

Retrospective study of heart injuries occurred in Manaus – Amazon

Estudo retrospectivo de ferimentos cardíacos ocorridos em Manaus/AM

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A B S T R A C T

Objective: To evaluate the forms of treatment employed to heart injuries and the main aspects related to their morbidity and mortality. **Methods:** A retrospective study of 102 patients with cardiac injuries treated in the two emergency rooms in Manaus (Dr. João Lucio Pereira Machado Emergency Hospital and August 28 County Emergency Hospital) from January 1998 to June 2006. **Results:** Of the 102 patients, 95.1% were men; mean age was 27 years; stab wounds accounted for 81.4% of cases and gunshot wounds for 18.6%; cardiorrhaphy was performed in 98.1% of cases. The heart chambers affected were: Right Ventricle (RV): 43.9% (36.2% isolated and 7.7% associated with other chambers); Left Ventricle (LV): 37.2%; Right Atrium (RA): 8.5%; and Left Atrium (LA): 10.4%; specific mortalities were of 21%, 23%, 22% and 45%, respectively. The mortality injuries to two associated chambers was 37.5%, 20% being for RA + RV, 100% for RV + LV, and zero for RV + LA. The lung accounted for 33.7% of the 89 associated lesions. Mean time of surgery and hospital stay were 121 minutes and 8.2 days, respectively. About 22.5% of patients displayed 41 complications. The mortality rate was 28.4%. Lesions grade IV and V corresponded to 55% and 41% of cases, with specific mortality of 26% and 15%, respectively. All patients with grade injuries VI died. **Conclusion:** Cardiac stab wounds were associated with lower mortality, cardiac lesions grade IV were associated with higher mortality and a shorter operative time was associated with greater severity and mortality.

Key words: Mortality. Wounds, penetrating. Heart injuries. Emergencies. Patients.

INTRODUCTION

Penetrating cardiac injuries have been considered lethal and intractable. The Greek poet Homer made the first description of the death of Sarpedon in the Iliad, in 3000 BC. In 1883, Billroth declared in a European Congress of Surgery, "The surgeon who tries to suture a heart wound should lose the respect of his colleagues." However, Rehn presented on April 22nd, 1897, in the German Congress of Surgery, the first successful case of cardiorrhaphy of right ventricle ¹.

In Brazil, the first two reports on the treatment of cardiac injuries are from Silvio Brauner in 1927 in Rio de Janeiro, who performed an atrial suture in a nine-year-old who had a chest stab wound with 12 hours of evolution and survived the operation without sequelae, and Euryclides de Jesus Zerbini, in 1942, in São Paulo, who successfully operated on a patient with heart wound^{2,3}.

Thus, it is observed that the treatment of penetrating cardiac injuries has undergone major advances over the centuries, ranging from observation and total mortality (800 BC to the seventeenth century), moving to experimentation (the seventeenth century until 1882) and strengthening its bases in cardiorrhaphy techniques and better understanding of the pathophysiology of these lesions after that period.

About 22% to 25% of trauma deaths are related to chest injuries and 90% of cardiovascular lesions are originated from penetrating trauma ^{4,5}.

The overall survival rates of penetrating cardiac injuries range from just under 20% to 81% ^{6,7}. However, 60% to 80% of victims with such injuries die at the scene or on the way to the emergency room despite advances in rescue and prehospital transport obtained in the last four decades.

In Brazil, the authors of a series of 121 patients with cardiac injuries called attention to its incidence: one

Study conducted at the Dr. João Lucio Pereira Machado Emergency Hospital and August 28 County Emergency Hospital – Manaus – Amazonas State – Brazil.

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for every 10,000 patients admitted, about one case per month⁸. Some studies have shown that victims of cardiac injuries are predominantly men in their productive years, with ages ranging between 24 and 33 years^{4,6,7,9-21}.

With respect to penetrating cardiac injuries, different ratios between their mechanisms are found in the literature, with predominance of gunshot wounds (GW)^{22,23}. Multiple risk factors significantly associated with assaults, robberies and homicides, to which the urban population is exposed to, are the genesis of cardiovascular injuries in 50% to 90% of cases²⁴. In this context, penetrating cardiac injuries affect an important segment of the trauma population.

The increasing incidence of patients who suffered cardiac injuries in our emergency rooms brought the need to understand them as a trauma and public health issue in Manaus. Thus, this study is justified to assess the forms of treatment employed to heart injuries and the main aspects related to their morbidity and mortality.

