



## Blunt Cardiac Rupture in Multiple Trauma Injured Patient - Case Report and Review of Literature

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### Abstract

Motorcycle accidents account almost half of total road accidents. This bareness vehicle increases the chance for severe multiple trauma cases. Head, thorax, abdomen - pelvis and extremities are the most injured. While head injury has the highest Odds Ratio for mortality (OR=5.383), none of the injuries is negligible. A well-organized trauma system or may change the odds in the favor of the injured patients. During the years the mortality rates due to trauma cases has decreased. Still the severity of these injuries, unfortunately, obligates a lifetime consequences and disabilities with very long rehabilitation processes. Herein, we present a case of a 28 -year-old male patient, who crashed with his motorcycle by street pole. The patient had presented with cardiac rupture and severe head injuries.

**Keywords:** Cardiac Rupture; Head Injury; Motorcycle; Severe Trauma Injury

**Abbreviations:** ISS: Injury Severity Score; BCI: Blunt Cardiac Injury; FAST: Focused Assessment with Sonography for Trauma; TBCT: Total Body Computerized Tomography; EVD: Extra Ventricular Drainage; GCS: Glasgow Coma Scale

### Introduction

Severe trauma causes enormous disruption of the patient's routine and quality of life. Nearly 16,000 people die every day from various injuries around the world, including road accidents that comprise the major causes of injury mortality in more than 22% of cases [1]. Looking at the traffic accident characteristics, we may notice that motorcyclists are involved in over 50% of the cases and most often will result in fatal trauma, scored by injury severity score  $\geq 50$  (ISS $\geq 50$ ) [2, 3]. Riding the motorcycle risks the driver with the possibility of severe and complicated injury that may involve various organs. Injuries with high mortality rates in developed and developing countries are head injuries, then thoracic, and intra-abdominal injuries [4, 5]. Helmet remains the main head protecting device and reduces the rate of severe head injuries in motorcyclists and its use is recommended by many trauma prevention societies, and enforced by laws [6].

Chest injuries are also harmful and can lead to severe blunt chest wall injuries, lung, major thoracic vessels and Blunt Cardiac Injury (BCI). Patients who sustained significant BCI would suffer in 70-80% of the cases from additional injuries. Severe BCI often causes death at scene, while the most common injury of those fatal outcomes is transmural rupture of the ventricular wall [7]. Over the past few decades, trauma systems improvement has resulted in 15% - 40% reduction in mortality rates in severe trauma injuries [8, 9]. Advances in pre-hospital management and transfer as part of the modern trauma systems contribute to the decreased trauma mortality [10]. Herein, we present a case of a 28-year-old male who was admitted after a motorcycle accident with a serious injury that combines cardiac wall rupture and severe brain injury.

### Case Presentation

A 28-years-old healthy male was admitted to our emergency department after he had crashed at street pole as a motorcycle driver while wearing a helmet. Our trauma center is a level I trauma center, with 40000 Emergency Room (ER) trauma patients visits annually and almost 4000 hospital admissions of trauma patients, with average of 850 trauma patients with ISS > 16. At scene, the patient was unconscious, his airway was secured with Laryngeal Mask Airway (LMA) due to unsuccessful attempt for oro-tracheal intubation. The time between his injury until our level I trauma

center ER arrival, last 50 minutes. Upon his admission to the trauma shock room his vital signs were heart rate 140bpm, blood pressure 102/55mmHg, SpO<sub>2</sub> 100%, and EtCO<sub>2</sub> 18mmHg. The LMA was replaced to endotracheal tube. A chest x-ray presented bilateral lung contusions. The Focused Assessment Sonography for Trauma (FAST) revealed pericardial effusion, meanwhile the values of EtCO<sub>2</sub> were dropped to 14mmHg and the heart rate decreased to 60bpm.

Emergency room, left anterolateral thoracotomy was performed immediately, revealed no heart beats, pericardial tamponade. Pericardiectomy was performed and the tamponade was evacuated with immediate normal cardiac activity, increased blood pressure and his ETCO<sub>2</sub> values increased to 37. No bleeding cardiac source was identified and the patient was transferred urgently to the operating room. A meticulous cardiac examination at the operating room identified a bleeding from rupture of the base of the left heart auricle. A primary closure was performed. Intraoperative Transesophageal Echocardiography (TEE) excluded septal, valvular or chordae tendineae injury or rupture and revealed normal cardiac function. The pericardium was closed, two chest drains were left. After chest wall closure the patient was transferred to the CT scan suit for total body scan which demonstrated multiple skull and facial fractures.

In addition right hemispheric extra-axial subdural hemorrhage with maximal width of 1.5 cm, accompanied by a mass effect on the adjacent brain tissue with a 1.3 cm midline shift to the left; The epidural component at the temporal lobe contained a hypodense zone, suspected with active bleeding; left sided subfalcine and uncal herniation. The sub-arachnoid hemorrhage was estimated as Fisher 2. As a result, the patient was rushed back to the operating room right-side decompression craniectomy. At the neurosurgery operation several findings were found that was compatible with the CT scan description. Fenestration of the dura; blood clots evacuation and control of the active bleeding were performed. Extra Ventricular Drainage (EVD) was placed in the decompression zone along with intracranial-pressure monitor. To notice that the bilateral dilated pupils prior to surgery - (-8) both contracted (+2) and reacted to light at the end of the neurosurgical procedure.

