

PENETRATING CARDIAC INJURIES: ROLE OF EMERGENCY THORACOTOMY IN IRAQI PATIENTSIhssan Ali Hais Elamery^{*1} and Maysa Edan²¹Specialist in Thoracic and Cardiovascular Surgery (M.B.Ch.B,F.I.C.M.S), Imam Hussein Medical City, Kerbala Health Directorate / Holy Kerbala - Iraq.²Practitioner Thoracic and Vascular Surgery, Imam Hussein Medical City, Kerbala Health Directorate /Holy Karbala – Iraq.***Corresponding Author: Ihssan Ali Hais Elamery**

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ABSTRACT

Background: Penetrating cardiac injuries continue to increase in proportion to the steady rise in violence in our society. **Aim:** The aim of study was to express the importance of emergency diagnosis and surgical approach in penetrating cardiac trauma patients. **Method:** Between January 2016 to January 2017, a five penetrating cardiac trauma were admitted to the emergency unit in imam Hussein medical city in kerbala, three of them stab wound and two cases is shell injury, all of them males in age range from 14-44 years old, the five patients were operated without using cardiopulmonary bypass machine and all of them pass without any complications. **Results:** The study consisted of five patients sustaining penetrating cardiac injuries, the five gunshot patients divided into two shell wound (40%) and three stab wounds (60%). An emergency department thoracotomy was performed in all patients and the wounded was sutured with 4/0 prolene after good resuscitation in ER. **Conclusion:** Penetrating wounds of the heart are one of the major cause of mortality and morbidity in our society due to violence, rapid action and good resuscitation with right decision of good skill hand cardiac surgeon will improve the outcome of the results.

INTRODUCTION

Penetrating cardiac injuries continue to increase in proportion to the steady rise in violence in our society. The method of assault has changed from knives and icepicks to more lethal low-velocity hand guns.^[1] With aggressive resuscitative therapy and emergency room thoracotomy, the salvage rate of these patients can reach up to 35%. This study reviews our experience with penetrating cardiac injuries over the past 15 years.^[2, 3]

Cardiac traumas may be blunt or penetrating. Increasing violence also leads to a progressive increase in penetrating traumas. These injuries account for the most important causes of death in the young population. The young average age of our patients is also consistent with this current knowledge. Most of the patients were male, as also found in most other series of the penetrating traumas^[4-6], the most frequent causes are stab wounds or gunshot wounds (GSWs). In the United States, 35-96% of penetrating cardiac traumas are due to GSWs. In developing countries, however, stab wounds are more frequent.^[7-9]

Except for a two cases gunshot victim, all other cases in our study suffered from stab wound.^[10, 11]

Rapid transfer to the emergency department, accurate and quick diagnosis and aggressive surgical approach will increase survival in penetrating cardiac trauma.^[12-14]

PATIENT AND METHOD

Five consecutive patients with penetrating wounds to the heart underwent operation at Imam Hussein medical city Hospital during the period January, 2016, to January, 2017. Most patients were taken to the hospital by ambulance, a large majority reaching the emergency area within thirty minutes from the time of injury. The patients ranged in age from 14 to 44 years. All of them were male. Two had gunshot wounds and the three other had stab wounds. Resuscitative measures including endotracheal intubation, volume replacement, and placement of chest tubes were carried out soon after admission to the emergency room. If the condition of the patient stabilized, then he would be moved to the operating room for further repair of the heart wound, and control of other thoracic and abdominal injuries.

Critically unstable patients show signs of life but are profoundly hypotensive, and cardiac arrest appears to be imminent. At the time of the study, in our hospital, the distance between the resuscitation room and the operating room (OR) was less than 20 m. We never

practice needle pericardiocentesis in patients with suspected penetrating cardiac trauma in our hospital, as we believe false negative results are relatively common. Occasionally computed tomography (CT) can be very helpful in detecting a transthoracic missile).

The study include 5 cases of cardiac injuries were presented, 3 of them had stab wound in the heart, one of them 14 years old patient with stab wound to LV near the apex of the heart and the 2nd case was 32 years old with stab to RV near the origin of Pulmonary. A, 3rd one was 20 years old with stab to epi-gastric region with injury to internal mammary artery and pericardium, the 2 other cases with shell injuries one is 17 years old with shell penetrating the heart (Lt. side of the heart) from apex to base, was stalled in mediastinum, and the other case was 23 years old with shell to the pericardium and stalled

in RV wall, all patients entered the theatre room immediately after insertion of chest tube and good resuscitation and left anterior thoracotomy done with direct suturing of pericardium with 4/0 prolene and repair the associated injury in the lung or abdomen if present then the patients transfer to ICU and after stabilization of their general condition they discharge to the ward and then discharge to home.

