Cardiac injuries Revision of local experience

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Abstract

Background: The sequel of cardiac injuries varies from benign to catastrophic ends. In United state, traumatic injuries still the fifth cause of death [(1)]. It has been observed that in the prehospital period, 20% of traumatic deaths are due to cardiac-related injuries [(2)]. Over the last twenty years, the quick and right transportation of patients and early application of advanced life support have enabled more of injured people who were previously non-survived to arrive the hospital in a terminal shock state. The level of suspicion and early identification of the cardiac injury is quite important. Reliable detection, however is challenging, as there are still no diagnostic criteria for penetrating cardiac injury [(3)]. The following review presents an evidencebased approach to the evaluation and management of the patient who presents with thoracic injury that may involve a cardiac injury. **Patients and methods:** Sixteen patients suffering from thoracic trauma and penetrating injury to the heart were retrospectively evaluated regarding the time of presentation state of presentation and the management that were done. The relation of prehospital and hospital variation and the faith of the victims was assessed thoroughly. **Results:** Of the 16 patients 4 (25%) were presented in a stable condition and 6 (37.5%) were in shock state, while 6 (37.5%) in terminal stage. The left ventricle was the injured part in 8 (50%), while right ventricle, left atrium, right atrium, and multiple site were 3 (18.75%), 2 (12.5%), 2 (12.5%) and 1 (6.25%) respectively. The pulmonary injuries is the most associated injured organ 13 (81.25%), with overall mortality of 6 (37.5%). **Conclusions:** Early transportation, early surgical intervention, and the site of injury were the main prognostic factors that affect cardiac injury outcome.

Key wards: Cardiac injury, penetrating cardiac injuries, stab wound, tamponade.

Introduction

Historically, the term “myocardial contusion and concussion” was criticized for its lack of specificity for severity and injury pattern. “Myocardial contusion” was used as a general term encompassing the gamut of myocardial injuries. The true incidence of myocardial injury is difficult to discern, since studies differ in their diagnostic criteria. The reported incidence of myocardial contusion ranges from 17 – 70% in different study populations despite similar mechanisms of injury [(4)].

Penetrating injury to the heart can include stab wounds or missile wounds of high or low velocity. Cardiac injury is suspected when any wound is present at or near the precordial region or when the missile transit is suspected to have included the mediastinum [(2, 5, 6)]. The number of patients arriving at hospitals *in extremis*, rather than expiring in the prehospital setting, has increased due to the maturation of regionalized

trauma systems throughout the world [7].

Outcomes vary from asymptomatic electrocardiographic changes to cardiogenic shock and death. [8].

Tamponade occurs as a result of the body's own compensatory mechanisms. The defect in the pericardium becomes sealed off by fat or clot. This leads to accumulation of blood in the pericardial sac that causes a reflex response of tachycardia. Increased circulating catecholamines lead to an increase in ventricular filling pressure and enhanced myocardial contractility. This, in turn, leads to augmentation of right ventricular diastolic filling, which produces pulsus paradoxus (exaggerated decrease in systolic blood pressure during inspiration). Cardiac output is initially maintained if the preload is improved with volume infusion. This produces compensated tamponade. However, when the limits of distensibility are reached, even small amounts of additional pericardial blood will cause a significant decrease in cardiac output. This decrease in cardiac output is also due to septal shift causing profound systemic hypotension, which can occur suddenly and unexpectedly in the patient.[9]

Cardiac injuries are repaired through a thoracotomy or median sternotomy incision. A thoracotomy incision is preferred if a posterior wall injury is suspected. The incision is made in the fifth intercostal space as a left anterior or anterolateral thoracotomy. The pericardium is opened anterior and parallel to the phrenic nerve. A sternotomy incision is versatile in allowing extension into the neck or abdomen. It allows superb exposure to anterior heart injuries [8,9].

