Case Report

“I Tripped and Broke My Heart”: A Case Report of Right Atrial Rupture

Liane A. Arcinas, MD, Malek Kass, MD, Hasib Hanif, MD, and Andrew L. Morris, MD

ABSTRACT

A 66-year-old woman tripped and fell onto outstretched hands. She did not hit her chest. She developed chest pain and presented to the emergency department in shock. Transthoracic echocardiography demonstrated a large pericardial effusion with cardiac tamponade. Despite recurrent pericardiocentesis, the fluid did not decrease on echocardiography, and she continued to be in profound shock. Emergent surgical exploration identified rupture of the right atrium at its insertion into the superior vena cava. This case demonstrates atrial rupture despite no obvious direct chest impact and emphasizes the need for emergent surgical exploration in patients with hemopericardium and persistent tamponade despite pericardiocentesis.

Her medical history was unremarkable aside from rheumatoid arthritis without active joints. She had no history of vasculitis or pericarditis. She was not on immunosuppressants and only took nonsteroidal anti-inflammatory drugs as needed.

She arrived in the community hospital within 1 hour of her fall. Her vital signs were slightly improved with a blood pressure of 81/52 mm Hg and a regular pulse of 55 beats/min. An emergent aortic computed tomography angiography scan of her chest showed no aortic dissection but revealed a large hemo-pericardium of uncertain etiology. There was no active radiographic extravasation in the pericardium. During the computed tomography scan, her blood pressure continued to decrease despite another 1 L bolus of intravenous normal saline. She was started on a dopamine infusion and was transferred to our tertiary care institution for further management and consultation with Cardiology and Cardiac Surgery.

She arrived in our emergency department within 1 hour. She was seen concurrently by the emergency physician, Cardiology Service, and cardiac surgeon on-call. Upon arrival, she was awake, alert, and able to provide a good history. She was profoundly diaphoretic and pale. Her extremities were cold and mottled. Her vital signs were temperature of 36.5°C, blood pressure of 64/48 mm Hg (on dopamine infusion of 10 μg/kg/minute), pulse rate of 84 beats/min, and oxygen saturation of 84% on room air. She was placed on oxygen and given 1 L of intravenous normal saline bolus and transferred to the operating room for emergent aortic computed tomography angiography scan of her chest. After approximately 20 minutes, her chest pain recurred and she continued to be in profound shock. Emergent echocardiography demonstrated a large pericardial effusion with cardiac tamponade. Despite recurrent pericardiocentesis, the fluid did not decrease on echocardiography and she continued to be in profound shock. Emergent surgical exploration identified rupture of the right atrium at its insertion into the superior vena cava. This case demonstrates atrial rupture despite no obvious direct chest impact and emphasizes the need for emergent surgical exploration in patients with hemopericardium and persistent tamponade despite pericardiocentesis.

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Ethics Statement: The research reported has adhered to the relevant ethical guidelines.

Corresponding author: Dr. Liane A. Arcinas, Section of Cardiology, University of Manitoba, Winnipeg, Manitoba, Canada. Tel.: +1-204-960-2638; fax: +1-204-233-9162. E-mail: umarcina@myumanitoba.ca

See page 76 for disclosure information.

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New Teaching Points

- Hemopericardium may occur as the result of a minor fall with no direct chest impact.
- The inability to detect intravascular contrast extravasation into the pericardium does not rule out bleeding into the pericardium.
- A failure to improve both clinically or echocardiographically after the aspiration of large quantities of intrapericardial blood during cardiac tamponade requires surgical exploration.
- Prompt diagnosis and treatment of this rare cause of hemopericardium can lead to complete recovery.

saturation of 97% on 5 L of oxy-mask. Pulsus paradoxus was difficult to demonstrate because of her significant hypotension. Physical examination revealed distant heart sounds and an elevated jugular venous pressure visible at the angle of the jaw at a 30-degree supine position. A rapid head-to-toe examination showed no evidence of skin lesions, bruising, hematoma, distension, or blunt or penetrating trauma along her head, neck, shoulders, arms, chest, or abdomen. Her left ankle (the ankle that she tripped on) was slightly swollen.

Her electrocardiogram showed normal sinus rhythm with intermittent atrial and ventricular ectopic beats with low QRS voltages and no ischemic changes. Laboratory results were unremarkable except for the following: hemoglobin 118 g/L, pH 7.24, and lactate 7.3 mmol/L.

Emergent bedside transthoracic echocardiogram revealed a large, anechoic pericardial effusion. Left ventricular function was normal with left ventricle underfilling. There was evidence of right atrial (RA) and right ventricular diastolic collapse, and a distended inferior vena cava with no respiratory variation, consistent with cardiac tamponade.

Pericardiocentesis using an angiocatheter through the subcostal space yielded 400 mL of nonpulsatile, freely flowing dark blood. Despite this, her vital signs remained compromised (mean arterial pressures of 40-50 mm Hg), and she was given more intravenous fluid boluses with no effect. Another 300 mL of dark nonpulsatile fluid was aspirated with no decrease in the large pericardial effusion under echocardiography and no improvement in her poor vital signs. The aspirated pericardial fluid clotted, suggestive of an intracardiac source of bleeding. The echocardiographer tried to insert a pericardial drain twice. However, this was unsuccessful because the guidewire cannot freely pass into the pericardial space from the angiocatheter. This was thought to be likely due to clotting of the hemopericardium. Contrast echocardiography did not reveal extravasation of contrast material into the pericardial space.

