I.

A CASE OF PURULENT PERICARDITIS TREATED BY
PARACENTESIS AND BY FREE INCISION,
WITH RECOVERY.

II.

THE STATISTICS OF PARACENTESIS PERICARDII
(WITH REMARKS).

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I. A CASE OF PURULENT PERICARDITIS TREATED BY PARACENTESIS AND BY FREE INCISION WITH RECOVERY.

ALFRED N—, æt. 16, a van boy on the railway, was admitted into the Hospital for Diseases of the Chest, Victoria Park, on September 7th, 1882, when the following history was obtained. Two months previously to his illness he had been struck in the back by a passing truck and knocked down. He felt a little pain in the right side for a week afterwards, though he did not trace any connection between the accident and his present illness. He had been in apparently robust health, and in active work until August 16th, when he was attacked with shivering and with pain in the left side and front of the chest, and his breath became so short that he was obliged to take to his bed. The pain was relieved by strapping the side firmly, and in a few days he was able to get up. On September 4th, three

weeks later, he went out for a short walk, but became suddenly very faint and almost fell down. Severe pain seized him "in the pit of the stomach," and his breath became shorter than ever. The symptoms gradually increased until September 7th, when he came to the hospital with great dyspnœa, deeply cyanised and almost pulseless, and was admitted at once.

On the night of admission he was frequently sick, was much distressed by dyspnœa, and hardly slept at all.

On the next day (September 8th) his condition was as follows: The patient was a well-nourished, strong-looking lad. He lay upon his back. He was deeply cyanosed. The respirations were 28 and laboured. The pulse was 78 at the wrist, markedly paradox, *i.e.* intermitting with each inspiration, and losing thus two or three beats with each intermission. The heart was beating regularly at about 120 a minute. The præcordial region was bulging and slightly œdematous, and the epigastrium looked full. The apex beat was not visible, nor could it be felt. There was an indistinct heaving felt over the whole præcordium, and impulses could be faintly felt in the third, fourth, and fifth spaces midway between

the left nipple and the sternum. Dulness extended in the fifth intercostal space from close to the right nipple line to nearly three

inches outside the left nipple line. The area of dulness was somewhat conical in shape and reached upwards to the middle of the second intercostal space near the sternum. (See diagram.)

The cardiac sounds were almost entirely inaudible except just where impulse was faintly felt. All round the limits of this area of dulness fine crackling crepitation (pleuritic) was heard, which extended also into the left axilla, but the lungs elsewhere were not affected and the bases behind were perfectly natural.

The liver dulness, which commenced at the sixth rib in the right nipple line, was increased for nearly an inch downwards and was distinctly felt below its normal position in the epigastrium. There was slight œdema of the feet, and also of the front part of the chest, chiefly over the area of dulness. The urine was acid, of 1030 specific gravity, and contained no albumen. There was no swelling of any joint.

The diagnosis was made of acute pericardial effusion, probably, it was thought, of rheumatic origin, for it transpired that the patient had suffered from flying joint pains a few days previously. The patient was ordered to have twelve leeches to the præcordium, and the bleeding to be encouraged with poultices.

The subsequent daily notes are as follows :

September 9th.—The leeches took well, and the bites bled freely during the night. The patient was sick during the night, and took but little food. He had some snatches of sleep. This morning he complains of no pain, but of great weakness, and of a nasty taste in the mouth. The patient is less cyanosed. The respirations are 32. the pulse 72, paradox, and feebler than yesterday. The area of præcordial dulness is slightly less than it was yesterday, and the heart sounds appear louder and audible over a wider area than they were. There is no trace of friction sound.

10th.—Patient slept fairly, and the sickness has stopped after some effervescing mixture with strychnia. He seems easier and has taken more food. Resp. 32, pulse 80, of the same characters as yesterday.

11th.—Patient slept fairly. Feet a little more swollen. Area of dulness not further diminished, but the heart sounds are louder. Crepitation as before round edges of dulness. Pulse fuller, still intermitting, but feeble beats occasionally felt during intermission, at the wrist 78. The heart beating regularly 104 (showing a loss of 26 at the wrist). Resp. 40.

12th.—Slept fairly. Is more cyanosed to-day. The dulness is again a little increased, and the heart sounds are feebler. Pulse 80 (paradox), resp. 28.

13th.—Patient slept badly, and had a cold sweat last night. He is more cyanosed. Pulse at wrist 60, paradox, and feebler. Heart beats 104 and regular. Resp. 32. The area of dulness has increased since yesterday; the whole præcordium is more prominent. There is an indistinct sense of impulse outside the left nipple. In the epigastrium immediately below the sternum is a slight depression, and from the difference in resistance the liver probably is pushed down.

14th.—Slept fairly during the night, though a little disturbed by sickness. The cyanosis is greater, and there is more œdema of the feet. Pulse 64, very soft, and easily compressible, and paradox. Resp. 32. The heart beating regularly at the rate of 120. The præcordial dulness reaches to the right nipple. I had made up my mind that paracentesis pericardii was called for, but before deciding finally I invited Dr. Hensley to see the patient with me. He agreed in the diagnosis and in the advisability of tapping. A puncture was then made with a small trocar and cannula connected with a syringe lent me for the purpose by Dr. Hensley. The place chosen was the fourth intercostal space, almost immediately below the left nipple. The cannula was two inches long and was cautiously pushed in up to the hilt in a direction straight backwards. Pus was obtained in the syringe, and, as it was very viscid and ran slowly, the tube was connected with an aspirator, and in this way thirteen ounces of laudable sweet pus were removed. Three ounces of 1 per cent. carbolic acid solution at a temperature of 100° F. were injected twice into the cavity and allowed to flow out again, bringing with them about one ounce more pus, thus making the quantity removed about fourteen ounces in all. The patient was very greatly relieved, became much less cyanotic and "smiled." The lines of dulness receded after the operation about one inch in all directions, and did not reach now above the upper border of the third rib. The pulse, which before the operation was distinctly paradox as hitherto, became much less irregular, some inspirations producing no intermission. Beyond some shrinking and a little pain on the first prick of the needle, no distress was occasioned to the patient by the operation. The depression in the epigastrium, where the feeling of resistance was diminished, became less distinct, and the liver appeared to have risen somewhat higher after the operation. Microscopically the pus teemed with rod-shaped bacteria. It was simple pus and contained no shreds or flocculi. 9 p.m.—The patient has had a little pain in the seat of puncture, but was otherwise more comfortable. He says that he feels warmer. Pulse 80, less intermittent; resp. 30. Morph. Hydrochlor. gr. $\frac{1}{3}$ th by mouth.

15th.—Slept well. Patient says that he feels quite different from

yesterday; he feels hungry and has taken food well. Except a little pricking at the seat of puncture he has had no pain anywhere. Patient is still very cyanotic. Dulness is slightly diminished, pulsation is felt now in third and fourth interspaces to left of sternum, and here the heart sounds are loud over an area of about two inches. No friction or murmur. Pulse 80 at wrist, still paradox. Heart 104, regular. Urine 1008, acid, no albumen. A good deal of fine crackling crepitation (pleuritic friction) all round the area of dulness, and over it on the left side nearly as far as the sternum.

16th.—The patient slept fairly after one twelfth of a grain of morphia by mouth. The appetite is fair. Patient is rather more cyanosed than yesterday. There is no decrease of the area of dulness, but the præcordium seems less bulging. Pulse 64, intermitting every three beats, rather small and feeble. Heart sounds 112, showing a loss of 58 at the wrist, that is, of two for each inspiration, the respiration being 28. 9 p.m.—The patient is not feeling so well; he complains of a sense of pain and weight in epigastrium, and there is more dyspnoea and cyanosis. Pulse 72.

17th.—Patient slept fairly after one sixteenth of morphia, but he feels worse this morning. He still has pain in epigastrium, and has been sick a few times. The dyspnoea and cyanosis is greater. There is an increase in the area of dulness, and the heart sounds are feebler. Pulse 70, intermittent; heart 115, regular; resp. 33. 1 p.m.—Patient was found to be very blue, and much distressed, complaining of very great pain, referred to the middle of the abdomen. The cardiac dulness seemed as large as at first. The condition of the patient was one of such urgent danger that I decided to perform paracentesis again. The puncture was made in the fifth interspace, in the left nipple line, with a trocar and cannula measuring about $\frac{3}{8}$ " in diameter. A slight preliminary incision in the skin was made with the scalpel. This was followed by an attack of retching which lasted for a few minutes. A trocar was then passed easily and without much pain into an enormous cavity, the end of which could not be reached with the whole length of the cannula (about $4\frac{1}{2}$ "). The pus came away with great difficulty although the aspirator was used. Only about four ounces were obtained, and on pushing a probe down the cannula backwards and forwards, several ounces more escaped with difficulty. The pus was extremely viscid, flaky and slightly offensive. With the view of aiding the flow, about four ounces of 1 per cent. carbolic-acid solution were slowly injected. This passed in fairly easily; it caused a good deal of pain and did not assist the flow at all, for it was only after long probing that some few ounces more of pus could be

evacuated. It was then decided to make a free opening. Chloroform was carefully administered by Mr. Bateman, and as soon as slight anaesthesia was obtained, a narrow-bladed, sharp-pointed bistoury was thrust along the side of the cannula, which I used as a director, into the cavity. This was followed by a copious discharge of pus, which was ejected on expiration a distance of four or five inches from the chest walls. When the cavity had fairly emptied itself, the opening was enlarged by means of the probe-pointed bistoury and a dressing forceps, care being taken to make the internal opening into the sac free. Air entered into the cavity on inspiration, and air and pus escaped on expiration. The dulness became very much less at once, but how great the diminution was could not be clearly made out on account of the entrance of air. It is difficult to say how much pus escaped but it must have been a very large quantity, for the whole bedding was soaked; it was estimated at at least two quarts.

The patient recovered much of his colour immediately after the operation and was greatly relieved. The pulse ceased to be distinctly paradox, and became almost regular. The patient took chloroform well, and without any alarming symptoms. Mr. Bateman and Mr. Hind assisted in the operation. The cavity was freely washed out with a warm solution (1 per cent.) of carbolic acid, and a large drainage-tube $\frac{1}{2}$ " in diameter inserted for about four inches. About two ounces of 1 in 40 solution of carbolic acid were injected before dressing and left in the cavity, and the wound was covered with picked oakum and carbolised cotton wool. The patient was transferred to another bed and soon fell asleep.