METHODS

A retrospective study was conducted from reviewing the medical records of 102 patients treated between January 1998 and June 2006 in the August 28 Emergency County Hospital and the Dr. João Lucio Pereira Machado Emergency Hospital, units of the Unified Health System (SUS), to which are taken all cases of serious injuries occurred in the city of Manaus, Amazonas state. The study included all patients arriving live at both emergency room and in which, during the initial treatment and / or during exploratory thoracotomy a cardiac injury was evident. The decision to exploratory thoracotomy was based on clinical parameters, such as the position of the perforation in the precordial region or Ziedler's area, hemodynamic status (hypotension refractory to fluid replacement) and the initial rate of the closed chest drainage. The emergency room thoracotomy was performed in patients with penetrating chest wounds, in cardiac arrest, but showing some vital signs on arrival in the emergency room.

In addition to collecting data such as age, gender, trauma mechanism and injury site, we applied the Organic Injury Scale of the American Association for the Surgery of Trauma (AAST) relative to Cardiac Injury²⁵. This classification stratifies cardiac injury by degrees of anatomic and functional damage, from contusion to several types of single or multiple penetrating injuries, as one or more heart chambers are affected.

Other variables were: the time elapsed between admission to the emergency room and the beginning of surgery, associated injuries, surgical procedure used for each patient, length of hospital stay, complications and mortality.

We performed a descriptive analysis of epidemiological data and to study the relationship between the variables death, cardiac chamber, mechanism of trauma,

AAST injury scale, transfusion of packed red blood cells and duration of surgery, using the chi-square test with 5% significance level.

This study was approved by the Ethics Committee of the Tropical Medicine Foundation of Amazonas, in Manaus, under number 772/2004.

RESULTS

Of the 102 patients studied, the majority (95.1%) were male. The average age was 27 years, ranging from 15 to 76. The most frequent age interval was between 21 and 30 years (46.1%). Stab wounds were responsible for 81.4% of cardiac lesions, representing a specific mortality of 24%, as opposed to the 47% mortality for gunshot wounds ($p = 0.042$), whose incidence was 18.6%. The precordium was the most frequently thoracic injury site (69.6%), with 112 lesions (Table 1).

The elapsed time between admission to the emergency room and the beginning of the operation was less than 20 minutes in 19.6% of patients, ranged from 21 to 41 minutes in 28.4% of patients, and more than 83 minutes in 25.5% (Table 2).

Most patients (52.0%) were operated using the anterolateral left thoracotomy, followed by median sternotomy (24.5%) and clamshell thoracotomy (20.5%),

Table 1 - Distribution of patients regarding gender, age group, trauma mechanism and entry of the lesions.

	Patient No.*	%
Gender		
Male	97	95.1
Female	5	4.9
Age group		
10 – 20	28	27.4
21 – 30	47	46.1
31 – 40	15	14.7
> 40	12	11.8
Trauma mechanism*		
SW	83	81.4
GW	19	18.6
Site of the lesions	No of injuries	%
Precordium	78	69.6
Right chest	18	16.1
Abdomen	9	8.0
Subxiphoid	3	2.7
Axillary	2	1.8
Posterior LHT	2	1.8

* There was more than a chest lesion for each patient.

*SW: stab wound; GW: gunshot wound. LHT: left Hemi-thorax.

Figure 1. Cardiorrhaphy was the predominant surgical maneuver (98.0%). One patient required Dacron® prosthesis and another required aTeflon® prosthesis besides cardiorrhaphy (Table 3).

The average crystalloid fluid resuscitation was 3500mL per patient. Between 2500-4000 ml of crystalloids were used in 35.2% of individuals. Eighty-two patients (80.3%) required packed red blood cells (PRBC); of these, 63.4% required one to three units, 30.4% four to six units and 6.2% seven to 11 PRBC units, achieving specific mortality of 26.9%, 20% and 20% respectively ($p = 0.781$). In these patients the overall mortality was 24% ($p = 0.161$).

