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Case report

# Delayed presentation of penetrating cardiac injury successfully managed in resource limited setting: A case report

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ABSTRACT

*Introduction and importance:* Penetrating cardiac injury is rare and historically known to have very poor prognosis. Even today, 90 % of patients die before arriving to hospital. Even though patient presentations can be atypical, organized timely intervention can lead to survival.

*Case report:* A 21 years old arrived 5 h after stab injury to right anterior chest. He was hypotensive with a sucking wound bleeding on his right chest as well as hemothorax on the same side. Chest tube and pericardial window were both done with blood in pericardial space. Median sternotomy was done and revealed right atrial perforation. The perforation was repaired and the patient was discharged and continues to do well on follow up.

*Clinical discussion:* For most patients, time from injury to surgery is short. Focused and organized surveys as well as resuscitation are valuable for any patent with penetrating thoracic trauma. With a patient in hemorrhagic shock and a penetrating wound near the heart, a pericardial window is required regardless of the absence of pericardial fluid on ultrasound and in this case proved to be lifesaving. If there is a hole in the pericardium communicating with the pleural space the pericardial blood may decompress into the pleural cavity and not be visible on ultrasound.

*Conclusion:* Regardless of its rare prevalence, high index of suspicion for cardiac injury is extremely important in all patients with penetrating chest trauma in the cardiac box regardless of atypical presentations. With rapid diagnosis, capable surgeon availability, and availability of blood products, patients can survive this injury.

## 1. Introduction

Penetrating cardiac injury is rare accounting only 0.1 % of most trauma admissions [1]. Although wounds of the heart had captured the imagination of poets and artists for centuries, their treatment continued to elude physicians until relatively recently. Historically, heart injuries had fatal outcomes and were considered untreatable. In the early 18th century Boerhaeve labeled all penetrating cardiac trauma as fatal. Billroth stated "The surgeon who should attempt to suture a wound of the heart should lose the respect of his colleagues" [2]. In 20th century emergency operative intervention was used as definitive treatment for cardiac trauma instead of pericardiocentesis.

Common presentation of patients after cardiac injury is with features of cardiac tamponade or hemorrhagic shock. Additional symptoms of chest pain and shortness of breath are present due to associated hemothorax or pneumothorax. In hemodynamically unstable patients with stab injury in "cardiac box", the diagnosis can be clinically straightforward. But delayed presentation of penetrating cardiac injuries is exceedingly rare due to the observed near 100 % pre-hospital mortality [11]. Even today, about 90 % of the patients die before reaching the hospital [3].

Although limited in Sub- Saharan Africa, recent experience from trauma centers in South Africa focus on structured approach for early definitive management and acceptable results [4]. The experience in Ethiopia is limited to few cases in the capital [8]. Here, we present a case of delayed penetrating cardiac injury successfully manages in a resource limited setting. This work has been reported in line with SCARE criteria [9].

## 2. Case description

A 21-year-old patient from remote area and low socioeconomic background arrived 5 h after he was stabbed to his anterior chest and neck by a sharp knife. He was involved in a family dispute over a plot of land. Following the trauma, he had bleeding from the injury sites, shortness of breath and chest pain. He was taken to a local clinic and

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referred immediately with penetrating thoracic trauma.

On arrival to hospital, his blood pressure was 91/61 mmHg, pulse 85 bpm and oxygen saturation of 98 % on oxygen support. Physical examination showed 1 by 2 cm right side lateral neck (zoneII) superficial wound with no active bleeding or expanding hematoma. There was 2 by 3 cm open sucking wound with active bleeding on his right chest 4th intercostal space (Fig. 1). On Auscultation, air entry on right side of his lung was decreased. Focused abdominal sonography for trauma (FAST) showed no collection in the abdomen or pericardial space. After starting resuscitation with crystalloid, chest x ray was done and it showed right side hemothorax (Fig. 2).

After typing and crossmatch for blood products, the patient was taken to operation theatre under leadership of a surgeon, prepped chin to pubis, and then intubated. Right side chest tube was inserted and 500 ml of frank blood was evacuated upon insertion and continued to increase. Subxiphoid pericardial window was done and it was positive for hemopericardium.

At this point median sternotomy was done. Clotted as well as fresh blood was found upon opening the pericardium. There was a hole in the right pericardium and about 1.5 cm long laceration on the right atrium was found and it was profusely bleeding. There was also a 3 cm laceration on the medial right lung. Two Alice clamps were placed on the atrial wound for temporary hemostasis. The heart was closed using prolene 3-0 suture in a running two layer fashion (Fig. 3). Wedge resection was done for the lung injury. Pleural opening was closed and drain left in the pericardial space. Hemostasis was achieved on the sternum using bone wax and closed by wires. Superficial laceration over his neck was washed and primarily repaired. Intraoperatively, he required four units of whole blood transfusion.

After the procedure, the patient was successfully extubated and transferred to intensive care unit. His first postoperative day was smooth and uneventful in ICU. Echocardiography showed good function of cardiac chambers, no valvular injury, and no thrombus. After three uneventful postoperative days in ICU, the patient was transferred to surgical ward and had his chest tubes removed on 6th day and discharged on 7th day.

