

Research Article

Cardiac Injuries: Experience with Six Cases at Fann National University Hospital

Papa Amath Diagne* , **Jean Claude Ndiougou Dione** , **Amadou Dioulde Diallo** , **Moussa Seck Diop** , **Moussa Mareme Samba** , **Cheikh Abdou Khadr Faye**, **Anta Mbaye Sall**, **Papa Ousmane Ba**, **Momar Sokhna Diop**, **Souleymane Diatta**, **Papa Salmane Ba**, **Amadou Gabriel Ciss**

Department of Thoracic and Cardiovascular Surgery, Fann University Hospital Center, Dakar, Senegal

Abstract

Cardiac injuries correspond to a disruption of the continuity of the cardiac layers caused by a penetrating mechanism, with or without loss of tissue; they are considered penetrating when they extend beyond the parietal pericardium. These lesions most frequently occur following penetrating chest trauma but may also complicate blunt trauma through myocardial contusion, occasionally leading to tears, ruptures of the cardiac walls, or valvular damage. Penetrating cardiac trauma represents one of the most severe forms of thoracic injury, with high mortality despite specialized management. We report a retrospective, descriptive, and analytical study conducted over a ten-year period (2014–2024) in the Thoracic and Cardiovascular Surgery Department of Fann University Hospital in Senegal, including all patients operated on for cardiac or great vessel injuries. Six cases were identified, with a male predominance (sex ratio 5:1) and a mean age of 22 years. Most injuries resulted from interpersonal violence and assaults. Four patients presented with hemodynamic instability on admission, including two with cardiac tamponade. Transthoracic echocardiography was performed in five patients, chest radiography and CT scanning were used in two cases. All patients underwent median sternotomy. The right ventricle was the most frequently affected structure (66%), requiring cardiomyorrhaphy. Postoperative outcomes were uneventful in four patients, whereas one case of seizures and one septic shock were reported. Overall mortality was 33.3%. Cardiac injuries remain rare but severe events, predominantly affecting young individuals; their diagnosis relies primarily on clinical evaluation supported by echocardiography, and their management is surgical, usually without extracorporeal circulation, with a prognosis still marked by significant mortality. Our objective is to describe the experience in the surgical management of six cases of cardiac injuries treated at Fann National University Hospital over a ten-year period.

Keywords

Cardiac Injury, Thoracic Trauma, Senegal

*Corresponding author: papaamath.diagne@ucad.edu.sn (Papa Amath Diagne)

Received: 23 November 2025; **Accepted:** 12 December 2025; **Published:** 20 January 2026



1. Introduction

Cardiac injuries constitute rare traumatic lesions in routine clinical practice, although their incidence tends to increase in parallel with the rise in civilian and urban violence. They account for approximately 8% of penetrating thoracic traumas, with an estimated incidence ranging from 0.1 to 0.3 cases per 100,000 inhabitants per year, depending on the local socio-security context [1]. Although iatrogenic cases have been reported, most cardiac wounds result from assaults involving stab weapons or firearms, or from severe traumatic events. The right ventricle, located immediately behind the sternum, is the cardiac chamber most exposed during anterior penetrating trauma, but the sometimes unpredictable trajectory of the wounding instrument may lead to a wide variety of injuries, ranging from simple hematomas to tears or full-thickness ruptures of the cardiac walls, and even valvular damage. In Senegal, the existence of a single specialized center for the management of cardiac trauma represents a major limitation, given that the prognosis of such lesions depends critically on the rapidity of intervention. The diversity of mechanisms and severity of injuries explains the wide variability of clinical presentations and the very high pre-hospital mortality, approaching 90%, to which is added a still significant in-hospital mortality in specialized centers, estimated between 16% and 43% [2, 3]. The objective of this study was to describe the experience in the surgical management of cardiac injuries. We report here a series of six cases of cardiac injuries managed in the Thoracic and Cardiovascular Surgery Department of Fann University Hospital in Dakar between January 2014 and December 2024.

