Empyema and its allies, considered historically / by Charles J. MacAlister.

FROM THE

LIVERPOOL MEDICO-CHIRURGICAL JOURNAL.

JANUARY 1896.

EMPYEMA AND ITS ALLIES, CONSIDERED HISTORICALLY.

By Charles J. Macalister, M.D. (Ed.), M.R.C.P. (Lond.), *Physician to the Liverpool Stanley Hospital and to the Home for Incurables; Lecturer on Practical Medicine to the Royal Southern Hospital.*

The term empyema[1] appears to have been used by the ancients to designate an internal collection of pus, whether in the pleural cavity or not, and the first restriction of its use to thoracic cases has been ascribed to Aetius;[2] but it has to be observed that in reading the older continental literature of the subject, an effusion of serum or of blood into the chest is not infrequently alluded to under this name.

The credit of describing the symptoms and nature of empyema is generally ascribed to Hippocrates, who makes frequent mention of it in his writings; and it is fully described in some of the books of the Hippocratean School, which are more doubtfully the direct product of his pen. Hippocrates, however, probably inherited some of his knowledge of this, in common with other diseases, from his ancestors the Asclepiadæ, who presided over the Temples of Health in Greece, and who are the accredited authors of the first book of *Prorrhetics* and of the *Coan Prognostics*, which, according to Dr Adams[3] and some other authorities, together formed the basis of the *Prognostics* of Hippocrates, containing so excellent an account of the means of recognising this disease, which may therefore be regarded as one of the oldest known to medicine.

Hippocrates, obiit B.C. 361, (about) æt. 99.

As examples of other suppurations which were called empyemata by Hippocrates, *Aph.* 10, sect. v.[4] might be cited,—where a purulent expectoration from the chest, resulting from extension of a disease of the throat to the lungs, is probably alluded to.[5] In the *Prognostics* (par. 7)[6] the empyema spoken of seems to refer to a suppuration in one or other hypochondrium, and many other references might be given to show that phthisical cavities

were also included in this term. But that Hippocrates was well acquainted with this disease, as we know it, is abundantly proved by the description which he gives both of its clinical features and of its treatment. It is commonly thought that he was accustomed to rely greatly upon succussion for arriving at a diagnosis of this condition; in other words, that he recognised it chiefly when associated with pneumothorax. In his description of pneumothorax, Dr Hilton Fagge[7] makes reference in a footnote to a quotation from the *De Morbis*, and remarks that the Hippocratic pathology of empyema consisted in the bursting of an abscess into the pleura as the result of peripneumony. That Hippocrates associated empyema with peripneumony there is no doubt, but it is equally certain that he was able to tell when a chest contained pus without the admixture of any gaseous material; this we know by his description of the means of arriving at a diagnosis, which is so excellent that I venture to quote it, in its entirety, from Dr Adam's translation of the *Prognostics*, paragraphs 16 and 17:[8]—

Prognostics, § 16.—"One should estimate when the commencement of the suppuration will take place by calculating from the day on which the patient was seized with the fever, or if he had a rigor, and if he says that there is a weight in the place where he had pain formerly, for these symptoms occur in the commencement of suppurations. One may then expect the rupture of the abscesses to take place from these times, according to the periods formerly stated. But if the empyema be only on either side, we should turn him and enquire if he has pain on the other side; and if the one side be hotter than the other, and when laid upon the sound side, one should enquire if he has the feeling of a weight hanging from above, for if so the empyema will be upon the opposite side to that on which the weight was felt" (*i.e.*, it causes distress to lie on the sound side).

Prognostics, § 17.—"Empyema may be recognised in all cases by the following symptoms:—In the first place, the fever does not go off, but is slight during the day, and increases at night, and copious sweats supervene; there is a desire to cough, and the patients expectorate nothing worth mentioning; the eyes become hollow, the cheeks have red spots on them, the nails of the hands are bent, the fingers are hot, especially their extremities, there are swellings in the feet, they have no desire for food, and small blisters (phlyctænæ) occur over the body. These symptoms attend chronic empyemata, and may be much trusted to; and such as are of short standing are indicated by the same, provided they be accompanied by these signs which occur at the commencement, and if at the same time the patient has some

difficulty of breathing. Whether they will break earlier or later may be determined by these symptoms:—If there be pain at the commencement, and if the dyspnœa, cough, and ptyalism be severe, the rupture may be expected in the course of 20 days or still earlier; but if the pain be more mild and all the other symptoms in proportion, you may expect from these the rupture to be later, but pain, dyspnœa, and ptyalism must take place before the rupture of the abscess. These patients recover most readily whom the fever leaves the same day that the abscess bursts; when they recover their appetite speedily, and are freed from thirst; when the alvine discharges are small and consistent, the matter white, smooth, uniform in colour, and free from phlegm, and if brought up without pain or strong coughing. These die whom the fever does not leave, or when appearing to leave them it returns with an exacerbation; when they have thirst, but no desire of food, and there are watery discharges from the bowels; when the expectoration is green or livid, or pituitous and frothy; if all these occur they die; but if certain of these symptoms supervene and others not, some patients die, and some recover after a long interval. But from all the symptoms taken together we should form a judgment, and so in all other cases."

It is evident from the above graphic clinical account that the "rupture" mentioned does not refer to the opening of an abscess into the pleura, but to its bursting into the lung, and consequent evacuation by cough and expectoration, which was the usual mode by which it was hoped that the disease would become cured,[9] and this, too, accounted for the frequency of the occurrence of pneumothorax in these days, and for the employment of succussion as a sign of empyema. But if this expectant line of treatment was commonly adopted, there are also evidences that operative measures were had recourse to. There is little said about the operations themselves in the books known to have been written by Hippocrates: he merely makes mention that "when empyema is treated either by the cautery or incision, if pure and white pus flow from the wound, the patients recover; but if mixed with blood, slimy and fœtid, they die."[10] In several of the books of the Hippocratean School, however, there are allusions to these operations which throw considerable light upon their nature and objects. The practitioners of that time seemed to recognise that the letting out of the pus was a successful means of treatment, and mention is made of it as a means of safety,[11] and one to which prompt recourse should be had;[12] but, nevertheless, their fear of the operation was great, and they

seem to have attributed the greatest danger to the too speedy evacuation of the fluid, whether serous or purulent,[13] which they supposed—as pointed out by Galen—to cause a fatal loss of the animal and vital spirits.[14] The operation, as already remarked, consisted either in incision with the knife or cautery, and was performed not only in cases where the pus had become partly evacuated through the lung, but also in cases where no such communication existed. There is a most interesting account of a method of confirming the presence of the pus in the chest in the *De Morbis*,[15] which directs that if the patient neither expectorates nor has the ordinary signs in the side, he is to be placed in a chair and shaken by the shoulders (his hands being held by assistants) in order to ascertain the situation of the pus by the splashing sound; and if this test failed, yet they were not to be deceived, but were to know that the thorax was full of pus by the difficulty of breathing, the swelling of the feet, and the cough; then, in order to ascertain which pleural cavity contained the pus, the chest was surrounded with a nakpin which had been dipped in hot water containing vermilion (*Rubrica liquida*), thoroughly ground, and whichever part of this dried first indicated the position in which the incision with knife or cautery was to be made. It may be well to mention here that in the 2nd book of the *De Morbis* it is recommended that the opening be made in the side which is most swollen and most painful, low down rather than in front, *i.e.*, with the patient on his back, in order that the pus may escape more easily, a remark which proves the antiquity of the surgical principle of making an incision for drainage at the most dependent part; and another most interesting historical point is the observation that when the pus was thin (watery) a pewter drainage-tube was to be introduced, which was gradually shortened to allow the wound to heal. When the knife was used, in one book of the *De Morbis* (iii.), it is stated that before making the incision the skin was marked; but elsewhere it is simply enjoined that an incision was to be made into the skin between the ribs with a knife, and then the subjacent parts were to be perforated with a pointed knife, guarded by having a piece of rag so wound round

it that only a portion the length of the thumb-nail remained exposed. On reaching the pus some of it was allowed to escape, and the incision was then plugged with a stiff linen tent fixed to a thread; this was removed twice daily (so that the fluid might be gradually evacuated) for ten days, at the end of which period the cavity was allowed to empty itself; and in order that the lung should not dry too quickly, being accustomed to the presence of a fluid, warm wine and oil was injected through the fistula.[16]

As before noted, much importance was attached to the gradual evacuation of the pus by the Hippocratean School, and the difficulty which they encountered in effectually controlling its escape by plugging a wound of the soft parts with the linen tent is said to have led to another frequent practice—that of perforating a rib (after making an incision through the skin) with a sharp trepan, so that they might have a rigid structure to cork and uncork, so to speak, as they found necessary.[17]

The writings on medicine during the five centuries which succeeded the Hippocratic era do not appear to indicate any change either in the methods of diagnosis or of treatment detailed above. Celsus makes no specific mention of empyema in his writings, or peripneumony, but in his chapter on fractures of the ribs he refers to suppuration as a complication.[18] It is, however, doubtful whether he here distinguishes between a pleural abscess and one connected with the ribs, but in any case he emphasises the necessity for speedy operation with the cautery by thrusting it through the most swollen part, and in the event of there being no external swelling, he instructs that the part is to be smeared over with Cimolian chalk (probably fuller's earth), and that at whatever spot this remained longest moist the pus would be most superficial, and that the cautery should be inserted there. This, it will be noted, is contrary to the experience of the Hippocratic writers, who state that the pus is to be found where the part dries first,—a difference of opinion which would seem to indicate that the method was somewhat unreliable. The reasons for thinking that Celsus here referred to empyema are, that he alludes to this absence of external swelling, and to the necessity

Celsus lived about A.D. 30.

for nourishing the body after the operation, to prevent a tabes which would prove fatal; and, furthermore, he states that in some cases "instead of pus there is an internal collection of a fluid like mucus," *i.e.*, a serous effusion.

