Penetrating Cardiac Injury

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Key Word

Penetrating cardiac injury

Abstract

Objectives: To report a case of penetrating cardiac injury with patient's survival. **Clinical Presentation and Intervention:** A 23-year-old man stabbed with a knife to the epigastric area just below the right costal margin was brought to the Emergency Room, Al-Adan Hospital, Kuwait, in a state of shock. Aggressive resuscitation was performed, chest X-ray showed no evidence of hemo- or pneumothorax. Exploratory laparotomy was performed revealing a severely congested liver, with no intraperitoneal hemorrhage to explain his being in a state of shock. Left thoracotomy revealed pericardial tamponade with perforation in the right ventricle and hemorrhage. A mattress suture was used to control bleeding from the right ventricle. Postoperative echography revealed a tear in the interventricular septum and papillary muscle. Open-heart surgery was performed to repair the injured tissues. The patient made an uneventful recovery. **Conclusion:** This report shows that patients with penetrating cardiac injuries and detectable vital signs on arrival at the hospital can be salvaged by prompt surgical intervention.

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Introduction

The mortality rate from penetrating cardiac injuries was much higher during World War I than World War II and decreased considerably during the Vietnam war as a result of improved transportation which enabled the evacuation of critically injured patients to reach medical care facilities alive [1].

Case Report

A 23-year-old man stabbed with a knife to the epigastric area just below the right costal margin was brought to the Emergency Room, Al-Adan Hospital, Kuwait, in a state of shock. Clinical examination revealed a pale, irritable, and diaphoretic patient with a blood pressure of 80/50 mm Hg, a pulse rate of 130/min and no apparent venous engorgement of the neck. His chest was clear with no evidence of hemo- or pneumothorax or surgical emphysema, his abdomen was distended, guarded and tender all over and his extremities were clinically free.

The patient was stabilized after aggressive resuscitative measures were applied. Chest X-ray revealed no pneumo- or hemothorax. Continuous colloids and crystalloids were given. Urgent exploratory laparotomy was performed because of the tender and guarded abdomen, hypotension and bradycardia, suggesting intra-abdominal hemorrhage. No intraperitoneal blood collection or injury to the abdominal viscera except for severe enlargement of the liver with congestion was seen. The patient's blood pressure continued to deteriorate in spite of aggressive resuscitation. Because of engorgement of the liver, hypotension and the site of the stab wound in the epigastric area, pericardial tamponade was suspected, so immediate left thoracotomy was performed; cardiac tamponade

was noted and profuse bleeding from a 2.5-cm wound in the right ventricle was evident. Bleeding was controlled by interrupted mattress nonabsorbable sutures that were applied to the right ventricular muscle defect one inch in length. The patient arrested twice during the procedure and was resuscitated with cardiac massage. He received about ten units of packed red blood cells and four units of fresh frozen plasma. Thoracotomy was closed with intercostal drainage.

The abdomen was left open and covered with a sterile nylon bag to prevent abdominal compartment syndrome because of an edematous bowel and a huge enlarged liver. As the patient's condition stabilized, he was transferred to the intensive care unit for further investigations. Transthoracic echocardiography, showed grade III mitral valve regurgitation, a significant traumatic ventricular septum defect and papillary muscle damage. The patient was transferred to the Chest Hospital, for open heart surgery to correct the defects. Transesophageal echocardiography showed moderate tricuspid valve regurgitation and an intraortic balloon was inserted during the open heart surgery. Mitral and tricuspid valves were replaced and ventricular septal perforation was repaired. The patient stayed in the hospital for more than 4 weeks and developed post-operative chest infection that required tracheostomy. The patient eventually stabilized and was discharged home.

Discussion

A review of the literature covering penetrating cardiac injuries reveals that approximately 25% of trauma deaths are due solely to thoracic injuries and 50% of the patients who die from multiple injuries have significant thoracic injury. Generally, mortality ranges between 4 and 12% and increases to 12–15% if extrathoracic regions are involved [1].

