A probationary surgical essay on bronchotomy : submitted, ... to the examination of the Royal College of Surgeons of Edinburgh, ... / by William Cullen ... July 1822.

A

PROBATIONARY

SURGICAL ESSAY

ON

BRONCHOTOMY;

SUBMITTED,

BY THE AUTHORITY OF THE PRESIDENT AND HIS COUNCIL,

TO THE EXAMINATION OF THE

Royal College of Surgeons of Edinburgh,

WHEN CANDIDATE

FOR ADMISSION INTO THEIR CORPORATION,

IN CONFORMITY TO THEIR REGULATIONS RESPECTING THE ADMISSION OF ORDINARY FELLOWS.

BY

WILLIAM CULLEN,

SURGEON, &c.

JULY 1822.

EDINBURGH:

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IN CONFORMITY TO THEIR REGULATIONS IN OBTAINING THE

ADMISSION AS CONJOINT FELLOW.

EDINBURGH:

1822.

TO

JAMES LAW, ESQUIRE,

OF ELVINGSTONE,

MEMBER OF THE ROYAL COLLEGE OF SURGEONS
OF EDINBURGH,

AS A MARK OF RESPECT AND GRATITUDE,

THIS ESSAY IS DEDICATED,

BY

HIS OBLIGED PUPIL,

WILLIAM CULLEN.

TO

JAMES LAW, Esquire,

OF ELVINGSTONE,

MEMBER OF THE ROYAL COLLEGE OF SURGEONS

OF EDINBURGH,

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THIS ESSAY IS DEDICATED,

BY

HIS OBLIGED FRIEND,

WILLIAM CULLEN.

ON BRONCHOTOMY.

THE limits necessarily assigned to such an essay as this, prevent me from going into any minute details, and I must content myself with giving, 1*st*, A very summary account of the diseases and accidents which render the operation of Bronchotomy advisable; 2*dly*, A careful comparison of the modes hitherto proposed for the performance of it.

Under the former head, it may be proper to begin with the *Cynanche Laryngea* of adults, of all the diseases of the air-passages the most interesting, if not for the frequency of its occurrence, at least for the nature of its symptoms, and not unusual termination in death. Till of late years our information on this subject was very imperfect. The disease was known only to a few learned men, and, for their even scanty knowledge, they were indebted more to the old records of medicine, than to any experience of their own; for, on perusing their works, it is evident they write rather from the observations of others, and cite few cases that occurred to themselves. Neither HOFFMANN nor MORGAGNI were acquainted with it but by description: they

both profess to treat of all diseases incidental to the human frame, and they were both of them too accurate observers of nature to have passed it unnoticed, had it ever presented itself in the course of their practice. It was reserved for the Physicians of our own times to revive the important knowledge of the diseases of the windpipe, and to set the writings of the ancients in their proper light.

For the first notices of this disease, as of many others, we are indebted to HIPPOCRATES, whose bold and spirited sketches have been copied, even to servility, by most succeeding writers. The Roman Physicians, and the Arabians especially, have commented upon it, but they have done little more than dilate the descriptions of the Father of Physic. To LOMMIUS, TULPIUS, and GREGORY HORSTIUS, I may refer for some interesting remarks; of these, the two last have given particular cases. In more modern times, it has been treated in a more methodical form by ELLER, under the name of *Cynauche Inflammatoria;* by RECOLIN, in the Memoirs of the French Academy of Surgery, under that of *Esquinancie Inflammatoire;* and, by Dr CULLEN, who has bestowed upon it the epithet *Trachealis.* But by far the most impressive, as well as accurate account, is to be found in the Commentaries of VAN SWIETEN on the Aphorisms of BOERHAAVE; and, indeed, after an attentive perusal of succeeding writers, I do not find they have added much to our knowledge, except the chronic form, in which it not unfrequently occurs. Dr BAILLIE, more lately, in the Transactions of a Society for Medical and Chirurgical Knowledge, recalled the attention of

the public to it, by publishing the result of three cases, drawn up with great talent and accuracy: since then, it has been the subject of many short memoirs in the Transactions of Medical Societies, both foreign and domestic, so that we may now be said to be in possession of a considerable mass of information.

This disease has, like most other inflammations, two forms, the acute and chronic, but the symptoms of both being generically the same, the descriptions of them may be blended together. It begins with the ordinary phenomena of Catarrh, viz. some uneasiness of the throat, with some difficulty of breathing: there is commonly no appearance of redness or swelling of the fauces, a remark as old as the days of Hippocrates, and set down by some as a proper diagnostic. Cough, to a certain extent, is always present; and we shall be assisted in our judgment of the case, if we observe, that it excites no pain of chest. The pulse is small, rapid, quick and oppressed, more so than is usual in simple quinzy. Still, however, nothing particular is noticed, and no alarm is excited in the mind of the practitioner. In a short time, however, these symptoms are lost in others far more dangerous and severe. The patient complains of constant acute pain low down in the throat, with sense of burning heat and stricture, commonly pointing to the thyroid cartilage as its seat. Deglutition is almost impossible; and, when we reflect that, during this act, the larynx must be moved along with the pharynx, while the posterior part must be pressed upon by the food, we shall be rather surprised that this symptom should be sometimes

