

Outcome of Penetrating Cardiac Injuries in Our Center

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Abstract: Penetrating heart injuries is considered a challenging problem. Patients who reach the hospital alive require immediate resuscitation and excellent surgery. Aim of this study to determine the patient's outcome of penetrating cardiac injuries in our center.

Material and methods: During the 7-year period from January 2008 to 2015, retrospectively we collected and recorded data of managed thirty-one patients with penetrating stab wound of the heart who presented at our trauma center in King Khalid hospital and Prince Sultan for medical services, Al Kharj, Kingdom of Saudi Arabia. Only patients discharged from the hospital considered survivors. **Results:** Twenty-six patients (83.9%) were males and five (16.1%) were females. The mean age of the patients was 26.48 ± 11.20 years. The overall mortality was eight patients (25.8%). Systolic blood pressure (SBP) ≤ 90 mmHg was found in 23 patients (74.2%) whereas eight (25.8%) had SBP ≤ 50 mmHg. Nine patients (29%) were unconscious. The percentage of patients with SBP ≤ 50 mmHg and unconscious was significantly higher among non-survivors. The right ventricle was the most frequently injured cardiac chamber (48.4%), followed by the left ventricle (19.4%), but right atrium was injured in four patients (12.9%), whereas the left atrium was in three patients (9.7%) like the pulmonary artery. Concerning wounded chambers, there is no significant differences between survivors and non-survivors.

Conclusion: The key to successful management is early diagnosis with aggressive and accurate resuscitation measurement and surgical repair to improve the patient's outcome.

Keywords: Penetrating, Cardiac, Injury, Outcome.

1. INTRODUCTION

Penetrating heart injuries considered as a difficult and challenging problem. Despite advances in emergency medical and surgical care for these injuries, immediate post-injury mortality rate is still high (1). Their occurrence is very low in Western European countries; however, it is relatively higher in certain cities in the United States and South Africa (2). Prognosis of penetrating cardiac injuries depends on the immediate resuscitation care, mechanism of injury and the hemodynamic state of the patients on arrival to the emergency department (3). Most of the patients who reach the hospital alive present with either cardiac tamponade or hypovolemic shock and require immediate surgery with excellent surgical technique and critical care postoperatively (4). Outcome after emergency thoracotomy varies widely depending on the injury mechanism, site of injury and hemodynamic of the patients (5).

This study reviewed clinical presentation, surgical experience, operative findings and clinical outcome in King Khalid hospital and Prince Sultan for medical services associated with Prince Sattam University, Al Kharj - kingdom of Saudi Arabia.

2. MATERIAL AND METHODS

All retrospectively collected and recorded data using Trauma Registry Database and medical records after approval of hospital review board, in order to identify demographic data concerning age, sex and to detect cardiac chamber injuries, associated injuries, vital signs on arrival, and all operative findings.

During the 7-year period from January 2008 to 2015, the managed Thirty-one patients with penetrating heart wounds presented at our trauma center in King Khalid hospital and Prince Sultan for medical services, Al Kharj, Saudi Arabia.

Their ages ranging between 14 and 51 years. Males were 26 patients while five were females. In all cases, the offending weapon was a knife. Only patients discharged from the hospital considered survivors. All patients with a suspected cardiac injury admitted to the emergency room (ER) at once and started Standard resuscitation protocols including intravenous fluid and blood transfusion. We attempt to restrict the volume of fluid administered before the operation, especially if we suspected that there is cardiac tamponade. Unstable patients shifted directly to the operating theater. If the patient had no cardiac activity on admission or arrested during resuscitation, we performed left thoracotomy and applied CPR protocol. All patient subjected if possible to chest radiograph, central venous pressure (CVP) measurements and echocardiography. Routinely Cautious digital exploration of the chest wound in ER to assess the direction of the tract of the wound towards or away from the heart. An anterolateral thoracotomy is the surgical approach when we are confident that the anticipated injury is accessible, if not, we use median sternotomy. The pericardium was opened longitudinally with care to avoid injury of the phrenic nerves. Control the cardiac wound bleeding by digital control of cardiac wound or if the injury is not controlled, we can insert a urinary catheter through the wound and the balloon-filled fluid to control of the bleeding. The cardiac injury was repaired with pledged non-absorbable sutures and Teflon® felt pads if needed. A horizontal mattress suture underrunning the vessel used to repair wounds in close to a coronary artery. The pericardium was closed with interrupted sutures with left an opening superiorly to prevent tamponade. Anatomical closure of thoracotomy or sternotomy with Chest drain. The patients admitted to the intensive care unit.

