

**Purulent pericarditis following pneumonia : pericardotomy; drainage; subsequent empyema; operation followed by erysipelas and axillary abscess; recovery / by F.C. Shattuck and Charles B. Porter.**

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OPERATION FOLLOWED BY ERYSIPELAS AND  
AXILLARY ABSCESS; RECOVERY

BY

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## PURULENT PERICARDITIS FOLLOWING PNEUMONIA.

PERICARDOTOMY; DRAINAGE; SUBSEQUENT EMPYEMA;  
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LARY ABSCESS; RECOVERY.

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sician to the Massachusetts General Hospital;*

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*Professor of Clinical Surgery, Harvard Medical School; Surgeon to  
the Massachusetts General Hospital.*

E. W. C., twenty-six years old — of good habits, family and previous history, and of rather slight build — came down suddenly October 22, 1895, with general malaise. Physical examination was negative, and everything pointed to the diagnosis of influenza except a white-cell count of 17,900. There was no rigor, only chilly sensations.

October 25th. The diagnosis was established by the development of consolidation at the right lower back, extending forward through the axilla into the right front in the next few days.

October 28th. A loud friction râle, accompanied with pain, appeared over the whole cardiac area. White cells 26,400.

October 31st. Pericardial friction very faint, but no effusion could be detected.

November 2d. The pneumonia seemed to be clearing in a measure; pleural friction was heard in the left axilla; pericardial friction had disappeared.



November 6th. For the first time signs of notable pericardial effusion were detected, the heart sounds being faint and dulness extending half an inch to the left of the left nipple.

November 9th. Signs indicate a diminution in the amount of pericardial effusion. Fine crackling râles in left axilla.

November 14th. Pericardial effusion has increased again. Dulness one and one-half to two inches beyond left nipple.

November 18th. Nausea and vomiting rendered rectal feeding necessary. Paradoxical pulse. White count 12,950.

November 22d. Paradoxical pulse very marked. Condition critical. On consultation with Dr. E. G. Cutler, the pericardium was aspirated in the fifth intercostal space, about one and one-half inches to the left of the left nipple, and 16 ounces of sero-purulent fluid were removed—specific gravity 1.021, albumin one-fourth per cent., cultures show pneumococci. The pulse and stomach showed marked improvement after the aspiration. The reason for tapping in the above place will be set forth in a paper soon to be published.

November 23d. Pulse irregular and weak; temperature steadily rising the last few days; respiration irregular, with a suggestion of the Cheyne-Stokes type; dyspnea in irregular attacks; slightly delirious.

November 24th. The pericardial effusion was again fully as large as before the aspiration, and it was evident that nothing but incision and free discharge of the sac could save the patient; and, upon consultation with Dr. C. B. Porter, operation was decided upon and immediately performed.

At the consultation it was decided to approach the pericardium at the point where aspiration had previously been done. A curved incision was made,



exposing the fifth interspace at the left of sternum. Incision carried down between ribs, and pleura was opened one and one-half inches to the left of the sternum, in the fifth interspace. The aspirating needle was introduced through the first opening, and purulent serum escaped under considerable tension. Pericardium seized with forceps and opened. A stream of purulent fluid gushed out, spurting 12 to 18 inches above patient, especially on any expiratory effort. The effect on the pulse was a striking improvement (observed by Dr. M. H. Richardson) in quality, tension and volume. Amount of fluid estimated at about one quart. Pericardium douched out with sterile salt solution, and two soft rubber tubes put into pericardium, which was first secured by four silkworm-gut sutures that passed through muscles, and two carried through the skin. Absorbent dressing. Enema: brandy, one ounce; coffee, three ounces; digitalis, twenty minims. Pulse greatly improved after operation, but no immediate effect on respiration was noted. Dressing changed after eight hours, a large amount of discharge soaking dressing (not foul). Fluid from pericardium contains fibrin flakes. Cultures show pneumococci. Pulse after coming out of ether 130. Sleeps four to five hours, with one-eighth of a grain of morphia. Breathing easier. Pneumothorax present. Tympany at top of left chest, with absence of respiration. Supplementary respiration right lung. Liquids, two ounces every hour; oxygen, every twenty minutes for three hours.

November 25th. Large amount of discharge during night saturating a large dressing. Siphon tubes arranged to collect discharge. The two-and-fro suction of air, apparently into pleura, has ceased, and tissue is close around tubes.

November 26th. Tubes work well. Amount of



thick pus collected from them eight ounces. Pericardium washed out with normal salt solution. The tube out of which the pus does not drain was selected as the one through which to put the salt solution. The outflow was immediate through the other tube. The amount injected was measured and compared with the amount coming out, thus any danger of distending the pericardium was obviated. Washings very thick. Does not disturb patient.

November 27th. Washed out this morning, condition better. Not as stupid. Pulse better. Taking liquids, 40 to 60 ounces daily. Brandy, 12 to 15 ounces. Somnolent. Perspiring freely about face and neck. Vomited twice. Wound about tubes tight. Pneumothorax less. Respiration heard fairly over left apex, with some râles. Loud pericardial friction. Respiration easier, 40. Pulse 140, fair, irregular.

November 28th. Washed out this morning at 10 A. M., 8 P. M. and 12 P. M. An attack of dyspnea in the afternoon. Amount of pus collected in last twenty-four hours, two ounces and one drachm. Washings contain many shreds and are rather thick, although they clear much more quickly than when washings were started. Nutritives omitted. Strychnia, one-fortieth of a grain every four hours.

November 29th. Air leaks in around tubes and destroys siphonage. Washed out at 9 A. M. and 3 P. M. A large number of flakes washed out. Washed in through both tubes to-day. Washings come clear very quickly. Has drained very little since morning.

