

CLINICAL OBSERVATIONS

ON THE

INTRODUCTION OF TRACHEAL TUBES BY THE MOUTH INSTEAD OF PERFORMING TRACHEOTOMY OR LARYNGOTOMY.

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A FEW facts concerning the introduction of tubes passed through the natural passages into the trachea, instead of having recourse to operations for opening the windpipe through the neck, are considered worthy of attention; and in presenting these, it is thought advisable to confine the remarks as far as practicable to the relation of facts, refraining from entering into the merely discursive side of the question.

In considering the practicability of such a procedure, facts were looked for from various sources. *Post mortem* experience showed that instruments of the tube kind could, after a little practice, be passed with facility through the mouth into the trachea. This was accomplished by introducing the finger into the mouth, depressing the epiglottis on the tongue, and so guiding the tube over the back of the finger into the larynx. In experimenting with various instruments, it was found more easy to introduce those of a large calibre, such as Nos. 18 to 20, than instruments of the size of 8 to 10 catheters—the latter being more liable to catch on the various irregularities on the internal laryngeal surface.

While it was easy to introduce instruments by the mouth into the trachea, it was difficult to pass them through the nose into the air-passages. The nasal passages being on each side of the middle line, catheters passed through them were found to glide to the side of the pharynx, away from the middle line, and consequently away from the larynx; so much was this the case, that it was found impossible to introduce a nasal unarmed catheter through the nose into the trachea by any manipulation outside the mouth. A catheter, having a strong properly curved stilette, after considerable labour and many efforts, might find its way into the larynx; but even this could not be depended on. An instrument can, however, be passed through the nose into the pharynx; then, by introducing the finger into the mouth and hooking the catheter forward and toward the middle line, it can be guided into the larynx, and in this way respiration in the living might be carried on through the nose; but, though nasal instruments can be so introduced into the trachea, it is yet difficult to pass them when compared to the passage of like instruments through the mouth. The nasal tubes have also a decided disadvantage; they are necessarily of much smaller calibre than the tubes which are admitted through the mouth; in most people, one or other nasal aperture does not admit a tube of sufficient calibre to enable the respiration to be carried on easily.

The facility of introducing tubes by the mouth into the trachea having been ascertained on the "subject", the question which next presented itself was: whether there were any obstacles in the living body which would prevent or contraindicate their use. The instructions given in almost every text-book teaching the introduction of œsophageal tubes, would lead one to suppose that not only could such instruments be passed into the trachea, but that it was necessary to give special indications of their presence there, in order to avoid the awkward mistake of injecting fluid or food into the lungs. These precautionary indications are necessary, as, on several occasions, the stomach-pump tube has been unwittingly introduced into the trachea and left there, for shorter or longer periods, before the mistake has been recognised. Among these, may be mentioned the mistake made by no less a surgeon than Desault, who passed a tube into the trachea, left it there for some hours, and only became aware of its true situation when he began to inject food into it.* After the performance of tracheotomy, tubes have been passed through the trachea into the mouth, and the reverse way; and, from the scanty reports of those cases, one gathers that the parts have exhibited considerable tolerance to the presence of those instruments. A couple of cases of cut-throat, which came into my wards about the same time—the one having the windpipe severed immediately above the vocal cords, the other beneath them—showed a great and growing tolerance to external impressions; so much so that, even when the cords were digitally pressed on and held aside, no spasm was produced. Besides these, the passage of metallic and vulcanite instruments, as proposed by Trendelenburg and

carried out by Schrötter, with the view of dilating strictures in chronic laryngeal stenoses, prove that instruments can be passed by the mouth and temporarily retained in the trachea without exciting an unsurmountable degree of spasm. And I would say that if they can be retained for ten minutes they might, as far as the fear of spasm is concerned, be retained for a much longer period. With these brief introductory observations, I will pass to the series of successful cases which I had during the year 1878.