At 9 p.m. the dressings and draw-sheet were quite saturated with discharge and were changed. Beyond a little pain in the left side the patient feels "all right." Pulse 108, not intermitting, slightly dicrotous. Resp. 48, chiefly abdominal. Cyanosis much less.

18th.—Patient slept fairly after one twelfth of a grain of morphia. He feels weak, but better. He has taken food well. The tongue is clean, and the temperature not raised. The cyanosis is much less. Pulse 108, much stronger, and no longer intermitting; resp. 34. 5 p.m.—Patient says he is quite comfortable. His face looks a little flushed, but the colour is red rather than blue. Respiration quiet, 34. Patient complains no longer of shortness of breath. Pulse 120, quite regular both in force and frequency, and of good volume. There has been no sickness since the operation. The præcordial area is now everywhere resonant from the air in cavity. No *bruit de moulin* or friction sound, and the heart sounds clear. The dressings are soaked with pus, which is quite sweet. The drainage-tube was removed, and a soft French catheter (No. 21) inserted; a little pain

was caused by its passage between the ribs. About eight ounces of a solution of carbolic acid (1 in 40) were injected by means of a syphon. It did not return easily through the catheter, which was then removed, and the pus and solution allowed to escape of themselves. After well washing the cavity out, as the opening seemed inclined to close too rapidly, a piece of the resistant catheter was inserted and tied in, the dressings of picked oakum and carbolised cotton wool being applied as before. While being dressed the patient had an attack of faintness, which passed off, however, on administering a little brandy. At 10 p.m. : patient had been a little light-headed during early part of evening, but had slept fairly. Resp. 40, pulse 120, regular.

19th.—Patient slept fairly after morphia (grain one twelfth). Pulse 120, slightly irregular in force, regular in time; resp. 32. Chest dressed, the tube removed, and about two ounces of very thick curdy pus, with a slightly fetid odour and of a brownish colour, came out. The catheter was replaced. Up to the present there has been no escape of anything but ordinary pus and the usual curdy flakes. 3 p.m.—Patient was put slightly under chloroform, and after removing the tube I inserted the little finger of my right hand into the opening; the finger passed in for its whole length. The line of the incision had become, from the contraction of the walls of the cavity, almost horizontal, running towards the sternum. The tip of the finger only just reached the cavity, and the heart was then felt beating upon it. The cavity was freely syringed out with carbolic-acid solution, which brought away a few ounces of pus containing some curdy flakes. A flexible india-rubber drainage-tube, $\frac{3}{4}$ " in diameter, was inserted. At 9 p.m. patient had pain in bowels, probably from constipation. Pulse 112, regular; resp. 24.

20th.—Patient has slept well; the appetite is better; the pain in abdomen was relieved by an action of the bowels after an enema. Pulse 108, regular; resp. 32. The chest was dressed. A fair amount of discharge had come out during night. No discharge escaped on removing tube except a little blood, chiefly from the granulations round the incision. The tube was replaced and some carbolic acid (one in forty) left in cavity. At 9 p.m. patient seems weaker, much prostrated, and had been sick once. Pulse 120, regular; resp. 28.

21st.—Fair night after morphia (one sixth grain). Much better. Resp. 20. Chest dressed. A few ounces only of discharge in dressings, quite sweet. Cavity washed out with (one in forty) carbolic-acid solution through the tube, which was not removed. In

the evening the patient had considerable pain in stomach, which was relieved by an enema and ol. Ricini.

22nd.—Patient slept fairly after morphia (one twelfth). Pulse 112, scanty, irregular. He looks a little blue still. At 2.30 p.m. chest dressed. Opening free, discharge runs freely from tube, and is quite sweet, wool soaked with some ounces of pus. Cavity washed out with one in eighty carbolic-acid solution. The cavity seemed to admit only about one ounce at each injection. No flakes came away. Patient has a much better colour and is much stronger. Pulse 120, fairly regular, occasionally intermitting with inspiration, but only now and then. Dulness much reduced, the apex being within the nipple and the right border extending only about three quarters of an inch beyond the edge of the sternum. Respiration good everywhere, still a little dry crackling round limits of dulness. The signs of air in the cavity have disappeared, cardiac sounds are heard well and are quite natural. At no time have any unusual pericardial or cardiac sounds been audible.

23rd.—Patient had a good night without morphia. He eat a little minced meat yesterday. He is much stronger, and was found to-day reading a book. The chest was dressed. A good deal of pus had drained into dressings during the twenty-four hours. The cavity was washed out through the tube which was not removed. Pulse 98, occasionally intermitting; resp. 28.

24th.—Patient slept well without morphia. The chest was dressed. Several ounces of pus had escaped in the twenty-four hours. The tube was not removed, but the cavity was washed out as usual. The whole body was found covered this morning with a small papular urticaria-like eruption, slightly itching, some of the spots fusing on the trunk.

25th.—Rash the same, only more profuse, and still itching; it is punctate, erythematous, raised in places in the form of circular patches with a yellowish smooth centre (? Lichen urticatus). The chest was dressed, the tube removed, and the cavity washed out, the fluid returned almost unchanged. The cavity does not hold more than an ounce. The cardiac sounds are normal; nothing abnormal audible except the usual pleuritic friction. The base of the lungs perfectly healthy, as they have been throughout.

26th.—The rash is fading on trunk, though still the same upon the legs and arms. It was very irritable yesterday. The cavity was washed out as usual and the dressings changed.

27th.—Hardly any discharge in dressings. Cavity closing. The patient was allowed to-day to sit up in bed to have some solid food.

28th.—The chest was dressed. Discharge in dressings hardly

more than one ounce in the twenty-four hours. The area of dulness reached just to the right edge of the sternum, and was slightly increased upwards and outwards towards the left. A good deal of pleuritic crackling was heard all round this area. Breath sounds were audible over the whole præcordium, but were quite natural over the lungs, back and front. A probe was passed in along the track of the tube. This ran almost horizontally from without inwards, towards the base of the xiphoid cartilage. The orifice had now approached nearer the sternum, so as to be within the left nipple line and almost in the position where the apex beat is normally found. The probe impinged at once upon the heart, the walls of which did not appear rough. On directing the probe towards the xiphoid cartilage it passed apparently under the heart, the movements of which were felt distinctly along the probe all the time. The probe passed in as far as the drainage-tube went and then stopped. It could not be passed in any other direction except along this track, and the cavity seemed entirely to have disappeared except along the fistulous track which was occupied by the tube. A smaller and shorter tube was inserted.

29th.—Patient better. Pulse 100. Chest dressed, hardly any discharge.

30th.—Chest dressed as usual. Pulse 88, a little irregular.

October 1st.—Chest dressed, hardly any discharge.

2nd.—Chest dressed, about one ounce of discharge in the dressing. Pulse 108, a little irregular.

6th.—Tube changed; a smaller one, one inch shorter put in. Pulse 116, slightly irregular.

10th.—Hardly any discharge. Patient's colour almost natural. Oedema of feet and of chest wall almost entirely gone. Pulse intermits only now and then with inspiration.

13th.—Tube shortened.

14th.—Tube removed. Incision kept open by a small piece of gutta-percha tissue.

17th.—Incision closed.

20th.—During the last week the patient has steadily gained strength. The cardiac dulness is now hardly increased beyond the normal, except along fourth rib, about one and a half inches from

the sternum, and in this part impulse is very distinctly felt. The heart sounds are everywhere normal. The breathing sounds healthy, and the crepitation over the margins of the dulness is almost gone. Pulse regular. Patient moves with ease and vigour, and has no dyspnoea.

21st.—Was up for one hour, and bore it without distress, but found "his legs very weak." The heart sounds are forcible, as the result, doubtless, of the extra exertion of being up.

31st.—Patient has been up every day for the last ten days, and grows daily stronger. He has no pain or dyspnoea, but he is not allowed to move about at all.

December 12th.—Patient is up nearly all day, and feels quite well. The cardiac dulness is somewhat increased in all directions, reaching a little to the right of the sternum, the apex being in the nipple line in the fifth space.

January 2nd.—Patient has complained lately of a little pain in the seat of the scar.

February 20th.—Cardiac dulness as above, but the apex is a little farther out than it was. The only change in the heart sounds is that the pulmonary is slightly accentuated. Pulse regular and of good volume. Patient looks the picture of health. The pain that he has at times seems to be dyspeptic.

23rd.—Patient left hospital perfectly well.

At the beginning of April he stated that he had returned to his usual work, which he could do as well as ever. He had no pain or dyspnoea on exertion and felt perfectly well. The cardiac dulness was almost normal, though slightly increased upwards; heart's apex-beat in normal position.

The patient was last seen in September, and was perfectly well, following his ordinary occupation.

The case may be briefly summarised thus:—A healthy lad of sixteen was suddenly seized with dyspnoea and with pain in the front of his chest. The dyspnoea gradually, in the course of three weeks, became so severe that he was admitted, as an urgent case, into the hospital.

On admission he was deeply cyanosed, with considerable dyspnoea, pulsus paradoxus, slight œdema of the feet and of the chest walls over the præcordium, and with all the ordinary physical signs of a large pericardial effusion. The temperature being not raised, it was assumed that the effusion was of some standing, and probably rheumatic in

origin. No permanent improvement occurred in spite of copious local bleeding by leeches, and on the sixth day after admission the symptoms became so urgent that paracentesis pericardii was performed, with the result of removing about fourteen ounces of pus. The patient was greatly relieved, the pulse became less paradox, and the physical signs of effusion diminished; three days later the symptoms again became urgent, the effusion had largely increased, and a second paracentesis was performed with the removal of about sixteen ounces of pus.

As the pus was slightly fetid it was then decided to make a free incision into the pericardial sac. This was done, using the cannula as a director. A very large amount of pus escaped, and air entered the sac. The operation was not antiseptic, except that all instruments were washed in 1-40 carbolic acid solution, and the cavity syringed out with a solution of the same strength. A drainage tube was inserted, and the wound dressed with oakum and carbolised cotton wool.

The pus contained, beyond numerous rod-shaped bacteria, nothing except what would come from an ordinary abscess cavity, namely, shreds of lymph and lumps of curdy pus.