November 30th. Washed out three times. Washings quite clear, few flakes. Tubes removed, and larger one shortened one-third and replaced. Heart's impulse can be felt with tube. Slight discharge on dressing. General condition of patient much better. Respiration irregular. Dyspnea, with tossing about



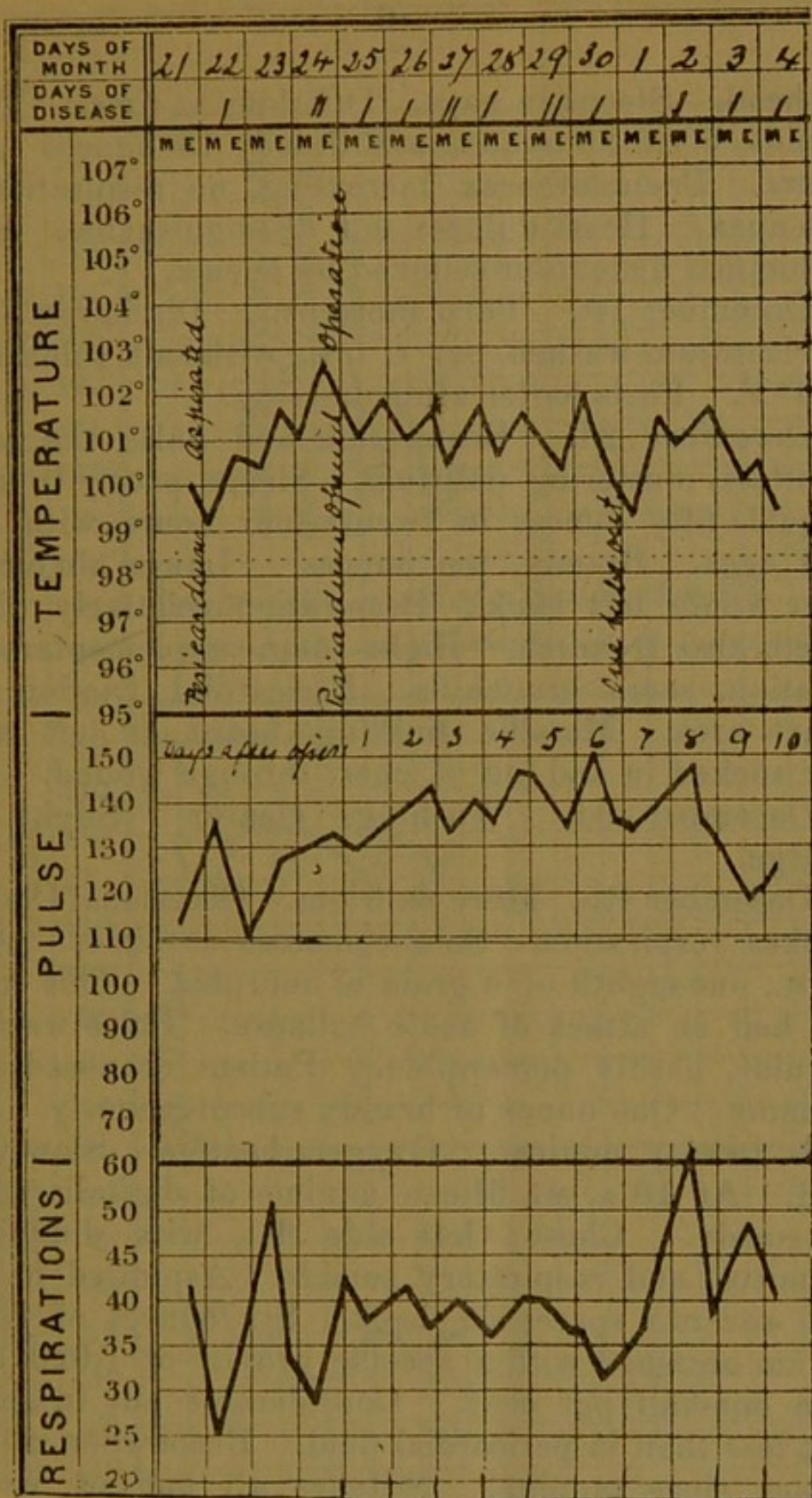


CHART I.— Pericarditis.



of head. Sleeps in naps. Delirious at times. Takes liquids, 60 to 80 ounces, and brandy 15 ounces in 24 hours. Pneumothorax increasing, no respiration at left apex. Heart dulness not distinguishable. Some abdominal distention relieved by enema.

December 1st. Tube shortened. Discharge slight. Pericardium washed out t. i. d. with salt solution at 110° F. Feels better after dressing.

December 2d. Respiration and pulse the same. Restless, muttering delirium. Sleeps poorly in naps. Liquids fifty ounces in twenty-four hours, with toast and eggs. Brandy, ten ounces. Lungs almost flat over whole left back. Respiration relatively diminished, also fremitus. Right lung, supplementary respiration, some bronchitis. Pericardial friction over heart area. Metallic tinkling heard at left apex. Air sucked in and out of chest through wound.

December 3d. Washings clearer. Slight discharge.

December 4th. More delirious. Occasional Cheyne-Stokes respiration. Semi-comatose at times. At 2 A. M., one-eighth of a grain of morphia. This morning had an attack of acute collapse. Pulse weak, irregular, hardly perceptible. Patient cyanosed, skin clammy. One ounce of brandy subcutaneously. Digitalis, twenty minims. Oxygen, heaters. Slowly rallied. At 10 A. M., fifteen minims of digitalis subcutaneously. Chest: left side flat, with diminished fremitus and respiratory sounds. Aspirated in fifth and seventh spaces in back. Six ounces of yellow serum obtained with a specific gravity of 1.020, albumin one-half per cent. Considerable pus in serum, but less than in pericardial fluid. Respiration a little easier since tapping. Stitches all out of wound. Small blind sinus sealed with rubber protective.

