operation simply in the light of a temporary expedient, and believe that, when the danger of suffocation has been set aside, the surgeon's real opportunity then commences. At present, however, this seems to be the exception rather than the rule; and many physicians and surgeons regard the operation in the light of a last effort, and, having done it, await the result with folded hands. Even the great Trousseau, who did so much to popularise the operation, wrote: "When once tracheotomy has been performed, we need not further occupy ourselves with the pharyngeal or the laryngeal manifestations of the diphtheria, which claimed such energetic measures previously to the operation. They get well of themselves."

The views I have briefly expressed in this paper may be summed up as follows.

1. The presence of membrane in the larynx is the chief cause of the symptoms which call for the operation.
2. Membrane is infective as well as obstructive. The re-formation after removal is the visible evidence of an infective process still active in the body.
3. The chief object of the operation is to remove this membrane.
4. The chief object of after-treatment is the prevention of any re-accumulation.

The limits of this paper prevent my entering into the subject of the after-treatment, which is a very large subject. Neither is it necessary before an assembly of surgeons such as this. Each one will be able to devise for himself a line of treatment suitable to the requirements of the individual case. As regards the treatment which I personally have been led to adopt, I will only say this: it consists in a careful treatment of the larynx and trachea, with a view to destroy the local manifestations of the disease; in the use of a limited amount of steam; and in the employment of silver tubes, the curve of which corresponds to the anatomical direction of the trachea.

As regards the future of the subject, I venture to think that we need the formulation of certain broad facts. Is "croup" a purely local disease at any time? Is it likewise an infective one? Then, if a local disease, can general remedies alone influence it? And is not the omission of local treatment therefore reprehensible? Are there not palpable analogies between diphtheria and hospital gangrene? What surgeon would be content with purely internal remedies for these diseases?

TRACHEOTOMY IN CROUP.*

By WILLIAM THOMSON, A.B., F.R.C.S.I.,
Surgeon to the Richmond Hospital, Dublin.

I DO NOT think that any more urgently important subject has been set for discussion at this meeting of the British Medical Association than that of tracheotomy in croup. It is of special interest in Ireland, because the professional feeling regarding the operation is not favourable, if it be not hostile. In Dublin, at all events, which is the centre of Irish medical opinion, the operation is not generally practised; and to those who see good in the proceeding it will be a great pleasure if discussion here should give it increased prominence.

On two occasions, I have brought this subject before the Surgical Society of Ireland, and have pleaded for at least a trial. My first cases were all fatal, but I was upheld by my own belief that the operation was a justifiable one, and by the personal encouragement of Mr. Spence of Edinburgh. On the second occasion, I was able to report success. As time has gone on, and the results have appeared more hopeful, it has been not a little encouraging to notice the gradual toning down of opposition in some, and the declared conversion of others. My own experience of the operation extends to six cases, besides a large number in which I have assisted my colleagues and others; for, in the Richmond Hospital, the staff adopts the principle of surgical relief when necessary. My success has been two, the fourth and sixth respectively; both occurring in hospital practice. Let me give a very short *résumé* of the cases.

CASE I.—A boy, aged 5, had been ill three days before admission. There was no sign of membrane on the tonsils or pharynx. Tracheotomy was performed on the fourth day from the commencement of illness. He lived thirty-seven hours. *Post mortem* examination showed membrane throughout the bronchi.

CASE II.—A boy, aged eighteen months, had been ill for several days. No membrane was visible. Tracheotomy was performed. He lived fourteen hours.

CASE III.—A boy, aged 5, had been very ill one day before admission, but had been complaining for some days. No membrane was

visible. Mercury and tartar emetic were administered. Great relief was derived from the operation. Death occurred on the third day, after a violent paroxysm caused by blocking of the tube.

CASE IV.—A boy, aged 5 had been ill for three days. No membrane was visible. Mercury and tartar emetic were given; leeches were applied to the upper end of the sternum. The symptoms becoming more urgent, I operated next day. A large piece of false membrane was removed from the trachea with a forceps. The relief was immediate. On the fourth day, the temperature was 99°; respirations 44. The tube was removed and a considerable portion of membrane was ejected. The tube was altogether removed on the eighth day, and the boy was discharged quite well in four weeks.

