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SOME ASPECTS, HISTORICAL AND OTHERWISE, OF SURGERY OF THE THORAX

Thoracic surgery, in some of its aspects, has an ancient history. It has had perforce to deal with wounds through all the ages, but we know too that the conditions of empyema, and abscess of the lung, were recognised and treated surgically by Hippocrates. Modern thoracic surgery however dates from about the end of the nineteenth century and since then its progress has been remarkable, but it has been much slower of development than the surgery of other regions, such as the abdomen, because of the difficulties of access, and the dangers associated with disturbance of the vital respiratory functions.

The dangers associated with an open pneumothorax were known to the ancient Greeks. Vesalius in his Fabricia of 1552 showed how artificial respiration by bellows will keep an animal alive after its chest had been opened, and Hewson the great English physiologist who worked with the Hunters, William and John, showed in 1767 that with an open chest wound blocking or closing the opening rapidly lessened the dyspnoea.

The respiratory difficulties of the open chest have been successfully overcome, and the past two decades have seen the first successful total pneumonectomy for bronchiectasis (1931) and the first total pneumonectomy for carcinoma (1933). It was only in 1941 that the first successful resection in the British Isles of the lower end of the oesophagus for carcinoma with restoration of continuity by oesophagus- gastrostomy was done. Within the past two years there has been the amazing attack on some congenital lesions of the heart – patent ductus arteriosus, co-arctation of the aorta, and pulmonic stenosis. Indeed so remarkable have been the strides lately that it is almost impossible to keep pace.

THORACIC SURGERY AND WAR

It is perhaps appropriate on this 25rd October, the fifth anniversary of the Battle of El Alamein, that some of my remarks should have to do with war

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surgery. Thoracic surgery owes much to war and these two are intimately linked, for the wounds and injuries of the chest have compelled the surgeon to show his art and skill in dealing with them, however reluctant he may have been to violate the sanctity of the intact cage.

Just over two years ago the second World War ended and James Wellard, the American war correspondent, in his book "The Man in a Helmet," which is the life of that colourful person General George Patton of the U.S. Army, has said of it that we may come to know it as the last of the "Gunpowder Wars." He may be right and there will no more be seen the wounds we have been familiar with, but rather the effects of the blast and searing heat of atomic fission. I should think, however, that the use of ordinary molecular disintegration will not wholly be discarded. It seemed to be effective enough.

If we have reached the end of an era it might be interesting to look back into it and see how some of the notable figures in surgery dealt with wounds of

the chest during that period. We shall see that some of these surgeons, notably those of the Napoleonic period, had taught lessons as regards chest wounds which later had to be relearned painfully. It seems indeed that Grey Turner is right when he says "surgical memory is very short."

The gunpowder era began about six hundred and fifty years ago when primitive cannon appeared. They were used at Crecy in 1346 but gunshot wounds cannot have been common until long after, as the first detailed account of gunshot wounds was given by Brunschwig in his Wund Artzney of 1497. He regarded them as being poisoned. At the very beginning of the era a Norman, Henri de Mondeville, declared that, contrary to the teachings of Galen, suppuration was not necessary in the healing of a wound but rather to be avoided, and showed that wounds when treated as we now call aseptically, heal without the formation of pus, and so anticipated Lister by six hundred years. He must be regarded as one of the great surgeons of history. His treatment for recent wounds which penetrate the chest is: "From whichever side it (the wound) may be, one treats them just in the same way as wounds penetrating the skull, i.e. removing foreign bodies, closing the edges of the wound, and giving powder with the pigment." Somewhat reminiscent of the present day, is it not? He goes on: "These wounds should be closed more quickly and sutured by stitches closer and tighter, even though they be smaller, than wounds of other parts because here greater danger follows delay if they remain open or gaping for some time. One must act so for three reasons: so that the vital heat should not be exhaled through the wounds; in order that the surrounding cold should not annihilate this heat – two things which are very harmful; and in order that the entry of circulating air should not cause suppuration in the wound because if suppuration is produced I know by experience that it is not cured without difficulty, if ever."

A little later came Guy de Chauliac, probably the most eminent authority in surgery in the fourteenth and fifteenth centuries, but a reactionary as regards the treatment of wounds, who discusses the differential diagnosis between penetrating and non-penetrating wounds and says that the evidence of penetration is that the breath comes out of the wound even when one closes the mouth and nostril of the patient, and which is demonstrated by a lighted candle or piece of wool or cotton put close to the wound. He does not recommend early closure of wounds and advises injection of medicaments. In the event of infection there should be no delay in opening and draining the wound, and if the patient is very ill he advises counter-incision with a razor in the eighth space.

