane and submucous tissues, which brought the under surfaces of the vocal cords in contact. This would be still further increased by the cessation of all attempts at abduction by the admission of air through the tracheal cannula, and all that was required to seal the opposing surfaces was a little ulceration followed by healing.

This view of the case rendered the prognosis much more favorable. All that appeared to be necessary was to break up the adhesions and insert a tube to prevent reunion.

For this purpose I had her removed to the New York Foundling Asylum, and on April 29, 1886, assisted by Dr. Dillon Brown, the resident physician, Dr. J. J. Reid, Dr. W. K. Simpson, Dr. J. J. Griffiths, and Dr. F. S. Sellw, I placed her under ether, and attempted to pass a small tube through the

larynx, but failed after using a great deal of force. I then enlarged the external opening, and realized for the first time that the cannula had been inserted, not, as I supposed, in the trachea, but in the crico-thyreoid space. No opening could be felt by passing the finger upward in the wound, nor could any be made out in the chink of the glottis, which was easily reached by pushing the larynx up on the outside at the same time that the finger was inserted through the mouth. All the force that could be exerted in this manner made no impression on the adhesions. I therefore passed a uterine sound with proper curve, guided by the finger, and forced it down and out through the wound, working it backward and forward, then passed it in the same way from below upward, and again tried the finger in both directions, but failed as before. A pair of strong forceps was now introduced closed from below, opened widely, and withdrawn in this condition. This gave room to admit the tip of the index finger, and by using much force the adhesions suddenly gave way, allowing the finger to pass up into the pharynx.

I now inserted a tube two inches and a half in length, the longest I had at the time, but here encountered a difficulty which I had not anticipated. - The lower end of the tube came out through the wound, and no means that I could devise would keep it in place. I was therefore obliged to reinsert the tracheal cannula until a tube three inches long could be made.

Nine days later it was necessary to etherize the patient again in order to break up the adhesions which had reformed before I could pass the long tube. While doing this an assistant drew forward the inferior angle of the wound with a blunt hook, and pressed the lower end of the tube backward as it passed the opening by means of a lead-pencil notched at the end to prevent it from slipping.

The increase of half an inch to the length of the tube removed the difficulty experienced with the shorter one. A cork was now placed in the external opening and retained by a tape passed through it and tied around the neck, which the patient could remove quickly if necessary.

To provide against the danger of the lower end of the tube

still engaging in the wound and thus obstructing both openings, the string was left attached to it and was passed behind the ear.

The fact that this patient could again breathe through the natural passages and communicate her thoughts in a very distinct whisper did not surprise her nearly as much as the ability to expectorate through the mouth, which was a great source of pleasure and amusement to her.

The tube was coughed out on the second day, notwithstanding its weight of an ounce and three quarters. The patient choked immediately and was obliged to remove the cork and have the nurse reinsert the tracheal cannula. I replaced the tube in the larynx four hours later without difficulty, and a week later removed it to see if she could get any air at all through the larynx, but to all appearances not a particle entered, and the tracheal cannula again had to be used.

A laryngoscopic examination showed the vocal cords in the old position of close adduction. I was now forced to the conclusion that the original diagnosis of paralysis was correct, and that adhesion resulted from ulceration produced by the tracheal cannula, which subsequently healed under antisyphilitic treatment.

Ether was again administered May 20, 1886, for the purpose of removing a portion of the vocal cords, as originally intended. I enlarged the wound downward in order to make room to keep the cannula in position during the operation, and at the same time out of the way, and tamponed the trachea around it to prevent any blood gaining admission to the bronchi. The incision was then carried up to, but not interfering with, the thyreoid cartilage. On separating the edges of the wound with retractors I missed the cricoid cartilage, or at least the anterior part of it. From the first ring of the trachea to the thyreoid cartilage there was no support for the soft yielding tissues, and when the flaps were allowed to drop back into position the anterior and posterior walls approximated in the same manner as those of the œsophagus or vagina. I hesitated now about proceeding further with the operation, as I regarded the case as next to hopeless; but, believing that the cricoid cartilage might have been cut in the original operation, and only displaced by

the cannula, which was of hard rubber and very large size, I decided to complete the operation by hooking a tenaculum into each cord, guided by the finger, and cutting on the outside of this with a blunt-pointed bistoury.

