

CASE REPORT

Open Access



Blunt cardiac injury due to trauma associated with snowboarding: a case report

Fuminori Yamaji¹, Hideshi Okada^{1*}, Yasuhiro Nakajima¹, Kodai Suzuki¹, Takahiro Yoshida¹, Yosuke Mizuno¹, Haruka Okamoto¹, Yuichiro Kitagawa¹, Taku Tanaka¹, Shiho Nakano¹, Sho Nachi¹, Tomoaki Doi¹, Keisuke Kumada¹, Shozo Yoshida¹, Narihiro Ishida², Katsuya Shimabukuro², Hiroaki Ushikoshi¹, Izumi Toyoda¹, Kiyoshi Doi² and Shinji Ogura¹

Abstract

Background: Cardiac trauma is associated with a much higher mortality rate than injuries to other organ systems, even though cardiac trauma is identified in less than 10% of all trauma admissions. Here we report blunt trauma of the left atrium due to snowboarding trauma.

Case presentation: A 45-year-old Asian man collided with a tree while he was snowboarding and drinking. He lost consciousness temporarily. An air ambulance was requested and he was transported to an advanced critical care center. On arrival, a pericardial effusion was detected by a focused assessment with sonography for trauma. His presenting electrocardiogram revealed normal sinus rhythm and complete right bundle branch block. Laboratory findings included a white blood cell count of $13.5 \times 10^3/\mu\text{l}$, serum creatine kinase level of 459 IU/l, and creatine kinase-myocardial band level of 185 IU/l.

Enhanced computed tomography showed a large pericardial effusion and bleeding from his left adrenal gland. There were no pelvic fractures. A diagnosis of cardiac tamponade due to blunt cardiac injury and left adrenal injury due to blunt trauma was made. Subsequently, emergency thoracic surgery and transcatheter arterial embolization of his left adrenal artery were performed simultaneously. A laceration of the left atrial appendage in the lateral wall of his left ventricle was detected intraoperatively and repaired. His postoperative course progressed favorably, although a pericardial effusion was still detected on chest computed tomography on hospital day 35. His electrocardiogram showed normal sinus rhythm and the complete right bundle branch block pattern changed to a narrow QRS wave pattern. He was discharged on hospital day 40.

Conclusions: The present case report illustrates two points: (1) severe injuries resulted from snowboarding, and (2) complete right bundle branch block was caused by blunt cardiac injury. The present report showed blunt trauma of the left atrium with complete right bundle branch block as an electrocardiogram change due to snowboarding trauma. To detect cardiac trauma in snowboarding accidents, an examination of an electrocardiogram is required in all patients who might have a bruised chest.

Keywords: Blunt cardiac injury, Snowboarding trauma

* Correspondence: hokada@gifu-u.ac.jp; hideshi@gifu-u.ac.jp

¹Department of Emergency and Disaster Medicine, Gifu University Graduate School of Medicine, 1-1 Yanagido, Gifu 501-1194, Japan

Full list of author information is available at the end of the article

Background

Cardiac trauma is associated with a much higher mortality rate than injuries to other organ systems, even though cardiac trauma is identified in less than 10% of all trauma admissions [1]. Owing to its anterior location, the right ventricle is the most commonly injured chamber; it is injured in 40% of trauma victims. On the other hand, left atrial injuries are the least common because of their location.

Snowboarding is remarkable for its dramatic rise in popularity and there is an increasing incidence in trauma ranging from minor injury to severe head injury, as well as multiple injuries [2]. The most common injuries were to the wrist, the hand, and the head [3]. However, there are few reports that cardiac trauma is caused in snowboarding trauma [4]. Here we report blunt trauma of the left atrium due to trauma associated with snowboarding.