In the sixteenth century Ambroise Paré and his contemporary in England, Thomas Gale, were alike in closing, by plaster or suture, wounds that penetrated but did not have wound of the inward viscera, and leaving tents or drains in penetrating wounds that had inward bleeding. Paré writes about the necessity of fastening the tent to the dressing in case it should become lost in the pleural cavity. The wound was kept open until the "sanies" or bloody matter was exhausted. He goes on to say: "Notwithstanding the art and care of the physician, sometimes the wound degenerates into a fistula; then the former evil is become much worse, for fistulae of the chest are scarce cured at any time."

In the seventeenth century Wilhelm Fabry of Hilden, near Dusseldorf (Fabricius Hildanus), regarded as the father of German surgery, in his "Century of Surgical Cases" relates a case in which there was a penetrating sword wound through which a portion of lung protruded. He amputated this by a red hot knife, and the patient, whose life had been despaired of, recovered and enjoyed good health for many years. Surely one of the earliest records of a partial pneumonectomy.

In the eighteenth century there was no particular change in the treatment of chest wounds. The great John Hunter, although he had much experience of wounds in the Belle Isle expedition of 1761, has little to say about thoracic wounds except that "in the cases arising from balls nothing in general is to be done but keep quiet, and dress wounds superficially; for any extravasated blood which might have got into the cavity of the thorax will generally make its escape by the external wound, as also any matter from suppuration. In the cases of wounds made by cutting instruments when there is reason to suspect a considerable quantity of blood in the cavity of the thorax – the operation for empyema should be performed."

Hunter makes a most interesting observation with regard to the limitation of thoracic movement often associated with a chest wound. "I have thought it a pity that we do not accustom ourselves to move one side of our thorax independently of the other as we from habit move one eyelid independently of the other." This is just what the patient is taught to do by the modern physiotherapist when breathing exercises are being carried out.

In the early part of the century Lorenz Heister, the leading German surgeon, served with the Dutch forces in the campaigns of Marlborough in the war of

the Spanish Succession and had much experience, as he was at the sieges of Lille, Tournai, and Mons and at the battle of Oudenarde. (I wonder what he thought of John Churchill, Duke of Marlborough.) He says that at the taking of Mons there were five thousand wounded on the side of the Hollanders only. In his textbook on surgery there is a good deal about wounds of the thorax, and he says that if it appears from the symptoms that there is a collection of blood in the thorax the utmost diligence must be used to get it out, lest it should be a foundation for greater mischief. He recommends enlarging the wound if necessary, using a syringe to suck out and wash out blood, and if the wound is high in the breast or between the upper ribs, a paracentesis with trocar is to be done in the lower part of the thorax towards the back.

Coming to the nineteenth century and the Napoleonic era, there were two great figures in military surgery, Guthrie in the English service and Larrey in the French. Guthrie treated thoracic wounds by removing foreign bodies, splintered bones, and the missile when accessible, and had no hesitation in enlarging the wound to allow of this. He was well aware of the relief to a distressing dyspnoea when an open chest wound was closed. This closure of course prevented the exit of fluids and led to the very curious practice of having the wounds sucked, Guthrie says, "by the mouths of irregular practitioners, generally the drum-major of the regiment, when the patient was a soldier; and the consequences, in some instances apparently miraculous, were in others quite as unfortunate." In the case of a large haemothorax he punctured it and if necessary drained it by an empyema incision.

Larrey went further in excising the wounds as far as the fractured ribs; the jagged ends of these were cut off and loose bone fragments removed. The ball was sought for and removed if within reach. Blood and air were sucked from the pleural cavity by the application of dry cups to the edges of the wound. The wound was sealed by an agglutination plaster.

The practice of sucking was carried out in the French army, but Larrey did not like it, as he thought it might disturb a clot or transfer a virus. It was referred to by Heister in the previous century as a method of treatment for a deep wound between the muscles of the chest wall and the ribs.