CASE 1.—*Removal of Epithelioma from Pharynx and Base of Tongue: Introduction of Tube into Trachea through Mouth to occlude Hemorrhage from Larynx, and for administration of Anæsthetic.*—W. P., aged 55, a plasterer,* was sent me by Dr. Anderson, Duke Street, Glasgow, who stated he believed him to be suffering from epithelioma of the mouth. There was an ulcerated surface of the tongue, and also one on the anterior pillars of the fauces. The last two right lower molars were very sharp and rugged, and, though the ulcer had an epitheliomatous look, it was thought advisable to try palliative measures in the first instance. The two lower molars spoken of were removed, and he was placed under a course of iodide of potassium. After a very full trial, these measures were found inefficient, as, when he was seen by me two months afterwards, the disease had extended. He was then admitted into the hospital.

On admission, he stated that he had experienced for over a year sore-throat, pain in the right ear, and shooting pain in the back part of the tongue. On examining, an ulceration was found on the right side of the fauces, extending from the anterior pillar backward to the posterior wall of the pharynx—the latter of which was invaded for about an inch. From the fauces it spread downwards and inwards to the dorsum of the tongue, and the raised ulcerated margins extended from a point opposite the last right molar to the immediate vicinity of the epiglottis. Histologically, the characters of this disease were epitheliomatous.

With the patient's concurrence, it was resolved to remove the growth. As it was an operation which would cause considerable bleeding, precautions had to be taken to secure the air-passages from occlusion. Hitherto this had been effected by opening the windpipe, by laryngotomy, and the introduction of Trendelenburg's tampon-cannula. Instead of this, I had determined, should an opportunity present, to introduce into the trachea, by way of the mouth, a tube, which would extend beyond the vocal cords, and through which the patient would respire. The upper laryngeal opening could then be plugged outside this tube, so as to prevent the entrance of blood into the larynx. The plug could then be effected in various ways, by causing the tracheal tube to perforate a close sponge of suitable size, which, after the tracheal tube had been introduced, could then be fixed in the laryngeal orifice; by fixing to the tube, at a convenient part, a piece of fine muslin or other material, which would act as the *canule à chemise* used after lithotomy; by inflation of a circular closely fitting bag, etc.

Preparatory to the operation, a tube was several times inserted through the mouth into the trachea, beyond the vocal cords; and it was found that, with the exception of the cough which ensued immediately on its insertion, he bore the tube sufficiently well to warrant the success of the procedure. He could breathe freely through it, and the mucus expectorated was expelled through the tube with considerable force.

The operation was performed on July 5th, 1878. The usual cough followed the introduction of the tube; but it ceased as soon as he received a few whiffs of chloroform, and long before he became constitutionally affected by the drug; the chloroform seemed to exercise a local sedative effect. The upper opening of the larynx was stuffed with a sponge to prevent the entrance of blood. The tube projected several inches beyond the mouth, thus enabling the administration of the anæsthetic to be continued uninterrupted during the whole operation, without in any way interfering with the manipulative procedure. The entrance and exit of air through the tube was both felt and heard distinctly, so that Dr. Symington (who administered the chloroform) had a ready guide to the state of the respirations. After the operation was finished, when the hæmorrhage had ceased and the patient had regained consciousness, the tube was withdrawn, it having acted throughout without the slightest hitch.

The operation may be briefly described as follows. An incision was made through the right cheek, from the angle of the mouth to the angle of the lower jaw—the latter being sawn through. This line of incision, once previously used by Dr. Foulis, though objectionable on *à priori* grounds, was followed chiefly on account of the extensive view of the internal parts afforded by it. The diseased surfaces were thoroughly removed by the knife, the instrument passing wide of the affected parts. The sawn angle of the jaw was afterwards drilled, and coupled by two strong silver wire stitches. The cheek was accurately brought together,

* Desault, by Bichat, *Œuvres Chirurgicales*, vol. ii, pp. 26c.

