

Haemopericardium and liver laceration associated with airbag deployment

有關安全氣囊展開的心包積血及肝裂傷

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Airbags and seat belts are safety devices in automobiles. First invented in the 1950s, they are now commonplace in most automobiles. However, a seat occupant may sustain unexpected injuries even if the airbag deploys in a car collision. We describe a patient who was suspected of simultaneously sustaining haemopericardium and liver laceration during the "punch out" and "membrane force" phases of airbag deployment. The patient's vital signs stabilised after an emergency pericardiocentesis was performed. In a car accident when high-energy injury is suspected despite airbag deployment, computed tomography of the chest and abdomen or echocardiography should be considered because of the possibility of abdominal solid organ and chest injury. (*Hong Kong j.emerg.med.* 2009;16:242-245)

安全帶及氣囊是汽車的安全裝置。自50年代發明後，它們常見於現在大多數的汽車內。然而，縱使汽車在碰撞時氣囊展開，乘客仍會蒙受意料不到的創傷。我們描述一名病人懷疑在氣囊展開的「重擊」及「壓力膜」階段，同時蒙受心包積血及肝裂傷。進行緊急心包穿刺放液術後，病人的維生指數穩定下來。汽車意外中，如懷疑是高能量創傷，不管氣囊展開與否，應考慮胸腹電腦掃描或超聲波心動掃描，因有可能腹部的實質器官及胸部受傷。

Keywords: Abdominal injuries; airbags; haemorrhage; lacerations; pericardium

關鍵詞：腹部受傷、氣囊、出血、裂傷、心包膜

Introduction

Airbags and seat belts reduce the risk of serious injury by preventing the occupant's head and upper body from striking the vehicle's interior during a crash. Today, airbags are mandatory in most automobiles. Contrary to the initial expectations, an increasing number of unexpected injuries have been reported despite airbag deployment.

Case report

A 29-year-old man was admitted to the emergency department in May 2008 after his car crashed into a truck in front. When found, the man was with his seat belt on and the airbag deployed (Figure 1).

On admission, the man was drunk and had a Glasgow Coma Scale score of 10/15. His vital signs were: blood pressure 70/50 mmHg, respiratory rate 22 breaths per minute, pulse rate 84 beats per minute, and temperature 36.4°C, and he had a Revised Trauma Score of 9. On physical examination, redness was observed on the left lower border of the sternum, and there was a 4-cm laceration on the right lower leg. His abdomen was soft, but bowel sounds were decreased. Focused assessment with sonography for trauma (FAST) conducted immediately on admission did not show any abnormalities.

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Blood tests revealed elevated myoglobin of 569.22 ng/ml, troponin-I 3.162 ng/ml, CK-MB 7.63 ng/ml, AST 274 IU/L, and ALT 170 IU/L. In addition, electrocardiography revealed mild ST segment depression in leads II, III, and aVF. Computed

tomography (CT) of the chest and abdomen showed contusion of both lungs with pleural and pericardial effusions, a liver laceration, minimal haemoperitoneum, and a fracture of the fifth rib (Figure 2).

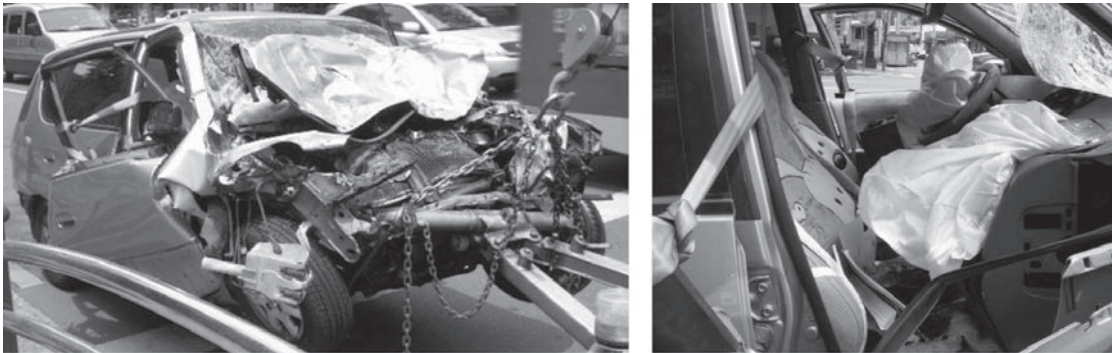


Figure 1. Picture of crushed car: the front windshield was shattered completely, the front door and bumper were damaged, and airbags deployed.