I found this much more difficult than I anticipated, for the cords, although not far above the external wound, were not visible. In doing this operation again, I would lay open the thyreoid cartilage, which would make it a very simple matter.

The wound was brought together with the exception of the opening for the tracheal cannula, in which a cork was placed as before, and the same tube was passed into the larynx. At the end of eight days I removed it and found that she could breathe for the first time through the larynx, with the external wound closed by adhesive plaster. A laryngoscopic examination showed that only a small portion of each cord had been removed, and from the seat of the incisions granulations were already springing which promised soon to supply the place of the tissue removed. I therefore reinserted the tube in the larynx one day and a half after its removal, during which time respiration was carried on comfortably through the natural passages.

More lateral pressure appeared to me to be the thing required to prevent the further growth of granulation tissue, and this could not be obtained with the ordinary oval tube, which was designed specially to avoid undue pressure on the vocal cords. I therefore had one made almost cylindrical in form and passed it into the larynx on June 15th, where I allowed it to remain until the 26th—eleven days. I then removed it, not because it was giving rise to pain or inconvenience in any way, but because my experience with the first case was against leaving the tube in the larynx continuously for much longer than a week. On laryngoscopic examination, more breathing room was found than at any previous time, but granulations were still present. During the following three days she continued to breathe comfortably through the larynx with moderate exercise, and could even ascend one flight of stairs without producing much dyspnœa.

On examining the external opening on June 29th, I noticed

a marked sinking in of the tissues both above and below it, where the cartilaginous support was defective, and I anticipated some difficulty in replacing the tube. So great was the contraction in this short space of time that, on using a great deal of force, I failed to pass the tube beyond this point until a slight incision was made downward.

The almost certain recurrence of this difficulty, every time the tube was allowed to remain out for a few days, convinced me of the necessity of leaving it in for a much longer time.

I therefore sent her back to Charity Hospital with the tube in her larynx and told her to return in a month, when I would remove it, or sooner in case it gave rise to much pain or any interference with respiration occurred.

Dr. Reid, in whose service she was, reported from time to time that she was doing well, and at the end of the month reminded her that it was time to have the tube removed. She left the hospital, but did not report to me, and months passed without hearing anything from her. Knowing that she was much given to dissipation, I believed that in all probability she was dead; but she surprised me very much by coming to my office on May 3d last, looking and feeling remarkably well with the exception of a cold recently contracted, which gave rise to a good deal of cough. She was still wearing the tube, which had remained in the larynx ten months and four days.

Her reason for not returning sooner was that she felt comfortable and happy, and did not wish to run the risk of having to wear the outside tube again.

It required some force to remove the tube, which was black from coating of the sulphides and closely dotted over with coarse granules of calcareous matter. When these were scraped off the surface of the metal was left quite uneven, and the tube is consequently somewhat smaller now than it was originally. The thin gold plating had probably disappeared before the tube was in the larynx a month.

For a moment after removing it inspiration was seriously obstructed, and I was about to insert another tube, which I had ready, when the breathing became perfectly free. On using the mirror, I found that the obstruction was due to masses of granu-

lation tissue growing from the sides of the larynx above the ventricular bands, which must have partially overlapped the head of the tube, and which were drawn together by the forced inspiration immediately following the removal of the tube. During quiet respiration this did not occur. A good view of the larynx could not be obtained, and if ulceration existed, which is more than probable, it was covered by the granulation tissue.

She complained for some days of a void in her throat, as if an important part of it were missing.

The granulations, which I believed at first would have to be removed in some manner, gradually decreased in size, and at the last examination, about July 1st, a better view of the larynx was obtained. A large cylindrical opening existed where the chink should be, and no trace of the vocal cords was visible. There was undoubted motion of the arytenoids during inspiration. In the seat of the external wound was a deep sulcus, extending down between the unapproximated edges of the cricoid cartilage. The cough was toneless, and the voice, as before, a distinct whisper.