Statistical analysis:

All statistical analyses were performed using Statistical Package for the Social Sciences (SPSS 16.0) for windows. The presentation of Continuous data using median (range) and mean ± standard deviation, and categorical data presented by using frequencies and percentage. Mann Whitney U test used to compare continuous variables. Fisher exact test used to compare categorical variables. A p value less than 0.05 considered statistically insignificant.

3. RESULTS

Over a seven-year period (2008-2015), thirty-one patients of trauma sustaining penetrating cardiac injury arrived alive at our center. All had been victims of stab wounds. Twenty-six patients (83.9%) were males and five (16.1%) were females. The age ranged from 14 to 51 years, with a mean age of 26.48±11.20 years (Table 1). The overall mortality was eight patients (25.8%). The main cause of death was shock due to bleeding. Two patients of eight non-survivors were expired after the first 24 hours of hospital admission, due to multiple organ failure. Age and gender distributions were not significantly different when comparing survivors with non-survivors (Table 1). Twenty-three patients (74.2%) had systolic blood pressure (SBP) ≤90 mmHg, 8 (25.8%) had SBP≤50 mmHg; six of them were in non-survivors group. With regards consciousness upon arrival at the hospital, 22 patients (71%) were conscious among them 20 (87%) had SBP >50 mmHg. The proportion of unconscious patients among non-survivors (75%) was significantly higher than among survivors (13%, *P*=0.003). The percentage of patients with SBP≤50 mmHg and unconscious) was significantly higher among non-survivors (Table 1). Hemothorax of variable amount detected in 15 patients (48.4%), nine of them in survivor group while six were in non-survivors. With regards, cardiac tamponade detected in eight patients (25.8%) with equal proportion in both survivors and non-survivors. (Table 1)The right ventricle was the most frequently injured cardiac chamber (48.4%), followed by the left ventricle (19.4%), right atrium (12.9%) left atrium (9.7%), and the pulmonary artery was 9.7%. This was the recorded distribution among survivors, but the left ventricle was the most injured chamber (37.5%) among non-survivors, followed by the pulmonary artery (25%). Nevertheless, concerning wounded chambers, the differences between survivors and non-survivors were not significant (Table 2).

Table1. Demographic and clinical characteristics upon arrival at the hospital

Variables	Overall (n=31)	Survivors (n=23)	Non-survivors (n=8)	p-value*
Age, year	26.48±11.20	25.74±11.04	28.62±12.14	0.492
Female gender	5 (16.1)	4 (17.4)	1 (12.5)	0.100
SBP ≤50 mmHg	8 (25.8)	2 (8.7)	6 (75.0)	0.001
Unconscious	9 (29.0)	3 (13.0)	6 (75.0)	0.003
Hemothorax	15 (48.4)	9 (39.1)	6 (75.0)	0.113
Tamponade	8 (25.8)	4 (17.4)	4 (50.0)	0.154

Data presented as mean ± standard deviation or number (percentage)

*Mann-Whitney *U* test: used for comparison of age and Fisher exact test for other variables SBP, systolic blood pressure.

