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CASE REPORT
Structural intervention

An infusion port for recurrent massive pericardial effusion: a case report

Yuechen Zhao [1], Ying He[2], Fengwei Zou [3], and Xiaofeng Hou [2]*

[1]Department of Cardiology, Nanjing Medical University First Clinical Medical College, 21008 Nanjing, China; [2]Department of Cardiology, First Affiliated Hospital of Nanjing Medical University, 210008 Nanjing, China; and [3]Department of Cardiology, Montefiore Medical Center, 10467 Bronx, NY, USA

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Background Patients with recurrent massive pericardial effusion are at risk of recurrent cardiac tamponade. The current standard of care includes repeat pericardiocentesis or pericardial window when recurrent effusions cause haemodynamic compromise. Here, we report a case of a patient in whom an infusion port was used for drainage of recurrent pericardial effusion. Patient was followed up for 10 months demonstrating convenience and safety of use without evidence of cardiac tamponade.

Case summary We present a patient with recurrent massive pericardial effusion after previously undergoing two difficult pericardiocenteses of posteriorly located pericardial effusion causing tamponade. An infusion port was implanted and periodical follow-up and drainage through the port were performed. During follow-up, there was no evidence of tamponade caused by recurrence of pericardial effusion and no complications from the port.

Discussion Pericardiocentesis can be challenging in certain circumstances such as loculated or posteriorly located pericardial effusion. For patients with recurrent effusion, there is an incremental risk of serious complications with every pericardiocentesis. This case illustrates the feasibility of using an infusion port in recurrent pericardial effusion. After subcutaneous implantation of the infusion port, repeat pericardiocentesis and its related complications were avoided. Later pericardial decompression and intrapericardial administration of medications were simple and safe by accessing the port top.

Keywords Case report • Infusion port • Recurrent pericardial effusion • Drainage

ESC curriculum 2.2 Echocardiography • 6.6 Pericardial disease • 7.6 End-of-life care • 9.9 Cardiological consultations

Learning points

- Infusion port can be useful for drainage of recurrent pericardial effusion.

Introduction

The infusion port, also known as an implantable drug delivery device, has a history of more than 40 years since its inception in 1982. It is widely used for drug infusion and intravenous nutrition in tumour patients. In addition to infusions, it is also used for thoracic and abdominal drainage and drug administration. Here, we described the first case of the use of an infusion port in a patient with recurrent massive pericardial effusion and cardiac tamponade. Through this port, effusion was drained periodically and tamponade was avoided.

* Corresponding author. Tel: +8613770609205, Email: xfhou@njmu.edu.cn
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Summary figure

Dates	Events
2 December 2021	A 40-year-old female with past medical history of multiple site tumours（solitary fibrous tumour of lung, low-grade fibromyxoid sarcoma of pancreas, and mediastinum） presented for elective immunotherapy and chemotherapy. On transthoracic echocardiogram, an incidental moderate–large pericardial effusion 1.46 cm in depth behind the left ventricular posterior wall and 0.5 cm in depth in front of the right ventricular anterior wall was first found on 2 December 2021. The effusion was managed conservatively since the patient was asymptomatic.
April to October 2022	The patient was admitted to the hospital twice due to chest tightness, palpitation, cough, and paroxysmal nocturnal dyspnoea. On chest X-ray, patient's heart shadow was significantly enlarged. Multimodality imaging revealed a large pericardial effusion. During this time, she received twice difficult pericardiocentesis due to posteriorly located pericardial effusion. Fluid analyses indicated that the fluid was exudative in nature and no tumour cells were found.
17 October 2022	The infusion port was implanted subcutaneously after successful pericardiocentesis. Pericardial fluid was drained unobstructedly through the infusion port.
18 November 2022	The patient was followed up, and 420 mL of effusion was drained through the port.
16 December 2022	The patient was followed up, and 250 mL of effusion was drained through the port.
17 January 2023	The patient was followed up, and 400 mL of effusion was drained through the port.
8 March 2023	The patient was followed up, and 250 mL of effusion was drained through the port.
28 April 2023	The patient was followed up, and 500 mL of effusion was drained through the port.
10 June 2023	The patient was followed up, and 650 mL of effusion was drained through the port.
11 July 2023	The patient was followed up, and 500 mL of effusion was drained through the port.
12 August 2023	The patient was followed up, and 500 mL of effusion was drained through the port.
The end of August 2023	During the follow-up of the patient, the family informed us that the patient died of multiple organ failure.