I have not seen this patient since, but Dr. Reid informed me that she returned to Charity Hospital in the early part of last August, suffering from alcoholism, and left in about a week. He examined the larynx, and found the same condition as described above. The breathing was perfectly free.

Had I had the least suspicion that the larynx would tolerate a tube continuously for so long a time, I should not have interfered with the vocal cords, as the tube, if it did cause their destruction by ulceration, would, in all probability, have fixed them permanently in the abducted position. I felt that I was assuming a serious responsibility when I concluded to leave the tube in the larynx for even the space of one month.

These two cases afford a remarkable illustration of the difference in sensibility displayed by the larynx in different

persons. One patient could not retain a gold-plated or finely polished vulcanite tube longer than a week at a time without its producing undue irritation, while the other practically wore a hollow file, and not a very fine one either, in her larynx for many months, and was happy in consequence.

I had previously noticed the same difference in children suffering from croup, and at first attributed it to the protection afforded to the living sensitive tissues by a greater or less deposit of pseudo-membrane, but was soon convinced that this was not the explanation.

CASE III.—Mrs. L., aged forty, the mother of eight children, in the early part of December, 1886, began to suffer from hoarseness and a feeling as though something loose existed in the upper part of the windpipe, which she could not get rid of by coughing. She consulted Dr. J. W. Lyman, who found bronchitis and albuminuria, and these, together with the hoarseness, were believed to be due to cold. Later the voice was lost, and dyspnoea developed, which became so urgent on the night of January 14, 1887, that everything was made ready for tracheotomy, when it occurred to Dr. H. Griswold, who was called in consultation, that it would be a good case for intubation. When I saw her, at 9 P. M., there was very little cyanosis, but the breathing was very laborious, almost noiseless. She was unable to assume the recumbent posture. Dr. Griswold had made a satisfactory laryngoscopic examination, and found nothing abnormal in or above the chink except hyperæmia, but below the cords he could see what appeared to be œdematous folds of the mucous membrane crowding in toward the center, and more marked on the left side. The diagnosis was therefore subglottic œdema. But the fact that she was also suffering from bronchitis and albuminuria rendered it doubtful as to whether the dyspnoea was not, in part at least, pulmonary. On listening to the chest, no air could be heard entering the lower posterior portion of the lungs, and a very marked up-and-down movement of the larynx could be detected by placing the fingers over it. The latter symptom alone was sufficient to locate the obstruction in the glottis.

I first attempted to insert a tube two and a half inches long, but, owing to the short curve on the introducer, it was necessary to detach it before the lower end of the tube had passed through the obstruction, and, the probe point being thus lost, the tube caught on the swollen tissues and was arrested. A three-inch tube which extended below the stricture before the obturator was removed passed without difficulty, and with complete relief to the dyspnœa. There were present Dr. J. W. Lyman, Dr. H. Griswold, Dr. G. G. Van Schaick, and Dr. Adolph Rupp.

On inquiring more closely into the history of this patient, it was found that she had contracted syphilis from her husband some years before, and since that time had had several miscarriages.

After the tube was inserted she refused to swallow anything either in the solid or fluid form, and was fed at first by the rectum, and later by the stomach-tube. The iodide was given mixed with the food in small doses, as the stomach would not tolerate large ones, and mercury by inunction.

The tube was removed in five days, but had to be replaced in twenty minutes, owing to the rapid return of the dyspnœa. It was again removed two days later, while Dr. George M. Leferts, who was called in consultation, made a careful laryngoscopic examination, and reinserted in half an hour. Dr. Leferts's diagnosis was subglottic laryngitis. It was removed for the third time on January 24th, ten days after first insertion. This time it was left out twenty-one hours, when the dyspnœa became so urgent that I was obliged to replace it, and Dr. Griswold removed it on February 4th, twenty-one days from first insertion. It produced no ulceration nor pain, but caused excessive coughing, which had to be moderated at night by opiates. A very large amount of tenacious mucus was secreted, which required considerable coughing to remove.

