Muhammad Nadeem Ahmad[1], Shahzeb Ali[2], Muhammad Ahmed[3], Naila Nadeem[3], Mallick Zohaibuddin[3], Hatem Eltaly[4], Muhammad Owais Rao[3], Faheemullah Khan[4], and Uffan Zafar[3]

[1]The Aga Khan University
[2]Quaid-e-Azam Medical College
[3]The Aga Khan University Hospital
[4]Cleveland Clinic Main Campus Hospital

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Surviving the storm: Insights into the pericardial injuries and roller coaster of multisystem trauma in bomb blast victims

Muhammad Nadeem Ahmad[1], Shahzeb Ali[2], Muhammad Ahmed[1], Naila Nadeem[1], Mallick Muhammad Zohaibuddin[1], Hatem Eltaly[3], Muhammad Owais Rao[1], Faheemullah Khan[3], Uffan Zafar[1]

[1] **The Aga Khan University Hospital, Karachi, Pakistan.**

[2] **Quaid-e-Azam Medical college, Bahawalpur, Punjab, Pakistan.**

[3] **Cleveland Clinic Main Campus Hospital, Cleveland, Ohio, USA** .

Corresponding Author:

Hatem Eltaly, Cleveland Clinic Main Campus Hospital, Cleveland, OH, USA.

Key Clinical Message:

Pericardial injuries from bomb blasts are rare but life-threatening. Early diagnosis through contrast enhanced CT scan and a multidisciplinary approach are crucial for effective management in such complex trauma cases.

Pericardial injuries due to penetrating trauma such as bomb blast shrapnel are rare but are associated with significant mortality. Timely diagnosis and multidisciplinary approach are essential for effective management. This case series, comprising two cases, emphasizes the need for rapid appropriate imaging and multidisciplinary care in management of all associated injuries in these complex polytrauma patients. It also underscores the need for a high index of suspicion despite negative clinical features of pericardial injuries for timely performing CT scan and then adaptive treatment strategies including life-saving surgical intervention.

Keywords: Pericardial injury, bomb blast, trauma, multidisciplinary approach, CT scan

1 INTRODUCTION

Pericardial injuries due to penetrating trauma such as bomb blast shrapnel is a rare occurrence and is associated with significant mortality. A previous study shows that out of 20,000 patients received in level 1 trauma center, only 59 patients had pericardial injury (1). Another study calculates mortality of all pericardial trauma at 28.4% (2). Pericardium is a fibrous, sac-like structure around the heart for its protection. However, due to its close proximity with other thoracic structures, it is prone to injury in thoracic trauma. Pericardial injury can result in cardiac tamponade, hemorrhagic shock, cardiac arrhythmia and arrest, and later on infection and these complications can prove fatal (2). Its management needs a timely and multi-

disciplinary approach including cardiothoracic surgeons, radiologists, and trauma surgeons. This case series presents two such cases that highlights the significant challenges in the management of such injury.

2 CASE HISTORY

2.1 Case 1

A 30-year-old male presented to the ER with a bomb blast injury, resulting in injuries to his neck, chest and right leg. His vitals were stable at the time of presentation and GCS was 15/15. There was reduced air entry on the left side of the chest.

2.2 Case 2

A 17-year-old boy presented to the ER with a bomb blast injury in an unconscious state. He had injuries on his head and chest. His presenting vitals were stable but GCS was low at 7/15. There was decreased air entry on chest auscultation and muffled heart sounds.

3 DIFFERENTIAL DIAGNOSIS, INVESTIGATIONS, AND TREATMENT

3.2 Case 2

The patient immediately underwent CT scans of head, neck and chest which showed left frontal bone fracture, hemorrhagic contusions in bilateral frontal and right parietal lobes, with a metallic shrapnel embedded in the right parietal lobe (Figure 4). There were multiple metallic shrapnels in the chest wall and base of heart with subcutaneous emphysema and gross hemothorax on the right side, underlying right lung contusion and atelectasis (Figure 5).