RESULTS

The survival rate of penetrating cardiac injuries was related to the time between the injury and initiation of resuscitation, in current study the 5 cases of cardiac injuries were males presented to our department in Imam Hussein medical city (**Fig 1**).

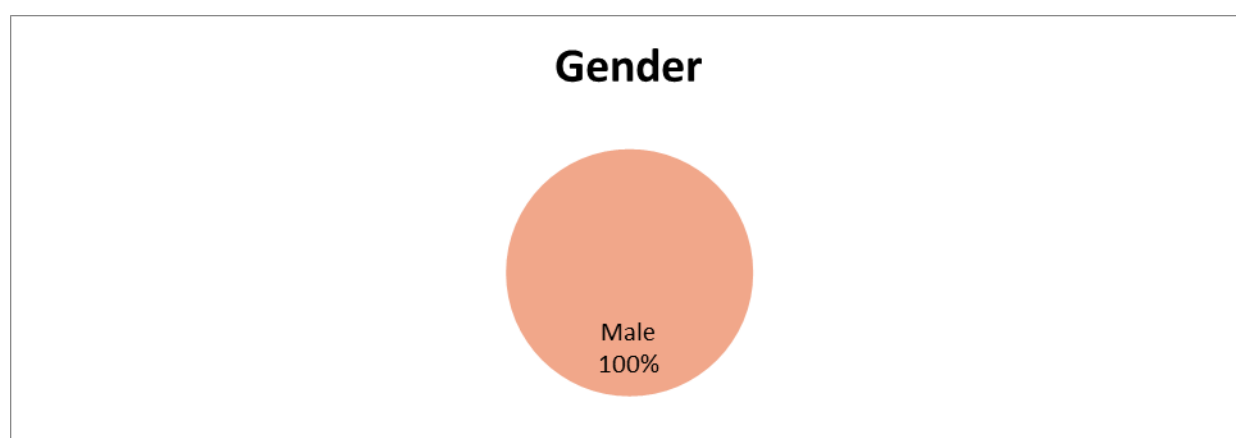


Figure 1: Number of patients according to gender.

The age in current study were divided into three groups as shown in (**table 1**): The first group (10 – 19) years the N. of patients in these group was (1) patient (20%), The

second group (20 – 29) years the N. of patient was (3) (60%) and the last group (30 – 39) years the n. of patient (1) (20%).

Table 1: Number of patients according to age.

Age	N. of patients	Percentage
10 – 19	1	20 %
20 – 29	3	60 %
30 – 39	1	20 %

Figure 2 In present study were shown site of injury, the n. of patients that shown in right atrium (RA) was (0), but the n. of patients were shown in left atrium (LA) was

(4), the right ventricle (RV) the n. of patients were shown (0) and in left ventricle (LV) the n. of patients (1).

