SAS Journal of Surgery
Abbreviated Key Title: SAS J Surg
ISSN 2454-5104
Journal homepage: https://www.saspublishers.com

OPEN ACCESS

Cardiothoracic Surgery

The Boy Who Lived: Traumatic Hemopericardium in A 12-Year-Old Who Survived Right Atrial Ventricular Groove Rupture, Malpositioned Pericardial Drain and Delayed Surgery

K. Rao[1*], T. Thangarajoo[1], S. Karupiah[2]

[1]Medical Officer, Department of Cardiothoracic Surgery, Hospital Queen Elizabeth 2, Kota Kinabalu, Sabah, Malaysia
[2]Consultant Cardiothoracic Surgeon, Department of Cardiothoracic Surgery, Hospital Sultan Aminah, Johor Bahru, Malaysia

DOI: https://doi.org/10.36347/sasjs.2025.v11i10.012 | **Received:** 22.08.2025 | **Accepted:** 10.10.2025 | **Published:** 13.10.2025

***Corresponding author:** K. Rao
Medical Officer, Department of Cardiothoracic Surgery, Hospital Queen Elizabeth 2, Kota Kinabalu, Sabah, Malaysia

Abstract | **Case Report**

Traumatic cardiac rupture in the pediatric setting is rare and frequently fatal. The management of such patients in resource-limited settings, where cardiothoracic expertise is scarce, poses profound challenges and may ultimately determine survival. We report the case of a 12-year-old boy who presented to a district hospital with hemopericardium following blunt chest trauma. A pericardial drain was promptly inserted but was later found to have malpositioned into the pleural cavity. Definitive surgery was hindered by logistical constraints and limited access to cardiothoracic surgical services. This case underscores the importance of rapid recognition of hemopericardium, careful imaging to confirm pericardial drain placement, and prompt transfer to facilities with cardiothoracic expertise. It also expands the limited literature on pediatric cardiac trauma cases and offers important insights for trauma team in district settings.

Keywords: Hemopericardium, Blunt Cardiac Trauma, Paediatric Cardiac Injury, Delayed Cardiac Surgery, Cardiac tamponade, Iatrogenic, Malposition pericardial pigtail drain, Resource Limited Settings, Delayed Cardiac Surgery.

INTRODUCTION

Traumatic cardiac injury following blunt chest trauma is rare but may be fatal, accounting for less than 2% of all blunt trauma cases [1]. In children, the incidence is even lower, yet mortality exceeds 80% when cardiac rupture occurs [2]. Pediatric patients are especially vulnerable due to incompletely ossified ribs and reduced muscle mass, which increase transmission of force to thoracic organs. Early recognition and immediate surgical repair are essential to survival, as delays in intervention are strongly associated with poor outcomes [4]. Management in resource-limited or peripheral settings, where cardiothoracic expertise is not readily available, poses additional challenges. Ppericardial drains often inserted as temporizing measures in cases like this can exacerbate morbidity if improperly placed [5]. We report the case of a 12-year-old boy with hemopericardium caused by a Right Atrial Ventricular groove tear following blunt chest trauma. He underwent definitive surgery and had a remarkable post op recovery despite initial setbacks.

CASE REPORT

A 12-year-old boy presented to a district hospital in Sabah, Malaysia, on 18th September 2025 after being struck by approximately 30 stacked plywood sheets (each 3 cm thick) that sequentially collapsed onto him while he was playing nearby. On arrival, he was restless with a Glasgow Coma Scale (GCS) score of E2V2M6. He was tachypneac, tachycardic and unable to speak in full sentences. Oxygen saturation was 90% on Face Mask 5 L/min. He was hypotensive requiring ionotropes Physical examination revealed multiple linear abrasions on the anterior chest without tenderness or crepitus. Lung auscultation demonstrated equal air entry. The abdomen was soft and non-distended with multiple superficial abrasions. A Focused Assessment with Sonography for Trauma (FAST) revealed free fluid in the hepatorenal and splenorenal regions.