The patient was at once relieved, the pulse became regular, and the cyanosis much less. The cavity rapidly contracted, and the discharge diminished. Two days later, under chloroform, the finger was inserted into the sac, and the heart felt beating upon the tip of it above.

A week after the operation the patient had an attack of general urticaria, which lasted for three days. From this time the patient made a rapid and uninterrupted recovery. The cavity contracted, so that at the end of twenty-seven days the tube was removed, and on the thirtieth day the incision had completely closed. The heart sounds were natural throughout. No murmur or pericardial friction developed. There was no affection of the lungs or pleura beyond some dry pleurisy immediately round the sac. The pulsus paradoxus disappeared, as well as the dyspnoea and the slight cedema of the feet and chest walls.

At the end of five weeks after the operation the patient was able to sit up, and from that time rapidly gathered strength. The cardiac dulness for a short time remained almost normal, within the limits to which it had slowly returned, but as the patient began to move about and exert himself, which he was soon able to do without any discomfort, the cardiac dulness slowly increased in size, and on examination, eight weeks after the operation, it extended about half an inch to the right of the sternum, the apex being just outside the nipple line. The patient complained that, if he exerted himself, he felt a little pain occasionally in the left side, near the seat of the scar. As he gathered strength this increase slowly subsided, and two months later the cardiac dulness had returned almost to its normal limits. These alterations in the cardiac dulness are, it appears to me, strongly confirmatory of the diagnosis. The lad grew much in height, and increased considerably in weight during his stay in the hospital.

In the absence of the confirmatory evidence of a post-mortem examination, it will be right in a case of such rarity as the present to state the grounds upon which the diagnosis of pus in the pericardium was made.

There was evidence of a large effusion of fluid in the anterior and lower part of the thorax. The area of dulness corresponded in position, extent, and shape with those usual in pericardial effusions. There was the usual absence of cardiac impulse, and the heart sounds were extremely weak. There was evidence of great obstruction to the circulation: first, in the enlarged liver, and in the œdema of the feet and chest walls; secondly, in the dyspnoea and cyanosis; and, lastly, in the character of the pulse (*pulsus paradoxus*). The peculiar, elastic, semi-fluctuating depression in the epigastrium which developed just before the last paracentesis I regard as additional evidence of the effusion having its seat in the pericardium.

The diagnosis was confirmed by the subsequent history of the case :

1. By the great and immediate relief given by the operation of paracentesis and by the subsequent incision ; a relief which is, as will be shown later, the especial characteristic of the removal of even small amounts of fluid from the pericardium.

2. By the evidence given by the trocar in the cavity, and by the finger inserted through the incision, for the heart was felt beating upon the end of the trocar and upon the tip of the finger.

3. By the variations in the cardiac dulness, which were observed during the patient's convalescence.

Two physical signs only are wanting to complete the case clinically, viz. the *bruit de moulin* and pericardial friction.

The *bruit de moulin*, or mill-wheel sound, which is met with where air and fluid exist together in the pericardium, is an extremely rare phenomenon. When it occurs it is no doubt pathognomonic of pyo-, or hydro-, pneumo-pericardium, but the converse is probably not true, that it always occurs under these conditions, for the analogous phenomenon in the pleura, viz. succussion, is not invariably present in pyo- or hydro-pneumothorax.

The absence of pericardial friction is a greater difficulty, for at no time throughout the illness was undoubted pericardial friction detected. Once only the heart sounds were described as sticky, as they frequently appear to be in rheumatic pericarditis, just before or just after the usual to-and-fro friction. Yet the single fact of the absence of friction is not sufficient to outweigh the concurrent testimony of the other physical signs, for cases of undoubted pericarditis are recorded in which pericardial friction has been absent throughout ; and it is stated, although only to be denied, by Bauer in 'Ziemmsen's Encyclopædia,' that in purulent pericarditis friction is usually absent. A case will be quoted later (Case No. 76) which clinically was in most respects similar to this ; the

pericardial effusion was also purulent, and there was throughout no friction.

To the absence of these two physical signs, viz. the *bruit de moulin* and pericardial friction, too much importance, then, must not be attached, for the former is of doubtful value, and the absence of the second admits of explanation.

Clear, however, as the case is clinically, it becomes still clearer, when we consider what other diagnoses were possible. The possible pathological conditions appear to be these :

1. An abscess making its way upwards from below the diaphragm.
2. A localised empyema.
3. A suppurating cyst, or an abscess, in the anterior mediastinum.

The first supposition, that of an abscess making its way up from below the diaphragm, from the liver, or from between the liver and diaphragm, may be set aside at once, for there is no evidence to support such a diagnosis.

If it were a collection of pus in the anterior mediastinum, we must suppose that it developed immediately in front of the pericardium, in such a way that it pushed both the pericardium and the heart neither up nor down nor outwards, but bodily backwards away from the anterior walls of the chest. This is an almost impossible pathological assumption.

Such a collection of pus, not in the pericardium, would be due either to a localised empyema, or to an abscess or suppurating cyst in the mediastinum. In either case there would certainly have been some dulness posteriorly in consequence of the displacement of the heart, and this there was not. The circumscribed area of dulness corresponding so exactly with that of pericardial effusion would be very remarkable, and it would be difficult to explain the cardiac symptoms.

Of empyema there was at no time any other physical

signs, and it is difficult to conceive how a cyst or abscess in the mediastinal tissue could have developed in this situation, in the direction of greatest and not of least resistance. It is, I think, almost impossible that a mediastinal cyst should have been limited to this situation.

The course of the case, the rapid contraction and closing of the cavity after removal of the fluid, make it clear that the pus was confined in a very resistant and elastic sac, and there are only two conditions which would provide such a sac, viz. a thick-walled mediastinal cyst (of the existence of which there was no other evidence) and an effusion into the pericardium.

I may quote in this connection a very remarkable case, in which the diagnosis was made during life of a mediastinal cyst, and in which paracentesis was several times performed with great relief, but which proved to be on post-mortem examination a case not of mediastinal cyst, but of chronic pericardial effusion. This case was under the care of Sir Risdon Bennett at the Chest Hospital, Victoria Park, to whom I am indebted for permission to refer to the clinical history of the case.

The patient, Charles E—, was a youth, *æt.* 20. He was admitted with symptoms of mediastinal pressure, and the diagnosis was made at first of mediastinal tumour, though it was subsequently altered to that of a cyst in the mediastinum. Paracentesis was performed, and a large quantity of clear serous fluid evacuated, which on cooling coagulated and deposited a large amount of cholesterine. The heart, which could not be localised, was found immediately after the tapping in its proper place. The patient was tapped several times, but only on the first occasion did the fluid contain cholesterine. Each time the tapping gave great relief. He was in the hospital four times altogether, for some months on each occasion, and on the last occasion for one year and three months. At this time the patient had considerable anasarca, and a large amount of fluid in the peritoneum. He died gradually of exhaustion four years and a half from the commencement

of the illness, and four years from the date of his first paracentesis. The post-mortem showed that what had been regarded as a mediastinal cyst was really a pericardial effusion.

The pericardium was greatly distended, extending from some distance beyond the right edge of the sternum to more than two inches outside the left nipple line. Its cavity was filled with slightly blood-stained serum. The whole parietal portion of the pericardium was enormously thickened, not only just under the sternum, but also behind and at the root of the lungs. Two inches outside the left nipple the pleura and pericardium together measured more than one inch in thickness, the internal surface was smooth and had not lost its polish, except where one or two long adhesions stretched from it across to the heart, which lay in the upper and right portion of the sac, some inches away from the apex. The heart was small and covered entirely by a soft, velvety, villous layer of recent lymph which easily peeled off. In the new membrane were numerous gray tubercles. The left pleural cavity was obliterated. There were a few gray tubercles in the liver and spleen, but none in the kidneys. The peritoneal cavity was crossed in all directions by dense adhesion, and contained a large quantity of turbid serum. The intestines were matted together and covered with recent lymph, in which as well as in the parietal layer of the peritoneum were scattered numerous gray tubercles. The liver was adherent to the abdominal walls and the capsule much thickened. It weighed 3 lb. 11 oz., was cirrhotic and granular, the fibrotic change being most marked at the periphery beneath the capsule.

I am unable to give the full clinical notes of this remarkable case, for it has not yet been published, but I quote it in connection with this paper as an instance of what had been during life always supposed to be a mediastinal cyst, proving to be on post-mortem examination a large pericardial effusion, for which paracentesis was several times performed with great relief to the patient. The case is of great importance in reference to that at present under consideration, for it lends strong support to the diagnosis.

After all that has been said, the conclusion is clear that we have to do here with a purulent pericardial effusion, for

with this diagnosis the clinical facts agree, while the assumption of any other diagnosis creates far more difficulties than it solves.

Purulent pericarditis is rare, and generally associated with some disease of itself incurable, for example, pyæmia, tubercle, or with some eruptive fever, &c. Primary pericarditis of any kind is uncommon, and primary purulent pericarditis, of which the present case is an instance, may be placed among the rarest of clinical rarities.

Though the evidence of pericardial effusion was conclusive, there was nothing in this case to indicate that it was purulent. The temperature was never raised, and even after the operation only once reached 100° F. There were no rigors, nor sweating, nor did the patient present any symptom which would suggest suppuration except the œdema of the chest walls, which was most marked over the præcordial region. The value, however, of this sign was discounted by the existence of œdema of the feet, a very common clinical phenomenon in cases of pericardial exudation, especially in young persons.

The operation in itself was extremely simple. More courage was required to perform the first paracentesis than to make a free incision with the knowledge that the effusion was purulent. Chloroform was administered with the view of avoiding the shock of the operation, and to keep the patient still while the knife was being used. There was, of course, some risk in giving chloroform, but no other anæsthetic was available at the time, and I thought the risk of even chloroform less than that which I should run by operating without any anæsthetic at all. The patient took chloroform well.

The operation being urgent, free use of antiseptics could not be made, although I had determined, if time had been given, to have had the operation performed under the spray with the usual antiseptic precautions. The result, however, could under no circumstances have been more satisfactory, for the patient recovered without a

single bad symptom at any time, the discharge and wound remaining throughout perfectly healthy.