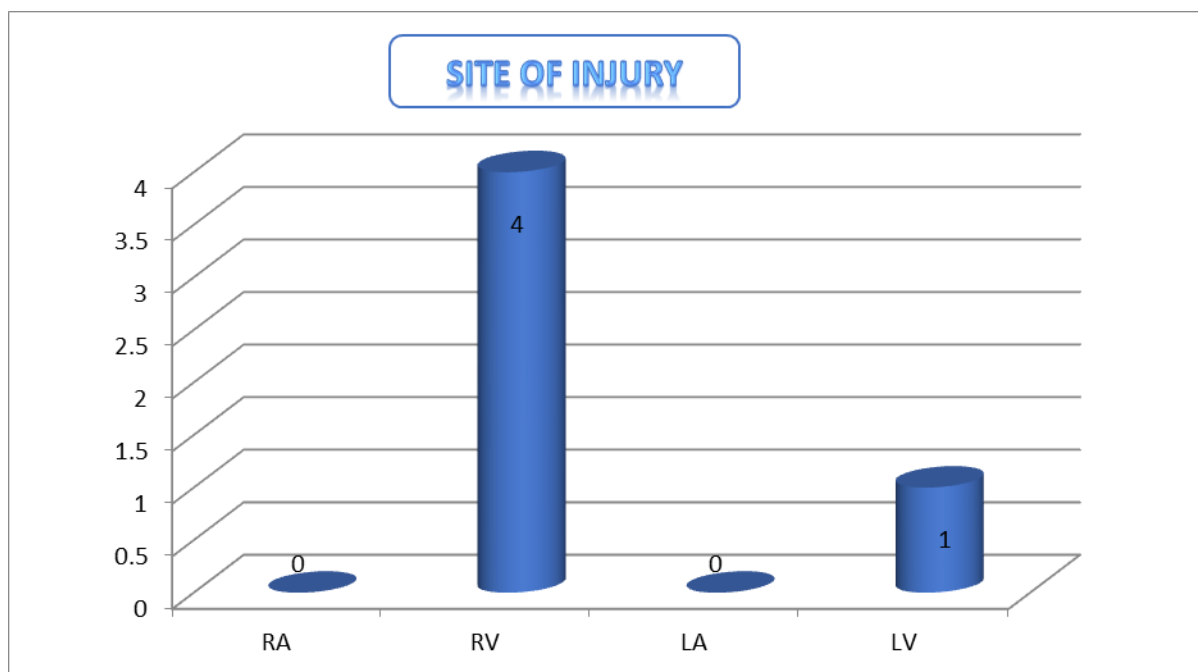


Figure 2: Number of cases according to site of injury.

Type of surgery were shown in (table 2) that revealed the n. of patients in left anterior thoracotomy was (4) (80%), while the n. of patients in right anterior

thoracotomy was (1) (20%) and the n. of patients in median sternotomy was (0) (0%).

Table 2: Number of patients according to type of surgery.

Type of surgery	N. of patients	Percentage
Left anterior thoracotomy	4	80 %
Right anterior thoracotomy	1	20 %
Median sternotomy	0	0 %

Type of injury in current study were shown in (table 3) that revealed the n. of patients had stab wounds was (3)

(60%) and n. of patients had shells wounds was (2) (40%).

Table 3: Number of patients according to type of injury.

Type of injury	N. of patients	Percentage
Stab wounds	3	60 %
Shells wounds	2	40 %

DISCUSSION

In a review in 1968, found that less than 20% of patients with penetrating wounds of the heart reached the hospital alive. With improved emergency transport systems increase the numbers of patients who reach to emergency room alive.^[15, 16] Penetrating cardiac injuries have shown a progressive increase over the past two decades, due to increase the violence in our society after the war on Iraq and increase the use of weapons and harmful sharp objects like knives, needles and gunshots, the gunshots and knives are the most penetrating cardiac injuries in our study^[17-19], the gunshot wounds carry a worse prognosis because they associated with larger defects in the pericardium, more destruction of myocardial tissue than the stab wounds, which produce a small injury in the pericardium that seals off and produces cardiac tamponed.^[20, 21] Eighty to ninety percent of stab wounds

demonstrate pericardial tamponed, but only 20% of gunshot wounds of the heart have cardiac tamponed when first seen.^[16, 22]

Our report represents the retrospective study in 5 patients with penetrating cardiac injuries. These patients were all managed under the close supervision of the single cardiac surgeons in the Imam Hussein medical city in kerbala, penetrating wound to the heart should be suspected in any patient with penetrating wounds to the chest, upper abdomen and neck, the diagnosis of patient with haemothorax after insertion of chest tube and drain more than 1500cc blood is exploratory thoracotomy.^[23] Agitation, lack of coordination, cold extremity, distended neck veins, paradoxical pulses with muffled heart sounds in patients with penetrating wounds to the chest, upper abdomen and neck suggested a cardiac injury with tamponed. early transport of patient and good

resuscitation play important role in the outcome of surgery.^[18] Immediate transport of patient to theatre room, The surgical team must concentrate on rapid resuscitation and insertion of an endotracheal tube, chest tubes, and intravenous lines as needed, with the use of immediate thoracotomy done, A left anterior thoracotomy in the fourth or fifth interspace provides good exposure to the heart and can be performed quickly.^[24-26] If additional exposure is needed, extension of the incision to the right chest with division of the sternum can be done which not used in our study. When the chest cavity has been opened, the pericardium should be extensively opened for treatment of tamponed, control of bleeding, and repair.^[27] Care must be taken to avoid injury to the phrenic nerve, underlying coronary arteries, and atrial appendages, If the heart is found arrested ,direct cardiac massage is done with direct injection of cardiac drugs (epinephrine or calcium)into the heart can be performed.^[28] If ventricular fibrillation is encountered, direct cardio version is carried out. In our study, all cases are managed without using cardiopulmonary bypass machine as in others, open and working on beating heart that lead to decrease the post-operative complications of using cardiopulmonary bypass machine like renal, pulmonary, neurological complications due to long time of clamping of aorta, so all patients pass smoothly without any complications after surgery, also we not use of pericardiocentesis in ER to prevent time lost in preparing the equipment for procedure and early transfer of patients to theatre room and manage the tamponed by open and evacuation, we see that the patients were more likely to survive if they presented with cardiac tamponed than without.^[29-31] Due to protective effect of tamponed. Chest X-R had no role in diagnosis of cardiac injuries so we never used it in our study, echo study and CT scan of the chest may help in diagnosis if the patient not in shocked and hemodynamically stable.^[32, 33] The mortality among patients with penetrating injuries to the heart is related in part to the nature, size, and location of the cardiac wound, associated injuries, and the length of time from injuries to initiation of resuscitation and treatment.^[34, 35] We firmly believe that rapid transfer of injured patient and early ER thoracotomy for decompensating patients, will help to reduce the mortality from penetrating cardiac injuries.^[36]

