Trauma Case Reports 28 (2020) 100327

Contents lists available at ScienceDirect

Trauma Case Reports

journal homepage: www.elsevier.com/locate/tcr

Case Report

False negative of pericardial effusion using focused assessment with sonography for trauma and enhanced CT following traumatic cardiac rupture; A case report

Shinichi Ijuin*, Akihiko Inoue, Yoei Takamiyagi, Hiroyuki Tsukayama, Haruki Nakayama, Shigenari Matsuyama, Tetsunori Kawase, Satoshi Ishihara, Shinichi Nakayama

Department of Emergency and Critical Care Medicine, Hyogo Emergency Medical Center, 1-3-1 Wakinohamakaigandori, Chuo-ku, Kobe, Hyogo 651-0073, Japan

ARTICLE INFO

Keywords:
FAST
Traumatic cardiac rupture
Left atrial appendage
Cardiac tamponade
Pericardial perforation

ABSTRACT

Background: The focused assessment with sonography for trauma (FAST) examination is helpful for the identification of pericardial effusion in trauma. However, in a cardiac rupture with a pericardial perforation, pericardial effusion is not always detected by FAST. We experienced the case that FAST and enhanced CT failed to detect pericardial effusion.

Case presentation: A 51-year old woman injured after falling from a height of 3 m was brought to our institute. Focused assessment with sonography for trauma and enhanced computed tomography did not reveal any pericardial effusion; however, a massive hemothorax was revealed. Because the patient's hemodynamic state had become unstable, we performed an urgent left anterolateral thoracotomy. A left pericardial perforation was detected. By performing a clamshell thoracotomy, we found a rupture of 1 cm in diameter at the left atrial appendage. The hemodynamic state was stabilized by suturing the injury site. The postoperative course was uneventful, and the patient was transferred to another hospital after 31 days of admission.

Conclusions: Cardiac injury in the left atrial appendage is rare and sometimes difficult to diagnose and to repair. In the case of a blunt chest trauma with a massive hemothorax, although focused assessment with sonography for trauma gives negative results for pericardial effusion, a cardiac rupture with pericardial perforation should be considered.

Introduction

Blunt traumatic cardiac rupture is a rare occurrence that accounts for 0.5% of blunt trauma cases [1]. When pericardial injury is complicated by traumatic cardiac injury, the mortality rate is high. The focused assessment with sonography for trauma (FAST) examination is a useful tool in the initial assessment of trauma patients. FAST can be helpful for the early identification of pericardial effusion in trauma. However, in a cardiac rupture with a pericardial perforation in which blood comes out of the thoracic cavity, pericardial effusion is not always detected by FAST. Furthermore, all medical images, such as those from computed tomography (CT), have limitations to their sensitivity. In this paper, we report the case of a woman false negative for pericardial effusion, determined using FAST, following a traumatic cardiac rupture with an emergency surgical intervention.

* Corresponding author.
E-mail address: s-ijuin@hemc.jp (S. Ijuin).

https://doi.org/10.1016/j.tcr.2020.100327
Accepted 26 June 2020
Available online 30 June 2020

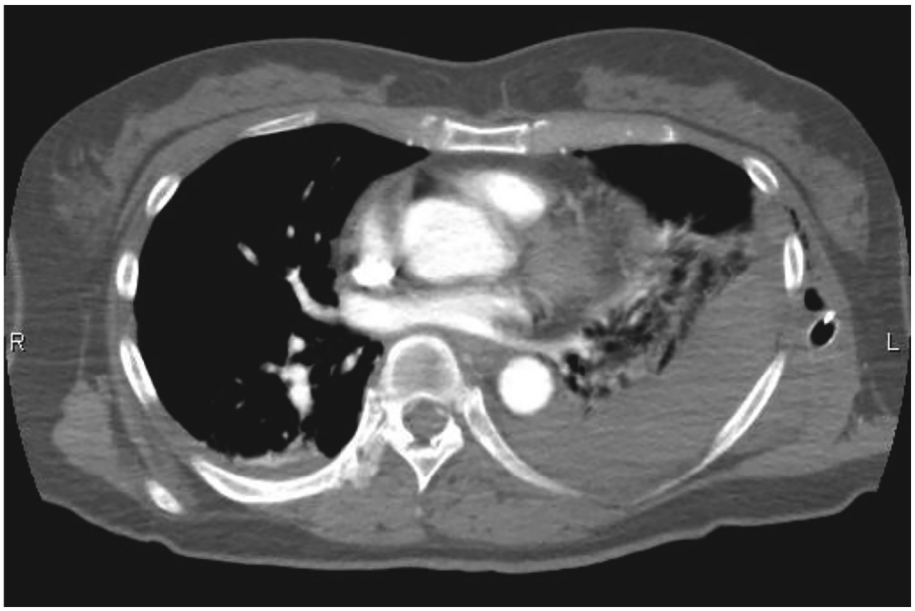

Fig. 1. Enhanced computed tomography scan.
The scan shows massive effusion to the left thoracic cavity, and no pericardial effusion.