The spot chosen for puncture was fixed as far to the left as possible, because in ordinary cases of paracentesis the heart is at this place farthest away from the chest walls. The objection to tapping so far out is that the trocar would puncture the pleura before reaching the pericardium, and on this account a spot is usually selected nearer the sternum, within the point to which the pleura usually reaches. In this case I felt safe in operating farther away from the sternum because I had reason to believe, from the duration of the disease, and from the signs of dry pleurisy, that the pleura was adherent over the præcordium, and that I should therefore run hardly any risk of opening the pleural cavity. The result proved the correctness of this supposition.

The fluid had, however, no sooner been evacuated than the cavity contracted and the incision, which had been direct, became horizontal, so that a long sinus formed. I did not quite expect this, and it would be an argument for adopting in the future a spot for puncture nearer to the sternum.

Of the large amount of fluid which escaped, and of the great relief immediately given to the patient, I shall speak again in discussing the cases recorded in the appendix to this paper.

The epigastric depression which developed just before the incision is a physical sign which has been described in some instances of pericardial effusion, but is a rare phenomenon. It is, I believe, due to bagging of the pericardium and central portion of the diaphragm, and may have indicated that the abscess would have burst, if it had not been opened, through the diaphragm into the peritoneum.¹

The quantity of urine before and after the operation

¹ Since writing the above a similar observation has been recorded in the 'Lancet' of January 27th, 1882, in a case of pericardial effusion, under Dr. Clifford Allbutt's care.

was not observed. In some cases which have been described recently, stress is laid upon the great increase noticed in the amount after paracentesis. The decrease is, I believe, simply due to the congestion of the kidneys, and the increase to the relief of their congestion by the operation.

The urticaria which developed over the whole body a few days after the operation is a curious clinical phenomenon, but one which has been observed commonly in cases of tapping of hydatids of the liver, and occasionally also after paracentesis of the pleura and peritoneum.

The *pulsus paradoxus*, or *pulsus cum respirazione intermittens*, which was so exquisite in this case, of which a tracing is given, is a very rare phenomenon. Pulses which vary with respiration are not at all uncommon in the minor degrees, especially in cases of heart disease; but the regularity is then nearly always cardiac in origin, that is to say, the irregularity of pulse is due to irregularity of the heart's action. The true *pulsus paradoxus* is essentially different. Here the heart continues to beat regularly, though the pulse intermits, and this intermission occurs during each inspiration, lasting as long as inspiration lasts. In the present case the heart throughout continued to beat regularly at the rate of about 112 in the minute. The pulse, however, varied. In some instances the difference between the heart and pulse beats were almost exactly twice the number of respirations, *e.g.* heart 112, pulse 64, respiration 28. $64 + 56 = 120$. After the operation the pulse became perfectly regular.

Nearly all the instances recorded of *pulsus paradoxus* have occurred in connection either with pericarditis or with affections of the mediastinum. Griesinger records a case in which the cause was found, post mortem, in a constriction of the aorta by bands of fibrous tissue surrounding the vessel. Kussmaul records other cases, and adopts this explanation, and seems to regard the *pulsus paradoxus* as pathognomonic of a condition which he names *mediastinitis fibrosa*. The mechanism in these cases appears to

be this : fibrous bands form round the great vessels, which are attached to the sternum and ribs in front. As the sternum and ribs move forwards on respiration the bands are tightened and the aorta constricted. In most of the cases, however, besides the mediastinitis there was also pericarditis, either with adhesion or with effusion, and Traube and Bäumlér record cases of *pulsus paradoxus* with simple pericardial effusion, and without any mediastinitis, and one instance is on record where it was observed in a case of very large left pleuritic effusion.

The simplest explanation is no doubt that of Kussmaul, if only the pathological condition it assumes were constant, but this is not the case. Two theories have been suggested for the *pulsus paradoxus* of pericarditis. The one, like Kussmaul's, is anatomical, and refers the interference to stretching of the pericardium, where it is reflected round the vessels by the descent of the diaphragm. The other is rather physiological, and refers the interference to the feeble condition of the heart, which has only just sufficient power to produce the pulse at the wrist during expiration, the slightly increased resistance offered to the exit of blood during inspiration proving too much for its strength. This I cannot regard as an adequate explanation, for if the heart was so feeble as the theory presupposes there would be more clinical evidence of cardiac weakness in these cases, and the *pulsus paradoxus* would be a more common phenomenon.

The only experiments I know conducted with the view of determining the mechanism of the *pulsus paradoxus* are those mentioned recently by Prof. Rosenbach.¹ An air ball was introduced into the right pleura and so adjusted that it compressed the inferior vena cava as it passed through the diaphragm. The *pulsus paradoxus* was produced in its most typical form. The author concluded therefore that another possible explanation of the phenomenon lies in the insufficient filling of the heart with blood, owing to the interference with the circulation

¹ Art. "Pericarditis," in Eulenburg's 'Real-Encyclopädie.'

through the inferior vena cava by constriction of its mouth, as it passes through the diaphragm.

This is a most important addition to our knowledge of the pulsus paradoxus, and will probably explain those cases in which it has been observed with simple pericardial effusion, or with the displacement of the heart in large pleural effusions. It is remarkable that the only reference to the pulsus paradoxus which I find among the cases of paracentesis pericardii which I have collected is in that of Prof. Rosenstein's, which in this as in every other respect is the counterpart of the present case. To this case I will now shortly refer :

A boy, æt. 10, was brought to Professor Rosenstein's clinic with the history of fourteen days' illness, during which time he had had pain in the epigastric region, dyspnoea, a dry cough, and some fever. He was found to have a large pericardial effusion. As the temperature was hardly raised above the normal and there was no oedema, surprise was felt when, on inserting a fine syringe, pus was drawn off. Paracentesis was at once performed in the fourth space on the left side, near the edge of the sternum, and 620 cc. of laudable pus removed. The pulse which before the operation was 140 and intermittent (paradox), became regular and 92. The respiration dropped from 52 to 28. A few days later the patient was found to have fluid in the left pleura, which was also tapped and 1100 cc. of serum removed, and at the same time 120 cc. more of pus were removed from the pericardium. The patient, however, was in a critical condition, there was great dyspnoea and cyanosis, the veins of the neck were much distended, oedema of the feet and scrotum had appeared, and the pulse was extremely paradox. The temperature, however, throughout had never risen above 100·5° F. A free incision was now made into the pericardium in the fourth left space near the edge of the sternum and a large amount of pus escaped. Two drainage-tubes were inserted. The patient was wonderfully relieved at once. A week later the pulse was regular and the oedema gone, and in three weeks after the operation the wound had completely healed. A little later the signs of pleuritic effusion reappeared on the left side, and paracentesis was again performed with the removal of 1000 cc. of pus. A day or two later a free incision was made with the evacuation of about 1500 cc. of pus. In six weeks' time the wound in the pleura also had completely healed and the patient was discharged perfectly well, having gained considerably in weight, fifteen weeks

from the commencement of his illness and ten weeks from the date of the incision of the pericardium.

The case of Prof. Rosenstein's just referred to and that of which I have given an account in the present paper are the only cases recorded in which purulent pericarditis has been treated like empyema, by free incision.¹ It is remarkable that in both recovery was rapid and complete, and with the exception of those rare instances in which inspissated or caseous pus has been found unexpectedly in the pericardium post mortem, and which have been regarded as evidence of the possibility of spontaneous cure, these are the only cases of purulent pericarditis in which recovery has taken place.

II. THE STATISTICS OF PARACENTESIS PERICARDII, WITH REMARKS.

Paracentesis pericardii is essentially an operation of the present century. It was advocated, it is true, by Senac in 1749, and it had been suggested exactly 100 years before by Riolan, but from that time up to the early part of this century no practical advance had been made. Those writers who referred to the operation contented themselves with either advocating or opposing it on purely theoretical grounds.

Van Swieten went so far as to describe a method, but never carried it out. Corvisart spoke of the operation in 1806 as too heroic to be justifiable. Laennec, however, describes it as practicable, though he records no cases in which it was performed. It was not until 1819 that paracentesis pericardii was for the first time performed, and that too with success, by Romero, of Barcelona, who operated upon three cases, two out of which

¹ At the end of the table, p. 281, will be found appended a brief note of a recent case which has occurred since the reading of this paper.

which recovered. Prior to this the operation is stated to have been performed in 1798 by Dessault, and 1810 by Larrey, but Dessault's case was an encysted pleurisy, and Larrey's is not conclusive, so that Romero's claims to priority are, I think, established. Eight years later Jowett, of Nottingham, punctured the pericardium with a trocar, the fluid escaping into the pleura, from which it was absorbed.

No other operation is recorded until the year 1839, when Schuh tapped the pericardium at the request of Prof. Skoda in a case which proved ultimately to be one of mediastinal tumour. Two punctures were made, but without result. In the next two years a most extraordinary series of cases was published in Russia during an outbreak of scurvy. They were remarkable not only for their success, but also for the nature (blood) and for the large quantity of the fluid which was removed.

In 1854 Trousseau wrote his memorable essay upon the subject, recording cases of his own and of M. Aran. This attracted great attention in France, and consequently we find a series of cases in French literature in the course of the next few years.

Dr. Clifford Allbutt was the first to introduce the operation into this country, which was performed upon his advice with complete success by Dr. Wheelhouse in 1866, and again by Dr. Teale in 1869.

Since the year 1865 the operation has been frequently performed in France, Germany, and England, and a few cases have been recorded from America. Of the seventy-nine cases recorded, fifty-three are subsequent to the year 1864.

In 1881 a further great advance was made by Prof. Rosenstein, of Leiden, who after twice tapping the pericardium in a case of purulent pericarditis, finally laid the sac freely open under antiseptics and inserted a drainage tube. The case was treated exactly as if it had been one of empyema. The result was entirely satisfactory, for the boy recovered completely. The present case is the

second of this kind recorded, and the first in this country.

I have collected all the cases of paracentesis pericardii which I have been able to find recorded, and I have added to them not a few others which have not yet been published. The difficulties of collection were much increased by the frequent double reference to the same case, in the literature of the subject, under the names both of the physician and of surgeon concerned. I have endeavoured as far as possible to identify these cases, and where they have been quoted under two names I have bracketed these names together. The references given I have been at pains so far as possible to check.