GALEN, born A.D. 130, died about A.D. 200.

Galen added nothing of importance to the knowledge of this disease. He appears to have favoured perforation of the bones, as exemplified by his well-known brilliant case of mediastinal abscess (called empyema), in which he removed a portion of the sternum, laying bare the heart, and so giving issue to the pus. But that he recognised true empyemata is evident from the manner in which he records his practice of injecting honey-water through the ulcer, and having shaken the patient well, of placing him on the affected side to allow the fluid to escape, to favour which the sick man was directed to cough violently. He elsewhere remarks that after a fit of coughing the patient sometimes spat up some of the honey-water which had been injected into the chest.[19]

I have already indicated that up to this period no material change had taken place either as regards the modes of recognising empyema or the means adopted for its relief, and I have related the former somewhat in detail because they became traditional, the teachings of Hippocrates having been handed down practically unchanged from century to century until the more refined clinical methods which were made known by the discoveries of Avenbrugger and Laennec came into use. But the treatment of this ailment has gone through many and various changes, which have depended in part upon modifications in surgical skill and appliances, and in part apparently upon the results which were attained by individual practitioners.

The first of these phases probably took place among the Greeks themselves, among whom during the 6th and 7th centuries thoracentesis seems to have become unpopular. A key to this is furnished by Paulus Ægineta, who says: "Others, as Leonidas says, having passed a knobbed cautery, heated in the fire, through the interstice between the ribs to the abscess, have carried the burning down to the pus. Some have dared to operate upon them by making a transverse incision, or one a

PAULUS ÆGINETA, end of 6th or beginning of 7th century.

little obliquely in the skin between the 5th and 6th ribs, then perforating with a knife the membrane lining the ribs, and thus evacuating the pus; but they and those who burn with iron to a considerable depth either occasion immediate death, the vital spirit being evacuated with the pus, or occasion incurable fistulæ."[20] Aetius, who is believed to have lived about the 6th century, made no mention of this operation, and both of the above ancient authorities preferred to produce superficial eschars by means of the actual cautery, presumably in the hope of causing absorption by this counter-irritation. This practice also extended itself among the Arabians, as noted in a commentary on the above translation by Dr Adams—who mentions that Haly Abbas[21] and Rhases were accustomed to recommend it, although the latter seems also to have practised paracentesis —by means of a small orifice—to allow of slow evacuation of the fluid.[22] For this superficial cauterisation, the root of the Long Birchwort (*aristolochia*) dipped in oil was frequently employed (*e.g.*, Paulus Ægineta) in preference to the hot iron.

Aetius, 6th century.

Haly Abbas.

Rhases

From this Arabian period up to the 16th century there were not many writers who advocated operative measures, and those who ventured to open the chest followed the Hippocratean directions, the only difference of opinion being as to whether it was better to use the knife or the cautery, or a combination of a caustic which produced a superficial eschar with the knife, which was subsequently employed to complete the perforation of the soft parts, the advantage claimed for this latter method and for the actual cautery over the simple incision with the knife probably having been that the sinus was less likely to heal too quickly.[23]

But during this period operations for the relief of intra-thoracic effusions—of whatever nature—the result of traumatism—where there were perforating wounds—were performed, and a good deal of discussion seems to have taken place as to whether it was best in these cases simply to dilate the original wound or to make a counter-opening; some writers advocating this latter as a rule where signs of effusion followed a wound, and the former in every case in which penetration of

the thorax had occurred, to afford a sufficient exit for blood or for pus if any subsequently collected.[24] On one further point there was some controversy—namely, regarding the most suitable situation in which to make the opening. Whether the case was one arising from a perforating wound or not, all seemed anxious to operate as low down as possible—some choosing the 9th, but most recommending the 8th interspace, on account of the danger of injuring the diaphragm in the former; and Salicetus and De Chauliac added the further precaution, that care was to be taken to avoid the origins of the nerves.[25] In all the cases injections of wine or of honey-water were employed, and in other respects the after-treatment was not different from that of the ancients.

The next stage in the history of our subject began during the latter half of the 16th century, when once again, despite considerable opposition, empyemata came to be regarded surgically, and there was more tendency to treat them by incision; and some practitioners seem about this period to have reintroduced perforation of the ribs or sternum, a practice which had been but little employed since the time of Galen. It is a little difficult to comprehend the circumstance that no injuries to the intercostal arteries are recorded by the advocates of this plan, but we may perhaps infer that accidents to the vessels were not unknown to the operators from the fact that, although it appears from Paré's article that he expresses himself as unfavourable to this interference with the osseous structures, because of the difficulty of making certain that the flow would be ample, yet, in advocating incision through the intercostal spaces, he gives the caution that when the knife is used, it should not be directed too obliquely downwards, for fear of wounding the intercostal artery. But Paré also made use of the trepan in cases where his patient was very large-chested or had very large ribs, presumably on account of his being able in these cases to get a sufficiently large opening to secure efficient drainage.[26]

Paré, A.D. 1579.

At this period there were several other well-known men who did much to re-establish these operative measures, and to render them more successful. Among these were Marcellus Donatus and

Marcellus Donatus, 1588.

Fabricius of Acquapendente, who both regarded operation as the only safe means of treatment; and the latter especially seems to have given the matter much study, and to have laid down very definite rules for its performance. He considered that the 5th interspace, four or five finger-lengths away from the sternal border, was the most suitable site for incision, thus avoiding the thicker muscles further back; but he also described a method whereby the point of puncture might be determined by measurement. The length of the 6th rib being taken with a thread, and the point chosen being distant one-third of its length from the sternum, there he made his incision parallel to the direction of the fibres of the external intercostals; and it is interesting to note, too, that he was among the first to point out the importance of keeping close to the upper border of the inferior rib, in order to avoid wounding the vessel.[27] He directed that the chest was to be in the expiratory condition while being perforated, in order that the diaphragm might be protected.[28] Both Fabricius and most of his contemporaries made use of canulæ after opening the chest, through which they injected fluids to dilute and wash out the pus (which was only allowed to escape little by little), the one employed by the former being specified as circular in shape, pierced with holes, and furnished with two wings which prevented it from slipping into the thoracic cavity.

Fabricius of Acquapendente, 1647.

Early in the 17th century we find for the first time that some attempt was made to break through the traditional practice of keeping empyemata open for prolonged periods by means of tents or canulæ. It was noted that cases of penetrating wounds of the chest sometimes got better sooner when allowed to heal early, and it was argued that it might be best to allow the sinus in empyema to close early also. This view was supported in a very sensible way by Gregorius Horstus[29] (and by Fabricius Hildanus[30] in a commentary on his questions), who opposed the prolonged keeping patent of all wounds of the chest, without distinction, unless a copious suppuration indicated it; but evidence is not wanting that errors were made in the direction of allowing these penetrating wounds to cicatrise too soon. Marchettis[31] recorded a case of this description, in

Gregorius Horstus, 1661.

which he reopened the scar and so relieved the empyema which had formed; but perhaps the most important suggestion in this century emanated from Bontius,[32] who, I think, must have argued that since the spontaneous evacuation of the pus through the mouth was associated in many cases with the entrance of air into the pleural cavity, there could be no harm in allowing air to come into contact with the lung through an external fistula. In his opinion, the trachea was the only natural channel of exit for the pus; but when this was insufficient, he freely opened the chest between the 4th and 5th ribs, employing the plan of making a superficial eschar with the potential cautery in the first place, and subsequently penetrating this with a knife, thus ensuring a large aperture, which would not be likely to heal quickly. But although Bontius had cases which were successfully treated by this method, and in which no care was taken to exclude the air, his suggestion met with opposition, for instead of less care being taken to prevent this accident, practitioners seem to have begun to consider other measures for avoiding it. Bartholin,[33] for instance, thought every care should be taken to prevent contact with the air, and that the opening should be speedily closed; and at the time of the operation he immediately followed the knife with his finger, in order to plug the wound, which was subsequently closed with a tent, or a canula was introduced which completely filled the wound, and which was, in turn, closed by the same means. It was with a view to the prevention of this contact with the air of the lungs that Scultetus[34] at this period (in common with many of his predecessors) made use of syringes to inject fluids into the thoracic cavity, which would not only prevent the lungs drying too suddenly, but would also obviate the evil effects of the cold air. After injecting them, Scultetus did not allow these medicated fluids to escape at once, but retained them with a tent, and they were changed night and morning, a silver canula being inserted to withdraw them. Many authors, most of whom quote Sprengel, state that Scultetus employed the syringe to withdraw pus from the chest. I have read this author very carefully, and can only find reference to his use of it to inject fluids (*i.e.*, in the

Bontius, 1629.

