ROBERTS (J. B.)

PARACENTESIS OF THE PERICARDIUM,

WITH AN

ANALYSIS OF FORTY-ONE CASES.

BY

JOHN B. ROBERTS, M. D.,

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PARACENTESIS OF THE PERICARDIUM, WITH AN ANALYSIS OF FORTY-ONE CASES.

When tapping the pleural cavity for the removal of effused fluid was first proposed by Bowditch, as an operation to be considered in cases of empyema or chronic pleuritis, it was looked upon with great suspicion, and was only undertaken after the patient had been allowed to go down-hill under the administration of diuretics, hydragogues, and other inefficacious remedies, until he had one foot literally in the grave. Now, however, thoracentesis is no longer an experiment, but is resorted to by every one, if the effusion be not easily diminished by internal medication. Paracentesis of the pericardium, unfortunately, holds at the present time the position formerly occupied by thoracentesis, though it may be that in time it will come to be as common a procedure as the latter now is.

The operation was proposed as far back as 1649, by Riolan,[1] but surgeons were timid in attempting it, because of the difficulty in making a correct diagnosis, and on account of the supposed danger of wounding an organ so vital as the heart. The obscurity involving thoracic diseases before the ap-

[1] Trousseau's "Clinical Medicine," iii., p. 374.

plication of auscultation and percussion to the unraveling of their mysteries, was doubtless the chief cause; for Van Swieten truly says, "Tentandum esse potius anceps remedium quam nullum." It is likely, therefore, that the doubtful remedy would have been tried, had the surgeon been certain that the presence of large pericardial effusion was the cause of the threatening symptoms. The feeling in regard to the operation is well shown by Mérat,[1] who says that when the report of two successful operations by Romero, of Barcelona, was presented to the Faculty of Medicine at Paris, they did not dare to have it printed in their "Transactions," lest this most delicate operation should thus be sanctioned, and others be induced to undertake it.

Trousseau gives Schuh the credit of being the first one to actually perform the operation, in 1840; but as Romero's cases are mentioned by Mérat in 1819, and as Trousseau mentions Romero's without expressing any doubt as to their authenticity, the latter must have priority by many years. Karawagen and Jowett were also earlier than Schuh. The following table gives all the authentic cases that I have been able to find. I have found a few others mentioned, of which no particulars were given, and have therefore rejected them.

[1] "Dictionnaire des Sciences Médicales," Paris, 1819, xl., p. 372.

OPERATOR.	Date.	Sex and Age.	Mode and Site of Operation.	Recovery.	Death.	Time that Patient survived the Operation.	REMARKS.	Complication.	REFERENCE.
1 Romero.	Before 1819	M. 25	Bistoury and scissors. 5th interspace.	1					Dict. des Sciences Médicales, Paris, 1819, xl., 371.
2 Romero.	Do.	M. 37	Do.	1					Do.
3 Romero.	Do.	M. 45	Do.		1				Do.
4 Jowett.	1827	F. 14	Not stated.		?	Life prolonged.	Hope of recovery.		Günther, Blutigen Operationen, iv., 3, 102.
5 Karawagen.	1839	M.	Trocar. 5th interspace.	1			Hæmorrhagic scorbutic pericarditis. Drew off Oiijss. Quite well five months later.	Scurvy.	British and Foreign Medical Review, July, 1841.
6 Karawagen.	1839	M.	Do.?		1	Life was prolonged.	Scorbutic pericarditis.	Scurvy	Do.
7 Schuh.	1840	F. 24	Trocar. 4th interspace.		1	160 days.	Tapped first in third interspace. Case was one of encephaloid disease of thoracic viscera.	Cancer.	Archives Générales de Médecine, November, 1854.
8 Kyber.	1840	M.	Trocar.[1] 4th interspace.	1			Scorbutic pericarditis.	Scurvy.	Monthly Retrospect of Medical Sciences, Edinburgh, March, 1848, i., 35.
9 Heger.	1841	M. 19	Trocar. 5th interspace.		1	69 days.	Tapped twice. 1,500 grammes and 400 grammes. Drainage-tube left in six hours.	Phthisis.	Archives Générales de Médecine, November, 1854.
10 Schönberg.	1842	M.	Trocar.	1			Hæmorrhagic effusion. Removed 5 lbs. Recovered in six weeks.	Scurvy?	Günther, Blutigen Operationen, iv., 3, 102.
11 Kyber.	1843	M.	Trocar. 4th interspace.	1			Scorbutic pericarditis. Was living one and a half year later.	Scurvy.	Do., and also Monthly Retrospect of Medical Sciences. March, 1848, i., p. 35.
12 Kyber.	1845	M.	Do.	1			Do.		Do.
13 Kyber.	1845	M.	Do.		1	17 days.	Tapped twice. Scorbutic pericarditis.	Scurvy.	Do.
14 Kyber.	184–	M.	Do.	1			Scorbutic pericarditis.	Scurvy.	Do.
15 J. C. Warren.	1852	F. 35	Incision and trocar. 6th interspace.	1			Removed f. oz. v. Left hospital in a few weeks.		H. H. Smith's Surgery, ii., 358.

