

SUGGESTIONS FOR THE TREATMENT OF SPECIAL CASES OF EMPYEMA BY THORACENTESIS AND THE SIMULTANEOUS INJECTION OF PURIFIED AIR.

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On September 7th, 1877, a little girl, S. A. Y., aged three and three-quarter years, was admitted into the East London Hospital for Children, under the care of my colleague, Dr. H. Donkin, with obvious signs of a large pleuritic effusion in the left chest, following an attack of scarlatinal nephritis; the heart was beating to the right of the right nipple. She was aspirated with a Potain's aspirator, but only three and a half ounces of pus (which was quite sweet) could be withdrawn. The needle was introduced a little below the angle of the scapula. There was but little alteration in the physical signs. During the next few days she lay on her left side, and had much distress in her breathing. A tracing taken with the cyrtometer at this time showed an increase in the size of the chest, and in its shape also, which approached to that of a circle. I

again attempted aspiration on September 13th, and failed to get out more than a few drops of pus, although the aspirator-needle measured quite one-eighth of an inch in size, and was pervious and clear. The chest was punctured in two or three places, but without success. After a consultation with Dr. Donkin, it was decided to incise the chest-wall, back and front, and to pass completely through the cavity a suitable drainage-tube. This was accomplished under chloroform, and with full Listerian precautions. As soon as the chest was incised, the pus gushed out. Between forty and fifty ounces were evacuated; it was quite sweet and uniform in appearance. In order to satisfy myself that it was thin enough to pass through the cannula which had been used, I drew up from the waterproof draw-sheet, in which the pus had collected, several ounces into the aspirator without making any alteration in the apparatus whatever.

After the abscess-cavity had emptied itself completely, the gauze dressings were applied. On the following day (September 14th) the dressings were removed; they were soaked through, so great had been the discharge. For nearly three weeks this discharge continued to be very copious, but remained free from smell. On October 9th, however, the antiseptic dressings were discontinued, as the pus began to smell. This was the first occasion on which any unpleasant odour had been observed, although the temperature for some days past had been rising and variable; it was now 101° Fahr. Under these circumstances, the empyema-cavity was washed out, first with warm water and then with a warm solution of quinine (5 grains to the fluid ounce). On October 21st, the quinine washings were discontinued, for the discharge had diminished considerably in quantity, and all unpleasant smell had passed away. The empyema-cavity was slowly contracting. The anterior opening was therefore allowed to close. On October 24th there was an exacerbation of symptoms, and on the 29th, fearing that a reaccumulation of pus might be taking place, the posterior opening, which was also becoming smaller, was dilated, and a larger drainage-tube put in. This was followed by an escape of pus, after which a steady improvement set in.

On December 2nd, there was another exacerbation of symptoms, but nothing could be discovered to account for it. Three or four days later, small-pox, which was epidemic in East London at that period, developed itself, and the child was sent to the Small-pox Hospital. The disease ran a mild course, and did not exercise any unfavourable influence on the empyema, nor, on the other hand, did it seem to be influenced by it. She was examined by Dr. Donkin in February of the following year, and found to be well in every respect. The chest had recovered itself, and scarcely showed any traces of the empyema.

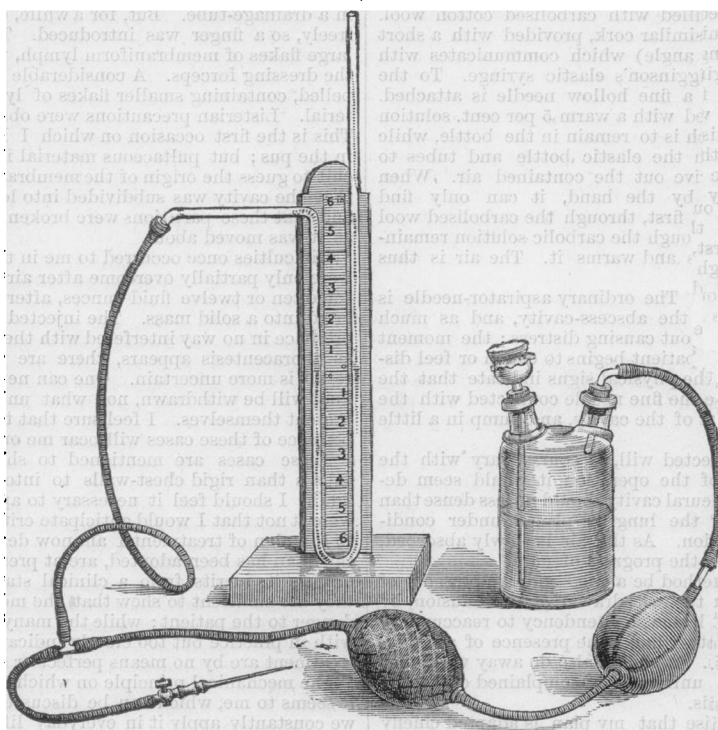
In the case I have just related, it is of course obvious that, for some reason or other, the walls of this empyema-cavity could not collapse, and thus there was no expulsive force to drive out the fluid when the aspirator was employed. For, as is well known, it is not by a *vis a fronte*, which attracts or draws out the fluid, that an empyema-cavity is emptied, but by a *vis a tergo*, which drives the fluid in front of it.

