Penetrating cardiac trauma. A case report.

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BACKGROUND: Cardiac trauma is the second most common cause of trauma-related death. Penetrating cardiac injury (PCI) is very lethal, with mortality rates of 70 % to 80 %. The common clinical presentation is cardiac tamponade with/ or hemorrhagic shock in most cases, which constitute a surgical emergency and require prompt treatment. Ultrasound and computed tomography (CT) are the main modality to evaluate it. The choice of the surgical approach depends on the experience of the surgeon, the expected injuries according to the probable trajectory of the wounds, and the evidence of associated injuries. We present the case of a 40-year-old male who presented a stab wound in Murdock's precordial zone that caused a penetrating injury to the right ventricle, which required emergency surgical management through median sternotomy with pericardiotomy and primary repair.

KEY WORDS: Cardiac trauma.

Introduction

ardiac trauma occurs in up to 76% of patients after chest trauma and is the second most common cause of death from trauma after central nervous system injuries. Penetrating cardiac trauma (PCT) mainly affects young men, as a result of stab or gunshot wounds, in addition to iatrogenic causes such as catheterization of cavities and installation of chest drains. Although any penetrating injury to the chest may be associated with a CT scan, those within Murdock's area, the boundaries of which are the lower border of the clavicles, the costal margin, and the midclavicular lines, are of most concern. [1] According to the type of traumatic agent and mechanism, different types of cardiac injuries can occur, from injury of the wall, of large intrapericardial vessels to coronary or intracavitary injuries altering the septum, valves or the conduction system. The clinical features depend on the mechanism of injury (blunt or penetrating) and the size of the wound to the myocardium or pericardium. Penetrating cardiac injury (PCI) is often dramatic and rare as most individuals die on site and patients who do present occasionally present with varying degrees of shock or even cardiac arrest requiring cardiopulmonary resuscitation. [2]

PCT is highly lethality, with a mortality rate ranging from 70% to 80%. The right ventricle is the most common affected site due to its anterior location in 62% of cases. The two most frequent causes of death in people with PCT are hemorrhagic shock (77.5%) and cardiac tamponade (22.5%), which constitute a surgical emergency and require timely treatment. [3] Diagnosis of cardiac tamponade is based on clinical and hemodynamic status and history of trauma. The first study to detect it is focused evaluation by ultrasound in trauma (FAST) to visualize hemopericardium, myocardial dysfunction, intracavitary lesions and lesions in the free wall of the heart.

Pericardiocentesis is considered a temporary measure while preparing the patient for surgery, however surgery should not be postponed in order to perform it. Once the primary assessment has been carried out in a hemodynamically stable patient, with the result of the initial chest ultrasound compatible with hemopericardium, a pericardial window can be performed and, if it is positive, drainage and lavage will proceed, with the indication to proceed to a formal sternotomy or a thoracotomy when active bleeding is detected.

Imaging studies have a crucial role in the diagnosis and characterization of cardiac trauma. In the chest X-ray, the signs that suggest a cardiac trauma are skeletal fractures (sternal, clavicular or rib fracture), hemothorax and widened mediastinum. In recent decades, chest CT has become the diagnostic modality of choice due to its rapid acquisition, high resolution, and noninvasive nature to accurately characterize cardiac lesions and their extent. [4]

The approach of choice is debatable, the left anterolateral thoracotomy has the advantages of comfort and ease, in addition to allowing access to posterior structures such as the esophagus, the descending aorta or the left hilum, however, cardiac

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Figure 1. Chest X-ray: left hemothorax.

exposure is limited and may aggravate hemodynamic instability. On the other hand, the median sternotomy allows an excellent exposure to structures of the anterior mediastinum and large intrapericardial vessels in a rapid manner and allows repair of the cardiac injury, the main disadvantage being the problematic sternal closure. Regardless of the incision chosen, once the mediastinum is exposed, pericardiotomy should be performed, the hemopericardium evacuated and the cardiac lesion temporarily controlled by digital control. Once the myocardium is repaired, the closure of the pericardium is partial, in order to avoid the formation of tamponade, with the consequent placement of large-caliber retrosternal tubes in the case of sternotomy or thoracic if it was approached by thoracotomy, the patient must be admitted to the intensive care unit to continue his resuscitation. [5-8]

