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Case Study

Emergency Care Management of Blunt Thoracic Chest Wall Trauma in Traumatic Cardiac Arrest

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Abstract

This case report describes the emergency management of a 35-year-old female motorcyclist who sustained critical injuries following a high-impact collision with a bus in Malaysia. The patient was brought to the Emergency Department of Hospital Selayang on April 24, 2025, where immediate resuscitation was initiated. Despite aggressive trauma life support measures, the patient succumbed after 30 minutes of continuous resuscitation efforts. The case highlights the clinical presentation and diagnostic evaluation of blunt thoracic chest wall trauma leading to traumatic cardiac arrest. On arrival, the patient was pulseless and required immediate cardiopulmonary resuscitation, advanced airway management, and insertion of bilateral chest tubes for hemothorax. Circulatory support included large-bore intravenous access, administration of crystalloids, and emergency blood transfusion. Point-of-care ultrasound revealed minimal pericardial effusion, prompting pericardiocentesis, although only minimal fluid was drained. Despite timely interventions and adherence to trauma resuscitation protocols, the patient did not achieve return of spontaneous circulation. The outcome emphasises the devastating consequences of blunt thoracic trauma, particularly massive hemothorax, and the challenges faced in managing traumatic cardiac arrest in emergency settings. This report underscores the importance of a systematic and structured approach in trauma care, including rapid assessment, identification of reversible causes, and early activation of multidisciplinary teams. It also highlights the need for continuous training, infrastructure development, and adherence to trauma protocols to optimise outcomes. Although survival in such cases remains rare, effective emergency systems and timely interventions remain essential for improving the chances of recovery.

Keywords: *Blunt Thoracic Trauma; Emergency Resuscitation; Massive Hemothorax; Trauma Life Support; Traumatic Cardiac Arrest*

Introduction

Motorcycle accidents are a leading cause of trauma in Malaysia, contributing significantly to morbidity and mortality. A study involving 1,653 injured motorcyclists reported a mortality rate of 8.6%, with factors such as age ≥35, lower Glasgow Coma Scale (GCS) scores, and the presence of head, chest, liver, and small bowel injuries being significant predictors of mortality (Tan Chor Lip *et al.*, 2019). Hospital Selayang's ED plays a crucial role in the initial management of trauma patients, providing comprehensive emergency care, including resuscitation, stabilization, and definitive management (Hospital Selayang, n.d.).

Trauma remains one of the leading causes of mortality in individuals under the age of 40, with road

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traffic accidents being a significant contributor, especially in low- and middle-income countries (Lockey *et al*., 2013). Blunt thoracic trauma is particularly lethal when it involves massive hemothorax, as it can rapidly lead to hemodynamic compromise and cardiac arrest (Van Rutte *et al*., 2014).

Blunt thoracic chest wall trauma (BTCWT) is a significant cause of traumatic cardiac arrest (TCA), presenting complex challenges in emergency care. The management of such patients requires rapid assessment, identification of reversible causes, and timely interventions to optimize survival outcomes. This article provides an in-depth review of the emergency care strategies for managing BTCWT in TCA patients, emphasizing the importance of a structured approach, advanced diagnostic tools, and multidisciplinary collaboration (American College of Surgeons, 2018).

Case Presentation

On April 24, 2025, at approximately 08:30 AM, a female patient was involved in a high-speed collision with a bus while riding her motorcycle. Emergency Medical Services (EMS) arrived within 10 minutes to find the patient unconscious, with visible deformities and multiple abrasions. Spinal precautions were immediately initiated, and the patient was transported to the Emergency Department (ED) at Hospital Selayang. Upon arrival, she was pulseless, prompting immediate cardiopulmonary resuscitation (CPR) as shown in Figure 1. The Trauma Life Support team activated Tier One of the Damage Control Resuscitation protocols (American College of Surgeons, 2018). Initial vital signs were unrecordable for blood pressure, heart rate, and respiratory rate, with oxygen saturation at 0% and a Glasgow Coma Scale (GCS) score of 3 (E1V1M1). Physical examination revealed scalp lacerations without palpable skull fractures, cervical spine tenderness with restricted motion, bilateral rib fractures with crepitus, abdominal distension and tenderness (particularly in the upper quadrants), a stable pelvis with no external signs of injury, and no deformities of both lower limbs.

