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# **RUPTURE OF LEFT ATRIAL APPENDAGE AND PERICARDIUM DUE TO BLUNT TRAUMA**

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## **ABSTRACT**

*A 37-year-old woman sustained a ruptured pericardium and two lacerations of the left atrial appendage in an automobile accident. Simple suture repair of the atrial appendage was achieved after clamping the base of the left atrium to control the bleeding.*

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## **INTRODUCTION**

Cardiac rupture as a result of blunt trauma is seldom encountered because such cases are rarely diagnosed early and most of the patients die before surgical intervention.<sup>1–3</sup> Motor vehicle accidents account for the majority of nonpenetrating cardiac ruptures.<sup>1</sup> The mortality from such ruptures ranges from 50% to 80%.<sup>3</sup> Overall, rupture of the left side of the heart has a worse prognosis than right-sided rupture.<sup>1</sup>

## **CASE REPORT**

A 37-year-old woman who had been driving seat-belted, had a high-speed front-end collision with a stationary vehicle. She was brought to the emergency department in a critical condition within 30 minutes of the accident. She was unconscious, in respiratory distress, and there were lacerations on her face. Her respiratory rate was 30 breaths per minute, pulse rate was 98 beats per minute, and systolic blood pressure was 80 mm Hg. Her pupils were 1 mm in size and reacted sluggishly. Auscultation showed decreased air entry in both lungs and muffled cardiac sounds. There was no obvious injury to the chest wall. Abdominal palpation revealed mild muscle guarding and distension in the epigastrium and left hypochondrium. In

view of the decreased breath sounds, a chest drain was placed on the right side and two on the left. Air issued from the right and 2 L of bright red blood drained from the left side. The patient developed an episode of profound bradycardia that responded to atropine. The left chest tube continued to drain blood freely. Chest radiography showed massive hemothorax with total collapse of the lung on the left side and minimal pneumothorax on the right side. There was an enlarged cardiac silhouette without mediastinal widening (Figure 1). Thoracic computed tomography (CT) scan with contrast enhancement showed massive left hemothorax, hemopericardium, and minimal hemomediastinum, without any recognizable site of intrathoracic organ injury, including the aorta (Figure 2). CT scan of the head revealed no intracranial injury. An abdominal CT scan and diagnostic peritoneal lavage were normal. A limited transthoracic echocardiogram indicated hemopericardium.

After initial resuscitation, anesthesia was induced and a double-lumen endotracheal tube was inserted. An emergency exploratory left posterolateral thoracotomy was performed via the 5th intercostal space. Massive hemothorax was found with approximately 2 L of blood

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and clots in the pleural cavity, and total collapse of the lung. When the blood was evacuated, a tear in the pericardium measuring  $3 \times 1$  cm was revealed posterior and parallel to the left phrenic nerve. The left atrial appendage protruded through the defect in the pericardium and bled profusely. The pericardium was opened longitudinally by extending the tear posteriorly, parallel to the left phrenic nerve, to control the bleeding. A vascular clamp was applied at the base of the left atrium. There were two lacerations on the atrial appendage: one on the lateral surface, measuring  $2 \times 0.5$  cm; and the other on the posterior surface, measuring  $1 \times 0.5$  cm. Hemopericardium was also observed. Simple suture repair of the ruptures in the atrial appendage was carried out using 4/0 Prolene (Johnson & Johnson, Somerville, NJ, USA). All other cardiac and intrathoracic structures were found to be normal. The patient had an episode of ventricular fibrillation intraoperatively and responded to internal defibrillation. The postoperative recovery was uneventful and she was discharged 12 days after the operation. Echocardiography was normal at the time of discharge.