This force is the pressure of the atmosphere, acting either on the condensed lung and causing it to re-expand, or on the diaphragm, causing it to ascend, or on the thoracic wall, causing it to fall in. One of these events taking place, the fluid is displaced; but it is probably by a combination of all three, rather than by any one alone, that we are enabled to "tap" an empyema. To judge from recorded cases, the extreme condition just described is very unusual; nevertheless, as the result of frequent observation, I am inclined to believe that a little of the difficulty constantly exists; it being, for obvious reasons, less frequent in children than in adults. It will also be within the experience of many surgeons that occasionally the aspirator-needle seems to move about freely, as if in a cavity after the withdrawal of the fluid, although, theoretically, no such cavity ought to exist. Under these circumstances, we are driven to surmise that only a very partial falling-in of the walls of the abscess-cavity has occurred, and that but a very partial emptying of its contents has, therefore, been obtained.

The case related at the commencement of this paper is unquestionably an extreme one. I only find one other quite parallel with it. This is recorded by Dr. Bouchut of Paris in the *Gazette des Hôpitaux*, May 15th, 1877, No. 55, under the title, "*Pleurésie Purulente: Adhërence du Poumon sur le*"

Rachis: Impossibilité de retirer le Pus par un Appareil Aspirateur." The physical signs indicated a large effusion. It was aspirated, but only 130 grammes (about 4 ounces) of fluid were withdrawn; then the flow ceased, although the tube was quite patent. In some remarks on the case, Dr. Bouchut said, "these cases are almost incurable; it would be necessary to inflate the lung through a Chaussier's tube, in order to get out the fluid. I was about to do so, when the child got diphtheria, of which it died."

I apprehend that all surgeons will have observed cases in which some difficulty has been experienced in evacuating from the chest as much fluid as the physical signs had led them to expect was present. *Post mortem* examination also occasionally reveals the presence of a considerable amount of fluid, in cases where death has occurred within too short a period of the last performance of thoracentesis to warrant the supposition that it had all been secreted since the operation; the only alternative is that the abscess-cavity had not been emptied at the time of the operation. Impressed with these considerations, it has for some time appeared to me that our recognised methods of thor-



acentesis—short of free incision—are, mechanically speaking, imperfect.

It is impossible to actually reproduce the conditions which obtain in empyema; but for the purposes of this paper the following simple scheme may be used. It illustrates, I venture to think, the first case recorded. Fill a glass bottle close up to the neck with fluid, put in a well-fitting cork, then attempt to aspirate the fluid in the usual way. It will be seen that the fluid cannot be withdrawn. Next fill this bottle to within an inch of the top, cork as before, and repeat the experiment. This time a small quantity of fluid can be withdrawn. This occurs because the air is more dense in the bottle with the fluid than that in the aspirator-bottle, in which a partial vacuum has been made. When the density of the air becomes equalised in the two, the fluid ceases to flow.

The suggestion I have to make is that air should be injected into the pleural cavity in sufficient quantity to expel all the fluid. To obviate the danger of septic germs, I would propose that the air, previously to its introduction, should be filtered, warmed, and carbolised.

The accompanying figure (p. 1167) represents the apparatus I have devised. It consists of a Wolff's bottle with two necks; into one of these necks is fitted a perforated India-rubber cork, provided with a long-stemmed glass funnel, tightly filled with carbolised cotton wool. The other neck is fitted with a similar cork, provided with a short glass tube (bent to a convenient angle) which communicates with the proximal extremity of a Higginson's elastic syringe. To the distal extremity of this syringe a fine hollow needle is attached. Just before use, the bottle is filled with a warm 5 per cent. solution of carbolic acid, one half of which is to remain in the bottle, while the other half is passed through the elastic bottle and tubes to thoroughly purify them, and drive out the contained air. When the elastic bottle is worked by the hand, it can only find itself with air, which has passed, first, through the carbolised wool in the glass funnel, and, next, through the carbolic solution remaining in the bottle, which moistens and warms it. The air is thus rendered perfectly pure.

Its mode of use is as follows. The ordinary aspirator-needle is introduced into the *lower* part of the abscess-cavity, and as much fluid is withdrawn as can be, without causing distress; the moment that the outflow ceases, or if the patient begins to cough or feel distressed, then—provided always the physical signs indicate that the cavity is not emptied—introduce the fine needle connected with the Wolff's bottle into the *upper* part of the cavity, and pump in a little air.

The amount of air to be injected will, of course, vary with the case; but, at the completion of the operation, it would seem desirable that the air within the pleural cavity should be less dense than the external air; in this way the lung is placed under conditions favourable to its re-expansion. As the air is slowly absorbed, these conditions continue during the progress of cure.