Patient was immediately rushed to the OR, where he first underwent median sternotomy and right ventricular repair. The shrapnel was seen impacted within the posterior wall of heart, away from any vessel and there was no oozing of blood through this foreign body. Therefore, the shrapnel was not removed. Chest tube was placed on the right side. Subsequently, the neurosurgery team took over the patient and performed bifrontal decompression and removal of foreign body. Overall, it took almost seven hours of surgery and the patient was transfused into seven units of packed RBCs and six units of FFPs and platelets intraoperatively.

Patient was kept in ICU for two days and was then extubated, but his postoperative period was complicated by acinetobacter and clostridium difficile infection that was managed by ID specialists. He was discharged in stable condition after one month.

4 OUTCOME AND FOLLOW-UP

4.1 Case 1

Patient was kept in ICU for one day and shifted out to the ward the next day. His postoperative management included morphine infusion for pain, incentive spirometry and physiotherapy to mitigate post-operative complications. He was gradually allowed full weight bearing and discharged after 5 days in stable condition. Patient had no late complications on one year follow-up.

4.2 Case 2

He was electively admitted for cranioplasty two months later. He underwent the procedure successfully and there was no postoperative complication. A follow up CT Post decompressive craniectomy shows improvement of cerebral edema, pneumocephalus and hemorrhage (Figure 6). The patient was discharged after six days. One year follow-up showed no late complications in the patient.

5 DISCUSSION

Pericardial injury is a rare occurrence in any trauma, and its timely diagnosis requires a high level of suspicion index. CT scans and echocardiograms are invaluable in diagnosing pericardial injury and its complications. Timely imaging can be the difference between life and death, especially when clinical symptoms are not evident. A study of blunt and penetrating trauma patients shows that out of 11 patients with evidence of

cardiac tamponade on imaging, only three had clinical features suggestive of it [3]. These imaging methods are crucial since they can detect small damage that may not be apparent during an initial clinical assessment. In both of our cases, patients were vitally stable throughout their admission period, although the presenting GCS of the second case was 7/15. In another case report in the literature, where the patient had self-inflicted a stab wound on his left anterior chest, he presented in stable vitals but soon after surgeons evacuated his left hemothorax, his bp dropped to 40/30 due to cardiac tamponade. He then underwent median sternotomy, opening of pericardium and evacuation of blood clots from it which immediately stabilized his circulation. (4)

In our second case, pericardial and right ventricular injury was easily diagnosed on CT scan. This emphasizes the significance of rapid imaging in such situations and the necessity of maintaining a high index of suspicion, where timely intervention can be life-saving. Most of the time, it becomes difficult to visualize the source of bleeding in pericardial injury on echocardiography. In that case, contrast-enhanced CT can be used if vitals of the patient permit. A case report of blunt trauma in the literature explains that initial echocardiography was not able to determine the source of pericardial blood that was causing cardiac tamponade as the underlying heart was not damaged. Only subsequent CECT was able to identify injury to the pericardiophrenic artery that was responsible for extravasation (5). In another case report, where early chest x-ray was normal without evidence of hemothorax, pneumothorax or mediastinal widening and echocardiography was also inconclusive but suspicion of pericardial injury was high. The surgeons performed a surgical subxiphoid pericardial window which diagnosed hemopericardium (6). This underscores the importance of a comprehensive diagnostic approach including proceeding directly to CT scan or invasive procedures in such high-risk cases.

Both cases highlight the significance of multidisciplinary approach in managing this complex and life-threatening injury, and that timely intervention resulted in good prognosis in each case. In such bomb-blast cases, teamwork of trauma surgeons, cardiothoracic surgeons, neurosurgeons, radiologists, and intensivists is crucial for the best patient outcomes. It is also crucial to prioritize and manage injuries based on their severity and urgency in the multi-system injuries of bomb-blast victims. Pericardial injuries must be managed with priority because they can initially be asymptomatic but may quickly become life-threatening. Early surgical intervention plays a crucial role in these scenarios, significantly reducing mortality and morbidity. It is also very significant to probe for other associated injuries that are often present in such scenarios. It is also very important to remove foreign bodies from pericardium to prevent further damage and mitigate complications including cardiac tamponade, hemorrhage and infection. However, risk-benefit analysis should be performed before removal of these foreign bodies (7). In our second case, the shrapnel was seen penetrating within the posterior cardiac wall. However, the shrapnel was not adjacent to any coronary vessel, sinoatrial node or atrioventricular node. Therefore, the foreign body was not removed.