Table 2. Wounded chambers and associated lung injury

Variables	Overall (n=31)	Survivors (n=23)	Non-survivors (n=8)	p-value*
Wounded chamber				
Right ventricle	15 (48.4)	14 (60.9)	1 (12.5)	0.037
Left ventricle	6 (19.4)	3 (13.0)	3 (37.5)	0.161
Left atrium	3 (9.7)	2 (8.7)	1 (12.5)	0.100
Right atrium	4 (12.9)	3 (13.0)	1 (12.5)	0.100
Pulmonary artery	3 (9.7)	1 (4.3)	2 (25.0)	0.156
Lung injury	11 (35.5)	7 (30.4)	4 (50.0)	0.405

*Fisher exact test

4. DISCUSSION

Penetrating heart injuries are rare conditions. It remains the most difficult and challenging of all injuries seen in the trauma centers. Management of cardiac injuries requires immediate surgical intervention, perfect surgical technique and postoperative critical care(6). The higher mortality rates depend on the mechanism of the lesions, the time delay, the initial care, the site of lesions, the presence or absence of associated lesions, presence or absence of cardiac tamponade(7).

This study represents our experience in the management of thirty-one patients found to have penetrating heart injuries during a seven-year time period, patients who presented with cardiac stab wounds were included in our study(8).

Tang and his associates(9) reported that the time elapsed between injury and definitive care is one of the most important predictors of survival for penetrating cardiac injuries. In our study mortality rate was eight patients (25.8%). The main cause of death was shock due to bleeding. Rhee and his associated(6) reviewed 1058 resuscitative thoracotomies performed for penetrating cardiac injuries in adults and found an overall survival rate of 19.4%. Predictive factors of a poor outcome were reported by Asensio and his associated(11). These factors included the absence cardiac activity and unconsciousness. Tyburski (12) reported that patients with great vessel injuries or multiple chamber wounds have a lower survival rate than those with a single-chamber wound. In patients with stab wounds, those with cardiac tamponade have a better outcome than those without tamponade(1). The clinical presentations of penetrating cardiac injuries range from complete hemodynamic stability to acute cardiac collapse. Blood loss was the main cause of hypotension in our series, mainly among non-survivors, Although there are data supporting that pericardial tamponade is a determinant of survival in penetrating cardiac injuries(13).The heart position in relation of the anterior chest wall for is very important in detection which areas of the heart are the most commonly affected by penetrating injuries. The most common site of a stabbing cardiac injury is the right ventricular because it has the greatest anterior exposure; this is followed by the LV, right atrium (RA), left atrium (LA) and the great vessels(4, 14). The right ventricle was injured in 15 patients (48.4%), followed by left ventricle in 19.4%. Atria are smaller-sized and more posteriorly located leading to a decreased incidence of injury where right-sided lesions were found in 9.7% of cases and left-sided lesions in 12.9% of cases. Injuries to the great vessels occurred with a frequency equal to that of the right atrium, which was in three patients (9.7 %).

Our results show a similar distribution of penetrating injuries as compared with mentioned study by Tang and coworkers(9), in which the right and left ventricular injuries included 86.5% of their patients. Demetriades and coworkers(10) reported that the location of cardiac injury correlated with survival, with right ventricular injuries having the best prognosis explained by the relatively low pressure in the right ventricle (25–30 mm Hg) and its relatively thick wall that contribute to an effective containment of hemorrhage avoiding lethal exsanguination or tamponade. In our results, the overall in-hospital survival was low at 25.8% with the highest survival rate for lesions of the right ventricle (60.9%).

The most important tool in the rapid evaluation of cardiac injury is echocardiography to detect the pericardial effusions and this is depending on the hemodynamic stability of the patient. Echocardiography can decrease the time needed to establish a diagnosis and thus it increases the survival rate(14).

The present study has several limitations that we should consider. This is a retrospective study from a single center, where the majority of our patients are collected. Furthermore, we recognize that the limitation of statistical study is due to small sample of our patients.

5. CONCLUSIONS

Penetrating heart injuries is a difficult and challenging problem necessitate early diagnosis and early surgical repair with accurate management concerning the resuscitation measurement to preserve adequate systolic blood pressure and hemodynamics which is the most determinate factor affecting the patients outcome.

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