[1] Sometimes Kyber adapted a syringe to the trocar.

OPERATOR.	Date.	Sex and Age.	Mode and Site of Operation.	Recovery.	Death.	Time that Patient survived the Operation.	REMARKS.	Complication.	REFERENCE.
16 Jobert.	1854	M. 16	Incision and trocar. 5th interspace.	1			Removed 400 grammes. Tapped pleura also for effusion. Under notice three months.	Phthisis.	Trousseau, Clinical Medicine, iii., 370.
17 Béhier.	1854	F. 22	Trocar. 6th interspace.		1	26 days.	Removed 250 grammes. Tapped previously in seventh interspace; no fluid obtained.	Died of pneumonia.	Archives Générales de Médecine, November, 1854.
18 Aran.	1855	M. 23	Incision and trocar. 5th interspace.	1			Tapped twice. F. oz. xxviij and f. oz. xlix. Injected iodine and iodide of potassium.	Phthisis.	Trousseau, Clinical Medicine, iii., 386.
19 Aran.			Do.	1					Id., iii., 391.
20 Aran.			Not stated.	1					Id., iii., 391.
21 Bowditch.	1856		Incision.		1				Id., iii., 391.
22 Skoda.			Not stated.		1				Id., iii., 383.
23 Vernay.	1855	M. 23	Trocar. 5th interspace.		1	21 days.	Tapped twice. First, 500 grammes; second, three days later, 400 grammes. Tapped abdomen for ascites.	Valvular disease.	Half-Yearly Abstract of the Medical Sciences, xxv., p. 95.
24 Trousseau.	1856	M. 27	Incision.		1	5 days.	Removed f. oz. iij. Tapped pleura accidently at same time.	Pleurisy and phthisis.	Trousseau, Clinical Medicine, iii, 364.
25 Wilczkowski.	1857				1	6 hours.	Hæmorrhagic pericarditis.	Scurvy?	Günther, Blutigen Operationen, iv., 3, 102.
26 Wheelhouse.	1866	M. 26	Trocar. 4th interspace.	1			Removed f. oz. iij. Living twenty-three months later. Acute rheumatic pericarditis.		British Medical Journal, October 10, 1868.
27 Roger.		F. 12	Trocar. 6th interspace.		1	1 day.	Removed 780 grammes.	Myocarditis and heart-clot.	Boston Medical and Surgical Journal, 1869, p. 85.
28 Mader.	1868?	F. 68	Aspiration. 3d interspace.		1	15 days.	Tapped twice. First, f. oz. ij. Second time at right of sternum.	Pleurisy.	Half-Yearly Abstract Medical Sciences, xlviii., p. 25.
29 Roger.	1868	F. 11	Trocar. 5th interspace.		1	30 days.	Tapped twice. First, 100 grammes blood; second time, 500 grammes serum.	Pulmonary disease.	Half-Yearly Abstract Medical Sciences, xlix., p. 79.
30 Teale.	1869	F. 27	Trocar. 4th interspace.		1	Few hours.	Tapped twice. Removed f. oz. v and f. oz. vj.	Phthisis?	Lancet, June 12, 1869.