* The patient was afterwards shown at the Glasgow Medico-Chirurgical Society.

and a bandage applied to secure immobility of the lower jaw. His after-treatment consisted in perfect quiescence and fluid food. In a week the wound was for the most part healed, the only portion remaining open was that where the wires uniting the jaw protruded through the skin. In a month the wires were withdrawn, the jaw being then firmly united. He was dismissed to the Convalescent Home July 26th, 1878. Since then, he has several times presented himself, and, as he has cultivated a vigorous growth of hair, the facial linear cicatrix is no longer visible. The larynx in no way seemed to suffer, and the voice was in no way affected. The administration of the anæsthetic was carried on through the tube, which projected several inches beyond the mouth, quite uninterrupted, and without in any way interfering with the operator. The respiration was felt and heard by the administrator; the tube, as it concentrated the flow of air, increased the sensation to the hand and ear. Once or twice during the time he was under the chloroform, mucus was thrown from the tube by an explosive expiratory effort. It must be obvious that as long as the tube which went beyond the vocal cords remained patent, there could not possibly be any fear of asphyxia, and the most frequent cause of fatality under chloroform would be avoided.

REMARKS.—It may be noticed that the tube answered all the purposes for which it was intended. 1. The chloroform was easily, uniformly, and uninterruptedly administered during the whole operation. 2. The administration of the chloroform in no way interfered with the performance of the operation. 3. The ingress and egress of air through the tube were both felt and heard, so that the administrator had a ready indication of the state of the respiration. 4. No blood entered the larynx. 5. The after-result was excellent.

CASE II.—*Edema Glottidis: Tube inserted into Trachea through Mouth.*—W. L., a commercial traveller, aged 42, was admitted into the Glasgow Royal Infirmary at 1.20 A.M. on 14th Sept., 1878, suffering from acute edema glottidis. He had a note from Dr. Macmillan of Paisley Road, Glasgow, headed, "urgent case", and stating, "case of inflammation of trachea, probably requiring operative interference". After the patient was examined by my house-surgeon, Dr. Symington, he considered it necessary to send for me, and at 2.15 A.M. I found the patient in the following state. He sat in bed supporting himself with stiffened arms; his head was thrown forwards, and he had the distressed anxiety so characteristic of impending suffocation depicted on his countenance. His inspirations were crowing and laboured, and there was a very frequent forced attempt to swallow, attended by extreme pain, at the termination of which a long crowing inspiration ensued. He spoke in a muffled whisper, and confined his answers, when possible, to monosyllables, or substituted signs by head or hand. He complained of intense pain—a feeling of suffocation, and begged that something should be done for his relief. On examination, it was seen that the base of the tongue and the fauces were covered with whitened mucous membrane, at parts shrivelled up and peeling off, at others adherent. The parts not so covered were in a reddened congested state. The fauces and the upper portion of the larynx were much swollen, and had a hard thickened feeling, as if they had been slightly burned. The respiratory orifice was so much constricted that the tip of the forefinger occluded it. He constantly signed for cold water, which he took into his mouth, and after abortive attempts to swallow, he rejected it during a fit of coughing.

History.—It was afterwards ascertained that he had entered the kitchen of his house just as the boiling water had been poured from the potatoes preparing for dinner; snatched up a small potato in his fingers, and, finding it too hot for them, unthinkingly threw it into his mouth and attempted to swallow it, but it stuck at the back of his throat and nearly choked him. This happened twelve hours prior to his admission into the hospital. An hour after this mishap he felt somewhat relieved, and went out to transact some very pressing business, but finding his breathing becoming rapidly impeded, he had to return and send for his medical attendant. From this time the symptoms steadily increased, until he arrived at the hospital in the condition already mentioned.

Treatment.—It was just such a case as required prompt operative interference. Instead of opening the windpipe through the neck, it was resolved to introduce an instrument by the mouth. As the passage was so constricted, a No. 12 catheter was first introduced, and, the orifice being found so far patent, a catheter of larger calibre, and in shape resembling a rectal tube, was introduced. On its introduction there was evinced considerable excitement, accompanied by a spasmodic fit of coughing, which lasted for about a couple of minutes. In order to gain the patient's confidence, he was asked to hold with his own hand the portion of the tube which projected from his mouth, and told that he was at liberty to withdraw it if he felt it necessary. Half an hour afterwards he withdrew the tube, stating that he did so as he wanted to cough. When it was withdrawn, even after this short interval, he could speak