Figure 1: Immediate Cardiopulmonary Resuscitation (CPR)

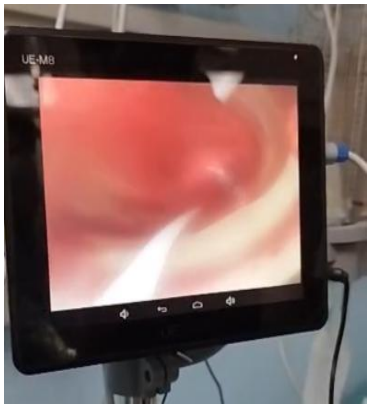

Figure 2: Gush of Blood in the Airway Shows in the Bronchoscopy

Figure 3: Tier 1 Team in Hospital Selayang Resuscitating the Patient

Laboratory results showed a hemoglobin level of 7.5 g/dL, elevated white blood cell count (18,000/µL), and platelet count of 120,000/µL. Airway was secured with endotracheal intubation; pooling of blood was noted through the endotracheal tube, and bilateral chest tubes were inserted for hemothorax. A left hemothorax was identified, with a gush of blood upon insertion. Bronchoscopy as shown in Figure 2, is done to show the gush of blood in the airway. Image 1.0. Circulatory support included two large-bore intravenous lines, administration of 3 liters of crystalloids, and initiation of blood transfusion with O-negative blood. Point-of-care ultrasound (POCUS) was performed; no free fluid was detected in the abdomen, but minimal pericardial effusion was present, prompting pericardiocentesis. Minimal fluid was drained. Despite surgical interventions and fluid resuscitation, the patient succumbed to her injuries. She was managed according to Advanced Trauma Life Support (ATLS) principles, with plans for surgical intervention and intensive monitoring if Return of Spontaneous Circulation (ROSC) was achieved (American College of Surgeons, 2018). Figure 3 shows the Tier 1 team in Hospital Selayang resuscitating the patient.

Discussion

This case underscores the importance of a systematic approach to trauma management, particularly in high-impact collisions involving motorcyclists. The application of Trauma Life Support protocols facilitated the timely identification and management of life-threatening injuries (American College of Surgeons, 2018). Mechanical obstruction such as flail chest, rib fractures, pneumothorax, and hemothorax can impair respiratory mechanics, leading to hypoxia and subsequent cardiac arrest. Hemorrhagic shock due to injuries to thoracic vessels can result in significant blood loss, precipitating hypovolemia and arrest. Cardiac contusion may cause arrhythmias or myocardial dysfunction, while pulmonary contusion compromises gas exchange, all contributing to hypoxia and arrest (Lockey *et al*., 2013; Hunt *et al*., 2006; Gummadi *et al*., 2025). The initial assessment and resuscitation of patients with BTCWT in the setting of TCA follow ATLS principles, emphasizing a structured approach: ensuring a patent airway and protecting it, evaluating breathing and signs of respiratory distress such as subcutaneous emphysema or tracheal deviation, establishing circulation by controlling external hemorrhage and initiating fluid resuscitation, assessing neurological status via the Glasgow Coma Scale, and fully exposing the patient to identify injuries while maintaining normothermia (American College of Surgeons, 2018). Diagnostic evaluation should include extended Focused Assessment with Sonography for Trauma (eFAST) to detect pericardial effusion, hemothorax, and pneumothorax; chest X-ray and CT scans for identifying thoracic fractures, confusion, and vascular injury; and point-of-care ultrasound to assess cardiac motion and guide surgical decision-making.