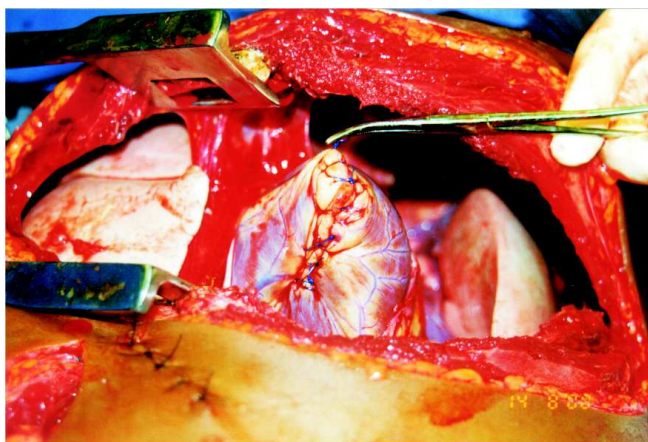


Figure 1 - Overview of clamshell thoracotomy showing right ventricular injury.

Table 2 - Distribution of patients regarding survival. length of stay. time elapsed between admission and the beginning of the surgery and duration of surgery.

	Patient No.*	%
Time interval between admission and the beginning of the surgery (min.)		
< 20	20	19.6
21 – 41	29	28.4
42 – 62	18	17.6
63 – 83	9	8.9
> 83	26	25.5
Surgery duration (min.)		
< 50	12	11.8
50 – 100	26	25.5
101 – 151	34	33.3
> 151	30	29.4
Length of stay (days)		
< 5	18	19.5
5 – 10	49	53.3
11 – 16	14	15.2
> 16	11	12.0

* 10 patients were not admitted.

Of the 37 patients requiring fresh frozen plasma (FFP), 51.4% used two to three units, 37.8% up to one unit and 10.8% required more than three units of FFP (Table 3).

The right ventricle (RV) was the most affected heart chamber, in 43.9% of cases (36.2% singly and 7.7% with other chambers – figure 2), followed by the left ventricle (LV) with 37, 2%, left atrium (LA) with 10.4% and the right atrium (RA) with 8.5% (Table 4). Specific mortality was 21%, 23%, 45% and 22%, respectively for RV, LV, LA and RA alone. In general, associated lesions displayed a mortality rate reaching 37.5%; 20% was the mortality

Table 3 - Distribution of patients regarding the type of surgical incision. conduct. replacement of crystalloids. blood transfusion and degree of injury.

	Number of patients	%
Incision*		
Median Sternotomy	53	52.0
Clamshell Thoracotomy	25	24.5
RAL Thoracotomy	21	20.5
LPL Thoracotomy	1	1.0
RPL Thoracotomy	1	1.0
Surgical conduct		
Cardiorrhaphy	100	98.0
Dacron® prosthesis	1	1.0
Cardiorrhaphy + Teflon® Prosthesis	1	1.0
Crystalloids (ml)		
1000 to 2500	23	22.5
2500 to 4000	36	35.2
4000 to 5500	29	28.5
5500 to 7000	14	13.8
PRBC (units)+		
1 to 3	52	63.4
4 to 7	25	30.4
8 to 11	5	6.2
FFP (units)		
< 1	14	37.8
2 – 3	19	51.4
> 3	4	10.8
Degree of injury (OIS-AAST)[§] 100.0		
I	0	0.0
II	0	0.0
III	1	1.0
IV	53	55.0
V	41	41.0
VI	3	3.0

* LAL: left anterolateral. RAL: right anterolateral. LPL: left posterolateral. RPL: right posterolateral

+ PRBC: packed red blood cells. FFP: fresh frozen plasma

§ four patients could not be classified.

rate for injuries of RV + RA, 100% for LV + RV and zero for RV + LA ($p = 0.169$).

The lung was the most affected anatomical structure associated with cardiac injury (33.7% of 89 associated injuries), followed by the diaphragm (13.4%), liver (11.2%) and stomach (7.8%) (Table 4).

The average time of surgery was 121 minutes, with 11.8% being operated at less than 50 minutes (100% mortality), 25.5% between 50 and 100 minutes (28% mortality); 33.3% between 101 and 151 minutes (22% mortality); and 29.4% in more than 151 minutes (3% mortality), with $p = 0.001$. The average length of stay was 8.2 days, with a more frequent time interval between five and ten days, 53.3% of 92 hospitalized patients (Table 2). In the records examined, there was no information on the time interval between trauma and admission.