He was admitted to the ICU and electively intubated for type 2 respiratory failure. Urgent contrast-enhanced CT of the thorax, abdomen, and pelvis revealed:

- Grade 1 liver injury
- Grade 3 left renal injury

- Suspicious pancreatic injury
- Periportal and gallbladder wall edema
- Circumferential bowel wall thickening at the hepatic flexure suspicious of bowel injury
- Hemopericardium measuring 1.9 cm depth (54 HU)

He underwent Exploratory Laparotomy with Peritoneal Washout on 19th September 2025. Intra Operatively, retroperitoneum was edematous without obvious solid organ or bowel injury. On 20th September 2025, Echocardiography done demonstrated global pericardial effusion (max dimensions 2.5cm) with Right Atrial and Ventricular collapse, consistent with Cardiac Tamponade. Emergency Pericardiocentesis with pericardial drain insertion was done, draining approximately 50 mL of blood upon entry. Reasssessment echocardiography on 21 September 2025 showed a reducing global pericardial effusion (max depth 1.5cm) with freely mobile fibrin strands within the pericardial cavity. Despite the presence of the pericardial drain, no further output was recorded thereafter.

Given his clinical instability and echocardiographic findings, a decision was made to transfer the patient via Medevac to Cardiac Intensive Care Unit, Hospital Queen Elizabeth II (HQE2) on 23th September 2025 for definitive surgical intervention. During transfer, the patient remained intubated, sedated, and inotropic dependent. Neurologically, his GCS was E4VTM5. Laboratory evaluation revealed acute kidney injury with preserved urine output (urea 23 → 26 → 25 mmol/L, creatinine 460 → 480 → 415 µmol/L), markedly deranged liver function tests (ALT 1200 → 1018 U/L, AST 1250 → 726 U/L), and worsening coagulopathy (INR 1.49 → 2.15, PT 16 → 23, APTT 39 → 45). He was commenced on IV N-acetylcysteine (NAC) protocol for hepatic support and underwent dialysis prior to op.

On 24th September 2025, he underwent Median Sternotomy, Open Pericardial Drainage, and Repair of a Ruptured Right Atrium. Intraoperative findings revealed that the pericardial drain was lying within the pleural cavity. The pericardial space was tense, containing approximately 200 mls of blood and multiple organized clots. A 2.5 × 1 cm laceration was identified at the right Atrial Ventricular groove, with active bleeding. The defect was repaired off-pump using multiple hemostatic pledgetted sutures, reinforced with Coseal application, achieving secure hemostasis. Myocardial contractility was preserved with no evidence of myocardial contusion. The pericardial cavity was irrigated, clots evacuated, and three drains placed prior to chest closure.

Postoperatively, the patient was gradually weaned off sedation and successfully extubated on postoperative day one. Both renal and liver functions normalized post op. His recovery post operatively was uneventful

Study Area & Ethical Considerations

This case was managed at a district hospital in Sabah and subsequently at Hospital Queen Elizabeth II, a tertiary referral center with cardiothoracic surgical services. Informed consent for publication was taken from the patient's guardian. Patient anonymity has been preserved.

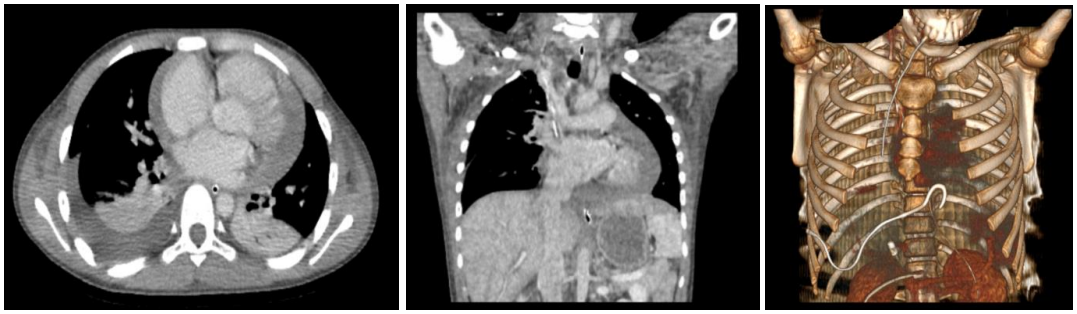

Figure 1: Multiplanar CT imaging of the thorax demonstrating presence of Global hemopericardium (-54HU). However unable to delineate site of injury. The 3D volume-rendered reconstruction image highlights the trajectory of the pericardial pigtail