Bartholin, 1663.

Scultetus, 1669.

only copy of the *Armamentarium Chirurgicum* to which I have had access, viz., Ed. Amstel., 1669). These procedures were followed by other practitioners of the time, with little modification, except that mention is made by some of the necessity for introducing a fluted sound, or the finger, to ascertain whether any adhesions existed; and some, too, about this period advocated the leaden canula instead of the silver one, apparently on account of its flexibility, which allowed of its being easily bent into various curves. Hey,[35] when writing upon this subject at the end of the 18th century, refers to his use of the leaden instrument, making its tube adapt itself to the shape of the wound, a detail which must have been of considerable importance where the tube was worn for many weeks, or even months, as it must have been at the period of which I am now speaking.

There is little else of interest to record in the history of empyema in the 17th century, beyond the fact that the use of the cautery for performing the operation became much lessened, as did also the perforation of the ribs or sternum; but it must be noted that in 1694 Drouin[36] first made general use of the trocar inserted between the third and fourth ribs for the relief of empyema and hydrothorax, a practice which was supported by Nück,[37] who stated his belief that it might be useful in thoracic as well as in abdominal effusions; and he pointed out that the needle would require to be as large for purulent thoracic effusions as the one used for abdominal paracentesis. Drouin, 1694. Nück, 1692.

The danger of wounding the lung, however, with the needle, especially when adhesions existed, deterred surgeons from confidently adopting the use of this instrument, and its employment quickly became abandoned until another century had elapsed, as we shall presently observe. Dionis[38] also supported the use of the trocar, but only in cases of hydrothorax, preferring the knife when the effusion was purulent. He objected to the cautery in these cases, because it destroyed the muscles and the coverings of the ribs, and made so large an opening that the canula afterwards inserted would not fit properly. If this instrument was selected, he enjoined that it should be applied Dionis, 1733.

through a piece of wood, previously pierced, in order that the surrounding parts might not be injured.

Almost at the commencement of the 18th century, once more attention began to be chiefly redirected to these effusions, of whatever nature, which resulted from penetrating wounds of the chest. It is probable, indeed, that the changes in the opinions of medical men regarding the treatment of intra-thoracic effusions, which arose apart from wounds of the parietes, had been greatly due to their observations of these cases.

Anel, 1707.

It was in connection with these cases (wounds) that Anel[39] in 1707 originated machines for pumping out the chest through canulæ of various shapes and sizes. He was led to this practice through observing that soldiers resorted to it, using only the mouth for withdrawing the fluid (blood), and that recovery frequently followed this primitive aspiration. De la Motte,[40] who wrote about this time, inferred that it was customary to be accompanied at every duel by a professional "sucker," and that the results of this treatment were sometimes so fortunate that many people attributed them to the devil. He had seen one of these professionals, after sucking such a wound, simply cover it with a piece of paper, and on the following day the patient, who had been grievously wounded, was able to attend to his affairs.[41] De la Motte, however, himself disapproved of suction in these cases, on account of the danger of increasing the hæmorrhage; and in most of his "observations" he records that, after attempting to get rid of the blood (or in one case, blood which had become purulent) by making the patient hold his breath or cough, he drew off the effusion with a hollow sound.

G. M. De la Motte, 1722.

L. Heister, 1748.

Heister[42] was another upholder of this practice of suction; and I only mention him in this connection because he recommended it for the purpose of removing the air contained in the chest. This author, as well as De la Motte, pointed out the importance of making a counter-opening low down in cases where the chest was wounded high up and in which effusion had occurred, and both of them mention the necessity for having a "chafing dish of hot coals held near to the wound to

warm and thin the air inspired." In cases of empyema proper, Heister preferred to incise the superficial structures, and afterwards to perforate the pleura with a trocar, whilst De la Motte used only the knife; but he was the first to give up the use of injections in the after-treatment of the cases, attributing to their use some unfortunate results.[43] It was about this time, too, that another observation was made, which, like the abandonment of injections by De la Motte, was opposed to the teaching of Hippocrates: I refer to the statement of Brunner,[44] who in 1715 remarked that an ichorous pus did not always necessitate a fatal issue—a fact which has been amply confirmed by many subsequent writers.

Brunner, 1715.

From the above it will be seen that, in the class of cases of which I am now speaking, there were two principal problems before the minds of practitioners, namely, the removal of the effusions, whether of blood or otherwise, and the withdrawal of air from the chest, or prevention of its entrance. Towards the latter half of this century there were some most important matters discussed having reference to these sanguineous effusions following penetrating wounds, some surgeons maintaining that they should be speedily removed, others holding that it was best to leave them, and to allow of their absorption or spontaneous evacuation by natural processes. Sharp,[45] for instance, opposed active interference strongly, on the ground that it favoured recurrence of the hæmorrhage, and that if coagulation had occurred, the clots would be unlikely to escape through the wound; whereas, on the other hand, Van Swieten[46] as strongly urged the removal of the blood whenever the general symptoms indicated the cessation of the hæmorrhage. If the blood remained in a fluid state, the patient having been placed conveniently, was instructed to hold his breath, and so to force the blood out; but if clotting had taken place, aspiration was resorted to by means of a syringe; the wound was dilated if need be, and fluids were injected to assist in the evacuation by dilution and breaking down of the clots. Various pumps were recommended to favour these measures: one invented by Breuer was introduced in 1769 by Ludwig, who advised the evacuation of all

S. Sharp, 1750.

Van Swieten, 1752.

Ludwig, 1769.

the fluid at one time, unless the person entrusted with the performance of the suction was inconvenienced by the least disagreeable odour. Another similar instrument was suggested in 1770 by Leber, simple in construction, and not requiring the application of the mouth; but Richter pointed out that these appliances were not serviceable, because if the blood remained fluid it would escape of itself through the wound, and if clotted it could not be pumped out.[47] It was at about this period, and probably in relation to these discussions, that surgeons began first to direct their attention to the prevention of these effusions of blood by appliances of various kinds to the injured intercostal vessels. The earliest of these consisted of ligatures passed round the rib by means of curved needles. Gerard, about 1740, employed a curved needle having a thread, to which was attached a pledget. The thread was carried through the wound and out above the superior border of the rib, until the pledget pressed the vessel against the inner costal surface, then the thread was tied over a thick external compress. Later, Goulard passed the ligature round the rib by means of a curved needle fixed to a handle, the curve of the needle being such that, when inserted at the upper costal border, it traversed the inner surface of the rib, without danger of wounding other structures, and projected again at its lower border when the handle was simply raised; then the thread was seized and the instrument withdrawn by again depressing the handle; a pledget was then attached to the inferior extremity of the thread and drawn into the wound until it pressed upon the vessel, when it was fixed by tying the ends of the thread over a compress, as suggested by Gerard.[48]

LEBER, 1770.

GERARD, 1740.

GOULARD, 1740.

LOTTERI of Turin.

QUESNAY.

Another method of arresting intercostal hæmorrhage consisted in the employment of a flat metal instrument, one end of which was bent to receive a pad which was introduced through the wound and applied against the inner surface of the rib, the requisite pressure being obtained by fixing the free extremity of the instrument to the chest wall by means of a bandage (Lotteri of Turin).[49] Quesnay made use of a counter pierced with holes, to which threads were attached, and which being drawn upon after the counter had been slipped into the chest,

caused compression of the vessel. Then Belloq invented a special tourniquet consisting of two plates, which could be brought together after introduction of one of them into the chest.[50] These methods or the application of astringents were relied upon with little modification until early in the 19th century, when Assalini (1812) expressed his opinion that the best way of stopping the hæmorrhage was to complete the section of the vessel and trust to its retraction, rather than run the risk of doing harm by instruments of compression. I have thought it right to speak of these traumatic cases, because they not uncommonly ended in suppuration themselves, and their treatment might be regarded as preventive of empyema.

Belloq.

Assalini, 1812.

The other point which I have mentioned as having received renewed attention at this time was the withdrawal or exclusion of air from the chest after operations for thoraic effusions. It was Henry Bass[51] who in 1717 first definitely suggested that the air should be excluded by means of a valvular opening, which would enable the orifice to be closed after the fluid had escaped. He suggested for this purpose that the cutaneous incision should be made at a different level from that of the subjacent structures (by pulling the skin aside before incising it), a practice which has had its advocates until a comparatively recent date. Lurde[52] in 1765 improved upon this method by again making use of the trocar, and by placing the finger on the orifice of the canula during each inspiration, so that air could not be drawn into the chest; but although this appeared to be a great advance, and must have been successful in some cases of hydrothorax, its obvious disadvantages in empyema evidently became apparent, for we find Chopart and Desault, ten years later, abandoning its use, and resorting again to simple incision,[53] and in 1778 Hemmann expressing the opinion that it was useless to take precautions for the exclusion of air.[54] I have incidentally remarked, when speaking of the suction of wounds, that Heister suggested it as a means of withdrawing air from the thoracic cavity, and that he spoke of making the patient take a deep breath as an alternative. This method of expelling the air was also practised by Van Swieten,[55] who regarded it of great import-

Bass, 1717.

Lurde, 1765.

Chopart and Desault.