December 5th. Tube omitted. Opening into peri-



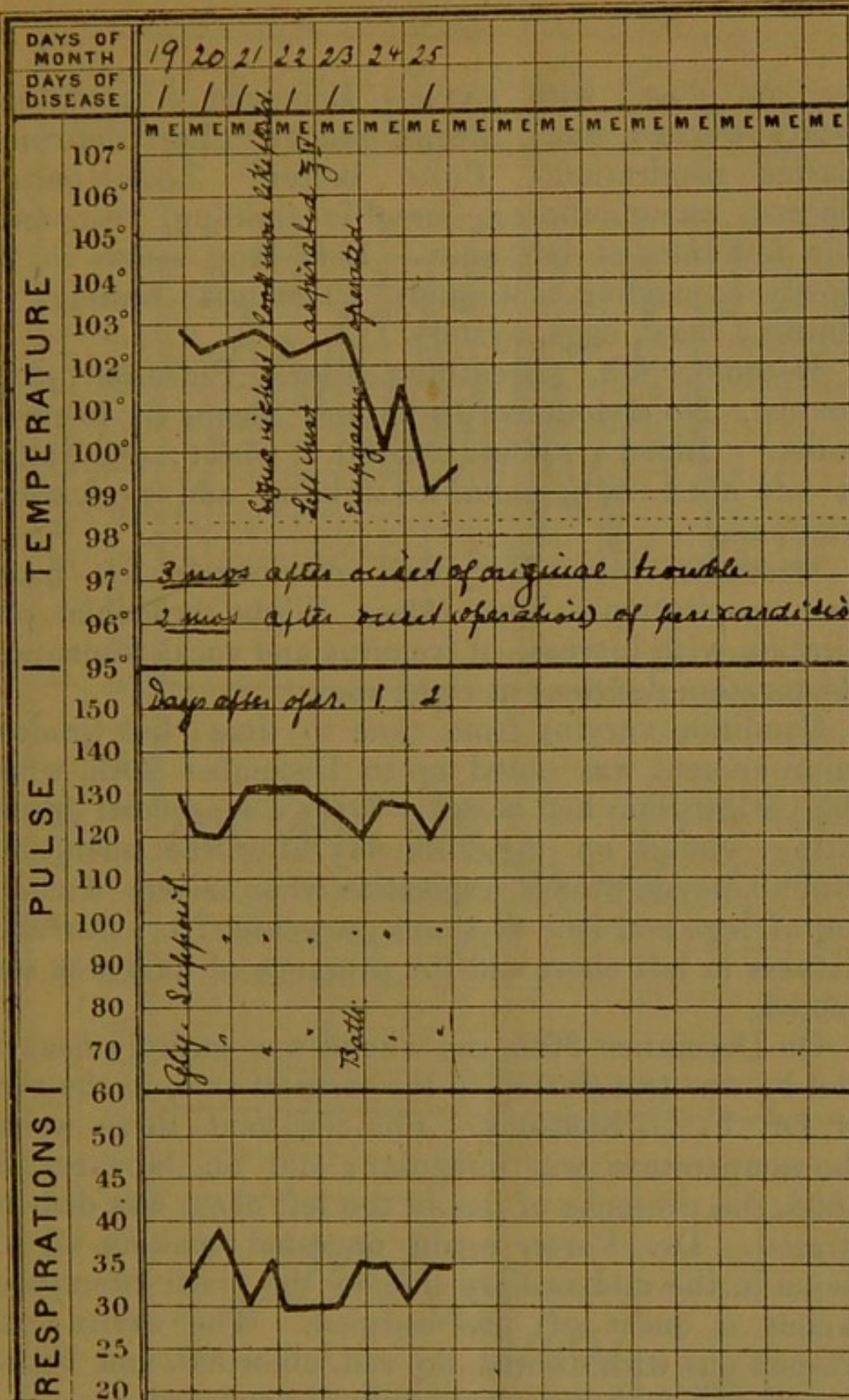


CHART II.—Empyema.



cardium closed with gauze. Removed t. i. d., and cavity washed out. Sleeps quietly. Less delirium. Easier respiration. Pulse better. Looks better. Chest: pneumothorax, metallic tinkling, resonance fair, few râles at left apex. Left lung seems to be slowly expanding. Liquids, 70 ounces; brandy, 10 ounces; toast, eggs, oysters.

December 6th. Breathing easier. Pulse fair, paradoxical. No abdominal distention. Sleeps six to seven hours. Blood: whites, 22,400. Chest: respiration at left apex fair; metallic tinkling and pericardial friction.

December 8th. Very dull over whole left back. Fair respiration. Few râles. Slight bronchial respiration with increase of fremitus and vocal resonance. Respiration deficient at right apex.

Condition varying from time to time; but gradual improvement was noted up to December 20th, when the pericardium had closed. Only a superficial granulating wound on the 26th day after the operation. Much Cheyne-Stokes respiration when asleep. Twitching of legs and face at times (strychnia?). Movable flatness in left chest and the presence of fluid was suspected.

On December 30th the wound was entirely healed, and he was transferred to the medical side, to the care of Dr. F. C. Shattuck. For the next three weeks the temperature was irregular; and on January 23, 1896, the presence of pus in the left chest was demonstrated. Dr. Porter again operated, making an incision in the mid-axillary line in the sixth interspace. About a quart of pus escaped. The cavity was washed out with diluted liq. sod. chlorinat. and boiled water, and rubber drainage-tubes introduced.

Six days later a resection of the fifth rib was found necessary to afford better drainage.