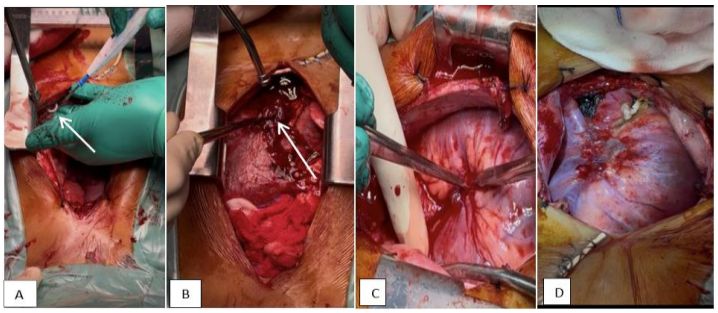

Figure 2: Intra-operative pictures Picture A-Arrow showing pericardial catheter malposition into pleural cavity instead of pericardial space Picture B-Noted gush of blood upon entering pericardial cavity Picture C-Arrow showing site of injury at Right Atrial Ventricular Groove Picture D-Post-repair view showing successful closure of the defect with multiple pledgeted hemostatic sutures reinforced with co seal

DISCUSSION

Blunt cardiac rupture is an exceedingly rare but life-threatening consequence of thoracic trauma. Large trauma registries report an incidence ranging from 0.002% to 0.041% of all trauma admissions, reflecting its rarity and the likelihood that many patients die before hospital arrival [12]. Talving *et al.,* reported survival of a 16-month-old toddler with right atrial rupture repaired via median sternotomy, highlighting the feasibility of surgical intervention in children [10]. Pediatric chest walls are more compliant than adult ribs, which may allow significant internal force transmission with minimal external signs of trauma. This elasticity can delay recognition of severe intrathoracic injury and underscores the importance of vigilance in pediatric trauma [4,10]. In our patient, external findings were limited to superficial abrasions and mild abdominal tenderness, yet internal injuries included hemopericardium, liver injury, renal injury, and a right atrial tear. This aligns with literature emphasizing that subtle external signs in children may hide life-threatening internal damage [10,11]

Mechanism of Injury and Diagnostic Challenge

Blunt cardiac rupture results from rapid deceleration, compression, or shear forces that exceed myocardial tensile strength, particularly at transitional zones like the atrioventricular grooves [12]. The collapsing plywood likely caused combined chest and abdominal forces leading to multiple intra- and extracardiac injuries. Pediatric patients may display minimal external trauma despite significant internal damage, delaying recognition [10,11]. CT imaging can detect hemopericardium but may not pinpoint the bleeding source. Echocardiography remains the cornerstone for detecting tamponade and chamber collapse [5], necessitating serial assessments when presentations evolve.

1. Pericardiocentesis: Role and Limitations

Pericardiocentesis is a temporizing measure and does not address a myocardial tear [5,6]. Aspirated blood may clot quickly or be insufficient to relieve compression. Many patients stabilized initially still require surgery [6]. In our case, approximately 50 mL of blood was drained, producing transient hemodynamic improvement. Persistent tamponade physiology and the absence of ongoing output indicated clot formation, necessitating definitive surgical intervention. This experience reflects prior reports where percutaneous drainage alone was insufficient in blunt cardiac rupture [12]

2. Surgical Timing and Technique

Definitive repair via sternotomy in a specialized center is the standard [6]. Cardiopulmonary bypass (CPB) is often prepared for, though off-pump repair can be successful in select cases, especially when anticoagulation is contraindicated [13]. In this patient, an off-pump approach with pledgetted sutures and Coseal reinforcement minimized procedural complexity and prevented systemic anticoagulation in the context of coexisting hepatic and renal dysfunction. This approach is supported by prior case reports demonstrating successful off-pump repair in selected traumatic atrial injuries [13]

3. Prognosis and Outcome

Survival depends on rapid recognition, hemodynamic stabilization, and definitive repair [2,6]. Despite delayed surgery and drain malposition, the combination of echocardiography, temporary drainage, escalation of care, and timely transfer to a tertiary center allowed survival. Multidisciplinary support—including hepatic and renal management—was vital.