Case report

A 40-year-old male presented with a sharp puncture wound in Murdock's precordial area, with 2 hours of evolution prior to his arrival at the shock unit. On the physical examination, he was with blood pressure of 70/40 mmHg, heart rate of 130 beats per minute, respiratory rate of 30 breaths per minute, and temperature of 35 °C. Disoriented, with pale skin and jugular engorgement, ventilatory support with a reservoir mask at 10 liters per minute to maintain oxygen saturation greater than 90%, in the anterior chest 2 centimeters from the sternum in the fifth intercostal space, two sharp wounds of 2 cm length were observed with blood clots and pain on palpation, on auscultation decreased intensity of the vesicular murmur in the left hemithorax, with matte on percussion, heart sounds with decreased intensity. A chest X-ray was performed (Figure 1) in which left hemothorax was observed.

A left endopleural catheter was placed and an initial volume of 1150 ml of blood was drained. Cardiology support was requested to perform an echocardiogram, which was reported without lesions, however, as the hemodynamic instability did not completely remit despite the water management and cessation of pleurostomy output, the decision was made to perform a CT (**Figure 2 A-B**) in which the presence of left pneumothorax, minimal hemothorax, areas of increased lung parenchyma density consistent with pulmonary contusion were evidenced and hemopneumopericardium.

Laboratories showed: leukocytes 21.3 x 10 3 / μ L, neutrophils 16.4 x 10 3 / μ L, hemoglobin 13.7 g / dL, hematocrit 40.7%, platelets 231 x 10 3 / μ L,



Figure 2. Chest tomography. Axial - Left pneumothorax, minimal hemothorax, pulmonary contusion and hemopneumopericardium (A). Sagittal - Hemopneumopericardium (B).



Figure 3. Repair of the cardiac wound with reinforcement of the sutures with autologous pericardium.

glucose 168 mg / dL, creatinine 1.23 mg/dL, INR 1.05. Resuscitation with crystalloid and transfusion of blood products was continued, emergency surgical management was offered, and he consented. Median sternotomy was performed with pericardiotomy, with the findings of blood clots and an injury of 1 cm in the right ventricle, which was closed with 3-0 nonabsorbable monofilament suture and placement of a pericardial patch, obtaining complete hemostasis (**Figure 3**).

Finally, an endopleural catheter was placed into the anterior mediastinum. During the transsurgical period, he presented mixed shock refractory to fluid resuscitation, for which he required vasoactive amine support. Therefore, he was maintained with medical management in the intensive care unit. He progressed adequately until the removal of the pleural and mediastinal tubes on the fourth day after the surgical event, showing adequate pulmonary expansion on chest X-ray (**Figure 4**). He was discharged 7 days after surgery without complications.

Discussion

Cardiac trauma is the second most common cause of trauma-related death. One should have a high index of suspicion for cardiac injuries after chest trauma, presenting clinically with cardiac tamponade or hemorrhagic shock in most cases. Injury to the ventricular cavities, mainly right, usually occurs and, is associated with significant morbidity and mortality.

Ultrasound and CT are the main modalities for evaluation. Nevertheless, ultrasound is operatordependent, that's why contrast-enhanced tomography is proposed as an initial diagnostic method in polytraumatized patients, leaving behind the dogma of



Figure 4. Chest X-ray: Lung expansion seven days after surgery.

do not perform this study modality in unstable patients. [9,10] The pericardiocentesis should only be performed by trained personnel and supported by ultrasound or echocardiography, and the pericardial window is not recommended in cases of penetrating injury with a hemodynamically unstable patient, the patient with tamponade data should be immediately treated with surgical exploration and in case of cardiac arrest, urgent resuscitation thoracotomy must be performed.

Conclusion

Evaluation of cardiac injury is often challenging, imaging plays a crucial role in guiding early diagnosis and treatment of cardiac trauma.

A high degree of clinical suspicion with an early and timely management strategy is definitely required to improve mortality and morbidity.

The choice of surgical approach depends on the experience of the surgeon, the injuries expected based on the probable trajectory of the wounds, and the evidence of associated injuries.

With standardized management of penetrating cardiac trauma, good results can be achieved in the short and long term.

Conflicts of interests

There was no conflict of interest during the study, and it was not funded by any organization.

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