Hemmann, 1777.

ance, but he admitted the impossibility of preventing the admission and retention of air so long as any fluid remained, and only endeavoured to expel it when the cavity had become empty. Then, holding the lips of wound together with his fingers, he made the patient take a long breath, opened the wound and closed it again before expiration took place; and having repeated this procedure several times, the sinus was at length sealed with sticking-plaster, which was afterwards renewed as seldom as possible.

Another point of interest in this connection, because it indicates that the need for proper expansion of the lung may have been before the minds of these practitioners, was the advice of Morand, who considered that the effusion should be partially withdrawn once or twice at intervals with a trocar before the chest was finally opened, in order that the lung might become accustomed to its enlargement, and the diaphragm resume its arched condition.[56]

Morand, 1819.

The treatment of adhesions complicating thoracic effusions commanded some attention during the latter part of this (18th) century and commencement of the next, some surgeons advocating their destruction with the finger or with the sound, others regarding this as likely to do harm to the lung, and preferring either to divide them with the knife or to leave them alone (Chopart and Desault); but if, when operating in a seat of election, it was found that an adhesion was come down upon, and that the fluid was missed in this way, it was by several recommended that the incision be prolonged; or failing this, that the operation be commenced in another situation.

It must not be thought, that because the various methods of treatment which I have mentioned were employed up to this time, that empyema was considered frequent, or that it was always easy of recognition; on the contrary, the writings of surgeons of the 18th and early part of the 19th centuries only too clearly prove that the diagnosis was often missed altogether, and that the symptoms required to be very pronounced to allow of its being with certainty recognised. Samuel Sharp,[57] for instance, who was surgeon to Guy's Hospital in 1750, considered what we

Samuel Sharp, 1750.

now regard as the true empyema to be a rare condition, and that operative measures were generally needless owing to the tendency of the lungs to cast off the matter in their substance or on their surface (the old theory of absorption and re-secretion of the pus). Joseph Warner,[58] who was also a surgeon at Guy's in 1754, recorded three cases upon which he operated, and two of them were certainly strikingly successful, considering the long duration of the disease before the pus was evacuated. In his annotations on his cases Warner remarks that he considers immediate operation imperative, and that it should not be deferred in expectation of the fluid being absorbed into the circulation, and evacuated by the urine, stool, or spitting; that cases of success by these means are rare, and that death frequently results from putting off the operation too long. In performing his operations, Warner always inserted his finger into the chest after making his incision, to ascertain whether there were any adhesions, and their absence in the cases which he records was doubtless regarded as a favourable prognostic, for I note that Le Dran,[59] who was a great authority, and was generally quoted by authors of the period, says in his chapter on empyema, "That" (empyema of pus—for he speaks also of empyemata of blood and of water) "which proceeds from a suppuration in the breast may be cured by an operation if the lungs do not adhere to the pleura; but if they do, and if the *pus* which was enclosed in a *cystis* happens to be diffused upon the diaphragm, there is very little to be done in such a case." Le Dran's descriptions of the physical and vital signs of the disease do not differ materially from those which other surgeons mention, but in naming the difficulty of lying on the sound side he remarks, that although this is a positive symptom, its absence does not prove that there is no fluid, since, when there is adhesion of the lungs to the mediastinum, the patient may be able to lie on either side, because, when the cyst gradually filling with matter is situated between the mediastinum and the lung, it causes the mediastinum to yield so gradually that "habitude becomes a second nature," whereas, where there are no such adhesions, the lying on the sound side causes so sudden a weight to be thrown on the

Joseph Warner, 1754.

Le Dran, 1749.

mediastinum that the unusual pressure of fluid causes distress to the other lung. This explanation of the cause of this symptom was disputed in 1808 by Richerand,[60] who made experiments to show that the patients objected to lie on the sound side, because this interfered simply with the expansion of that side of the chest, and was not related to pressure on the mediastinum. To prove this, he injected fluid into the thoraces of several dead subjects (taking care that no adhesions existed), and when from 3 to 4 pints had been introduced, the ribs and lung were removed from the opposite side, and the mediastinum could be distinctly seen reaching from the vertebræ to the sternum, and supporting, without yielding, the weight of the liquid in whatever position the body might be placed. That this was erroneous was claimed by most subsequent authorities, on the ground that in many cases—after evacuation of the fluid—the patient can lie at once on the sound side although the lung remains unexpanded, and he still depends upon the muscles of the sound side for his respiration; and Townsend pointed out, in support of this view, that in cases of empyema combined with pneumothorax the patient can generally lie on the sound side as long as the collection is chiefly gaseous, but that the difficulty increases *pari passu* with the increase in the proportion of liquid effused.

RICHERAND, 1808.

Up to the year 1808 the custom which had existed since the days of Hippocrates of allowing all kinds of thoracic effusions to escape a little at a time had remained in force. There were surgeons who made occasional exceptions to this rule in their practice, but the principle remained unchanged; at this date, however, Audouard proved that the sudden withdrawal of large quantities of fluid was not liable to be followed by such harmful results as was commonly thought, and he had seen a case, in which there had been a considerable collection, quickly restored to health after having all the pus withdrawn at one time.[61] There is a very full and interesting record illustrating this practice (although the patient eventually died) in Baron Larrey's *Memoirs de Chirurgie Militaire*,—that of a young soldier who, after an attack of pleurisy in April 1802, complained for some

AUDOUARD, 1808.

LARREY, 1812.

time of a pain in a particular part of his side when he underwent violent exercise.[62] It was associated with shortness of breath, palpitation, and gradually increasing weakness, until, on account of threatening suffocation, he again entered the hospital in May 1804. His left chest was found to contain liquid, which spurted out to a distance of more than 4 feet on the intercostal space being incised. It was all allowed to escape, and the amount was estimated at from 4 to 5 litres. The operation was followed by no syncope or other ill effects; on the contrary, there was great relief to the respiratory distress, and the contractions of the heart appeared to take place more easily. After going on satisfactorily for some weeks, he was one day suddenly seized with rigors, stupor, oppression, difficulty of respiration, and colic, the result of exposure to cold, having been found uncovered on a very stormy night, and in spite of vigorous treatment he afterwards rapidly wasted—with hectic—and died on July 31st, 1804. Larrey regarded it as important to prevent contact of the external air with membranes accustomed to the presence of a liquid, but he considered injections to be rarely useful, and as tending rather to irritate the organic capillaries formed in the pleura by their mechanical action. He did not use tents, and dressed his incision with a simple compress after inserting a strip of lint into the wound. He regarded these cases as likely to be of long duration and very difficult to cure.

But interesting as the above particulars are, another and greater interest is attached to the case which I have just referred to, in that it brings to our notice the fact that at this period displacements of the heart, the result of left-sided pleuritic effusions, were probably only beginning to be clearly recognised, and that the value of this sign for diagnostic purposes was as yet uncertain. This patient was at first admitted into the medical wards under M. le docteur Sue, who quickly recognised that the heart was beating in the right side, and he inferred that it had become dislocated from its ordinary situation by a blow from a stone which the man had received on the right side of the chest at the siege of Saint-Jean d'Acre. The pulsations of the radial arteries were

very feeble, whilst those of the heart seemed very strong, being directly transmitted to the chest wall, and the doctor considered that this transposition, by constraining the heart's action, was deranging the circulation.

The case, on account of this displacement of the heart, excited much curiosity among the pupils and practitioners of the town, and it was not until Larrey discovered that there was a thoracic effusion on the left side that the nature of the condition appears to have been understood.

This displacement of the heart is noticed by most writers since the year in which the above case was narrated, but in the books of antecedent date to which I have been able to refer I can find no mention of it, from which I judge that it must have been first observed about this period (the dexiocardia due to drawing of the heart over after contraction of the right side was described by Stokes). It was, however, only recorded as occurring in left-sided effusions until about the year 1833, when Dr Townsend pointed out that there was cardiac displacement to the left in cases in which the disease was in the right side of the chest,[63] and he spoke of these dislocations, since they seldom arise from any other cause, as being the most constant and least equivocal of all the signs of effusion. Prior to this time the displacement of the heart seems to have been considered as of rather occasional occurrence, even when the effusion was on the left; Cooper mentions it in this way, and comments upon a post-mortem which he saw at St Bartholomew's Hospital, where there was a large left empyema. During life the heart had been noticed pulsating to the right of the sternum, but the diagnosis had been missed, and some had thought it was a case of aneurism,[64] a mistake which was not without precedent, for Le Roy in 1804 observed that in empyema the movements of the heart and thoracic vessels frequently gave rise to an aneurismal appearance;[65] but some of the cases referred to were probably instances in which pulsations were transmitted to those localised bulgings occurring in empyemata pointing externally (pulsating empyema of necessity). Such a case is mentioned in the *Dictionnaire des Sciences Medicales*, where, on

Townsend, 1833.

Le Roy, 1804.

the left side posteriorly, there was a swelling having all the appearance of an aneurism, due to the pulsation being transmitted through the pus. The pulsation observed occasionally in the intercostal spaces when the chest is full of pus was first described by Fréteau,[66] and it must not be confounded with the *fluctuation* in the spaces, which, together with a *sense of resistance*, had been relied on as confirmatory signs for some time previously, although Trousseau lays claim to the credit of having first observed the former.[67] In 1813 Bichat[68] endeavoured to establish an aid to diagnosis by means of abdominal pressure; he thought that by pressing upwards from the hypochondriac region a sense of suffocation would be produced when the side containing the pus was thus compressed, but the value of this method was never confirmed by experience, since it was found that many healthy persons suffered respiratory discomfort when it was practised upon them, and that in cases of disease, pressure on the sound side produced as much suffocation as did that in the affected one, owing to its causing interference with the function of the lung which was doing most of the work.