March 14th, or about six weeks after the tube was last removed, I was hastily summoned in the night by the husband, who said that his wife would in all probability be dead before I reached her. I found her deeply cyanosed and much worse than at any previous time. I was obliged to make three at-

tempts before I succeeded in placing the tube in the larynx, and they had to be made very rapidly, as cutting off the small amount of air that was entering the lungs for even a short time would have produced *asphyxia*. I was without assistance on this occasion, and had heard nothing from the case for some time, but when I met Dr. Lyman the next day I learned that there was a new development. Her left arytenoid was very much swollen and ankylosed, and on its anterior surface and involving a considerable part of the posterior region of the larynx was a growth which overlapped the chink of the glottis. This explained the difficulty experienced in passing the tube, and also, in part at least, the dyspnœa. Another physician who examined this patient's larynx a short time previously regarded it as a perichondritis. The history of the case, the appearance and location of the *tumor*, and the absence of any swelling or tenderness on the outside, were, I think, sufficient to exclude this and to leave very little doubt that it was a *gumma*, which had developed while the patient was said to be taking large doses of the iodide and bichloride. The tube was removed in a week, and immediately replaced by a larger one of hard rubber, which was prepared in the following manner: Those portions of it which would come in contact with the diseased surfaces in the larynx were coated with gelatin, liquefied by heating, and dusted over while still moist with dry powdered alum, and as one layer dried another was applied until a sufficient thickness was obtained. Gelatin swells considerably as it absorbs moisture, and the dilating power of the tube thus treated can be temporarily increased to any extent with or without the astringent or other applications. This can be prolonged by covering the gelatin with a layer of collodion, which prevents the too rapid absorption of moisture.

This tube was removed for the last time on March 28th, having been in the larynx seven days. It gave rise to considerable pain and irritation, which were attributed principally to the alum. I have not seen this patient since, but have recently been informed that there is still some dyspnœa on exertion and very little voice, both probably due to remaining subglottic thickening, but I have no knowledge of the recent laryngoscopic appearances.

This patient, who was firmly convinced that she could not swallow anything during the first period of treatment, subsequently learned how to swallow a sufficient quantity of both liquid and solid nourishment and large doses of the iodide without much difficulty. But she could not swallow nearly so well with the hard rubber as with the heavy metal tube; the latter, as she expressed it, sank lower down than the light tube. She could not distinguish any difference in the weight, although one weighed an ounce and three quarters and the other only one hundred grains, nor any difference in the ability to expectorate, and the caliber of the hard-rubber tube was almost double that of the other. It will be remembered that the first patient expressed a decided preference for the light tube, which was the same one used in both cases, and principally because she expectorated better through it. Although my experience is yet very limited, I have some reason to believe that while deglutition will be more difficult with the hard-rubber tube, which necessarily stands higher in the larynx on account of its lightness, secretions will be more easily expelled, as they do not appear to adhere so firmly as to the metallic tube.

CASE IV.—This patient was treated by Dr. J. J. Reid in his wards at Charity Hospital and briefly reported by him in the "Philadelphia Medical and Surgical Reporter" of May 14, 1887.

J. K., aged twenty-two years, entered hospital May 1, 1886. He stated that four years previously he had contracted a severe cold, accompanied by hoarseness, which had continued more or less ever since. He sought relief at various dispensaries, but, steadily growing worse, finally entered the hospital. At this time there were considerable emaciation, hoarseness, cough, and dyspnoea at night. He gave no direct history of syphilis, but there was necrosis of the hyoid bone, part of which had escaped by the mouth, leaving a discharging sinus on the inside. Ulcer-