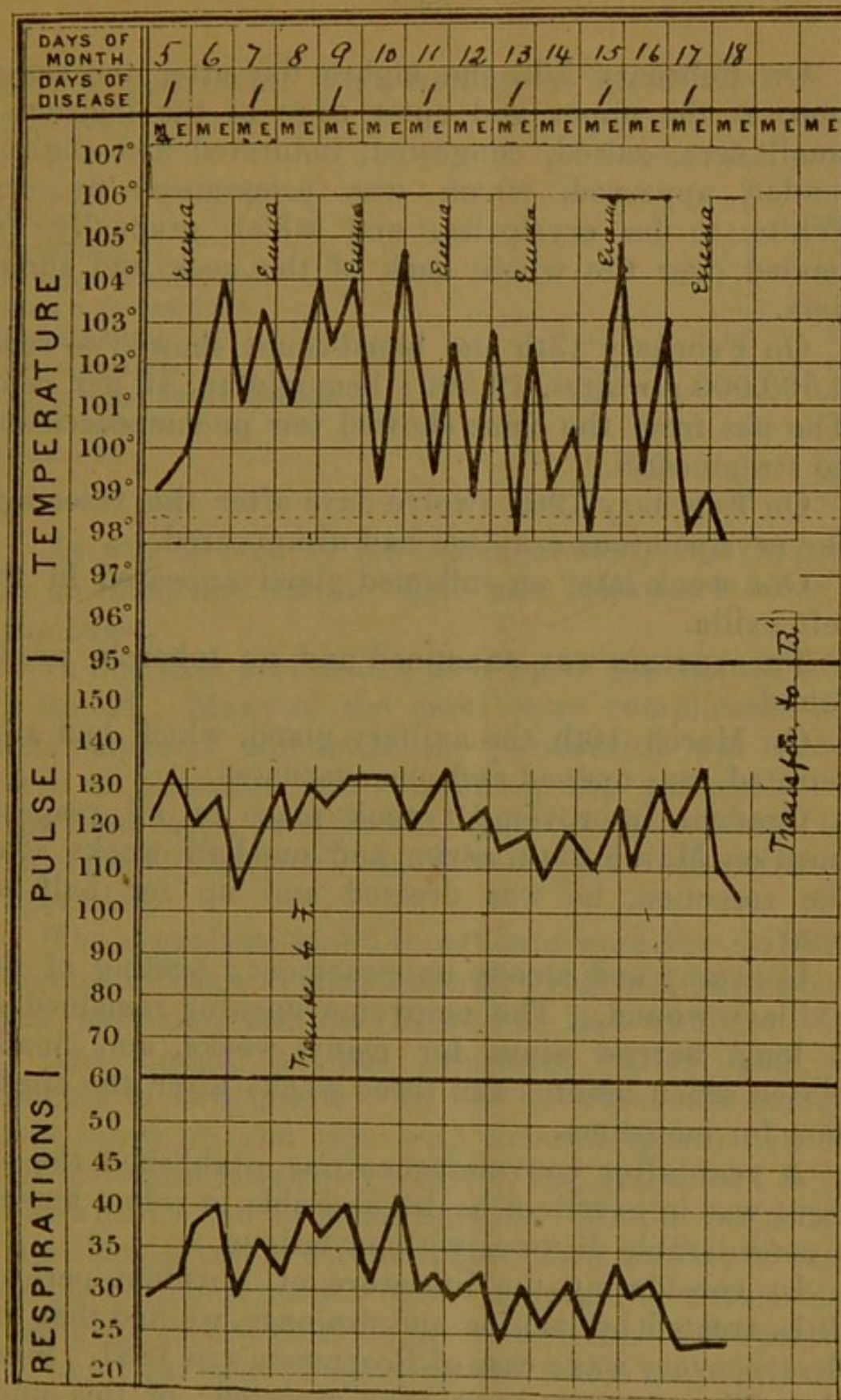


CHART III.—Erysipelas.



On February 7th, the eighth day after the resection, at the upper and outer edge of the incision a small area, raised, congested, indurated and slightly tender, appeared, which was pronounced by Dr. White to be erysipelas, and which gradually extended over the whole back of the neck and shoulders.

On February 13th the blood-count showed — reds, 3,500,000; whites, 19,500; hemoglobin, 40 per cent. The pus from the chest showed few pneumococci and no streptococci.

On February 19th, twelve days after the resection, the erysipelatous eruption had disappeared.

One week later an inflamed gland appeared in the left axilla.

The sputum was examined and no tubercle bacilli found.

On March 10th the axillary gland, which had suppurated, was opened and pus evacuated.

Gradual improvement took place in all respects until on March 25th, seven and one-half weeks after the resection, he was dressed and up for half an hour.

Constant and steady improvement; healing of the axillary wound. The empyema opening remained as a long, narrow sinus for many weeks, and finally closed seven months and three weeks after the operation for empyema.

A year after convalescence was established the patient was in excellent health and able to ride a bicycle a considerable distance without fatigue.

In considering the literature of purulent pericarditis, treated by incision and drainage, we find that the first recovery was a case of Rosenstein's in 1881. Since then 23 more cases have been reported; of this number 8 have recovered, 16 died, and in one the re-



sult is unknown. The etiology of these cases is as follows :

	Rec.	Died.	Total.
Anterior Mediastinitis . . . . .	..	1	1
Primary . . . . .	1	2	3
Empyema . . . . .	1	3	4
Trauma of chest wall . . . . .	1	..	1
Stab in pericardium . . . . .	1	..	1
Pneumonia . . . . .	1	1	2
Osteo-myelitis . . . . .	1	4	5
Pyemia (following abscess) . . . . .	1	1	2
Tubercular . . . . .	..	1	1
Unknown . . . . .	1	3	4
	<hr/> 8	<hr/> 16	<hr/> 24

As will be seen by the table, osteo-myelitis appears as an important cause. One case followed a blow on the chest.

In one case pericarditis developed one month after a wound. Many of the cases were complicated with left empyema, and twice the pericarditis was discovered at operation while draining the empyema. Of the fatal cases, two died at operation; one lived two days; one (Delorme's case) lived eight weeks after the operation.

The organisms found in exudate were the staphylococcus aureus and streptococcus pyogenes, pneumococcus, and colon bacillus (in case of stab wound).

The amount of pus evacuated varied from ten ounces to two quarts. In one (Dickinson's case), it was brownish and thin with arterial blood; in two (Körte's and Eiselsberg's cases), foul and thick; in two (Newman's and Delorme's), thin. In the majority it was thick, creamy, without odor. In a number of cases, large fibrinous masses were found, the pericardium being covered with thick layers of lymph. At autopsy in one fatal case (Pepper's), the whole sac was full of a thick mass of fibrin as large as the fist; the drainage had been good, and the heart probably failed



from pressure of these fibrinous clots. The shortest case of healing of the sinus after drainage was nineteen days, the longest two months.

Preliminary aspiration was done in all cases before opening the pericardium. In a number of cases paracentesis was done more than once, with and without injection of carbolic acid; and incision was finally re-

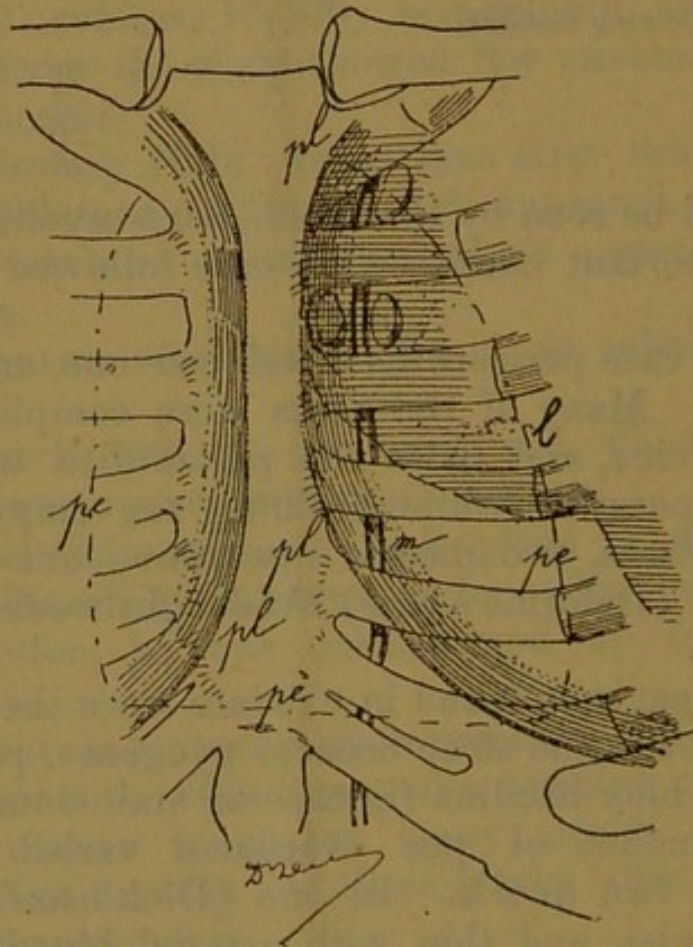


FIG. I.—Normal Contour of Pleura and Pericardium (Delorme and Mignon). pl, pleura; pe, pericardium; l, border of lung.

sorted to owing to the rapidity of the reaccumulation. The immediate relief to pulse and respiration was almost always striking.

