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Case Report *Volume 6 Issue 1*

Hidden danger: Undiagnosed Heart Injury and Arrhythmia Risks

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Abstract

Sternal fractures are common in blunt chest trauma, often associated with significant morbidity and mortality. The sternum serves as a protective barrier for vital organs, including the heart. Sternal fractures can cause injury to the underlying and adjacent vital organs like heart, lungs and the great vessels. Myocardial injury associated with sternal fractures occurs when the force of the impact is transmitted through the sternum to the heart, causing direct trauma to the myocardium. The severity of myocardial injury can vary depending on factors such as the magnitude of the force, the angle of impact, and the presence of underlying cardiac conditions. Severe pain associated with sternal fractures can lead to impaired ventilation, low partial pressure of arterial oxygen, need for non-invasive or invasive ventilation. Myocardial injury can result in symptoms such as chest pain, arrhythmias, or even cardiac dysfunction. It's important for individuals with sternal fractures to undergo thorough evaluation to assess for any potential cardiac involvement and to receive appropriate treatment if myocardial injury is suspected. Early recognition and intervention can help mitigate the risk of complications and improve outcomes for affected individuals. This report explores the intricate relationship between sternal fractures and myocardial injury, shedding light on diagnostic challenges, clinical implications, and management strategies.

Keywords: Arrhythmia Risks; Myocardial Injury; Sternal Fractures; Morbidity and Mortality

Abbreviations

ICU: Intensive Care Unit; e-FAST: Extended Focused Assessment with Sonography for Trauma; CECT: Contrast-Enhanced Computed Tomography; VPCs: Ventricular Premature Complexes; ECG: Electrocardiography; ABG: Arterial Blood Gas.

Introduction

Sternal fractures are predominantly associated with deceleration injuries and blunt anterior chest trauma. Direct trauma is the most common cause of injury during motor vehicle accidents, sports, and falls [1]. Severe pain associated with sternal fractures can lead to impaired ventilation, low

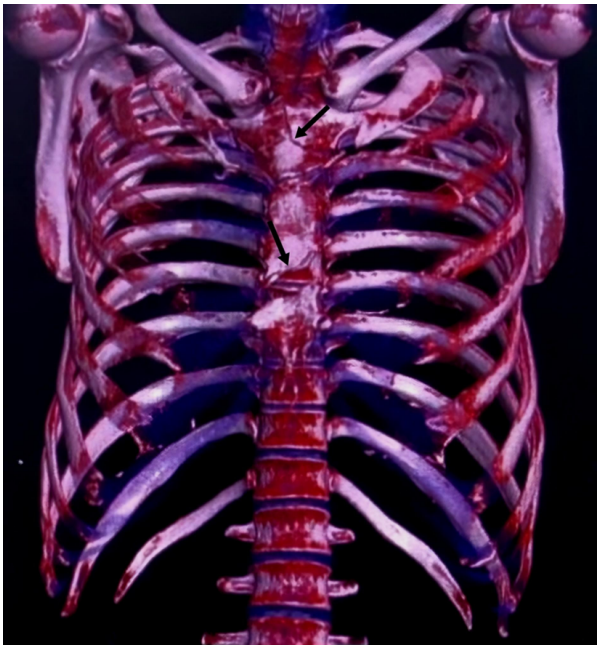
partial pressure of arterial oxygen, need for non-invasive or invasive ventilation with an endotracheal tube, and all these lead to significant morbidity. Such injuries are associated with myocardial injury and can lead to arrhythmias [2]. These narrative details a road traffic accident associated with chest trauma, highlighting the complexities encountered in diagnosis of myocardial contusion and its management.