The second case had a postoperative complication of infection similar to another case report of pericardial injury in the literature which improved with antibiotics (4). It highlights the significance of proper post-operative care and monitoring to prevent complications including lung atelectasis and infection. Our cases also demonstrated the significance of flexible and adaptive treatment methods. For example, the unexpected absence of a foreign body in the pericardium on surgical exploration in Case 1 necessitates a rethinking of our diagnostic assumptions, emphasizing the importance of ongoing review and revision of treatment regimens in such complex multi-system injuries.

6 CONCLUSION

This case series highlights the importance of a multidisciplinary approach, effective use of advanced diagnostics, and provides practical insights through detailed case management. Sharing such insights contributes to a better understanding and improved management of similar cases in the future. The study's small sample size limits the generalizability of the findings.

AUTHOR CONTRIBUTIONS

Muhammad Nadeem Ahmad: Conceptualization; data curation; investigation; project administration,

writing – original draft; writing – review & editing. **Shahzeb Ali:** Writing – original draft; writing – review & editing. **Muhammad Ahmed:** Conceptualization; data curation; supervision; validation.**Naila Nadeem:** Conceptualization; data curation; investigation; supervision; validation; writing – original draft. **Mallick Muhammad Zohaibuddin:** Data curation; conceptualization. **Hatem Eltaly:** Conceptualization; data curation; investigation; supervision; validation; writing – original draft; writing – review & editing.**Muhammad Owais Rao:** Supervision; validation.**Faheemullah Khan:** Conceptualization; supervision; validation.**Uffan Zafar:** Conceptualization; data curation; investigation; project administration, writing – original draft; writing – review & editing.

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ETHICS STATEMENT

Not applicable.

DATA AVAILABILITY STATEMENT

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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PATIENT CONSENT Written informed consent was obtained from the Participants.

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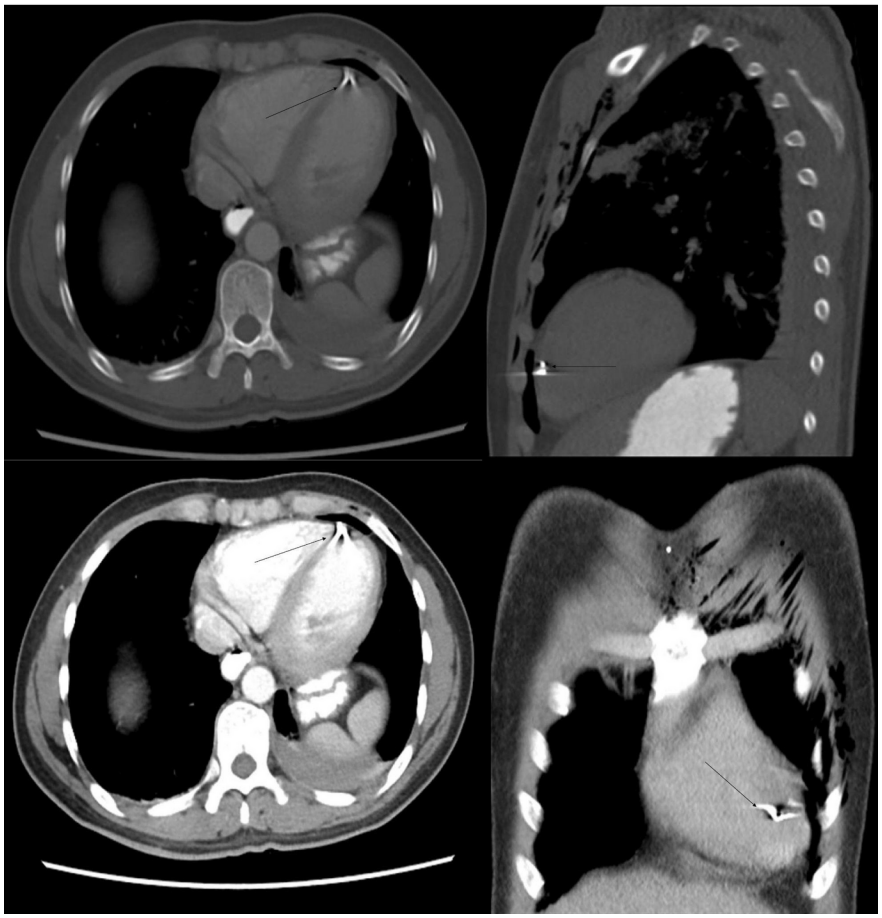