The cases number seventy-nine; I have arranged them in chronological order, and have given in successive columns the sex, age, clinical history, and result. I have made a short note of the method and place of operation, of the nature and amount of the fluid removed, and in fatal cases I have added, when possible, a brief abstract of the pathological conditions found. I propose to discuss the subject to a great extent according to these headings.

Sex.—Of the seventy-nine cases the sex was specified in seventy-one, and of these fifty-seven were males and fourteen females. For this remarkable prevalence of males I can find no explanation.

Age.—In twelve the age was not stated. The rest I have arranged in periods.

	Under 10	Up to 15	-20	-25	-30	-40	-50	-60	-70	Total.
Males . . .	6	6	8	13	10	6	1	1	2	53
Females . . .	1	4	2	2	3	1	...	...	1	14
Totals . . .	7	10	10	15	13	7	1	1	3	67

The distribution is fairly equal in the different periods

of early life. From the facts as regards age as well as sex, we may conclude that the majority of the cases was probably not of rheumatic nature. Otherwise there would be a greater proportion among young persons. This further agrees with the clinical experience that, as a rule, rheumatic cases recover without the necessity of operative interference.

The causes.—The accompanying table shows the diseases with which the pericarditis was associated :

Disease.	Number of cases.	Recovery.	Death.
Phthisis	13	4	9
Purulent pericarditis	12	2	10
Rheumatic fever	11	7	4
Scorbutus	9	6	3
Pleurisy	6	5	1
Injury	3	2	1
Pneumonia	2	...	2
General dropsy, { <i>a.</i> Morbus cordis	2	...	2
<i>b.</i> Nephritis	2	2	...
<i>c.</i> Chronic bronchitis	1	1	...
Mediastinal tumour	1	...	1
Unassigned	17	7	10
	79	36	43

Rheumatic fever.—Of the seventy-nine cases, in twelve only did the pericarditis occur in the course of rheumatic fever, and one even of these is doubtful. Of the remaining eleven, seven recovered completely, and of the four fatal cases two were relieved by the operation, and one of them ought almost to be called a recovery, for the patient lived for six months after the operation. The other lived for six days. Of the remaining two, in one the operation was performed so late that the patient was moribund at the time, and in the last the operation was in itself fatal, the trocar penetrating the right ventricle, and the patient dying of hæmorrhage into the pericardium in a few minutes. This, it may be stated, is the only instance among these cases of a fatal result from the operation itself.

The amount removed was small, a few ounces only, except in one case, where it was as much as two pints.

The doubtful case was one of purulent pericarditis, and though there was a history of joint pains, the disease was probably not rheumatic fever, but rather some form of pyæmia, for purulent pericarditis is very rare in rheumatic fever, and joint pains resembling rheumatism are not uncommon in the course of diseases of pyæmic or septicæmic nature.

In six of these cases the attack was acute, and in four it was the first attack. In the remaining five the disease was chronic. It is worthy of note how great was the relief given by the operation in all the cases.

The analysis of this table confirms the preceding conclusion that the great majority of the pericardial cases, which were severe enough to require operation, were not cases of rheumatic origin.

Scorbutus.—Nine cases are recorded of paracentesis pericardii in the course of scorbutus, all occurring in males. They were remarkable, first, for the nature, and secondly, for the large amount of fluid which was removed. It was in all cases hæmorrhagic, and varied from one and a half to five pints. Six recovered completely. One died six hours after the operation, and the other two at later periods. Two cases, which lived six months and six years respectively, were found on post-mortem examination to have the pericardium adherent.

Phthisis.—It has long been remarked that chronic pericarditis like chronic pleurisy is commonly associated with tubercular disease, and to a certain extent this is borne out by these cases, for we find no less than thirteen of them to have been cases of phthisis; and to this number may be added six cases of pleuritic effusion and four cases of phthisis which on post-mortem examination proved to be associated with tubercular disease, making altogether twenty-three cases (or nearly thirty per cent.) in which the lungs and pleura, one or both, were affected.

Of the thirteen cases of phthisis seven had pleuritic

effusion as well, so that we seem to trace a connection between phthisis, and pleuritic and pericardial effusion.

All the phthisis cases occurred in the course of chronic illness. Four were so far relieved by the operation as to be put down as recoveries. Two lived for more than two months, and one for nearly one month. Only two died within a short time of the operation (eight hours and two days). In none could the death be attributed to the operation itself but rather to the pre-existing disease.

The effusion removed was in all cases serous, and except in four cases the quantity was but a few ounces. The larger quantities were 22, 27, 28, 35, and 49 ounces.

Pleurisy.—Of the six pleuritic cases the effusion into the pericardium was purulent in two, one of these being a case of empyema. In the others it was serous. One only of all these six recovered. Most were relieved by the operation, though one died in a few hours and another in six days.

General dropsy.—In five cases the pericardial effusion occurred in the course of general dropsy, as the result in two of morbus cordis (both of these patients died), in two of nephritis (both of these recovered), and in one of general bronchitis (this case also recovered).

Pneumonia.—In the two cases of pneumonia the effusion was purulent. They were both probably of pyæmic nature, and will be referred to subsequently with the purulent pericarditis cases.

Miscellaneous.—In three cases the pericarditis followed exposure to cold, a surgical operation, and a mediastinal tumour respectively, and in another case it was referred to injury.

Unassigned.—Of the remaining seventeen cases, in which the cause is not assigned, six recovered and eleven died. Post-mortem examination was made in six, and the pericarditis was found in four cases to be due to tubercular disease, associated in two cases with tubercle in both lungs and pleura, and in another with tubercle as well in the peritoneum. In one of the remaining cases double

hydrothorax was found, and in the other a pericardial effusion with adherent pleura.

Purulent pericarditis.—I have reserved to the last an account of this perhaps the most interesting group, viz. purulent pericarditis. Twelve cases are recorded, all fatal with the exception of the two last, those of Professor Rosenstein and myself, which were treated by free incision. In only one case did death take place within a few hours of the paracentesis, some of the cases surviving to have the operation repeated many times, in one case as often as six times.

The quantity removed varied a good deal, but the average was higher than with serous effusion, and in two cases the amount is described as considerable.

The cause of the affection is by no means clear. Six of the cases were probably pyæmic in origin, though this is not quite certain. Two were associated with empyema, although in one the empyema was subsequent to the operation.

The relation of tubercle to purulent pericarditis does not appear to be established by these returns, for among the cases of tubercular pericarditis recorded in the table, the effusion was serous in several, but in none was it purulent or hæmorrhagic.

All the cases were in males, and seven out of the ten in which the age is given were between ten and twenty years of age, the oldest of all being only thirty-one.

It is worthy of notice that in no case was the diagnosis of the nature of the effusion made previous to the operation, nor does there seem to have been any physical sign by which the diagnosis could have been determined.

Length of illness before operation.—The illness in the great majority of cases had been of long duration, in several of some months. The longest on record is that of Sir Risdon Bennett, in which the effusion was present for more than four years. In only twenty-five cases (or 1—3) was the duration short, and the attack therefore more or less acute.

The effect of the operation.—The immediate result was in nearly every case good. It is remarkable how great was the relief given even by the removal of only a few ounces of fluid, in some cases this appearing to be sufficient to lead to the complete absorption of the rest.

One case only is recorded in which the operation itself was fatal, and this was due to laceration by the trocar of the right ventricle. Six cases died within twenty-four hours of the operation, but with these deaths the operation itself had nothing to do. The one case, which died within two hours of paracentesis was moribund at the time of operation. Twelve persons lived for a week after the operation, eight for about a month, six for a period longer than one month but less than ninety days, three lived for a little more than six months, and twelve lived very much longer, and in some others recovery appears to have been complete.

When the mechanical effects of the effusion were obviated by paracentesis, death it appears was the result not of the pericarditis or the paracentesis, but of the disease to which the pericarditis was due.

The nature of the fluid.—In ten cases the fluid was pure blood; nine of these occurred in scorbutics, the tenth was a case of hæmorrhage into the pericardium in consequence of laceration of the right ventricle. In twelve it was purulent, and of these only those two recovered which were treated by free incision. In the rest the effusion, where it is specified, was serous.

The quantity of the fluid removed.

Up to 5 oz.	-10	-15	-20	-30	-40	-50	Above 50
13	16	9	8	12	11	4	11
46				38			

The amount is tabulated in the table. Any quantity

above one pint may be regarded as large, and it will be seen that where less than one pint was removed in forty-six instances, more than one pint was removed in thirty-eight instances.

The largest quantity occurred in the hæmorrhagic (scorbutic) cases: $3\frac{1}{2}$, $4\frac{1}{2}$, 5, and $5\frac{1}{2}$ pints; but even serum has been met with in large quantities, and as much as 2 and $2\frac{1}{2}$ pints have been removed by operation. On post-mortem examination, in a case recorded by Sibson, serum was found to the amount of $3\frac{1}{2}$ lbs., and in another case,¹ the amount measured three litres, *i.e.* rather more than five pints, while Kyber records a still more remarkable case, in which the pericardium was filled with blood to the incredible amount of 10 lbs.

The number of punctures.—In many cases the operation was frequently repeated. In sixteen cases the pericardium was tapped twice, in three thrice, in one six times, in one eight times, in one many times over a period of four and a half years; and in two, after twice puncturing, the pericardium was incised and laid freely open.

The mode of operation.—The methods employed have been various. The earliest operations, those of Romero, were performed by making an incision through the skin and muscles in the intercostal space over the pericardium, exposing the pericardium, picking it up with a pair of forceps, and opening it by knife or scissors, the fluid being allowed to flow away.

It is noteworthy that with this, according to our present views coarse, way of operating, the results were satisfactory.

Trousseau incised the skin and exposed the pericardium and then punctured with a trocar. In one case he passed a gum elastic sound through the opening into the sac.

Lobel used a large injecting syringe with a needle which he removed each time after filling the barrel of the syringe, and re-inserted.

Since the invention of the aspirator by Dieulafoy, this

¹ 'Recueil de Mem. de Med. Militaire,' 1880, 3rd s., xxxvi, 97.

has been the favourite instrument, though recently paracentesis has several times been performed without any suction, by means of an ordinary trocar and cannula, and this is a simple and it appears a perfectly satisfactory method of operation in many cases.

