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Short Communication

Sudden Cardiac Death Caused by Migration of a TrapEase Inferior Vena Cava Filter: Case Report and Review of the Literature

Babak Haddadian, M.D., Fareed Shaikh, M.D., Mohamed Djelmami-Hani, M.D., Yoseph Shalev, M.D.
Division of Cardiology, Department of Internal Medicine, Aurora Sinai/Aurora St. Luke's Medical Centers, University of Wisconsin School of Medicine and Public Health-Milwaukee Clinical Campus, Milwaukee, Wisconsin, USA

Summary

Case: A 43-year-old female presented with sudden onset of palpitations, chest pain, and shortness of breath associated with hypoxemia. A helical computed tomography (CT) scan of the chest revealed a large saddle pulmonary embolism. Intravenous tPA relieved the shortness of breath and improved the hypoxemia. Inferior vena cava (IVC) filter (TrapEase, Cordis Corp., Miami, FL, USA) was placed. On day 6 of her hospitalization, she went into cardiopulmonary arrest while walking back from the rest room. The patient died despite a prolonged attempt at cardiopulmonary resuscitation. At that time, ventricular tachycardia and then ventricular fibrillation were recorded. Autopsy of the heart showed the IVC filter entrapped within the tricuspid valve.

Discussion: The incidence of IVC filter migration ranges from 0.3 to 6% with rare migration to the heart or lung (0.1–1.25%). Sudden cardiac death from migration of IVC filter is extremely rare. We report the first case of sudden cardiac death caused by migration of the TrapEase filter to the heart. There are two reports in the literature of death from migrating Greenfield and Antheor filters.

Conclusion: An IVC filter migration to the heart, although rare, can cause serious arrhythmia and sudden cardiac death.

Address for reprints:
Yoseph Shalev, M.D.
960 N. 12th Street, Suite #400
Milwaukee, Wisconsin 53233, USA
e-mail: bdanek@hrtcare.com

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Introduction

Case Presentation

A 43-year-old African–American female with a medical history significant for morbid obesity (body mass index: 51.6 [18.0–30.0]) hypertension, depression, and hypercholesterolemia presented with sudden onset of shortness of breath, palpitations, and chest pain. She denied previous history of myocardial infarction, deep vein thrombosis, pulmonary embolism (PE), hypercoagulapathy, or recent travel. Her medication list included ferrous sulfate, atorvastatin, hydrochlorothiazide/triamterene, ibuprofen, and orgestrel birth control pill. Physical examination was remarkable for temperature of 97.3°F, heart rate of 121 beats per minute, respiratory rate of 20 breaths per minute, and room air pulse oximetry of 85% with mild activity. Initial blood tests revealed elevated troponin at 0.82 ng/mL (<0.10), CK-MB: 2.4 ng/mL (<10), D-Dimer: 8.43 mg/L (0.43–2.80), Na: 130 mmol/L (135–145), K: 3.6 mmol/L (3.5–5), blood sugar: 119 mg/dL (65–99), creatinine: 0.8 mg/dL (0.6–1.1) and calcium ionized: 1.13 mmol/L (1.17–1.31), with blood cell count: 16.1 K/μl (4.2–11.0) neutrophils: 84% and lymphocytes: 11%, hemoglobin: 12.6 gm/dL (12–15.5), platelets: 302 K/μL (140–450), international normalized ratio (INR): 1.0. An electrocardiogram (EKG) showed sinus tachycardia with a rate of 123/min, premature ventricular complexes, tall P waves in inferior leads and T inversion in leads V1-3. A bedside echocardiogram showed a significantly dilated and hypocontractile right ventricle, paradoxical motion and flattening of the interventricular septum, right atrial enlargement with bulging of the interatrial septum towards

the left atrium (Fig. 1), mild tricuspid regurgitation and pulmonary artery pressure of 30 mmHg. A stat helical chest computed tomography (CT) scan revealed a large saddle PE in the main pulmonary artery with extension into all major branches of the right and left pulmonary arteries (Fig. 2 Panel A). A venous duplex of the legs was negative for deep vein thrombosis. Owing to the high-risk PE, 100 mg tPA was administered intravenously over 2 hours. The patient's signs and symptoms improved.