2. Materials and Methods

This was a retrospective descriptive study conducted in the Thoracic and Cardiovascular Surgery Department of Fann University Hospital, covering a ten-year period from January 2014 to December 2024. It included all patients presenting with cardiac wounds or great vessel injuries, whether isolated or associated with other trauma, who underwent surgical intervention. Patients who arrived deceased were excluded. The specific objective of the study was to describe the clinical presentation, diagnostic modalities, surgical management, and outcomes of six patients operated for cardiac injuries over a ten-year period.

The parameters analyzed included epidemiological data (age, sex, occupation, residence, and medical history), the location where the trauma occurred (Dakar, suburban areas, or other regions of the country), the circumstances and time of occurrence, the type of wounding agent (stab weapon, firearm, or other), the mode of transport, the admission delay, and the conditions at presentation. Clinical data collected comprised functional symptoms, vital signs, physical findings, and the possible presence of shock, cardiac tamponade, respiratory distress, or specific characteristics of the wound. Associated

injuries were recorded according to their anatomical location. Paraclinical investigations included radiological examinations such as ECG, chest radiography, transthoracic echocardiography, and thoracic CT scan when the hemodynamic status allowed it, in addition to standard laboratory tests. Therapeutic data focused on initial resuscitation measures, possible pericardial drainage, medical treatments administered, and the surgical procedures performed. Finally, post-operative outcomes were assessed through the length of hospitalization, the duration of intensive care stay, the occurrence of complications, the presence or absence of sequelae, and the final outcome, including survival or death.

3. Results

Six patients underwent surgery for a cardiac or great vessel injury during the study period. The mean age was 21.8 years (range: 8 - 49 years), with a male predominance (five males, one female). The mechanisms of injury were mainly assaults involving stab weapons (five cases), and one iatrogenic case occurred during pericardial drainage. The mean admission delay was 4.5 hours, ranging from 10 minutes to 11 hours, with some patients transferred from distant healthcare facilities, including one case referred from Saint-Louis, 260 km away. Upon admission, four patients presented with hemodynamic instability, two of whom had cardiac tamponade. Clinical presentations included, depending on the case, chest pain, dyspnea, signs of pleural effusion, shock, seizures, or altered consciousness. Physical examination revealed a penetrating chest wound in all patients, sometimes associated with a retained foreign body such as a screwdriver (Figure 1).



Figure 1. Screwdriver penetrating through the sternum.

Additional investigations revealed pericardial effusion in five cases, pneumothorax or hemothorax in four cases, and varying degrees of anemia (8–11 g/dL). Echocardiography identified an intracardiac foreign object in two patients, a “swinging heart” in one case, and variations in mitral or

inferior vena cava flow suggestive of cardiac compression. Thoracic computed tomography, performed in three patients, provided detailed information on the trajectory of the penetrating objects, the depth of penetration, and the associated pleuropulmonary injuries (Figure 2).

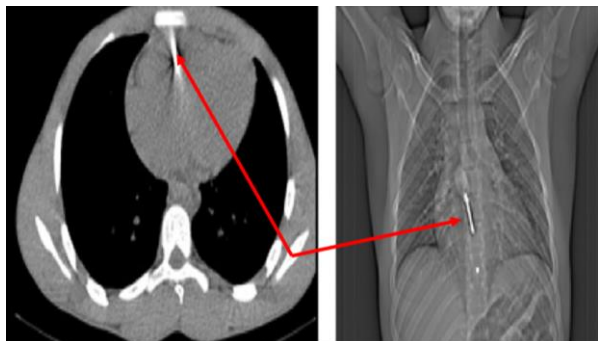


Figure 2. Imaging (CT scan on the left and chest X-ray on the right) showing the foreign object within the heart.

All patients underwent surgery via a vertical median sternotomy following anesthetic preparation. Intraoperative exploration revealed a right ventricular injury in four cases (Figure 3), including one associated with damage to the right coronary vein, one isolated epicardial injury of the right atrium, and one transfixing wound of the aortic root caused by a metallic object.