Trephining of the sternum was a method suggested rather by theory than by practical experience. This operation introduces dangers of its own by exposing so vascular a bone as the sternum, and has now been entirely abandoned.

The place of punctures.—In thirty instances the fifth intercostal space was selected ; in twenty the fourth ; in three the sixth ; in three the third ; in one the seventh ; in one the eighth. This last was a dry tapping. In most of the cases a spot was chosen as near as possible to the left edge of the sternum.

In three cases the puncture was made on the right side of the sternum ; in one in the third right space ; in two in the fifth right space.

The most convenient spot to puncture the pericardium was determined experimentally by Dieulafoy by the injection of fluid into the pericardium post-mortem. His observations showed that as the pericardium became distended, it stretched away in all directions from the base of the heart. The heart itself was gradually raised so as to be higher up than normal. In this way a considerable distance often intervened between the wall of the sac and the heart, even as much as two or three inches.

Dieulafoy recommended, therefore, the lowest convenient intercostal space, and, in order to avoid wounding the pleura, at no great distance from the sternum. These two conditions were best realized in the fifth space about one inch from the left edge of the sternum, and accordingly this is the place which he advocates for puncture. This is also the place which has been usually selected. The internal mammary artery is not at all likely to be wounded at this spot, for it has rarely been found more

than one third to one half of an inch from the edge of the sternum in this place.

Some recent experiments of Rotch,¹ by means of injection of cacao butter, has led this observer to recommend a very different place, viz. the right side of the sternum in the fifth space, about half an inch from the sternal edge. This he does upon certain theoretical considerations suggested by his cacao-butter injections. His conclusions I cannot think correct. They are directly opposed to Dieulafoy's and also to ordinary post-mortem experience. The position which the heart is found to occupy in the post-mortem examination of large pericardial effusions confirms the experiments of Dieulafoy, for in these cases the heart is found slightly displaced upwards, and the distended wall of the pericardium is at the greatest distance away from the heart walls at about the position of the normal apex. The danger of a wound to the heart is not very great, as has been shown many times by the results of injury and accident, and recently tapping of the right ventricle has been advocated in cases where it was greatly distended with blood, and has several times been performed with apparently good success. Whatever risk there might be could be avoided by carefully inserting the trocar, and sheathing it as soon as the heart was felt in contact with it.

When the pleura is obliterated and adherent to the pericardium the operation becomes much simpler. Then a spot may be safely selected as far out as possible, in the nipple line or even further, without any danger of opening the pleura.

From the preceding observations, the following conclusions may be drawn :

1. Paracentesis pericardii is not only justifiable, but an operation which may be safely undertaken with ordinary precautions. One case only is recorded in which the operation was in itself fatal. With this exception all

¹ 'Absence of Resonance in the Fifth Right Intercostal Space diagnostic of Pericardial Effusion,' by T. M. Rotch. Boston, 1878.

the patients were greatly relieved by the removal even of a small amount of fluid, and many recovered completely, who would probably have died if the operation had not been performed.

2. The most suitable place for puncture is, in ordinary cases, in the fifth left intercostal space one inch from the edge of the sternum, but if the pleura be adherent, the puncture may be made safely much further out, and even in the sixth space.

3. The instrument employed should be a trocar and cannula, with or without aspiration.

4. The operation may be performed with advantage not only in the pericardial effusions of rheumatic or primary origin, but also in those which occur in the later stages of general dropsy, if it should appear that the fluid in the pericardium is adding to the difficulties under which the heart is placed.

5. Purulent pericarditis is best treated on general principles, like an empyema.

a. The pericardial sac may in these cases be safely opened and drained.

b. This treatment moreover appears to be the only one which offers the slightest hope of recovery.

c. The results are likely to be more favorable than those of empyema, for the walls of the cavity are better able to contract rapidly and thus permit of complete obliteration.

Table of Cases of *Paracentesis Pericardii*.

Case.	Date.	Author and reference.	Sex and age.	Clinical history.	Method and place of operation.	Nature and amount of fluid.	Result.	Post-mortem record.
1	1819	Romero, 'Dict. Sc. Med.,' 1819, xl, 371	M., 35	5 months ill	Incision, 5th space at junction of cartilage and rib; pericardium picked up with forceps and incised Do.	—	R.	—
2	"	Do.	M., 37	3 months ill	Do.	—	R.	—
3	"	Do.	M., 45	8 months ill	Do.	—	D.	Adherent pericardium.
4	1827	Jousselt, Gunther, 'Blut. Oper.,' 1861, l.f. 56, 57	F., 14	Rheumatism	Puncture, fluid escaping into the pleura	—	R.	—
5	1839	Schub, Gunther ut supra, 'Ester. Med. Jahrb.'	F., 24	Mediastinal tumour; operation produced no effect	Puncture with trocar in 4th left space	None obtained	D.	Mediastinal tumour.
6	"	Karawegiew, Gunther, 'Brit. and For. Med. R.,' July, 1841	M., 23	Scorbutus	Puncture with trocar in 5th left space	Blood—3½ pints	R.	Patient died 6 mos. later, and peric. was found adherent.
7	"	Do.	M.	Do.	Do.	Blood	Life prolonged by operation	—
8	1840	Kyber, Gunther, 'Schmidt's Jahrb.,' 1848, 168; 'Med. Zeit. Russl.,' 1847	M., 28	Scorbutus; illness of 2 days duration; in 14 days sat up in bed; in 10 weeks well. Died 10 mos. later of phthisis	Puncture in 4th left space, 1 inch from edge of sternum	Blood—5½ pounds	R.	—
9	1841	Heger, Gunther, 'Arch. Gen. de Med.,' 1854	M., 19	Patient had phthisis; ill 4½ mos. before operation; parac. performed twice, each followed by	Puncture in 5th space: 1st puncture 2nd puncture (19	Serum : 52 oz. (1500 cc.)	Relief. Died 2½ mos. later	Peric. adherent in parts, with several ounces of flocculent yellow

		an attack of pneumonia; after the 2nd parac. the cannula was left in for 6 hours	days later).....	17½ oz. (500 cc.)	fluid; double pleuritic effusion; tubercular lungs.
10	1842	M. <i>Schöberg</i> , Gunther, do.	—	Blood—5 pounds	R.
11	"	M., 27 Do., do.	—	Blood	R.
12	1845	M. <i>Kyber</i> , ut supra	Puncture with trocar in 4th left space	Blood—4½ pounds	R.
13	"	M. Do.	Do	Blood—1½ pounds	R.
14	"	M., 17 Do.	Do., 2 punctures	Blood	D.
15	1852	F., 35 <i>Warren & Smith</i> , 'Smith's Surgery,' ii, 207	Incision through skin and puncture with trocar in 6th left space	— 5 ounces	R.
16	1854	M., 16 <i>Trousseau</i> , <i>Joubert</i> , and <i>Lasèque</i> , 'Arch. Gen. de Med,' Nov., 1854	Incision and trocar in 5th left space, 1½ inches from the left edge of sternum	Serum—(400 cc.) 14 oz.	R.
17	"	F., 11 <i>Roger</i> , 'Bull. Soc. Med. des Hôp.,' 1868	Hydrocele trocar in 5th left space: 1st punct. ¼ in. from edge of sternum	Relieved by operation	Phthisis; 400 cc. of puriform fluid in pericardium, 500 cc. in peritoneum.
18	"	F., 22 <i>Behier</i> , 'Bull. Soc. Med. des Hôp.,' 1854, No. 9	2nd punct. 1½ in. do. Trocar; at first puncture in 7th left space, and failing there in 6th left space	Blood—(100 cc.) 3½ oz. Serum—(500 cc.) 17½ oz. Serum—(250 cc.) 9 oz.	Relieved by operation

Case.	Date.	Author and reference.	Sex and age.	Clinical history.	Method and place of operation.	Nature and amount of fluid.	Result.	Post-mortem record.
19	1855	<i>Aran, Trousseau, 'Clin. Med.,' iii, 391</i>	M., 23	Patient had phthisis; parac. was performed twice, and a solution of iodine injected	Trocar in 5th left space: 1st puncture 2nd puncture	Serum—22 oz. Serum—49 oz.	R.	—
20	"	Do., do.	—	{ Both cases referred to by Trousseau, but no particulars given }	—	—	R.	—
21	"	Do., do.	—		—	—	D.	—
22	"	<i>Vernay, 'Gaz. hebdomadaire,' 1856, 793</i>	M., 23	Patient had valvular disease of the heart; was ill 1 month before parac. peric., and died 21 days after the operation, parac. abdominis being performed during this time	Trocar in 5th left space: 1st puncture 2nd puncture	Serum—500 cc. (17 oz.) Serum—400 cc. (14 oz.)	D.	Peric. contained "5 wine bottles full" of serum; peric. measured 25 cm. in diameter.
23	1856	<i>Trousseau, 'Clin. Med.,'</i>	M., 27	Patient had phthisis, and had been very ill for 70 days before operation; after parac. effusion took place into left pleura, and 300 cc. were removed. Pat. died 5 days after operation, having had convulsions fits 3 days previously	Incision in the 4th left space, under the nipple; a gum sound was introduced through the incision	Serum—100 cc. (3½ oz.)	Patient relieved by operation D.	Peric. contained 1 litre of serous fluid; heart was 4" away from the puncture; pleuritic effusion on left side.
24	"	<i>Bowditch</i>	—	Pepper (cf. Case 60) says it is doubtful whether this operation was completed	Incision	—	D.	—
25	1857	<i>Wilostowsky, Gunther, ut supra</i>	—	Scorbutus. Patient died 8 hours after operation	—	Blood	D.	—