Case presentation

A 45-year-old Asian man collided with a tree while snowboarding and drinking. He temporarily lost consciousness; therefore, an air ambulance was requested. His level of consciousness improved, and his Glasgow Coma Scale (GCS) score was 15 when the air ambulance physicians reached him. However, his condition subsequently deteriorated. His radial artery pulse was not palpable bilaterally and his carotid artery pulse was faint. Subcutaneous emphysema and flail chest were not detected and there was no active bleeding from the site of injury. A physical examination revealed tachypnea with a respiratory rate (RR) of 30 breaths per minutes. Oxygen saturation (SpO₂) based on pulse oximetry was not measurable. Jugular venous distention was not

observed and there was no pelvic instability. A focused assessment with sonography for trauma (FAST) was performed. Intraperitoneal hemorrhage was not detected and there was no pericardial effusion.

During air ambulance transportation, his blood pressure became unstable. On arrival at our advanced critical care center, his heart rate was 95 beats per minute and blood pressure was 75/50 mmHg. A pericardial effusion was detected when FAST was performed again.

Anteroposterior chest radiographs showed an enlarged mediastinum (Fig. 1a). No fractures were detected on radiographs of his pelvis (Fig. 1b). His presenting electrocardiogram (ECG) revealed normal sinus rhythm and complete right bundle branch block (CRBBB; Fig. 1c).

Arterial blood gas analysis on 100% oxygen revealed a pH of 6.958, partial pressure of oxygen in arterial blood (PaO₂) of 342 mmHg, partial pressure of carbon dioxide in arterial blood (PaCO₂) of 31.3 mmHg, bicarbonate (HCO₃⁻) of 6.7 mmol/l, base excess of -25.3 mmol/l, and lactate of 157 mg/dl. Laboratory findings included a white blood cell count of 13.5 × 10³/μl, serum creatine kinase (CK) level of 459 IU/l, and CK-myocardial band (CK-MB) level of 185 IU/l.

For a systemic evaluation, enhanced whole body computed tomography (CT) was then performed. It revealed: a large pericardial effusion (Fig. 1d); bleeding from his left adrenal gland and abdominal aorta (Fig. 1e); fractures of his left fourth, sixth, and seventh ribs; and no pelvic fractures. Therefore, we diagnosed cardiac tamponade due to blunt cardiac injury, as well as left adrenal injury, and abdominal aortic dissection due to blunt trauma. Subsequently,

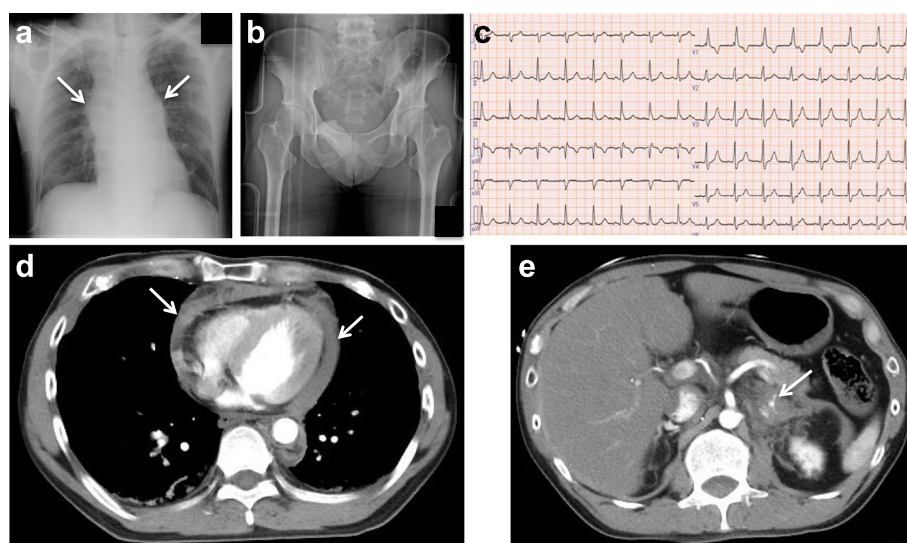


Fig. 1 **a** An anteroposterior chest radiograph showed an enlarged mediastinum (arrows). **b** A pelvis radiograph showed no obvious pelvic fractures. **c** The electrocardiogram on arrival at our hospital showed complete right bundle block and normal sinus rhythm. **d** Two-dimensional enhanced axial chest computed tomography showed a large pericardial effusion (arrows). Since the pericardium had a radiodensity of 30 to 50 Hounsfield units, it was thought that the pericardial effusion was bloody. **e** Two-dimensional enhanced axial abdominal computed tomography showed bleeding from left adrenal gland (arrow)