Case presentation

A 51-year old woman was brought to our institute after falling from a height of 3 m. On admission, the patient's hemodynamic state was unstable, with a heart rate of 138 beats per min and blood pressure of 64/29 mmHg. FAST detected left massive hemothorax but did not detect any pericardial effusion by emergency physician. The left-sided chest drain tube was inserted immediately, and 1000 ml of blood was drained out. Tracheal intubation and fluid resuscitation with blood products were performed simultaneously. After a moderate improvement in the haemodynamic state which was reflected by a systolic blood pressure increase to 90 mmHg, a CT scan was performed. The CT scan revealed a skull fracture, multiple rib fractures, a spleen injury with extravasation, classified as grade 3 in Organ Injury Scale, and a left-sided massive hemothorax without extravasation, but it did not detect any pericardial effusion (Fig. 1). First, we performed a transcatheter arterial embolization (TAE) for the spleen injury. The TAE procedure was uneventful. However, after the TAE, the patient's hemodynamic state suddenly worsened, so an urgent left anterolateral thoracotomy was performed. There was no active bleeding source in the left thoracic cavity, but a hematoma could be seen through the pericardium. Next, we performed pericardiotomy and removed the hematoma around the heart. Although we could not find the bleeding site in the operational view, there was a small amount hematoma on the posterior aspect of the heart. Therefore, an additional thoracotomy, called a clamshell thoracotomy, was performed from the sternum to the right thoracic cavity. A rupture of 1 cm in diameter at the left atrial appendage was found (Fig. 2). Hemostasis was achieved by suturing the injury using 4–0 polypropylene monofilament. We found a pleuro-pericardial perforation on the back close to the cardiac perforation. After the procedure, the hemodynamic state was stable. The postoperative course was uneventful, and the patient was transferred to another hospital for rehabilitation after 31 days of admission. The patient's injury severity score, revised trauma score, and prognostic probability of survival were 41, 4.3, and 0.2, respectively.

Discussion

In the present case, because the hemodynamic state transiently improved after transfusion, we could perform CT in the emergency room. However, CT could not detect the pericardial effusion or the extravasation in the left-sided massive hemothorax. Even when the thoracotomy was completed, despite a massive amount of blood filling the left thoracic cavity, we could not find the bleeding source. Due to seeing a hematoma through the pericardium, we performed a clamshell thoracotomy, which resulted in identifying the source of bleeding, and thus, achieving hemostasis. From this case, it should be noted that there may be pericardial effusion that is not detected by FAST or CT.

For patients with an isolated cardiac injury, FAST is considered to be a useful and non-invasive diagnostic modality that can detect pericardial effusion in a short time with high sensitivity and specificity [2]. In the present case, although small amount of hematoma was stored on the posterior aspect of the heart in the operative view, FAST and CT failed to detect the pericardial effusion. In consideration of blunt mechanism and operative finding, it can be speculated that the reasons for this failure of detection were that both the left atrium and the pericardium were damaged simultaneously and that most blood coming out of the cardiac rupture flowed through the pericardial perforation into the thoracic cavity.