ation existed around the base of the epiglottis and involving the left side of the larynx to the arytenoids, both of which were much swollen and partially ankylosed, as there was very little motion of the vocal cords. Notwithstanding the free use of the iodide, the dyspnoea increased, especially at night, until the question of surgical interference had to be considered. I saw the patient with Dr. Reid and advised against intubation, as I believed the tube would aggravate the existing ulceration. Dr. Reid thought differently and inserted a small tube on September 20, 1886, which was coughed out in twenty-one hours. Strange as it may seem, it did not give rise to much irritation, or at least the patient made no complaint. He was able to take nourishment well and slept comfortably without opiates, except a dose immediately after the insertion of the tube. The same day a larger tube was introduced, and expelled in twenty-four hours. A still larger one was then used, and retained only half an hour. As the dyspnoea was now much relieved, no tube was used for a week, when, on September 29th, a much larger size was introduced and retained for eighteen days, and then rejected while the patient was sitting up. There was a slight return of the dyspnoea on December 15, 1886, and the same tube was inserted for only twenty-four hours. He left the hospital soon after to resume work as a cigar-maker. He was seen the following June, six months after the final removal of the tube, and was then working at his trade and had had no return of the dyspnoea.

CASE V.—This case was operated on by Dr. Dillon Brown, assisted by Dr. W. H. Wilmer and Dr. Howard Lilienthal. There were also present Dr. H. E. Sanderson, Dr. H. S. Stark, Dr. G. C. Rich, Dr. E. F. Walsh, and Dr. C. E. Giddings.

The patient was a German, aged thirty-nine years, who for some time had been subject to *severe* attacks of laryngitis accompanied by dyspnoea. On laryngoscopic examination, a subglottic neoplasm was discovered, for the removal of which a high tracheotomy was performed on December 24, 1886. The growth was found to be very vascular, and, on scraping it out with a curette, a piece of a lucifer match, three quarters of an inch long, was discovered imbedded in its center. The cannula

was replaced for three days, then removed, and the wound allowed to heal. As it did so the dyspnoea increased until, on January 18, 1887, while the patient was almost asphyxiated and pulseless, Dr. A. G. Gerster reopened the trachea and inserted the cannula. Nine days later, when the patient had regained sufficient strength, Dr. Gerster laid open the thyroid cartilage to seek and remove if possible the cause of the obstruction.

The notes furnished me merely state that the cannula was reinserted, but give no further particulars of the operation.

He continued to wear the cannula until March 25, 1887, when Dr. Brown inserted a tube in the larynx, under the influence of ether. Two previous attempts had been made without ether and failed, owing to the same difficulty that I experienced in my second case—viz., the lower end of the tube engaging in the external opening. He was of a very nervous, irritable temperament, and the tube gave rise to excessive irritation, which called for the frequent use of opiates.

Notwithstanding the fact that he was very sensitive in regard to his personal appearance and very anxious to get rid of the tracheal cannula, he frequently begged to have the tube removed from the larynx. The irritation was not so great after the first day or two, but it is safe to say that toleration was never established in this case.

The tube was removed in a week and there was no return of the dyspnoea, but as the one used was very small it was considered safer to produce further dilatation by a larger tube. This was introduced April 26th, but immediately rejected, and no further attempt was made and none was necessary. The patient was last seen August 12th, in good health and free from dyspnoea, and had a good voice. He wore the tracheal cannula three months, and was cured by wearing a tube in the larynx one week.

As yet I am unable to speak from my own experience in regard to the prognosis in chronic stenosis of the larynx. Permanent cures have been reported, particularly by Schroetter, of Vienna, but I have no knowledge as to the

length of time, after final treatment, when such cases are reported as permanently cured, and this is the important point. I might report my second case now, more than four months after the removal of the tube, as cured, but I believe it would be premature to do so even at the end of a year.

No one would call a stricture of the urethra that required ten or more years for its development as permanently cured because it had not returned in one year after thorough dilatation or cutting.

The contraction of cicatricial tissue may be very slow, and as it requires only a small portion of the normal lumen of the air-passages for free respiration, a considerable degree of contraction must exist before manifesting itself in the form of dyspnoea.