Case Report

A 43-year-old male patient was admitted to our Intensive Care Unit (ICU) with an alleged history of motor vehicle accident presented with symptoms indicative of severe thoracic trauma, including paradoxical breathing, chest pain, and hypoxemia, alongside hemodynamic instability marked by hypotension and tachycardia. These clinical manifestations prompted immediate resuscitative measures, including intravenous fluid administration and packed red blood cell transfusion to address both hypovolemia and potential haemorrhagic shock. The initial assessment also involved bedside ultrasonography, specifically an extended focused assessment with sonography for trauma (e-FAST), to evaluate for the presence of free fluid in the abdominal and pleural cavities. While negative findings ruled out intra-abdominal bleeding, imaging modalities such as chest X-ray and contrast-enhanced computed tomography (CECT) revealed a spectrum of thoracic injuries, including multiple rib fractures, multi-fragmented sternal fractures, lung contusions, and haemothorax (Figure 1). There was severe pain and tenderness over the chest leading to restrictive chest movement and resultant hypoxia. Thus, the patient was intubated and mechanically ventilated in view of type 1 respiratory failure. On further evaluation, the cardiac activity was deemed normal and there was no evidence of pericardial effusion. Preoperative cardiac biomarkers such as troponin I and creatinine kinase-MB (CK-MB) were not elevated. Intercostal drainage was secured before the operative procedure revealed 600ml of frank blood. Meticulous attention was paid to pain management and respiratory support to optimize recovery and mitigate potential complications. Following surgical intervention for thoracic stabilization and limb fixation, the patient was managed with a multimodal analgesic approach, including epidural infusion of bupivacaine and fentanyl, to alleviate discomfort and facilitate early mobilization. Mechanical ventilation was judiciously employed in the immediate postoperative period to ensure adequate oxygenation and ventilation, with subsequent transition to non-invasive ventilation and supportive measures such as incentive spirometry and chest physiotherapy to promote pulmonary rehabilitation (Figure 2).

Of particular concern was the development of significant ventricular premature complexes (VPCs) on postoperative day 3 despite apparently normal cardiac function observed via echocardiography and negative troponin I quantification. The emergence of VPCs, accompanied by tachycardia and right bundle branch block on electrocardiography (ECG), raised suspicion of underlying cardiac pathology or sympathetic nervous system activation secondary to trauma (Figure 3). Initial pharmacological interventions aimed at rate control, with the administration of lignocaine and metoprolol, provided temporary relief without hemodynamic compromise. However, the persistence of PVCs necessitated a comprehensive reassessment to elucidate the underlying etiology.

Serial monitoring of cardiac biomarkers, including troponin I and CK-MB, failed to identify myocardial injury or ischemia as contributing factors to the arrhythmia. Similarly, repeated assessments of serum electrolytes, magnesium, calcium, and arterial blood gas (ABG) revealed no significant abnormalities, suggesting that metabolic derangements were not implicated in the observed cardiac dysrhythmia. Despite the absence of conclusive findings, the treating team had opted for conservative management, maintaining beta-blocker therapy with metoprolol to achieve sustained rate control. The number of PVCs reduced through the fifth postoperative day. On follow up, the cardio-respiratory parameter was insignificant, and the cardiac biomarker level was normal at seventh and fourteenth post ICU discharge day.



Source: Black arrow pointing towards the fractured segments.

Figure 1: Dimensional Computed Tomography showing Fracture of the manubrium sterni and sternal fracture.

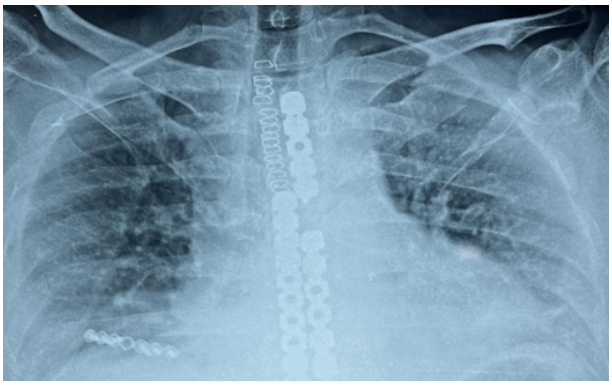


Figure 2: Postoperative Chest X-ray showing sternal fixation.