Complications occurred in 22.5% of patients, representing a total of 41 events. A second thoracotomy for hemostasis review, along with nosocomial pneumonia, were the most frequent (12.2% each), followed by hypovolemic shock and respiratory failure (9.8% each). Other complications included cardiogenic shock (7.3%), clotted hemothorax, lung entrapment, thoracic wall abscess, reversed cardiac arrest (4.9% each), supraventricular tachycardia, gastrointestinal bleeding, empyema, persistent chest pain, respiratory distress syndrome adult, bedsore ulcers, persistent hypokalemia, pericardial effusion, myocardial infarction and hyponatremia (2.4% each).

Table 4 - Distribution of patients with regard to associated injuries.

Heart Chamber	No injuries	%
LV	39	37.2
RV	38	36.2
RA	9	8.5
LA	11	10.4
RV + LV	2	2.0
RV + RA	5	4.7
RV + LA	1	1.0
Associated injuries		
Lung	30	33.7
Diaphragm	12	13.4
Liver	10	11.2
Stomach	7	7.8
Internal thoracic artery	6	6.8
Small intestine	5	5.6
Thoracic Aorta	4	4.5
Trunk of the pulmonary artery	2	2.3
Spleen	2	2.3
Pulmonary hilum	2	2.3
Esophagus	2	2.3
Other	7	7.8
Total	89	100.0

Reoperation by thoracotomy was indicated by bleeding that became active after restoration of blood volume and blood pressure or, on a later time, retained hemothorax. Overall mortality rate was 28.4%.

Lesions grade IV and V corresponded to 55% and 41%, a total of 96% of the classified cardiac lesions, reaching a specific mortality of 26% and 17% ($p = 0.012$), respectively (Table 3). Grade VI injuries reached 100% mortality.

DISCUSSION

In Manaus, capital of Amazonas state, with an urban population estimated at nearly two million inhabitants, we have an integrated system of trauma, maintained by the National Health System, consisting of the August 28 Emergency Room and the Dr. João Lucio Pereira Machado Emergency Hospital. These hospitals are the destinations of the cases of serious injuries occurred in the city. Prehospital care is developed by a multiprofessional System Mobile Emergency Care (SAMU) and surgical hospital care has been done according to the Advanced Trauma Life Support – ATLS® – program, since 1996²⁶.

In the last three decades, trauma centers have been developed, as well as integrated systems of care to the patients sustaining trauma, culminating in the safe rescue and fast transportation, and significant shift in thinking and systematization of the initial care of trauma during the first hour²⁷.

In the United States of America, injuries involving the chest are estimated at nine million a year, approximately 22-25% of trauma deaths being due to thoracic trauma⁴.

Urban violence is the genesis of cardiovascular and thoracic injuries. In Medellin, Colombia, from 1990 to 1994, the problem of violence overcame atherosclerotic disease as the major cause of morbidity and mortality²⁸.

Although the most affected age group in our study is between 21 and 30 years, not even the extremes of age are spared from the injury, children aged three years and elders of 78 years of age being described in the literature^{18,29}. Mean age varies in the literature from 24 to 33 years^{11,19} and in our study it was 27.

In this study, heart injuries from stabbing were clearly predominant, almost 82% of the sample. These data differ greatly from national and worldwide literature^{4,7,12,30-33}. This suggests a regional peculiarity, which is confirmed by data from the State Department of Public Safety, which recorded 5840 injuries by stabbing and only 2267 by gunshots in the period from 1997 to 1999³⁴. In China there is also a predominance of stabbing, representing 86.58% of patients, as reported by a study³⁵. The stab wound is considered less severe than that produced by gunshots and is thus associated with a better prognosis^{4,9,17,30,36}. Spencer Neto *et al.*³⁶ drew attention to this issue by mentioning the probable selection of patients arriving with vital signs to

the operating room and therefore with less myocardial damage. His hypothesis is confirmed when analyzing violent deaths in the state of Pernambuco in 1991, where 70% of trauma deaths were produced by firearms.

Thus, the case series hospital mortality rates recorded by stab wounds and smaller, while the firearm is responsible for most cardiac injuries in autopsy studies³⁷. In our study, overall mortality was 28.4%, reflecting a better prognosis of these patients, most of whom suffered stab wounds, with specific mortality of 24%, whereas mortality was 47% for gunshot wounds ($p = 0.042$). Similarly, a Chinese study mortality reached only 3.66% in a series of 82 patients, reviewed over 16 years, with 86.58% stab wounds³⁵. Roberts *et al.*³⁸ reported overall mortality of 32.9%, 47.8% specific for stab wounds and 52.2% for gunshot wounds³⁸. They also stated that the main cause of death was exsanguination and that from the total of 23 deaths, only four occurred after the first 24 hours of hospital admission, due to multiple organ failure or sepsis³⁸.

