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Forensic-medical retrospective analysis of cardiovascular injuries admitted to the emergency department

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ABSTRACT

Aim: Vascular and cardiac injuries are rare cases compared to other traumas in terms of admission rates to emergency services. Vascular emergencies secondary to trauma are among 1-2.5% of all trauma patients admitted to the emergency department. In addition, the admission rate of heart injuries is around 1%. With this study, we will analyze and interpret cardio-vascular injuries, which are rare compared to other traumas, from a forensic-medical aspect.

Material and Method: This study is a retrospective cohort study using data from our hospital's automation and archive system. Patients who developed iatrogenic trauma, had solid organ injury in addition to their existing injury, were brought to the emergency room as deceased, and patients who came to the emergency room with cardio-pulmonary resuscitation were not included in the study. A total of 411 cases, 88 cardiac injuries and 323 vascular injuries, aged 16-82 years were included in the study.

Results: In the 5-year analysis, the rate of life-threatening injuries due to cardiac and vascular injuries among cardiovascular emergencies is 22%. 88 patients with cardiac injury were included in this study.18 (20.5%) of the patients were female and 70 (79.5%) were male. The most common injury sites were upper extremity (43.7%), lower extremity (25.7%), thorax (21.4%), abdomen-pelvic region (4.1%), head-neck (2.6%), multiple vascular injury (2.1%), respectively.

Conclusion: Cardiovascular injuries are among the traumas with high mortality and morbidity. It is important that the cases consulted to cardiovascular surgery in the emergency department are forensic cases and that the forensic reports of these cases are carefully prepared.

Keywords: Cardiac injury, vascular injury, emergency department, forensic medicine

INTRODUCTION

All cases that occur due to traffic accidents, assault, force, explosive and firearm injuries, injuries with various tools and similar actions of people or reasons for which they are responsible are in the nature of forensic cases (1,2). Vascular emergencies secondary to trauma are among 1-2.5% of all trauma patients admitted to the emergency department (3,4). Although vascular injuries are less common than other trauma cases, the risk of developing morbidity and mortality is high if intervention is delayed. If the medicotechnical structure of the center applied with vascular trauma is weak or there is little experience in approaching vascular emergencies, mortality rates can reach up to 25%. In addition, if it is taken into account that vascular injuries can be accompanied by additional damage such as nerve and muscle injury or loss of limb, especially in relation to the extremity, it will be better understood how high the morbidity of vascular traumas is (5-7).

Cardiac injuries have a relatively low rate of admission to emergency services compared to vascular traumas. The clinical course of cardiac injuries tends to worsen rapidly. Cardiac tamponade, shock and death due to trauma occur before the patient arrives at the hospital. The rate of reaching the hospital is around 6% of patients with cardiac injury. Those who can reach the hospital have only a 50% chance of survival (8,9). As can be seen, early intervention is very important in patients presenting with both cardiac and vascular injuries. Regarding these patients, diagnosis and treatment protocols should be clearly defined, and health institutions should always be prepared to meet this particular patient group. Cardio-vascular traumas are etiologically blunt, penetrating

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and iatrogenic. Because iatrogenic injuries occur in healthcare settings, they may not be considered a true traumatic injury. Since blunt or penetrating injuries are in the category of both emergency and forensic cases, they are cases that should be approached sensitively from a medico-legal perspective. With this study, we will analyze the last 5 years of cardiovascular injuries admitted to Bursa Yüksek İhtisas Training and Research Hospital Emergency Department. In this way, we aim to share the experience of our cardiovascular surgery clinic in terms of approach to cardiovascular emergencies and to evaluate this special patient group from a forensic perspective.