OPERATOR.	Date.	Sex and Age.	Mode and Site of Operation.	Recovery.	Death.	Time that Patient survived the Operation.	REMARKS.	Complication.	REFERENCE.
31 Duncan.		M. boy.	Trocar.		1	Few hours.			Edinburgh Medical Journal, October, 1872, p. 376.
32 Champouillon.		M.		1			Complete cure (Roger).		Gazette Hebdom. de Méd. et de Chirur., November 5, 1875.
33 Chairou.	1872	M. 23	Aspiration. 5th interspace.	1			1,000 grammes. Tapped pleura 1,430 grammes. Walked about and had recovered, but died in forty-nine days of diarrhœa and phthisis.	Diarrhœa and phthisis.	Do.
34 Maclaren.	1872	M. 27	Incision and trocar. 5th interspace.		1	6 days.	Removed f. oz. xxxv.	Pleurisy.	Edinburgh Medical Journal, June, 1872.
35 Heath.	1873	M. 6	Aspiration. 3d interspace.		1	50 days.	Tapped pericardium twice. F. oz. iij^{ss} and f. oz. vj. Last time in fourth interspace. Tapped abdomen twice.	Phthisis and tubercular peritonitis.	Practitioner, xi., 265.
36 Saundby.	1874	M. 13	Aspiration. 4th interspace.		1	Few hours.	Removed pus f. oz. xxx; probably from rupture of pulmonary abscess.	Pleurisy and abscess of lung.	Edinburgh Medical Journal, March, 1875.
37 Gooch.	1874	M. 13	Aspiration. 5th interspace.		1	38 days.	Tapped six times. Purulent fluid. F. oz. xxj; f. oz. xxxv; f. oz. lx—iodine injected; f. oz. l—iodine; f. oz. xxx; f. oz. xx—iodine.	Peritonitis.	British Medical Journal, June 19, 1875.
38 Steele.	1874		Aspiration.	1			Acute rheumatic pericarditis.		British Medical Journal, October 24, 1874.
39 Bartleet.	1874	M. 20	Aspiration. 4th interspace.	1			Acute rheumatic pericarditis. Removed f. oz. xiv. Walking about in twenty-seven days.		Lancet, December 19, 1874.
40 Elliott.	1875	M. 60	Aspiration. 5th interspace.	1			History of rheumatic attacks. Removed f. oz. xlij. Left hospital in nine weeks as out-patient.		Lancet, January 8, 1876.
41 Nixon.	1876	M. 20	Aspiration. 5th interspace.		1	6 days.	Removed f. oz. iijss.	Pleurisy.	Dublin Journal of Medical Sciences, June 1, 1876.

Paracentesis of the pericardium is indicated when the effusion is large and threatens life, refusing to undergo absorption from the administration of the ordinary remedies. How long we are to wait in given cases, before undertaking operative interference, is a question yet to be determined.

Roger says the operation is not indicated in cases where the effusion results from a general condition that leaves no chance of cure, as in hæmorrhagic scorbutic pericarditis, when it will be soon reproduced as in Bright's disease, or when the patient is the subject of purulent infection. He adds: "Paracentesis of the pericardium remains always an operation of urgency; contraindicated in a general way every time we have reason to suspect a case complicated with some incurable lesion, applicable especially to large acute and chronic effusions of rheumatism and to chronic effusions of which the diathetic nature is not evident. . . . In the immense majority of cases it is only palliative."[1] Admit that the operation is only palliative, if it can be shown that no immediate evil results from its performance (which can be done), should the surgeon hesitate because the patient may die in a few days or weeks of some concomitant disorder? Who would decline to tap an immensely distended abdomen because the patient suffered at the time from incurable hepatic disease, or to draw the fluid from the pleura because the patient was tuberculous? It would seem that Clifford Allbutt, for whom Wheelhouse and Teale each operated, took the most reasonable view of the expediency of the operation. In speaking of Heaton's objection that "in the majority of cases I believe the result has been unfavorable,"[2] he argues that "unfavorable" must mean that the operation itself caused death, hastened the fatal issue, or augmented the suffering of the patient while doing no good whatsoever.[3]

From viewing the preceding table of cases it will be seen that these results have not followed paracentesis pericardii. Therefore, the operation is not open to this criticism, but pro-

[1] *Gazette Hebdomadaire de Médecine et de Chirurgie*, November 5, 1875.
[2] *British Medical Journal*, July 2, 1870.
[3] *British Medical Journal*, July 9, 1870, p. 32.

longs life and gives much relief even in those cases where the patient soon dies.