The precordium as the most frequent point of entry of the offending agent agreed with the literature^{5,14,29}. Wounds of entry in the "cardiac box", or Ziedler area, whose boundaries include the clavicle (superior), the margins of the costal edges (inferiorly) and the midclavicular line (laterally) must turn attention to a possible heart injury³⁹. Survival rates generally range from 20 to 81%^{6,7}. These high rates reflect improvements in patient care occurred over the years, whether in improving prehospital care, particularly in fast transportation, or in the advent of new diagnostic methods, such as echocardiography in the emergency room and aggressive resuscitation measures, as the emergency thoracotomy^{10,39}.

The length of stay in the literature varies between 4.6 and 15.2 days⁵. In this study, the average was 8.2 days. Andrade-Alegre *et al.*⁹ reported the time between the injury and the diagnostic and therapeutic procedure of three hours. This has practical importance because the time between the accident and hospital treatment greatly influences the prognosis of the cardiac injury. In this series, this time interval was not registered. However, the time interval between admission to the emergency room and the beginning of the operation may indirectly provide us with the severity of patients, noting that those with lower severity may be associated with delayed diagnosis and definitive treatment, since they had been stable at admission. Our study found an average of 77 minutes for that range.

Similarly, the duration of the operation can be used to assume greater or lesser severity of patients, but in reverse, because when we look at the time of surgery, we observed that as this time increased, mortality decreased. For patients with operation time of less than 50 minutes, the mortality was 100%, 28% for the time interval between 50 and 100 minutes; 22% for patients with operating time between 101 and 151 minutes; and 3% for those with times longer than 151 minutes. These findings were statistically significant ($p = 0.001$). Few studies describe

the duration of the surgery and do not elaborate on these data⁹.

Certainly due to its anatomical position, the right ventricle is the chamber most frequently affected in cardiac injuries^{4,11,13,20,21}. These wounds are associated with a better prognosis and can be managed, at first, by closing the laceration digitally, while the sutures are placed using a single polypropylene suture (Prolene®) 3-0 (Figure 2)³⁰. These patients arrive at trauma centers with one or two distinct syndromes: the pericardial tamponade and / or hemorrhagic shock^{13,39}. The triad of Beck, which includes muffled heart sounds, jugular venous distention and hypotension, is a classic description of cardiac tamponade, but appears to be uncommon³⁹. Roberts *et al.*³⁸ reported an incidence of 15% of this triad. Another important maneuver described is the diagnostic pericardial window, whether by subxiphoid or transdiaphragmatic approach. Due to its sensitivity and effectiveness, it is quoted in the literature as the gold standard and is indicated in suspected cardiac injury in stable patients^{23,40}. Thoracoscopy has also been being considered a diagnostic option in these cases⁴¹.

There are several analyzes on the aspects that determine the prognosis of cardiac lesions, such as the presence of pericardial tamponade, where thoracotomy was performed (emergency room or operating room), the injured heart chamber and the number of chambers involved, and physiological parameters^{4,17,18,21,30}.

There is a correlation between mortality and cardiac chamber affected, showing that the left chambers are associated with higher mortality (80% for the atrium and 77% for the ventricle)³⁰. We found a mortality of 45% and 23%, respectively, for left atrial and ventricular wounds alone ($p = 0.169$). Injuries involving multiple chambers can reach up to 100% mortality and are more commonly produced by firearms³⁰. However, since most of the injuries described in this series was caused by stab wounds, the mortality associated with injuries of multiple chambers was 37.5%, although the injuries of LV associated with RV achieved 100% mortality.

The lung is the most commonly affected thoracic organ associated with cardiac injury, followed by the major thoracic vessels^{5,10,14,19,30}. In the abdomen, bowel injuries are most frequent, being second in the total number of associated injuries³⁰. In this study, lung injury was associated with heart injury in 30 patients, the stomach and intestine in 12 other patients.