With regard to the indications for the operation, we may affirm with confidence that the percentage of recovery after its performance warrants the statement



that it is indicated in all cases of purulent pericarditis, and perhaps in serous pericarditis in cases where aspiration once or twice repeated is followed by reaccumulation of the fluid.

#### THE SURGICAL ANATOMY OF THE PERICARDIUM.

All authorities agree as to the great variations in the line of reflection of the pleura and pericardium.

Sick found that in the adult, out of 23 cases the pleural reflection at the level of the fifth rib cartilage lay either at or within the left border of the sternum in 17; at the level of the sixth cartilage the pleural border had not gone beyond the sternal border in 10; at the level of the sternal articulation of the seventh cartilage it was in nine cases at the sternal border, or this cartilage was below its lower border. Twice it was less than one centimetre from the sternal border.

In 12 children Sick found at the level of the fifth rib cartilage the pleura was either within or just at the sternal border in 11. At the level of the sixth cartilage the pleura had not left the sternal border eight times.

It will thus be seen that, according to Sick's careful observations, even at the fifth space the reflection of the pleura will often be behind the sternal border. Brooks (quoted by Quain) in four out of seven quite healthy cases, found the left pleural reflection entirely behind the sternum, and in one at the sternal border.

According to Luschka (quoted by Quain) the pleura normally diverges from the median line at the upper border of the fifth costal cartilage, so that at the level of the fifth cartilage it is one-fifth centimetre, at the sixth, two centimetres, and at the seventh, 3.5 centimetres, external to the left border of the sternum.

Delorme and Mignon found in 32 adults that in the fourth interspace the left pleural border was within



the border of the sternum in 17. At the level of the fifth cartilage it lay 15 times internal to the sternal border, and 17 times outside. In 12 cases at the fifth interspace the pleural border was at, or inside, the sternal; and in the sixth space the pleural border was outside the sternum in 26 cases, and at or within it in eight.

Dr. Thomas Dwight, Professor of Anatomy at Har-

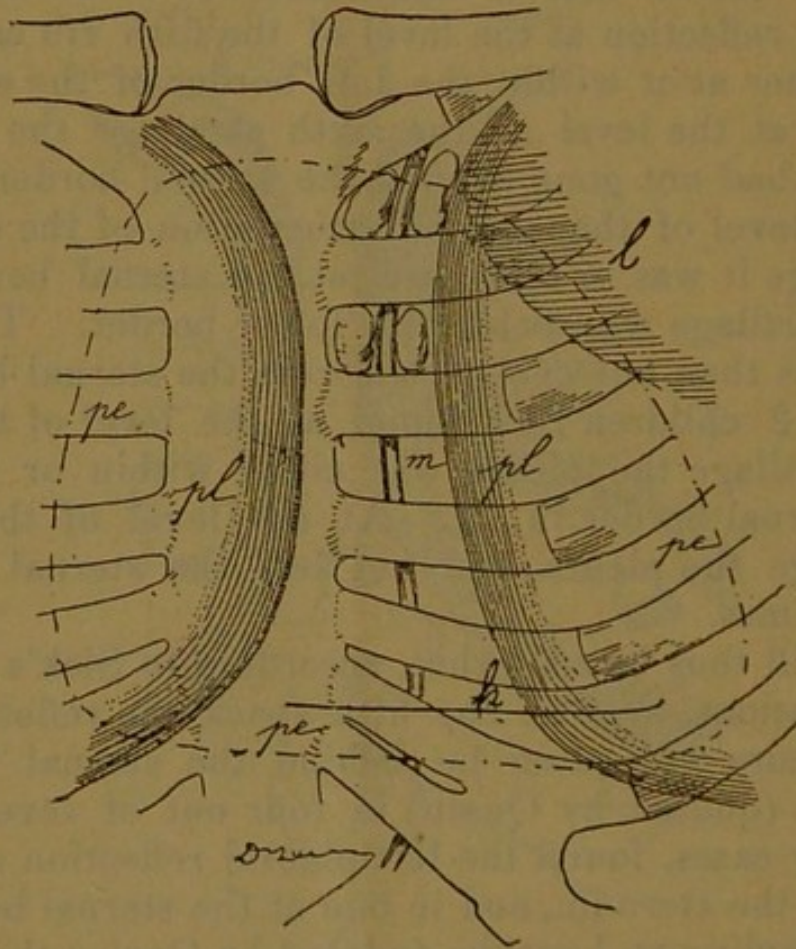


FIG. II.—Line of Pleura, abnormally to left of sternum (Delorme and Mignon). pl, pleura; pe, pericardium; l, border of lung; h, base of heart.

vard University, agrees in the main with Sick's observations, but states that there are many variations, and that frequently it is possible to reach the pericardium through the fifth intercostal space and frequently not. Owing to the fact that the sixth intercostal space



is small and narrow, and that even here the pleura often reaches the sternal border, he concurs with the writer in advising resection of the fifth costal cartilage, and if necessary the excision of a piece of the sternum opposite this cartilage.