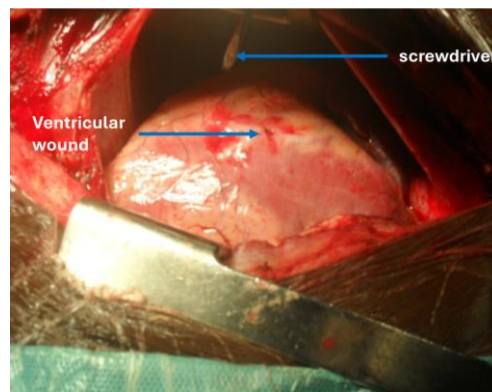


Figure 3. Right ventricular injury after removal of the foreign body

Associated lesions included pulmonary lacerations, pleuropericardial breaches, and pulmonary contusions. The surgical procedures consisted of beating-heart cardiomyorrhaphy in four cases, ligation of the right coronary vein, epicardial closure combined with haemothorax evacuation, and aortic root repair in the pediatric case. In two situations of severe tamponade, initial pericardial drainage resulted in transient hemodynamic stabilization prior to sternotomy. Additional procedures included pleuropulmonary repairs, partial pericardiectomy, massive blood transfusion (up to 3 units of packed red blood cells and 2 units of fresh frozen plasma), and placement of multiple thoracic drains. Postoperative courses were uneventful in four patients, with no immediate complications. Two deaths were recorded: one due to septic shock following an iatrogenic ventricular injury, and the other due to status epilepticus complicated by subarachnoid haemorrhage after repair of an aortic root injury. Overall mortality was 33.3%. Table 1 summarizes the patient characteristics and management.

Table 1. Summary Table of the Cases.

Age (ans)/Sex	Delay	Etiology	Cardiac Injury	Memodynamic Status	Tamponade	Treatment	Complications
16/M	8 h	Stab wound	RV + right coronary vein	Stable	No	Cardiorrhaphy + ligation of right coronary vein	None
13/M	10 min	Iatrogenic	RV	Stable	No	Cardiorrhaphy + pericardiectomy	Septic shock (Death)
23/M	2 h	Stab wound	RV	Unstable	No	Cardiorrhaphy	None
22/M	11 h	Stab wound	Right atrial epicardium	Unstable	Yes	Epicardial repair / pericardial closure	None
8/F	1 h	Stab wound	Racine de l'aorte	Unstable	Yes	Aortic suture	Death
49/M	5 h	Stab wound	RV	Unstable	No	Cardiorrhaphy	None

RV = Right ventricle

4. Discussion

Our retrospective study is consistent with the existing literature regarding the rarity of cardiac injuries, a pathology whose frequency remains low in hospital practice due to a prehospital mortality that can reach 90%, thereby significantly reducing the number of patients who survive long enough to reach medical facilities [2, 3]. Over a ten-year period, only six cases were managed in our department, confirming this low incidence. The international variability in prevalence is largely influenced by the level of societal violence and the accessibility of medical care. Postmortem analyses, such as those conducted in Cape Town in 1990, have shown that only a minority of patients with cardiac wounds survive long enough to reach the hospital, with major vessel injuries and massive haemorrhage explaining the early mortality [4]. Thus, only a limited proportion of victims arrive alive at the hospital, making rapid diagnosis essential, particularly since any parasternal wound should raise strong suspicion of cardiac injury [5]. Our data confirm the male predominance (83.3%) and the preferential involvement of young individuals (mean age 22 years), which is consistent with numerous international series (ELIAS, Bassora, McFarlane, Ilker, Mustafa) [6]. The mechanisms were dominated by stab wounds (83.33%), in contrast with countries where firearms are more prevalent and account for 30 - 60% of cardiac injuries [7]. Penetrating stab wounds are known for their more predictable trajectory, sometimes without initial massive haemorrhage, which may explain the relatively higher survival rate compared with gunshot wounds [8]. Clinically, four of the six patients were hemodynamically unstable, a finding that contrasts with the observations of Perel, who reported that unstable patients rarely reach the hospital alive in resource-limited countries [9]. Clinical presentation was marked by chest pain, dyspnea, and in two cases, cardiac tamponade, complications reported in 33% to 75% of international series [10]. Cardiac lesions were predominantly single (83.3%) and mainly involved the right ventricle (66.6%), the most frequently injured chamber because of its anterior location and thin free wall [11]. We also observed one case involving the aortic root, one of the most severe types of lesions due to the risk of massive haemorrhage and myocardial ischemia [12]. Isolated epicardial wounds, rare and often pauci-symptomatic, were identified in one patient. A lesion of the right coronary vein was also observed. Associated injuries were present in 33% of cases, mainly pleuropulmonary, consistent with the literature where they are reported in up to 56% of patients [13]. From a paraclinical standpoint, transthoracic echocardiography was crucial in all patients, revealing pericardial effusions (sometimes significant) and identifying intracardiac foreign bodies. The FAST protocol, widely used in trauma settings, was applied in our context, although none of the patients benefited from transesophageal echocardiography, which is particularly