Three days after thrombolytic therapy, the patient underwent an inferior vena cava filter placement with TrapEase filter. Venogram and fluoroscopy showed appropriate caval diameter and position (Fig. 3). Repeat CT scan of the chest revealed that the prominent large saddle embolism had resolved (Fig. 2, Panel B). On day 5 of her hospitalization, the patient developed gross hematuria and abdominal pain for which a CT scan of the abdomen was obtained. The inferior vena cava filter was in place with no sign of migration (Fig. 4). On day 6, while returning to bed from the bathroom, she collapsed and was found to be in cardiorespiratory arrest. Telemetry revealed ventricular tachycardia and then fibrillation. A prolonged attempt at resuscitation was unsuccessful. Autopsy of the heart revealed the TrapEase filter was entrapped within the tricuspid valve with a small clot attached to the filter with no evidence of myocardial infarction (Fig. 5). Autopsy of the lungs was negative for large emboli or infarction.

Discussion

Percutaneous placement of inferior vena cava (IVC) filter is indicated for patients at high risk for recurrence

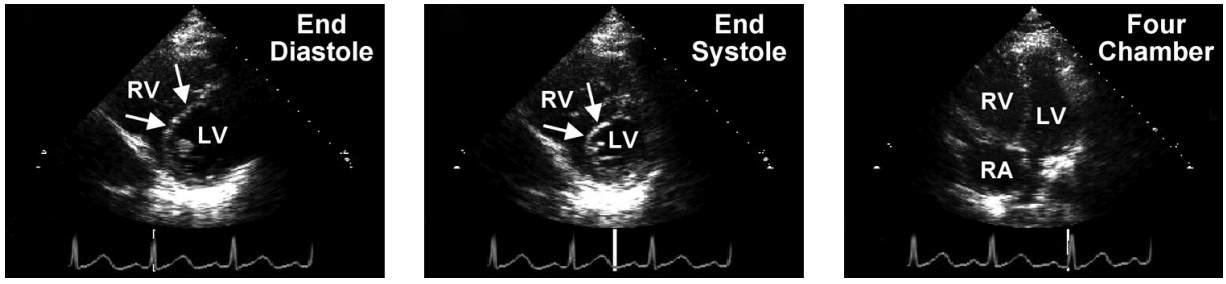


FIG. 1 A 2-D echo. Panels A and B: short-axis view showing RV enlargement and flattening of the interventricular septum due to increased RV pressure. Panel C: four-chamber view showing severe RV dilatation with paradoxical motion of interventricular septum, RA enlargement and bulging of interatrial septum. RV: right ventricle; LV: left ventricle; RA: right atrium.