The literature shows many different complications, such as coagulopathy, sepsis, myocardial infarction, anoxic encephalopathy, valve lesion, atelectasis, pleural adhesion, pneumothorax, pericarditis and pneumonia^{13,15,17,29,30}. Nevertheless, the number of patients for each complication is very small, except for hemopneumothorax and shock¹³. In our series, the most frequent complications were retained hemothorax and persistent shock. These complications were associated, in most cases, with postoperative bleeding of the internal thoracic artery after



Figure 2 - Injury by screwdriver in the precordial region with a lesion of the left ventricle.

restoration of blood volume. Late complications are common after heart injuries. In Manaus, Westphal *et al.*⁴² analyzed five cases of late cardiac tamponade, whose surgical treatment consisted of posterolateral thoracotomy and pericardiectomy in four cases and pericardiostomy in the fifth. All had a satisfactory outcome.

The preferred surgical approach was left anterolateral thoracotomy, which could be transformed into clamshell thoracotomy according to needs (Figure 1). These incisions are indicated in cases of hemodynamic instability

and allow rapid, comprehensive surgical approach to thoracic structures²⁹. However, the choice of incision can be influenced by the experience of the surgeon and the facility to implement it. The posterolateral thoracotomy, for example, provides an excellent exposition of the pleural cavity, but potentially limits the approach to the cardiac lesions. Its use is therefore an exception in this situation³⁹.

In this study, 98% of patients were treated with cardiorrhaphy and survival was 71.6%. Only one patient had received a woven polyester prosthesis (Dacron®). Cha *et al.* reported a 68% survival in their study¹¹.

In our series, 82 patients (80.3%) required transfusion. Of these, 63.4% received between one and three units of packed red blood cells. Spencer Neto *et al.*³⁶ concluded that patients who required more than three units of packed red blood cells in the pre and trans-operative periods had a higher relative risk of death; those who did not require transfusion, survived. Reversely, in our series there was no time to require transfusion in 20 cases and mortality reached 40%. When transfusion was required, mortality was 24% ($p = 0.161$). And still, in patients who received transfusions from seven to 11 units of packed red blood cells, 20% died. These findings were not statistically significant, though ($p = 0.781$).

As for stratification of cardiac injuries according to the degree of anatomical and functional damage, we observed that mortality reached 26% for patients with grade IV injuries. In contrast, grade V injuries, theoretically more serious, achieved lower mortality (17%), with a statistically significant result ($p = 0.012$). Stabbing as the most common mechanism may have influenced this outcome.

In conclusion, cardiac stab wounds were associated with lower mortality. Cardiac lesions of grade IV AAST-OIS were associated with higher mortality. A shorter operative time was associated with greater severity and mortality.

RESUMO

Objetivo: Avaliar as formas de tratamento empregadas e os principais aspectos relacionados à morbidade e à mortalidade dos ferimentos cardíacos. **Métodos:** Estudo retrospectivo de 102 doentes com lesão cardíaca, atendidos nos dois prontos socorros de Manaus (Pronto Socorro Municipal 28 de Agosto e Hospital Pronto Socorro Dr. João Lúcio P. Machado) no período de janeiro de 1998 a junho de 2006. **Resultados:** Dos 102 doentes, 95,1% eram homens; a média de idade foi 27 anos; ferimentos por arma branca representaram 81,4% dos casos, contra 18,6% por arma de fogo; cardiografia foi realizada em 98,1% dos casos. As câmaras cardíacas atingidas foram: VD: 43,9% (36,2% isoladamente e 7,7% associada a outras câmaras); VE: 37,2%; AD: 8,5% e AE: 10,4%, com mortalidades específicas de 21%, 23%, 22% e 45%, respectivamente. Lesões de duas câmaras associadas alcançaram mortalidade de 37,5%, sendo 20% para VD+AD, 100% para VD+VE e zero para VD+AE. O pulmão correspondeu a 33,7% de 89 lesões associadas. Os tempos médios de cirurgia e de internação foram de 121 minutos e 8,2 dias, respectivamente. Cerca de 22,5% complicaram representando 41 complicações. A mortalidade foi 28,4%. Lesões grau IV e V corresponderam a 55% e 41% dos casos, com mortalidade específica de 26% e 15%, respectivamente. Todos os doentes com lesão grau VI morreram. **Conclusão:** O ferimentos cardíacos por arma branca estiveram associados a menor mortalidade, as lesões cardíacas grau IV estiveram associadas à maior mortalidade e um menor tempo operatório esteve associado à maior gravidade e mortalidade.

Descritores: Mortalidade. Ferimentos penetrantes. Traumatismos cardíacos. Emergências. Pacientes.