useful when transthoracic windows are limited. Chest radiography, performed in two cases, identified pneumothorax and cardiomegaly, while CT scanning, performed in two patients, clarified the trajectory of penetrating objects and associated pleuropulmonary lesions. No troponin measurement was performed, contrary to recommendations indicating that normal troponin levels combined with a normal ECG have a negative predictive value close to 100% [14].

The complete absence of prehospital medical management in our series reflects a major problem in many African countries, where deficiencies in emergency response systems contribute significantly to delays in care [15]. From a surgical standpoint, all patients underwent median sternotomy, the preferred approach for penetrating cardiac injuries [16], as it provides excellent exposure and allows both cardiac chamber repair and pleuropulmonary exploration. Surgical interventions included four beating-heart cardiomyorrhaphies, one epicardial suture, and one aortic root repair, all performed without cardiopulmonary bypass, whose use remains exceptional in trauma settings. Sutures were performed using 4-0 or 5-0 polypropylene. Pleuropulmonary repairs were required in two cases. All patients received blood transfusion despite local constraints in blood product availability (a well-documented issue in low-resource countries) leading some teams to advocate autotransfusion as a practical alternative. The mean hospital stay was 17.6 days (range: 1 - 48 days), similar to that reported by Tariq et al. (14.8 days) [17]. Overall mortality was 33.33%, including one death from septic shock following an iatrogenic ventricular wound and one neurological death after an aortic root injury complicated by status epilepticus. This rate is comparable to that reported in other series. Several negative prognostic factors described in the literature (hypotension, cardiac arrest, Glasgow Coma Scale < 8, absence of spontaneous movements, and massive haemorrhage) were present in our deceased patients. Debate remains regarding the protective or deleterious role of cardiac tamponade. Some authors consider it protective, while others describe it as harmful. Recent studies suggest that tamponade may be initially protective by limiting haemorrhage but becomes deleterious once intrapericardial pressure exceeds the heart's filling capacity. Finally, the mechanism of injury, initial hemodynamic stability, and the presence of sinus rhythm at the time of pericardiotomy are consistently identified as major predictors of survival in several retrospective studies.

Thus, despite the limited number of cases observed in our department, our findings are broadly consistent with international data, highlighting the extreme severity of such injuries and emphasizing the need for early diagnosis, urgent surgical management, and strengthened prehospital systems to improve survival outcomes.

5. Conclusion

Cardiac injuries remain surgical emergencies of exceptional severity, whose apparent rarity masks a very high prehospital mortality. In our series, despite the small sample size, the findings align with international trends characterized by a predominance of male patients, mechanisms most often related to stab assaults, and a high proportion of hemodynamic instability on admission. The right ventricle was the most frequently injured cardiac chamber, reflecting the anatomical vulnerability of its anterior wall. Transthoracic echocardiography, readily available in emergency settings, remains the key examination for initial diagnosis, while median sternotomy provides optimal exposure for cardiac repair.

The outcomes observed highlight the crucial importance of timely management and the organization of prehospital care, whose shortcomings contribute significantly to overall mortality. Enhancing emergency response systems, increasing healthcare providers' awareness of atypical presentations, and strengthening emergency surgical capabilities represent priority strategies to reduce the lethality of cardiac injuries in resource-limited settings.

Abbreviations

CT	Computed Tomography
ECG	Electrocardiogram
RV	Right Ventricle
FAST	Focused Assessment with Sonography for Trauma
ICU	Intensive Care Unit (Unit é de soins intensifs)

Conflicts of Interest

No conflicts of interest.