4. Limited Cardiac Surgical Resources in Sabah

Cardiothoracic coverage is limited in Sabah, with no specialists in district hospitals and very few in tertiary centers. Most definitive procedures rely on visiting cardiac surgeons. This case highlights the importance of regional referral pathways, telemedicine support, and strategic capacity building to improve outcomes in critical pediatric trauma cases.

CONCLUSION

Blunt pediatric right atrial rupture is exceptionally rare and usually fatal without timely intervention. This case illustrates that survival is possible despite a delayed operation and malpositioned pericardial drain when high suspicion, bedside echocardiography, and prompt escalation are applied. Off-pump repair may be safe when anticoagulation is undesirable. Imaging-guided pericardial drainage is critical to avoid complications. Strengthening referral systems, surgical coverage, and telemedicine support can significantly improve survival in resource-limited regions. Greater multicenter data collection is needed to better define optimal strategies and prognostic indicators.

Acknowledgements

The authors would like to sincerely thank the visiting cardiothoracic surgeons from Peninsular Malaysia for their expert surgical intervention and guidance, which were instrumental in achieving a favorable outcome for this patient. Their dedication and timely involvement exemplify the critical role of specialist support in regions with limited in-house cardiothoracic services. We also acknowledge the contributions of the emergency department, intensive care, and anesthesiology teams in Sabah for their prompt stabilization and coordination during the patient's transfer.

REFERENCES

1. El-Chami, M. F., Nicholson, W., & Helmy, T. (2008). Blunt cardiac trauma. *Journal of Emergency Medicine, 35*(2), 127–133.
2. Teixeira, P. G., Inaba, K., Oncel, D., DuBose, J., Chan, L., & Demetriades, D. (2009). Blunt cardiac trauma: Lessons learned from the Medical Examiner. *Journal of Trauma, 67*(6), 1259–1264.
3. Parmley, L. F., Manion, W. C., & Mattingly, T. W. (1958). Nonpenetrating traumatic injury of the heart. *Circulation, 18*(3), 371–396.
4. Christensen, M. D., Nielsen, P. E., & Sleight, P. (1992). Traumatic rupture of the heart. *Chest, 102*(3), 710–714.
5. Tsang, T. S., Oh, J. K., Seward, J. B., & Tajik, A. J. (2000). Diagnostic value of echocardiography in cardiac tamponade. *Herz, 25*(8), 734–740.
6. Symbas, P. N., Harlaftis, N., & Symbas, J. D. (1992). Rupture of the heart in blunt trauma: A 30-year experience. *Annals of Thoracic Surgery, 54*(3), 661–664.
7. Nan, Y. Y., Lu, M. S., Liu, K. S., et al. (2009). Blunt traumatic cardiac rupture: Therapeutic options and outcomes. *Injury, 40*(9), 938–945.
8. Brathwaite, C. E., Rodriguez, A., Turney, S. Z., Dunham, C. M., & Cowley, R. (1990). Blunt traumatic cardiac rupture: A 5-year experience. *Annals of Surgery, 212*(6), 701–704.
9. Ismailov, R. M., Weiss, H. B., Ness, R. B., Lawrence, B. A., & Miller, T. R. (2005). Blunt cardiac injury associated with cardiac valve insufficiency: Trauma links to chronic disease? *Injury, 36*(1), 102–108.
10. Talving, P., Teixeira, P. G., Barmparas, G., et al. (2010). Intrapericardial cardiac rupture following blunt chest trauma: A case report and review of the literature. *Journal of Pediatric Surgery, 45*(3), e9–e12.
11. Sybrandy, K. C., Cramer, M. J., & Burgersdijk, C. (2003). Diagnosing cardiac contusion: Old wisdom and new insights. *Heart, 89*(5), 485–489.
12. Moore, E. E., Knudson, M. M., & Burlew, C. C. (2006). Emergency department thoracotomy for the critically injured patient: Objectives, indications, and outcomes. *World Journal of Emergency Surgery, 1*, 4.
13. Angouras, D. C., Sokolis, D. P., & Dosios, T. (2002). Rupture of the right atrium after blunt trauma: Case report and literature review. *Journal of Trauma, 52*(3), 557–560.