Case presentation

A 40-year-old female with past medical history of multiple site tumours (solitary fibrous tumour of lung, low-grade fibromyxoid sarcoma of pancreas, and mediastinum) presented for elective immunotherapy and chemotherapy. On transthoracic echocardiogram, an incidental moderate–large pericardial effusion 1.46 cm in depth behind the left ventricular posterior wall and 0.5 cm in depth in front of the right ventricular anterior wall was first found on 2 December 2021. The effusion was managed conservatively since the patient was asymptomatic. From April to October 2022, the patient was admitted to the hospital twice due to chest tightness, palpitation, cough, and paroxysmal nocturnal dyspnoea. Our physical examination at the time of the patient's visit revealed enlarged heart boundaries and distant heart sounds. On chest X-ray, patient's heart shadow was significantly enlarged. Multimodality imaging revealed a large pericardial effusion (*Figure 1A–C*). During this time, she underwent two instances of difficult pericardiocentesis for cardiac tamponade due to posterior location of the pericardial effusion. Fluid analyses indicated that the fluid was exudative in nature and no tumour cells were found (white blood cell count $98 * 10^6$/L, red blood cell count $100 * 10^6$/L, lactate dehydrogenase 207 U/L, glucose 5.83 mmol/L, total protein 56.4 g/L, and albumin 33.7 g/L). Serum examination on the same day showed lactate dehydrogenase 182 U/L, glucose 5.57 mmol/L, total protein 81.4 g/L, and albumin 41.4 g/L (details in *Table 1*). The drainage device was a central venous catheter, with an average indwelling time of 4.5 days.

After multidisciplinary discussion, the patient's mediastinal tumour was deemed refractory to chemotherapy and radiotherapy and unresectable and palliative measures were recommended due to the disease progression. Since the pericardial effusion has demonstrated its ability to reaccumulate rather rapidly and could cause significant haemodynamic effects, a pericardial window was recommended. After thorough goals of care discussions, the patient preferred less invasive measures and declined surgical interventions. Considering the technical difficulty and risk of repeat pericardiocentesis, we recommended implantation of an infusion port in the pericardium to drain pericardial effusion when needed. The patient and her family consented to the procedure and an infusion port was implanted (*Figure 1D–G*).

The detailed description of the implantation process is as below: After local anaesthesia, the patient underwent apical pericardiocentesis under ultrasound guidance in the cardiac catheterization lab, and a guidewire was inserted into pericardial cavity. After fluoroscopy confirmed that the guidewire was placed in the pericardial cavity, a catheter was introduced into the pericardial cavity over the wire. A total of 150 mL of fluid was drained through the catheter and a 2 cm skin incision was made immediately to the right of the sternum and in front of the costal cartilage, and the incision was dissected down to the deep fascia layer. The catheter was pulled subcutaneously from the apex to the incision using a tunnel needle. The catheter was then trimmed with a scapel to a final length of 30 cm and locked to the port. The port was embedded and fixated in a subcutaneous pocket, and then the incision was sutured. A needle can be used to puncture the port percutaneously to drainage pericardial fluid, and the position of catheter was confirmed by X-ray. The stitches were removed on Day 7 after implantation and the incision healed well. Computed tomography of the chest after implantation provided a 3D reconstruction of the placement of the port and its catheter in the pericardial cavity (*Figure 1H–J*).

