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Case Report

Traumatic right ventricular rupture: Case report and brief review of the literature [☆]

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ABSTRACT

Rupture of the right ventricular (RV) myocardium is associated with serious morbidity and mortality. Under very rare conditions, a tear in the ventricular wall can lead to the formation of a pseudoaneurysm: an external outpouching of the ventricle that is stabilized by the pericardium, thrombus formation, and/or adhesions. Here, we present a 75-year-old man with RV free wall rupture with pseudoaneurysm following a motor vehicle collision. With concerns for blunt cardiac trauma, initial CTA chest revealed focal outpouching and extension of contrast outside of the confines of the RV chamber, compatible with pseudoaneurysm formation. In this case, conservative management of the pseudoaneurysm was preferred over surgical management, due to the thin RV free wall and present comorbid conditions. We highlight how CTA chest offers a reliable tool for tracking the stability of pseudoaneurysms in the RV and can guide clinical management through directing treatment strategies and appropriate follow-up intervals.

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Background

Right ventricular (RV) rupture is precipitated from right coronary artery occlusion, catheter and instrument associated trauma, cardiopulmonary resuscitation, and blunt cardiac trauma [1,2]. Of these causes, blunt cardiac trauma is an underdiagnosed cause of RV rupture due to complex and multiple distracting injuries [3]. By definition, blunt cardiac trauma

is considered any nonpenetrating chest trauma that results in myocardial injury [4], with rupture of the myocardium occurring in up to 0.5% of people with blunt cardiac trauma [5]. While blunt cardiac trauma is reported in less than 10% of trauma admissions, the degree of mortality from these injuries can be as high as 25% [3]. While mortality rates following RV pseudoaneurysm are not known, cardiac rupture in the setting of a motor vehicle collision can lead to mortality in up to 80% of patients [6].

Abbreviations: CTA, computed tomography angiography; MRI, magnetic resonance imaging; TEE, transesophageal echocardiogram; TTE, transthoracic echocardiogram; RV, right ventricle; LV, left ventricle.

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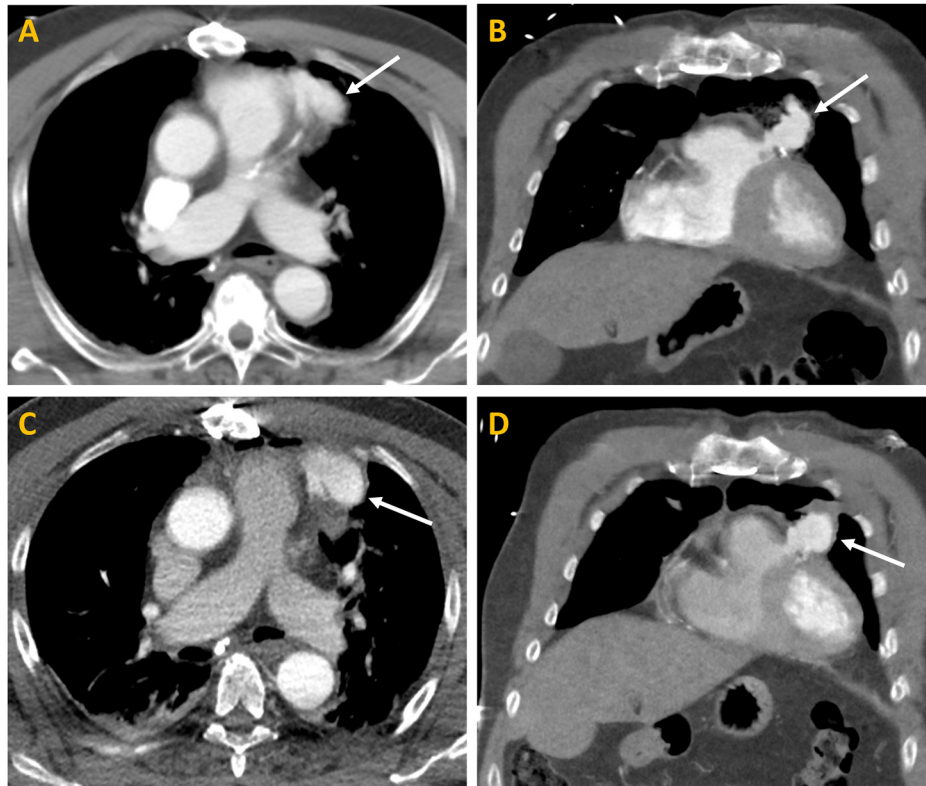


