



# CARDIAC ARREST FOLLOWING RETRIEVAL OF INFERIOR VENA CAVA FILTER: A CASE REPORT AND LITERATURE REVIEW OF PERICARDIAL EFFUSION AND CARDIAC TAMPONADE

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## ABSTRACT

This report presents the clinical details and management of a 58-year-old Caucasian male with pericardial effusion and cardiac tamponade following outpatient inferior vena cava (IVC) filter removal. The patient was unresponsive and experienced cardiac arrest minutes after the procedure, requiring cardiopulmonary resuscitation. After return of spontaneous circulation he displayed somnolence, confusion and chest discomfort. Investigations revealed a large pericardial effusion, and an echocardiography confirmed cardiac tamponade. Prompt intervention involved pericardiocentesis, resulting in haemodynamic stabilisation and reduction in effusion size. The patient responded favourably with treatment. Differential diagnoses were considered and treatment options were discussed, highlighting the importance of timely recognition and appropriate intervention in managing pericardial effusion and cardiac tamponade. This report adds to the limited literature on pericardial effusion and cardiac tamponade following a scheduled outpatient IVC filter removal, emphasising the unique clinical presentation and successful management of this rare phenomenon.

## KEYWORDS

IVC filter retrieval, pericardial effusion, cardiac tamponade

## LEARNING POINTS

- Understanding the link between pericardial effusion and cardiac tamponade following IVC filter removal.
- Recognising and differentiating cardiac tamponade from other emergencies using clinical and diagnostic tools.
- Learning the immediate management of cardiac tamponade, emphasising the role of pericardiocentesis.

## INTRODUCTION

Pericardial effusion is a pathological condition characterised by the abnormal accumulation of fluid within the pericardial

sac enveloping the heart. If left untreated, it can progress to cardiac tamponade, an acute and potentially life-threatening condition that compromises cardiac filling due to elevated



intrapericardial pressure, leading to haemodynamic instability. Timely recognition and prompt intervention are paramount in effectively managing pericardial effusion to mitigate adverse outcomes<sup>[1-5]</sup>.

In this report, we present a unique and rare case of pericardial effusion with cardiac tamponade following endovascular removal of an inferior vena cava (IVC) filter. Our report underscores the critical importance of early diagnosis and emphasises the significant role of timely intervention through pericardiocentesis in successfully managing this challenging condition. By sharing our experience, our objective is to raise awareness, enhance understanding and facilitate improved management of similar cases within the medical community.

## CASE DESCRIPTION

The patient is a 58-year-old male of Caucasian ethnicity with a notable medical background suggestive of a potential prothrombin gene mutation. In 2019, following an arthroscopic procedure on his left knee, he experienced bilateral pulmonary embolism accompanied by right ventricular strain. He was initiated on a prolonged course of apixaban. Additionally, in anticipation of future knee procedures, an IVC filter was surgically implanted in 2021.

The patient presented to the emergency department (ED) from outpatient interventional radiology following unresponsiveness, minutes after IVC filter removal in 2023. During the event, cardiac monitoring demonstrated the presence of pulseless electrical activity. Naloxone was administered and cardiopulmonary resuscitation (CPR) was initiated, resulting in return of spontaneous circulation after approximately 4 minutes. Upon arrival at the ED, the patient remained sluggish despite an additional dose of naloxone given by emergency medical services. He exhibited drowsiness and confusion and reported chest discomfort. A comprehensive review of systems was limited due to the patient's critical condition.

Upon examination the patient presented with somnolence and disorientation, and responsiveness solely to voice. Diaphoresis, cool skin and evident shivering were observed. Cardiovascular, respiratory and abdominal examinations yielded unremarkable findings. The patient also experienced a bout of emesis.

Initial vital signs were stable upon presentation. Laboratory results demonstrated significantly elevated lactic acidosis, sensitive troponin levels and a negative delta.

Other laboratory findings were within normal limits.

Within 1 to 2 hours, the patient experienced a notable drop in blood pressure to the low 60s systolic and developed hypoxia, necessitating 6 L of oxygen therapy and IV fluid boluses. Repeat laboratory tests indicated worsening lactic acidosis and significant metabolic acidosis on blood gases.