Figure 3: Electrocardiogram (ECG) showing multiple premature ventricular complexes and right bundle branch block.

Discussion

Sternal fractures are relatively rare but not uncommon. Morbidity related to this fracture is typically determined by their presentation and associated injury. Majority of traumatic sternal fractures are a part of polytrauma, which are usually caused by blunt trauma to the chest during motor vehicle collision [3]. Most commonly associated injuries include pulmonary contusion, mediastinal hematoma, rib fracture etc [4]. Blunt cardiac injury leading to myocardial contusion is a rare but serious event in this kind of polytrauma [5]. High level of suspicion is required to diagnose myocardial contusion based on the clinical features and mode of injury. In contrary to our case, Mult fragmentary sternal body fracture may lead to myocardial contusion showing changes in electrocardiogram and cardiac enzyme levels. Apart from surgical management, pain control, ventilatory support and chest physiotherapy are the integral part of in these cases

Lieshout, et al. [6] in a retrospective study found the association of blunt thoracic trauma with myocardial contusion. Myocardial contusion was observed in 38% of blunt thoracic trauma, of which 52 % were due to sternal fracture. Most common adverse event associated with myocardial contusion was arrythmia (30%) of which only 5% cases present with premature ventricular complexes (PVC) as an initial presentation [6]. They concluded that electrocardiogram along with cardiac biomarker were highly sensitivity and specificity for detecting myocardial contusion. However, in the present case, cardiac arrythmia was only observed after 72 hours without any rise of troponin I level. Heart rate was reaching more than 150/minute because of frequent PVCs without any signs of hemodynamic instability. The burden of PVC in excess of 10000 ectopic ventricular beats or greater than 10% of all beats recorded on 24-hour ambulatory monitoring, marked as sustained PVC which is associated with various life-threatening complications like left ventricular dysfunction, dilated cardiomyopathy, sustained ventricular tachycardia, sudden cardiac arrest, if remained unattended [7]. Other etiologies like dyselectrolytemia, anaemia, thyroid abnormalities, essential hypertension, and underlying ischemic heart disease were ruled out [8]. Other diagnostic modalities like chest CT, CXR and echocardiogram did not show any significant finding in the given case.

In this case, despite initial attempts at medical management with beta-blockers and class 1b antiarrhythmic agents proving ineffective, the patient maintained stable hemodynamic, precluding the need for treatment escalation. However,in patients with unstable hemodynamics, alternative anti-arrhythmic like non-dihydropyridine calcium channel blockers, class Ic antiarrhythmics and amiodarone may be considered [9]. Lastly, the drug-resistant cases may be dealt with ablation therapy [10].

Patients with blunt thoracic trauma and sternal fracture may display normal cardiac biomarkers, which at times insufficient to rule out myocardial contusion. In such cases, ECG may reveal cardiac dysrhythmias (may be the only sign), warranting close follow-up and telemonitoring. It's recommended to send cardiac biomarkers upon arrival, repeating them after 3 hours if initially normal [6]. The biomarker may be repeated at new onset of arrhythmia. Blunt chest trauma with myocardial contusion may lead to fatal cardiac arrhythmias even after several days, particularly when other severe injuries are present [11]. Patients with normal ECG and biomarkers, after managing other thoracic injuries, can be discharged home.

Conclusion

The critical care management of trauma patients encompasses a multifaceted approach, particularly in cases of thoracic injury where respiratory compromise and

cardiac abnormalities can pose significant challenges. This case underscores the complexity of managing refractory PVCs despite initial pharmacological interventions. Sternal fractures are serious injuries that require prompt evaluation and management. Comprehensive diagnostic evaluation for myocardial injury with continuous ECG monitoring and serial Troponin I level are essential in guiding therapeutic decisions.

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