Fig. 1 – Axial (A) and coronal (B) representative images from contrast-enhanced CT chest on the day of trauma. Axial (C) and coronal (D) representative images from contrast-enhanced CT chest day 2 following trauma. Initial CTA chest (Day 1) revealed focal outpouching and extension of contrast outside of the confines of the RV chamber (arrow), compatible with pseudoaneurysm formation. Initial size of the pseudoaneurysm was 3.2 × 2.4 cm (arrow) (A and B). On the following day (Day 2), repeat CTA revealed interval increase size of the aneurysmal sac and measured 3.4 × 2.4 cm (arrow) (C and D).

Rupture of the RV commonly results in hemopericardium, cardiac tamponade, and/or death [7]. Very rarely, the pericardium can limit the escape of blood from the RV [8,9]; this formation, devoid of myocardial tissue and connected to the pericardium, is defined as a pseudoaneurysm. A pseudoaneurysm of the RV myocardium is extremely rare, with very few cases reported in the literature. These reports of RV pseudoaneurysm have occurred in the setting of endomyocardial biopsy [10], heart catheterization [11,12], device-related complications [13], blunt cardiac trauma [14,15], and idiopathic [8,16,17]. Radiographically, the use of echocardiography, CTA, and cardiac MRI can be used to diagnosis, track progression, and guide management of RV pseudoaneurysms [14].

Treatment of RV rupture is generally surgical, through Teflon or Dacron patches or biologic glues [7,18]. Because of the large volume blood loss, the use of cardiopulmonary bypass is typically needed [18]. While RV pseudoaneurysms can be treated surgically, other approaches are also considered. The use of a percutaneous closure technique has been attempted in a trauma-induced RV pseudoaneurysm with partial success (ie, some residual communication to the pseudoaneurysm remained following the procedure) [19]. Ultimately, in patients who cannot undergo surgery, such as the patient in this case report, conservative treatment is trialed [20].

Here, we present a case of 75-year-old man presenting with traumatic right ventricle free wall rupture.

Case report

We present the case of a 75-year-old man with RV free wall rupture with pseudoaneurysm following a motor vehicle collision. The patient was an unrestrained driver involved in a head-on collision at an unknown speed. The blunt trauma included an acute transverse sternal fracture, multiple displaced left-sided anterior rib fractures, and a C1 fracture. The patient had a past medical history of coronary artery disease status-post coronary artery bypass graft surgery 6 years prior, hypertension, hyperlipidemia, gastroesophageal reflux disease, and osteoarthritis.

Initial CTA chest (Day 1) revealed focal outpouching and extension of contrast outside of the confines of the RV chamber, compatible with pseudoaneurysm formation. Initial size of the pseudoaneurysm was 3.2 × 2.4 cm (Figs. 1A and B). On the following day (Day 2), repeat CTA revealed interval increased size of the aneurysmal sac and measured 3.4 × 2.4 cm (Figs. 1C and D).

On Day 8, CTA chest was performed to assess for stability. There was continued evidence of RV pseudoaneurysm (Figs. 2A and B), the sac was unchanged in size measuring 3.4 × 2.5 cm with interval development of peripheral thrombosis. The contrast opacified aneurysm sac measured 1.6 × 2.4 cm. Considering stability on imaging and improve-



Fig. 2 – Axial (A) and coronal (B) representative images from CTA heart morphology protocol performed on Day 8 following trauma. There was continued evidence of right ventricular (RV) pseudoaneurysm (arrow). The sac was unchanged in size measuring 3.4 × 2.5 cm (arrow) with interval development of peripheral thrombosis. The contrast opacified aneurysm sac measured 1.6 × 2.4 cm.