Moreover, if the suggested method be a good one, the presence of air in the pleural cavity after the withdrawal of the effusion, by supporting the vessels, ought to lessen the tendency to reaccumulation of the fluid, which, on the other hand, the presence of a diminished pressure decidedly favours. It should also do away with that dragging sensation which is not unfrequently complained of at the close of an ordinary thoracentesis.

I wish especially to emphasise that my plan is adapted chiefly for those cases in which the difficulty of removing the fluid depends on rigidity of the walls of the empyema-cavity. This, of course, is most likely to occur in adults with long standing disease. Finally, the condition may obtain in children. I consider the case quoted at the commencement of the paper as a typical one of the kind. Here a cure was ultimately obtained by a double opening; but I would suggest, when simple aspiration does not suffice, that this proposed method be tried before free incision, which is a somewhat severe measure, is adopted. I have to thank Dr. Symes Thompson for allowing me to try this plan on one of his patients in the Brompton Hospital. The case was fully reported in the *Medical Times and Gazette*, May 22nd, 1880. The chief points are as follow. A single woman, aged 23 years, inheriting phthisis, was admitted in February under Dr. S. Thompson's care. Her chest was expanded and motionless on the left side, and in its semi-diameter one inch larger than the right. The heart's impulse was distinct in the third and fourth spaces on the right of the sternum. On February 24th, she was aspirated, and sixty-six ounces of sero-purulent fluid were removed. The fluid, however, gradually reaccumulated. On April 16th, she was again aspirated, according to the preceding plan. The chest was emptied; there was no cough or

irritation. When she left the hospital a month later, there was some dullness at the extreme base, and it was feared that reaccumulation would take place. This, however, did not occur to any appreciable extent. The patient quite recovered.

The amount of injected air can, of course, be measured, and its pressure gauged by a manometer, as shown in the drawing; but such additions to an instrument of this kind would complicate it without adding much to its practical utility.

I do not in the least imagine that this method will simplify all cases of difficult thoracentesis. To illustrate this, I may refer very briefly to a case, in which the difficulty of withdrawing the pus did not depend on rigid chest-walls. A child, aged 1 year and 8 months, was admitted under the care of my friend and colleague Dr. Eustace Smith, with the physical signs of a large left effusion; an exploratory puncture revealed the presence of pus. On attempting to aspirate, not more than half an ounce of pus could be obtained; the needle, however, seemed to move freely in what appeared to be a large cavity. On the following day another attempt was made; and again failing, I injected some purified air; but this did not materially help. Three-and-a-half ounces of pus were withdrawn after considerable difficulty, and several renewed attempts. Not feeling satisfied with the result, I decided to incise the chest-wall and put in a drainage-tube. But, for a while, even now, the pus did not flow freely, so a finger was introduced. This detected the presence of large flakes of membraniform lymph, which had to be removed with the dressing forceps. A considerable quantity of pus was then expelled, containing smaller flakes of lymph, besides pultaceous material. Listerian precautions were observed, and the case did well. This is the first occasion on which I have found actual membrane in the pus; but pultaceous material is not uncommon. It is difficult to guess the origin of the membrane; but it would seem possible that the cavity was subdivided into loculi by well organised lymph, and that these partitions were broken down by the aspirator-needle, as it was moved about.

Difficulties once occurred to me in tapping a serous effusion; they were only partially overcome after air had been injected. The fluid, some ten or twelve fluid ounces, after its withdrawal quickly coagulated into a solid mass. The injected air was rapidly absorbed; its presence in no way interfered with the progress of the case. Simple as thoracentesis appears, there are few operations in which the result is more uncertain. One can never predicate what amount of fluid will be withdrawn, nor what unexpected difficulties may not present themselves. I feel sure that those who have had a large experience of these cases will bear me out in this statement.

These cases are mentioned to show that there may be other causes than rigid chest-walls to interfere with the withdrawal of fluid. I should feel it necessary to apologise for mentioning them, were it not that I would anticipate criticisms and possible objections to the plan of treatment I am now describing. The cases in which this plan has been adopted, are at present too few to allow one to discuss its merits from a clinical standpoint; on the other hand, they are sufficient to shew that the method is not fraught with any danger to the patient; while the many almost intractable cases met with in practice but too clearly indicate that our present methods of treatment are by no means perfect or sufficient.

The mechanical principle on which the suggestion is based, is one, it seems to me, which can be discussed irrespectively of cases; for we constantly apply it in everyday life in transferring fluids from one vessel to another.

SOME CASES OF LAMENESS FROM ABNORMAL CONDITIONS OF THE FEET, CHIEFLY FROM CONTRACTIONS OF THE MUSCLES AND FASCIAE.

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(Continued from page 1112.)

CASE V.—Miss H., aged 19, was brought to me through the recommendation of Mr. Malcolm Morris. She had suffered for many years from pain in the feet and difficulty of walking; symptoms which were gradually increasing. There was a contracted band of the plantar fascia of the left foot, as well as some contraction of the gastrocnemius. Here there was a constitutional tendency to contraction. Several members of the family had contracted fingers, and the