The patient was followed up every 28–35 days, and the effusion was drained through the port each time. The total follow-up time was 10 months. The interval between the third and fourth follow-up visits was as long as 49 days (due to the patient's hospitalization for tracheal stent implantation). At the fourth follow-up visit, the infusion port remained unobstructed. The amount of drainage fluid from the first to the

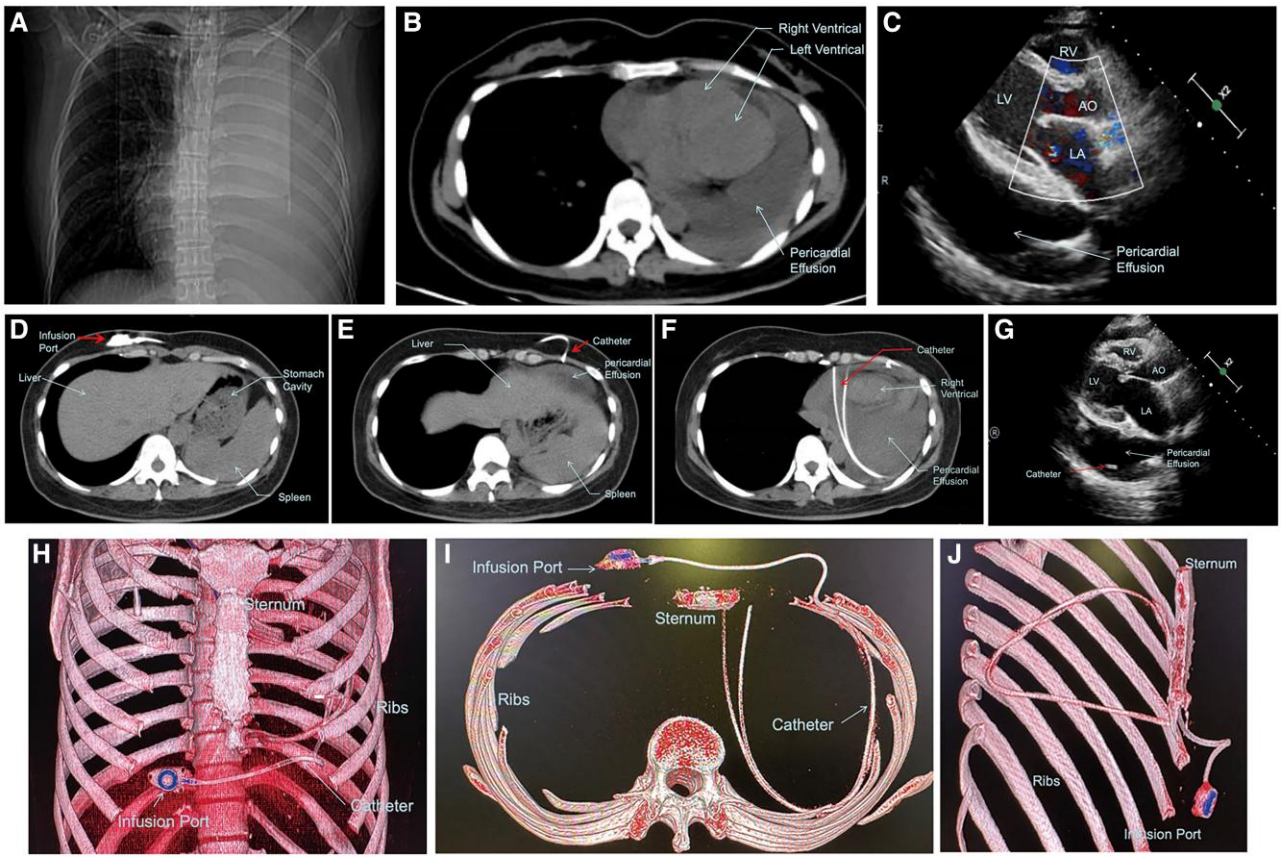

Figure 1 (*A*) Computer tomography (CT) scout image showed there was a large patchy high-density shadow in the left lung. The left hilum and costophrenic angle were not clear, and the heart shadow was enlarged. (*B–C*) CT and transthoracic echocardiography showed a large amount of effusion around the heart. (*D–F*) CT images showed the infusion port and its catheter. (*G*) The catheter in the pericardial cavity was visible on ultrasound transthoracic echocardiography (red arrow). (*H–J*) CT scan provided a 3D reconstruction of the placement of the catheter in the pericardial cavity, showing the complete course of pericardial infusion port.