CONCLUSION

With the continuing rise of violence, surgeons are faced with an increasing number of patients with heart wounds. So it is mandatory for surgeons to be prepared to tackle penetrating injury to the heart immediately, as delay is likely to lead to adverse outcomes. The mortality among patients with penetrating injuries to the heart is related in part to the nature, size, and location of the cardiac wound, associated injuries, and the length of time from injuries to time of starting resuscitation and treatment.as the cardiac injury regarding the most common cause of mortality and morbidity among the body trauma and need rapid action and good management to preserve the life.

REFERENCE

1. Veit J. aimed point shooting or P&S for self defense. 2015.
2. Brenner M, Teeter W, Hoehn M, Pasley J, Hu P, Yang S, et al. Use of resuscitative endovascular balloon occlusion of the aorta for proximal aortic control in patients with severe hemorrhage and arrest. *JAMA surgery*. 2018; 153(2): 130-5.
3. Moore LJ, Brenner M, Kozar RA, Pasley J, Wade CE, Baraniuk MS, et al. Implementation of resuscitative endovascular balloon occlusion of the aorta as an alternative to resuscitative thoracotomy for noncompressible truncal hemorrhage. *Journal of Trauma and Acute Care Surgery*. 2015; 79(4): 523-32.
4. Brooks SE, Peetz AB. Evidence-based care of geriatric trauma patients. *Surgical Clinics*. 2017; 97(5): 1157-74.
5. Garvin R, Mangat HS. Emergency neurological life support: severe traumatic brain injury. *Neurocritical care*. 2017; 27(1): 159-69.
6. Tonerini M, Pancrazi F, Lorenzi S, Angelini G, Aringhieri G, Rossi P, et al. Traumatic Chest Wall Injuries. *Diagnostic Imaging in Polytrauma Patients*: Springer; 2018. p. 249-82.
7. Rosenfeld JV, Bell RS, Armonda R. Current concepts in penetrating and blast injury to the central nervous system. *World journal of surgery*. 2015; 39(6): 1352-62.
8. Serafetinides E, Kitrey ND, Djakovic N, Kuehhas FE, Lumen N, Sharma DM, et al. Review of the current management of upper urinary tract injuries by the EAU Trauma Guidelines Panel. *European urology*. 2015; 67(5): 930-6.
9. Peev MP, Chang Y, King DR, Yeh DD, Kaafarani H, Fagenholz PJ, et al. Delayed laparotomy after selective non-operative management of penetrating abdominal injuries. *World journal of surgery*. 2015; 39(2): 380-6.
10. Kleck G. Targeting guns: Firearms and their control: Routledge; 2017.
11. Franke A, Bieler D, Friemert B, Schwab R, Kollig E, GÜsgen C. The first aid and hospital treatment of gunshot and blast injuries. *Deutsches Ärzteblatt International*. 2017; 114(14): 237.
12. Wahlen BM, De Gasperi A. Preoperative Assessment of the Acute Critically Ill Trauma Patient in the Emergency Department. *Operative Techniques and Recent Advances in Acute Care and Emergency Surgery*: Springer; 2019. p. 55-68.
13. Martin MJ, Beekley AC, Eckert MJ. Front line surgery: a practical approach: springer; 2017.
14. West N, Dawes R. Trauma resuscitation and the damage control approach. *Surgery (Oxford)*. 2018.
15. Nessen SC, Gurney J, Rasmussen TE, Cap AP, Mann-Salinas E, Le TD, et al. Unrealized potential of the US military battlefield trauma system: DOW rate is higher in Iraq and Afghanistan than in Vietnam, but CFR and KIA rate are lower. *Journal*