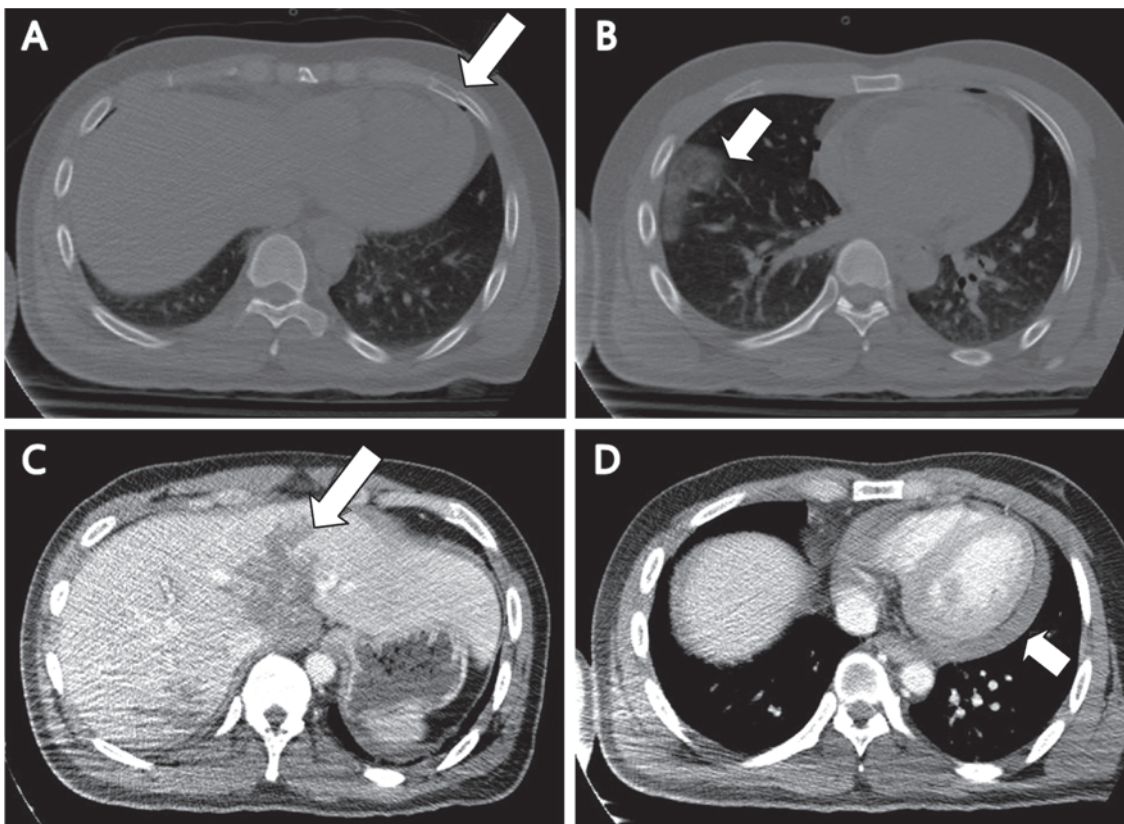


Figure 2. CT findings showing contusion of lung with pericardial effusion, a liver laceration with minimal haemoperitoneum, and a fracture of the left fifth rib (white arrows).

Based on the CT results, echocardiography-guided emergency pericardiocentesis was conducted, and 50 ml of blood was drained. After this treatment, the patient's blood pressure increased to 110/70 mmHg, and his vital signs stabilised. He was then transferred to the intensive care unit.

A follow-up chest X-ray taken on the next day showed increased pleural effusion. A right chest tube was inserted and drained 50 ml of blood. The echocardiography on day 6 was normal, although a bone scan revealed microfractures or bone contusion of both anterior ribs (Figure 3). A follow-up CT on day 7 showed recovery of the pericardial and pleural effusions, lung contusion, and liver laceration. On day 15, the patient had recovered well with no complications and was discharged from the hospital.

