Tracheotomy in croup and diphtheria / by George Buchanan.

TRACHEOTOMY

IN

CROUP AND DIPHTHERIA.

BY

GEORGE BUCHANAN, A.M., M.D.,

SURGEON TO THE GLASGOW ROYAL INFIRMARY; LECTURER ON ANATOMY, ANDERSON'S UNIVERSITY
ETC., ETC., ETC.

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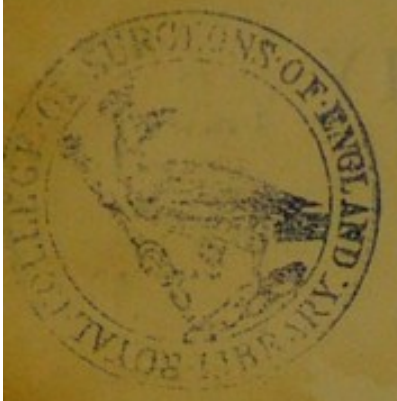
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(Read before the Medico-Chirurgical Society.)

DISEASES of the fauces, larynx, and trachea, accompanied by exudation, have been remarkably prevalent of late in Glasgow and its neighbourhood. From the Registration Tables it appears that during the month of April there were nineteen deaths from diphtheria, and twenty-seven from croup; and the previous months of the present year also show a large mortality from these affections.* The experience of most of the medical men of this city will confirm this statement, both as to their prevalence and fatal nature. As I do not engage in medical practice, my experience is confined to those cases in which my opinion has been asked by the family attendant, with a view to the operation of tracheotomy, where it seemed called for and justifiable. Since I first performed this operation in a case of croup, in March, 1861, I have seen in this way twelve cases, in nine of which I operated; and it may interest the members of this society if I detail these, and add a few remarks which have occurred to me in considering this most important subject.

* The following extracts from the Registration Tables show the prevalence of these diseases:—

Total deaths in eight towns in Scotland in 1861,	23,130
Diphtheria carried off,	151
Croup, "	354
Total deaths in 1862,	24,965
Diphtheria,	285
Croup,	626
Total deaths for four months of 1863.	9,170
Diphtheria, 90 in Glasgow,	150
Croup, 140 "	300

The first case has been already published in the *Glasgow Medical Journal;* but I may be excused for recalling it to your notice, as it possesses many features of interest :—The child, aged 6 years, had been ill two days, and was very actively treated, without success. I was suddenly called on the 8th March, 1862, and found the patient on the point of dying from suffocation. It seemed very hopeless, but the operation was successfully accomplished, and respiration was at once restored. She got rapidly well, and in three weeks the wound was cicatrized, and she was running about the house with the other children. Six weeks after she was suddenly seized with convulsions, and died of that disease. Post mortem examination of the trachea showed that the parts had become perfectly healthy.

Case II.—On the morning of the 25th February, 1862, I was requested by Dr. Mather of Belgrove to visit a child apparently dying of croup. Dr. Hamilton, my assistant in the Infirmary, accompanied me, bringing the instruments requisite for tracheotomy. Dr. Mather informed me that the child, a boy of $3\frac{1}{2}$ years of age, was seized with the first symptoms the day previous. Three leeches had been applied to the neck, and a blister over the sternum, and ipecacuan wine had been administered freely, but without checking the symptoms. When I arrived the child was weak, cold, and suffering greatly from impeded respiration. I at once performed tracheotomy, with the assistance of Drs. Mather, sen. and jun. The opening of the trachea was attended with instant relief to the breathing, and after introducing a tube the child soon recovered its heat and natural colour. A considerable quantity of tough shreds, mingled with mucus, was sponged from time to time from the orifice; and when I left the respiration was comparatively free. Dr. Mather remained for some time in charge of the tube, and while he was in attendance the little patient got better, and swallowed easily some milk and water. Having to leave about three hours after, he gave instructions to the attendant how to manage the tube; but, through some want of care, it got dislodged or clogged, and the orifice in the trachea becoming obstructed by some secretion, the child suddenly died suffocated.