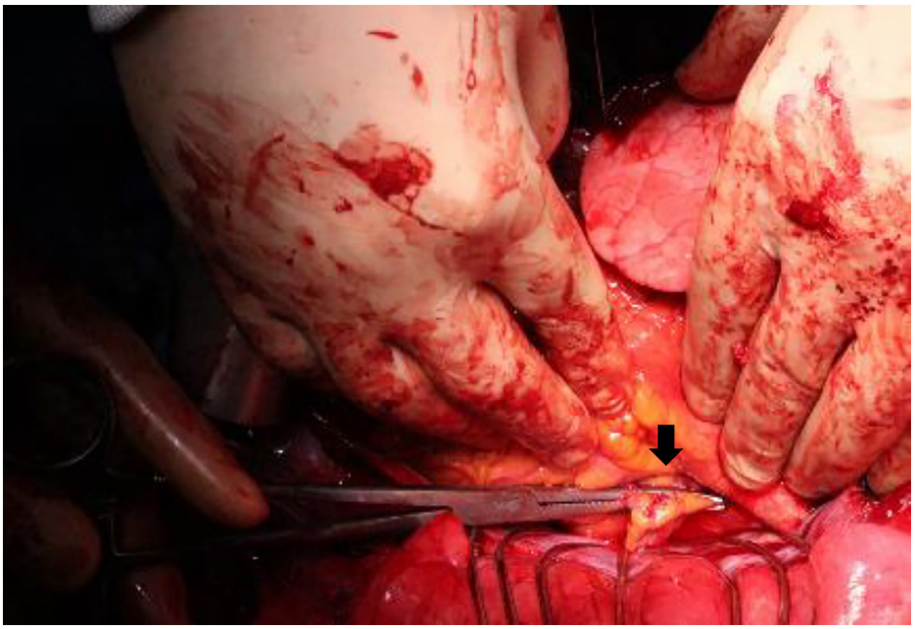

Fig. 2. Operative findings.
A perforation of the left atrial appendage with a laceration of the left pleuro-pericardium was detected.
Arrow shows the injury site of the left atrial appendage.

May et al. reported a case of a negative pericardial FAST in which pericardial blood was drained through the right thoracic cavity [3] and Ball et al. reported five similar cases with penetrating injuries [4]. According to the results of our case, if a case of blunt chest trauma without pericardial effusion but with a left massive hemothorax determined by the FAST and without extravasation in the CT was encountered, it could be considered as a combined blunt cardiac and pericardial injury. Although CT and FAST could not detect the pericardial effusion in this case, hematoma was seen through the pericardium in operative findings. Because those images were obtained just before a thoracotomy, it is difficult to speculate that the blood was not stored in the pericardial space at images obtained.

Fulda et al. reported that the incidence of combined pericardial perforation and cardiac rupture was 8% for patients with blunt chest trauma and the rate of survival was less than 15% [5]. The combination of blunt cardiac and pericardial injury is very rare [5]. Associated cardiac injuries were seen in 20%–40% of patients with a pericardial injury who presented with stable hemodynamics on admission [5,6]. Patients with pericardial perforations are less likely to complicate a cardiac tamponade, which leads to diagnosis as hemothorax, the delayed treatment of cardiac injuries, and increased mortality rates [7–9]. As image examinations have limitations, the diagnosis of cardiac injuries with pericardial perforation is challenging, and making a decision about surgical intervention is often difficult.

Conclusions

We reported a false negative case for pericardial effusion, determined using FAST, following a traumatic cardiac rupture. In thoracic trauma patients with a massive hemothorax, although FAST or CT give negative results for pericardial effusion, a cardiac rupture with pericardial perforation should be considered as a possibility.

Declaration of competing interest

All authors have no conflict of interest.

Acknowledgement

Not applicable.

References

[1] T.D. Martin, T.C. Flynn, B.J. Rowlands, Blunt traumatic pericardial rupture, J. Trauma 24 (1984) 287–290.
[2] G.S. Rozycki, D.V. Feliciano, M.G. Ochsner, et al., The role of ultrasound in patients with possible penetrating cardiac wounds: a prospective multicenter study, J. Trauma 46 (1999) 543–551 (discussion 551-2).

[3] A.K. May, M.A. Patterson, L.W. Rue 3rdet al., Combined blunt cardiac and pericardial rupture: reviews of the literature and report of a new diagnostic algorithm, Am. Surg. 65 (1999) 568–574.
[4] C.G. Ball, B.H. Williams, A.D. Wyrzykowski, et al., A caveat to the performance of pericardial ultrasound in patients with penetrating cardiac wounds, J.Trauma 67 (2009) 1123–1124.
[5] G. Fulda, A. Gondriguez, S.Z. Turney, R.A. Cowley, Blunt traumatic pericardial rupture. A ten-year experience 1979 to 1989, J. Cardiovasc. Surg. 31 (1990) 525–530.
[6] C.E. Brathwaite, A. Gondriguez, S.Z. Turney, C.N. Dunham, R. Cowley, Blunt traumatic cardiac rupture. A 5-year experience, Ann. Surg. 212 (1990) 701–704.
[7] Y.Y. Nan, M.S. Lu, K.S. Liu, et al., Blunt traumatic cardiac rupture: therapeutic options and outcomes, Injury 40 (2009) 938–945.
[8] Y.K. Huang, M.S. Lu, K.S. Liu, et al., Traumatic pericardial effusion: impact of diagnostic and surgical approaches, Resuscitation 81 (2010) 1682–1686.
[9] S.W. Chen, Y.K. Huang, C.H. Liao, et al., Right massive hemothorax as the presentation of blunt cardiac rupture: the pitfall of coexisting pericardial laceration, Interact. Cardiovasc. Thorac. Surg. 18 (2014) 245–246.