Cicatricial tissue produced by the healing of deep tertiary ulcers, if situated in the subglottic division of the larynx, such as was present in my first case, will in all probability require occasional stretching throughout life. If, on the contrary, it is confined to the chink of the glottis, the prognosis will be better, as here we have the inspiratory abduction of the vocal cords twenty times a minute, which must antagonize to some extent the tendency to recontraction.

We know that cicatricial tissue in other parts of the body finally loses the power to contract by persistent and long-continued stretching, and if the first case reported could tolerate the tube continuously for several months instead of a week, the outlook would be better.

The third case was not, properly speaking, one of chronic stenosis, but a specific inflammatory infiltration which required only constitutional treatment for its cure, the temporary use of the tube being necessary to tide over the immediate danger of asphyxia, although it no doubt also hastened absorption by its pressure.

If constitutional treatment be neglected in a case of this kind, deep ulceration will follow, and the development of cicatricial stenosis is then only a question of time.

Syphilitic lesions of the larynx, in my experience, do not yield as readily to specific treatment as the manifestations of this disease in other parts, and therefore more perseverance is necessary.

In Dr. Reid's case, although of long standing, the ulceration was apparently confined to the supraglottic region and not very deep. The occasional use of mercury and the iodide extending over a long period would probably in this case insure a permanent cure. Without this it will be very likely to recur.

In Dr. Brown's case there was no cicatricial tissue, but simply inflammatory thickening produced by the presence of a foreign body. The removal of this still left more or less thickening, and, what was probably more important, partial ankylosis of the arytenoids from want of use. All that is necessary to effect a cure in such a case is to produce sufficient dilatation to admit air through the larynx, and thus excite contraction of the abductor muscles, or, in other words, to set the machinery in motion.

Thus far I have dealt almost exclusively with facts. In the concluding part of my paper, which treats of stricture of the trachea, I find it necessary to fall back on theories, as I have not yet treated a case of this kind. These theories are not visionary, but, on the contrary, are strongly supported, if not demonstrated, by the foregoing facts.

The oval laryngeal tubes are not suitable for stricture of the trachea, which retains the cylindrical form, and requires tubes to correspond. I had one of this kind made for an old lady, aged sixty-eight years, who was suffering from stricture of the trachea caused by a process from a large bronchocele surrounding it. I saw this patient with Dr.

Edmund J. Palmer at the suggestion of Dr. Henry B. Sands, with a view to practicing intubation. The tumor was very large, especially in front, covering the whole of the trachea and the greatest part of the larynx. Tracheotomy did not offer much hope, as, in order to get into the trachea below the obstruction, a large mass of vascular tissue would have to be cut through, and none of the ordinary tracheal cannulas would be long enough to reach it. To open into the larynx above, where there was less of the growth, would still leave the stricture below. Dr. Sands, who was first called to consider the advisability of opening the trachea, did not give much encouragement, and would operate only in case of impending asphyxia.

Before I could procure the tube which I intended to use, the patient insisted on returning to her old home in the western part of the State, where she subsequently died.

That portion of the tumor which surrounded the trachea, by also pressing on the œsophagus, interfered very much with deglutition. Solids could scarcely be swallowed at all, and, even had we succeeded in relieving the dyspnœa, death from inanition was only a question of time, as it would have been impossible to pass a stomach-tube.

The difficulty of intubating in such a case would result from the small size of the stricture. I am as fully convinced as if I had tried it that it would have been impossible to pass a tube as large as the one I have shown without previous divulsion under ether. This I intended doing with the smallest of Schroetter's long vulcanite tubes.

Many years ago I heard the late Professor F. H. Hamilton relate his experience with an almost identical case. His patient was a clergyman far advanced in years, who for the greater part of his life had suffered from a large goître. When death by strangulation was only a question of a little time, Dr. Hamilton performed tracheotomy, but

the insertion of the cannula gave no relief, and the patient died soon afterward. The autopsy showed that the trachea at the seat of the stricture was reduced to the size of a crow-quill. I have no recollection of further particulars, but the tube must have been inserted above the obstruction, and was, of course, many times too large to pass through, even if it had been long enough.