A pan CT scan unveiled a moderate-sized pericardial effusion. Bedside transthoracic echocardiography (TTE) confirmed the presence of a large pericardial effusion with evidence of cardiac tamponade physiology. The arterial

line demonstrated pulsus paradoxus, while telemetry exhibited electrical alternans, which was confirmed by electrocardiography. More focused examination revealed distant heart sounds.

*Assessment:* This case involves a 58-year-old Caucasian male with no significant cardiac history, who was on apixaban due to a previous bilateral pulmonary embolism with right ventricular strain following an orthopaedic procedure. The patient presented to the hospital after experiencing cardiac arrest and unresponsiveness following outpatient IVC filter removal by interventional radiology. Clinical and radiographic findings revealed a significant pericardial effusion with suspected cardiac tamponade. The patient was admitted to the ICU for pressor support, and the cardiology department was consulted for emergent pericardiocentesis. The likely reason behind the complication was iatrogenic. It is believed to be secondary to IVC filter removal causing vasculature damage in the context of anticoagulation therapy.

*Management:* The patient received three boluses of normal saline for haemodynamic stabilisation. A bicarbonate drip was initiated to treat severe acidosis, norepinephrine bitartrate was administered and broad-spectrum antibiotics were started for suspected aspiration.

Immediate pericardiocentesis was performed, draining 250 ml of dark blood initially, followed by an additional 600 ml of serosanguinous fluid over 24 hours.

Post-procedure, the patient remained haemodynamically stable without pressor support. A subsequent TTE revealed reduced pericardial effusion and normal right ventricular function.

A repeat TTE conducted after 12 hours showed minimal pericardial effusion. Laboratory findings normalised, and the patient's mental status gradually improved; he only experienced some chest pain, which worsened on inspiration secondary to CPR and pericardial drain.

A contrast-enhanced chest CT scan did not reveal any extracardiac haematoma and showed residual posterior fusion. The pericardial effusion remained minimal and stable. The drain was successfully removed after 2 days due to continued reduction in drain output and stable TTE findings, obviating the need for a pericardial window.

During hospitalisation, the patient experienced intermittent fever spikes. However, blood and pericardial fluid cultures were repeatedly negative. A chest X-ray showed no signs of pneumonia. Antibiotics were discontinued, and ibuprofen and colchicine were administered for pericarditis.

The patient was transferred to the general ward on a heparin infusion with continued trivial pericardial effusion seen on TTE. Subsequently, the patient transitioned to low-dose apixaban and was discharged on colchicine only, with close follow-up by the cardiology and haematology departments.

## DISCUSSION

Pericardial effusion occurs when an abnormal accumulation of fluid collects within the pericardial space, which is located

between the visceral and parietal layers of the pericardium surrounding the heart. This condition can arise from various aetiologies including inflammation, infection, malignancy, trauma or iatrogenic causes. As the volume of the effusion increases, it elevates the intrapericardial pressure. Cardiac tamponade arises when the pericardial effusion restricts the expansion of the cardiac chambers, compromising diastolic filling of the heart. Consequently, cardiac output and systemic perfusion are impaired, leading to clinical manifestations such as hypotension, tachycardia and altered mental status, as observed in our patient. It is crucial to consider and differentiate other potential conditions that may present with similar clinical features, including acute coronary syndromes, pulmonary embolism, aortic dissection and tension pneumothorax. In our case, the presence of pericardial effusion and subsequent cardiac tamponade was confirmed, and it was likely attributed to trauma, possibly resulting from iatrogenic injury during outpatient IVC filter removal<sup>[1-3]</sup>.

The incidence of pericardial effusion and cardiac tamponade following IVC filter insertion or removal is very rare, ranging from 0.1% to 0.6% in different studies. Case reports<sup>[6-8]</sup> highlight the occurrence of cardiac tamponade as a complication of IVC filter removal, emphasising the importance of prompt recognition and intervention. Factors such as filter design and duration of implantation may contribute to the risk of complications, including cardiac tamponade<sup>[9]</sup>. These case reports, alongside a 2015 retrospective study on IVC filter complications<sup>[10]</sup>, collectively underscore the importance of vigilance during the retrieval procedure. Overall, these findings emphasise the significance of promptly recognising and effectively managing cardiac tamponade associated with IVC filter retrieval to optimise patient outcomes<sup>[6-12]</sup>.