No improvement took place regarding thoracic wounds in the Crimean, American Civil, or Franco-Prussian wars, although in the latter some sporadic attempts were made on the German side, I think by Volkmann, to utilise Listerian methods. In the Crimean war the mortality for wounds in which the lung was involved was over 79 per cent. in the American Civil war it was 62½ per cent. for penetrating wounds, and in the Franco-Prussian war for penetrating wounds at Sedan, it was nearly 55 per cent. Experiences were very much different in the South African and Russo-Japanese wars, and a complacent attitude was engendered as regards wounds of the chest, but this was soon dispelled at the beginning of World War I, when it was seen how severe were the wounds, and how frequently there occurred septic complications; complications chiefly in the change from a simple haemothorax into an infected empyema. Moreover, when sepsis had once developed nearly 50 per cent. of such cases died in spite of rib resection and drainage. This had not been expected, because the experience in the South African war had suggested that a conservative attitude should be adopted with regard to chest wounds, as in that war these had been relatively benign in their course. Stevenson in a series of cases found a 14 per cent. mortality, and primary empyemata rarely existed. But the South African wounds were made for the most part by small cylindrical bullets at long range frequently; the percentage of shell wounds was low; the soil dry and clean and the climate good, whereas the Great War wounds were made by pointed or spitze bullets with centre of gravity far back so that they turned readily on meeting slight obstructions, thus often producing larger wounds, and by irregular often jagged portions of high explosive shell. The soil too was highly cultivated. These lacerated wounds must have been similar to the wounds produced by the large round leaden bullet of low velocity fired from the smooth bore flintlock musket of a .7 inch calibre (about the same as the twelve bore gun), which in the seventeenth century superseded the harquebus and was the weapon of the infantryman at Blenheim and Waterloo.

Up till 1916 surgeons were reluctant to deal with chest wounds in the way other wounds were being dealt with, as it was assumed that it would be fatal to open widely the thoracic cavity without the aid of some form of differential pressure apparatus, and that handling the wounded lung would start fresh and uncontrollable bleeding. Experience proved that these assumptions were wrong when Pierre Duval in the French service and several surgeons, George E. Gask in particular, in the British service, found that it was possible to open the chest freely, deal with the lesions, and close it again without special devices for maintaining respiration. The dangers associated with

the wide open thorax were minimised by fixation of the collapsed lung either by the hand, the device of Muller, or by holding it in forceps, and by shutting off the opening into the thorax by thick pads in order to prevent air passing in and out – the traumatopnoea or wound breathing. The operation had also to be done quickly.

In 1916 then a radical change was made and the thoracic wound was no longer considered as a thing wholly apart, but had applied to it the surgical principles which were correct for wounds in general, namely, "surgical revision" or wound excision as regards the chest wall and lungs, the removal of foreign bodies, the removal of blood from the pleural cavity, closure of the open pneumothorax, and promotion of early expansion of the lung.

Gask relates that "his first big thoracic operation was done in the latter end of 1916 on a young Australian doctor who was admitted with a large open wound of the lower part of the thorax and a retained missile. He was anaesthetised with chloroform, the wound opened up, about four inches of the broken rib excised and the pleural cavity opened widely by means of a rib spreader. In the cavity of the pleura were found a shrapnel ball, a bit of rib and a large piece of khaki tunic. These were removed, the jagged ends of rib cut cleanly off and all the pleural cavity cleared of blood; then the chest was closed in layers. The patient did well, the wound healed by first intention and remained healed, the lung rapidly expanded, and the pneumothorax disappeared. His convalescence was short, he rejoined his unit, and was later awarded the D.S.O. for gallantry in the field while serving with his field ambulance."

This was the pattern of the ideal procedure for the open penetrating wound with haemothorax and retained missile. It was required possibly in about one quarter of the cases of gunshot wounds of the chest.

The same principles were applied to wounds of the thorax in World War II but with new and powerful adjuvants, as the sulphonamides were in use at the beginning of the war, and penicillin was available in 1943. As will be seen, the results have been so good as to be almost unbelievable.

A notable advance has been made with regard to haemothorax, which after all is the most common complication of injury of the chest and occurs in 70 to 80 per cent. of cases. The blood remains unclotted as a rule, for reasons not yet properly understood, and so can be aspirated. Here I would like to remind you that it was one of the Fellows of our Society, indeed a Vice-President at the moment, who showed that slow aspiration of the haemothorax on the first or second day was not attended by fresh bleeding- and that this early aspiration gave the best results. I refer to Dr. S. R. Armstrong, who was with a casualty clearing station in Bailleul. The time was 1915. It has been found, however, and various observers agree to the figures, that in roughly 10 per cent. clotting does take place and that about one-third of these clotted haemothoraces become infected. The collapsed lung is bound down by a fibro-blastic and fibrous membrane which may be one or more centimetres thick, and which is not thickened pleura. The normal pleura is found deep to it. Organization of the clot produces the "frozen" or "fused" chest and causes much respiratory crippling, and if infection supervenes, results in a chronic empyema often of the total variety. This had been noted in World War I.

