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Blunt Cardiac Rupture: A Rare Case of Catastrophic Injury in Trauma

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ABSTRACT

Trauma is a leading cause of mortality in individuals between 1 and 44 years of age. Among thoracic traumas, blunt cardiac injury (BCI) represents a relatively uncommon but potentially fatal entity. Approximately 20% of blunt chest traumas involve some form of cardiac injury, with this number increasing to 76% in cases of polytrauma. BCIs span a clinical spectrum from benign myocardial contusions to fatal multi-chamber ruptures. Blunt cardiac rupture, although rare, carries a high pre-hospital mortality rate and accounts for only 0.16–2% of hospital trauma admissions. We report a case of a 24-year-old male involved in a high-speed car-to-car collision, who arrived at the emergency department in cardiac arrest. He underwent immediate resuscitative thoracotomy, revealing a full-thickness rupture of the left ventricle. Although spontaneous circulation was restored after pericardial decompression and bleeding was temporarily controlled using a Foley catheter, the patient later developed cardiac edema and refractory arrhythmia and did not survive.

This case emphasizes the rarity and lethality of blunt cardiac rupture, the need for rapid surgical intervention, and the critical role of multidisciplinary trauma care, including emergency medicine, surgery, and anesthesiology, in optimizing outcomes.

Introduction

Blunt cardiac injury (BCI) is a spectrum of cardiac trauma resulting from non-penetrating force to the thorax. Although frequently underdiagnosed, BCI is present in roughly 20% of all blunt thoracic traumas, and its incidence rises significantly among patients with high-energy mechanisms or multiple injuries [1]. The manifestations of BCI vary widely, from minor arrhythmias and myocardial bruising to catastrophic cardiac chamber rupture [2]. Among these, blunt cardiac rupture remains one of the most lethal forms of thoracic trauma. Due to rapid exsanguination or cardiac tamponade, many patients die at the scene, and those who do reach medical care often deteriorate rapidly [3].

The diagnosis of blunt cardiac rupture is notoriously difficult, particularly in polytrauma cases where clinical signs may be nonspecific or masked [4]. Prompt identification and emergent surgical management

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are essential for survival. Here, we present a case of a young male who sustained a blunt cardiac rupture, managed surgically but with an ultimately fatal outcome, to underscore the clinical and surgical challenges of this rare condition.

Case Presentation

A 24-year-old male was brought to the emergency department (ED) by emergency medical services (EMS) following a high-energy car-to-car motor vehicle collision. According to prehospital reports, the patient experienced cardiac arrest five minutes prior to arrival and had been intubated and undergoing CPR en route.

Upon arrival, a resuscitative left anterolateral thoracotomy was performed immediately due to pulseless electrical activity and signs of pericardial tamponade. Surgical exploration revealed a full-thickness perforation at the apex of the left ventricle, with significant hemopericardium (Figure 1).

After evacuating the pericardial clot, spontaneous cardiac activity resumed. Hemorrhage control was temporarily achieved by inserting a 14-Fr Foley catheter into the myocardial defect and inflating the balloon.

The patient was transferred emergently to the operating room for definitive repair. A pledgeted horizontal mattress suture technique was used to close the ventricular perforation. Cardiopulmonary bypass was not required. Hemostasis was achieved, and the pericardium was left open. Bilateral thoracostomy tubes were inserted, and the thoracotomy incision was closed at the skin level only.

The patient was then admitted to the intensive care unit (ICU) for close monitoring. Five hours postoperatively, he developed polymorphic ventricular tachycardia, followed by asystole. Open cardiac massage was initiated through the previous thoracotomy incision, but the myocardium was noted to be grossly edematous and non-compliant. Despite



Fig. 1. Intraoperative photograph obtained during emergency resuscitative thoracotomy showing the full-thickness perforation at the apex of the left ventricle prior to definitive repair.

administration of high-dose inotropes and multiple defibrillations, return of spontaneous circulation could not be achieved. The patient was declared deceased after 40 minutes of unsuccessful resuscitation.