Figure 1: Contrast enhance CT Chest shows metallic density shrapnel's (arrows) near the cardiac apex in the pericardium. Extensive subcutaneous emphysema in anterior chest wall and left sided effusion.

Figure 2: Radiograph right lower extremity showing proximal fibular neck comminuted fracture and oblique tibial shaft fractures and tiny metallic densities in soft tissues i.e. shrapnels.

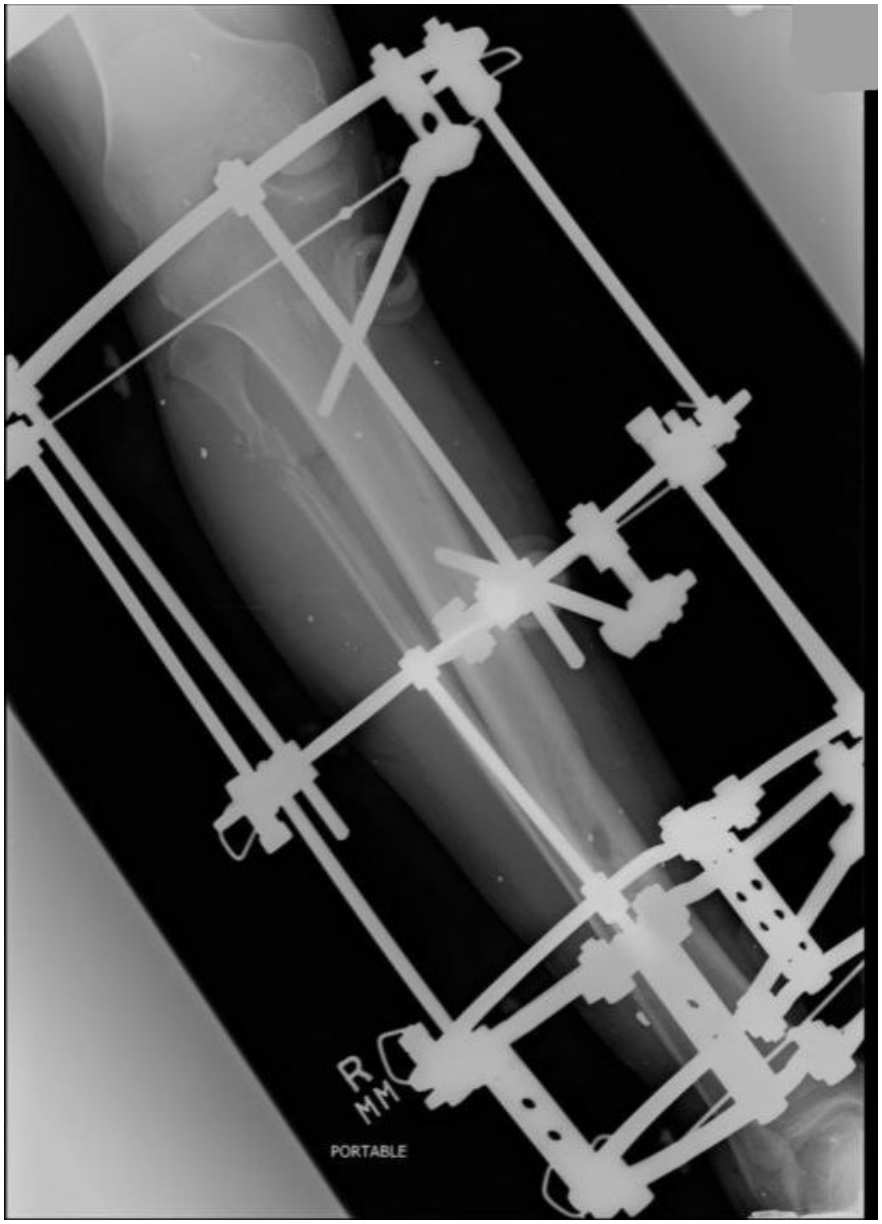

Figure 4: Initial CT showing intraparenchymal hemorrhage, pneumocephalus, diffuse cerebral edema and scalp hematoma.