Cardiorrhaphy is done using pledgeted mattress sutures. Strips of pericardium can be used as pledgets if the synthetic variety is unavailable. Digital pressure is maintained over the injury to allow ease of repair. Heart lacerations in proximity to coronary vessels are repaired using a horizontal mattress suture placed deep to the vessel to avoid vascular occlusion [10]. For large wounds, balloon occlusion of the heart injury can be used by inserting a Foley catheter and applying gentle traction to provide temporary hemostasis. Injuries to coronary vessels may be repaired primarily with or without bypass. Adjacent small coronary vessels that are injured may be ligated.[9]

Patients and methods

This study was carried out at Al Sadr teaching hospital / Al Najaf Al Ashraf and Ibn Al Nafees cardiac hospital / Baghdad / Iraq, March 2003 to December 2007. A Retrospective analysis was performed on 16 consecutive patients who presented to the causality unit with penetrating cardiac trauma. Patients who died on arrival (minimum time required for medical and surgical intervention) were excluded from the study. The data were recorded in a data sheet.

Preoperative period; Name, age, gender, hemodynamic state, time from injury to reach causality, time from reach hospital till surgery, type of resuscitation.

Intraoperative period: Type of injury, type of surgery, the associated injuries, and the surgical intervention.

Postoperative period: Outcome and any associated morbidity and mortality.

The variables were compared among each other and analyzed statistically by the X^2 test for the significance of the results.

Results

12 (75%) had bullet injury (including missile), while 4 (25%) were submitted for stabbing. There ages were ranged from 7 years to 60 years with mean age of 26.6 year, the male victims were three fold the female 12/ 4.patients were presented to the causality after the accident with 1 to 48 hours (the mean time 17. 1 hour).

According to their hemodynamic state on presentation, we classified the patient in to three groups (Table 1).

Table 1: Shows the classifications of patients according to the hemodynamic state on presentation and the underlying cause.

Groups	Bullet		Stab		total
	No.	%	No.	%	
A*	3	3	1	1	4
B**	4	4.5	2	1.5	6
C***	5	4.5	1	1.5	6
Total	12		4		16
X2= 0.444 df= 2 $p > 0.05$					

* Patients who were presented to the causality in stable hemodynamic state (systolic blood pressure above 80 mmHg).
** Patients who were presented to the causality in shock (systolic blood pressure below 80 mmHg).
*** Patients who were presented to the causality ***in extremis***.

The access to the heart was through left anterolateral thoracotomy in 10 patients(62.5%), and though median sternotomy in 5 (31.25%) cases, but only one (6.25%) case was through right anterior thoracotomy.

The left ventricle is the most common injured part (8 (50%) then the right ventricle, right atrium, left atrium, and combined left and right ventricle 3(18.75%), 2(12.5%), 2(12.%), and 1(6.25%) respectively (Table 2).

Table 2: Correlation between the site of injury and the hemodynamic state on presentation.

Site in the heart	A		B		C		Total
	No.	%	No.	%	No.	%	
LV	0	0	4	50	4	50	8
RV	2	66.67	1	33.33	0	0	3
LA	1	50	0	0	1	50	2
RA	1	50	1	50	0	0	2
LV+RV	0	0	0	0	1	100	1
Total	4		6		6		16
X2= 10.365 df= 8 $p > 0.05$							

Although pulmonary injuries were the most common associated injuries 13(81%), only one patient require right lower lobectomy, the others either direct repair or just simple tube thoracostomy.

Table 3: Shows the associated injuries

Associated injuries	Total	
	No.	%
Pulmonary	13	81.25
Intra-abdominal	2	12.5
Vascular	2	12.5
Bone	4	25
Isolated	3	18.75

Most of the cases that presented *in extremis* were died with one survival. From the 16 patients 6(37.5%) were died as has been shown in Table 4.

Table 4: The mortality among the patients

Groups	Mortality		Total
	No.	%	
A	0	0	4
B	1	16.67	6
C	5	83.33	6
Total	6	37.5	16

Discussion

Cardiac injury from penetrating wounds of the precordium poses significant challenges. The spectrum of injuries is dependent upon the mechanism and degree of force [2, 5]. Most injuries lead to death, but an estimated 20% of patients with cardiac wounds arrive at hospitals with some signs of life [11]. Cardiac injuries that lead to immediate death do so from exsanguination, cardiac tamponade, coronary artery laceration, valvular disruption, or interruption of essential conduction pathways [12].