CASE V.—This was the case of a little girl aged 3, whom I saw in the King's County, in consultation with my friends Dr. Saunderson, senior, and Dr. Saunderson, junior. The child had been several days ill. Mercury and antimony had been freely administered without improvement. Operation was performed, with great temporary relief, but the child died in nineteen hours.

CASE VI.—A boy, aged 4½, had been ill for several days. There was a membrane on the left tonsil. Mercury had been administered. When I saw the case with my colleagues, the symptoms were judged urgent, and I operated. The child made an uninterruptedly good recovery, the tube being permanently removed on the seventh day.

I take it that the form which our inquiries ought to assume is: 1. Under what circumstances ought the operation to be performed? 2. What conditions will tend to ensure its success?

Now, it may be necessary for some that we should assure them that the surgeons who adopt this method do not look upon it as the remedy for croup or diphtheria. On the contrary, all are ready to admit the advantage of medication up to a certain point; but, when failure to relieve is the result, the surgeon asks that some regard should be had to the good offices which surgery can render; and that the struggling dying child shall not be abandoned to death without one effort to save it at least from pain. Our opponents point to our results as justifying their opposition. Unhappily, they do not show a high percentage of recovery; but, at least, they show better than the results of the same class of patients left to medicine only. In a large number of cases, I have seen one only recover without operation, in which operation was proposed. Steiner, who has seen one hundred thousand cases of children's disease, says: "Out of quite a large number of cases occurring in my practice, before I had adopted the operation of tracheotomy, I saw but three recoveries." (Ziemssen.) But it is further to be said in our defence—for that is necessary—that the surgeon rarely sees the case until all the damage is done; when, indeed, its state almost accords with one of Liston's reasons against operation: that when done too early, it is dangerous; and when done too late, it is useless. The history of a case of croup, as we usually see it, is that the child has been ill for some days; that then it has been brought to the physician, who uses his remedies. These too often fail, so that the surgeon sees the child when it has been dosed with mercury or tartar emetic, or both; when the lungs are becoming engorged with carbonised blood; when the nerve-centres are being poisoned; when, in a word, the child is in a condition which almost precludes success from any opening in the trachea. Yet even here, the results are very encouraging, as any one who has watched the effect of such an operation must admit; for, where life is not saved, the patient is relieved from the pain that otherwise accompanies his death.

I have said that I believe in medication up to a certain point. In some of my own cases, calomel and tartar emetic were given, in the hope that the patient was yet in the pre-exudation stage, and that the tumidity of the membranes might be reduced by this means and by leeching. But when a membrane is present in the larynx and trachea, I do not believe that calomel does anything but harm; it will not remove it, and the giving of it only leads to hopes that are disappointed and to the loss of precious time. If any good is to be done, it is by emetics of ipecacuanha or sulphate of zinc; and this plan ought to be tried. These are preferable to tartar emetic, which is too depressing, particularly as it may not cause vomiting, owing to paralysis of the pneumogastric nerve, and may then help to kill the patient.

As the obstruction in the air-passages increases, there are indications which point urgently to the necessity of some relief. These are the sinking in of the chest-wall, especially of the lower end of the sternum; of the soft parts about the root of the neck in front; and of the epigastric region. They can all be easily recognised in a bad case; and, although the lips may not be blue, nor the symptoms of collapse yet be present, I would recommend operation; for, if the membrane cannot be expelled, these other symptoms will only too surely come, which indicate lower vitality and less fitness for surgical interference.

Those who hold the identity of croup and diphtheria maintain that tracheotomy cannot do good in a case of constitutional disease, because

* Read in the Section of Medicine at the Annual Meeting of the British Medical Association in Cork, August 1879.

already the poison is present in the blood. No one argues that it will cure the disease, but that it will relieve a condition of which the patient may die, even before the virus of the disease would otherwise kill him; and that, therefore, we prolong the time for the actions of general remedies. But, beyond this, it is to be borne in mind that a mechanical obstruction in the larynx is itself producing poisoning in the shape of heavily carbonised blood. A child with scalded glottis will die of blood-poison generated within itself, if the obstruction be not removed; and those who oppose tracheotomy in diphtheria and croup are in the position of allowing a second and removable poison to operate, in addition to that already existing in the blood.