wanting; the breathing, and chiefly the act of inspiration, becomes short and difficult, and is accompanied with a peculiar, harsh, stridulous noise, in some cases imitating the crowing of a cock, in others, not unlike the rattling in the throats of the moribund. The voice becomes altered by degrees; at first it is merely hoarse, but in the later stage it is either entirely lost, or uttered in whispers only. The celebrated Dr David Pitcairn of London, the most melancholy victim of this disease, wrote whatever he had to communicate, for he could not prevail on himself to speak. We observe, along with these symptoms, and as one of the most prominent, a frequent and horribly painful, loud and shrill cough, resembling in sound that which occurs in common croup, but differing from it in this, that in the expectoration, which is copious, and often of puriform appearance, we never observe the membranous shreds, so constantly coughed up in the croup of children. In the course of a few hours, spasmodic symptoms supervene, to complete the dreadful picture. The pulse becomes small, feeble, and intermitting; the cough convulsive, and agitates the whole frame. Respiration is almost interrupted, and all the secondary muscles are called into play: the patient gasps, throws off the bed-clothes, and stretches out his neck, as if for fresh air; the face grows livid, the eyes are turbid, and appear to start from their sockets; clammy sweats break out, till, at last, nature is unable to struggle longer, and death, by suffocation, ensues. But these last symptoms occur in paroxysms, with intervals of comparative remission, and it often happens that many of these oc-

cur before the last and fatal one. The above striking characters have been elegantly summed up by an ancient writer, in the following sentence: "Porro mortifera est, et omnium horrendissima angina, certissimeque incidit, et necat, quæ neque in cervice, neque in faucibus, quicquam conspicuum vel tumoris, vel ruboris exhibet; simulque summi doloris tormentum, et vehementem febrem, et tantum non præsentem suffocationem, infert."

Such are the general symptoms of the complaint, symptoms, if they were always present, sufficiently well marked to distinguish it from every other. But, in different cases, we meet with different modifications. There is sometimes a total absence of spasmodic symptoms, the disease going on to the last, characterised only by stridulous cough, and difficult respiration. It is sometimes astonishingly rapid in its course, and sometimes comparatively slow. At a convivial party, a young man was suddenly seized with sonorous inspiration, so that he appeared to imitate the crowing of a cock. His gay companions, thinking he made this odd noise on purpose to heighten their merriment, exhorted him to continue so unusual a piece of drollery, and enjoyed his sufferings. After some time, however, thinking it lasted too long, even for a good joke, they sent in haste for Boerhaave, but the young man was dead before his arrival. Fonseca, according to Bonetus, saw it fatal in ten hours; Lommius, in eighteen; and a case is cited from Dodonæus, of a butcher, who was seized at mid-day, and died in the course of the ensuing night. But, in these cases, it may be presumed, that it had remained latent for some time, and,

in general it is not nearly so rapid in its progress. Hippocrates, in the Coan Prognostics, pronounces it fatal on the first or third day. Of Dr Baillie's three cases, one terminated on the second, the others on the third day. This, of course, is to be considered as the very acute form of the disease, the only one with which the older writers were acquainted. But we are indebted to Dr Farre and Mr Lawrence, for our knowledge of the chronic form, of which many cases have been related in the different medical journals. Dr Latham's case must have lasted at least six weeks, and Dr Marshall Hall's three months. But the disease in this state does not differ so much from the former, as to deserve a separate notice in this place. I may remark, that it is the form generally met with in this country, our physicians not being familiar with those acute characters, which render the inflammations of the larynx so formidable in the eyes of foreign practitioners.

Besides occurring as an idiopathic disease, Cynanche Laryngea is often one of the secondary symptoms of Syphilis. With this form, Astruc, among the moderns, appears to have been acquainted, and he attributes it, with great probability, to the immoderate use of mercury. His observations, however, have been overlooked, and no one has treated of it but in a very cursory way, and by no means in proportion to its importance. According to Carmichael, it is invariably fatal, an assertion which I likewise may maintain, from the different cases I have seen. It is but fair to mention, that Mr Charles Bell informed me that he had seen it repeatedly cured. The symptoms of

the syphilitic inflammation of the larynx are nearly the same as the idiopathic; but, in general, there is less spasmodic action, and more cough and irritation. When the epiglottis, and parts adjacent, are affected with extensive ulceration, liquids find a ready entrance to the trachea, and thus suffocation is sometimes induced.

To the Croup of children, Bronchotomy has been thought peculiarly applicable. This disease differs so little from the Cynanche Laryngea, and is otherwise so well known, that it were useless to consider it here. The following points, however, will mark some distinction between them: The croup is much more rapid in its course; it attacks infants and children especially, so that one physician, in an extensive practice for fifty years, and in a district where it was rife, had never seen it occur above the age of puberty. Besides, what is particularly worthy of notice, in the expectoration of croup, we always observe patches of fibrous viscid matter, and the disease terminates commonly in the production of a thick, loosely coherent membrane, applied more or less closely to the parietes of the trachea, in some cases lining it throughout its whole extent, even to its most minute ramifications, so as to form a perfect cast of the tube. Michaelis calls it a Polypous Membrane; Dr Cheyne affirms it to be mucus or pus condensed; from its external character, it may be safely pronounced to consist of albumen chiefly.

