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Emergency room thoracotomy for acute traumatic cardiac tamponade caused by a blunt cardiac injury: A case report

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ABSTRACT

INTRODUCTION: Traumatic blunt cardiac injuries have a high mortality rate, and prompt diagnosis and treatment can be lifesaving in cardiac tamponade.
PRESENTATION OF CASE: A 62-year-old man was transferred to the emergency department after a motor vehicle accident. He was hemodynamically unstable. A focused assessment with sonography in trauma (FAST) showed pericardial fluid with right ventricular collapse consistent with cardiac tamponade in the subxiphoid view. He collapsed despite a subxiphoid pericardiotomy. Owing to the ongoing hemodynamic instability, we performed a left anterolateral thoracotomy. Direct incision of the pericardium showed blood and clots within the pericardial space, indicating hemopericardium. The heart stroke and hemodynamic status recovered on removing the clot.
DISCUSSION: Although the physical findings of cardiac tamponade are not always apparent in life-threatening acute cardiac tamponade after blunt trauma, FAST is a reliable tool for diagnosing and following cardiac tamponade. A median sternotomy is a standard approach for evaluating cardiac injury in hemodynamically stable patients with or without cardiopulmonary bypass. However, a left anterior thoracotomy was the fastest, simplest life-saving procedure considering the need for open-chest cardiac massage given our patient's life-threatening condition.
CONCLUSION: A prompt diagnosis using FAST and treatment can be lifesaving in traumatic acute cardiac tamponade. A pericardiotomy via a thoracotomy is mandatory for lifesaving cardiac decompression in acute traumatic cardiac tamponade in cases of ineffective drainage due to clot formation within the pericardial space.

1. Introduction

Traumatic blunt cardiac injuries have a high mortality rate. However, a prompt diagnosis and treatment can be lifesaving in cardiac tamponade [1,2]. Although chronic cardiac tamponade is relieved using pericardiocentesis or a subxiphoid pericardiotomy in heart disease, these are often ineffective as cardiac decompression procedures with clot formation within the pericardial space in traumatic cases [3]. The typical physical findings of cardiac tamponade are not always apparent with life-threatening acute cardiac tamponade after blunt trauma. We present a case involving an emergency room (ER) thoracotomy for acute traumatic cardiac tamponade with a blunt cardiac injury. This work has been written in accordance with the SCARE criteria [4].

2. Case presentation

A 62-year-old otherwise healthy man was transferred to the ER about 30 min after a motor vehicle accident. He had been wearing a seatbelt and the airbag deployed. Examination at the scene showed a systolic blood pressure (BP) of 80 mmHg, heart rate of 120 beats/min, and a Glasgow Coma Scale of 12/15 with anterior chest bruising. On arrival in the ER, his blood pressure was non-recordable with a palpable radial artery and a heart rate of 127 beats/min (normal sinus rhythm). His jugular vein was not distended. A focused assessment with sonography in trauma (FAST) showed pericardial fluid with right ventricular collapse consistent with cardiac tamponade in the subxiphoid view [Fig. 1]. A chest x-ray revealed a widened mediastinum.

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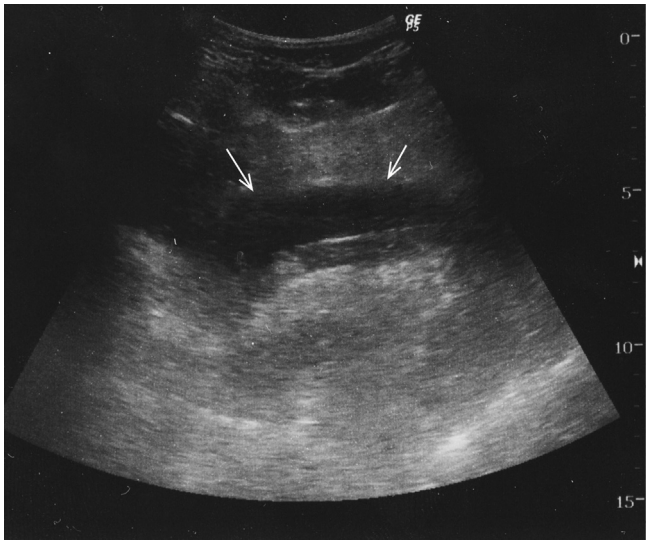

Fig. 1. FAST was positive for pericardial fluid (arrow) with right ventricular collapse consistent with cardiac tamponade.

A subxiphoid pericardiotomy was performed simultaneously with tracheal intubation and fluid resuscitation [Fig. 2A]. The hemodynamic instability did not improve after evacuating blood from the pericardial sac (systolic BP 56 mmHg). Repeat FAST investigation following the subxiphoid pericardiotomy showed a pericardial clot. Because of the ongoing hemodynamic instability, a left anterolateral thoracotomy was made to perform a pericardiotomy, considering the possible need for open-chest cardiac massage. Although he developed cardiac arrest just after the thoracotomy, a few seconds of open-chest cardiac massage resumed the spontaneous circulation. On making the incision, blood and a clot were seen within the pericardial space, resulting in hemopericardium. The heart stroke and hemodynamic status (BP 148/117 mmHg) recovered on removing the clot. Despite continuous oozing within the pericardial sac, his hemodynamic status stabilized following this procedure.