Table 1 Laboratory test results the same day blood biochemical test/pericardial effusion biochemical test/blood routine test indicated that the pericardial effusion was exudate

Metabolic panel			
Time: 2022-4-16			Type: serum
Inspection items	**Test values**	**Unit**	**Normal reference ranges**
Alanine amino transferase	9.8	U/L	7.0–40.0
Aspartate amino transferase	16.1	U/L	13.0–35.0
Alkaline Pphosphatase	90	U/L	30–120
γ-Glutamyl transpeptidase	14.0	U/L	7.0–45.0
Lactate dehydrogenase	182	U/L	140–271
Creatine kinase	25	U/L	0–145
α-Hydroxybutyrate dehydrogenase	119	U/L	90–180
Total bilirubin	7.2	μmol/L	5.1–19.0
Direct bilirubin	2.9	μmol/L	0.0–6.8
Indirect bilirubin	4.3	μmol/L	0.0–20.0
Total cholesterol	3.04	mmol/L	3.0–5.70
Triglyceride	0.66	mmol/L	0.00–2.25

Continued

Table 1 *Continued*

Metabolic panel			
Time: 2022-4-16			Type: serum
Inspection items	**Test values**	**Unit**	**Normal reference ranges**
High-density lipoprotein cholesterol	0.81	mmol/L	1.03–1.55
Low density lipoprotein cholesterol	1.98	mmol/L	2.60–4.10
Lipoprotein(a)	83	mg/L	0–300
Total protein	81.4	g/L	65.0–85.0
Albumin	41.4	g/L	40.0–55.0
Globulin	40.0	g/L	20.0–40.0
Albumin/globulin	1.0		1.2–2.4
Glucose	5.57	mmol/L	3.90–6.10
UREA	1.97	mmol/L	2.90–8.20
Creatinine	36.2	μmol/L	44.0–133.0
Uric acid	246	μmol/L	155–357
Calcium	2.42	mmol/L	2.20–2.65
Phosphonium	1.04	mmol/L	0.81–1.45

Time: 2022-4-16		Type: pericardial fluid	
Inspection items	**Test values**	**Unit**	**Normal reference ranges**
Color	Yellow		–
Transparency	Clear		–
Rivalta test	Positive (+)		–
White blood cell count	98	$*10^6$/L	–
Red blood cell count	100	$*10^6$/L	–
Neutrophil percentage	–	%	–
Lymphocyte percentage	–	%	–
Eosinophil percentage	–	%	–
Monocyte percentage	–	%	–
Chlorine	105.6	mmol/L	–
Lactate dehydrogenase	207	U/L	–
Glucose	5.83	mmol/L	3.6–6.2
Amylase	35.0	U/L	0–110
Total protein	56.4	g/L	63–82
Albumin	33.7	g/L	–

Routine blood test			
Time: 2022-4-16			Type: whole blood
Inspection items	**Test values**	**Unit**	**Normal reference ranges**
White blood cell count	9.86	10^9/L	3.50–9.50
Lymphocyte count	1.66	10^9/L	1.10–3.20
Monocyte count	0.79	10^9/L	0.10–0.60
Neutrophil count	6.99	10^9/L	1.80–6.30
Eosinophil count	0.40	10^9/L	0.02–0.52
Basophil count	0.02	10^9/L	0.00–0.06
Lymphocyte percentage	16.80	%	20.00–50.00
Monocyte percentage	8.00	%	3.00–10.00
Neutrophil percentage	70.90	%	40.00–75.00
Eosinophil percentage	4.10	%	0.40–8.00