This is the proper place for taking a short notice of the pathological state of the Trachea, in the above mentioned complaints, for it is from such considerations alone, that

we can estimate the operation of Bronchotomy. It is peculiarly unfortunate, that the subdivisions of the systematic writers, have no where been attended with more unhappy consequences than in the present instance, and much harm has arisen from their having separated the diseases of the Larynx from those of the Trachea and Bronchii. These parts form one continuous organ, have the same anatomical structure, and the affections of them are similar, and in general simultaneous. It rarely happens that the inflammatory action is confined to the larynx alone. In the Cynanche Laryngea of adults, the membrane of the epiglottis is red and much thickened; the vocal ligaments, and the other cartilages, are in the same state, and it not unfrequently happens, that the aperture of the glottis is rendered still more contracted by an œdematous effusion into the submucous cellular tissue. This latter state sometimes exists alone, with but little appearance of vascularity, and is considered by the French practitioners, who have paid it particular attention, as a peculiar disease, under the name of *Angine Œdemateuse.* We observe, in some cases, patches of effused lymph on different parts of the membrane of the trachea; these adhere very firmly to it, and are never, so far as I have observed, coughed up with the expectoration. This lymph often covers the surface of superficial ulcers, varying in size and colour, which never, except in the syphilitic variety, extend farther than the superficial stratum of the membrane. The latter being a mucous one, secretes pus to such a degree, that the ventricles of the larynx are quite filled with it. In some cases,

the disease stops here, and the remainder of the tube is quite natural. But, most commonly, the redness extends down the trachea, gradually diminishing in intensity, accompanied with little or no œdematous effusion, and comparatively scanty formation of pus. Did we stop here, we should conclude the rest of the tube to be quite sound, but it is proper to examine the minute branches of the bronchiæ. At the secondary or ternary division of them, the disease appears to revive, becomes more decidedly pronounced as we cut farther down; and, finally, at the minuter branches, puts on exactly the same appearances, ulceration excepted, as has been noticed in the larynx; here we find puriform fluid in abundance, often more than enough of itself to have caused a fatal termination, and the mucous membrane is thickened, and often quite purple from increased vascularity. Hence, it is evident, that we are to look upon the Cynanche Laryngea, not as a separate disease, but merely as the inflammation of the lining membrane of the trachea, developing itself in this situation in preference to or along with another; and it is accompanied with peculiar symptoms, only because the larynx has a peculiar structure and functions of its own. This disease is to be considered as a part of the great disease denominated Pulmonary Catarrh; and unless we keep this in mind, we shall never know when to practise, or when to abstain from operation. This general catarrh, if I may so term it, has often other pathological states combined with it. Cynanche Tonsillaris being a disease comparatively so trifling, need not detain us here, but inflammation of the lungs being much more im-

portant, is well worthy of consideration. Sometimes it is found in one lung, sometimes in both together. It is extremely insidious, and is not betrayed by its usual symptoms; for, in such cases, the peculiar expectoration of peripneumony, resembling a weak solution of blood in mucus, is mixed with pus secreted in the bronchii, and thus its qualities are altered, and the cough and difficulty of breathing seem to the practitioner so distinctly referable to the affection of the larynx, that no alarm is excited by it. Of course, the presence of Peripneumony must have an important influence on our determination with regard to Bronchotomy, and no one ought to proceed to the operation, till he has assured himself of the absence of that disease, at least to any considerable extent. Fortunately, the Stethoscope, assisted by percussion of the chest, will be an infallible guide, and lead us to ascertain with certainty the state of the lungs. What the signs of Peripneumony are, may be learned from LAENNEC, in whose remarks on this subject, a pretty extensive experience has taught me to place the highest confidence.

The syphilitic form of the Cynanche Laryngea, depends on nearly the same pathological state, except that ulceration is the basis of the latter disease, and inflammatory thickening of the former. This process, I mean ulceration, is sometimes primitive, sometimes it is caused by the bursting of small abscesses, and occasionally, but rarely, of the suppuration of tubercles. The cartilages are partially absorbed, they are often black, as if in a state of mortification, a condition probably preceded by an ossific process;

portions of them are often coughed up; sometimes they have been known to fall down the trachea, and cause the most distressing symptoms. It is likely that this disease does not begin primarily in the larynx, but is communicated to it from the soft palate and pharynx.

The pathology of Croup is so well known, that I may be excused from treating of it here, except in so far as is connected with Bronchotomy. If the Cynanche Laryngea be really nothing more than a general affection of the mucous membrane of the trachea, exciting particular symptoms, from attacking a particular organ, the same may be more justly affirmed of the Croup of children. This disease is extremely common in Paris, from the low damp situation of the town; and I had occasion to see much of it in the Hôpital des Enfans Malades. Of all the cases I saw, in none was the disease confined to the larynx alone, but extended all along the trachea. It was most distinct in the above-mentioned organ, less so from below to the division of the bronchii, and it became still more remarkable in the minute ramifications of them, where the tube-like form of the secretion was entirely lost. Here, there was commonly a mixture of pus and fibrous matter, floating loose in the bronchii, and completely obstructing the entrance of air into the cells of the lungs, a state most evident in those who have been cut off soon after the invasion of the disease. The sudden death is commonly attributed to spasm of the glottis, but the cases I have seen have convinced me, for the present at least, that it is more justly to be ascribed to the disease having begun in the bronchii; and remaining unnoti-

ced, until it had spread slowly to the larynx, so that the patients, though cut off soon after the invasion of the symptoms, had really laboured under the affection a considerable time. But, to shew more clearly that Croup is a general action of the mucous system, and not of the respiratory tube alone, I may mention, that I have often seen in the bodies of children, the cavities of the nose and pharynx affected in common with the bronchii; the œsophagus and membrane of the stomach more rarely; once I saw croupy matter on the conjunctiva, and twice or thrice on the vagina. My distinguished friend Monsieur BRESCHET, informed me in Paris of a case of his, where it formed a complete lining of the mucous coat of the bladder. In a preceding paragraph, allusion was made to the frequent combination of Peripneumony with Cynanche Laryngea, but the same is not true in reference to Croup, probably because the disease in children is so rapid, that sufficient time is not given for its production.