REFERENCES

1. Asensio JA, Petrone P, Pereira B, Peña D, Prichayudh S, Tsunoyama T, et al. Penetrating cardiac injuries: a historic perspective and fascinating trip through time. *J Am Coll Surg.* 2009;208(3):462-72.
2. Nunes RA, Higa C, Saito EH, Netto AR. Trauma cardíaco. In: Freire E, editor. *Trauma: A doença dos séculos.* São Paulo: Atheneu; 2001. p.1395-430.
3. Magi JC, Luiz ATS, Monteiro WNB, Magi DAS, Pinto MM, Aguiar A, et al. Lesões cardíacas penetrantes: experiência em oito casos. *Rev paul med.* 1985;103(6):315-7.
4. Thourani VH, Feliciano DV, Cooper WA, Brady KM, Adams AB, Rozycki GS, et al. Penetrating cardiac trauma at an urban trauma center: a 22-year perspective. *Am Surg.* 1999;65(9):811-6; discussion 817-8.
5. Böstman LA, Salo JA, Böstman OM. Stab wounds to the pericardium and heart: an analysis of 85 consecutive patients. *Eur J Surg.* 1992;158(5):271-5.
6. Plummer D, Brunette D, Asinger R, Ruiz E. Emergency department echocardiography improves outcome in penetrating cardiac injury. *Ann Emerg Med.* 1992;21(6):709-12.
7. Rhee PM, Foy H, Kaufmann C, Areola C, Boyle E, Maier RV, et al. Penetrating cardiac injuries: a population-based study. *J Trauma.* 1998;45(2):366-70.
8. Lemos PCP, Okumura M, Azevedo AC, Paula W, Zerbini EJ. Wounds of the heart. *J Cardiovascular Surg.* 1976;17(1):391.
9. Andrade-Alegre R, Mon L. Subxiphoid pericardial window in the diagnosis of penetrating cardiac trauma. *Ann Thorac Surg.* 1994;58(4):1139-41.
10. Blake DP, Gisbert VL, Ney AL, Helseth HK, Plummer DW, Ruiz E, et al. Survival after emergency department versus operating room thoracotomy for penetrating cardiac injuries. *Am Surg.* 1992;58(6):329-32; discussion 332-3.
11. Cha EK, Mittal V, Allaben RD. Delayed sequelae of penetrating cardiac injury. *Arch Surg.* 1993;128(8):836-9; discussion 839-41.
12. Coimbra R, Pinto MC, Razuk A, Aguiar JR, Rasslan S. Penetrating cardiac wounds: predictive value of trauma indices and the necessity of terminology standardization. *Am Surg.* 1995;61(5):448-52.
13. Delibegović Dedić S, Bazardzanović M, Budalica M. Penetrating injuries of heart and great vessels in patients wounded during the 1992-1994 war in Bosnia and Herzegovina. *Croat Med J.* 1999;40(1):85-7.
14. Grewal H, Ivatury RR, Divakar M, Simon RJ, Rohman M. Evaluation of subxiphoid pericardial window used in the detection of occult cardiac injury. *Injury.* 1995;26(5):305-10.
15. Kaplan AJ, Norcross ED, Crawford FA. Predictors of mortality in penetrating cardiac injury. *Am Surg.* 1993;59(6):338-41.
16. Meyer DM, Jessen ME, Grayburn PA. Use of echocardiography to detect occult cardiac injury after penetrating thoracic trauma: a prospective study. *J Trauma.* 1995;39(5):902-7; discussion 907-9.
17. Mittal V, McAleese P, Young S, Cohen M. Penetrating cardiac injuries. *Am Surg.* 1999;65(5):444-8.
18. Moreno C, Moore EE, Majure JA, Hopeman AR. Pericardial tamponade: a critical determinant for survival following penetrating cardiac wounds. *J Trauma.* 1986;26(9):821-5.
19. Rashid MA, Wikström T, Ortenwall P. Cardiac injuries: a ten-year experience. *Eur J Surg.* 2000;166(1):18-21.
20. Rozycki GS, Feliciano DV, Schmidt JA, Cushman JG, Sisley AC, Ingram W, et al. The role of surgeon-performed ultrasound in patients with possible cardiac wounds. *Ann Surg.* 1996;223(6):737-44; discussion 744-6.
21. Tyburski JG, Astra L, Wilson RF, Dente C, Steffes C. Factors affecting prognosis with penetrating wound of the heart. *J Trauma.* 2000;48(4):587-90; discussion 590-1.