more distinctly, and stated that his breathing was relieved. The tube was then reinserted, and fixed *in situ* for twelve hours. It was then removed, washed, and, after the patient had something to drink, it was reintroduced, and retained for other twelve hours. After the end of the first twenty-four hours, when the tube was withdrawn, he could breathe very much more freely, and could swallow solid food. It was, however, considered prudent to introduce and retain the tube in the trachea for other twelve hours, which was done. During the last period, he slept for four or five hours with the tube in the trachea. After the end of this time, the swelling round the orifice of the larynx had almost entirely subsided. The tube was then finally removed. This would be about thirty-nine hours from the time the tube was first introduced; but, excluding the time during which the tube was withdrawn for the purpose of cleaning it and feeding the patient, the instrument would be retained *in situ* for thirty-six hours. He afterwards made an uninterrupted recovery, and went out of the hospital six days after admission.* Regarding this case, the following facts seem worthy of note. The first introduction of the tube was followed by a prolonged (fully two minutes) spasmodic cough, which evidently gave pain. The second insertion was likewise followed by a spasmodic expiratory effort, but much slighter and of short duration. The sequence of the third intromission was a single abrupt expiratory effort, resembling a person clearing his throat, but there was neither cough nor pain. On the occasion of the first and second introductions, I perceived that the cough and the painful sensation subsided at the moment when a long inspiration took place. Before introducing the tube a third time, the patient was instructed to take a long inspiration as soon as the tube was inserted. He did so, and it is possible that this affected the result.

It will be observed that the word cough is used; and physiologists will be apt to say that, if the patient coughed, the tube could not have been passed through the vocal cords. The tube was passed into the trachea until the rings of that organ were felt, so that there can be no doubt that the tube had penetrated further than the true cords. The sound, which has been called a cough was at times rather like a person violently clearing the throat, but at others it was a distinct explosion—at such times generally sending some mucus forcibly from the orifice of the tube. A cylindrical tube of the calibre used does not fill the whole larynx at the level of the cords, but, resting chiefly on the respiratory portion, still permits the cords to come into contact anteriorly, to a greater or less extent. It is, therefore, possible that the portions of these structures remaining free could exercise sufficient restraining power on the air on the outside of the tube in front, so as to enable an explosion to take place, provided the volume of air coming from the lungs be greater than what could find ready egress through the tube itself. Whether this explanation be correct or not, there can be no doubt that the patient could say "Yes" and "No" distinctly while the tube was *in situ*—leading the air to the outside of the mouth—and to attempt other sounds and phrases, though the latter were unrecognisable.

Mucus was expelled from the tube by coughing. Sometimes a little mucus would be heard in the tube for a number of seconds, when a sudden expiratory effort would send it to the outlet of the tube, where it would be wiped away, or the cough might be strong enough to expel the mucus clear of the tube. In this instance, the mucus in the tube formed an impediment which was sufficient in itself to permit a distinct explosion when an effort to expel it took place.

This patient was extremely thirsty, constantly crying for drink, owing probably to the burned state of the parts. After the tube was inserted, he demanded a drink, and was much annoyed when he was presented with a teaspoonful of fluid. It was explained to him that it was feared the fluid "would go down the wrong way". This fear on our part was soon dispelled by the patient taking several mouthfuls of milk, and swallowing it while the tube was *in situ*. This he afterwards many times repeated, the parts encircling the tube so as to prevent the ingress of fluid.

CASE III.—*Acute Edema Glottidis, following Chronic Laryngeal Affection: Insertion of Tube into Trachea through Mouth.*—M. R., a housewife, † aged 38, was admitted into the Royal Infirmary on December 8th, 1878, suffering from a laryngeal affection requiring operative interference. For more than a month previously she had suffered from a throat-affection, supposed to be ulceration of the larynx, for which she was treated by Dr. Nairn of Glasgow. From this she partially recovered, but on December 5th she took a relapse. She then experienced pain in the throat and right ear, and difficulty of deglutition, which increased until, when she attempted to swallow, the fluid passed by the nose. Her respirations became greatly impeded until, on the day of admission, her medical attendant considered operative interference imperative, and with

* This man was shown by me afterwards at the Glasgow Pathological and Clinical Society.