Such, then, being the state of the parts, in the inflammatory affections of the larynx, we can now form an estimate of the value of the operation, and even specify the circumstances in which it ought to be practised. As to Cynanche Laryngea, our chief dependence for relief and final cure should be placed in Bronchotomy, and we have the highest authority for performing it as early as the first symptoms of suffocation come on, I mean Dr BAILLIE and Monsieur LOUIS. I should not, however, be disposed to wait so long as 30 hours, the period assigned by the former, but would put it in immediate execution, as soon as the nature

of the symptoms removed all doubt of the case. Fabricius ab Aqua Pendente, Ambrose Paré, Scultelus, and Van Swieten restrict it to the most desperate circumstances, to the last stage of the disease, when all other remedies had previously failed. But when we reflect upon the familiar surgical principles which guide us in the treatment of other inflammations, we can hardly allow ourselves to be guided by their opinions. In all other parts of the body, nothing excites and aggravates vascular action so much as undue motion, and nothing is so conducive to the restoration of the healthy tone, as perfect rest and tranquillity. Is the trachea alone exempted from this general law? In the Cynanche, the cough, which is always present, the succussion of the whole tube, perhaps the spasmodic action of the glottis, and even the efforts of speaking and deglutition, must all contribute to support the disease, and, if possible, insure its fatality. Hence, an early, not a late opening, is to be insisted on, and is recommended on every good principle in surgery. It will at least prevent the aggravation of the symptoms, and relieve the horrible sufferings of the patient. Let me observe, too, that when the disease has subsisted for some time, such a state of lungs is produced, as is incompatible with respiration, and several have died of this consecutive effect, after an operation had been performed at an advanced period. I have already noticed the frequency of Peripneumony as a complication of Cynanche Laryngea, but I have reason to believe that it is to be considered as consecutive, and to be obviated by the measure above mentioned. Let it be well un-

derstood, that we make the opening into the windpipe, not with a view of curing the disease by this measure alone, for over it the operation of course has no direct controul; it only prevents the cough, gives relief to the difficulty of breathing, wards off the danger of suffocation, and thus, by protracting the case, allows time for the operation of those remedies which are commonly found successful in similar circumstances.

Though I would recommend Bronchotomy as a general practice, yet there are some states which forbid it altogether, or at least greatly diminish the chance of ultimate success. If the disease extend far into the bronchii, giving rise to pulmonary catarrh in both lungs, indicated by great expectoration, we should be cautious in advising the operation, and we may say the same for Peripneumony, only that a considerable extent of this affection in one lung, is of itself sufficient to make us withhold. Nevertheless, if the disease were moderate, it should be no impediment, and even when considerable, we should probably err on the safe side, by doing the operation, as the case cannot be rendered worse by a trifling incision in the neck, and we might diminish by one the causes of suffocation. These are, of course, points of great difficulty and delicacy; but, luckily, the Stethoscope can tell us with certainty the state of the lungs, and the rest, not being susceptible of reduction to general rules, must be left to the judgment of the surgeon.

It may be argued, from what I have already stated, that Bronchotomy should never be advised, since the disease

extends more or less all along the air-tube, even to the minutest branches of the bronchii. But, in answer, it may be stated, that the secretion is of such a fluid nature, as to be easily expectorated, even when the larynx is much diminished in its caliber.

In croup, so different is the state of matters, that we may justly wonder the measure had ever been proposed. It does not, however, want patrons of distinguished reputation, to begin with Dr Francis Home and Michaelis. But Dr Crawford, Dr Rush, and Dr Cheyne, have taught us sounder notions, and, as a general principle, we ought religiously to abstain from Bronchotomy. In Cynanche of adults, the disease is sometimes confined to the larynx alone, in the Croup never. In the former, we have to obviate the consequences of thickening only; in the latter, we have to contend, into the bargain, with an adventitious membrane, of which a very trifling portion only can be extracted through the opening. Moreover, the albuminous mixture of pus, which is always present in the extreme branches of the bronchii, is so tough, as, when accumulated in quantity, to prevent the entrance of air sufficient to expel it, and, therefore, the operation would do no good. The artificial opening might perhaps afford a better outlet for the expectoration, than the contracted and irritable glottis; but this can have little influence on our judgment, as what is chiefly wanted is an inlet for a quantity of air, so that the thorax may be properly dilated, and the abdominal muscles, acting with a powerful lever, expel it with force simultaneously with the secreted matter. There

may be cases, however, though as yet I have seen none of them, where the disease is confined to the larynx alone, and in them the operation may be safely advised. But it should be remembered, in estimating this practice, that we must not infer, because some patients recover after Bronchotomy, that, therefore, they would have died, had it not been performed. The affections of respiration occurring in paroxysms, commonly soon subside, perhaps from their own violence; and it is a matter of daily observation, that in asthma, hooping-cough, and even the croup itself, we see some revive, apparently after the most desperate circumstances.