Fréteau, 1812.

Bichat, 1813.

The revival of the discovery of Avenbrugger (1761) by Corvisart, which took place about this period (1808), had a very different bearing upon the diagnosis of thoracic effusions, for it quickly became evident that it might afford a means of telling not only that fluid was present by the dull sound, but also the height to which it reached; in fact, it was the first clinical method which had thus far existed whereby the presence of effusions in their earlier stages might be recognised. To distinguish liquid from other causes of dulness, the patient was examined in various postures, much as we now examine a case of ascites, and by observing whether the dulness disappeared from a dependent part when this was made superior in position. It is not surprising, however, that we find it noted that the results of percussion were often untrustworthy, and had proved fallacious on many occasions, when we consider that the levels of pleuritic effusions fail to be altered by changes of bodily posture, even when they are moderate in amount; and it must therefore, even in the

Avenbrugger, 1761. Corvisart, 1808.

presence of some of the other then known signs, have been often impossible to say whether the dulness was due to fluid or not. Hence, although a great advance was made by the recognition of this dulness on percussion, which is at the present day perhaps the most reliable of the cardinal signs of thoracic effusions, its full value did not become manifest until Laennec made known the greatest of all the discoveries relative to the diagnosis of thoracic diseases, the combination of which with percussion has enabled practitioners since then to make those more refined examinations by means of which at the present day we are able not only to say with precision that there is an effusion, but also to estimate its extent or its gradual increase or decrease with comparative exactness. It is right that we should mention here that Piorry[69] contributed much to this improvement when he introduced mediate percussion by means of an ivory pleximeter in 1828. Prior to this time no pleximeter was used, the ribs or interspaces being simply struck with the ends or flats of the fingers. Piorry's modification of Corvisart's method served to enlarge the field of physical diagnosis, and afforded a means whereby the anatomical limits of organs both normal and abnormal as well as of pathological effusions might be determined. His motto on the title-page of his book is "*un organe étant donné, chercher a determiner pendant la vie sa disposition physique.*" When we consider the more limited utility of immediate percussion, I think Laennec's[70] observation which I quote from the introduction to his book might well have been deferred until auscultation had been established. He says (page 3—Forbes' translation), "Nay, I will go so far as to assert, and without fear of contradiction from those who have been long accustomed to morbid dissections, that before the discovery of Avenbrugger one-half of the cases of peripneumony and pleurisy and almost all the chronic pleurisies were mistaken by practitioners;" for I do not think we can assert that the accuracy of diagnosis had become very much more assured until Laennec contributed his own discovery to the one above referred to, and it cannot be said that much advance in the physical diagnosis of empyema and other thoracic effusions has been made since he published

LAENNEC, 1819.

PIORRY, 1828.

his work, to which I refer the reader for a detailed account of all the additions which he made to previous knowledge of the signs of these diseases; for since they are practically unchanged at the present day, and are known to every physician, it is hardly within the scope of this essay that they should be mentioned.[71]

Although Laennec did so much to place the diagnosis of this disease on a more certain footing, he made no suggestions of importance regarding its treatment, and indeed many years elapsed before any improvement in this respect took place. As an early measure, he recommended a succession of small bleedings, blisters, caustic issues or setons to the side,—tonics, antiscorbutics, and diuretics being taken internally; but when a very copious acute effusion occurred, which threatened to suffocate the patient in a few days, or when, in the chronic form, every other means had proved unavailing, and the œdema, emaciation, and debility threatened the patient, he advised operation, although he regarded it as seldom successful, either on account of the tuberculous state of the lung, or because that organ having been so long compressed, had lost its elasticity, and could not expand to its normal extent, so that the two pleural surfaces being unable to become united, and being irritated by the air, gave rise to a long-continued purulent discharge, which caused exhaustion of the patient.

Laennec did not recommend the trocar, because the chest refilled after withdrawal of the pus, although he thought it might be serviceable in the acute empyema (not necessarily purulent). He preferred thoracentesis, and prophesied that early operation would probably become popular, as the effusions became recognised earlier, owing to the expansibility of the lung being less interfered with; and it is interesting to note that he suggested the use of an exhaustion-glass over the wound after evacuation of the fluid, to cause a vacuum in the chest cavity, and thereby aid expansion of the lung. This idea had, however, been thought of previously by an anonymous French writer (quoted by Sprengel), who advised the application each day of cupping-glasses over the wound, a proceeding which was denounced by Severinus as being too cruel (*De Efficaci Medicina*, ed. Francof, 1646).[72]

Jowett, 1826. This principle was again suggested by Mr Jowett of Nottingham in the *Medico-Chirurgical Review* for 1826. He relates the case of a girl in whom, after the operation, he allowed the wound to close by the 5th day, with the result that much air which he thought had been sucked into the pleural cavity through the wound was included (although it was more probably derived from a bronchial fistula, because the patient had expectorated pus). The empyema again pointed, and burst at the seat of incision on the 25th day, after which the patient recovered. Mr Jowett attributed much of the danger of thoracentesis to the entrance of air, and thought it necessary to exclude it, because it simply substituted a gaseous for a liquid compressor, and because it gave rise to decomposition, which in turn was another source of gaseous accumulation. On these accounts he suggested, as a substitute for operation by incision, the introduction of a small trocar and canula, to which latter a tube connected with a Reid's or Weiss's syringe was attached after its insertion into the chest. By this means he proposed to withdraw the pus, subsequently removing the canula without detaching the tube, and then sealing the puncture with plasters and a compress. I have not been able to discover that Mr Jowett's plan was ever acted upon, although it was probably the nearest approach to true aspiration which had thus far been proposed.

During the fifteen years which succeeded the publication of Laennec's work, his methods of diagnosis gradually gained ground, although some time elapsed before practitioners relied on them rather than upon the older signs. In the descriptions of cases published in the various medical works of the period, it is noticeable that at first the disease was very often recognised before the stethoscope was employed, and that it was then used as an additional means of diagnosis, and so at length its use in this way became confirmatory of its own utility. Some books, more especially the surgical ones, make no mention of auscultation as an aid to diagnosis: for instance, *Cooper's Surgical Dictionary* (1825), a classic work, describes all the older signs of the disease, including percussion, but omits the stethoscopic signs, and states that the symptoms altogether are very equivocal,

and the existence (*i.e.*, the diagnosis) of the disease somewhat doubtful. The medical writers, however, generally described the stethoscopic signs in detail.

I have omitted hitherto to refer to vocal fremitus as being of importance for confirming, by its diminution or absence, the presence of pleural effusions, owing to the fact that although it was known to Laennec (having been described in 1819 by Reynaud),[73] he did not esteem it a valuable sign, and we find no mention made of it even by the best writers after his time, until Hudson independently directed attention to its value in this country, his observations being published in 1833 by Stokes of Dublin.[74] Since then it has been regarded as one of the cardinal signs of the diseases now under consideration. To Stokes is due the credit of asserting that the intercostal muscles and diaphragm become distended not so much on account of the pressure to which they are subjected by the accumulated fluid, as because they become paralysed owing to an inflammatory action, much in the same way that a hollow viscus becomes distended when inflamed; and in support of this observation he directed attention not only to the feebleness with which the muscles act after absorption of the fluid, but also to the circumstance that non-inflammatory conditions causing distension of the chest, such as hydrothorax (passive), Laennec's emphysema, and enlargement of the liver, do not cause flattening and loss of tone of the intercostal muscles; and finally he pointed out, in further proof of the paralytic nature of this phenomenon, the circumstance that in some cases of empyema the diaphragm, after retaining its convexity up to a certain point, suddenly yields without any necessary increase in the amount of fluid effused. He considered that protrusion of the intercostal spaces was a sure sign of the purulent nature of an effusion, and he was supported in this view by Dr Hamilton Roe. This was, however, subsequently disputed by Walsh and some others. Stokes also directed attention, in this connection, to the displacement of the liver, which he had observed in 1822, and to the reputed depression of the spleen, of which he had had no personal experience, but he was by no means the first to discover the hepatic displacements,

Reynaud, 1819.

Hudson, 1833.

Stokes, 1837.

for they had been previously described, but had nevertheless been frequently mistaken for enlargements of that organ, as exemplified in a quotation by Townsend (1833),[75] from a memoir by Roux, relating a case pronounced as an incurable enlargement of the liver, which proved to be a depression of that viscus, disappearing when paracentesis was performed by Bichat. I might here mention that the difficulty which sometimes existed in distinguishing an enlarged liver from a right-sided empyema was known to most authors of the 18th and early part of the 19th centuries, and that not a few cases of abscess of the liver had been operated upon in mistake for this disease (Le Dran, Morand, &c. &c.).

There remains but one physical sign and one physical method to be mentioned, namely, the tympanitic resonance heard in moderate effusions on percussion underneath the clavicle, which
Skoda, 1850. was pointed out by Skoda; and the employment of the grooved needle for puncturing the chest, as a means of distinction between serous and purulent effusions which was introduced by
Thos. Davies, 1835. Dr Thomas Davies in 1835, and was very generally employed, until supplanted by the hypodermic needle, first recommended
Ringer. for this purpose by Dr Ringer, and which in turn has led to the invention of the modern exploring syringe.