Various methods were used by the early operators; some thrusting a trocar through the tissues directly into the sac, while others, and Trousseau among them, preferred cutting down, layer by layer, until the pericardium was uncovered, and then puncturing it. Others still even proposed trephining the sternum over the cardiac region, in order to give access to the distended covering of the heart. At the present time, suction, or aspiration as the term now is, is so universally employed for tapping the cavities of the body, and its superiority over the simple trocar and canula is so well established, that there is no longer question as to the most favorable method of tapping the pericardium. The needle used is very small, and therefore makes simply a small puncture, doing little harm should the instrument wound the lung; no air comes in contact with the intrathoracic viscera, and hence there is as little disturbance as possible. And there is, moreover, no opportunity for the pericardial fluid to leak into the pleural cavity.

As to the point of puncture, opinions differ. Roger advises[1] opening the pericardium in the fifth interspace, about midway between the left nipple and the sternum, but a little nearer the former, penetrating directly backward. Dieulafoy[2] recommends the same intercostal space about three-quarters of an inch from the edge of the sternum, because, from experiments in the dead subject, he finds that the maximum distention takes place about the fourth interspace; and that here, and at the fifth interspace, the lung slopes away from the median line. Out of thirty-four points mentioned in the table, this was the point chosen in fifteen cases. Of course, the surgeon should determine, by accurate percussion and auscultation in every case, that point where there exists the greatest amount of fluid between the surface and the heart, and introduce the needle there.

The dangers to be most dreaded are wounding the internal mammary artery, and striking the heart as it is thrown for-

[1] *Loc. cit.*

[2] *Lancet*, December 28, 1872, from *La France Médicale*, December 17, 1872.

ward by the systole. The artery is situated a quarter or hal an inch from the edge of the sternum, and is avoided by tapping at the point recommended by Roger and Dieulafoy. Injury to the heart could be most certainly avoided by having the exhausted air-chamber of the aspirator attached to the needle as soon as it was buried beneath the skin; then, to have the point of the needle sheathed by an appropriate apparatus as soon as it entered the pericardial sac, which would be immediately shown by the flow of fluid into the vacuum of the syringe or air-chamber. Fitch's "dome-shaped trocar," in which the blunt fenestrated canula slides *within* the penetrating trocar, would answer, I should think, if adapted to the aspirator admirably.[1] The fact is, however, that in ordinary cases, where the effusion is sufficient to warrant tapping, there is not so much danger of wounding the heart as was formerly supposed. And, moreover, recent observation has proved that the heart can be punctured with a certain degree of impunity. Eve reports a case where recovery followed the extraction of a large needle from the heart three days after the injury.[2] Dr. Steiner, of Vienna, has shown that needles may be quite safely introduced into either ventricle, provided they are withdrawn at once.[3] Wounds of the auricle, however, are not so innocuous.

In this connection, a most remarkable case, reported in the "Transactions of the Clinical Society of London,"[4] may be mentioned. A woman, aged twenty-seven years, had pleuro-pneumonia, and signs of large pericardial effusion; as she was almost moribund, a trocar was introduced at the fourth intercostal space, but, to the dismay of the surgeon, dark venous blood escaped. The instrument was immediately withdrawn, and the patient, instead of showing unfavorable symptoms, seemed to be relieved of the distress and dyspnœa. She died about four weeks later of a complication of diseases; and the autopsy showed dilatation and valvular disease of the heart,

[1] *See* "Proceedings of International Medical Congress," *Philadelphia Medical Times*, September 16, 1876.

[2] "Remarkable Cases in Surgery," p. 223.

[3] *Medical Times and Gazette*, May, 1873, p. 492.

[4] Vol. viii., p. 169.

but no effusion. This is a valuable case in regard to the risk of striking the heart, for, although the right ventricle was here tapped in error, and one drachm of blood withdrawn, the patient exhibited no shock or distress. On the contrary, the abstraction of blood seemed to relieve the distended heart much better than phlebotomy would have done, as was evinced by the diminution of threatening symptoms, and the decrease of area of percussion dullness. A similar accident occurred to Baizeau, and also to Roger,[1] the former abstracting 100, the latter 220 grammes of blood from the ventricle, without doing any harm, for both these cases also survived the operation.