As to the ulcerative or syphilitic form of Cynanche Laryngea, I should be much more decided, and should have no scruple to perform Bronchotomy, as soon as it was evident the vocal ligaments were affected. Here we have nothing to fear from the lungs. The disease, at least in the first stage, is confined to the larynx alone, having been communicated to it from the pharynx and soft palate; and by it we free the patient from most sources of irritation, as coughing, speaking and breathing through diseased parts, prevent the formation of disease in the lungs, and allow time for the operation of remedies, or the salutary efforts of nature. Experience, the grand test, it must be confessed, has not as yet decided in the matter, for she has not as yet been appealed to; but, without presumption, it may be said, that there is in favour of it a just theory, which ought to be acted upon, till refuted by the better testimony of observation. As the last argument, it should be remem-

bered, that by this means we may possibly cure a disease, hitherto almost uniformly fatal, and surely this consideration alone should warrant, or rather command, the attempt. About the year 1735, DETHARDING, Professor of Anatomy at the Hague, recommended Bronchotomy for the recovery of persons seemingly drowned. He had found, that, both in man and in animals, if they be quickly taken out of the water, very little fluid finds admission to the trachea, and that the epiglottis is closed down over the entrance of the larynx. Hence he inferred, that drowning was suffocation merely, from obstructed breathing; and that, in many cases, the vital spark might be re-animated, by the excitement of artificial respiration. But DE HAEN and M. LOUIS denied the theory, and discouraged the practice, of whom the latter called in the assistance of many experiments on animals, performed with coloured fluids. He tells us, that these had constantly found a passage to the lungs, and that the epiglottis was not closed down, as DETHARDNG had maintained. Since the time of LOUIS, however, much more accurate experiments have been made by Dr CULLEN, Mr HUNTER, Dr GOODWIN, Dr FOTHERGILL, Mr COLEMAN, and others, and they all agree in the following statement. During the first struggles of the animal, a certain quantity of air escapes, and a certain portion of the fluid rushes in; but this is quite trivial, for the glottis becomes affected with spasm, and no more fluid can find admittance. The violent and unavailing attempts to respire continuing, the lungs become, as in cases of Asphyxia, more or less gorged with blood; there takes place a co-

pious secretion into their cells, which becomes frothy by admixture with the air, and it is this increased secretion, which has led some into the erroneous notion, that fluid, in all cases, was to be found. Another cause of mistake has been, that a distinction is not always made between recent and long continued submersion; in the former, spasmodic causes effectually prevent the ingress of the water, but, in the latter, these have ceased to operate, the natural elasticity of the parts has restored the passage, and the water gravitates gradually to the lungs. Such being the phenomena, it must be evident, that the artificial excitement of respiration is imperiously called for, and the only question to be discussed is, whether it can be best done by an operation on the windpipe, or by means of a tube introduced through the mouth or nostrils. The latter method being by far the most easy and agreeable, is entitled to the preference. DESSAULT had the merit of discovering it, and it was abundantly successful in his hands. At the great Hôpital de la Maternité at Paris, Professor CHAUSSIER is in the habit of introducing a tube through the nostrils, in all cases where there is reason to believe that the animation of the fœtus has been but a short while suspended. If a proper tube be not ready, then, no doubt, Bronchotomy should be had recourse to, and the ease and celerity with which it may be performed on an insensible patient, entitle us to urge it on any friends who may be present. The only piece of practice requiring to be inculcated is, that the artificial breathing should be continued a sufficient length of time, for, it is to be feared, that

many lives, which might have been saved, have been lost from the surgeon despairing, and desisting too soon. Indeed, we must bear in mind, that different persons have, if I may so express myself, different capacities for resuscitation. Some have perished, though taken out of the water almost immediately, while others have recovered with astonishing rapidity, after very long immersion.

Foreign bodies which have fallen into the trachea, form the last class of cases requiring the operation. On this point all authors are agreed, since, when allowed to remain, they invariably prove fatal. If not discharged by some lucky fit of coughing, they either occasion sudden death, by exciting sooner or later spasmodic action of the glottis, as it is called, or more slowly by inducing chronic disease of the lungs. Children, from their careless mode of playing with substances, are most frequently the victims of this accident; but, of course, adults are not exempt from it, and we have one memorable instance on record, where a monk, playing with cherry-stones during prayers, was punished for his unseasonable and irreligious gluttony, by the infliction of this disaster. From the small size of the glottis, small bodies alone can find admittance, and these have commonly been bones, beans, plum or cherry stones, or nut-shells. The symptoms to which they give rise are unequivocal, and, provided deglutition be not impossible, can never mislead. The patient complains of fixed pain, generally in the region of the thyroid cartilage, respiration is difficult, anxious, and accompanied with a peculiar rattling noise, denominated *Rale* by French authors. In inflam-

mation of the larynx, inspiration alone is difficult, but, in the present case, expiration chiefly is affected. There is frequent convulsive cough, with expectoration of frothy mucus: in one well known case, there took place emphysema at the top of the sternum, from the cells of the lungs having burst, and the air finding a circuitous route to the mediastinum, and so on to the neck. It is a good diagnosis, that the symptoms are not constant, but recur in paroxysms, with intervals more or less distinct, during which they assume a character probably depending on spasmodic causes. The cough becomes more violent and frequent, the breathing more laborious, or interrupted altogether; the face grows livid, and not unfrequently the patient is seized with convulsions. In such a case, he either dies suddenly from suffocation, or he becomes comparatively easy, and remains so till a fresh paroxysm throws him again into the same critical conjuncture. In one instance, the foreign body, a piece of veal, was found wedged in the superior aperture of the larynx. In several others, it was lodged in the ventricles of GALEN, but it most commonly floats loose in the trachea. It is probable that it changes its position with the posture of the patient; that in the erect, it descends by its own gravity, till stopped in one of the branches of the bronchii; and in the supine, that it remains at rest on the œsophagal side of the trachea. It must be influenced, too, by the force of the cough and respiration, and by them be driven from its resting place, upwards to the glottis, there to give rise to the symptoms of threatened suffocation. That it is most commonly loose in the trachea, may be inferred from