22. Aihara R, Millham FH, Blansfield J, Hirsch EF. Emergency room thoracotomy for penetrating chest injury: effect of an institutional protocol. *J Trauma.* 2001;50(6):1027-30.
23. Uchimura MM, Battiston J, Moreira P, Stahlschmidt CMM, Lubachevski FL. Análise epidemiológica das pericardiotomias realizadas em um hospital universitário de Curitiba. *Rev Col Bras Cir.* 2010;37(2):92-5.
24. Caps MT. The epidemiology of vascular trauma. *Semin Vasc Surg.* 1998;11(4):227-31.
25. Moore EE, Malangoni MA, Cogbill TH, Shackford SR, Champion HR, Jurkovich GJ, et al. Organ injury scaling. IV: Thoracic vascular, lung, cardiac, and diaphragm. *J Trauma.* 1994;36(3):299-300.
26. American College of Surgeons. *ATLS: student course manual.* 8th ed. American College of Surgeons; 2008.
27. NAEMT. *PHTLS: Prehospital trauma life support.* 7th ed. St. Louis: Mosby; 2010.
28. Duque HA, Florez LE, Moreno A, Jurado H, Jaramillo CJ, Restrepo MC. Penetrating cardiac trauma: follow-up study including electrocardiography, echocardiography, and functional test. *World J Surg.* 1999;23(12):1254-7.
29. Buckman RF Jr, Badellino MM, Mauro LH, Asensio JA, Caputo C, Gass J, et al. Penetrating cardiac wounds: prospective study of factors influencing initial resuscitation. *J Trauma.* 1993;34(5):717-25; discussion 725-7.
30. Asensio JA, Berne JD, Demetriades D, Chan L, Murray J, Falabella A, et al. One hundred five penetrating cardiac injuries: a 2-year prospective evaluation. *J Trauma.* 1998;44(6):1073-82.
31. Baker JM, Battistella FD, Kraut E, Owings JT, Follette DM. Use of cardiopulmonary bypass to salvage patients with multiple-chamber heart wounds. *Arch Surg.* 1999;133:855-60.
32. Brathwaite CE, Weiss RL, Baldino WA, Hoganson N, Ross SE. Multichamber gunshot wounds of the heart. The utility of transesophageal echocardiography. *Chest.* 1992;101(1):287-8.
33. Henderson VJ, Smith RS, Fry WR, Morabito D, Peskin GW, Barkan H, et al. Cardiac injuries: analysis of an unselected series of 251 cases. *J Trauma.* 1994;36(3):341-8.
34. Gao JM, Gao YH, Wei GB, Liu GL, Tian XY, Hu P, et al. Penetrating cardiac wounds: principles for surgical management. *World J Surg.* 2004;28(10):1025-9.
35. Spencer Netto FAC, Campos JM, Lima LFC, Rivera MACP, Kreimer F, Silveira RK. Fatores prognósticos de mortalidade em pacientes com trauma cardíaco que chegam à sala de cirurgia. *Rev Col Bras Cir.* 2001;28(2):87-94.
36. Fraga GP, Espínola JP, Mantovani M. Pericardial window used in the diagnosis of cardiac injury. *Acta Cir Bras.* 2008;23(2):208-15.
37. Rodrigues AJ, Furlanetti LL, Faidiga GB, Scarpelini S, Barbosa Évora PR, de Andrade Vicente WV. Penetrating cardiac injuries: a 13-year retrospective evaluation from a Brazilian trauma center. *Interact Cardiovasc Thorac Surg.* 2005;4(3):212-5.
38. O'Connor J, Dittilo M, Scalea T. Penetrating cardiac injury. *J R Army Med Corps.* 2009;155(3):185-90.
39. Fraga GP, Heinzl RL, Longhi BS, Silva DC, Fernandes Neto FA, Mantovani M. Trauma cardíaco: estudo de necropsias. *Rev Col Bras Cir.* 2004;31(6):386-90.
40. Pons F, Lang-Lazdunski L, Kerangal X, Chapuis O, Bonnet PM, Jancovici R. The role of videothoracoscopy in management of precordial thoracic penetrating injuries. *Eur J Cardiothorac Surg.* 2002;22(1):7-12.
41. Westphal FL, Lima LC, Jaber BA. Tamponamento cardíaco traumático: análise de cinco casos. *J Pneumologia.* 2000;26(5):241-4.

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