Case III.—Dr. Miller of Castle Street asked me to perform tracheotomy on a child aged 3 years, on the point of death from croup. The disease had existed for forty-eight hours, and had resisted very active treatment. Assisted by Dr. Miller, Mr. Miller, and Dr. Hamilton, I opened the trachea, but during the progress of the operation the apnœa became excessive, and I was obliged to hurry the proceedings, fearing that death would occur before it was completed. Shreds of false membrane and tough mucus were expelled from the wound, but before respiration

could be fairly re-established the child died. A gum elastic catheter, with an opening in the point, was introduced, and artificial respiration attempted without avail. The trachea was evidently quite obstructed below the point at which it was opened.

Case IV.—On the 27th of August, 1862, Mr. M'M. asked me to visit his boy, aged 14 months, who was suffering from croup. Dr. Renfrew was in attendance, and sent word for me to bring tracheotomy instruments. On my arrival, I found that Dr. Renfrew had been called away, but left the case in my hands. I afterwards learned that the child had been ill four days, and that the symptoms had rapidly become very serious in spite of treatment. I explained the danger of the operation, and the certain result if the child was left without surgical interference. Mr. M. at once requested me to perform tracheotomy. Dr. T. D. Buchanan, who lived in the vicinity, came to assist me, and the trachea was soon safely opened. I found that the aperture in the trachea could easily be held open with the blades of a pair of dressing forceps; and Dr. Renfrew, who arrived soon after, along with Dr. Buchanan, agreed to take a share in attending for a considerable period; after which I got a student to undertake the management of the case. After an hour or two the respiration became so free through the wound, that it was found unnecessary to keep the forceps constantly in the trachea. At intervals, however, a spasmodic fit of coughing came on, which expelled quantities of tough thick mucus, and at these times the wound required to be opened up and sponged to free it from the obstruction. The child soon fell asleep, and passed the night in comparative quiet. Next morning the child was still continuing to breathe easily, and readily swallowed beef tea and milk at intervals. Towards midday, however, he began to be hot and restless; the pulse became rapid but small, and the respiration laboured, even when the tracheal opening was kept patent. The face became puffy and livid, and all the signs of non-aeration of the blood having supervened, the child died at 4 p.m., sixteen hours after the operation.

Case V.—This case occurred in the practice of Dr. Paterson of Partick, who sent for me with the intention of requesting me to perform tracheotomy, if it seemed to offer any hope of success. Dr. Drummond had been called in consultation, and, along with Dr. Paterson and myself, was quite of opinion that death was near at hand. The child, aged two years, had been affected with diphtheria for five days, and the exudation had now spread to the trachea, causing the impending suffocation. The little patient was so weak, and the breathing so obstructed, that the face was already cold, and I feared that it was too late for the

operation to offer a chance of recovery. I therefore told Mr. and Mrs. D., the parents, that in all probability the child would not survive; but, knowing that death was certainly close at hand, they requested me to give, by the operation, the only hopes there was of warding off the immediate result of the disease. After the first incision, a good deal of blood oozed from the bottom of the wound, but no vessel of any size was visible. Sponging with cold water at length arrested this, and the bistoury was easily passed into the trachea, but as soon as the wound was made, a quantity of dark, tarry-looking blood flowed from the edges, and was with difficulty cleared away by firm and repeated applications of a moist sponge. A large quantity of exudation was pulled and sponged from the wound, but it continued to be driven up from the trachea in such quantities that before the opening could be entirely freed from it, as well as from the viscid blood which still continued to escape from the bottom of the wound, respiration was completely arrested, and the child died without having been relieved in any degree by surgical interference. It was a case very unsuitable for the operation, and I only yielded to the parents' desire, after telling them the probability of the result, which actually occurred.