Having said so much in defence of the operation in general, I may say a few words as to some practical points which tend to render it successful. The operation is by no means an easy one. I have seen more than one fatal, and several nearly fatal, results on the table. I think that chloroform ought to be given, except where the child is already narcotised by blood-poison. It lessens the dangers, and facilitates the operation. A moistened atmosphere ought to be provided by means of a regular croup-kettle, the current of steam being directed towards the patient's head.

The suprathyroid operation diminishes the risks. It is as favourable as the infrathyroid, the theory of which is that you are likely to get below the membrane. But the theory goes for nothing. In both my successful cases, the membrane extended far below the opening. In one, I removed a large piece with a forceps passed down to the bifurcation of the trachea; in the other, the membrane was expelled subsequently. It is always most convenient to secure the trachea with a hook before opening, and for that purpose an ordinary tenaculum is best. This being fixed somewhat to the side of the median line of the trachea, an incision may at once be made, and the tube be introduced before the tenaculum is removed. I prefer a small tenotome for the tracheal incision. It slips between the rings without any force. The tube should be as large as the trachea will hold. I believe I lost one case by using one too small.

As to the tube itself, I have always used Fuller's ordinary bivalve; but, if the neck be deep, it is often difficult to slip the ends of the blades into the tracheal wound. A better instrument is that with two parallel blades—one movable, and fitting into the other until this is introduced. Then, by a small crank fixed to the shield, the blades of the cannula can be separated, and a tube of suitable size inserted. Very much depends upon careful nutrition and skilful nursing. At any moment, asphyxia may follow from blocking of the tube by a loosened membrane, and the child may be lost if some one be not present to relieve the obstruction. If it cannot be done by passing down a feather, the tube ought to be taken out at once. There will be no difficulty in putting it back after the first twenty-four hours, as the parts will remain patent. The viscid secretion collects in the trachea, and brings on paroxysms of coughing. In the cases which were successful, I had a spray of lactic acid solution (ten grains to the ounce) in one instance, and of lime-water in the other, thrown across the orifice of the tube. It was the experience of those watching that the relief given was very great, and that the membrane was more readily expectorated. The last patient always signed for the spray when the paroxysm came on, and was evidently himself conscious of the advantage of it. It may be that the virtue lay in the simple moistening of the tube, and not in any solvent powers of the fluids; but the fact is as I have said.

From what I have seen, even in non-successful cases, I cannot withhold from any patient the relief and the hope of life which this operation offers. It is one that is surrounded by difficulties, and is too often followed by death; but, until those who oppose it can offer some better substitute, I, for one, feel it my duty to recommend it and to practise it.

TRACHEOTOMY IN DIPHTHERIA AND CROUP.

By GEORGE BUCHANAN, A.M.,

Professor of Clinical Surgery in the University of Glasgow.

THE following case is recorded, because it affords some lessons which can never be too often enforced. In speaking of my experience in tracheotomy, I have sometimes been met with the observation, that no doubt some of my cases have been examples of simple spasmodic croup, and that, if I had waited longer, the fits would have passed off and the child recovered without operation. But, in reply, I can say that in most if not in all the cases the child was approaching or had actually arrived at a stage, when life could no longer be supported without an additional supply of air to the lungs, whatever was the cause of the necessary quantity being prevented from entering. Secondly, simple spasmodic croup or *laryngismus stridulus* is a very rare affection; indeed, I have never

seen it among the cases of approaching suffocation to which I have been called. Thirdly, and this is the point on which I wish to insist, because it is of practical importance—in all cases of croup and tracheal diphtheria, there is an element of spasm, intermittent, sometimes with long intervals of relief, which leads to the belief that the obstruction is not permanent, but only occasional, and often causes the operation to be too long delayed. As the disease advances, the spasms become more frequent, and end in a continuous obstruction, which then, but often too late, is recognised as depending on mechanical narrowing of the trachea.