From the anesthesiology team's perspective, this case involved significant perioperative challenges. The patient arrived intubated and in cardiac arrest, requiring rapid coordination between surgical and anesthetic teams. Given the profound hemodynamic instability, anesthetic induction was modified. Etomidate and ketamine were considered, but induction was deferred until return of spontaneous circulation. After achieving ROSC post-thoracotomy, ketamine was used in sub-anesthetic doses to maintain cardiovascular tone, while fentanyl was administered cautiously for analgesia.

Intraoperatively, central venous and radial arterial lines were established under urgent conditions. Hemodynamic parameters were maintained with titrated norepinephrine and crystalloid boluses. Volatile agents were avoided due to their negative inotropic effects, and depth of anesthesia was managed with bolus doses of benzodiazepines and opioids. Post-repair, the patient was sedated with propofol and fentanyl infusions in the ICU.

Despite aggressive hemodynamic monitoring, the patient developed signs of myocardial dysfunction, including hypotension, rising central venous pressure, and decreasing cardiac output. Antiarrhythmic therapy (amiodarone and lidocaine) and synchronized cardioversion were attempted during the onset of arrhythmias, but myocardial edema rendered the heart refractory to resuscitation. The lack of access to advanced circulatory support such as ECMO may have limited rescue options.

Discussion

Blunt cardiac rupture is a life-threatening injury characterized by full-thickness myocardial laceration, most commonly involving the right ventricle or atria due to their anterior location [5]. However, in this case, the injury involved the apex of the left ventricle—an unusual and highly lethal site given its muscular thickness and high systolic pressure [2]. The mechanism is believed to involve sudden deceleration forces that compress the heart between the sternum and vertebral column [1, 3].

Most patients with blunt cardiac rupture die before reaching definitive care. For those who arrive at a hospital, the window for surgical intervention is exceedingly narrow. Initial management centers on rapid identification of tamponade and hemorrhage, followed by resuscitative thoracotomy. The anterolateral approach is preferred in the emergency setting due to rapid access [6].

In our patient, temporary bleeding control with a Foley catheter followed by definitive repair allowed initial stabilization. However, reperfusion injury and cardiac edema likely contributed to postoperative arrhythmia and mortality. This case reflects both the technical feasibility and the physiological limits of current trauma care.

A multidisciplinary team approach, including emergency physicians, trauma surgeons, anesthesiologists, and intensivists, is essential for improving survival. Furthermore, where available, extracorporeal life support may offer a bridge to recovery in select cases with profound myocardial dysfunction [4]. Blunt cardiac rupture is a rare but often fatal consequence of high-impact thoracic trauma. Although definitive surgical management remains the cornerstone of survival, this case highlights that early, prehospital recognition of blunt cardiac injury (BCI) plays a pivotal role in the patient's outcome. Given the extremely narrow window, the patient sustained a high-energy mechanism, and rapid transport to a trauma-equipped facility was critical.

Conclusion

In this case, the patient sustained a high-energy motor vehicle collision with immediate deterioration and cardiac arrest at the scene. Key prehospital warning signs—including persistent hypotension despite fluid resuscitation, signs of poor perfusion (altered mental status, cyanosis), jugular venous distension, and pulseless electrical activity (PEA) without external hemorrhage—should raise suspicion for BCI or pericardial tamponade. Importantly, the presence of cardiac arrest in the context of blunt trauma with no obvious external bleeding source should prompt consideration of intrathoracic hemorrhage or cardiac rupture.

EMS providers should be trained to recognize mechanism-based red flags, such as high-velocity deceleration injuries and direct chest trauma, especially with anterior chest wall deformities, flail segments, or sternal fractures.

Early communication with the emergency department regarding a suspected cardiac injury can significantly shorten the time to thoracotomy.

Furthermore, protocols for activating trauma teams upon suspicion of BCI based on mechanism and clinical signs should be reinforced in emergency medical services systems.

In conclusion, while operative intervention is essential for survival in blunt cardiac rupture, prehospital suspicion, triage, and communication are equally critical. Improved training of EMS providers in recognizing BCI-specific signs and integrating prehospital diagnostic tools may provide a life-saving advantage in the small subset of patients who reach the hospital with salvageable injuries.

Ethical Considerations

Compliance with ethical guidelines

There were no ethical considerations to be considered in this article.

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Conflict of Interests

The authors have no conflict of interest to declare.

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