Regarding treatment. Until Trousseau published his memoir advocating the performance of paracentesis in all cases of considerable effusion (published 1843, and amplified in 1868), the universal practice was to trust to bleedings for the purpose of arresting the causal inflammation, and to diminish the amount of blood passing through the compressed lung; local derivatives in the shape of cataplasms and (after the subsidence of the fever) blisters, or the application of the moxa. Internally it was customary to give mercury and iodide of potassium, diuretics, purgatives, and low diet (a quotation from Broussais being sometimes cited, "The more a patient eats, the sooner will he die"). All of these remedies were intended to keep the vascular system as empty as possible, in order to render it likely to absorb the effused liquids. By these means simple effusions were expected to subside, and Stokes considered that most cases

which came to require operative interference had resulted from some error in treatment at an early stage of the disease. "At least," he says, "it is certain that in every instance with which I have been acquainted, the disease was either wholly overlooked in the commencement, or improperly or insufficiently treated." Up to this time (1843), whether performed with the trocar or by incision, thoracentesis was regarded as a *dernier ressort*, never to be had recourse to unless the life of the patient was threatened; and even when the effusion was known to be purulent, derivative remedies were often employed for long before the operation was ventured upon. The principal fear in connection with the removal of a serous effusion seems to have been that the entrance of air might convert it into a purulent one, or that it would by its retention keep up the compression of the lung, circumstances which led to the suggestion that thoracentesis should be performed under water; to Professor Schuh's invention of a small trough, fitted with a valve which could be affixed to the canula after withdrawal of the trocar (1841); and to Reyberd's simpler idea (1841) of making a valvular opening to the canula with a piece of moistened gold-beater's skin.[76] In cases already purulent, most of the best authors agreed with Laennec's edict that thoracentesis by incision was preferable to the use of the trocar, and that it was best to let all the pus escape and to provide a free aperture for drainage; and one might mention here that once again, in 1841, perforation of a rib was practised by Reyberd,[77] with the object of having a solid support for the canula, which he inserted through the hole and retained there as a drainage-tube. Dr C. J. B. Williams[78] recommended repeated tapping of the chest in empyema, and also the displacement of the pus with water which he injected through a double-tubed canula, his idea being that the water would, like a serous effusion, be capable of absorption; but if after these repeated tappings the matter still continued to form, he employed weak solutions of nitrate of silver or of common salt. In later years some mention is made of chlorinated solutions, especially where the discharge had become fœtid, and Trousseau was particularly fond of injecting

Schuh, 1841.

Reyberd, 1841.

Trousseau, 1843.

iodine under similar circumstances. As already stated, Trousseau in 1843 announced his belief in the early removal of serous effusions with the trocar, on the ground that, contrary to the teachings of Louis (who regarded them as never fatal), they were liable *per se* to cause sudden death.

In his lectures (Syd. Soc., 1868) he furnished, as an additional reason for this practice, his belief that serosity effused as the result of inflammation of the pleura is likely to undergo a transition into pus, *i.e.*, that the later secretion is liable to be purulent, just as the later secretion of a bronchial catarrh is purulent. On this account he urged operation in cases where there was a large effusion. Trousseau certainly did much to forward the successful treatment of simple effusions; but in empyema, which he also treated with the trocar and canula, the cases were of very long duration, and I doubt if it can be said that he improved on former methods, or that his cases were more satisfactory. He recognised that the empyemata of children were the cases most likely to recover; and he relates as a successful example, the case of Edme Belize, who was tapped three times between the end of January and August 15th, 1853, and on the last occasion a horribly fœtid pus mixed with gas was withdrawn. A canula having a metallic stopper was then left in, and iodine solutions injected each day. This treatment was continued for six months, when a bronchial fistula formed, and chlorine water, and eventually aromatic wine, was substituted for the iodine. The canula was finally withdrawn in July 1854, *i.e.*, after having been worn for *eleven* months, and eighteen months from the commencement of the disease,—more than 200 injections of iodine and as many of chlorinated and aromatic solutions having been administered.[79] Since the time of Trousseau the circumstances which have chiefly contributed to modify and improve the treatment of thoracic effusions have been the introduction of the aspirator[80] (of which Drs Protheroe Smith and Dieulafoy claim to be the inventors), and of the antiseptic system of surgery,—the former instrument, in some of its improved forms, having almost entirely superseded all previous methods of treating serous effusions, whereas the latter system

Protheroe Smith, 1866, and Dieulafoy, 1869.

has been responsible for most of the changes which have taken place regarding the treatment of empyemata in the past twenty years. It would be out of place to enter into any detailed description of the many special operations and appliances which have been employed during this period, but the principle of providing free drainage, combined with asepsis, has been at the foundation of the most important of them. As a result of the introduction of antiseptics, every method which does not allow of free and continuous drainage has been abandoned; and the free incision drainage-tube and antiseptic precautions employed in past years have no doubt reduced the mortality from this disease, shortened its course, and rendered sequent ill-health far less common than formerly.

NOTES AND REFERENCES.

[1] Definition, εν πυον—εμπυημα.

[2] AETIUS lived at the end of the 5th or beginning of the 6th century. *Vide Cooper's Surgical Dicty.*, 1825.

[3] The Genuine Works of Hippocrates—Francis Adams.—Sydenham Soc., 1849–50.

[4] *Ibid.*, *Aphor.* 10, sect. 5. Persons who escape an attack of quinsy, and when the disease is turned upon the lungs, die in seven days; or if they pass these they become affected with empyema.

[5] *Ibid.*, *Prognostics*, § 23.

[6] *Ibid.*, *Prognostics*, parag. 7. A swelling in the hypochondrium, that is hard and painful, is very bad provided it occupy the whole hypochondrium, but if on either side, it is less dangerous when on the left. . . . But if the fever continues beyond sixty days without any subsidence of the swelling, it indicates that empyema is about to take place.

[7] *Principles and Practice of Med.*, 2nd ed., vol. ii. p. 195.

[8] The Genuine Works of Hippocrates—Francis Adams, LL.D.—Syd. Soc., 1849.

[9] The same thing is surely to be understood in *Aphor.* No. 15, sect. v.—Persons who become affected with empyema after pleurisy, if they get clear of it in 40 days from the breaking of it, escape the disease; but if not, it passes into phthisis.

[10] *Aph.* 44, sect. vii., and *Prognostics*, § 18.

[11] HIPPOCRATES, *Opera Omnia* quae extant in viii. sectiones ex Erotiani mente distributa, nunc recens latina interpretatione et annotationbus illustrata, Anutio Foesio (Greek and Latin), Franc, 1595. *De Locis in homine*, sect. iv., "Et haec quidem inustione curantur."

[12] *Ibid.*, *De Morb. Vulgaris*, lib. vi. sect. 7, No. 8, "Aqua inter cutem laborentes cito incidere oportet," &c., &c.

[13] *Aph.* 27, sect. vi., Those cases of empyema or dropsy which are treated by incision or the cautery, if the water or pus flow rapidly all at once, certainly prove fatal (Genuine Works of Hipp., ADAMS).

[14] *Vid.* commentary on the above aphorism (ADAMS).

[15] HIPPOCRATES, *Opera Omnia*, &c., ed. Anutio Foesio, *De Morbis*, lib. iii. p. 496, "Quod si propter crassitudinem humor non fluctuet, neque strepitus edatur in pectore, crebrum autem spiritum trahat, pedes intumescant, et tussicula quaedam

vexat, ne decipearis videro, sed scito thoracem pure plenum esse. Linteo itaque tenui in rubrica liquida admodum trite et tepida intincto, thoracem in orbem, obtegito, quaque parte primum resiccatum fuerit, ea sectionem aut ustionem facere oportet, ut quam proxime ad septum transversum accedas, ea tamen adhibita cautione ne ipsum attingas."

[16] *Ibid.*, *De Morbis*, lib. ii. p. 476. . . . latus quod intumuerit a magis doluerit, quam infima parte sub ipsum tumorem potius quam anteriore parte secato, quo facilior puri exitus pateat. Primum autem inter costas cutem specillo lato excisorio secato, deinde specillo acuto panniculo deligato, cuius extremam partem unguis pollicis magnitudine relictam intro adigito. Postea ubi quantum puris videbitur emiseris vulnus penicillo ex lino crudo cui filum alligaris obducito, quotidie pus semel emittito . . . At ubi pus tenue velut aqua, aut ad digiti contactum glutinosum et paucum fuerit, stanneum penicillum cavum indito, &c., &c. See also *De intern. affectionbus*, sect. v. p. 536.

[17] *Ibid.*, *De intern. affectionbus*, sect. v. p. 544. Quod cum intellexeris, tertiam ab ultima costam ad os usque secato deinde terebra acuta ulterius perforato, cumque perforata fuerit, paucam aquam educito. Qua educta penicillium ex lino crudo in vulnus immittito et mollem spongiam super apponito deinde ne penicillus decidat deligato per duodecem autem dies, semel die aqua educenda, post duodecim vero die decimotertio die tota aqua educenda et de cæteris, &c. &c.