The internal mammary artery, according to Quain, runs parallel to the sternum at a distance from it of one centimetre. Delorme and Mignon, in 30 cases,

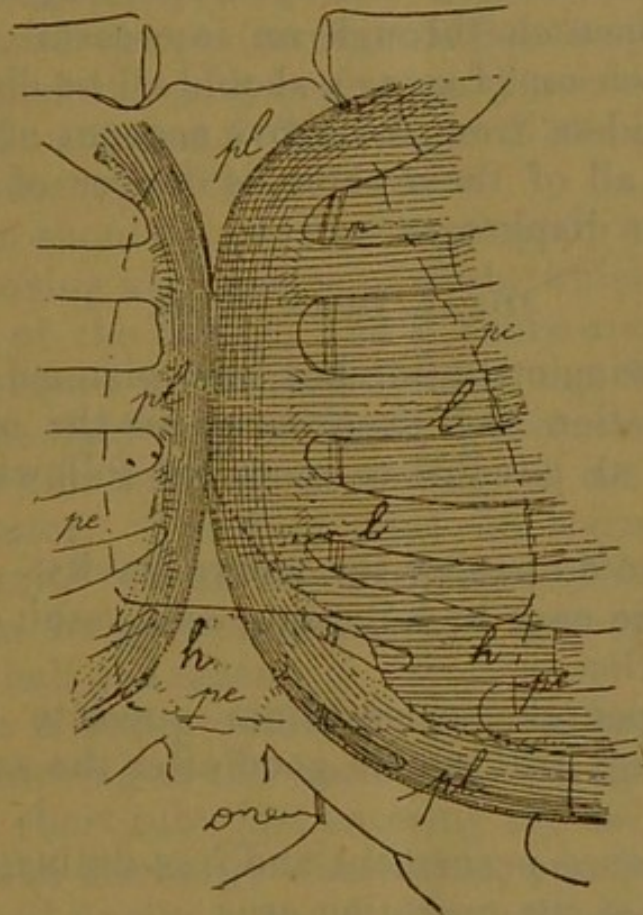


FIG. III.—Left Pleura, behind Sternum, reaching beyond middle line (Delorme and Mignon). pl, pleura; pe, pericardium; l, border of lung; h, base of heart.

found it a distance from the sternum of from one-half to two centimetres, the distance averaging about the same in the first six interspaces.

In looking over the arrangement of the left pleura by Dwight, Delorme, Sick, Quain and Testut, all agree that there is a varied arrangement. Below the fourth



intercostal space in the majority, there is a slight interspace close to the border of the sternum which is free from pleura. In 22 operations on the cadaver by myself it was found that the removal of the fifth intercostal cartilage, and the removal of half an inch of the sternum opposite the sterno-costal joint, gave free access to the normal pericardium near its lowest level.

Three of the methods of operation which have been proposed and practised, namely, trephining the sternum (Riolan), approach through an intercostal space, and epigastric incision (Larrey), should all be discarded, as it will be evident from the above account of the anatomy that in all of them there is danger of wounding the pleura or diaphragm.

#### IDEAL OPERATION.

The following operation has been planned after careful consideration and experiment on the cadaver, in order as far as possible to meet the following indications:

(1) To avoid opening the pleural cavity. This may be made more easy by adhesions as a result of tapping or inflammation.

(2) To open the pericardium opposite the point where drainage will remain good after the sac has contracted.

(3) To secure permanent and free drainage.

The steps of the operation are:

(1) An incision from the middle of the sternum outward over the fifth costal cartilage to its junction with the rib.

The soft parts are cleaned from the cartilage with periosteum elevator, care being taken not to wound the pleura on the under surface. The cartilage is divided with bone forceps from the rib and the sternum. The internal mammary artery and vein are



thus exposed, ligated in two places, and divided between. The triangularis sterni is separated from the sternum and pushed to the left.

A little careful dissection with the director in case fat is encountered, exposes the pericardium, which is normally much thicker than the pleura. An aspirating needle should now be introduced, if this has not been previously done, in order to corroborate the diagnosis. If confirmed, the knife should follow the needle. The incision in the pericardium is best made obliquely downward and outward, beginning close to the excised border of the sternum. The edges of the pericardium should be stitched to the soft parts.

Irrigation should always be employed, with the object of removing any masses of fibrin which may lie at the bottom of the cavity; and if there are many such masses, it should be continued until the fluid returns clear.<sup>1</sup> The fluid may be weak sublimate or carbolic solution, or salt solution, according to the preference of the operator. The fluid must be warm, and must have free exit.<sup>2</sup> With this exception no harm has resulted from irrigation, which has been practised in more than half the cases.

Drainage is best provided by two rubber tubes, one long and reaching to the bottom of the sac for the inflow, and a short tube just entering the sac for the outflow. As the discharge diminishes, one tube may be removed, and finally gauze drainage inserted. Gauze drainage has proved adequate from the first, but where the fluid is thick or flocculent, tubes give the only adequate facilities for the subsequent daily irrigation.

The after-treatment must, of course, be directed to two ends: first, systemic treatment, consisting of forced

<sup>1</sup> Cf. Delorme's case in which at the autopsy two handfuls of fibrin were found in the pericardium.

<sup>2</sup> Cf. Parker's case of death on the table from distention of the sac by irrigating fluid, which did not have free outflow.



feeding and free stimulation, to maintain the patient's strength; and second, the care of the wound and the maintenance of drainage. The wound should be irrigated daily and the patient, if his strength is sufficient to allow it, turned on his stomach to afford drainage.

The following cases have been reported of recovery from purulent pericarditis treated by incision and drainage:

Rosenstein, in 1881, had the first reported case of recovery. A boy of ten had been sick at home for two weeks, with pain in epigastrium, dyspnea and fever. On entrance there were signs of pericardial effusion. Aspirated twice in left fourth interspace, and a half-pint of pus evacuated. Finally, an incision was made over fourth space close to sternum: careful dissection to pericardium; pleural cavity adherent; large amount of pus evacuated; two rubber drainage-tubes inserted. Closure of sinus in nineteen days, and ultimate perfect recovery.

Gussenbauer. Boy of thirteen, osteo-myelitis of humerus, and pleurisy. Dulness of precordium not noted. Opened in fifth interspace in anterior axillary line, expecting to evacuate an empyema. Found effusion in pleura, and after resecting rib discovered enlarged pericardium. This was opened after aspiration, and pus evacuated. Rubber drainage, irrigation with thymol, recovery.

Davidson. Boy of six. Left empyema. Incision, evacuation of 10 ounces of pus. Ten days later high temperature, with increased cardiac dulness. Incision in fourth left interspace, one inch from sternum. Several ounces of creamy pus, drainage. Perfect recovery in five weeks.

Dickinson. Boy, aged ten. Pyemia from gluteal abscess. Left effusion into pleura and pyo-pericardium. Pleura aspirated nine times, and pericardium



three times; finally, drainage in fifth interspace on right of sternum.