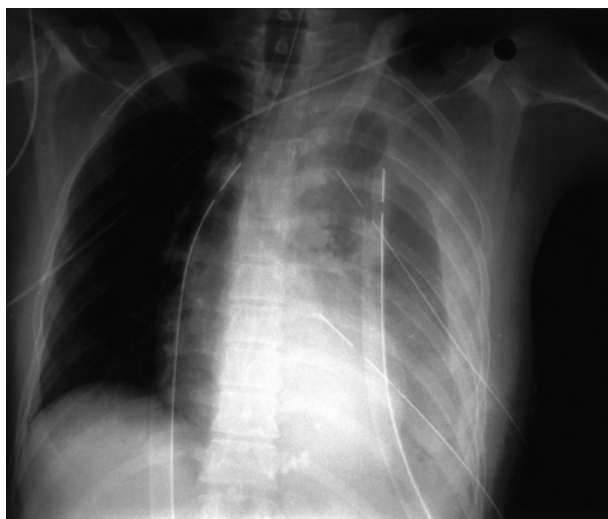
## DISCUSSION

Isolated left atrial and pericardial ruptures are classified as two separate forms of cardiac trauma and such injuries without associated impairment, such as sternal or rib fractures, or thoracic organ damage, are extremely rare. Cardiac injuries are classified as pericardial laceration, hemopericardium, cardiac contusion, myocardial laceration, and rupture including valvular injuries.<sup>4</sup> The forces responsible for these injuries are deceleration, blast, contusion, or combined forces. The causes of cardiac rupture range from a simple blow to a more severe directional force and the heart is susceptible to injury from sudden acceleration, deceleration, or compression because it hangs freely in the mediastinum between the sternum and the thoracic vertebrae, and it is suspended

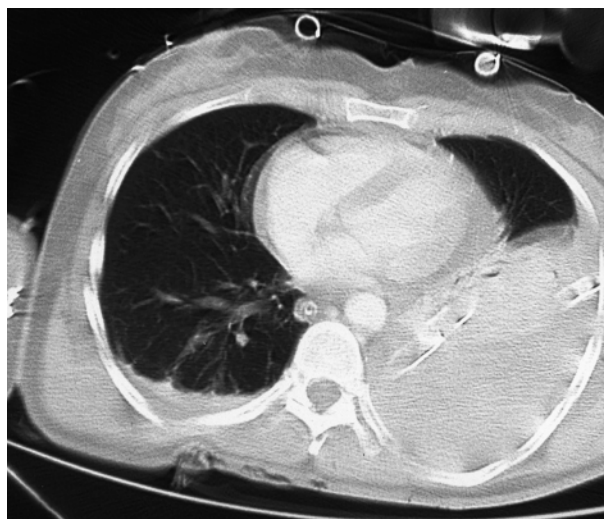
by the great vessels.<sup>5,6</sup> A sudden forceful impact on the sternum can raise the intrathoracic pressure immediately. A sudden increase in intraabdominal pressure can elevate intrathoracic pressure and cause a cardiac rupture, without any concomitant chest injury.<sup>6</sup> In adults, the mediastinum is less mobile and therefore, more susceptible to direct forces.<sup>5,6</sup> The mechanism of cardiac rupture by blunt trauma also includes compression of the heart between the sternum and the vertebral column, and direct contusion.<sup>4-6</sup> All chambers of the heart are susceptible to traumatic rupture but the atrial appendage is most vulnerable because of its relative thinness.<sup>1,7</sup> Right-sided (atrium and ventricle) cardiac ruptures have a better prognosis with 78% survival compared to 25% survival after left-sided rupture.<sup>1,7</sup> Pericardial rupture after blunt chest trauma is mostly caused by high-velocity trauma and is usually associated with other injuries.<sup>2</sup>

It is difficult to see why this patient survived long enough to come to surgery. Possibly the split in the pericardium through which the torn atrial appendage was protruding, acted as a soft clamp to restrict bleeding and prevent fatal exsanguination. The pericardial tear also allowed bleeding into the left pleural cavity, avoiding cardiac tamponade. It is of interest that there was no evidence of injury to the chest wall. This lack of injury and the fact that the patient was restrained by a sash seat belt during the impact is consistent with the injuries caused purely by deceleration force rather than direct impact. The position of the tear was consistent with the force of deceleration and also the upright position of the patient during impact.

If this scenario is correct, then patients who present with cardiovascular instability, a history of rapid deceleration without any external chest injury but with left hemothorax, may have a left atrial and pericardial tear. Management should be by left thoracotomy, which is also appropriate



**Figure 1.** Chest radiograph (anteroposterior view) showing massive left hemothorax, collapsed left lung, enlarged cardiac silhouette, and intercostal pleural drains on both sides.



**Figure 2.** Contrast-enhanced computed tomography scan of chest, showing hemopericardium, left hemothorax, collapsed left lung, and chest drains in position.

if the hemothorax is caused by avulsion of the pulmonary veins. However, if an atrial tear is suspected, the incision should be extended as far posteriorly as possible, to optimize access. Currently, there is no consensus on either the clinical definition or appropriate management protocol, including diagnostic work-up, for such injuries. Therefore, only a high index of suspicion, rapid transport, evaluation, and expeditious management may save such patients.

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