the body, whatever it be, being generally expelled as soon as an artificial opening is made, and from the nature and course of the symptoms. It would appear, that the sensibility in the membrane of the trachea is different in different places, being more acute in the larynx, gradually diminishing as it goes downwards, till it revives in the minute branches of the bronchii, where it again becomes considerable. Hence, the foreign body remains at rest, in the place to which it had descended, and only creates slight uneasiness from mechanical obstruction to respiration. After a time, however, it excites irritation by its continuance, and either cough, or a stronger expiration than usual, takes place; it is projected upwards, arrives at more sensible parts, and stimulates the ligaments of the glottis, as is immediately demonstrated by the symptoms. That such is the *ratio symptomatum* is proved, both from observation, and still more clearly by the following experiment of Monsieur Favier, repeated again and again before a Committee of the French Academy. On a dog of a pretty large size, he made such an incision below the jaw, as enabled him to draw out the tongue, and see down into the larynx. Taking advantage of a strong inspiration, he threw down the tube a small hard rough body; immediately vomiting ensued with cough, difficulty of breathing, and convulsions so violent, that the animal seemed on the point of perishing. But these symptoms soon subsided, and returned afterwards in paroxysms, with the same violence as before. Tracheotomy was performed at the end of six hours, and the knife of the operator was no sooner

withdrawn, than the body immediately burst through the wound. Wishing to vary the experiment, he introduced it a second time, pushing it as far as possible towards the lungs, and again it was expelled at the first expiration. A third time he introduced it, thrusting it upwards to the glottis, when, on the first inspiration, it was carried downwards to the bronchii, and, at the succeeding expiration, forcibly projected to some distance through the opening. This experiment was repeated ten times, with bodies of all shapes and kinds, and always with the same results.

Such, then, being the danger, and the cause of the symptoms, we ought to perform the operation as soon as the nature of the case is understood. The operation was deemed necessary in these circumstances, by WILLIS and BONETUS; but they were both prevented from carrying their ideas into execution, by the ignorance and fears of the Physicians whom they had called into consultation. About the end of the seventeenth century, VERDUC perforated the membranes between the cricoid and thyroid cartilages, and happily extracted a bone from the trachea of a man; in 1739 HEISTER related, that he had some years before removed a piece of mushroom from the windpipe of a jocose little tailor, who had the misfortune to swallow it while laughing during dinner. He changed the incision of VERDUC, from the transverse to the longitudinal direction, and did not scruple, at the same time, to cut through the cricoid cartilage, and several rings of the trachea. He tells us also, that he had seen RAW, the celebrated lithotomist, extract a horse-bean by the same method. Since the pub-

lication of HEISTER's work, many interesting details had been given to the public, particularly by ROMIQUIERE, LOUIS, DESSAULT and PELLITAN. From their observations, we are entitled to draw the important conclusion, that so long as the foreign body remains in the trachea, so long is the patient's life in danger, at first from suffocation, or at a more distant period, from a disease of the larynx or lungs. The operation may even be too late, for instances are not wanting, where death has taken place long after its performance, from disease previously excited. It is hardly necessary for me to remark, that we can place no reliance on emetics, recommended by ETTMULLER, to the exclusion of Bronchotomy, for the most violent vomiting is seen to be ineffectual in those frequent cases, where it is one of the symptoms of the accident. For the same reason, we may reject the use of sternutatories, though they have the sanction of MUYS and VERDUC, nor can we expect sneezing to produce what the most violent cough has failed to effect.

Such are some of the diseases and accidents which render Bronchotomy advisable, and they must be considered alarming enough to justify measures of greater severity. We come now to consider the operation itself, which, however, cannot long engage our attention, since it would be quite superfluous, at this day, to advance any laboured arguments to prove its safety and practicability. These have long ago been brought forward with great force by M. LOUIS; and indeed, were necessary at the time he wrote, for the Surgeons of his own, as well as preceding ages,

were so blinded by their fears, that they could hardly reconcile the measure to their consciences.

Before I enter on this subject, I may take notice of an opinion very common among practitioners, viz. that many symptoms of the most alarming nature are to be attributed to the spasm of the glottis. From this hypothesis, for it is not proved by experiment, I should beg leave to express my dissent, and for the following reasons. If the cause of the spasm act, as has been commonly stated, on the muscles of the glottis in general, then must this aperture be dilated instead of contracted, for the crico-aretenoidei postici, which directly opens the rima, and the crico-aretenoidei laterales, and thyro-aretenoidei, which maintain it so, aided by the natural elasticity of the parts, will be much more powerful than the aretenoidei muscles alone. The division of the inferior laryngeal nerves, which paralyses the dilating muscles, while it leaves the constrictors in full vigour, is not, except in young animals, the cause of sudden death. In the third place, all the phænomena supposed to depend on the spasm of the glottis, may be readily explained by natural circumstances of the disease or accident, whatever it may be, and also by spasm of the pharynx and soft palate, which, we are sure, is of frequent occurrence.

