Rupture of the left atrial roof due to blunt trauma

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Abstract

Cardiac rupture after blunt trauma is rare and associated with high mortality. The anatomic pattern of blunt cardiac rupture has been demonstrated with the right cardiac chambers more frequently affected than the left. Furthermore, left atrial injury is usually restricted to the atrial appendage and the pulmonary vein–atrial junction. Herein, we report the first case of a 61-year old man with a rupture of the left atrial roof after blunt trauma with minimal thoracic injury.

Keywords: Cardiac rupture • Left atrial roof • Blunt trauma

INTRODUCTION

Cardiac rupture after blunt trauma is rare and often overlooked. Despite advances in emergency care and transportation systems, the mortality rate remains high. Typical symptoms of tamponade are not manifested in all patients in the early stage; thus, the condition is easily overlooked if patients have a minimal thoracic injury, associated injury or relatively stable vital signs. The right side is most commonly affected; a review of literature indicated that left atrial injury accounts for 25% of cardiac rupture cases, most of which are injuries of the atrial appendage and pulmonary vein–atrial junction [1].

We report a case of successful management of left atrial ‘roof’ rupture after blunt trauma with minimal thoracic injury.

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

CASE PRESENTATION

A 61-year old man presented to our hospital with chest pain after being trapped between the handle of a cultivator and pillar at work. On admission, he was alert and complained of chest pain. However, no remarkable sign of traumatic injury was observed. His vital signs were normal, except for decreased blood pressure (80/40 mmHg), which was normalized after initial intravenous fluid administration.

Results of laboratory tests revealed elevated creatine kinase (CK; 775 IU/l) and CK-MB levels (38 ng/ml) and a normal troponin T level. The remaining laboratory values were within the normal limits.

An electrocardiogram indicated normal rhythm. An initial contrast-enhanced computed tomography (CT) scan showed haemorrhagic fluid collection in the pericardium and multiple fractured ribs on the right side (Fig. 1). An echocardiogram revealed haematoma on the anterior wall of the right ventricle; however, the exact point of rupture could not be identified.

We diagnosed the patient with right-sided heart rupture and performed an emergency operation. After median sternotomy, we performed surgery under partial cardiopulmonary bypass. Immediately after pericardial excision, ~200 ml of stagnated blood gushed out and the blood pressure normalized. Continuous flow of small amounts of fresh blood without any lesion was found on the right side of the heart. After careful inspection, a laceration wound ~1.5 cm in size was found on the roof of the left atrium (Fig. 2). We sutured the wound with a 4-0 pledged polypropylene suture. The patient was discharged after 10 days, without any complications.

DISCUSSION

Cardiac rupture after blunt trauma is rare, with an incidence rate of only 0.041–0.5%; however, it is associated with very high mortality (50–90%) [1, 2]. Teixeira et al. [2] reported the following factors likely to affect the survival of admitted patients: physiological condition, pattern of cardiac rupture, rapidity of diagnosis and treatment.

Cardiac rupture is predominantly observed in the relatively weaker right side of the heart than in the left side. Leavitt et al. [3] reported the anatomical distribution of 42 injuries as follows: right atrium, 21 patients (50%); right ventricle, 7 patients (17%); left atrium, 10 patients (24%) and left ventricle, 4 patients (9%). In addition, a review of literature indicated that most left atrial injuries occurred in the atrial appendage and the pulmonary vein–atrial junction. To our knowledge, this is the first case of left atrial roof injury to be reported in the English literature.

The following are the five primary underlying mechanisms of blunt cardiac rupture: (i) direct precordial impact, (ii) compression of the heart between the sternum and vertebral column, (iii) rapidly increased hydrostatic venous pressure transferred from...
the abdomen or lower extremities to the heart, (iv) acceleration/deceleration force and (v) direct penetration by the sternum or rib fractures [3]. A rapidly increased hydrostatic pressure usually affects the right atrium, and deceleration force usually causes a disruption of the vena cava-atrial and pulmonary vein-atrial junctions [4]. In our patient, forced compression of the heart and thorax may have caused the excessive pressure that ruptured the atrial roof.

The most notable feature of cardiac rupture is cardiac tamponade. Hypotension without an identifiable bleeding site, elevation of central venous pressure, decreased heart sounds and tachycardia are the typical symptoms of cardiac rupture; however, these are not manifested in all patients in the early stage [1]. If the patient has multiple associated injuries, minimal thoracic injury or relatively stable vital signs, these conditions are easily overlooked [5]. In our case, the patient experienced only chest pain and hypotension, which was normalized after initial intravenous fluid administration, with no visible external wound. Therefore, we nearly overlooked cardiac tamponade in our patient, but were finally able to detect it in the initial CT scan.

A CT scan can provide information on solid organ injuries, retroperitoneal injuries, free intraperitoneal air and diaphragm injury; hence, it may be considered as the first-line diagnostic tool for evaluating blunt trauma in haemodynamically stable patients.

When the diagnosis is confirmed, prompt surgical management is necessitated. Either median sternotomy or left anterior thoracotomy can be used, as appropriate. However, we prefer median sternotomy because it allows good exposure of the heart and is suitable for cardiopulmonary bypass.

In conclusion, the possibility of cardiac rupture after blunt trauma is easily overlooked when no external wound is visible and vital signs are relatively stable. To increase the diagnostic rate, CT scanning may be considered as the first-line diagnostic approach to evaluate blunt trauma. Though useful in diagnosing cardiac rupture, the current diagnostic modality rarely identifies the exact location and degree of the damage. Given that an unexpected lesion can be ruptured, as in our case, the surgery should be performed under cardiopulmonary bypass for safe management.

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**REFERENCES**