The operation was performed under ether with a narrow-bladed knife thrust along a trocar to right of sternum. Pus, blood and air escaped. Air probably sucked into pericardium by contraction of heart. Boy much better. No right pneumothorax; much discharge from the rubber tube; again in dyspnea; tube stopped up; exchanged for a larger one, and under good drainage immediate improvement. Air always bubbling through the tube with action of heart. Boy on his face three times a day to better drain the back of sac.

In three weeks two to three ounces of pus daily were draining from pericardium. The pus was still sweet. Tube in. In one week more the tube was removed and an oiled-silk wick inserted. In another week all healed. No mention of irrigation.

West's case, 1883. Boy, aged sixteen. Two months after an injury to chest there were signs and symptoms of effusion into pericardium.

Operation, September 14th. Paracentesis, fourth left intercostal space, just under nipple. Thirteen ounces of pus were obtained by aspiration, creamy and without flocculi. One-per-cent. carbolic-acid solution was injected, and allowed to flow out.

September 17th. Again worse. Paracentesis in fifth interspace, left nipple line. Needle passed into enormous cavity, four and one-half inches without touching anything. Pus more flaky, and did not flow well.

Operation under chloroform. Narrow knife thrust along canula as a guide. Two quarts of pus washed out with warm one-per-cent. carbolic solution. Rubber drainage-tube, one-half inch in diameter, inserted. Two ounces of 1-40 carbolic solution left



in cavity. Very free discharge of sweet pus. Next day a soft catheter was inserted instead of tube. Irrigation with weak carbolic solution.

September 19th to 21st. Finger inserted, could just reach pericardial sac. Tube meanwhile washed with carbolic solution, 1-40.

September 25th. Tube removed, cleaned and replaced after washing cavity with carbolic. Cavity holds one ounce.

September 27th. Cavity closing. Very little discharge.

October 13th. Tube shortened. On the 14th it was removed; and on the 17th the incision was closed.

The operation was done September 14th, and the wound closed October 17th. Ultimate perfect recovery in one month.

Eiselsberg. October, 1893. The patient was stabbed with a knife over the heart. The wound healed a month afterwards. Fever, signs and symptoms of pericardial effusion.

January 20th. Trocar inserted in fourth interspace, and a quart of brownish, purulent fluid evacuated with great relief to symptoms.

February 2d. Thirteen days later. Evacuation in same manner of 900 grammes purulent fluid, with much less relief.

February 9th. Again, 1,000 grammes pus.

February 20th. Incision made over fourth left rib cartilage; and after resection of rib the healthy pleura, with lungs moving in it, could be seen. This was pushed aside and held off with iodoform gauze; then came onto a thick, white membrane, which was aspirated and found to contain pus. An incision, four centimetres long, was made, evacuating two quarts of pus. This sac was then irrigated with warm salicylic-



acid solution. The pericardium was sewed to the muscles and two drainage-tubes inserted. The pus contained large fibrin masses. The heart could be easily felt with the finger, beating powerfully.

During the first eight days daily dressing was necessary and irrigation was attended by escape of flocculi of fibrin. On the second day iodoform injections were made through drainage-tubes.

On the 17th day both tubes were removed; they had already been shortened. In four weeks more the wound entirely healed.

The colon bacillus was found in the fluid. It is a question whether it was on the original knife, got in later, or came through the blood. Eiselsberg believes in drainage if rapid reaccumulations occur after tapping, and speaks of the advantages of seeing where puncture goes, and thus avoiding injury to the heart.

Mr. H. Betham Robinson. Male, age sixteen. Complained of sore throat, and on the following day developed diaphragmatic pleurisy on the right side. Six days later an unmistakable pericardial rub. The area of cardiac dulness increased much upwards and to the mid-axillary line laterally. About two weeks from date of pericardial involvement the aspirator was introduced in sixth interspace just behind anterior axillary line. A small amount of pus obtained. Next day a piece of the sixth rib was resected, and left pleura opened. Lung fixed by recent adhesions. Pericardium incised, and pus washed out freely — over two quarts. No irrigation, owing to patient's feeble condition. Drainage-tube introduced, stitched to margin of wound. Tube removed on the sixty-first day after operation, and wound soon healed. At no time was there pus in the left pleura. Patient recovered fair strength. Can walk ten miles, but not equal to active exercise.



The following fatal cases have been collected :

Parker. Case of osteo-myelitis of both tibiæ, later development of pericardial effusion, fever. Aspiration in fourth left intercostal space. Eight ounces sweet, flocculent pus. Marked improvement. In four days return of effusion. A. C. E. mixture. Incision, two inches long, by left sternal border, centre opposite fourth interspace. One inch of fifth cartilage removed. On cutting through perichondrium, distended pericardium presented; this was sewed to chest wall and opened; much membranous pus and large flocculi of fibrin escaped. Irrigation with warm carbolic. Suddenly heart stopped beating, and patient died. Examination showed the sac distended with irrigation fluid, which had no proper escape.

Post-mortem. Lungs not collapsed. Pericardium much thickened, covered with large curds of pus, and layers of lymph.

Bronner. Girl of eleven. During an influenza epidemic, had first pneumonia of right base followed by another consolidation in left apex. In two weeks right empyema developed. A pint and a half of sweet pus was evacuated by incision. Pulse and respiration still remained high, though temperature was normal — pulse 145, respiration 45. Finally, signs of pericardial effusion appeared. Aspiration in fourth left intercostal space, one inch from sternum; pus appeared; incision carried down to pericardium. A quart of pus evacuated; rubber drainage inserted. Great relief after operation.

Temperature and respiration soon rose, in spite of free drainage and daily irrigations with boric acid. No harm resulted at all from these irrigations. Child gradually lost strength, and finally died, three weeks after operation. No autopsy allowed. Pericardial sac was felt to be full of granulations and not obliterated.



W. A. Edwards. In a child of six, symptoms of anterior mediastinitis, later of pericarditis. Aspiration of pericardium showed presence of pus. Drainage with rubber tube after incision in fifth interspace and evacuation of eight ounces of pus. Later, left empyema. Sixteen ounces of pus evacuated. Finally, resection of ribs was done and death followed. At the autopsy it was found that the pericardium was almost universally adherent to the heart, with here and there the intervention of fibrinous masses.

