An autopsy case of blunt chest trauma from a traffic accident complicated by chest compression due to resuscitation attempts

Satoshi Furukawa1*, Lisa Wingenfeld1, Akari Takaya1, Tokiko Nakagawa1, Ikuo Sakaguchi1, Yoshio Yamamoto2, Katsuji Nishi1

Abstract: Coronary artery dissection leading to acute myocardial infarction after blunt chest trauma is extremely rare. A 67-year-old woman suffered blunt chest trauma following a traffic accident. The electrocardiogram revealed acute posterior ST-segment elevation and myocardial infarction and coronary angiography demonstrated acute right coronary artery dissection. Following the death of the victim an autopsy was performed after cardio-pulmonary support had been carried out. In this case report, we describe the case of a woman with blunt chest trauma, who developed an acute myocardial infarction secondary to right coronary artery dissection. Although there was additional the blunt chest trauma due to chest compression, we confirmed the injury at autopsy and by histological findings.

Key Words: blunt chest trauma, right coronary artery dissection, coronary angiography, autopsy, histological examination

Blunt chest trauma can cause significant cardiac complications, such as: acute myocardial infarction, arrhythmia, myocardial rupture, and cardiac contusion. Electrocardiographic changes in ST-T segment elevations after blunt chest trauma are not rare. Most commonly ST-T segment elevation changes represent myocardial contusion [1].

However, significant ST-T segment elevation changes can be caused by coronary artery spasm, thrombosis, dissection of the aorta with propagation to the coronary arteries, or coronary artery dissection [1]. Coronary artery dissection following blunt chest trauma is rare [1-3] but the diagnosis is often delayed and in some cases is only diagnosed postmortem.

It is difficult to estimate the true incidence of traumatic coronary dissections because most coronary dissections, both spontaneous and non-spontaneous, are seen at the time of post-mortem examination. We describe an autopsy case with acute coronary artery dissection after blunt chest trauma.

Case report
A 67-year-old woman was admitted to the emergency room after an automobile collision in which she was a belted driver. On arrival at the emergency room, she complained of right shoulder pain. Examination on arrival revealed a Glasgow Coma Scale score of 15, a heart rate of 110 beats/min, blood pressure of 113/76mmHg and O2 saturation of 98% (O2 5L).

Laboratory data included a hematocrit of 38.9% and a platelet count of 315,000/μL. A physical examination was significant for chest wall tenderness, right clavicle fracture and fractures of ribs 2 through 5 on the right side.

The patient had a past history of hypertension and hyperlipidemia. She was a non-smoker and did not take drugs except for hypertension. There were no significant findings on plain computed tomography (CT)
apart from the fractures and a chest CT did not show any hemorrhaging in bilateral thoracic cavities (Figure 1) but enhanced CT showed several layers of different densities in the left ventricle (Figure 2).

The electrocardiogram showed ST elevations in leads II, III, aVF and V1 through V4. (Figure 3) After returning from the CT suite she suffered sudden cardiac arrest and was immediately transferred to the catheterization laboratory. Diagnostic coronary angiography revealed right coronary artery dissection (Fig.4) but the other coronary arteries were normal. Despite cardiopulmonary resuscitation she died 4h after the traffic accident. An autopsy was performed the following day.

**Autopsy findings**

The victim had a body weight of 76.4 kg.

There were a right clavicle fracture, a sternum fracture and fractures of ribs 1 through 7 on the right side and 2 through 9 on the left. There was massive hemorrhaging and a clump of fibrin network in the left thoracic cavity (Figure 5). The pericardial sac was lacerated and the heart protruded into the left thoracic cavity (Figure 6).

In the heart there were penetrating contusions which extended into the ventricle but were not surrounded by hemorrhage (Figure 7) and the contusion which was a comparatively larger hemorrhage in adipose tissue (Figure 8). Histological examination revealed a right coronary artery dissection with a dilated false lumen and true lumen (Figure 9). There were not arterio-sclerotic changes but he infracted myocardial area was found on histological findings.

**Discussion**

Coronary artery dissection is a well-known but unusual complication of blunt chest trauma. The left anterior descending coronary artery is the most frequently injured artery (76%) followed by the right coronary (12%) and the circumflex (6%) arteries [1]. The dissection begins with a small intimal tear caused by the combination of sudden compression of the chest wall and shearing forces.
following the impact [4]. Acute myocardial infarction after blunt chest trauma can be caused by a shearing force on the coronary artery leading to an intimal tear and subsequent platelet aggregation and thrombosis [4,5].

The diagnosis is frequently overlooked or delayed and sometimes only found at postmortem examination. The patient described here was taken for cardiac catheterization and found to have a right coronary artery dissection. Post-mortem pathological examination revealed concomitant disruption of the vasa vasorum and tunica intima resulting in a false lumen [6]. Traumatic myocardial injury occurs in up to 55% of patients sustaining blunt chest trauma [7]. Myocardial contusion needs be differentiated from blunt chest trauma related coronary artery events, but this can be difficult [8].

This autopsy case was complicated by additional blunt chest trauma due to the chest compression. There was a massive hemorrhage in the left thoracic cavity at autopsy but this was not detectable by chest CT on admission.

**Figure 5.** Massive hemorrhage in the left thoracic cavity (autopsy).

**Figure 6.** The pericardial sac was lacerated and the heart protruded into the left thoracic cavity (autopsy).

**Figure 7.** The penetrating contusion extending to the ventricle (arrow)(autopsy).

**Figure 8.** The contusion was accompanied by a large superficial hemorrhage in the adipose tissue (circle)(autopsy).

**Figure 9.** Histological findings (Hematoxylin - eosin stain): coronary artery dissection and hemorrhage from the false lumen (x2).
Enhanced CT clearly demonstrated a hypodensity area in the left ventricle, which suggested a fibrin network and it is thought that the chest compression lacerated the pericardial sac.

The penetrating contusion which reached the ventricle was caused by chest compression because there were no hemorrhages around this region and the patient survived for 4h after the traffic accident. The superficial hemorrhagic myocardial contusion in adipose tissue was attributed to the right coronary artery dissection. In histological findings light microscopic observations with hematoxylin & eosin (HE) staining revealed the presence of the hemorrhage accompanying the dissection in this region.

Conclusions
Coronary dissection is a pathophysiological mechanism for myocardial infarction following blunt chest trauma. The presence of electrocardiogram changes, along with segmental wall motion abnormalities should alert the clinician to the presence of coronary artery damage.

Acknowledgements
We thank Shiga University of Medical Science for supporting this project and permission to publish the article.

References