Several factors that determine prognosis in penetrating cardiac injuries include time from injury to operation, type of injury, site and size of cardiac injuries, the presence of cardiac tamponade, associated injuries and the experience of the trauma center and trauma team [2]. Our patient was transferred to the operation theater within 20 min.

Major cardiac injuries can be defined as injuries that disrupt one or more cardiac chambers, such as myocardial contusions, are responsible for most of the deaths from cardiac trauma [3]. Cases seen at high volume cardiac trauma units are predominantly victims of penetrating trauma [3–5]. Clinical manifestations include restlessness, confusion, shock state (often mistakenly attributed to alcohol or illicit drug use), tachycardia and weak peripheral pulses. Every penetrating injury to the chest associated with shock should be considered as a cardiac injury until proven otherwise [2]. As the case reported here showed signs of shock, immediate aggressive resuscitation measures were taken on the spot; the site of the

stab injury below the right costal margin, hypotension, engorged and congested liver on abdominal exploration with no evidence of an intra-abdominal source of bleeding led to perform urgent left thoracotomy for the strong possibility of cardiac tamponade even though clinical signs of cardiac tamponade were not evident (congested neck pain, muffled heart sounds) except for hypotension. Rapid thoracotomy and repair of the right ventricular tear with interrupted sutures to control bleeding helped to save the patient.

History taking is very important especially in trauma cases, notably because of the medico-legal aspects. As well, all physical evidence of the weapon should be presented and neither finger prints nor adherent tissue, hair or clothing should be removed from the weapon. Quick thorough examination of the anterior and posterior aspects of the chest for associated injuries must be carried out [1].

If the diagnosis is obvious, time must not be wasted on investigations as in our case, where operative intervention was the appropriate decision for the patient's survival. Since the patient had a penetrating injury and his general condition was unstable with hypotension, it was decided to do a laparotomy without using laparoscopy. Echocardiography was not available at midnight to evaluate the heart and pericardium before laparotomy was undertaken.

Echocardiography is the investigation of choice because it is a fast, reliable and noninvasive procedure. Other investigations such as chest X-ray, pericardiocentesis could be applied if the situation permits. Tamponade is suspected if central venous pressure (CVP) is more than 12 cm H₂O. But on the other hand, cardiac tamponade associated with significant blood loss may not give a high CVP [2].

Severe shock in the absence of tension pneumothorax is a strong indication for thoracotomy [2]. It is a matter of personal preference and experience but many trauma surgeons prefer a median sternotomy for most cardiac injuries. Reserving a left thoractomy for posterior injuries. Some surgeons prefer a left thoractomy for all cases [2]. As in our case, ventricular wounds are controlled with large mattress nonabsorbable sutures [6, 7]. Mattress sutures are helpful to buttress large ventricular lacerations. Extensive ventricular injuries may require cardio-pulmonary bypass, chamber decompression and patch closure [8, 9]. For residual intracardiac shunt or valvular disruption, no attempt should be made to repair these defects unless hemodynamic instability persisted without additional surgery. Postoperative echocardiography and cath-

eterization are helpful for detecting residual internal cardiac problems [10].

A literature review revealed that length of hospital stay for surviving patients ranged from 4 to 52 days with a mean of $15-6 \pm 14-9$ days. Survival was not related to patient's age [10, 11].

Our patient stayed for more than 4 weeks and when he became stable and fit, he was discharged. The sharp and rapid decision to interfere surgically and explore the patient was behind our success in the survival of our patient.

According to the classification of cardiac injuries our case can be graded as 6th grade on the heart injury scale. In this patient all injuries were repaired successfully and the patient recovered fully [12].

Conclusion

This case shows that patients with penetrating cardiac injuries and detectable vital signs on hospital arrival can be salvaged by prompt surgical intervention.

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