On the authority of Galen and Pliny, the invention of Bronchotomy is ascribed to Asclepiades, the Founder of the Methodic sect, who flourished at Rome about 100 years before the birth of Christ. But all the ancients, whether Greeks, Romans, or Arabians, misled by their notions of the nature of Membrane and Cartilage, possessed

little or no real knowledge of the subject, and talk of the operation, rather as one that might be attempted, than which they had performed themselves. We learn from CASSERIUS, that ANTONIUS MUSA BRASSAVOLUS of Ferrara, was the first of the moderns who fairly cut down to the trachea, and his case having terminated successfully, it soon led others to imitate his example. If we choose the trachea as the place of operation, the following method may be advantageously followed. An incision should be made through the integuments on the fore part of the neck, exactly on the median line, commencing from below the isthmus of the thyroid gland, and extending to near the top of the sternum. When the edges are drawn asunder, the sterno-hyoidei will be seen, and below them, and rather on the outside, the sterno-thyroidei, which must be turned aside by blunt hooks. Below the thyroid gland, we meet with the thyroid plexus of veins, which throw the greatest difficulty in the way of the operator, both from their number, and because they are generally enormously distended. The patient, at this stage, should be desired to take in as deep inspirations as possible, by which means, these veins will be in a great measure emptied; should any one of large size be divided, it should immediately be secured by a ligature; for, if any blood were to find an entrance into the trachea, it could not fail to be the cause of troublesome, though not of dangerous symptoms. In one case related by M. VIRGELI, where this accident occurred, such a severe fit of coughing was induced, as prevented for some time the introduction of the canula; but the opera-

tor, after boldly cutting through several cartilaginous rings, desired the patient to bend forwards, and at once relieved him from his uneasiness. In such circumstances, it would be better to desire the patient to breathe freely, which, in all operations on the head and neck, effectually stops venous hæmorrhage. When the trachea is fairly laid bare, our future manipulations must be guided by circumstances. If it be a case of Cynanche, we should introduce a trocar and canula through the intercartilaginous space; if we wish merely to extract a foreign body, we should cut through two or more rings of the trachea, in proportion to the size of it. The introduction of the canula is by far the most important step of the operation, and perhaps the one least understood. Casserius had employed a large curved canula, which he thrust downwards towards the lungs; but Fabricius ab Aqua Pendente shewed well, that it was both inconvenient and troublesome, since it often caused severe cough, and had to be removed for a time. Hence he changed both its shape and size, and substituted for it one that was small, and so short, as just fairly to enter the trachea. Those who have, of late years, talked so loudly of the canula causing cough, have not specified the nature of their instrument, and I suspeet that it was often longer and larger than was either necessary or proper. Death, in some cases, has been threatened, and even caused, by the canula becoming obstructed with mucus, an inconvenience that may be obviated by employing a double one on the principle recommended by Dr Martin in the Philosophical Transactions; and thus, by attention to a few circum-

stances, apparently trifling, but really important, many awkward accidents may be avoided. The canula should be fastened round the neck by a proper bandage, and allowed to remain till respiration becomes free. It occasions no other inconvenience than loss of voice, the necessary consequence of all wounds preventing the air passing through the larynx. It sometimes happens that the wound is long of healing, or does not heal at all, from the edges of the skin turning and adhering immediately to the edges of the cartilages. In one case with which I am acquainted, where my friend Mr LAWRENCE had operated, the opening remained, and the patient breathed through it; whenever he wished to speak, he stopped up the hole with his finger, and articulated quite distinctly. This effect might be obviated by the use of lunar caustic, or of the needle and suture. Should the case be that of a foreign body, we have no occasion for the trocar and canula; we have only to make a fair incision into the tube, when it will he generally expelled by the first expiration. If it happened to be sticking fast for the moment in one of the bronchii, we may desire the patient to cough, and should even this not succeed, we may safely put him to bed, in the full confidence that it will be got rid of in the course of a few hours. I had lately an opportunity of seeing M. DUPUYTREN operate in a case where a child had swallowed a bean; it did not present itself immediately after the operation, but was found next morning between the sheets of the bed, having been coughed out during the night, all bad symptoms ceased the moment after the incision was made.

The operation of Bronchotomy, as above described, was the one most commonly practiced by the older surgeons, an operation neither difficult in its execution, nor dangerous in its consequences. It may be worth while to notice here, very briefly, some different modifications of it, and different instruments which have been proposed by most able men.

Sanctorius, according to Pauli of Leipsic, first recommended the use of the trocar and canula, but Deckers, in 1675, gave a much fuller account of the method, and transferred to himself all the honour of the discovery. He made use of a flat trocar, very short, and of small caliber, which he introduced between two of the cartilages. The advantages of this proceeding are very great in cases of Cynanche Laryngea, as it effectually prevents the blood from falling into the trachea, and thus removes the delay or inconvenience a fit of coughing might occasion. Dionis, as a still further improvement, advised the trocar of Deckers to be plunged in at once, without any preliminary incision, but there are solid objections against this innovation. The trachea is very moveable, and readily glides from the point of the instrument; the force necessary to perforate to the proper depth, through parts so different in consistency, is not easily calculated, and we should run the risk of perforating the œsophagus; and, lastly, the canula might be easily displaced by the motion of the windpipe acting on one part of it, while the other is kept steady by the integuments; the latter objection is a real one, and is confirmed by a case of Mr Samuel Sharpe's. M. Bau-

CHOT found some difficulty in introducing the trocar of DECKERS, and he invented one that was very short and flat, and which had a broad plate of steel attached to it, to steady the wind-pipe; the last is hardly an improvement at all, for a finger placed on the cricoid cartilage, will press the larynx against the vertebræ, and secure it as firmly as can be done by any instrument.

