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Case Report

Left atrial appendage rupture: A rare complication of right-sided haemothorax: A case report

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ABSTRACT

Cardiac injury accounts for less than 10 % of all traumas and it is a fatal condition associated with cardiac tamponade or massive haemothorax, which requires immediate intervention, such as resuscitative thoracotomy. However, in case of haemothorax without the findings suggestive of cardiac damage such as pericardial effusion, it is difficult to determine the complications of cardiac injury, because injury of the lung or intercostal arteries is usually considered first. We describe a rare case of left atrial appendage rupture with a right-sided massive haemothorax with slight cardiac effusion. A 47-year-old man with no significant medical history was transferred to our emergency department after crashing his motorcycle into a car. A right resuscitative thoracotomy for massive haemothorax was performed, followed by hilarious clamping and pericardial drainage. We found continuous bleeding from a right dorsal pericardial injury which indicated cardiac injury. Soon after the patient was referred to the operating room, left atrial appendage rupture was found, and ligated. The postoperative course was uneventful, and he was discharged on 15th postoperative day without complication. Left atrial appendage rupture is caused by a direct external force to the left atrium, so the pericardial injury is usually ipsilateral to the left side of the pericardium, resulting in perforation of the left thoracic cavity. Therefore, left atrial appendage rupture with a right-sided massive haemothorax is rare. In addition, when a cardiac injury is associated with a pericardial injury, most of the pericardial effusion drains into the thoracic cavity, resulting in a small amount of pericardial effusion, which make it difficult to recognize the cardiac injury. In conclusion, in blunt trauma, even in the case of a right-sided haemothorax, the possibility of cardiac injury in addition to pulmonary contusion should be considered and explored, because cardiac injury could be fatal.

Background

Cardiac injury accounts for less than 10 % of all traumas and it is a fatal condition that requires immediate intervention, such as emergent thoracotomy [1]. Frequency of cardiac injury occurs in the order of right atrium, right ventricle, left atrium, and left ventricle

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[2]. Therefore, left atrial appendage rupture is relatively rare. Fatal complications of cardiac injury include cardiac tamponade and massive haemothorax due to perforation to the thoracic cavity, which immediately results in cardiac arrest and requires rapid intervention. When left atrial appendage rupture is associated with haemothorax, rupture to the left side is common [3–6].

In cases of massive haemothorax, injury of the lung or intercostal arteries is usually considered first. In the absence of findings suggestive of cardiac damage, such as pericardial effusion, it is difficult to determine the complications of cardiac injury.

Here, we describe a rare case of left atrial appendage rupture with a right-sided massive haemothorax with slight cardiac effusion.

Case presentation

A 47-year-old man with no significant medical history was transferred to our emergency department after crashing his motorcycle into a car. Blood pressure (BP) was difficult to measure in the ambulance because the patient was agitated; however, the radial artery pulse remained palpable. A backboard and cervical collar were used to immobilise the spine. On arrival (approximately 40 min after the occurrence of the accident), the patient presented with agitation (Glasgow Coma Scale of E4V2M5), tachycardia (heart rate (HR), 109 beats/min), and tachypnoea (respiratory rate (RR), 26 breaths per minute). Oxygen saturation was 100 % at 10 L/min of oxygen. Because of the agitation, it was still impossible to measure the BP. He had mild abrasions on the right side of his chest, and his extremities were cold.

Ultrasonography showed right pleural effusion, and a chest radiograph indicated massive right-sided haemothorax (Fig. 1). We administered a small amount of ketamine for the agitation, then inserted a thoracic tube and the right femoral artery and venous sheaths immediately after administering intravenous tranexamic acid. An initial blood test indicated a haemoglobin level of 12.7 g/dL. We drained more than 1 L of blood from thoracic tube within 25 min of placement, which resulted in a drop in the blood pressure (BP 68/42 mmHg, HR 112 beats/min). Thereafter, massive blood transfusion of red blood cells and fresh frozen plasma was initiated with tracheal intubation. After increasing blood pressure, we performed a contrast-enhanced computed tomography which revealed right-sided haemothorax, small amount of pericardial effusion, and no other organ damage. Persistent bleeding required immediate surgical exploration, and a right resuscitative thoracotomy was performed, followed by hilar clamping and pericardial drainage. Cardiac injury was not suspected at this point because of small amount of pericardial effusion. However, we discovered a right dorsal pericardial injury, which indicated cardiac injury; subsequently, the patient was referred to the operating room.