References

- [1] Henderson VJ, Smith RS, Fry WR, Morabito D, Peskin GW, Barkan H, et al. Cardiac injuries: analysis of an unselected series of 251 cases. *J Trauma*. 1994; 36: 341-8. <https://doi.org/10.1097/00005373-199403000-00008>
- [2] Seamon MJ, Fisher CA, Gaughan J, Lloyd M, Bradley KM, Santora TA, et al. Prehospital procedures before emergency department thoracotomy: "scoop and run" saves lives. *J Trauma*. 2007; 63: 113-20. <https://doi.org/10.1097/TA.0b013e318068c8e5>
- [3] Ivatury RR, Nallathambi MN, Rohman M, Stahl WM. Penetrating cardiac trauma: quantifying the severity of anatomic and physiologic injury. *Ann Surg*. 1987; 205: 61-6. <https://doi.org/10.1097/0000658-198701000-00010>
- [4] von Oppell UO, Bautz P, De Groot M. Penetrating thoracic injuries: what we have learnt. *Thorac Cardiovasc Surg*. 2000; 48: 55-61. <https://doi.org/10.1055/s-2000-6905>
- [5] Campbell NC, Thomson SR, Muckart DJ, Meumann CM, Van Middelkoop I, Botha JB. Review of 1198 cases of penetrating cardiac trauma. *Br J Surg*. 1997; 84: 1737-40. <https://doi.org/10.1002/bjs.1800841230>
- [6] Degiannis E, Loogna P, Doll D, Bonanno F, Bowley DM, Smith MD. Penetrating cardiac injuries: recent experience in South Africa. *World J Surg*. 2006; 30: 1258-64. <https://doi.org/10.1007/s00268-005-0483-1>
- [7] Asensio JA, Stewart BM, Murray J, Fox AH, Falabella A, Gomez H, et al. Penetrating cardiac injuries. *Surg Clin North Am*. 1996; 76: 685-724. [https://doi.org/10.1016/S0039-6109\(05\)70469-1](https://doi.org/10.1016/S0039-6109(05)70469-1)
- [8] Gao J-M, Gao Y, Wei G, Liu G, Tian X, Hu P, et al. Penetrating cardiac wounds: principles for surgical management. *World J Surg*. 2004; 28: 1025-9. <https://doi.org/10.1007/s00268-004-7514-2>
- [9] Perel P, Prieto-Merino D, Shakur H, Clayton T, Lecky F, Bouamra O, et al. Predicting early death in patients with traumatic bleeding. *BMJ*. 2012; 345: e5166. <https://doi.org/10.1136/bmj.e5166>
- [10] Fowler NO. Cardiac tamponade. A clinical or an echocardiographic diagnosis? *Circulation*. 1993; 87(5): 1738-41. <https://doi.org/10.1161/01.CIR.87.5.1738>
- [11] Soto JR, Murry JS, Truitt MS, Dunn EL. Penetrating cardiac injuries at a Level II trauma center: a 15-year review. *Am Surg*. 2015; 81: 324-5.
- [12] González-Hadad A, Ordoñez CA, Parra MW, Caicedo Y, Padilla N, Millán M, et al. Damage control in penetrating cardiac trauma. *Colomb Med*. 2021; 52: e4034519. <https://doi.org/10.25100/cm.v52i1.4519>
- [13] Ferrara M, Baldari B, Vittorio S, Bertozzi G, Cipolloni L, De Simone S. Penetrating cardiac injuries: literature review. *Front Biosci*. 2022; 27: 29. <https://doi.org/10.31083/j.fbl2701029>
- [14] Riou B. Troponin: important in severe trauma. *Anesthesiology*. 2004; 101: 1259-60. <https://doi.org/10.1097/0000542-200411000-00038>
- [15] Naughton MJ, Brissie RM, Bessey PQ, McEachern MM, Donald JM, Laws HL. Demography of penetrating cardiac trauma. *Ann Surg*. 1989; 209: 676-81. <https://doi.org/10.1097/0000658-198906000-00014>
- [16] Beall AC, Diethrich EB, Crawford HW, Cooley DA, De Bakey ME. Surgical management of penetrating cardiac injuries. *Am J Surg*. 1966; 112: 686-92.
- [17] Tariq K, Achakzai A, Amanullah M, Awan A. A Stab in the Forbidden Territory. *J Ayub Med Coll Abbottabad*. 2022; 34(Suppl 1): S1040-2.