Mere evacuation of the clot by thoracotomy was not enough. The lung did not expand and it was found that the limiting membrane, "rind," or "peel" as it has been styled, had to be stripped off the visceral pleura which is left intact. The lung could then be expanded fully. This was a re-introduction of an operation done many years ago, in fact in 1893 by Fowler, the Fowler of the familiar Fowler's position. It is also particularly associated with Delorme. Fowler's operation was done for a condition in which there was a mass of cicatricial tissue occupying three-fifths of the right pleural cavity in an empyema of thirty-three months' duration. The cavity was packed with gauze and the lung expanded in twenty-eight days.

Lilienthal in 1915 described decortication again, as applied to acute empyema, and this was probably the first time that acute empyema had been so dealt with. The operation was used a good deal and with much success following World War I by such surgeons as Tuffier of France and Graham, Eggers, and Hedblom of United States in dealing with the very chronic empyemata. At any rate, in World War II it was first applied in the Mediterranean theatre to the clotted haemothorax by T. H. Burford of the U.S. Army Medical Corps in May, 1943, and soon after by Nicholson of the British army. Later it was found that infected clotted haemothorax could be dealt with in the same way and also the haemothoracic empyema. The remarkable result is that 75 per cent. have had primary healing with complete pulmonary restoration. The operation was done when there was much lateral compression of the lung and especially if the apex was collapsed, and it was found best to do it in from three to five weeks. It is a procedure of considerable magnitude associated with loss of blood and much shock, and blood transfusion is necessary. Yet it has been estimated that fifteen hundred early

decortications have been done with a mortality of probably less than 2 per cent.

The unbelievable outcome that I have already indicated as regards wounds of the thorax is this, that whereas in World War I, as given in the official history, the mortality was 27 per cent., in World War II it was only 5.7 per cent. This figure was given two months ago by Major-General Mitchiner. Just last month D'Abreu at the Congress in London of the International Society of Surgery, in a review of two thousand gunshot wounds of the chest on the Italian front, gave the astonishing figure of 1 per cent. as the mortality in the battle for the River Po.

Surely a triumph for the linkage of proper surgical principles and chemotherapy, and it may be truly said that if thoracic surgery owes much to war it has repaid its debt, and with interest.

But lest it should be thought that a wound of the thorax is of comparatively small importance, it must not be forgotten that probably 70 per cent. of those hit in the chest die in the field, and that of those killed in battle 20 to 30 per cent. or more possibly had wounds of the thorax. The sinister reputation too of thoracoabdominal wounds is well supported by a mortality up to 50 per cent. in World War II. It was worse in World War I.

Empyema

What has history to say of the other ancient associate of thoracic surgery – empyema, so often a grave complication of its chest wounds. As has been said, Hippocrates was familiar with it, and directs that when the collection protrudes externally an opening should be made in it: but if not, he directs that the patient should be shaken by the shoulders, when the sound of the fluid within will be heard. When the side is ascertained he recommends cutting down to the third rib from the last and making a perforation with a trocar or trepan to give vent to a small portion of the fluid; the opening is then to be filled with a tent and the remainder evacuated after twelve days. In the Aphorisms he remarks that when empyema is treated either with the cautery or incision, if pure and white pus flow from the wound the patients recover; but if mixed with blood, slimy and foetid, they die. This is probably the first recorded statement of the difference between the ordinary pyogenic empyema and the putrid anaerobic variety due to rupture of a lung abscess. And again in the Aphorisms he says that those cases of empyema or dropsy which are treated by incision or the cautery, if water or pus flow rapidly all at once, certainly prove fatal.

R. A. Young in his Lumleian Lectures says that the Hippocratic rules were followed till the fifth or sixth centuries, and then were forgotten or discarded. At any rate they were revived in the Middle Ages, and Paré, after describing drainage of empyema by intercostal incision or by the actual cautery, goes on to say, "but if the patient shall have a large body, chest, and ribs, you may divide and perforate the ribs themselves with a trepan," thus following the Hippocratic teaching about drainage.

During the eighteenth century the practice of tapping came into vogue, and drainage with a cannula. There were apparently very few successes from incision, and operation must have had a sinister reputation, as Dupuytren refused operation when he himself had empyema. The great Sir Astley Cooper said he could never get a single cure.