Some have objected that adhesion of the visceral and parietal pericardium may occur after paracentesis, and thus induce valvular disease, or pathological changes in the cavities of the heart.[2] Kyber took a diametrically opposite view, and considered that adhesions, instead of being feared, are to be looked upon as the condition of radical cure, as was proved by three autopsies which he made of patients dying of other diseases long after paracentesis had been performed.[3] Probably Aran had a similar view when he injected iodine into the sac after evacuating the fluid; at any rate, his case was successful. That the production of adhesions is not an objection of sufficient force to bear much against the advisability of paracentesis in appropriate cases, is shown by the long discussion that has taken place between authorities regarding the agency or non-agency of pericardial adhesions in inducing cardiac disease.[4]

Again, it has been objected that the fluid reaccumulates with greater rapidity after tapping, and that it has a tendency to become purulent. We have not sufficient data to answer this question in the affirmative or negative, but I do not see that the objection is of any more value than in pleurisy, where, if the fluid does reaccumulate, the trocar is introduced again

[1] *Boston Medical and Surgical Journal*, October 12, 1876.

[2] *Gazette Hebdomadaire de Médecine et de Chirurgie*, November 5, 1875.

[3] *Monthly Retrospect of Medical Sciences*, Edinburgh, March, 1848, and also Guenther, "Blutigen Operationen," IV., iii.

[4] Hayden's "Diseases of the Heart and Aorta," vol. i., pp. 345–366.

and again, and stimulating injections employed until cure results. In Frerich's ward, where thoracentesis is frequently performed, no serous exudation becomes purulent if the instrument be disinfected and the air excluded from the pleural cavity.[1] Why should we, therefore, expect a different result in pericarditis? If purulent pericarditis did occur, a drainage-tube might even be used. Examination of the accompanying table will show that subsequent operations are no more dangerous than primary ones. Omitting the cases of Schuh and Béhier, because in them the first tapping failed to give exit to the fluid, and a second operation was immediately performed, we find that in eight cases paracentesis was done twice, while in Gooch's case it was performed six different times. In this last case the patient lived thirty-eight days after the first operation, or ten days after the sixth, and finally died, having peritonitis in addition to the pericarditis. The shortest interval between the original operation and the second was in Teale's case, where it was demanded in two days. In other cases, the period was as long as twelve, fourteen and seventeen days (Kyber's).

But to return to the questions: Does paracentesis itself cause rapid reaccumulation? and, if so, is the second operation more dangerous than the first? In the first place, there are eighteen cases reported where recovery followed paracentesis without a second operation being necessitated, and in the nine cases where it was required there was additional disease in every case. Secondly, in the nine cases of repeated tapping, eight died; but in all of them there was either disease of the heart or lungs, as in six, or scurvy or peritonitis, as in two cases; and, indeed, the one patient who recovered had phthisis (Aran's). These statistics seem to show pretty conclusively that repeated tapping is not demanded as a sequela of first paracentesis, but is required because the patient's general condition causes a spontaneous reaccumulation, which would occur if the effusion was suddenly removed by any other method that did not at the same time improve his diathesis.

They also militate against the idea that there is decided

[1] *Medical and Surgical Reporter*, September 30, 1876, p. 274.

risk in tapping more than once, for, though it is not proved that these patients died of the accompanying disease, yet it is shown that the fatal cases, where repeated paracentesis was performed, were decidedly unfavorable cases. Therefore, the evidence is of value, though it be negative. More positive evidence is the fact that, in six of the eight fatal cases of repeated tapping, the time of survival after the last operation was one day or more, the average being twenty-four and a third. In only two cases did the patient die in a few hours after the pericardial effusion was withdrawn for the second time.

We have now seen the indications for performing paracentesis pericardii, have selected the method and point of operation, considered the dangers to be avoided, and the objections to be answered; and there only remains to discuss the results, etc., of the operation.

In the table there are forty-one cases recorded. Of these there were:

Males	27 cases.
Females	8 "
Sex not mentioned	6 "

In regard to the age of the patients, there were:

Under twenty years (inclusive)	11 cases.
Over twenty years	15 "
Age not given	15 "

The greatest age at which the operation was done was sixty-eight years; the patient being tapped twice, the last time at right of sternum. She died fifteen days after first tapping. The youngest patient was only six years old; he had the pericardium and peritoneum each tapped twice, but died fifty days after first operation.