Blunt thoracic trauma results from non-penetrating forces causing compression, sharing, or deceleration of thoracic structures. In this patient, the lethal injury was a massive hemothorax, likely from pulmonary vascular laceration near the left hilum—a region vulnerable in deceleration injuries (Rhee *et al*., 1998). Pulmonary and vascular injury mechanisms involve parenchymal rupture during rapid deceleration, particularly around the hilum where major vessels converge. A tear in the left pulmonary artery or superior pulmonary vein can lead to profuse intrapleural bleeding. Given the patient's pulseless state upon EMS arrival, the injury was both immediate and severe, likely causing accumulation of more than 1.5 liters of blood—a massive hemothorax (Van Rutte *et al*., 2014).

Massive hemothorax has dire physiological consequences: hypovolemia reduces preload and cardiac output, leading to shock and pulseless electrical activity (PEA); collapsed lung tissue contributes to hypoxia; mediastinal shift impairs venous return; and the hemothorax mimics tension physiology, causing obstructive shock (Hunt *et al*., 2006). Although less emphasized here, pericardial effusion likely indicated hemopericardium, possibly from myocardial contusion or coronary rupture. If fluid accumulation exceeds pericardial compliance, tamponade ensues, severely limiting ventricular filling and cardiac output. In hypovolemia, tamponade is especially lethal as the heart cannot compensate (Rhee *et al*., 1998).

Traumatic cardiac arrest is distinct from medical arrest, often caused by hypovolemia, hypoxia, obstructive shock, or direct cardiac injury. Survival is poor, with rates between 2–5%, but improves with organized cardiac rhythms like PEA, witnessed arrest, and presence of reversible causes (Lockey *et al*., 2013). Asystole, as likely in this case, correlates with near-zero survival, particularly if downtime exceeds 10–15 minutes without ROSC. Emergency department thoracotomy (EDT) may be life-saving in select TCA cases—especially penetrating trauma or blunt trauma with witnessed signs of life such as organized ECG rhythm or spontaneous movements (Van Rutte *et al*., 2014; Hunt *et al*., 2006). Though controversial in blunt trauma, EDT can address tamponade, control hemorrhage, and evacuate massive hemothorax.

Hemodynamic collapse follows a predictable trajectory: initial vascular injury causes bleeding; rapid hemothorax forms; compensatory mechanisms fail; PEA progresses to asystole; and irreversible cellular hypoxia, acidosis, and coagulopathy ensue. Successful resuscitation depends on swift recognition, rapid transport, and immediate access to trauma care (Lockey *et al*., 2013). The "Golden Hour" remains crucial; seamless coordination between prehospital responders and trauma teams is vital. Here, EMS initiated CPR and expedited transport, while Hospital Selayang activated its DCR suite,

reflecting an effective trauma system (Hospital Selayang, n.d.). DCR prioritizes permissive hypotension, hemostatic resuscitation using blood products over crystalloids, and rapid control of hemorrhage. However, once TCA occurs, survival odds drop significantly.

Conclusion

The mechanism of injury in this case illustrates the devastating consequences of blunt thoracic trauma, particularly involving the pulmonary vasculature and heart. The rapid accumulation of blood in the pleural space, compounded by pericardial tamponade, created a lethal combination of obstructive and hypovolemic shock that progressed to traumatic cardiac arrest. Despite timely and skilled intervention at Hospital Selayang, the injuries were incompatible with life. This case emphasizes the need for rapid recognition of reversible causes of TCA and the importance of structured trauma systems in optimizing outcomes, even in the most challenging scenarios. The management of trauma patients in Malaysia requires a coordinated effort across multiple specialties and adherence to established protocols. Hospital Selayang's ED exemplifies the effective application of Trauma Life Support principles in a resource-constrained setting. Continuous training and infrastructure development are essential to improve outcomes for trauma patients.

Conflict of Interest

The authors affirm that they have no conflicting interests.

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