There is scarcely any doubt that, of all strictures, that of the trachea is the most unfavorable as regards permanent cure. It can unquestionably be dilated if not situated too near the bifurcation, but the power of the contracting tissue, whether on the inside or outside, which is sufficient to overcome the resistance offered by the almost bony rings of the adult trachea, will not be destroyed by temporary dilatation.

My second case of chronic stenosis of the larynx, who retained a tube in the larynx continuously for over ten months without its becoming obstructed, suggested another plan of treating stricture of the trachea. It consists of first accomplishing sufficient dilatation with tubes, such as I have already shown, of different sizes, and then passing a tube of proper length and having a shoulder just large enough or small enough to pass completely through the larynx and rest on the upper surface of the stricture. It would also have a retaining swell near the lower extremity to prevent it from being driven upward by coughing.

If the stricture be situated too low down to be reached through the larynx it would be necessary to lay open the trachea at the seat of obstruction and insert a tube of hour-glass shape, such as I have here, and close the wound over it.

I do not entertain the slightest doubt that such a tube can be worn for a life-time without danger of obstruction from secretions, because the expulsive power of the cough

would not be impaired as it necessarily is when the tube occupies the larynx and prevents approximation of the vocal cords. Neither would there be anything to fear from excessive irritation, as the mucous membrane of the trachea is infinitely less sensitive than that of the larynx.

As it stands at present, without actual demonstration, I know of no impediment to the permanent wearing of a tube in the trachea save the deposit of calcareous matter, to which I have already alluded, and this was probably caused by electrical currents excited by the copper and zinc alloy of which the tube was composed. I have noticed a slight amount of this deposit on the gold-plated brass tubes when retained for only one week, but not the least trace of it on the vulcanite tube when worn for the same time.

To avoid this objectionable feature, therefore, and at the same time insure durability, it will be necessary to have such tubes constructed of hard rubber burned on a frame-work of metal, or cast in pure gold.

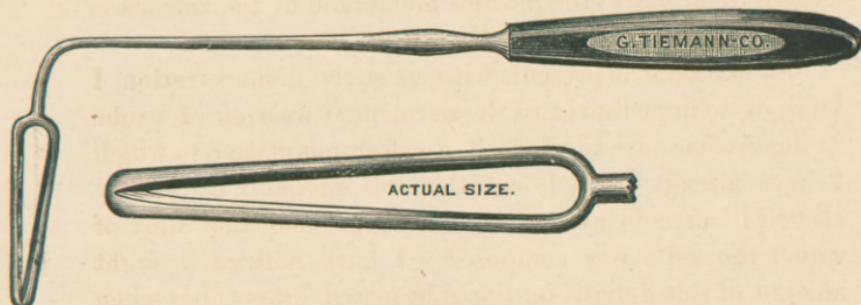
A tube passed into a stricture in the trachea through the larynx can also be removed through the same channel by making the curved part of the extractor long enough.

I am not aware that any attempt has ever been made to excise the strictured portion of the trachea, but it is quite probable that the great elasticity of this tube, which is necessary to permit of that elongation that takes place during the act of swallowing, would admit of the removal of at least half an inch without anything more than temporary interference with deglutition.

A child's trachea suspended with a slight weight attached gains three quarters of an inch in length, and the adult trachea, being much longer, should increase in proportion.

I have also devised a snare for the removal of laryngeal growths, particularly when situated in the subglottic region, where it is difficult to reach them with forceps in adults and

impossible in children. For growths attached to the lateral aspects of the larynx the snare is passed far enough down to give room for the neoplasm to slip between the blades



when it is pressed firmly against the side of the larynx and withdrawn. If the seat of attachment is unknown, both sides, and then the anterior and posterior portions of the glottis, can be curetted in succession.

This instrument will not seize any of the normal tissues when applied laterally, but in removing it, when used antero-posteriorly, it is necessary to protect the epiglottis and uvula with the finger. Two sizes of this snare are necessary, that shown in the cut being suitable for children. In young subjects it is guided into the larynx in the same manner as in practicing intubation. In adults it can be inserted with greater facility by the aid of the mirror.



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