A decision to bring the patient emergently for surgical exploration was chosen because of the following: (1) persistent profound shock that did not improve with large-volume pericardiocentesis, fluid resuscitation (she had already received 5 L of intravenous fluids in our emergency department at this time), and vasopressors; and (2) evidence of hemopericardium from a likely intracardiac source. Full sternotomy initially revealed a large hemopericardium with no active bleeding. Upon closer inspection and evacuation of blood from the pericardial space, an area in the RA was discovered to be bleeding profusely and was controlled with digital compression. Active bleeding was identified to be due to rupture of the RA at its junction with the superior vena cava (SVC). The lesion was successfully repaired with sutures, with immediate improvement in the patient’s vital signs. She remained stable with no evidence of further bleeding upon closure of her chest. Her postoperative course was uneventful, and she was discharged home on postoperative day 5.

Discussion

Cardiac rupture may involve the myocardium, pericardium, endocardial structures, and coronary arteries.1 Rupture of the RA is not unique, and all cardiac cavities have been reported to be subject to rupture; however, this is rare.2–4

RA rupture was reported to have occurred in 35 of 273 cases of cardiac rupture in a series of cases of nonpenetrating cardiac trauma by Parmley et al.2 Isolated right atrial rupture (IRAR) is a rare injury, most commonly resulting from blunt chest trauma. Maraqa et al.3 cited an incidence of IRAR of 0.2% to 0.5%. In their review of reported cases since 1955, they identified 75 patients with IRAR. Most cases (92%) occurred secondary to motor vehicle accidents. IRAR occurred at the following 5 sites: RA appendage (35%), RA/inferior vena cava junction (21%), RA/SVC junction (17%), free RA wall (15%), or multiple RA sites (12%). All patients presented with hypotension. Tamponade occurred in 62% of cases.

Our case is thought provoking in that RA rupture occurred after a relatively minor fall from standing height and without direct impact to the chest. Although cases of RA rupture have been reported to occur from falls, these were sustained from significant heights with high impact velocities and associated extracardiac trauma, such as pelvic fractures, arterial ruptures, and mesenteric injury.3,4,5 Most reported cases of IRAR occur from blunt chest trauma from motor vehicle accidents, with the direct impact to the chest as the mechanism for rupture.5 The mechanism for IRAR in our case is unclear but is likely related to hydraulic and deceleration forces potentially occurring at a particular moment in the cardiac cycle during the patient’s fall.3 Comotio cordis, for example, requires a blow to the heart at a very specific period during cardiac repolarization. Such a temporal coincidence may also be required in RA rupture but can only be hypothesized. Getz et al.4 suggested that atrial rupture likely occurs in late systole when the atrioventricular valves are closed and atrial distension is maximal. For our patient, we hypothesize that she likely tripped and fell during this phase of the cardiac cycle, and that the balance between her intracardiac hydraulic pressures and the deceleration from her fall onto outstretched hands created an unfortunate but perfect combination of events that led to her RA rupture.

In this case, neither the computed tomography angiography scan nor the echocardiogram demonstrated active extravasation of contrast into the pericardium. This is likely due to equalization of intracardiac and intrapericardial pressures during cardiac tamponade. It was only after surgical evacuation of the pericardium (i.e., when the intrapericardial pressure was low enough) that active venous bleeding became detectable. It is probable that had contrast been administered
coincident with pericardiocentesis that the diagnosis of cardiac rupture into the pericardium would have been more immediately evident before surgical exploration.

A few patients with atrial rupture can survive for 30 minutes or longer after injury, as seen in our case. The decision to undergo emergent surgical exploration rather than expectant management was warranted because of the patient’s persistent hemodynamic instability despite fluid resuscitation and large-volume pericardiocentesis. Although cases of RA rupture managed medically have been reported, it is necessary to release cardiac tamponade by surgical exploration if the patient does not respond to initial resuscitation or pericardiocentesis. Moreover, after intraoperative visualization of profusely active bleeding from her ruptured RA/SVC junction, this patient undoubtedly would have failed expectant management.

Conclusions

Our report demonstrates an unusual case of IRAR from a relatively common and usually trivial scenario: tripping and falling onto outstretched hands without direct chest impact. Prompt diagnosis and treatment of cardiac tamponade and rupture were essential in saving this patient’s life.

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Disclosures

The authors have no conflicts of interest to disclose.

References

1. Jackson DH, Murphy GW. Nonpenetrating cardiac trauma. Med Conc Cardiovasc Dis 1976;45:123-8.
2. Parmley LF, Manion WC, Mattingly TW. Nonpenetrating traumatic injury of the heart. Circulation 1958;18:371-96.
3. Maraqa T, Mohamed MT, Wilson KL, et al. Isolated right atrial rupture from blunt trauma: a case report with systematic review of a lethal injury. J Cardiothorac Surg 2019;14:28.
4. Getz BS, Davies E, Steinberg SM, et al. Blunt cardiac trauma resulting in right atrial rupture. JAMA 1986;255:761-3.
5. Baldwin D, Chow KL, Mashbari H, et al. Case reports of atrial and pericardial rupture from blunt cardiac trauma. J Cardiothorac Surg 2018;13:71.
6. Yun JH, Byun JH, Kim SH, et al. Blunt traumatic cardiac rupture: single-institution experiences over 14 years. Korean J Thorac Cardiovasc Surg 2016;49:435-42.
7. Teixeira PG, Inaba K, Oncel D, et al. Blunt cardiac rupture: a 5-year NTDB analysis. J Trauma 2009;67:788-91.
8. Hakuba T, Minato N, Minematsu T, Kamohara K. Surgical management and treatment of a traumatic right atrial rupture. Gen Thorac Cardiovasc Surg 2008;56:551-4.