In connection with this case I would call attention to the unusual state of the blood. I have not seen any remarks on the state of the blood in diphtheria, nor have I had any other opportunity of extending the observations. But it was quite evident that that fluid was in a dark and viscid state. The darkness might be accounted for by the impeded respiration, but the tarry consistency struck me as a condition which might be one of the pathological elements of the disease in an advanced stage. Further observations may tend to modify or confirm this remark.

Case VI.—Dr. Gairdner called for me on the 28th of January, 1863, at 5 a.m., and informed me that he had been in attendance on the child of Dr. Forbes, aged 2½ years, which had been seized with symptoms of diphtheria a week before. Dr. Forbes has kindly furnished me with the following particulars of his illness:

"On Tuesday week before he died his throat was observed to be slightly ulcerated about the tonsils; but as his general health was not affected, and he was lively and running about as usual, this was thought lightly of; and, moreover, under the chlorate of potash gargle, and a little tincture of muriate of iron, he seemed considerably better, if not well. On Saturday, however, he was evidently worse again, and now he was languid. On Sunday he had a slight cough, evidently of a croupy character, and he had an emetic of ipecachuan and a warm bath. The disease progressing, antimony was substituted for ipecachuan by the advice of Drs. Drummond and Gairdner. On Monday a layer of exu-

dation was easily seen coating the tonsils, and extending backwards and downwards. On Tuesday he was weaker, with quickened pulse and respiration. The hot bath and emetic seemed to give temporary relief, but the serious symptoms continued to advance. About two o'clock on Wednesday morning, and seemingly without effort, he coughed up a cast of the larynx and trachea, and immediately after the spasmodic breathing came on so alarmingly as to threaten instant suffocation. I fancy the cast broke off beneath the vocal cords, and very likely portions of loose membrane were left which were worse than the whole coating continuously applied."

About 5 a.m. when I arrived the symptoms of suffocation were so urgent, that Dr. Gairdner concurred with me in advising tracheotomy as the only resource left, and Dr. Forbes at once requested me to perform it. The opening of the trachea was attended with instant relief to the respiration, and the aperture could easily be kept open with the blades of the dressing forceps, which caused so little irritation that I recommended their use instead of a tube. Dr. Forbes and his friend Dr. Stirton undertook the management after I got the trachea sufficiently clear to allow free and tranquil breathing.

Dr. Forbes in his note adds—"A free and large supply of oxygen was most kindly supplied to me by Professor Anderson of the College, but it was seemingly without effect. Death took place from pure *asthenia* about two o'clock in the afternoon, just nine hours after the operation."

In this case, the relief to the distressing and painful efforts to respire was most marked. The poor boy was tossing about, gasping for breath; but from the moment of the operation he lay quiet, breathing easily and apparently without any pain. As a palliative in soothing the last agonies of the little child, and the pain of those who witnessed his struggles, the operation answered a good purpose.

Case VII.—While in the act of performing the operation just detailed on the 28th of January, I was sent for along with Dr. Gairdner to see the child of Mr. W., which was under the care of Dr. Drummond, and Dr. Newman, who had been called in on a sudden emergency. The child was 18 months old; the disease had existed three or four days, and the symptoms of suffocation were at times very urgent. It seemed, however, that these came on in spasms, with intervals of comparative repose. The fits of suffocation were becoming more frequent, and the child was getting exhausted. It was agreed to postpone any surgical interference till 11 o'clock, and that small quantities of brandy should be given to restore the strength if possible.