Syme in his textbook of surgery of the year 1832 only describes paracentesis by incision and likewise Liston in his textbook of the following year. Erichsen in his "Science and Art of Surgery" of 1853 does not mention empyema at all except as a complication of chest wound. So that at that time it would look as if empyema had been entirely in the hands of the physicians. Lister, after he had introduced his antiseptic method, carried out rib resection for drainage and it was thought that this might be the answer to the problem, but apparently open operation had a high mortality in an influenzal pandemic between 1889-1892, but the problems peculiar to empyema in influenzal outbreaks had been appreciated and noted. They had to be relearned twenty-six years later.

There had, of course, been introduced methods of closed continuous drainage, and Potain must be regarded as the pioneer in that field. He described a method of siphonage combined with lavage in 1869. Curiously enough, it was an obstetrician Playfair who must be credited with water-seal intercostal drainage in this country. He introduced it in 1872 and thus antedated Bülau in Germany and Revilliod in Switzerland, who described similar methods some years later.

Open drainage with rib resection appears to have been the more frequently used form of treatment up till the Great War (World War I) and various estimates of its mortality have been made. Osler and McCrae, for example, in a series of cases give the mortality as 22.2 per cent. and Graham says that 25 per cent. was not unusual. A rude shock came during the worldwide influenzal or haemolytic streptococcal epidemic when it was realised how great was the mortality with open drainage of the empyema. In military camps in the United States the average mortality was 30 per cent. and in many of the camps it was well over 50 per

cent. A special Commission was set up by the Surgeon-General U.S. to investigate the causes of the high mortality, and the report of this Commission is the most notable landmark in the history of empyema. As a result of the work of that Commission the reduction in mortality was very striking; at one camp, for example, it fell from 40 per cent to 4 per cent. and it was concluded that death should not occur in cases of empyema, other than tuberculous empyema, unless complicated by such conditions as lung abscess and suppurative pericarditis. The most important one of the principles advocated by the Commission in the treatment of empyema was the avoidance of an open pneumothorax during the formative or pneumonic stage, and it was recommended that open drainage whether by rib resection or intercostal incision should not be carried out, but rather aspiration or closed drainage until the pneumonic phase had passed. It was dangerous to create an open pneumothorax when the vital capacity was low, and when there were no adhesions or no induration of the mediastinal pleura to prevent displacement of the mediastinal structures towards the opposite side. Practical experience showed that when the character of the effusion changed to definite frank pus, open drainage could be done without the deleterious effects that would have occurred earlier. Evarts Graham, who was a member of that Commission, pointed out the marked difference between streptococcal and pneumococcal infections and suggested that the high mortality in the streptococcal cases was due to the application to them of the principles commonly and correctly applied to pneumococcal cases. In streptococcal infections the effusion is synpneumonic in its appearance, copious, and rapidly formed, and there are no limiting adhesions, whereas in pneumococcal infections the empyema is generally metapneumonic, and adhesions have already fixed the lung to the chest wall.

Adherence to these principles, so well set out, has been the feature of the treatment of empyema up till the present. They have not been forgotten and it has been recognised that empyema is a problem in bacteriology and physics. Fortunately too there has not been a repetition of the fearful influenzal pandemic of 1918 and 1919, when streptococcal empyema was such a common complication.

The advent of penicillin has been of considerable importance with regard to empyema, as, of course, most of the cases are caused by penicillin-sensitive organisms. The empyema can be sterilised in several days, but this does not mean that it is cured – there is still the empyema cavity until expansion of the lung occurs, and often it is quite impossible to gain this by aspiration, as the only measure, because of the thick pus and probably masses of fibrin in the pneumococcal and staphylococcal cases. For these open drainage is still obviously required.

An important role for penicillin is in the case diagnosed very early in which the pleural fluid is still thin and localisation has not yet occurred, as has been recommended by Fatti and his colleagues. It would apply particularly to the synpneumonic empyema of streptococcal origin in children and in old people.

With regard to the chronic empyema which so often is due to inadequate drainage of the acute empyema, the recent excellent results from decortication in infected haemothorax cases may well stimulate a return to that procedure, as an early measure, in total and subtotal empyemata with collapsed apex.

The Control of the Open Pneumothorax and Anaesthesia

A most important thing, if not the most important, in surgery of the thorax is the control of the open pneumothorax, and this very responsible task, in addition to the maintenance of anaesthesia, devolves on the anaesthetist. I must apologise to my friends who practise that art for daring to trespass in their domain. My excuses are that the open pneumothorax is very much a mutual concern, and that I have been intensely interested in the mechanics of the various methods of maintaining lung function, since those far-off days in World War I when I was endeavouring to cope with the open chest, using a somewhat primitive and homemade Boyle-type anaesthetic machine. Another excuse for my trespass is my desire in this the centenary year, and almost to the day, of the introduction of chloroform, to pay homage to that new saint, St. Anaesthesia, whose name, among others, has been put forward as very worthy by Mr. Winston Churchill when he suggested at a dinner in the Guildhall, London, that there should be a hagiology of medical science.