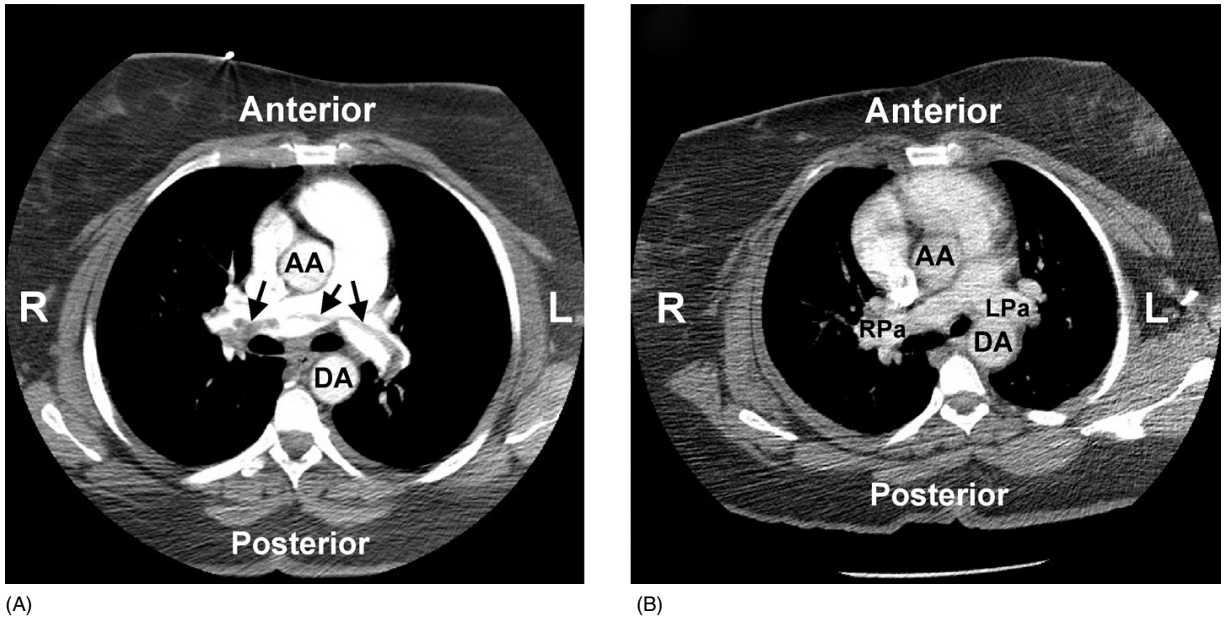


FIG. 2 Chest CT scan with contrast. Panel A: Day 1–saddle embolism seen extending to both main pulmonary arteries (black arrows). Panel B: Day 5–resolution of saddle clot. R: right, L: left; AA: ascending aorta; DA: descending aorta; Rpa: right pulmonary artery; LPa: left pulmonary artery.

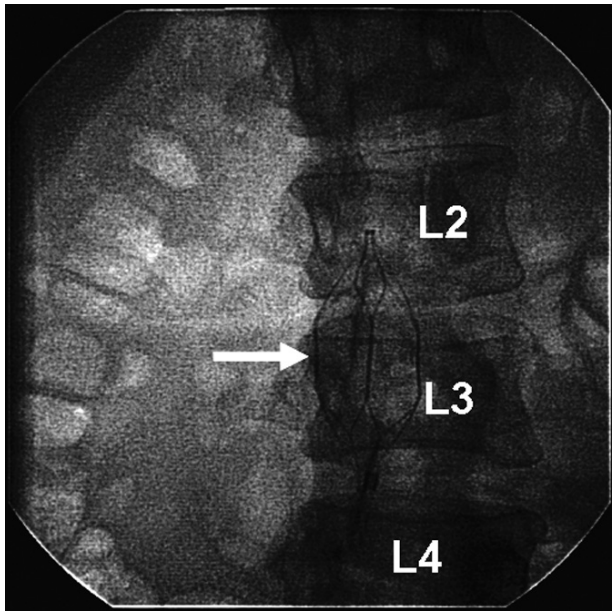
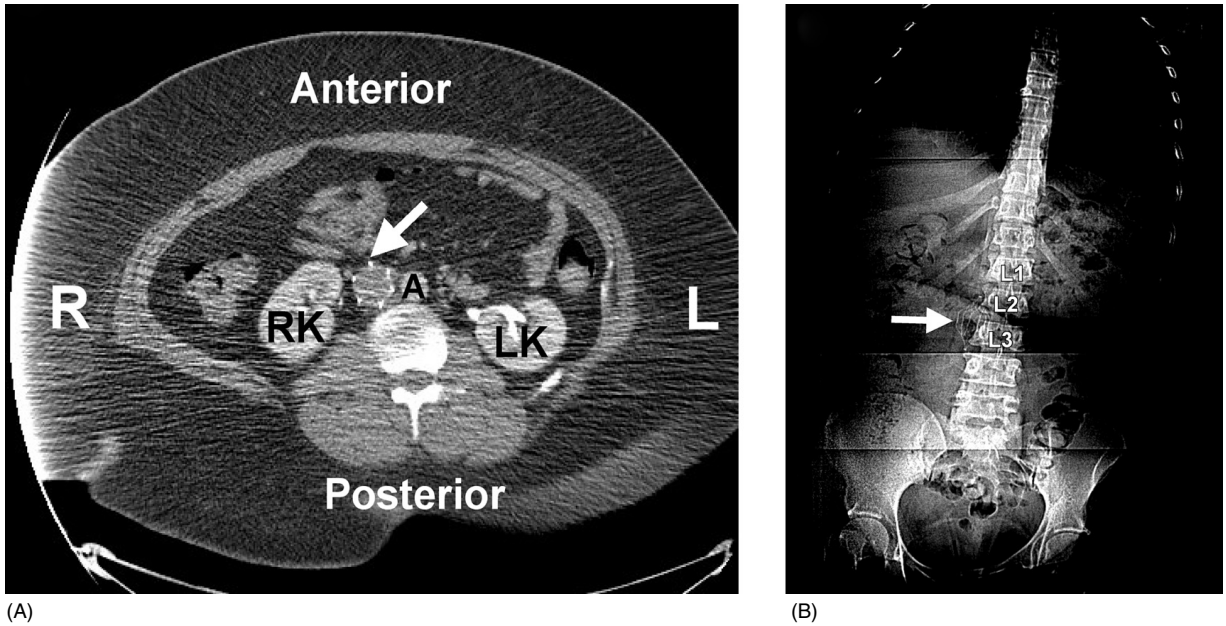