Discussion

Advances in transportation in modern societies have significantly increased the death rate caused by car accidents. As a result, the seat belt was invented in the 1950s and introduced commercially in the 1960s. Airbags became more prevalent in the 1980s and

eventually became mandatory for all cars produced in the USA after 1990. Although airbags have reduced morbidity and mortality caused by trauma,¹ McGwin et al² reported that it was still not certain whether the airbag had actually reduced injury severity. Moreover, when an airbag deploys and the occupant is not wearing a seat belt, it may cause more severe injuries of the lower extremities. Recent reports indicate that airbags may cause unexpected injuries, including eye injuries and temporary hearing loss.^{3,4}

An airbag is triggered in two phases. The first phase is called the "punch out" phase, when the air bag is inflated in less than 10 ms, and the resulting high sternal force may cause thoracic injury. The second phase is the "membrane force" phase, during which the inflated airbag strongly compresses the body parts away from the centre, causing injuries such as those in the abdomen.⁵

Although our patient wore a seat belt and the airbag deployed on collision, the emergency physicians suspected that he might sustain a haemopericardium from cardiac injury accompanying a rib fracture and lung contusion during the "punch out" phase. The liver laceration is suspected to be secondary to the

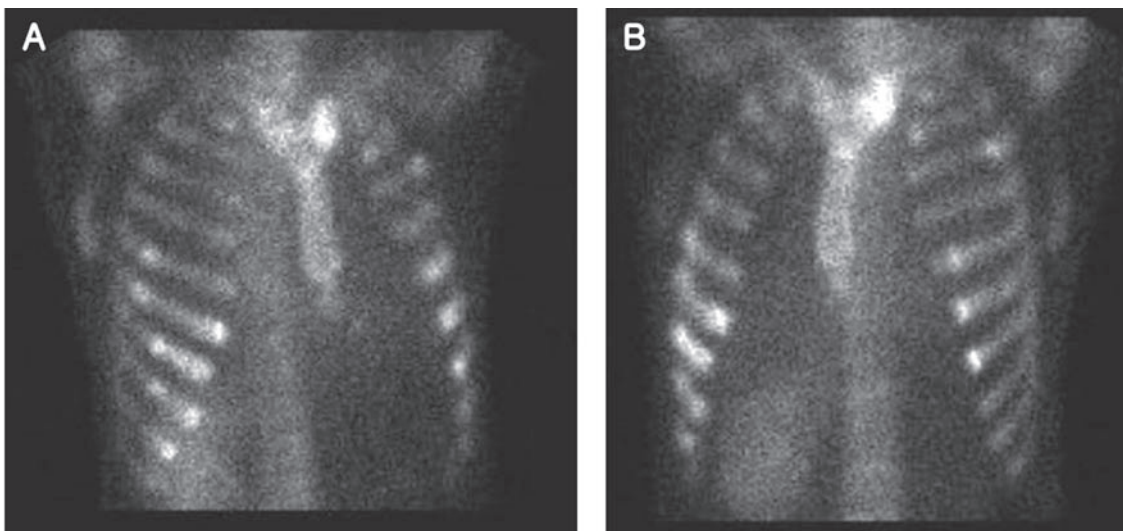


Figure 3. Bone scan showing increased uptakes at right 6th-10th anterior ribs and left 2nd/3rd/5th-7th anterior ribs and left manubrioclavicular junction.

trauma of the "membrane force" phase. Case reports of such severe injuries associated with the deployment of an airbag while wearing a seat belt are very rare.

When the anterior chest is injured as a result of airbag-triggered trauma, it can injure the tricuspid valve of the right ventricle, and possibly, although rare, the aortic valve. In cardiac valve injury, even if the symptoms seem to be mild, emergency physicians must have a high index of suspicion.

Great numbers of patients are admitted to the emergency departments following car accidents, although many have minor injuries only. However, even if a patient was wearing a seat belt and the airbag was deployed, emergency physicians should watch out for severe injuries, including haemopericardium, liver laceration, rib fracture, and lung contusion, for more

accurate diagnosis and speedy treatment of the patient at an early stage.

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