The baleful effects of an open pneumothorax have long been known; the collapse of the lung on the opened side, the futile to and fro movement of air from one lung to the other across the tracheal bifurcation which Brauer styled “pendelluft,” the flutter of the mediastinum and the loss of aspirating effect on the great veins. These have to be prevented and sufficient lung function maintained, as well as anaesthesia, during operations in which the pleural cavity is widely opened or when the chest wall is deprived of rigid support, as may happen in the course of a thoracoplasty. Indeed, often a completely

artificial respiration has to be undertaken.

A somewhat erroneous impression of the dangers of open pneumothorax had arisen because of the experiences with chest wounds in World War I. Gask and Duval in particular had found it possible to do thoracotomies without any special anaesthetic apparatus, but these operations were of short duration and various manoeuvres such as narrowing the wound with packs, fixing the lung with the hand or with holding forceps, were used as correctives.

As long ago as 1895 Tuffier had shown that a pressure of 10 cm. of water in the bronchial tree would keep the lungs expanded even if the chest were widely opened, and Quéénu in 1896 actually used a modified diver's helmet in which the pressure was raised when the pleura was opened, the anaesthetic being chloroform, on a sponge, in the helmet.

Then in 1904 Sauerbruch began to elaborate his negative pressure chamber in which the operation was performed, and in its final stage it held not only the patient below the neck, but also the surgeon and assistants. At the same time Brauer was working on a positive pressure chamber in which the patient's head was contained, and there was much controversy as to which method was the better, but when a simple mask was introduced the positive pressure method gained the field. Meltzer and Auer of the Rockefeller Institute in 1909 simplified matters somewhat by their introduction of insufflation through an intracheal catheter passed as far as the bifurcation, and this also was a constant positive pressure method. Positive differential pressure methods were those commonly used up till about 1938 in spite of the criticism by Giertz, the Swedish surgeon, who as long ago as 1916 showed that with differential pressure, whether negative or positive, breathing, i.e. autorespiration, might be so inefficient as to lead to slow suffocation, and strongly maintained that rhythmical ventilation was much superior to constant positive pressure breathing in which any ventilation effect is brought about by the patient's own respiratory muscles and in which expiration, which should be free, requires some effort. Crafoord, whose chief Giertz was, and who has now succeeded him in Stockholm, confirmed all the findings of Giertz and showed too that in the dog in a period of a little more than three hours under positive pressure anaesthesia, the blood $C0_2$ may rise from the normal value of 40 per cent. to over 80 and 90 per cent. and the animal will die of $C0_2$ poisoning, even when pure oxygen is being breathed.

In conjunction with the Aga engineer Anderson, Crafoord has elaborated a ventilation anaesthesia machine using the Frenckener spiro-pulsator to produce the rhythmic action, and with this machine a fully controlled respiration is maintained.

In this country and in the U.S.A. controlled respiration is achieved by manual pressure on the breathing bag, using the closed circuit and CO_2 absorption apparatus. Nosworthy, who in this country was the pioneer of this method, credits Guedel of South California as being the first to make use of controlled respiration.

It is a curious thing that the use of rhythmic ventilation in thoracic surgery has been so late in development, although it must be said that for some time the methods of carrying out anaesthesia with positive pressure were not far removed, e.g. the gas flow was interrupted frequently to allow the lungs to empty and if the respiration became poor and superficial, manual rhythmic compression of the breathing bag was carried out.

The physiologists have been much in advance of the surgeons in the use of rhythmic ventilation, e.g. the Palmer pump designed by Starling has been in use since 1926, and this was by no means the first of the pumps. This is a single-cylinder pump with solid piston, with valves in the course of the inlet and outlet tubes, so that the lungs receive a constant adjustable volume of air at each thrust of the pump, and are then allowed to deflate by their own elasticity. Starling says that with this arrangement the lungs remain in perfect condition throughout experiments lasting four to five hours.

The tardy development may be due to the Sauerbruch advocacy of differential pressures, and indirectly may be associated with the popularising of the artificial respiration methods of Hall (1857), Howard (1868), Sylvester (1859), and Schaefer (1890), so that insufflatory rhythmic methods and the designing of the apparatus to carry these out have been neglected, although these are more ancient, and as George Edward Fell showed in 1887, could rescue from death cases in which the external methods had failed.