FIG. 3 Fluoroscopy showing IVC filter located between L2 and L3 (white arrow). L: Lumbar spine.

of pulmonary embolism (PE), those with extensive deep vein thrombosis involving common femoral vein or iliac vein, or if there is contraindication for the use of coumadin therapy.[1] Recently, with the availability of removable IVC filters, the indications for IVC filter were expanded to include patients who are at high risk for PE. Our patient met all the criteria for high-risk PE but the source of the embolism was unclear. We assumed that the pelvic veins were the source, although we could not safely exclude an embolization from the legs.

Complications of IVC filter include recurrent PE (2–5%),[1–3] of IVC filter thrombosis (2.7–19%)[4,5] and, rarely, IVC filter migration to the heart or lungs.[4,5] Incidence of IVC filter migration has decreased during the last decade, probably as a result of improved strut design preinsertion venography to measure caval diameter.[2] Sudden cardiac death, as a direct cause of IVC filter migration to the heart, is an extremely rare complication. Izutani et al., in their review of the literature, found 12 reported cases of IVC filter migration of which 5 migrated to right atrium, 5 to the right ventricle, and 2 to the pulmonary artery. Most of the patients were asymptomatic and there were no reports of sudden cardiac death.[6] James et al. reviewed 19 cases of Greenfield IVC filter migration to the heart with one death recorded as being the direct result of migration. The filter in that case was adhered to the myocardium and was not retrievable.[7,8] Bustamonte et al. reported a case of sudden cardiac death in a patient with an Antheor vena cava filter, which migrated to the heart. The patient was rehospitalized 7 days post placement of the IVC filter for abdominal pain and died suddenly a few hours after admission. Autopsy revealed the filter was embedded within leaflets of the tricuspid valve with a small attached clot.[9]

TrapEase filter was approved by the Food and Drug Administration (FDA) in 2000.[1] This device can be used in patients with an IVC diameter 30 mm and smaller. It is magnetic resonance imaging (MRI) compatible[1] and has an advantage in terms of ease of deployment.[10] The only published trial on the TrapEase IVC filter was the short-term prospective follow-up of 65 patients by Rousseau et al.[11] which reported no evidence of filter migration.