His post-operative course at the neurosurgical intensive care unit was long and complicated. After hemodynamic, respiratory and neurosurgical stabilization the patient underwent Maxillo-facial surgery. Ventilator associated pneumonia was treated by antibiotics and cleared. His neurologic status improved, left residual hemiparesis was noted. Normal cardiac function was achieved (TTE - Trans Thoracic Echocardiography). The patient was discharged to rehabilitation on post-admission day 50 with Cerebral Performance Category (CPC) score of 2. The patient had continuous follow-up by multi-disciplinary teams during his

rehabilitation. A cranioplasty was made after three months, while after half a year the patient was presenting weakness of the upper left extremity; absolute unilateral deafness of the right ear; and chronic pain of the right lower jaw and summed as CPC 1.

## Discussion

As the world gets more motorized the number of motorcyclists' increases. There are countries with over 45% of the registered vehicles are motorcycles [11]. The motorcycle itself is an unprotected vehicle that can risk the driver in every simple accident with critical injuries. Studies showed that compared to car passenger occupants, motorcyclists are 37 times more likely to die and 8 times more likely to be injured [12]. Von Ruden et al. showed that motorcycle accidents cause more major trauma with ISS $\geq$  50 than with ISS <50 [2]. The major trauma injuries (ISS $\geq$ 50) were characterized by severe head or neck, chest, abdomen and limb injuries. The abbreviated injury scale also showed a significant difference in the severity of injury at these anatomical areas when ISS $\geq$ 50 compared to ISS<50 [2]. Head injuries are one of the major problems in motorcycle accidents. In study of 1653 trauma patients involved in a motorcycle accident, 23% had a head injury, however the odds ratio for mortality was most significant at head injuries comparing to other anatomical sites (OR = 5.383) [13].

A low Glasgow Coma Score (GCS) at the admission of patient with head injury has high predicting accuracy of mortality rates [13]. Helmet is a proven protective accessory for reducing the risk of serious head injuries. Tham et al. showed a reduction in the risk of severe head injuries by up to 70% in helmeted motorcyclists, however, in the absence of a helmet, higher numbers of unconscious patients (GCS <8), more head and neck injuries, cranial fractures and the need for intensive care unit were reported [3, 14]. Chest trauma accounts for about 25% of all causes of death in trauma cases [15]. Blunt chest injuries can result at 0.16-2% of the cases to devastating cardiac rupture accompanied by mortality rate of 89.2%, while left atrial wall rupture can occur in 13-24% of those catastrophic mechanisms [7, 16-18]. Emergency department thoracotomy is a fundamental procedure while managing traumatic chest blunt injury with pericardial tamponade and loss of vital signs in the ER. Emergent thoracotomy has shown to improve survival rates from 7.9% to 11.3% over the years [19].

Over the years there has been an improvement in trauma systems and in the management of the trauma patients. Those improvements decreased the trauma mortality rate [10]. Trauma standards and protocols were established at pre-hospital level of care, and designated level I trauma centers that have been built considering the level of facilities and staff training. Various studies have shown a significant reduction in mortality rates in the major trauma centers and even higher survival rates in the level I trauma centers versus level II [20]. Teixeira et al. has shown that

despite global improvement trends, still, where trauma centers or trauma teams are not well organized, the preventable deaths is consider to be very high [21]. Young et al. have shown that time for treatment is very important in treating those serious injuries and the immediate availability of surgery facilities and a surgical team is essential for patient survival [22]. Trauma surgeons have come to rely on a number of diagnostic adjuncts. The FAST has impacted the assessment and treatment of the injured patients with improved trauma management time [23, 24].

This modality helps identifying intra-abdominal fluid and as a result can be primary assessment modality for hemoperitoneum (around liver, spleen and pelvis) and hemopericardium with sensitivity rates of 85% to 96% and specificity approaching 98% [25]. CT is still the gold standard for the detection of intra-abdominal injuries [26]. However, the FAST, which performed next to the patient's bed, can spare the transportation which is critical at unstable patients. Moreover, the FAST has been shown to decrease time to operative intervention; patient length of stay; cost; and the rates of complications [27]. Severe injuries in motorcycle accidents have long-lasting with significant consequences. In many cases, a young age driver may experience the consequences of injury for a lifetime. Less is known about the final outcome of these injuries, but it is clear that this is a lengthy process that starts from the accident scene, initial treatment until the end of rehabilitation. The effects concerned on the psychological, the economic and routine of life.

Several studies have shown deterioration in the first six months after hospital discharge, with some improvement at the health-related quality of life during two years from discharge [28-30]. On one hand, von Rden et al. showed a decrease in hospitalization days in patients with ISS $\geq$ 50 compared to previous studies from the eighties, but showed that 62% of the patients would suffer from chronic pain, while 38% would be inadequate to keep their daily activities due to the intensity of pain [2]. In addition, further study has shown that even after 5 years of severe injury there will be a significant disability in young people, when only 20% of them experiencing no restriction at all [31]. In our presented case a combination of two fatal injuries, blunt cardiac injury and severe head injuries in young male patient were diagnosed and treated properly and efficiently. The life threatening intrapericardial hemorrhage due to the blunt cardiac injury was diagnosed and treated in very short time in the emergency room based on international trauma protocols, and definitive surgical repair was performed in the operating room. The head injury diagnosis was made by the CT scan and also managed in very short time after the diagnosis.

## Conclusions

Blunt cardiac injury and rupture is not common but it is not rare. An organized trauma system can offer high performance

management at the levels of prehospital, hospital and rehabilitation with short time of response and transfer to level I trauma center and in hospital high quality of care. These improvements in the chain of trauma care increases the chances for survivability in multiple trauma patients with devastating injuries includes blunt cardiac injuries. However, despite the improvement in the response and the quality of care of the modern trauma centers, it is important to reduce the incidence of these injuries by acts of prevention.

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