His outpatient follow up was also smooth. His last follow up was 18 months after surgery and he continued doing his regular job and daily activities without functional limitations. His follow up echocardiography, EKG and chest x ray were normal as well (Fig. 4).

## 3. Discussion

Time from injury to surgery for penetrating cardiac injuries must be short. In their study Andres Isaza et al. found the average was 60 min [3]. Penetrating cardiac injury survival is seemingly less likely in a patient 5 h out from trauma. But penetrating wounds in the anatomic area known as the “cardiac box” should elicit highest levels of concern for penetrating cardiac injury [5]. Focused and organized surveys as well as resuscitation are valuable for any patent with penetrating thoracic trauma.



**Fig. 1.** Anterior chest stab wound.



**Fig. 2.** Chest X ray showing hemothorax on right side.

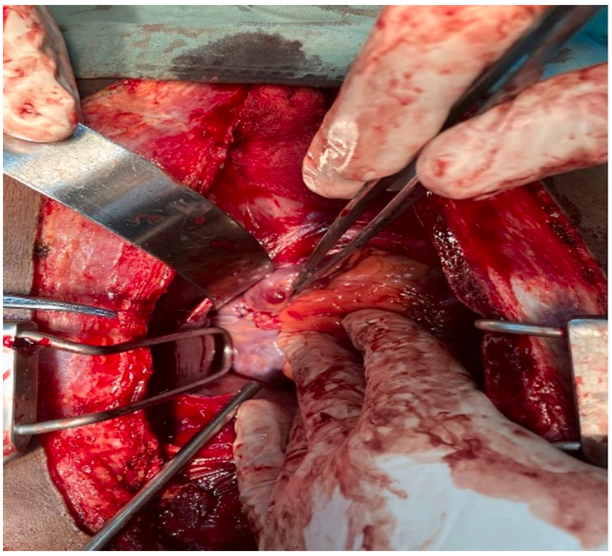


**Fig. 3.** Sternotomy showing right artrial penetrating injury repair.

Although many patients with penetrating cardiac injury might have features of tamponade [3], it is not always easy to appreciate muffled heart sounds in hectic trauma bays. In addition, if there is a hole in the pericardium communicating with the pleural space the pericardial blood may decompress into the pleural cavity and not be visible on ultrasound. Hypotension too can be ascribed to associated traumas and factors. Ultrasound is easiest and non-invasive tool to examine the heart but it is operator dependent.

With a patient in hemorrhagic shock and a penetrating wound near the heart, a pericardial window is required regardless of the absence of pericardial fluid on ultrasound and in this case proved to be lifesaving. In situations where ultrasound is not available, pericardial window can be helpful to rule out cardiac injury [6]. Median sternotomy is best and reasonable approach for penetrating cardiac injuries since it provides access to the heart, both pleura, great vessels and other mediastinal structures [7]. Thoracotomy is acceptable as well but access to all surfaces of the heart may be more challenging.

The right ventricle is most commonly involved in penetrating cardiac injuries [5]. Although its prevalence is low in most studies, others found



**Fig. 4.** 18 months after surgery.

right atrial injuries are associated with highest mortality compared to other chambers [3]. Temporary hemostasis using digital pressure or blunt instruments should be followed by repair. For hemodynamically unstable patient undergoing damage control trauma surgery, the repair technique differs based on location. For atrial injuries, continuous suture with 3/0 monofilament is recommended in literatures [10].

Cardiothoracic surgery is at its early stage in Ethiopia with surgical cardiac care provided only at 4 local centers in the capital. And there are only 5 cardiac surgeons for 120 million people [13]. Standard of care to manage cases like this requires ability to correct acidosis, proper set of instruments to execute thoracic surgery and presence of cardiopulmonary bypass as backup for anticipated extensive cardiac injury [12]. This patient is managed in a general hospital located in southern Ethiopia where these resources do not properly exist. But timely and organized application of ATLS principles led to survival of the patient.

With rapid diagnosis, capable surgeon availability, and availability of blood products, patients can survive this injury. In addition, a pre-hospital rapid medical transport system and a tiered trauma center designation system would also benefit critically ill trauma patients.

## 4. Conclusion

Regardless of its rare prevalence, high index of suspicion for cardiac injury is extremely important in all patients with penetrating chest trauma in the cardiac box regardless of atypical presentations. Appropriate diagnostic and management with applications of ATLS principles can lead to survival even in resource limited setting like ours.

## CRediT authorship contribution statement

1, Ayenew Gucho, MD, General Surgery resident: Organized, wrote and submitted the case report. Involved in postoperative inpatient as well as outpatient care of the patient.

2, David Jeffcoach, MD, Attending surgeon, Chair of general surgery: operated on the patient. Reviewed the case report.

## Consent

Written informed consent in a local language was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

## Ethical approval

Ethical approval was provided by the author's institution.

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## Guarantor

David Jeffcoach, MD.

## Provenance and peer review

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## Declaration of competing interest

The authors declare no conflicts of interest.

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