The initial chest x-ray showed a widened mediastinum, so we also considered an occult aortic injury. We could not perform transesophageal echography immediately in our ER. We could not get a good operative view for assessing the aortic injury via a left anterior thoracotomy. His hemodynamic status was stabilized following the pericardiotomy. Considering the effort involved in a repeat thoracotomy for aortic injury, we transferred the patient to the computed tomography (CT) room adjacent to the ER following temporary chest closure using sterile iodine-impregnated adhesive drapes [Fig. 2B]. Contrast-enhanced CT showed bilateral multiple rib fractures with no aortic or lung injury.

We repaired the cardiac injury via the left thoracotomy site after the patient returned from the CT room. Continuous oozing was noted from an isolated non-penetrating traumatic rupture of the left ventricular free wall. Hemostasis was achieved with digital pressure and a horizontal mattress suture with 3-0 polypropylene and pledges without cardiopulmonary bypass [Fig. 3]. The patient was concurrently transfused 12 units of packed red blood cells and 12 units of fresh frozen plasma and was transferred to the intensive care unit (ICU) for further resuscitation.

Right thoracic drainage was required because of a gradually increasing right hemothorax during his ICU stay. On postoperative day 1, the serum cardiac enzyme marker troponin I was elevated at 4095 (normal < 0.040) ng/L. This resolved spontaneously. The mechanical ventilation was protracted due to respiratory complications following massive fluid resuscitation. On postoperative day 10, the patient was weaned from mechanical ventilation and extubated. He remained in the ICU for 12 days and was then transferred to a clinical ward. He was discharged without any complications 43 days postoperatively.

3. Discussion

Our experience raises two important issues. First, the physical findings of cardiac tamponade may not be apparent in life-threatening acute cardiac tamponade after blunt trauma: FAST is a reliable tool for correctly diagnosing and following cardiac tamponade. Second, a direct pericardiotomy via a thoracotomy is mandatory for lifesaving cardiac decompression in acute traumatic cardiac tamponade with ineffective drainage due to clot formation within the pericardial space by pericardiocentesis and subxiphoid pericardiotomy.

Traumatic blunt cardiac rupture has a high mortality rate. However, the time to diagnosis, presence of vital signs on admission, low injury severity score, and cardiac tamponade are prognostic factors in traumatic blunt cardiac rupture [5]. In our patient, blood and clots were localized within the pericardial space without hemothorax. Based on the sudden hemodynamic recovery following clot removal, he was in cardiac tamponade. The physical diagnosis of traumatic acute cardiac tamponade is challenging. The signs may be difficult to evaluate because of neck swelling from the injury, hypovolemic status, or use of a protective cervical collar. Moreover, Beck's triad (low blood pressure, raised central venous pressure, and distant cardiac sounds) has insufficient sensitivity and specificity with proven tamponade in cases of multi-system trauma [6]. Pericardiocentesis was the original diagnostic and therapeutic procedure for traumatic acute cardiac tamponade. Cardiac tamponade is now often detected non-invasively using FAST, although sub-

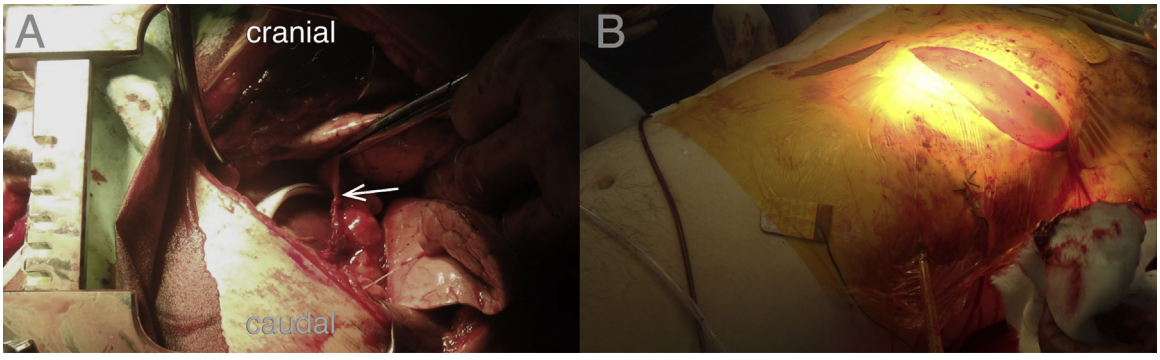

Fig. 2. Emergency room thoracotomy. The clot removal restored the heart stroke and hemodynamic status following direct pericardiotomy (A, arrow). We transferred our patient to the CT room following temporary chest closure using sterile iodine-impregnated adhesive drapes (B).