It was obvious that the annual number of victims was in direct relation with the general condition of the area and the effect of wars was strong. Although, in stable country like Turkey, Gunay C. and his colleagues [13] and Simek J. and Zácek P. [14], both recorded about 2 cases of penetrating cardiac injuries per year, also Li Hsee et al, in their revision of all trauma admissions to Auckland City Hospital over the last 10 years (1997–2006), noticed that from 13,070 cases only 12 were suffering from penetrating heart injury (15), but in our study the number was raised to about 4 victims annually, and further increment during the 1992-1994 war in Bosnia and Herzegovina to reach nearly 10 victims annually [16].

Our study shew that the most common part that involved in cardiac injuries was the LV (50%) this was in agreement with Delibegovi D. and his colleagues [16], but Gunay C. and his colleagues [13] observed that the RV is the most common site of injury (64.7%) and the LV was came in the second stage (17.7%). Also In 1997, Brown and Grover noted the following distribution of penetrating cardiac injuries [17]:

- **Right ventricle - 43%**
- **Left ventricle - 34%**
- **Right atrium - 16%**
- **Left atrium - 7%**

The isolated cardiac injury was 18.75% in our study, that was similar to Delibegovi D. and his colleagues [16] with (16.13%).

Survival approaches 70% for those who arrive with recordable vital signs,[11] while in our study the survival reach up to 90% for such group. This salvage rate requires rapid diagnosis and transport to the operating room for repair of the cardiac injury.

The outcome of patients with penetrating heart injuries depends to a great extent on aggressive primary care and fast transport to the closest appropriate trauma center. There, after confirming the diagnosis, the injured victim has to be transferred without any delay to the operating room where the penetrating injury can be dealt with [7, 8].

Cardiac injury can be missed due to concomitant bodily injuries. Patients with neurologic, multiple extremity or organ injuries are especially at risk, as their manifestations can mask those of the injured heart. A high index of suspicion and proper triage is essential [6].

Pericardiocentesis does not provide definitive treatment of cardiac penetration with tamponade but may be used as an adjunct in initial stabilization of patients awaiting transport to tertiary care facilities. An indwelling catheter in the pericardial sac may provide a means to remove accumulating blood and allow hemodynamic stability before thoracotomy. The subxyphoid pericardial window should be used to confirm the diagnosis of pericardial tamponade in stable patients if results of ultrasonography or echocardiography are equivocal. For patients in unstable condition, an urgent thoracotomy or median sternotomy is the recommended procedure of choice. [8, 9,18] These diagnostic modalities are useful because the classic physical signs of pericardial tamponade -- hypotension, muffled heart sounds, and distended neck veins -- are often lacking in the trauma situation[19].

Mortality rate in our study was 37.5%, which is better than Delibegovi D. and his colleagues [16] (the mortality in their study was 58%), while Simek J. and Zácek P. [14] recorded mortality rate of 23.8%, and Gunay C. and his colleagues [13] recorded mortality rate of 29%.

Postoperative complications are common and include immediate coagulopathy, sepsis, shock, arrhythmias, myocardial infarction, and encephalopathy [20]. Delayed complications include ventricular septal defects, conduction problems, wound infection, or costochondritis. The most common delayed complication is a ventricular septal defect. Because interventricular septal injuries are often not diagnosed at the time of injury, follow-up should include 2-dimensional echocardiography, electrocardiography, and cardiac catheterization in symptomatic patients[21].

Conclusion

In spite of the big gab between our clinical facilities and that of the global centers, but our result was within the acceptable limits.

Although the most important factor affecting mortality in penetrating heart injuries is rapid transport, an urgent approach applied by a specialist team can decrease potential mortality and morbidity rates.

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