In the Old Ashmolean at Oxford I saw recently a case containing a bellows and leather-wire-covered pipes with this astonishing legend: "For the resuscitation of the apparently drowned as recommended by the Royal Humane Society (c. 1800), contains bellows and leather pipes for rectal insufflations with tobacco-smoke," but there was no chamber that I could see in which the tobacco could be burnt such as Heister illustrates in his "System of Surgery" (1748) when describing the tobacco-smoke clyster for quite a different purpose, and I was

confirmed in my idea that some mistake had been made, for close at hand was the Royal Humane Society's Pocket Companion of 1814 with the following instructions: "To restore breathing, introduce the pipe of a pair of bellows into one nostril, the other nostril and the mouth being closed, inflate the lungs till the breast be a little raised, the mouth and nose must then be let free. Repeat the process until life appears."

About this curious smoke clyster, Heister says of it: "The moderns have a new kind of clyster made of the smoke of tobacco which appears to be of considerable efficacy and was introduced first by the English, after whom it has been used by several of the other European nations. It is used chiefly when other clysters prove ineffectual and particularly in the Iliac Passion and in the Hernia Incarcerata . . . They have an iron or brass capsula large enough to hold about half an ounce of tobacco to which capsula are fastened two pipes, one to be inserted into the anus and the opposite pipe is made like the end of a trumpet which is applied to the mouth and being made of ivory the patient or an assistant may blow through it and force the smoke of the burning tobacco in the capsula into the anus. In this manner the smoke is to be blown up the anus until the patient received stimulus enough to excite him to stool; and if one pipeful of tobacco does not produce the desired effect the same may be repeated at discretion; or if the common tobacco is too weak, recourse may be had to the strongest kind termed canaster, the usefulness of which kind of tobacco has been experienced to good purpose by myself and others in obstinate and incarcerated ruptures when the common tobacco has proved ineffectual, and when at the same time the patient's case had been judged desperate, it has succeeded so well that I have had no occasion to use the knife."

So it seems as if the rectum can be as fastidious in its choice of tobacco as the palate.

I have very recently seen another reference to tobacco smoke, this time by one of the peripatetic correspondents in the Lancet, who, commenting on a work entitled "A Physical Dissertation on Drowning" by Dr. Rowland Jackson published in 1746, says that "Dr. Jackson suggests tracheotomy if others measures prove ineffectual, and if no tracheotomy tube is at hand the shank of a common pipe – presumably a churchwarden – is to be slipped into the tracheotomy opening and the operator 'blows into the bole.' He recommends another and much more extraordinary use of the pipe, this time loaded and burning. The small end is to be introduced into the anus, the bowl covered with a piece of perforated paper, and the operator is then to blow tobacco smoke into the intestines as strongly as he possibly can. On one occasion when this remedy was put to trial at the instigation of a soldier: "At the fifth blast a considerable rumbling in the woman's abdomen was heard upon which she discharged some water from her mouth and in a moment after returned to life." Dr. Jackson was so impressed by reports of this method that he invented an instrument "contrived on purpose for impelling the smoke of tobacco into the intestines." It enables the blower to operate from a distance of some feet, but has no advantage for the patient, the peripatetic gentleman says, "unless like the users of cigarette-holders he prefers his smoke cool."

There may be something in it, after all.

The Surgery of Pulmonary Tuberculosis

What of the surgery of pulmonary tuberculosis, which bulks largely in everyday thoracic work and will do so, as far as can be judged at present, until a chemotherapeutic or an antibiotic remedy is found? This goal, I feel, is not very far distant.

The surgery of pulmonary tuberculosis is still largely collapse therapy, and comprises operations on the phrenic nerve often with pneumo-peritoneum, closed internal pneumonolysis in conjunction with artificial pneumothorax, and thoracoplasty. The results of thoracoplasty are good in spite of some pessimistic expectation. At a recent meeting of the Tuberculosis Association, Sellors reported that on reviewing just under six hundred cases, of which five hundred and fifteen were traced, he found there was a good result in 77 per cent; of four hundred and thirty-five cavities, three hundred and ninety-two or 90 per cent. were closed and that sputum conversion had occurred in 83 per cent., and again Lewis, collecting the figures of seventeen American authors amounting to a total of three thousand and forty-five cases, found that the average percentage of arrested or apparently arrested cases was practically 70 per cent. In one large series in that collection, 91 per cent. of cures was claimed.