The most important item, however, is the success of the procedure, which was as follows:

Recoveries	19
Hope of recovery (probably death)	1
Death	21
Total	41

Counting the one case where there is no final result given as a fatal case, we have yet 46.34 per cent. as the average of recovery, or 53.66 percentage of mortality. This average is certainly a good one, when the almost always fatal result of let-alone treatment is remembered. If the fluid be not evacuated, the quantity increases until the pressure on, and the maceration of, the heart, as well as the injurious tension to which the surrounding intrathoracic structures are subjected, cause the death of the patient after most harassing symptoms, with as much, perhaps, as five pints of pus in the enormously-distended sac.[1]

Barthez gives the mortality of tracheotomy in croup (an accepted operation) in the St.-Eugénie Hospital at about 66⅔ per cent.[2] Why, then, should one hesitate to tap the pericardium in large chronic effusions, when it is seen that its mortality is only 53⅓ per cent.? And, certainly, the danger of hesitating is as great as in croup. So it is, however. A surgeon who would open a child's trachea for croup without the least hesitation, would in many cases let that child's father die from pericarditis with effusion, because he dare not tap the pericardium, and thus remove the agent which was preventing the proper oxygenation of blood as effectually as the membrane in the child's larynx.

This mortality (53.66 per cent.) in paracentesis pericardii is inclusive of all cases found in the table; but it must be recollected that very many of the cases had serious diseases complicating the pericardial effusion.

Among the deaths, there suffered from other concomitant and often incurable disease, seventeen cases. There was no other disease, or at least none mentioned, in five cases. This would make only five cases of death from the cardiac dropsy alone in a series of forty-one cases, which gives the astonishingly low mortality of 12.19 per cent.

Let us look, however, at the results of the operation since the year 1850, for the cases before that time are not fully reported. Since 1850 there are in the table twenty-seven cases;

[1] *See* case in *Boston Medical and Surgical Journal*, February, 1866, p. 29.

[2] Aitkin's "Practice of Medicine," American edition, vol. ii., p. 998.

of which there was recovery (although two had phthisis) in eleven cases; and of which there was death in sixteen cases. Of the sixteen patients who died there was additional disease in thirteen cases, leaving only three cases where the patient seemed to succumb from the pericarditis alone. In other words, taking the recoveries into consideration, there were out of fourteen cases of pericardial effusion, where other disease did not *act* as a complication, eleven recoveries and three deaths.

This gives us a mortality of 21.43 per cent., which, although not as low as that given by the whole number of cases in the table, after throwing out the deaths in complicated cases, yet is as low as the mortality in many other operative procedures, which are considered perfectly justifiable. It may be objected that in these operations there is no election: the surgeon must operate, or the patient die. My answer is, "So it is in cases of large chronic pericardial effusion."

By looking over the table it will be seen that the time of survival after tapping is given in nineteen cases.

Death occurred less than a day after operation in four cases; time not accurately given (life prolonged), in two cases.

In the remaining thirteen cases the longest time was 160 days; the shortest time one day; the average 34.15 days. That is to say, if patients survive more than a day, the average time added to their life after tapping is 34.15 days.

Surely here is a record which should add much force to this plea for the adoption of paracentesis pericardii into the family of accepted operations.

Some authors have spoken of paracentesis of the pericardium with a sneer, as merely a palliative procedure. Well, suppose it is palliative. Do not we excise carcinomatous breasts and tongues for palliation? Doesn't every one tap ascitic bellies, when cirrhotic liver exists, for palliation? Who can estimate the value of thirty days added to the life of a Bismarck; or the numberless political convulsions that would never have occurred had a month been added to the life of a Cæsar?

Especially has success attended the paracentesis of the pericardium in acute rheumatic pericardial effusions, as in the cases

of Wheelhouse, in 1863, Steele, and Bartleet. When the disease becomes chronic, a perfect cure is almost hopeless, even irrespective of the distress produced by the quantity of the effusion. By the long continuance of the inflammation, the maceration of the heart, and the pressure of the distended sac, the tissues have assumed new pathological characters; and one might as well expect to have a perfect joint after chronic hip-disease as perfect hearts after chronic pericarditis.

The time will doubtless come when we shall throw aside our fears, and consider him negligent who does not propose paracentesis pericardii before symptoms become imminent, and employ it as a recognized therapeutic measure in all acute cardiac dropsies which do not rapidly respond to internal medication.

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