† This patient was afterwards shown at the Glasgow Medico-Chirurgical Society.

this view advised her to go to the Royal Infirmary, whither he himself conducted her in a cab. On admission, she was in the following condition. She had an anxious pained look; her respirations were laboured, crowing, and much impeded. The saliva trickled from her mouth, as she could not swallow, and very often a spasmodic cough took place, ending in bringing up some mucus mixed with saliva and slightly tinged with blood. She had aphonia; attempts to whisper evidently gave pain, so she curtailed them to monosyllables, or substituted a sign, such as a shake or nod of the head. She hesitated about making any attempt at deglutition; she did try, however, and apparently took a spoonful of milk, but after four or five seconds it was expelled during a fit of coughing. This was repeated with a like result. On examining the throat, the orifice of the larynx was found to be very much narrowed—oedematous tissue surrounding it on all sides and extending backwards in the form of a tumour, which completely blocked the pharynx. The tip of the forefinger could occlude the portion of the laryngeal orifice that remained patent. The epiglottis was not active, and neither it nor the surrounding parts exhibited the usual sensitiveness to touch. In consequence of the tumour-like extension of the oedema behind and to the sides, the larynx was pushed well forward and fixed in that position. Her pulse was rapid and weak; her skin was hot and clammy. She was about three months pregnant. It was just such a case as would have been operated upon by tracheotomy under ordinary circumstances.

A fresh No. 12 catheter was passed into the trachea by way of exploration, and then the smallest sized tracheal tube that was at the time obtainable. This was found to be just on the thick side, but it passed. A fit of coughing, which lasted more or less for a couple of minutes, ensued; after which she had comparative ease. The tube was inserted at 6.20 P.M. on December 8th, and was retained till 8 A.M. on December 10th—it being removed at intervals of about twelve hours to be cleaned and to permit an œsophageal tube to be inserted for feeding purposes. In all, it was in the larynx thirty-five hours. At the end of that time, the oedema had greatly subsided; she then breathed easily. She could swallow and speak a little, and from this time she made an uninterrupted recovery.

The following points are particularly noted. The introduction of the tube was easy, as the laryngeal orifice was thrown well forward and fixed, owing to the great amount of oedema; and from the same cause the parts had an impaired sensibility, which rendered the manipulation tolerable. The first tube seemed to fill the entire free portion of the larynx above the cords. The next tube was very slightly narrower, at the same time thinner in its walls, thereby affording a large internal diameter relatively to the size of the tube. The ease which this gave was great, and, after it was introduced, the patient marked her appreciation of it by grasping and clapping the hands of the operator by way of thanks. She turned on her side afterwards, and soon fell asleep. The two last times the tube was inserted, it did not cause any cough or spasm.

In the former case, it was noticed that there was a distinct cough; in this case, the expiratory explosion of air was not what could come clearly under the physiological term cough, except toward the end of treatment, when there were sounds which were more purely explosive in character. Again: at first, after the introduction of the tube, the patient could not give the monosyllables as noted in the former case. It must be remembered, however, that she had complete aphonia on admission. Toward the end of the first twenty-four hours, she began to say "Yes" and "No"; and, after the thirtieth hour, the monosyllables were sounded distinctly.

The expectoration was profuse, semi-purulent, fluid, and streaked or mixed with blood; but it afterwards, towards the end of the first twenty-four hours, began to be thick and tenacious. The expectoration was thrown to the outside of the tube, sometimes by a distinct cough, when a quantity of the mucus had partly occluded the tube for a moment. On several occasions, when the mucus began to be tenacious, a little brush, mounted on a wire of definite length, was pushed into the tube and the expectoration removed. Twice, when the breathing was not quite so free, the tube was removed, and a very thin coating of mucus was found in the interior; this was washed off and the instrument returned.

Remembering the state of the pharynx, rendering deglutition impossible, and the loss of sensibility of the larynx prior to the introduction of the tubes, she was not asked to swallow during the first twenty-four hours while the tube was in position. Several times, a catheter was introduced into the œsophagus, and beef-tea, eggs, milk, and brandy were injected. At the end of the first day she began to swallow a little, and about the thirtieth hour she took several mouthfuls with the tube *in situ*. Several times she slept for hours with the tube in the trachea, and often she had snatches of sleep besides.