There are published case reports demonstrating the migration of IVC filter fragments to the heart, leading to a wide range of clinical presentations. However, complications occurring during or after the procedure of IVC filter retrieval are scarce. To our knowledge, only four cases are reported; they are summarised in *Table 1*. We believe that our case is unique as it is the only reported incidence of cardiac arrest happening soon after the procedure of IVC filter retrieval<sup>[13-16]</sup>.

Regardless of this, the primary goal in managing pericardial effusion and cardiac tamponade is to promptly relieve increased intrapericardial pressure and restore normal cardiac function. Immediate pericardiocentesis – the drainage of pericardial fluid – is the preferred treatment, providing rapid relief by reducing pressure and improving cardiac output. Surgical interventions such as pericardial window creation are typically reserved for recurrent or persistent effusion cases, which was not necessary for our patient<sup>[4-5]</sup>.

Prognosis in pericardial effusion depends on the underlying cause, effusion size and timely intervention. Prompt recognition and treatment, particularly pericardiocentesis,

can lead to favourable short-term outcomes by restoring cardiac function and preventing complications. Reversible causes such as inflammation, infection or trauma generally have better prognoses with appropriate treatment leading to resolution. However, if the effusion is due to malignancy or chronic conditions, prognosis may be influenced by disease progression<sup>[6,7]</sup>.

In our case, the patient responded well to pericardiocentesis, with reduced effusion and improved clinical and radiographic findings. The short-term prognosis is favourable. Close monitoring, follow-up with cardiology and haematology specialists and consideration of long-term management, including anticoagulation therapy, are crucial for optimal long-term outcomes and prevention of recurrence.

## CONCLUSION

The timely recognition and intervention in managing pericardial effusion and cardiac tamponade are crucial. A thorough understanding of the pathophysiology, accurate differentiation from similar conditions and appropriate treatments such as pericardiocentesis are key contributors to favourable outcomes. Our report is unique as it investigates the occurrence of pericardial effusion and cardiac tamponade following outpatient IVC filter removal performed by interventional radiology and leading to cardiac arrest. By presenting a comprehensive analysis of the patient's clinical course and successful management, this report contributes valuable insights to enhance the understanding and treatment of similar cases in the future.

Author, year of publication	Study design	Age and gender	Primary diagnosis	Procedure	Access site	Clinical presentation at the time of IVC filter retrieval	Complication	Time to event	Outcome
Moses et al., 2015 <sup>[7]</sup>	Case report	68, female	Post-Whipple procedure left LE DVT for pancreatic cystadenoma	Aborted retrieval of Meridian retrievable IVC filter (Bard Peripheral Vascular, Tempe, Ariz) because of thrombus superior to IVC filter	Right IJV	Chest pain and shortness of breath	Embolisation of a fragment of the IVC filter, with subsequent perforation of the RV causing moderate pericardial effusion	Eleven months after the aborted retrieval	Survival
Chou et al., 2015 <sup>[48]</sup>	Case report	64, male	Recurrent PEs in protein C and S deficiency	Failure of proper deployment of two IVC filters and entangled retrieval snare in the suprarenal filter; all kept in place and patient was discharged on anticoagulation	Right IJV	Progressive Fatigue	Spontaneous suprarenal IVC strut with the retrieval device penetrating through the IVC into the RA causing pericardial effusion	One year after the aborted retrieval	Survival
Margolin et al., 2020 <sup>[9]</sup>	Case report	74, female	Left LE DVT and bilateral PE following prolonged immobilisation after MVA	Scheduled difficult IVC filter retrieval (Option ELITE – Argon Medical Devices, Frisco, Texas)	Right IJV	Asymptomatic	Filter hook protruded and caused a linear tear in the retrieval sheath with subsequent perforation of the vena caval wall causing cardiac tamponade	10 minutes after retrieval	Survival
Roomi et al., 2020 <sup>[10]</sup>	Case report	49, female	Right LE DVT and right sub-segmental PE with contraindication to anticoagulation	Scheduled difficult IVC filter retrieval	IJV	Asymptomatic	Manipulation of the vasculature and possible migration of small IVC fragments causing cardiac tamponade	1 hour after retrieval	Survival