The Monaldi intracavitary drainage, of which so much was hoped, has proved disappointing, but has a place as a preparatory measure for thoracoplasty in cases with very large excavations. Cavernostomy too, in a limited way, has proved to be a useful method in dealing with some of the so-called tension cavities.

Since 1944 a good deal of surgery of the extirpative kind, i.e. lobectomy and pneumonectomy, has been done for tuberculous lesions in which collapse measures have failed or which were not likely

to benefit by thoracoplasty, such as tuberculoma, lower lobe cavity, broncho-stenosis, "destroyed lung" with multiple cavitation, some of these latter cases being described as "desperate risk" cases.

The best results have been obtained by pneumonectomy in cases of bronchostenosis and thoracoplasty failure. Extirpation has, apparently failed to solve the problem of the cases with enormous cavities which are not amenable to collapse therapy.

It has been found that it is a good thing to do thoracoplasty as a supplemental measure following lobectomy and pneumonectomy to avoid over-expansion of remaining lung tissue. The results of lobectomy have been disappointing because of spreads or reactivations in roughly 50 per cent. on the side of operation or in the other lung.

As I see it, the position as regards extirpation in pulmonary tuberculosis may well be expressed in the words of one of the contributors at a recent discussion on the subject: ". . . extirpation of the disease is still not the philosopher's stone in the treatment of pulmonary tuberculosis . . . the imponderables which, for want of a better term, we call the immunobiologic balance, weigh as heavily in these procedures as they ever did in a given case of pulmonary tuberculosis. If the balance can be weighted by some factor as, for example, streptomycin, the complexion of the procedures may change."

In May this year Glover, Clagett, and Hinshaw reported from the Mayo Clinic five cases of resection, three of which were pneumonectomies in which streptomycin was used as a protective. No spreads took place. They think that in this prophylactic sense streptomycin may find its greatest field of service.

THE SURGERY OF THE OESOPHAGUS

For a good number of years I have been treating oesophageal cancers by radium intubation, and while I cannot claim any definite cures, a fair measure of palliation has been achieved. Indeed, quite often it has been seen that the cancerous manifestation in the lumen has disappeared and has been replaced by fibrous tissue, so that dilatation for the resulting stricture has been required.

The story of the surgery of oesophageal carcinoma has been a melancholy one since Billroth in 1871 showed experimentally that resection was feasible. It was not until 1913 that a successful operation for carcinoma of the thoracic oesophagus was done. That was the classical operation of Torek which was done in two stages, the first stage being the establishment of a gastrostomy. In the second stage the oesophagus was resected and its upper end exteriorised via the neck on the anterior chest wall. Continuity was established by a rubber tube. This patient of Torek's lived for eleven years and died of pneumonia at the age of eighty. Between 1913 and 1941 only fifty-eight operations of similar sort were reported and of these forty-one died – a mortality of over 70 per cent.

The first successful purely transthoracic resection for cancer of the oesophagus with immediate junction of oesophagus and stomach was done by Adams and Phemister in 1938, and that seems to have determined a wave of enthusiasm for resection, especially for tumours of the lower end.

Up till 1943 the Torek operation, or a modification, was the operation of choice for cancers of the middle third, but in that year Garlock showed that it was possible to anastomose the stomach to the oesophagus in front of the arch of the aorta and near the apex of the thorax. Dickson Wright told me not long ago that he had actually done this anastomosis on the surface in the lower part of the neck, thus instancing to what an extent the stomach can be mobilised without jeopardising too greatly its blood supply.

The Torek operation is thus more or less completely outmoded. The mortality of these operations is still too high. At a recent meeting of The Association of Surgeons of Great Britain and Ireland, a joint presentation was made by four British surgeons of eighty-two cases of resection with immediate oesophago-gastrostomy. The mortality was 49 per cent. Garlock's (New York) mortality was 48 per cent., whereas another series from Boston (Sweet) had the low figure of 19 per cent.

But to quote Grey Turner again; "In surgery, as in the affairs of life, with concerted and sustained effort insuperable difficulties seem gradually to fade away."

And now, Mr. Ex-President, Ladies and Gentlemen, I fear I have wearied you with these few facets of thoracic surgery, yet I have said nothing of the tumours of the lung, of abscess, or of bronchiectasis; nothing of the tumours of nerve tissue, the neurofibroma and ganglioneuroma; nothing of the vagi and their section for peptic ulcer; nothing of the thymus in its relationship to myasthenia gravis; nothing of the pericardium; nothing of the congenital lesions of the heart which have been very much a high light at the recent meeting of The Association of Physicians and the International Congress of Surgery.

So many worlds, so much to do, so little done.