In this case, the oedema glottidis, mechanically blocking the pharynx, was so great as to exercise pressure on the superior laryngeal nerves,

exhibited in the non-sensibility of the epiglottis and the parts of the larynx above the true cords. This constituted a danger, as was shewn when she attempted to swallow. The impaired laryngeal sensibility, coupled with the fixity of the structure from the oedema, prevented the epiglottis and the neighbouring parts from closing the laryngeal orifice, when an attempt at deglutition was made. As a consequence of this and the pharyngeal obstruction, the fluid entered the larynx, passing down into the trachea before it produced the irritation necessary for its expulsion. A few seconds of quiescence ensued after the attempt to swallow the fluid before it was again brought up by coughing, and it is likely that the time might have been extended if persistent efforts to feed the patient were made. From cases which I have seen and heard of, this is not an unfrequent cause of at least hastening a fatal issue in children affected with oedema of the glottis. It is satisfactory to note that the patient, who was pregnant at the time when she was suffering from the throat-affection, afterwards had a well-developed strong child at full time.

[To be continued.]

ON A NEW METHOD OF ARRESTING GONORRHŒA.

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HAVING been for some time past occupied with the problem of the infective diseases of wounds, the subject of gonorrhœa, as an affection probably belonging to the same class of diseases, has occupied my attention. The extreme contagiousness of this disease, the existence of a distinct period of incubation, and the steady spread of the inflammation from a given spot, all point strongly to a parasitic origin. Acting on this idea, I made, in the spring of 1879, a number of inoculations of gonorrhœal pus, under certain precautions, into flasks containing infusion of meat or infusion of cucumber. In these flasks micrococci grew in large numbers, and also sometimes bacteria, showing that these organisms were present in the gonorrhœal pus. Circumstances prevented me from pursuing this subject further at that time. In the meantime, Dr. Neisser published an elaborate research on this subject, in which he showed the presence of enormous numbers of micrococci in gonorrhœal pus, and in the pus from contagious ophthalmia. He further asserted that these organisms were always of a definite size, and that they differed in respect of size from the micrococci found in wounds. The presence of large numbers of micrococci in gonorrhœal pus has since been confirmed by several observers. Whether these micrococci are the cause of the gonorrhœal inflammation or not, I do not attempt to say, but the general history of the disease, taken together with these facts, points strongly to the idea that its essence consists in the growth of these or allied organisms.

If this disease be due to the spread of organisms, where are they situated? Several facts lead to the supposition that they are not only free in the urethral canal, but that they are also present in the substance of the inflamed mucous membrane. Thus, in the case of erysipelas, it has been demonstrated that the skin at the margin of the inflammatory redness is full of micrococci. Koch found, in his case of erysipelas in rabbits, that bacilli were present throughout the inflamed part, and coextensive with the inflammation. The same writer obtained a progressive gangrene of the tissues in mice by the injection of putrid blood, and he has demonstrated conclusively that this gangrene is due to an organism—streptococcus—which is present in large numbers around the limits of the gangrenous part. A similar observation was made by him in a case of spreading suppuration in rabbits. Mr. Lister has long held the opinion that, in the case of putrid sinuses, the organisms were present, not only in the canal of the sinus, but also in the substance of the unhealthy granulation-tissue lining them. This view has been justified by the fact that, though formerly, by the simple injection of the sinuses with antiseptics, he did not often succeed in eradicating the septic element, yet, since he has adopted the use of Volkmann's sharp spoon, and has removed the layer of granulation-tissue lining them, success is by no means uncommon. And, lastly, I have demonstrated that, though many forms of organisms will not survive if introduced into a healthy animal, yet, if an animal be previously in a state of ill health, these forms of organisms are not destroyed, but may be found alive in the blood or tissues.

In the case of gonorrhœa, then, I suppose that, at the time of infection, a small number of the specific organisms, which in all probability possess a considerable resisting power to the destroying action of the healthy living tissues, are retained in the urethra, that these go on developing, that the products of their growth irritate and weaken the