At 11 o'clock the symptoms of impeded respiration were less

spasmodic and more continuous, and it was obvious that the only chance of recovery was in an artificial admission of air. I had to operate with great caution, for the tracheal obstruction caused such irritation that the child could scarcely be kept quiet for a second. At each inspiration there was a remarkable drawing in of the sternum, which caused a general motion of the whole chest and neck. One or two veins in the first incision bled freely, and these I tied before proceeding. When the trachea was opened a fit of coughing expelled a large quantity of viscid exudation, and when this was cleared away the breathing became more easy. Still there seemed some obstruction below the opening, so I introduced a gum elastic catheter with an opening in the point, and pushed it first into the right then into the left bronchus, and each time it was withdrawn it was found filled with a whitish tough substance, which was clearly the exudation. In a short time the child lay quiet, breathing easily; its colour and heat were restored, and the relief to the distressing paroxyms most evident. The opening in the trachea did not require a tube, but two assistants kindly remained, and from time to time introduced the forceps and cleared the exudation, which was sometimes coughed up to it. The child's strength gradually sunk; and although the symptoms of impeded respiration were removed, the pulse continued to get feebler, and death took place at 4 p.m. Post mortem examination showed that the exudation had extended down to the bronchi, which were somewhat obstructed with it, not sufficiently to have caused death if the child's strength had not given way.

Case VIII.—At 1 a.m. on the 23rd February, 1863, Dr. Gray called for me and requested me to accompany him to a case of croup in which he had proposed tracheotomy. J. A., aged 3 years, had been ill with croup for three days, which, notwithstanding active treatment, had advanced to the third stage. Although not yet on the point of suffocation, it was quite evident that the false membrane would completely impede respiration in a very few hours. Even then the face was puffed and cold; breathing stridulous, and the child agonized and restless. With the consent of the parents I lost no time in performing tracheotomy. It was one of the most difficult cases I have had to perform. After the first incision a large vein bulged into view on each side, and nearly filled the space between the cut edges, while in the lower part of the wound the thymus gland plainly made its appearance. I got the veins held aside with blunt hooks, and carefully dissected down to the trachea, which I laid bare for the extent of three or four rings. The completion of the operation was then easy enough. A large quantity of tough mucus and exudation was expelled by coughing and drawn out with a sponge.

After the opening was rendered free by sponging, the forceps easily kept it quite patent, and in a short time they could be removed altogether. Occasionally, however, some tough mucus obstructed the orifice, but the introduction of the forceps and application of a sponge was sufficient to clear a passage for the air. This way of treating the opening seemed so effectual that I resolved to adhere to it, as a number of students kindly offered their services to me as assistants; and so efficient was their aid that next day the child continued to breathe with perfect ease, and slept soundly at intervals. Beef tea and milk were given alternately, and in the afternoon I had great hopes of a successful issue. At 10 p.m. when I left the little patient in charge of two of the gentlemen who had undertaken the attendance during night, it was very well; but about an hour after it took a sudden spasmodic attack, during which a quantity of tough mucus was driven up to the wound, and before the respiration could be restored the child died suffocated. The forceps were introduced into the wound in the way I explained, but the manipulation was not effectual in opening up a sufficiently free communication between the trachea and external atmosphere. From the progress of this case I am satisfied that if I had employed a tracheal tube the operation would have been followed by success.

Case IX.—John M., aged 4 years, began to complain of sore throat on the 11th of May, 1863, and on the 13th was visited by Dr. Gray, who at once pronounced the disease to be diphtheria. A white exudation coated the fauces and back of tongue. Emetics of ipecachuana were first administered, and subsequently bichromate of potash and chlorate of potash gargle, with nourishing diet. Under this treatment the child got nearly well. On the 20th, however, he complained of pain in the throat, with some difficulty in breathing, which was not relieved by an ipecachuan emetic. On the morning of the 21st, there were distinct symptoms of exudation in the larynx and trachea, and the distress in breathing rapidly got worse towards evening. I was called at 10·30 p.m., and found Dr. Gray and Dr. Burns in attendance. The little patient was in great distress, tossing in bed in the agony of obstructed respiration, which was accompanied with hoarse stridor. It was quite plain that suffocation was impending. The gentlemen in attendance had already told the parents that life could not be prolonged beyond an hour or two, without surgical interference, a statement in which I fully agreed. I performed the operation with great caution, fearing hæmorrhage from the swollen state of the veins of the neck. One vein, which lay across the seat of the incision, was cut and tied; and after waiting till the bleeding had completely ceased, I opened the trachea, and inserted a double tube. Nothing could be more