- of Trauma and Acute Care Surgery. 2018; 85(1S): S4-S12.
16. Reginelli A, Russo A, Maresca D, Martiniello C, Cappabianca S, Brunese L, editors. Imaging assessment of gunshot wounds. *Seminars in Ultrasound, CT and MRI*; 2015: Elsevier.
 17. Pilisuk M, Rountree JA. The hidden structure of violence: Who benefits from global violence and war: NYU Press; 2015.
 18. Monaghan AM, Dover MS. Etiology and Prevention of Craniomaxillofacial Trauma C. Michael Hill, Barry L. Eppley, David W. Thomas, Stephen E. Bond. *Maxillofacial Trauma and Esthetic Facial Reconstruction*. 2016.
 19. Bourke J. Deep violence: military violence, war play, and the social life of weapons: Counterpoint; 2015.
 20. Linsenmaier U, Geyer LL. Cardiac Injuries. *Emergency Radiology of the Chest and Cardiovascular System*: Springer; 2016. p. 105-22.
 21. Khan MA, McMonagle M. Trauma: Code Red: Companion to the RCSEng Definitive Surgical Trauma Skills Course: CRC Press; 2018.
 22. Illman JE, Maleszewski JJ, Byrne SC, Gotway MB, Kligerman SJ, Foley TA, et al. Multimodality imaging of foreign bodies in and around the heart. *Future cardiology*. 2016; 12(3): 351-71.
 23. Koganti D, Beekley AC. Fundamentals of Exploratory Thoracotomy for Trauma. *Fundamentals of General Surgery*: Springer; 2018. p. 275-88.
 24. Pace N. Pre-Hospital Emergency Medicine E-Book: Prepare for the FRCA E-Book: Key Articles from the Anesthesia and Intensive Care Medicine Journal: Elsevier Health Sciences; 2015.
 25. O'Connor J, Adamski J. The diagnosis and treatment of non-cardiac thoracic trauma. *Journal of the Royal Army Medical Corps*. 2010; 156(1): 5-14.
 26. Cuschieri A, Grace PA, Darzi A, Rowley DI, Borley NR. *Clinical surgery*: John Wiley & Sons; 2003.
 27. DuBose JJ, Williams TK, Starnes B. Thoracic Vascular Injuries: Operative Management in "Enemy" Territory. *Front Line Surgery*: Springer; 2017. p. 297-312.
 28. Macleod DC, Scott I, Macrae CA, Uren N, Grubb N, Bell D, et al. Cardiac diseases and resuscitation. *Oxford Desk Reference: Acute Medicine*. 2016:58.
 29. Navia JL, Kapadia S, Elgharably H, Maluenda G, Bartuś K, Baeza C, et al. Transcatheter tricuspid valve implantation of NaviGate bioprosthesis in a preclinical model. *JACC: Basic to Translational Science*. 2018; 3(1): 67-79.
 30. Carvalho AR, Guizilini S, Murai GM, Begot I, Rocco IS, Hossne Jr NA, et al. Hemodynamic Changes During Heart Displacement in Aorta No-Touch Off-Pump Coronary Artery Bypass Surgery: A Pilot Study. *Brazilian Journal of Cardiovascular Surgery*. 2018; 33(5): 469-75.
 31. Musa AF, Quan CZ, Xin LZ, Soni T, Dillon J, Hay YK, et al. artery bypass grafting surgery at The National Heart Institute, Kuala Lumpur [version 2; referees: 2 approved]. 2018.
 32. Dickstein K, Members ATF, Cohen-Solal A, Filippatos G, McMurray JJ, Ponikowski P, et al. ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure 2008†: The Task Force for the Diagnosis and Treatment of Acute and Chronic Heart Failure 2008 of the European Society of Cardiology. Developed in collaboration with the Heart Failure Association of the ESC (HFA) and endorsed by the European Society of Intensive Care Medicine (ESICM). *European journal of heart failure*. 2008; 10(10): 933-89.
 33. Ponikowski P, Voors AA, Anker SD, Bueno H, Cleland JG, Coats AJ, et al. 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure: The Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC). Developed with the special contribution of the Heart Failure Association (HFA) of the ESC. *European journal of heart failure*. 2016; 18(8): 891-975.
 34. Vanden Hoek TL, Morrison LJ, Shuster M, Donnino M, Sinz E, Lavonas EJ, et al. Part 12: cardiac arrest in special situations: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2010; 122(18_suppl_3): S829-S61.
 35. Rossaint R, Bouillon B, Cerny V, Coats TJ, Duranteau J, Fernández-Mondéjar E, et al. The European guideline on management of major bleeding and coagulopathy following trauma. *Critical care*. 2016; 20(1): 100.
 36. King DR. Initial care of the severely injured patient. *New England Journal of Medicine*. 2019; 380(8): 763-70.