F. J. Newman. Man, age thirty-two, having been sick for three weeks. Symptoms were typhoidal until the week after admission to hospital, when signs of symptoms of purulent pericarditis developed. Aspiration in sixth interspace withdrew eight ounces of thin pus. Marked relief from profound collapse. In two days aspiration again in fourth right interspace, and 46 ounces of pus obtained. Three more times about the same amount was withdrawn at intervals of a few days. Finally, a silver canula was thrust into the pericardial sac. Permanent drainage for two days, with irrigation with carbolic, 1-40. Then incision of sac with bistoury, and large drainage-tube inserted. Profuse discharge. Gradual and steady improvement to convalescence, when chills and bloody expectoration began, and in a few days death occurred. At autopsy there was found empyema on one side, pleurisy on the other; the pericardium, much thickened (not ulcerated); some fibrin; sinus from pericardium was found advancing towards the second intercostal space; much inflammation of anterior mediastinum.

Savory. Boy with pyemia, after large abscess of the shoulder. Left empyema developed later. Twice aspirated. Finally an incision in the mammary line, fifth left interspace, drained pus from localized empyema and revealed a much distended pericardium. This



was opened and 24 ounces of creamy pus evacuated. Drainage and irrigation through catheter; profuse discharge. Child died at end of fifteen days. At autopsy lymph and adhesions were found walling off pleural cavity; parietal pericardium much thickened; good drainage of sac.

William Pepper. Young man of nineteen. Influenza; joint pains; temperature  $104.2^{\circ}$ ; enlarged pericardium. After aspiration drainage by rubber tube in fifth left space; profuse discharge of pus. Lived two days. At autopsy a little pus was found in pericardium, but the whole sac was greatly distended with very large masses of fibrin. Regrets not making much larger incision.

Osler-Halsted. Purulent pericarditis after acute necrosis of bones of nose. Incision in fifth space. Drainage with gauze wick. Excellent drainage up to death in sixteen days.

Mr. Howard Marsh recorded a case of suppurative pericarditis. Male, age fourteen. Admitted to hospital in very exhausted condition. Incision made just below nipple, through an intercostal space. Pericardium bulged forward. Patient died on fourth day. No drainage-tube. Amount of fluid in sac not stated. No irrigation.

Körte. Child of seven. Osteo-myelitis of tibia, pyemia, with staphylococcus aureus. Large area of pericardial dulness; pulse 160; cyanosis. Aspiration in fifth left intercostal space; purulent fluid containing aureus. Resection of fifth rib for two inches from sternum. On opening pericardium a quart of offensive pus was evacuated. Pericardium was covered with an abundant coating of lymph. Irrigation had no bad effect on the heart, which improved after drainage. Abundant discharge for a number of days. Child died on twelfth day. At autopsy the pericardium con-



tained considerable pus posteriorly, with purulent infiltration of myocardium and posterior papillary muscle. As there were also purulent foci in kidneys, an abscess of the heart wall was thought to have ruptured into the pericardium.

Davidson. Boy of six. Pyemia, after necrosis of third metatarsal bone; pleurisy; wandering pneumonia. Signs of enlarged pericardium, which was aspirated and opened in fifth interspace. Eight ounces of sweet pus were evacuated. A rubber tube, three and a half inches long, was inserted. No irrigation. Patient gradually failed and died on seventh day. At autopsy a small amount of sero-purulent fluid in each pleura; heart covered with lymph; drainage good.

Dr. O'Carroll, gives an account of a case of suppurative pericarditis secondary to pneumonia, which had been treated by free and constant drainage. The pericardial cavity contained less and less pus, but the patient died from asthenia two months afterward. The walls of the pericardial cavity were found to be adherent everywhere but in front, where there was about a drachm of pus. The puncture was made in the fourth space, a thumb's breadth internal to the line of the nipple.

Partzensky. Case of serous pericarditis of unknown etiology in a male twenty-three years of age. At the end of the third month of the disease paracentesis was performed and a litre of brownish serous fluid withdrawn. Eleven days later it was necessary to perform paracentesis again, and 100 grammes of pus were evacuated. On the following day an incision into the pericardium was made through the fourth intercostal space, much pus evacuated, and two drainage-tubes introduced. Lavage with a three-per-cent solution of salicylic acid. Death thirty hours after the operation. Autopsy: 100 grammes of pus in



pericardium, fatty degeneration of myocardium, double adhesive pleurisy, and hypertrophy of the right side of the heart.

Klefberg. A sailor, aged nineteen years, had an enormous purulent pericardial effusion following influenza. Puncture and aspiration of 150 grammes of pus. Great cyanosis. Pulse could not be counted. Incision in fourth intercostal space under local anesthesia. More than one litre of pus evacuated. Death on the sixth day. Autopsy: pericardium empty, but pus in right ankle-joint and right sterno-clavicular joint.

Sievers. A woman, twenty-two years old, had purulent pericarditis following a right-sided empyema. Paracentesis showed a sero-purulent fluid; and two days later an incision in the third intercostal space opened the pleura and then the pericardium. Sero-purulent fluid, drainage. Improvement in pulse and general condition. Four days later empyema developed on the left, and pleurotomy was performed. Death occurred six days after opening the pericardium, and a not inconsiderable amount of purulent fluid was found in the pericardial sac. Double purulent pleurisy was also found.

Delorme and Mignon. Two cases.

The first was a male, nineteen years old. A case of empyema following influenza, operated on by Delorme, was followed by pericarditis three days after the operation. The pericardium was opened in the fourth intercostal space by the same operator after a superficial examination, which was all that the moribund condition of the patient would allow. Only a few drops of fluid escaped, and the patient died in a few minutes. The autopsy showed the heart adherent to the whole anterior surface of the pericardium, except at its lower part; 500 grammes of sero-purulent



fluid were collected in the lower and back part of the pericardium, together with a double handful of flakes of fibrin. If the incision had been carried further downward and to the left, this fluid would have been reached. Paracentesis, as ordinarily performed would have wounded the adherent heart.

The second case was a male, twenty-two years old. Tubercular pericarditis and left pleurisy. Incision in the fourth intercostal space. Pleura was opened, and 250 grammes of serous fluid escaped. An incision being made through what was supposed to be the pericardium, and no fluid escaping, the latter was thought to be adherent to the heart, and operation was suspended. Death, eight weeks later, of tubercular meningitis. Autopsy showed heart adherent to anterior surface of pericardium, and a large amount of fluid distending the sac below and behind.

The following case is added to the list, although it is one of serous and not purulent pericarditis, as showing that incision may be of benefit where puncture has failed to permanently relieve.

Rullier. Serous pericarditis. Tapped four times and then injected with iodine, but the effusion returned. The pericardium was incised in the fourth left intercostal space. Recovery was delayed by left bronchopneumonia, but was finally complete.

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