satisfactory than the instant relief to all the distressing symptoms. Presently the child swallowed a few spoonfuls of milk, and soon fell asleep, breathing perfectly quietly. A young medical friend of Dr. Gray's took charge of the case during the night, and when I saw it next morning at 6 a.m., I was rejoiced to find everything going on well. However, I was so anxious that the tube should be properly managed, that I told the case to my students, who kindly volunteered their services, and from the date of the operation for six days a medical attendant was by the bedside day and night. The inner tube became stopped up with a clear viscid exudation at intervals of an hour or two, but was readily extracted and cleaned. Milk and beef tea in small quantities were given, and easily swallowed. On the sixth day the secretion had become so scanty and thin that I removed the tubes, and found that breathing was quite free, and going on through both wound and mouth. Next day his voice was audible, and after the eighth day was loud enough to be heard in the next room. For a few days mucus continued to be expelled during coughing through the tracheal wound, but by the 3rd of June it was filled up, and the little patient rapidly regained strength.

Besides the cases now narrated in which the operation was performed, I was called to see three others, in which I declined to operate for the reasons after detailed.

Case X.—In August, 1862, I was asked to see Mrs. G. in Blythswood Square, who was suffering from diphtheria. She was attended by Dr. Greenlees. The disease had steadily and rapidly progressed from bad to worse, and when I saw her the false membrane had invaded the whole fauces, and evidently extended through the larynx into the trachea. Respiration was accompanied by a loud stridor, and the face and lips were cold and livid. Pulse almost imperceptible. It was certain that tracheotomy would have afforded no chance of life, as the patient was dying more from asthenia than apnœa. I therefore declined interference, and death occurred in an hour. An autopsy was granted, when the whole of the air passages, as far as the bronchi, were found thickly coated with false membrane.

Case XI.—Dr. Spiers sent for me on the morning of the 7th December, 1862. He was attending a child, aged 4 years, who had been suffering from symptoms of croup for two days. Active treatment had been employed, and an emetic of ipecachuan had been given shortly before I arrived. The symptoms were not very urgent, the pulse was of fair strength, the face warm, and the child not struggling at all. Dr. Spiers and I agreed that there seemed as much hope of recovery in the continuance of the medical treatment as in the operation of tracheotomy. I, there-

fore, advised the parents to leave their child in the hands of Dr. Spiers for further treatment. I have since had reason to regret that I did not urge the operation at the time I saw it; for I learned that the symptoms rapidly grew worse, and the child died of suffocation a few hours after.

Case XII. occurred in the practice of Dr. Ritchie. The child of Mr. W., aged 2 years, was in the last stage of croup. It had been ill several days, and the disease had steadily advanced in spite of treatment. When I saw it with Dr. Ritchie, we both agreed that the operation of tracheotomy afforded almost no chance of prolonging life. The child was tossing about in all the agony of approaching death. Respiration crowing; face cold and livid; pulse almost imperceptible, and the lungs obstructed with bronchial secretion. Altogether the case seemed so hopeless that I did not offer any inducement, but dissuaded from the operation. The child died in half an hour.

Remarks.—I have now performed the operation of tracheotomy nine times, in two of these with a successful result. It is to be remembered that in none of these instances was the operation undertaken till it became evident that death was imminent, consequently tracheotomy saved the lives of these two children. Had I made a selection, and declined to operate in Cases III., V. and VII., which were very far advanced, and the children very weak, the mortality of the operation in my hands would not have been so great. In the practice of those who have operated frequently the average success has been one in four. Bouchut states that of 160 operations he saved 45. Bretonneau saved 6 out of 20. Velpeau cured 2 out of 10. Of 198 operations collected by Bouchut 57 were successful. Mr. Spence saved 6 out of 13. Trousseau states that he has practised the operation more than 200 times with a success of 1 in 4. But in truth the propriety of the operation should not be judged by its average success. The question is—Does tracheotomy lessen the mortality of croup in its latest stages—does the operation save the lives of *any* children which would be lost without surgical interference? There can be no doubt as to the answer to this inquiry; and I can only repeat the conclusion of a former paper on this subject, that in a case of immediate danger of death by suffocation the surgeon is not only warranted, but called on from motives of humanity, to give the patient the chance of life by performing tracheotomy.