A median sternotomy was performed, which revealed left atrial appendage rupture with right pericardial tear (Fig. 2A); the tear of

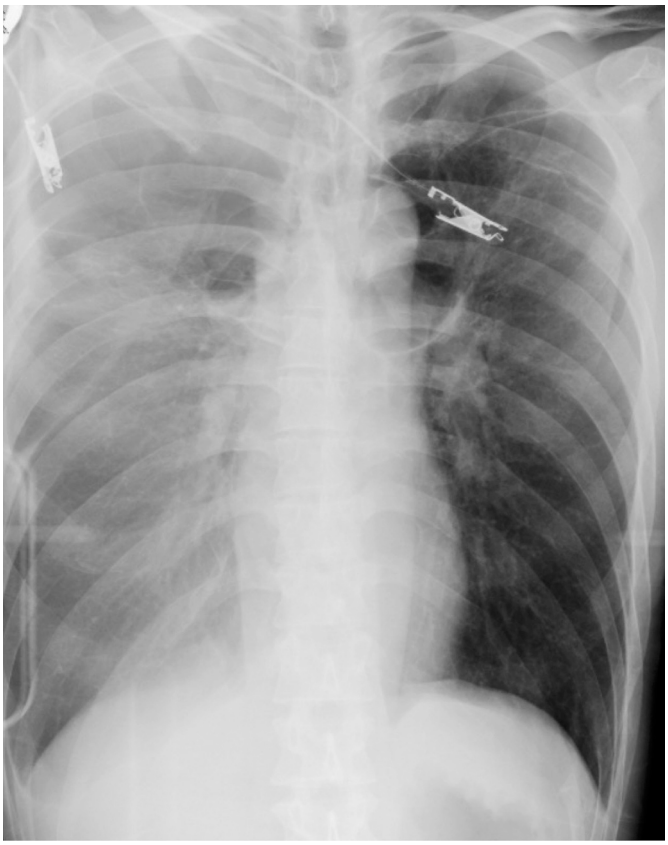

Fig. 1. Massive right-sided haemothorax.

the appendage was clamped (Fig. 2B) followed by ligation (Fig. 2C), and haemodynamics stabilized. No other trauma, apart from cardiac injury, was noted in the right chest cavity. During the operation, he received 1400 mL of red blood cells, 2880 mL of fresh frozen plasma, 250 mL of platelet cells, 225 mL of intraoperative autotransfusion. The patient was admitted to the intensive care unit (ICU).

The postoperative course was uneventful, and he was extubated on the day 1 of ICU admission. All drains (pericardial, substernal, and chest) were removed without any problem, and he was discharged from this hospital on day 15 without complication.

Discussion

This case is a rare presentation of left atrial appendage rupture and right pericardial injury with right-sided massive haemothorax. Since left atrial appendage rupture is caused by a direct external force to the left atrium, the pericardial injury is usually ipsilateral to the left side of the pericardium, resulting in perforation of the left thoracic cavity. Therefore, a massive haemothorax caused by left pericardial injury is almost always a left-sided haemothorax [3–6]. Left atrial appendage rupture with right-sided haemothorax due to right pericardial injury is uncommon, as in this case. Although there is insufficient evidence for this mechanism, given that most left atrial appendage ruptures are caused by a direct external force, it is suggested that the heart being shaken by a solid direct external force may have placed a substantial load on the contralateral pericardium, similar to the contrecoup injury in head trauma, causing the pericardium to rupture. In this case, pericardial injury was found along with the right dorsal pericardial attachment, and the position of the pericardial sac was directly contralateral to the left atrial appendage.