Continued

Table 1 *Continued*

Routine blood test			
Time: 2022-4-16			Type: whole blood
Inspection items	**Test values**	**Unit**	**Normal reference ranges**
Basophil percentage	0.20	%	0.00–1.00
Red blood cell count	4.73	10^{12}/L	3.80–5.10
Haemoglobin	91	g/L	115–150
Haematocrit	31.9	%	35.0–45.0
Mean corpuscular volume	67.4	Fl	82.0–100.0
Mean corpuscular haemoglobin	19.2	Pg	27.0–34.0
Mean corpuscular haemoglobin Concentration	285	g/L	316–354
Coefficient of variation of red cell Distribution width (RDW-CV)	20.50	%	10.00–15.70
Platelet count	403	10^9/L	125–350
Plateletcrit	0.49	%	0.11–0.27
Mean platelet volume	10.20	fl	6.00–14.00
Platelet distribution width	12.60	%	9.00–17.00

Results: pericardial fluid TP/serum TP = 56.4/81.4 > 0.5; pericardial fluid LDH/serum LDH = 207/182 > 0.6; pericardial fluid LDH > 200 U/L.

eighth follow-up visits was 420, 250, 400, 250, 500, 650, 500, and 500 mL, respectively. During the follow-up period, the patient no longer had symptoms of cardiac tamponade and no infection or catheter obstruction occurred.

Discussion

Recurrent pericardial effusion is often seen in cancer patients, especially in patients with metastatic tumours,[1] and pericardial effusion drainage is needed in such patients. In present clinical practice, we use pigtail catheters or central venous catheters for effusion drainage after pericardiocentesis, and the indwelling time of the catheter is usually <4 weeks. Repeated pericardial puncture and/or catheterization increase the risk of complications such as infection, bleeding, and myocardial or coronary artery injury. The procedure can be technically difficult in certain circumstances such as loculated or posteriorly located effusions. Repeated pericardiocentesis in these cases often increases the psychological burden of patients, and some patients wait to seek help until they suffer from severe symptoms of cardiac tamponade, which increases the risk of out-of-hospital death.[2–10]

Infusion port has been widely used for fluid infusions.[11–14] This report used an infusion port to access pericardial effusion drainage chronically for the first time. In this case, no cardiac tamponade occurred after periodical drainage, and the catheter remained unobstructed. This special application reduced the risk of repeated puncture.

Despite its obvious benefits, questions such as the required length of the catheter remaining in the pericardial cavity, the appropriate follow-up period, and whether the nature of the pericardial fluid could affect the patency rates of the port and catheter need to be further explored. In addition, the implantation of the infusion port brings convenience for effusion drainage. While not observed in this patient, expected complications can include infection, arrhythmias, catheter thrombosis, or other causes of occlusion.

Conclusion

This case illustrates the feasibility of draining pericardial fluid through implanted infusion port for patients with recurrent massive pericardial effusion. It can reduce the risk of cardiac tamponade and painful experience in repeated pericardiocentesis.

Lead author biography

Xiaofeng Hou is a doctor of medicine, chief physician, and master supervisor, graduated from Chinese Academy of Medical Sciences, Peking Union Medical College. He works in Department of Cardiology, First Affiliated Hospital, Nanjing Medical University. His research interests include interventional diagnosis and treatment of arrhythmia and pacemaker implantation. He has rich experience in pacemaker implantation and conduction system pacing.

Supplementary material

Supplementary material is available at *European Heart Journal – Case Reports* online.

Consent: The authors confirm that consent for submission and publication of this case report including images and associated text has been obtained from the patient in line with the COPE guidance.

Conflict of interest: None declared.

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Data availability

The authors confirm that the data supporting the findings of this study are available within the article and its Supplementary materials.

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