In almost every instance the parents were thankful for the measure of relief to the agony which the operation afforded, even when the result was ultimately unsuccessful, and the temporary restoration of tranquil respiration was a sufficient encouragement to warrant me in continuing the practice in any case which was brought before me.

But an important question for solution is—Are we not warranted in performing the operation sooner in the disease than has usually been done in this country? It is to this that the minds of practitioners ought to be directed, as unquestionably in all the cases in which I have operated, and I believe most of the surgeons in this country, the children were in the last stage of the disease. It will always be difficult to fix a limit to the period at which recovery may take place from croup; but in most cases which prove fatal there is a stage more or less marked at which the medical attendant can decide that the treatment employed has been of no avail, and the patient will progress from bad to worse. When the child has been treated from the outset of the disease, when the treatment has been active and energetic, while the malady has passed from stage to stage, notwithstanding the remedial measures, the medical attendant ought not to wait for impending suffocation; but as soon as he judges that exudation has taken place, and finds himself unable to combat the symptoms, he ought to recommend that advantage should be taken of tracheotomy before the impeded respiration has produced its effect on the system. I believe that if the operation were resorted to in an earlier stage of croup than has hitherto been done, the results would be much more favourable, and the mortality from the disease lessened.

In diphtheria it is a nicer question whether and when tracheotomy is admissible. In those cases in which prostration is the symptom most to be dreaded, of course the operation will be of no avail, and in a great many instances it could not be undertaken with any hope of success; but the existence of this disease does not preclude the chance of success in every case. In the last narrated in this paper, the little patient had a distinct attack of diphtheria the week previous to the operation, and in the second attack the disease, which was probably of the same nature, was confined to the trachea. In general terms, it may be said that if the tendency to death is rather from apnœa than asthenia, the operation is justifiable whether the primary disease has been croup or diphtheria. On the other hand, if the little patient is extremely enfeebled from whatever cause, and especially in an advanced stage of diphtheria, one can hardly hope that opening the trachea could do anything towards saving life—the vital powers are already so much reduced that death from asthenia follows at no distant period.

With regard to the operative proceedings, I can add nothing to the directions usually given in surgical works; but experience has forced on my mind, in a way which no study could do, the importance of caution and deliberation in each step of the operation. Trousseau's maxim ought to be the watchword of the

surgeon—"Operate slowly, very slowly." I have laid down a rule for my own guidance which I know is of great use, namely, never to thrust the bistoury into the trachea until I can with the forefinger of the left hand touch the bare rings of the air-tube over the extent to which I mean to incise it. I believe also it is better to prolong the operation than to advance while any vessel is bleeding. Some of the gentlemen who assisted me at the operations detailed, I doubt not, were surprised at the time occupied in sponging the wound, tying little vessels, and cutting down to the tracheal rings; but the result was a free opening at the bottom of a perfectly clean wound. I always fix the trachea with a sharp hook, and plunging the knife with its back to the hook and the isthmus of the thyroid gland, cut downwards as far as I desire the opening to extend.

Although the first case was successful without the tube, and the second proved fatal, I believe from want of proper attention to it, I cannot hesitate to decide that the use of the double tube affords most hope of success when it can be borne, as usually it can, both from its efficacy and simplicity in management. In every case I have endeavoured to render the air of the apartment suitable for entering the lungs by keeping up the temperature, admitting fresh air by an open door or window, and diffusing a little moisture through it by the simple means of having a large kettle of water constantly boiling on the fire, and guiding the steam towards the bed on which the little patient is lying. There need be no hurry in removing the tube; it may be safely left till the fifth or sixth day, or even longer, as the wound soon heals up and leaves very little mark.