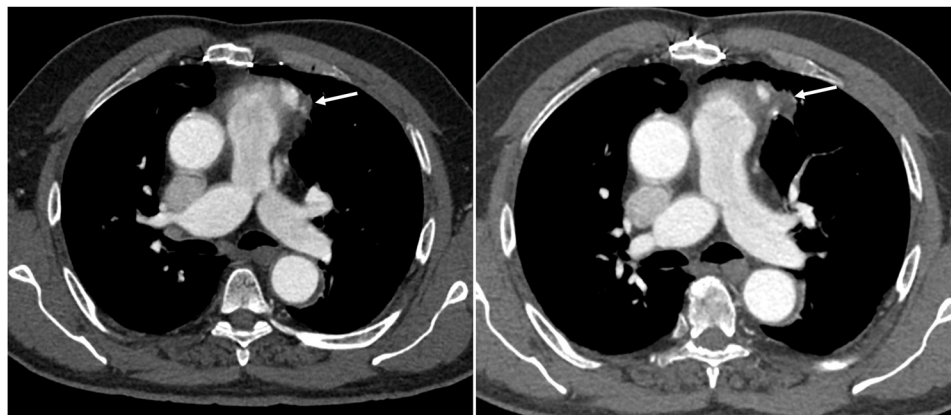


Fig. 3 – Slice 1 (A) and 2 (B) of axial representative images from CTA chest performed on Day 46 following trauma. There was continued decrease in size of right ventricular (RV) pseudoaneurysm (arrow). The aneurysm sac measured 1.5 × 3.0 cm and the contrast opacified aneurysm sac measured 1.2 × 1.5 cm.

ment in clinical status, patient was discharged home with close follow-up.

Follow-up on Day 46 revealed decreased size of the RV pseudoaneurysm and measured 1.5 × 3.0 cm (Fig. 3). The contrast opacified core measured 1.2 × 1.5 cm. Currently, the patient continues to follow with cardiology and cardiothoracic surgery.

In our case, the patient was treated conservatively due to his comorbid conditions and stability of the pseudoaneurysm.

Discussion

Imaging is a critical component in the management of patients with ventricular rupture and can effectively guide treatment decisions. As detailed in this case, both CTA chest and TTE were effective in capturing the pseudoaneurysm in the

RV free wall, with other reports highlighting the effectiveness of MRI [14]. CTA can successfully assess the stability of pseudoaneurysms and guide clinical decision making. With the patient's past cardiac history, comorbid conditions, and age, the decision was made to conservatively manage his condition, with close interval follow-up from cardiology and cardiothoracic surgery.

The patient presented following a motor vehicle collision, which is the leading cause of blunt cardiac trauma [3]. In the emergency department he endorsed left-sided chest pain and physical exam findings of pain to palpation of the left chest. With this patient's presentation of RV free wall rupture with pseudoaneurysm, extravasation of significant blood into the pericardial sac was minimal, resulting in a negative FAST exam during initial presentation. AP CXR was the first imaging modality to reveal left-sided rib fractures. Follow-up CTA demonstrated the presence of a transverse sternal fracture and left-sided anterior ribs 3-8 fractures. The presence of a sternal fracture is one of the highest predictors of blunt

cardiac trauma following a motor vehicle collision and aligns well in this case [21].

In left ventricular (LV) ruptures with pseudoaneurysm, surgical repair is superior to conservative management [22,23]. Additionally, the risk of stroke from an untreated LV pseudoaneurysm poses a significant risk from the accumulating thrombus [24]. While most reports of prognosis with pseudoaneurysm have been identified in the LV, it is likely that a similar prognosis exists for those with untreated RV pseudoaneurysms. In the current case, the patient was treated conservatively due to lack of active extravasation observed on CTA, his comorbid conditions, and the decreased efficacy of treatment compared to left ventricular (LV) pseudoaneurysms (ie, the RV free wall is much thinner at 3–4 mm). Of note, these patients with RV pseudoaneurysms are likely at higher risk of pulmonary embolus, and thus should be screened for symptoms of shortness of breath and pleuritic chest pain on follow-up examinations. Anticoagulation therapy, such as in the patient presented herein, should be considered in nonsurgical candidates.

Like ventricular pseudoaneurysms, a ventricular aneurysm can share similar imaging findings, but the treatment and management are distinctly different. True aneurysms involve the myocardial wall, commonly affecting the wall motion of that segment and resulting in akinesis/dyskinesis, while pseudoaneurysms are formed from a tear in the myocardial wall and involve the pericardium [25,26]. On imaging, a pseudoaneurysm typically has a narrower neck than the total diameter, while true aneurysms have a wider neck than the total diameter. Additionally, pseudoaneurysms are commonly seen in the posterior and lateral wall segments, with true aneurysms in the anterior wall and apex of the heart [25].

Patient consent

Written consent was obtained for the publication of the current case. No patient identifiers are disclosed.

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