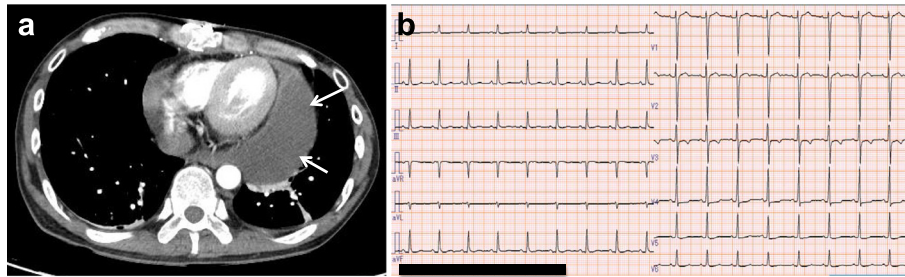


Fig. 2 **a** Two-dimensional axial enhanced chest computed tomography on hospital day 35. An effusion remained in the pericardium (arrows). **b** Electrocardiography on hospital day 35 revealed a narrow QRS pattern with normal sinus rhythm

emergency thoracic surgery and transcatheter arterial embolization of his left adrenal artery were performed simultaneously. A laceration of the left atrial appendage was detected in the lateral wall of his left ventricle during surgery, which was thought to be responsible for the cardiac tamponade. We repaired the laceration. His postoperative course progressed favorably, although pericardial effusion was still detected on chest CT (Fig. 2a) and echocardiography on hospital day 35. His ECG showed normal sinus rhythm, and the CRBBB pattern changed to a narrow QRS wave pattern (Fig. 2b). He was discharged on hospital day 40.

Discussion

The present case illustrates two important points. The first is that severe injury resulted from a snowboarding accident. Like some other winter sports, snowboarding comes with a level of risk. The most common injuries are simple sprains (31 to 53%), followed by fractures (24 to 27%), and contusions (12%). Blunt cardiac injury associated with snowboarding is extremely rare [4]. More than 90% of blunt cardiac trauma occurs in traffic accidents [1]. In other words, the snowboarding injuries in this patient are similar to injuries from high-energy trauma involving traffic accidents. Snowboarders on new equipment achieve high speeds when doing downhill snowboarding. It is possible that a high level of participation by novice snowboarders without protective gear could lead to severe extremity injury.

The second point is in regards to ECG abnormalities in blunt cardiac injury. The present case showed blunt trauma of his left atrium. The heart moves relatively freely in the anteroposterior direction. Hence, it often collides to the inside of sternal by external force such as a traffic accident. Therefore, typical blunt cardiac trauma occurs at the right ventricle. Blunt trauma of the left atrium is very rare [1]. It was reported that ECG abnormalities, increasing serum CK-MB and troponin concentrations, and echocardiographic findings were useful for diagnosing cardiac injury [5, 6]. In particular, ECG is an important screening test for patients with potential blunt

cardiac injury. ECG abnormalities in blunt cardiac injury can include sinus tachycardia, other arrhythmias, new bundle branch block, or ST depression or elevation [7, 8]. In the present case, CRBBB was the only ECG abnormality detected. The right bundle branch is vulnerable to stretch by trauma [9]. The CRBBB pattern changed to a narrow QRS pattern after surgery in the present case, and this change may have been caused by blunt cardiac injury, even though the site of injury was the left atrium. Although CRBBB generally can be considered benign, in trauma, all ECG changes should be suspected to indicate cardiac injury until proven otherwise. To detect cardiac trauma in snowboarding accidents, an examination of an ECG is required in all patients who might have a bruised chest.