26	1865	<i>Champonillon</i> , 'Gaz. heb.', 1875, Nov.; 'Gaz. des Hôp.', 1865	M., 28	Patient had been 6 wks. ill, completely recovered, and was in active work as a sailor 16 mos. later	Trocar in 5th left space	Serum—615 cc. (21½ oz.), greenish and cloudy	R.	—
27	1866	<i>Clifford Albutt</i> and <i>Wheehouse</i> , 'Brit. Med. J.', 1868, Oct. 10	M., 26	Acute rheumatism. Patient left with a mitral murmur, but was well 23 mos. later	Trocar in 4th left space, ½ inch from edge of sternum	Serum—3 oz.	R.	—
28	1867	<i>Lovel & Mader</i> , 'Ctibitt.', 1870, No. 3; 'Schmidt's Jahrb.', 143, p. 137	F., 68	—	Needle and syringe, operation was performed twice, the needle on each occasion being inserted 3 times: 1st puncture in 3rd left space 2nd puncture in 3rd right space	Serum—3 oz.	D.	Double hydrothorax; only a little pericardial fluid.
29	"	<i>Baizeau</i> , quoted by <i>Roger</i> , 'Gaz. heb.', 1868, p. 515; 'Bull. de l'Acad. de Méd.', Nov. 2, 1873	M.	Patient had been ill 17 days after an operation for the removal of a gland at the angle of the jaw. Air entered into the left pleura, the heart was wounded, and the patient died 2 hours after the operation	Skin incision, and trocar in the 6th left space, three fingers' breadth from the edge of the sternum	Venous blood—400 cc. (10½ oz.)	D.	450 cc. of blood in the left pleura, probably from the wound in the heart.
30	1868	<i>Roger</i> , 'Soc. Med. des Hôp.', 1869	F., 12	Patient had phthisis, and lived 2 days after the operation	Trocar in 5th left space	Serum—780 cc. (27 oz.)	D.	300—400 cc. of bloody serum in peric.; tubercular pericarditis, myocarditis, and cardiac thrombi.
31	1869	<i>Clifford Albutt</i> and <i>Teale</i> , 'Lancet', 1869, p. 807	F., 27	Patient had phthisis, and died 8 hours after the operation	Trocar in 4th left space: 1st puncture 2nd puncture	Serum—5 oz. Serum—6 oz.	D.	—

Case.	Date.	Author and reference.	Sex and age.	Clinical history.	Method and place of operation.	Nature and amount of fluid.	Result.	Post-mortem record.
32	1870	<i>Powroy & Fremy</i> , 'Gaz. d. Hôp.', 1870; 'Dieulafoy Aspiration,' 1873	M., 21	Patient had phthisis; had pericarditis and left pleuritic effusion; had been ill 14 days with pain in the left side	Aspirator 1 cm. above lower line of dulness, 6 cm. from middle line of sternum; cannula pushed in 8 cm.	Sero-purulent—800 cc. (28 oz.)	R.	—
33	1871	<i>Malle</i> , 'Thèse de Labrousse,' 1871	—	Patient lived 8 days after parac.	Trepanning sternum, and injection of iodine	—	D.	—
34	1872	<i>Duncan</i>	M., 12	Patient lived 15 hours after parac.	—	—	D.	—
35	"	' <i>Chaillon</i> , 'Dieulafoy Aspiration,' 1873	—	Patient had phthisis and pleuritic effusion; died 4 days after parac.	Aspirator	—	D.	—
36	"	' <i>Charron</i> , 'Bull. Acad. de Méd.,' 1872; 'Lancet,' 1872, Nov. 30	M., 23	Patient had phthisis and pleuritic effusion, 1430 cc. (52 oz.) removed; parac. peric. 2 days later. Patient had been ill 4 mos., and died 7 weeks after parac.	Aspirator in 5th left space, 2 cm. (1 inch) from edge of sternum	Serum—35 oz.	Relief. D.	Peric. contained 1000 cc. of serous fluid, tubercular; lungs tubercular.
37	"	' <i>MacLaren</i> , 'Ed. Med. J.,' 1872, June	M., 27	Ill 4 weeks with pleurisy; died 6 days after operation	Skin incision, and trocar in 5th left space, close to edge of sternum	Serum—35 oz.	Relief. D.	Peric. contained 12 oz. of serum; pleura 2½ quartas of serum; lungs tubercular.
38	"	' <i>Roger</i> , 'Bull. Acad. de Méd.,' 1875	M., 5	Patient admitted for rheumatic fever; had been ill for 4 mos. before with mitral disease. The heart was wounded during operation, but no ill effects followed.	Aspirator in 6th left space, 1 cm. (½ inch) under apex beat	Serum, then blood—200 cc. (7 oz.)	Relief. D.	Morbus cordis (mitral); adherent peric.

39	"	<i>Labrie</i> , quoted by Roger	Patient died of heart disease 6 mos. later 5 weeks ill with pain in the left side, thought to be pleural	Trocar in 5th left space, 2 inches inside nipple line	Pus—1000 cc. (35 oz.)	D.	Pleura adherent; 31 oz. of reddish serum in peric. 630 cc. (22 oz.) in peric.; pleuritic effusion; tubercles in pleura and peric.
40	"	<i>S. Gemell</i> and <i>Gairdner</i> , 'Glasg. Med. J.,' Nov., 1872	Puncture caused great pain. Patient died 2 days after parac.	Aspirator in 6th left space, $\frac{1}{2}$ inch inside nipple line; apparatus did not work well	—	D.	
41	"	<i>Jürgensen</i> , 'Ziemssen Handb.,' v, 134	Patient had acute pneumonia for 14 days. Died 4 days after operation with brain symptoms	Aspirator: 1st puncture 2nd puncture, 3 days later; 1% salt sol. injected	Pus—220 cc. (8 oz.)	D.	Purulent peric. and meningitis.
42	1873	<i>Heath</i> , <i>Barlow</i> , <i>Ringer</i> , 'Practitioner,' xi, 265	Patient had phthisis and later, ascites, which was tapped. Died 7 mos. after commencement of illness, and 2 $\frac{1}{4}$ mos. after first parac. peric.	Aspirator: 1st puncture in 4th left space, 1 inch below, and $\frac{1}{2}$ inch inside, left nipple 2nd puncture in 5th space 8 days later	Pus Serum—3 $\frac{1}{2}$ oz. Reddish-brown serum—6 oz.	D.	Tubercular peritonitis; peric. contained half a pint of straw-coloured fluid.
43	"	<i>Bouchut</i> , <i>Dantos</i> , 'Gaz. d. Hôp.,' 1873, 142	Patient had pleuritic effusion on left side for 6 weeks; parac. peric. 8 times. Death 3 days after the last, 34 days after the first parac. Heart wounded twice without bad result	Trocar in 5th left space, 1 $\frac{1}{2}$ in. from edge of sternum: 1st puncture 2nd puncture 3rd puncture 4th puncture 5th puncture (heart pricked) 6th puncture 7th puncture 8th puncture (air entered)	Serum 320cc. (11 $\frac{1}{2}$ oz.) Reddish do. 510cc. (17 $\frac{1}{2}$ oz.) Bloody do. 150cc. (5 oz.) Dry — Bloody do. 220cc. (8 oz.) Bloody do. 150cc. (5 oz.) Chocol. do. 330cc. (11 $\frac{1}{2}$ oz.) Dry — Total... 1680cc. (58 $\frac{1}{2}$ oz.)	D.	800 cc. of chocolate coloured fluid in peric.

Case.	Date.	Author and reference.	Sex and age.	Clinical history.	Method and place of operation.	Nature and amount of fluid.	Result.	Post-mortem record.
44	1873	<i>Villeneuve</i> , 'Gaz. Med.,' 1875	M., 5½	Traumatic peric. after a fall; œdema of skin and fluctuation; after the parac. a fistula formed in the track of the puncture, which discharged serum, and later pus, for 5 months. At the end of 6 mos. the fistula closed. Patient was well 10 mos. later	Trocar in the prominent part of the swelling	Serum—2 syringefulls	R.	—
45	1874	<i>Saundby</i> , 'Ed. Med. J.', 1875	M., 13	Patient had been ill 7 days with pleurisy; died a few hours after parac. peric.	Aspirator in 4th left space, ½ inch from edge of sternum	Pus—30 oz.	D.	Purulent pericarditis; peric. contained 36 oz. of pus; it was villous and adherent posteriorly; small abscesses in lower lobe of right lung.
46	"	<i>Bartlett</i> , 'Lancet,' 1874, 866	M., 20	Patient had been ill with rheumatic fever 14 days; had old mitral disease and recent left pleuritic effusion. Complete recovery in 4 weeks, the fluid in both peric. and pleura being absorbed	Aspirator in 4th left space, 2 inches from middle line of sternum	Bloody serum—14 oz.	R.	—
47	"	<i>Lyon</i> , New York Med. Rec., April, 1867	M., 31	Patient died 16 days after the parac. peric.	2 punctures	Pus	D.	—

48	<i>Ferrari-Bravo and Valloiti, 'L. Med. Rec,' iii, 1875</i>	M., 35	Parac. of the peric. pleura and abdomen. Patient had phthisis	Skin incision, and aspirator in 5th left space, $\frac{3}{4}$ inch from sternum	Serum—10 oz.	D.	Peric.much thickened, containing 3 pints of serum; right lung tubercular; left compressed by pleuritic effusion.
49	<i>Singleton-Smith and Steele, 'Lancet,' 1874, 271</i>	M., 25	Patient had had rheumatic fever four times; had been ill 9 mos. Died 67 days after parac.	Trocar in 4th left space, midway between mid-sternal line and the left nipple	Bloody serum—10 oz.	R.	—
50	<i>Macleod Gairdner, 'Glas. Med. J., 1877</i>	M., 23	Patient had been ill 30 days after getting wet. Peric. was tapped 3 times. Patient died 3 days after the last, 28 days after the first parac.	Trocar in 5th left space, 2 in. from edge of sternum : 1st puncture 2nd puncture (10 days later)..... 3rd puncture (11 days after 2nd).... Trocar and cannula in 4th left space, near edge of sternum	Bloody serum—20 oz. Do. 30 oz. More blood — 15 oz. Blood—2 oz.	D.	—
51	<i>Andrew Callender (not published); record in St. Barth. Hosp. Notes</i>	M., 14	In course of rheumatic fever	Many punctures	Clear serous, once containing cholesterin. Large quantity on each tapping	—	5 min. after puncture from hæmorrhage into peric.; right ventricle torn by trocar about middle of ant. surface, close to ordinary position of the white spot. Chr. peric. effusion; acute tubercular pericarditis and peritonitis, with chr. adh. peritonitis.
52	<i>Sir Eison Bennett (not published)</i>	M., 20	Supposed to be a mediastinal cyst. Case under observation 4 years and 3 mos. Was tapped many times with great relief, and temporary recovery. P.M. showed chr. peric. effusion				