When there is only haemothorax with no or a small amount of pericardial effusion, pericardial or cardiac injury diagnosis could be difficult because the primary concern is usually lung or chest wall injury. Nevertheless, early detection of cardiac injury is essential [3]. In this case, despite right thoracotomy being performed, followed by right pulmonary hilum clamping and pericardial drainage, the BP remains low, and bleeding persists. We suspected bleeding from the dorsal side of the pericardial sac because the bleeding was persistent above the vertebral body with mild accumulation in the pericardial sac. Haemorrhage from the pericardial sac was highly suggestive of cardiac injury, and we decided to perform surgery. Emergency physician should consider cardiac injury in patients with unstable vital signs, when emergency thoracotomy could not detect bleeding source even in right-sided haemothorax. Depending on the size and severity of the pericardial injury, haemothorax with no or a small amount of pericardial effusion may occur that cause difficulty in diagnosing a cardiac injury.

In our case, the patient's vital signs became unstable after right thoracotomy. We chose to perform median sternotomy in the operating room instead of a clamshell thoracotomy in the emergency room. Although there are reports that an emergency room can start surgery sooner than an operating room, various factors such as preparation of instruments, personnel issues, and, whether the facility is familiar with the procedure, influence the treatment strategy [7]. We chose median sternotomy in the operating room because the median sternotomy provides an excellent view of the heart compared with lateral thoracotomy.

Conclusions

We report a case of left atrial appendage rupture with right pericardial tear and right-sided massive haemothorax caused by blunt trauma. In blunt trauma, even in the case of a right-sided haemothorax, the possibility of cardiac injury in addition to pulmonary contusion should be considered and explored, because cardiac injury could be fatal.

CRediT authorship contribution statement

Akihiko Sugaya: Writing - original draft preparation, Writing - Review and Editing. Hiraku Funakoshi: Writing - original draft preparation, Writing - Review and Editing. Mizobe Michiko: Writing - Review and Editing. Ryota Hara: Writing - Review and Editing. Shinsuke Kotani: Writing - Review and Editing. Tadao Kubota: Writing - Review and Editing. All authors read and approved the final

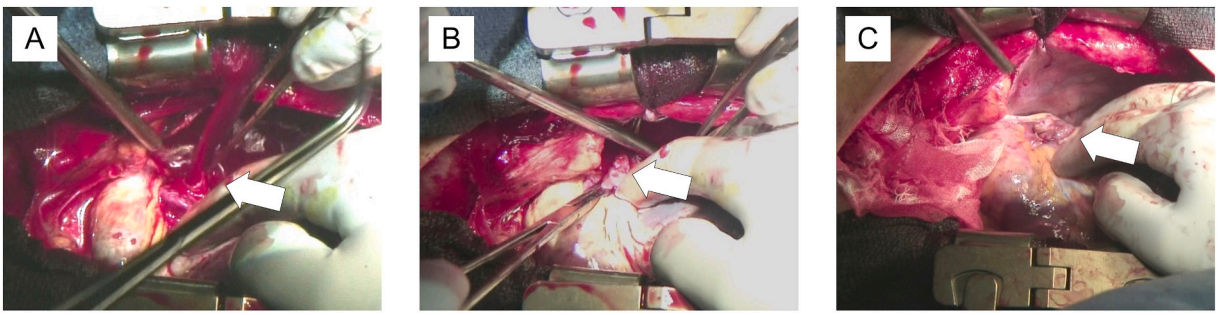

Fig. 2. Operative findings.
A: Bleeding from the ruptured left atrial appendage (white arrow).
B: Clamped left atrial appendage (white arrow).
C: Ligated left atrial appendage (white arrow).

manuscript.

Consent for publication

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Declaration of competing interest

None.

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None.

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