[18] A. Cornelius Celsus.—Translation of the eight books on Medicine, by G. F. Collier, M.D., 2nd ed., lib. viii. cap. ix. p. 344.

[19] Galen.—*Methodi Medendi*, lib. v. cap. viii.

[20] Paulus Ægineta.—Dr Adam's Translation, Syd. Soc., 1844–48, lib. vi. cap. 44.

[21] *Vid.* also La Grande Chyrurgie de Maistre Guy de Chauliac, Montpelliere; Translation and remarks by Maistre Simon Mingelvusaulx, 1672 (De Chauliac = about 1589), p. 218, "Pourtant Haly Abbas au discours neufieme de la disposition Royale tient l'incision et la cauterisation faite avec le fer pour suspectes et douteuses parce dit il qu'on ne guarentie pas le malade de la mort, ou que pour le moins il se fait une fistule qui ne guerit jamais; c'est pourquoy avant faire cette operation il faut se precautionner contre toute forte de reproches par le moyen des prognostics et cet auteur rapporte une autre maniere de cauteriser la partie; il l'execute avec la racine d'aristoloche longue brulante, et avec l'huile bouillante," &c. &c.

[22] *Vid.* Paulus Ægineta—(Adams' Translation).

[23] *Vid.* Guy de Chauliac.—Remarks by the translator, p. 222, "par cette application du cautere on oste à la partie le sentiment, car elle demeure bruslée et l'escarre venant a tomber, et lóverture est plus long temps a se fermer, et on n'est pas obliger de la dilater par les tentes ce qui est tres doloreux," &c. &c.

[24] *e.g.*, Guy de Chauliac.—"Dans les playes penetrantes du thorax, si on connoit par les signes desia proposez qu'il y ait quelques matière epanchée dans sa capacité qu'on la vuide sans aucun retardement, et conformement au conseil de Guilleaume de Salicet qu'on ait soin de dilater la playe afin que le sang ou le pus, ou les serositez puissent sortir a l'aise et comme a plain canal. . . . . Si le blessé n'a peu souffrir l'injectio n'y que l'evacuation de la matière ne se soit pas bien faite et que cependant il sente une grande pesanteur au coste, qu'il y ait enfleure ou eminence, ou qu'on ait des signes qui fassent juger qu'il y'a des matière assemblée sur la reduplicature du diaphragm, s'il est vigoreuse et vou'aut permettre qu'on execute ce qu'on doit tanter dans les pareilles occasions Guilleaume conseille de faire avec un bistory une nouvelle overture dans la partie inferieure et penchante du coste malade tirant vers l'espine," &c. &c.

[25] Guy de Chauliac.—*Remarks by Simon Mingelvusaulx*, "ordinairement on la fait dans la partie posterieure et laterale a quatre ou cinq travers de doigts de l'espine à cause des corps nerveuse qui en sortent," p. 221.

[26] Ambrose Paré.—*Introduction to Surgery*, 1579, page 234, "wherefore the chirurgeon must then be called, who beginning to reckon from below upwards, may make a vent between the third and fourth true and legitimate ribs; and that must be done with an actual or potentiall cautery, or with a sharpe knife drawn upwards, towards the back, but not downwards, lest the vessels should be violated which are disseminated under the rib. . . . . But if the patient shall have a large body and ribs, you may divide and perforate the ribs themselves with a trepan; howsoever the operation be made, the pus or matter must be evacuated by little and little at several times," &c. &c.

[27] Hieronymi Fabricii ab Aquapendente.—*Opera Chirurgica*, 1647, "Exactissime autem locum invenies, si filo metieus spatium unam fili partem a medio pectore ad costam sextam et sesquialteram, hoc est unam cum dimidia ab illo sextae costae termino ad spinam dimetiaris. In summa, quo pertingit tertia pers fili totius sextae costae longitudinis."

[28] *Ibid.*, "Quae noxa omnino denitabitur si in statu expirationis aeger consistat dum fit incisio."

[29] Gregorius Horstus.—*Operum Medicorum*, Tom. iii. questio v. *Ibid.*, Questio x. fol. 61. An lateris incisio in empyemate tentanda. "Cum autem hic modus evacuationis sat periculosus, ideo quæritur, num forte convenientior dari possit? Hic sectio pectoris sese offert, quam forte fortuna inventum esse putant à milite quodam empyematico qui de saluti restitutionis desperans, ferè tabe consumptus, ad bellum accessisse dicitur, ubi ab hoste punctim læsus in thorace, puri exitum, molitus et ab empyemata liberatus fuit."

The above evidently refers to the case of Jason Pheræus, surnamed Prometheus, who is stated to have lived about 390 B.C., and who was supposed to have had an incurable empyema. He is stated to have enlisted in a combat, really seeking his death, but his side being punctured by the weapon of his enemy, the matter escaped, and he ultimately recovered. The following translation from Plutarch, "Of Benefit from Enemies," from Henry Vaughan's Works (Grosart), refers to the same history: "For as that enemie of Prometheus, by running at him with his sword to have killed him, broke only the imposthume in his body, and so cured him; in like manner an evill word spoken sometimes out of anger or enmitie, may cure some ulcer in our manners, which either wee knew not of before or else neglected," &c. &c.

[30] Guilhelmi Fabricii Hildani.—*Opera*, 1682. Observatio xxxvi., de Vulnere Pectoris, cum pulmonis læsione Gregorius Horstus, &c. "Sed Mirabitur fortasis aliquis cur statim brevissime hoc tempore spe consolidationis faciam ægro cur tamen non pauci sint in ea opinione, vulnera thoracis diutissime aperta esse debere: nimirum quaemaximam partis copiam præ reliquas quotidie fundunt. Hinc igitur secunda dubitatis sequitur, an hæc vulnera diutius aperta esse debuerint? Negativè respondeo, quia non necessarium esse videtur, diutius vulnera pectoris à consolidatione defendere, quando nihil, purulentæ materiæ, vel thromborum sanguinis in cavitate pectoris continetur, quod pluribus demonstramus in cent. prob. therap. dec. 5 quest. 5. Contrarium vero merito concedimus tunc temporis, ubi materia purulenta in ipsa cavitate thoracis etiam colligitur; In quo casu non tantum apertaretinenda sunt vulnera, sed simul etiam per injectiones digestivis," &c. &c.

[31] Marchettis.—*Observationum Medico Chirurgicorum rariorum sylloge, &c. Vid.* Observatio xlv., entitled "Ex vulnere in thoracis cavum penetrante inferius, perperam viginti dies obligato febris, totius corporis macies, cum delirio suborta, a suppresso pure, quo expurgato, omnina remissa, sanato ægris," &c. See also Haller, *Biblioth. Chirurg.*, vol. i. § cclxxi., "Movet ne vulnera pectoris præpropere claudantur."

[32] An account of the Diseases, Natural History, and Medicines of the East Indies, translated from the Latin of James Bontius, Physician to the Dutch Settlement at Batavia (1629 = date of dedication of book), "And yet there is no other passage for the discharge of the matter than the trachea arteria, whatever people may affirm of its being frequently carried through the left ventricle of the heart into the liver and meseraic veins and thence discharged critically in the course of the circulation either by purulent stools or urine. . . . I never was so fortunate as once to see such an excretion. But the method of cure I am now to propose, though no question somewhat ticklish and precarious, will certainly be acknowledged by every judicious person to be the most excellent and effective resource."

[33] Haller's *Biblioth. Chirurg.*, vol. i. § ccliv. Thomas Bartholinus—In libello de pulmonibus suadet, in paracentesi digitis cultrum sequi, ne in pectus aër irruat.

[34] Scultetus, *Armamentarium Chirurgicum*, 1669, Tabululæ xxxvii. declaratio, ". . . . deinde cannula argentea ut liquor mane vel vespere infusus, emitti possit. quod enim mane in thoracem infunditur, ad vesperam evacuetur, quod vero vesperi, mane," &c.

[35] Hey, *Practical Observations in Surgery*, 1803.

[36] Drouin *vid.* Sprengel.—*Hist. de la Medicine*, Tom. ix. p. 29, quoted from *Journal des Savants*, 1694. Also see Trousseau's *Clin. Lect.*, Syd. Soc., vol. iii. p. 207.

[37] A. Nück.—*Operationes et Experimenta Chirurgica* (*Lugduni Batavorum apud Cornelium Boutesteyn*, 1692, p. 113), Expt. xxxi., "In Hydrope Pectoris si fluidior fuerit aqua, simpliciter acu minori perforatio instituenda. Si vero minus fluida, major acus in usum vocanda, uti infra in abdominis paracentesi explicaturi sumus. Nulla siquidem obesse videtur ratio cur non æquè hoc in loco, quam in abdomine talis perforatio locum habere posset."

[38] *Cours d'Operations de Chirurgie* par M. Dionis, 4th ed. Revue, &c. par G. de la Faye, 1740, pp. 438–9.

[39] Dominique Anel.—L'art de succer les plaies sans se servir de la bouche d'un homme, 1707. Page 24: "L'on peut a la faveur de cette sonde qu'il faut introduire dans la plaie en suivant son trajet, succer non seulement le sang repandu dans le trajet, mais encore la matière et le sang repandu sur le diafragme, pourveu que l'un et l'autre soient encore liquides, et par là on epargnera par consequent au malade les violantes douleurs qu'il a à souffrir, et les dangers qu'il a à risquer, quand il est exposé pour toute ressource à souffrir l'operation de l'Empiéme," &c. &c. Page 30: "Quand on est convaincu de l'Empiéme dans les plaies de poitrine par des signes univoques, il faut en prevenir l'operation du même nom, en pratiquant la method de le succer avec la sonde de poitrine dont j'ai parlé ci devant."