In the first volume of the Transactions of the Societé de Médecine, VICQ D'AZYR, who might have borrowed the idea from HEISTER, proposed to substitute Laryngotomy for Bronchotomy, by making an incision into the crico-thyroid membrane. He does not appear to have practised this operation himself, and reasons from the nature of the parts, and from experiments on animals. Since his time, tracheotomy has been almost entirely abandoned by the French practitioners. The operation on the membrane is performed on the same general principle as the other. Guided by the prominence of the thyroid cartilage, termed *Pomum Adami*, we begin our incision exactly on the median line, and carry it down to about half an inch below the cricoid cartilage. Arriving at the small triangular space which separates the crico-thyroidei and sterno-hyodei from each other, we must cut and tie an arterial branch, which is sometimes of considerable size, and is constantly found between the two cartilages; the membrane is then laid bare, and we divide it in a longitudinal direction. This operation is recommended to our notice by several circumstances, which would seem, at first sight, to give it a preference over every other. It is more simple than the pre-

ceding one; the membrane lies almost immediately under the integuments; we have no venous plexus to arrest our progress, and, moreover, the proper situation can always be exactly ascertained by reason of the projection of the thyroid and cricoid cartilages. This last argument has perhaps had more weight than all the others; and has probably led its patrons to overlook some objections which might otherwise have been urged against it. As for the boasted facility with which it may be performed, all that can be said upon the matter is, that it is more easy than tracheotomy, but can never be really difficult to a Surgeon, who would not scruple to cut down and tie the femoral artery, in the case of wound or aneurism. In no operation on the windpipe do we run any risk, if we are only cautious to cut on the medial line; the bloodvessels interested are veins only, and, if wounded, all bad consequences would be avoided, by desiring the patient to breathe freely, and making him bend forward, in the manner formerly mentioned to have been practiced with success by M. Virgeli. Those varieties of the larger arteries, mentioned by Haller, Mr Allan Burns, and Dr Barclay, are not to be taken into consideration, and are only to be remembered, in so far as they teach us a useful caution in making our incisions. If we have in view merely to allow the patient to breathe, the introduction of a trocar and canula will prevent the possibility of danger from the entrance of blood. Again, in our judgment of the comparative merits of the two operations, we ought to take into consideration the nature of the cases for which they may be required. The most frequent of

of these undoubtedly is the inflammation of the larynx. Now, the most accurate dissections prove, that, often the disease is confined to the larynx alone, and that where the rest of the tube is affected, the minute branches of the bronchii are so to a considerable degree, and the intermediate part least of all. Hence, inflammatory action and irritability being most violent in the first, it seems unreasonable to aggravate them, by the mechanical injury of the knife, and the increased vascular action, which must necessarily result. This seems to me a very valid objection against Laryngotomy, and if I may hazard the opinion, had no inconsiderable share in causing the fatality of some of Mr LAWRENCE's cases. Moreover, so abundantly is the larynx supplied with nerves, that its sensibility is remarkably acute; and in some cases, recorded by the above gentlemen, Dr LATHAM, and Dr HALL, the canula could not be borne by reason of its exciting violent cough; and to preserve the opening, it was necessary to have recourse to the unscientific practice of removing a portion of the cartilages. Dividing the crico-thyroid membrane, in general, does not afford sufficient room, and such a division must be made of the cricoid cartilage and part of the thyroid, as creates great havock about the larynx, which cannot fail to alter the voice, and protract the recovery. Though Laryngotomy, therefore, be a bad operation in cases of inflammation, it is, from its simplicity and facility, much preferable to Tracheotomy, in cases where it is intended to give relief to respiration, or to extract foreign

bodies, when, of course, it is entirely free from the above mentioned objections.

The wounds of the cartilages of the windpipe commonly heal rapidly. The edges do not consolidate like the edges of a fractured bone, but the granulations which spring from them, become of a ligamentous nature, and are further strengthed by adhesion to the subjacent cellular membrane and integuments. If the patient be advanced in age, this ligamentous matter is often converted into bone, along with the cartilages from which it had sprung.

The following conclusions may be drawn from the foregoing remarks:

Bronchotomy should be practised,

a. In cases where foreign bodies have fallen into the Trachea.

b. In Cynanche Laryngea, as soon as spasmodic symptoms supervene.

c. In Syphilitic Laryngitis, as soon as it is evident that the vocal ligaments have been affected.

Bronchotomy should not be performed, or with great reserve,

a. In Croup, unless in some exceedingly rare cases, where the larynx alone is attacked.

b. In Cynanche Laryngea, where both lungs are affected with catarrh.

c. In Cynanche Laryngea, where the parenchyma of the

lungs is inflamed. These two last states may be recognised by the stethoscope.

Tracheotomy should be advised

In Cynanche Laryngea, as we operate on the part of the tube naturally endowed with the lowest vital powers, and where the disease is least considerable.

Laryngotomy is preferable

a. In cases of Asphyxia, where a proper tube to be introduced into the nostrils is not at hand.

b. In cases of foreign bodies in the Trachea.

FINIS.