Conclusions

The present case involved blunt trauma of the left atrium with CRBBB on ECG due to snowboarding trauma.

Acknowledgements

We thank Chihiro Takada of Gifu University.

Funding

None.

Availability of data and materials

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

FY, HOkada, YN, TY, YM, KSuzuki, HOkamoto, YK, TT, SNakano, SNachi, TD, KK, SY, NI, KShimabukuro, HU, IT, KD, and SO treated the patient. FY wrote the manuscript and HOkada revised and edited the manuscript. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

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.

Ethics approval and consent to participate

In Japan, a case report does not require ethics approval as described in Ethical Guidelines for Medical and Health Research Involving Human Subjects, which was made by the government of Japan [10].

Author details

¹Department of Emergency and Disaster Medicine, Gifu University Graduate School of Medicine, 1-1 Yanagido, Gifu 501-1194, Japan. ²General and Cardiothoracic Surgery, Gifu University Graduate School of Medicine, 1-1 Yanagido, Gifu 501-1194, Japan.

Received: 8 November 2016 Accepted: 13 February 2017

Published online: 25 March 2017

References

1. Yousef R, Carr JA. Blunt cardiac trauma: a review of the current knowledge and management. *Ann Thorac Surg*. 2014;98(3):1134–40. doi:10.1016/j.athoracsur.2014.04.043.
2. Geddes R, Irish K. Boarder belly: splenic injuries resulting from ski and snowboarding accidents. *Emerg Med Australas*. 2005;17(2):157–62. doi:10.1111/j.1742-6723.2005.00706.x.
3. Machold W, Kwasny O, Gassler P, Kolonja A, Reddy B, Bauer E, *et al*. Risk of injury through snowboarding. *J Trauma*. 2000;48(6):1109–14.
4. Bladin C, McCrory P, Pogorzelski A. Snowboarding injuries: current trends and future directions. *Sports Med*. 2004;34(2):133–9.
5. Mattox KL, Limacher MC, Feliciano DV, Colosimo L, O'Meara ME, Beall Jr AC, *et al*. Cardiac evaluation following heart injury. *J Trauma*. 1985;25(8):758–65.
6. Moore EE, Malangoni MA, Cogbill TH, Shackford SR, Champion HR, Jurkovich GJ, *et al*. Organ injury scaling. IV: Thoracic vascular, lung, cardiac, and diaphragm. *J Trauma*. 1994;36(3):299–300.
7. Milligan J, Potts JE, Human DG, Sanatani S. The protean manifestations of blunt cardiac trauma in children. *Pediatr Emerg Care*. 2005;21(5):312–7.
8. Sybrandy KC, Cramer MJ, Burgersdijk C. Diagnosing cardiac contusion: old wisdom and new insights. *Heart*. 2003;89(5):485–9.
9. Ismailov RM. Trauma Associated with Cardiac Conduction Abnormalities: Population-Based Perspective, Mechanism and Review of Literature. *Eur J Trauma Emerg Surg*. 2010;36(3):227–32. doi:10.1007/s00068-009-9096-y.
10. Minister of Education, Culture, Sports, Science and Technology-Japan. Ethical Guidelines for Medical and Health Research Involving Human Subjects. 2014. http://www.lifescience.mext.go.jp/files/pdf/n1500_01.pdf.

Submit your next manuscript to BioMed Central and we will help you at every step:

- We accept pre-submission inquiries
- Our selector tool helps you to find the most relevant journal
- We provide round the clock customer support
- Convenient online submission
- Thorough peer review
- Inclusion in PubMed and all major indexing services
- Maximum visibility for your research

Submit your manuscript at
www.biomedcentral.com/submit