[40] G. M. de la Motte.—*Traité complet de Chirurgie*, 1722. "Au mois de Mars, 1696, je fus prie le soir d'aller chez un Rotiffeur de cette ville pour voir un soldat du Regiment de Benge, qui étoit blessé d'un coup d'epee en la partie anterieure de la poitrine entre la cinq et la sexieme des vraies côtes inferieures assez pres de leur union avec le sternum, qui penetroit un dedans de la capacité, et lui causoit un oppression si violente, qu'il étoit près d'expirer. Le vicaire étoit auprès de lui, qui refusoit de lui donner les sacremens à cause qu'il s'étoit fait panser du secret qui selon ces messieurs les Docteurs n'opere que par art magique, auquel il faut renoncer comme à Satan et à ses pompes, autrement point de salut."

[41] *Vid.* Sprengel.—*Hist. de la Med.*, Tom. ix. p. 38.

[42] L. Heister—*General System of Surgery*, Translation, 3rd ed., 1748. Cap. X. Of Wounds of the Thorax. "Each dressing should be performed with all possible expedition. At the time of dressing, a chafing dish of hot coals should be held near the wound, to warm and thin the air; and if too great a quantity of air is already got into the cavity of the thorax, it must be drawn out with a syphon. This being rightly performed, the wound is to be dressed up with the greatest expedition." See also Dela Motte—*Traite complet de chirurg.*, Tom. ii. page 291—A. D. 1722.

[43] De la Motte.—*Ibid.*, page 297. "Je ne me servis pas d'injections, si recommandées des anciens dans les plaves de poitrine, ne voïant pas que leur usage me pût être d'aucun secours," &c. &c.

[44] *Vid.* Sprengel, *Hist. de la Medicine*, Tom. ix. p. 31.

[45] S. Sharp, *Treatise on the Operations of Surgery*, 8th ed., Lond., 1761.

[46] Gerardi Van Swieten.—*Commentaria in Hermanni Boerhaave aphorismos de cognoscendis et curandis morbis*, 1752, Tom. Primus, "Si jam pulsus sit satis fortis et aequabilis; calor ad extrema corporis usque adsit, nullus singultus, nulli spasmi appareant, et virium simul adsit constantia, novimus cessare internam hœmorrhagiam, et tuto tentari posse illa arrentis molimina, quæ requiruntur ad eductionem sanguinis in cavis thoracis haerentis," et seq.

[47] *Vid.* Sprengel, *Hist. de la Medicine*, Tom. ix. p. 59.

[48] For references *re* Gerard's and Goulard's methods, see *Cours d'operations de chirurgie*, par M. Dionis, 4th ed., Revue par G. de la Faye, 1740, footnote, p. 425; also *Memoires de l'Academie Royal des Sciences*, 1740, De l'aigulle à manche pour la ligature de l'artere intercostal par M. Goulard.

[49] *Memoires de l'Academie Royal de Chirurgie*, Tom. ii., 1819, gives a full description of the instrument of Lotteri of Turin in the "*Histoire*," p. lxiv.

[50] For particulars of the history of instruments and means for arresting intercostal hæmorrhage see "Description d'une machine pour arrêter le sang de l'artère intercostale par M. Belloq" in *Mém. de l'Acad. Royal de Chirurg.*; picture of Belloq's instrument, p. 88. This article contains a description of Quesnay's method at p. 89.

[51] SPRENGEL.—*Hist. de la Med.*, Tom. ix. p. 40.

[52] *Ibid.*, p. 58.

[53] *Traité des Maladies Chirurgicales et des Operations qui leur conviennent par Chopart et Desault.—Des maladies de la poitrine*, p. 71, "La ponction alors conseillée est dangereuse et souvent insuffisante, l'operation de l'Empyème toujours préférable."

[54] Quoted from *Journal de Médecine*, vol. xlvii., 1777, by Sprengel. *Hist. de la Med.*, Tom. ix. p. 65.

[55] G. VAN SWIETEN.—*Comment. in Boerhaave, Aph.*, vol. 1, § 304: Thoracis Vulnera, "Delecti vulneris labia digitis adducuntur, ut nullus aër ingredi possit. Deinde æger lenta et profunda inspiratione magnam copiam aëris hauriat, illumque retineat in pulmone, quamdiu hoc commode facere poterit, aër ille sic retentus calore rarefactus expandet pulmonem et comprimetur aër inter pleuram et pulmonem haereus. Si tunc antequam exspiret æger, deducantur vulneris labia, pars magna aëris, contenti in cavo thoracis, expremetur. Statim iterum claudenda vulneris labia, et bene exspiret æger, non prius. Dum hoc repetitur aliquoties, omnis omnino aër en pectoris cavo expelletur, et sentiet vulneratus statim, se longe commodius respirare. Omni aëre sic expulso, subito vulneri applicatur tenax emplastrum illo tempore, dum æger inspiratum aërem in pulmone retinet, tunc enim pulmo distentus, pleuræ contiguus, obturabit viam aëre per vulnus ingressuro," &c. &c.

[56] *Memoir de l'Academie de Chirurg.*, 1819, Tom. ii. p. 386.—Morand sur une hydropisie de poitrine guerie par operation. "Je conclus de cette remarque qu'il est necessaire de ne point evacuer a la fois toute l'eau epanchée, et qu'il seroit peutétre plus prudent de ne faire l'overture de la poitrine en forme, qu'apres une ou deux ponctions, pour permettre au poumon un expansion douce et graduée."

[57] *Inquiry into the Present State of Surgery*, 2nd ed., Lond., 1750.

[58] *Cases in Surgery*, 2nd ed., Lond., 1754.

[59] The *Operations in Surgery* of *Mons. Le Dran*, translated by Thomas Gataker, Surgeon, Lond., 1749, p. 310.

[60] Vid. *Cooper's Surgical Dictionary*, 1825, p. 434.

[61] Another observation of this author is worthy of mention.—Recognising that in cases of empyema the thoracic organs are in a debilitated condition, he considered that the entrance of air after operation was likely to be rather beneficial than otherwise, and that, on account of its tonic effect, it would stimulate the absorbent power of the pleura, and hasten the production of these organic adhesions between the visceral and parietal surfaces, by means of which nature, in fortunate cases, obliterated the empyemal cavity. This recommendation was not favourably received or commented upon by subsequent authorities, who, although admitting the impossibility of absolutely preventing the entrance of air, were of opinion that it was very irritating, that its access should be as limited as possible, and that what did find its way into the chest cavity should be modified as regards temperature and humidity. Audouard named this ingress and egress of air—which took place during the early days after operation—on account of its resembling a respiration, "respiration illegitime."—AUDOUARD, *De L'Empyeme*, Paris, 1808, *vid.* Trousseau, Syd. Soc., vol. iii. p. 207.

[62] *Memoires de chirurgie Militaire et Campagnes*, Tom. iii., 1812, p. 447 *et seq.*

[63] *Cyclopædia of Practical Medicine*, article "Empyema."

[64] *Cooper's Surgical Dict.*, 1825.

[65] *Dictionnaire des Sciences Medicales*, Paris, 1815, Tom. xii. p. 58.

[66] *Ibid.*, p, 58, quoted from "Memoire sur une operation d'Empyème de pus," par M. Fréteau, *Journal général de Méd.*, Tom. xlvii.

[67] *Clin. Lect.* (Syd. Soc.), vol. iii. p. 192. Townsend described intercostal fluctuation as a sign of Empyema (1833). See also HEY, 1803.

[68] *Mémoire sur la pression abdominale comparée avec la percussion thoracique*, M. Roux, ouvres de Desault, Tom. ii., Paris, 1813.

[69] "De la percussion mediate et des signes obtenus a l'aide de ce nouveau moyen d'exploration dans les maladies des organes thoraciques et abdominaux," 1828.

[70] *A treatise on the Diseases of the Chest and on Mediate Auscultation*, by R. T. H. Leannec. Trans. by John Forbes, 1829 (1816–18=date written).

[71] Pleuritic friction was not observed by Leannec. It was described by Reynaud, 1829.

[72] SPRENGEL.—*Hist. de la Med.*, Tom. ix. p. 21.

[73] See ANDRAL, *Clinique Medicale*, p. 604, footnote, for description in Reynaud's own words.

[74] *Diseases of the Chest* (Syd. Soc., 1882), footnote, p. 506.

[75] *Cyclopædia of Practical Med.*, article "Empyema."

[76] REYBERD and SCHUH—*Vid.* Trousseau, *Clin. Med.* (Syd. Soc.), vol. iii. p. 215, footnote.

[77] *Ibid.*, p. 269.

[78] *Path. and Diag. of Diseases of the Chest*, 4th ed., 1840.

[79] *Clin. Lect.* (Syd. Soc.), vol. iii. p. 234.

[80] Protheroe Smith claims to have invented the aspirator in 1866. Dieulafoy's instrument was first made in 1869.