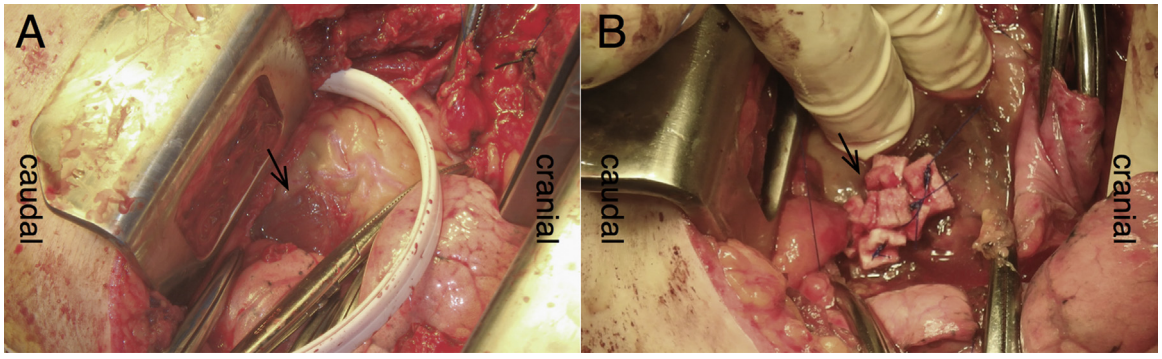

Fig. 3. Cardiac non-penetrating traumatic rupture of the left ventricular free wall (A, arrow). Hemostasis was achieved with digital pressure and a horizontal mattress sutures with 3-0 polypropylene and pledges (B, arrow) without cardiopulmonary bypass.

cutaneous emphysema and pneumothorax reduce the diagnostic accuracy [7]. Despite the possible false-negative results, FAST is a rapid, straightforward initial diagnostic tool that can be employed in the ER setting to identify pericardial fluid with high sensitivity and specificity [7]. Moreover, repeat FAST enables trauma surgeons to judge therapeutic performance in the ER and during surgery. In cardiac tamponade, a prompt diagnosis and treatment are lifesaving. FAST is mandatory for multi-system trauma.

Stable patients with hemopericardium can be managed safely with a subxiphoid pericardial window and drainage only [8]. However, pericardiocentesis and a subxiphoid pericardiotomy are often ineffective for cardiac decompression with clot formation within the pericardial space [3]. In our patient, adequate drainage and hemodynamic stabilization were not achieved with a subxiphoid pericardiotomy. Given the life-threatening situation, a direct pericardiotomy in the ER was the most efficient procedure, considering the need for open-chest cardiac massage.

A median sternotomy and left anterior thoracotomy are surgical approaches to patients with cardiac rupture [9]. In descending order, the injury to the heart most frequently involves the right atrium, right ventricle, left ventricle, left atrium, intraventricular septum, and, least commonly, rupture of the intra-atrial septum [9–11]. A diagnosis of ventricular rupture in a living patient is very rare. Contrast-enhanced CT showed multiple bilateral rib fractures without hemothorax. The underlying mechanism of the cardiac injury was thought to be a direct injury caused by the sternum. A median sternotomy is a standard approach for evaluating cardiac injury in hemodynamically stable patients with or without cardiopulmonary bypass [9]. However, a left anterior thoracotomy was the fastest and simplest life-saving procedure considering the need for open-chest cardiac massage given our patient's life-threatening condition. Uncontrolled bleeding may occur despite cardiac decompression with a pericardiotomy via a left anterior thoracotomy. In such situations, the incision is extended to a median sternotomy or clamshell incision to evaluate the right heart chambers and institute cardiopulmonary bypass [12–15].

4. Conclusion

We present a case of ER thoracotomy for acute traumatic cardiac tamponade secondary to blunt cardiac injury. The physical findings of cardiac tamponade are not always apparent despite life-threatening acute cardiac tamponade after blunt trauma: a prompt diagnosis using FAST and treatment are lifesaving. Pericardiotomy via a thoracotomy is mandatory for lifesaving cardiac decompression in acute traumatic cardiac tamponade with ineffective drainage due to clot formation within the pericardial space.

Conflict of interest

None.

Funding source

None.

Ethical approval

Approval to publish case report is waived by the institution.

Consent

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

Authors contribution

Kenichiro Ishida was the major contributor in writing the case report and he was involved in the acquisition, analysis and interpretation of the data. Yoshihiro Kinoshita, Nobutaka Iwasa, Masaro Nakae, Masayuki Sakaki, Yohei Ieki, Kyosuke Takahashi, Yumiko Shimahara, Taku Sogabe, Keiichiro Shimono, Mitsuhiro Noborio, and Daikai Sadamitsu critically reviewed the manuscript. All authors read and approved the final manuscript with Daikai Sadamitsu giving the final approval of the manuscript for submission.

Guarantor

Daikai Sadamitsu.

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