Case.	Date.	Author and reference.	Sex and age.	Clinical history.	Method and place of operation.	Nature and amount of fluid.	Result.	Post-mortem record.
53	1875	Moore, Gooch, G. Johnson, 'Brit. Med. J.,' 1874	M., 13	Patient died 38 days after parac. from rhoea	Trocar in 5th left space, just inside the normal position of the apex beat. 1st puncture 2nd (5 days later) 3rd (7 " 4th (10 " 5th (3 " 6th (3 " Iodine sol. injected after the last 3	Pus 21 oz. 35 oz. 60 oz. 50 oz. 30 oz. 9 oz. Total 205 oz.	D.	1 pint of pus in peric.; fatty heart; abscess in thigh; peritonitis.
54	"	Elliott, Burder, 'Lancet,' 1876; 'Trans. Bristol Med.-Chir. Soc.,' 1878, i, 76	M., 60	Patient had rheumatic fever; was made O.P. 9 weeks after parac.	Trocar in 5th left space, 1 inch inside left nipple line	Serum—42 oz.	R.	—
55	"	Eschwege, Polans, 'Bull. Soc. Anat.,' 1875	M., 60	? Traumatic pericarditis after a fall	Trocar in 8th left space	Dry	D.	2 pints of sero-purulent fluid in peric.
56	1876	Nixon, 'Dubl. J. of Med. Sc.,' 1876	M., 20	Patient had rheumatic fever, with pleurisy and congestion of lungs. Died 6 days after parac.	Skin incision and aspirator (No. 2 Dieulafoy, and then No. 4) in 5th left space, 1½ inch from edge of sternum	Bloody serum—3 oz.	D.	30 oz. of sero-purulent fluid in peric.
57	"	Welch, 'Amer. J. of Med. Sc.,' 1877	—	Patient lived a few days after parac.	Aspirator	Pus—28 oz.	D.	—

58	1877	<i>Hunt, Wilson</i> <i>Fox, Lancet,</i> March, 1877	F., 16	Rheumatic fever (2nd attack)	Aspirator in 5th left space, close to sternum	Serum and a little blood— $\frac{1}{2}$ oz.	D.	12 to 14 oz. of serous fluid in peric; vegetation in mitral valve.
59	1878	<i>Steel</i> , quoted by <i>Wheelhouse,</i> <i>'Med. T. and G.,'</i> 1878, 191	M., 35	Chronic bronchitis. Pa- tient much relieved by parac.	Aspirator	Serum—4 oz.	R.	—
60	1879	<i>Pepper, Rev.</i> <i>'Amer. J. of</i> <i>Med. Sc.,'</i> 1879, April	F., 17	Patient had albumen and casts in urine, which disappeared after ope- ration. Patient much relieved by parac.; could walk about at end of the month. Died sud- denly with ascites 3½ months later	Aspirator in 5th left space, 1 inch inside nipple line	Reddish serum—8 oz.	Relief. D.	Adh. peric; gra- nular kidney; ascites.
61	"	<i>Reitz & Levinson,</i> <i>'Hosp. Tidend,'</i> 1879, 2 R., vi	M., 10	Patient had been ill for 4 weeks with recurrent pneumonia; had 3 at- tacks before parac., and one after, which proved fatal	Aspirator in 5th left space	Pus, blood-stained— "considerable quantity"	D.	—
62	"	<i>Hindemlang,</i> <i>'Deutsch Arch,</i> <i>f. Klin. Med.,'</i> 1879, 452	M., 20	Case of acute pericar- ditis of 2½ mos. dura- tion before treatment. Well marked pulsus paradoxus, with cyano- sis. Parac. performed 3 times. Marked in- creased in urine after operation. Patient was discharged in 6 mos. still cyanotic. Died 9 mos. after operation	Aspirator. 1st, several punc- tures in 5th left space, 5 cm. (2") from sternum ... 2nd, in 5th space, 6 cm. from sternum (2½"), next day ... 3rd, in 4th space, 2 cm. from stern- um (1").....	Failed Serum—300 cc. (10½ oz.) Serum—500 cc. (17½ oz.)	R.	—

Case.	Date.	Author and reference.	Sex and age.	Clinical history.	Method and place of operation.	Nature and amount of fluid.	Result.	Post-mortem record.
63	1879	<i>Hindenlang and Kuesmanl</i>	M., 21	Patient had right pleuritic effusion; puncture was made from right side, but as it drew off two kinds of fluid on pushing needle deeper, K. thought the peric. had been tapped as well as the pleura. Patient quite well 7 mos. after operation	Aspirator in 5th left space, 1½ cm. from nipple line: 1st puncture 2nd puncture	Serum—750 cc. 26 oz.; uncertain how much came from pleura 550 cc. (19 oz.) from pleura 250 cc. (9 oz.) from peric.	R.	—
64	"	<i>McCall Anderson</i> , 'Glas. Med. J.', 1879, 214	M., 17	—	Aspirator in 5th left space, 1 inch from nipple line	Serum—38 oz.	R.	—
65	"	<i>Viry</i> , 'Union Médic.', 1879, 3 s., xxvii, 315	M., 22	Pneumonia, right base. 1 week later pericard.; no friction. 7 days later parac. Next day parac.; cannula left in. Died 12 hours later	Aspirator, trocar, and cannula. In 5th left space, 3 cm. from edge of sternum Two punctures ...	Pus— 43 cc. (1½ oz.) 140 cc. (5 oz.) Bloody serum—2 oz.	D.	Traces of pneumonia; purulent peric.; peric. villous, pouched, containing 2 to 3 litres of pus.
66	1880	<i>P. Kummell</i> , 'Berl. Klin. Wochsch.', 1880, No. 23	M., 22	Rheumatic fever (2nd attack)	Aspirator in 4th left space		R.	—
67	"	Ditto	M., 50	Effusion into left pleura	Aspirator in 4th left space, 4 cm. from edge of sternum: 1st puncture 2nd puncture	Serum— 27 oz. 30 oz. Reddish-brown serum—1180 cc. (41 oz.)	D.	Peric. partially adherent, containing 35 oz. of serum.
68	"	<i>Richard</i> , 'Rec. d. Mem. d. Med. Milit.', 1880, 3 S., xxxvi, 97	M., 28	Patient had been ill 1 month before operation; had left pleurisy after, and died 6 weeks after parac.	Aspirator in 4th left space, 5½ cm. (2 inches) from edge of sternum		Relief. D.	Tubercular pericarditis; peric. contains 2100 cc. (75 oz.) brown, thick almost oily fluid.

69	"	<i>Gee, Stevenson,</i> 'St. Barth. Hosp. Rep., 1881	F., 5½	Patient was ill 3½ mos. with left empyema, which was tapped twice (21 oz. and 3 oz.). Died 14 days after parac. peric. which gave great relief Strumous child. Great relief from operation. Died 14 days later	Trocar in 3rd left space, ½ inch from sternum	Serum—5½ oz.	Relief. D.	Empyema; chro- nic pericarditis.
70	"	<i>E. Wagner,</i> 'Berl. Klin. Wochens., 1881, 361	M., 12		Trocar. 1st puncture to right of sternum, because the dul- ness extended so far 2nd to left of sternum..... 3rd, 14 days later Trocar	Serum—Little " 6 oz. " — Serum—1100—1200 cc. (40 oz.)	D.	Tubercular peri- carditis; tuber- cles in lungs and pleura.
71	1881	<i>Fiedler, 'Jahrb. d. Ges. f. Nat. Heilk. in Dresden,' 1881, 137</i>	F., 25	Patient had general renal dropsy, which dis- appeared after parac.; great increase in urine after operation. Pa- tient left well, and was afterwards a nurse in a lunatic asylum	Trocar. 1st puncture 2nd (8 days later)	Pus— 800—1000 cc. (30—35 oz.) 700 cc. (25 oz.)	D.	Purulent pericar- ditis; cor. vil- losum; recent vegetations on aortic and mitral valves.
72	"	Ditto	M., 25	Rheumatic fever. Pre- liminary exploration with injecting syringe; increase of urine after operation	Trocar. 1st puncture 2nd (3 days later)	Pus— 800 cc. (28 oz.) 1500 cc. (52 oz.)	D.	Purulent pericar- ditis; caries of 8th & 9th dorsal vertebrae, with abscess, under pleura. No con- nection with pe- ric. found.
73	"	Ditto	M., 30	5 weeks ill with right pleuritic effusion. Pre- liminary exploratory puncture. Increase of urine after operation				

Case.	Date.	Author and reference.	Sex and age.	Clinical history.	Method and place of operation.	Nature and amount of fluid.	Result.	Post-mortem record.
74	1881	<i>Hunt, 'Lancet,'</i> 1881, May	M., 28	Patient had aortic disease; peric. friction developed. The trocar wounded the heart and was withdrawn; no harm was done	Trocar in 4th left space, near the sternum	0	D.	Peric. adherent in places, but contained a large amount of fluid.
75	"	<i>Pitts, Harley</i> (not recorded), from St. Thos. Hosp. Notes	F., 28	Rheumatic fever 1 mo. before admission; dyspnea 1 week. Melancholia, with delusions, during convalescence. Left 4 mos. later quite well, but had been employed for some weeks previously as a scrubber in the hospital	Skin incision and aspirator in 5th left space, 1½ inch from edge of sternum	Bloody serum, which coagulated immediately— 9 oz.	R.	—
76	"	<i>Rosenstein</i> <i>Hierson,</i> 'Berl. Klin. Wochsc.,' 1881, xviii	M., 10	After twice tapping the peric. a free incision was made, which gave exit to a very large quantity of pus; operation was antiseptic, and drainage tube inserted. Discharge lasted 68 days, during which time the left pleura was laid open for empyema. 1100 cc. and 1000 cc. had been removed by parac. previously	Trocar in 4th left space, close to edge of sternum. 1st puncture 2nd puncture Free incision	Pus— 620 cc. (22 oz.) 120 cc. (4 oz.) Large quantity	R.	—
77	"	<i>Douglas Powell,</i> from private notes	M., 17	3 mos. ill from "inflammation of the lungs." Died 3 days after operation	Aspirator; after preliminary exploration, in 5th right	Bloody serum—17 oz.	D.	Dense-walled pericardium; sac contained 25 oz.