List of abbreviation. IVC: inferior vena cava; LE: left lower extremity; DVT: deep vein thrombosis; IJV: internal jugular vein; RV: right ventricle; PE: pulmonary embolism; RA: right atrium; MVA: motor vehicle accident; PT: prothrombin; PEA: pulseless electrical activity

Table 1. Summary of reported cases of IVC filter retrieval-related cardiac complications

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## REFERENCES

1. Ivens EL, Munt BI, Moss RR. Pericardial disease: what the general cardiologist needs to know. *Heart* 2007;**93**:993–1000.
2. Vakamudi S, Ho N, Cremer PC. Pericardial effusions: causes, diagnosis, and management. *Prog Cardiovasc Dis* 2017;**59**:380–388.
3. Goldstein JA. Cardiac tamponade, constrictive pericarditis, and restrictive cardiomyopathy. *Curr Probl Cardiol* 2004;**29**:503–567.
4. Bodson L, Bouferrache K, Vieillard-Baron A. Cardiac tamponade. *Curr Opin Crit Care* 2011;**17**:416–424.
5. Stremmel C, Scherer C, Lüsebrink E, Kupka D, Schid T, Stocker T, et al. Treatment of acute cardiac tamponade: a retrospective analysis of classical intermittent versus continuous pericardial drainage. *Int J Cardiol Heart Vasc* 2021;**32**:100722.
6. Cheong XP, Law LKP, Seow S-C, Tay LWE, Tan HC, Yeo WY, et al. Causes and prognosis of symptomatic pericardial effusions treated by pericardiocentesis in an Asian academic medical centre. *Singapore Med J* 2020;**61**:137–141.
7. Sagristà-Sauleda J, Mercé AS, Soler-Soler J. Diagnosis and management of pericardial effusion. *World J Cardiol* 2011;**3**:135–143.
8. Chandra PA, Nwokolo C, Chuprun D, Chandra AB. Cardiac tamponade caused by fracture and migration of inferior vena cava filter. *South Med J* 2008;**101**:1163–1164.
9. Margolin E, Kwan W, Kanjanauthai S, Sohn J. Cardiac tamponade secondary to IVC filter retrieval. *JACC Case Rep* 2020;**2**:873–876.
10. Roomi S, Haq S, Ullah W, Jafar MS, Sherazi M. Cardiac tamponade due to inferior vena cava filter removal: a case report and review of literature. *Cureus* 2020;**12**:e6996.
11. Brian T, Tianzhi An, Eunice M, Russell K, Weiping W. Retrospective Review of 516 Implantations of Option Inferior Vena Cava Filters at a Single Health Care System. *Journal of Vascular and Interventional Radiology* 2016;**27**:345–353.
12. Marquess JS, Burke CT, Beecham AH, Dixon RG, Stavas JM, Sag AA, et al. Factors associated with failed retrieval of the Günther Tulip inferior vena cava filter. *J Vasc Interv Radiol* 2008;**19**:1321–1327.
13. Rossi P, Arata FM, Bonaiuti P, Pedicini V. Fatal outcome in atrial migration of the Tempofilter. *Cardiovasc Intervent Radiol* 1999;**22**:227–231.
14. Buda KG, Urbach J, Rivard M, Knoper RC, Carlson MD, Kohl L. A pericardial pin: embolization of an inferior vena cava filter strut presenting as acute pericarditis. *JACC. Case Rep* 2021;**3**:304–308.
15. Khurana D, Raza J, Abrol S, Coplan NL. Fractured inferior vena cava filter strut presenting with ST-segment elevation and cardiac tamponade. *Tex Heart Inst J* 42:181–183.
16. Ollila T, Naeem S, Poppas A, McKendall G, Ehsan A. Embolization of inferior vena cava filter tyne and right ventricular perforation: a cardiac missile. *Ann Thorac Surg* 2016;**102**:e515–e516.
17. Moses JB, Brown RA, Miller KH, Creswell LL. An unexpected cause of pericardial effusion. *J Vasc Surg Cases* 2015;**1**:100–101.
18. Chou EL, Sgroi MD, Fujitani RM, Kabutey NK. Complex hybrid suprarenal inferior vena cava filter retrieval. *Ann Vasc Surg* 2015;**29**:125.e19–22.