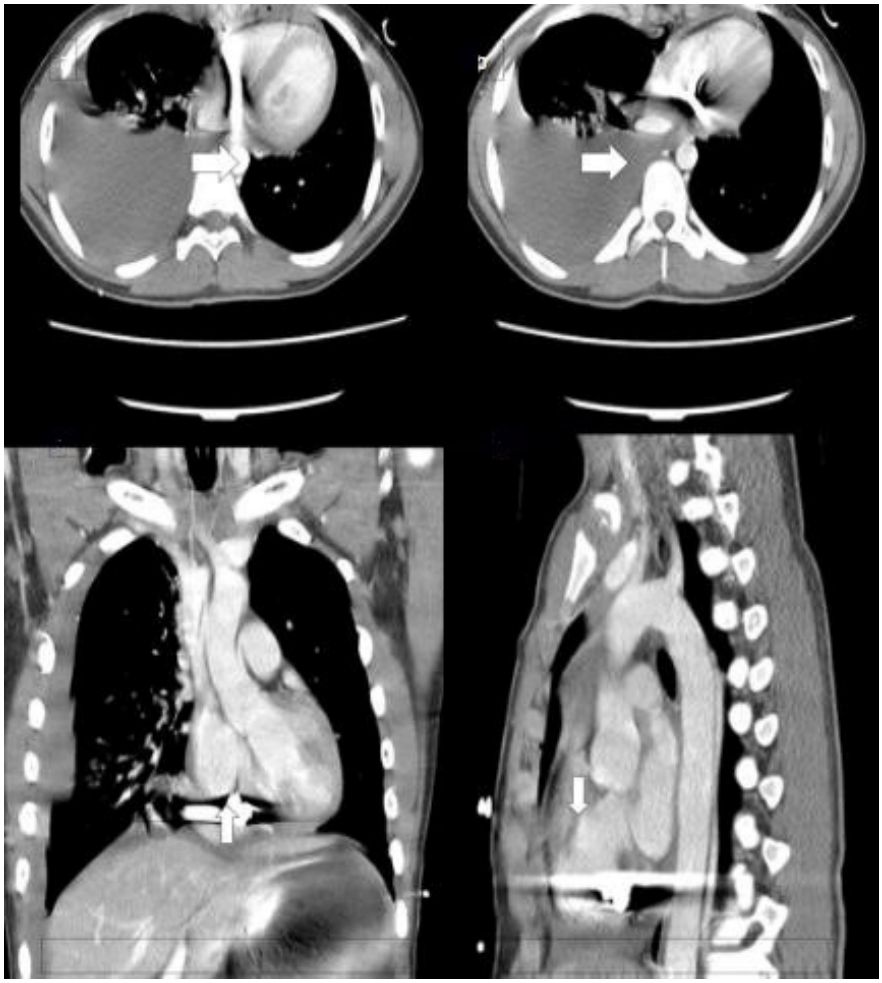

Figure 5: Contrast enhanced CT chest of 17-year-old bomb blast victim: Multiplanar images show shrapnel fragments (arrows) within the pericardial space. Streak pericardial effusion and large right pleural effusion are seen.

Figure 6: Follow up CT Post decompressive craniectomy shows improvement of cerebral edema, pneumocephalus and hemorrhage.

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