(A) (B)

FIG. 4 CT abdomen–axial view (panel A) and coronal view (panel B). Day 6–IVC filter in place (white arrows). (A) abdominal aorta; RK: right kidney; LK: left kidney, L: lumbar spine.

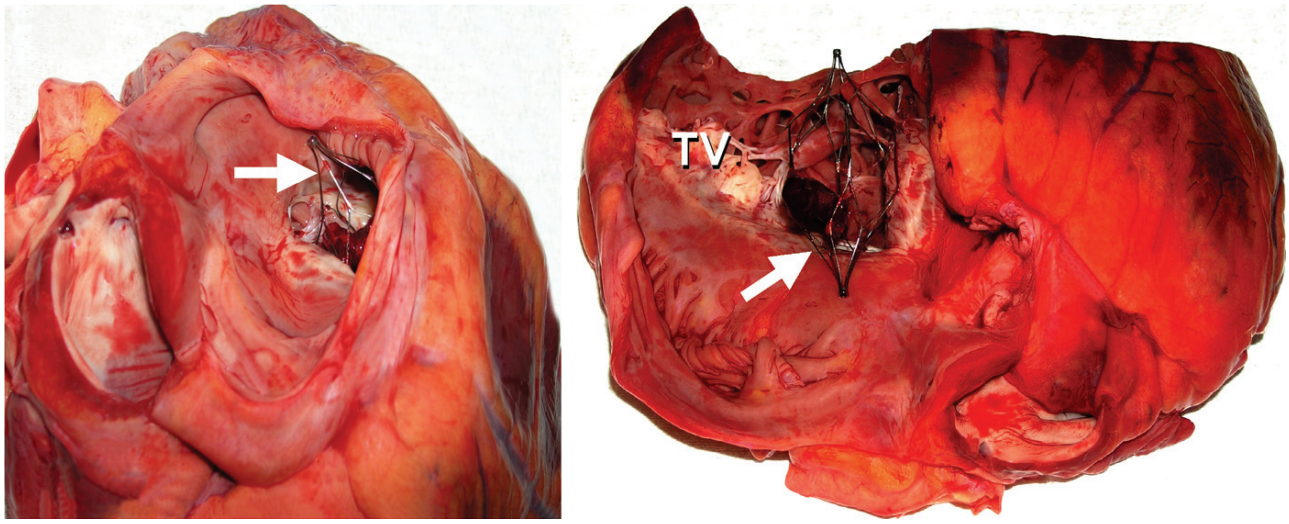


FIG. 5 Autopsy photographs of two views of the heart showing embedded filter within the tricuspid valve with a small clot attached to the IVC filter (white arrows). TV: tricuspid valve. (Photos courtesy of Dr. Robert B. Hall).

Porcellini et al.[12] described a case of TrapEase filter migration to the right ventricle one week after insertion, which resulted in severe cardiogenic shock and paradoxical emboli through a patent foramen ovale to the brain. The filter was retrieved surgically. The cause of filter migration was thought to be a large thrombosis on the filter, which caused increased venous pressure and migration of the filter to the right ventricle.

In our patient, the actual cause of IVC filter migration was unknown. One possible explanation could be the migration of the filter because of an increase in caval pressure secondary to valsava maneuver. Unlike the case reported by Porcellini et al.,[12] there was only a small clot attached to the filter, which would not have created significant obstruction of blood flow in the inferior vena cava, and the autopsy was negative for myocardial infarction or new massive PE. On the other hand, it is probable that the trapped IVC filter within the tricuspid valve caused ventricular tachycardia, then fibrillation and finally resulted in death, whereas, in the other cases, there were no documented arrhythmias reported.

Conclusion

To the best of our knowledge, this is the first case report of TrapEase filter migration to the heart, that caused cardiac death due to ventricular arrhythmia.

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