Of course, it is familiarly known that the suffocation of croup and diphtheria may depend on two different conditions. First, it may be caused by the obstruction being situated in the trachea and larynx; second, it may depend on the viscid secretion extending down into the bronchi and smaller bronchial tubes, thus stuffing up the lungs and preventing either the free ingress or egress of air. To either of these conditions the element of spasm may be added; and, as this is often the most prominent and alarming feature, it may mask either of the other two, or render it difficult to decide which is the real essence of the disease.

But I have long ago pointed out a diagnostic mark which cannot be too frequently insisted on and promulgated, and which is the only true means for enabling us to decide when tracheotomy is justifiable and when it is *not*—viz., the respiratory movements as seen by observing the naked chest. When the obstruction is situated in the trachea or larynx, the lungs remaining normal, the efforts of the child to obtain breath are painfully visible by the powerful drawing inwards of the ensiform cartilage, the intercostal spaces, and every elastic part of the chest-wall; showing the thirst for air, and the capacity of the lungs to receive it, if only it could gain entrance. But when the smaller bronchial tubes are full of viscid and perhaps pseudo-membranous effusion, the movements of the chest-wall are impeded; the chest is puffed out like one affected with chronic emphysema of the lung, and heaves in a mass with difficulty.

In the first of these cases, tracheotomy affords instant relief—often permanent—and ultimate saving of life; in the second, if unfortunately it be performed, it affords at best a temporary and short interval of repose, if even that, and only when the element of spasm is present.

It will be seen that in these few remarks I have avoided all reference to the disputed question as to the identity or non-identity of croup and diphtheria. I leave that to those who, as general practitioners, see the diseases in their early stage. As a surgeon, I am only concerned with cases in which it has become probable that tracheotomy may be required. My remarks apply to all cases, whatever may be the original malady, in which it appears nearly certain that the patient will die of suffocation from obstruction situated in the larynx or trachea unless a free supply of air is obtained by tracheotomy. And I have given the diagnostic mark on which I now invariably rely in determining whether to perform or refrain from performing tracheotomy.*

I shall now give a short report of my last case. Peabody Grierson, a boy aged 8, in previous good health, a stout well-formed boy, on Saturday, November 15th, 1879, began to complain of his throat, with a slight tickling cough coming at intervals, with some slight feeling of choking. On Sunday, the 16th, Dr. Pirie was called, who detected incipient croup by the fever, flushed face, pain in the neck, and a crowing sound with the cough, which came at intervals. Ipecacuan, mustard blisters, steam in the apartment, were kept up till Monday at 8 A.M., when I saw the patient with Dr. Pirie. The spasms, though severe, were not frequent; and in the intervals the breathing was fairly normal; so we determined to delay changing the treatment for some hours. In the afternoon, it became quite evident that the spasms, which were becoming more frequent and severe, were only the reflex effect of a permanent obstruction in the trachea. At no time was there any inflammation, swelling, or false membrane, to be seen on tonsil, palate, or fauces. The agony of the little sufferer was very painful to witness, and the diagnostic mark of the powerful indrawing of the intercostal spaces was as characteristic as I ever saw it. I sent for Dr. Pirie, and drove home for my instruments and an assistant; and, by the time I got back, the case was indeed urgent. In fact, it seemed as if we were too late. The lips were livid; the face pallid, and covered with a cold sweat; the pulse flagging; the breathing very laboured; the eyes staring, open, and glazed; in fact, the child seemed *in articulo mortis*, and I said to his mother that I feared it was too late. I have rarely heard a more piteous appeal. The mother was an intelligent woman, who had been educated as a nurse in Guy's Hospital, and had afterwards come to Glasgow Royal Infirmary, where

* For a more detailed account of the varieties of croup and diphtheria, and the diagnosis of the cases suitable and unsuitable for operation, see my paper in the BRITISH MEDICAL JOURNAL for September 4th, 1875; see also a Clinical Lecture in BRITISH MEDICAL JOURNAL for March 4th, 1871; also for February 14th, 1880.