MATERIAL AND METHOD

The study was carried out with the permission of University of Health Sciences, Bursa Yüksek İhtisas Training and Research Hospital Clinical Researches Ethics Committee (Date: 10.01.2022, Decision No: 2011-KAEK-25 2022/02-26). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

This study is a retrospective cohort study using data from our hospital's automation and archive system. The requirement for written informed consent was waived. In this study, which was planned as a single center, cardiac and vascular injury cases who applied to the emergency department of Bursa Yüksek İhtisas Training and Research Hospital between 01.01.2017 and 01.01.2022 and were consulted to our cardiovascular surgery clinic were examined. Those who applicated arterial or venous catheters, those who develop injury during cardiac catheterization, iatrogenic traumas, patients with solid organ injury in addition to their current injury, patients who were brought to the emergency room as dead and those who came to the emergency room with cardiopulmonary resuscitation were excluded from the study. A total of 411 cases, 88 cardiac injuries and 323 vascular injuries, aged 18-82 years were included in the study. These 411 cases constitute approximately 22% of the total 1868 consultations requested from our clinic by the emergency department clinic within the specified date range.

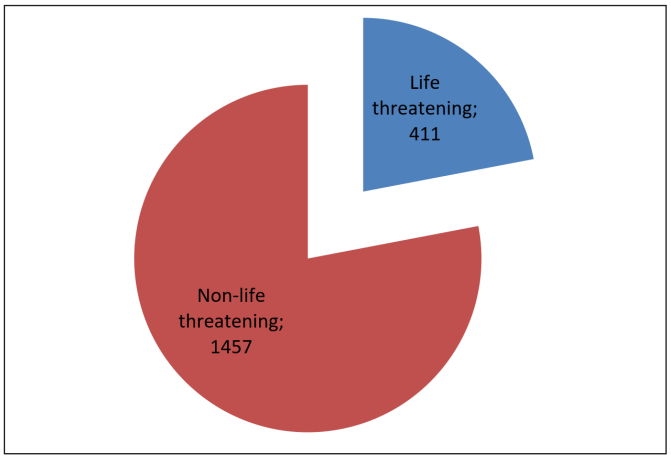
The patients were handled separately as cardiac injuries and vascular injuries at the time of admission. Each group was divided into two groups, survivor and non-survivor, and analyzed by considering parameters such as gender and injury type. In addition, separate analyzes were performed according to the site of injury and the injured vessel. Etiologically, the data were interpreted by grouping such as those who developed penetrating and blunt trauma, those who survived and those who developed death.

RESULTS

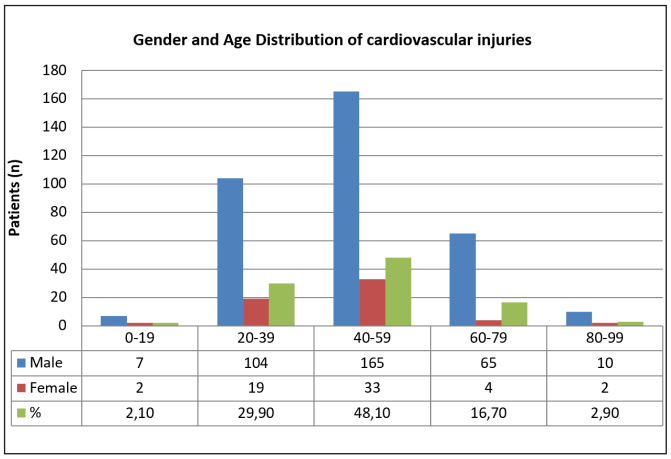
In the 5-year analysis, the rate of life-threatening injuries due to cardiac and vascular injuries among cardiovascular emergencies is 22%. (**Graph 1**) 88 patients with cardiac injury were included in this study. 18 (20.5%) of the patients were female and 70 (79.5%) were male. Those who did not develop in-hospital mortality were included in survivors group (n = 60, 68.2%) and those who did were included in non-survivors group (n = 28, 31.8%). In the non-survivors group, there were 12 patients (13.6%) with stab wounds and 16 patients (18.1%) with gunshot wounds. Of the 411 patients presenting with cardio-vascular injury, there were 60 (14.5%) female and 351 (85.4%) male patients. Of 39 (9.4%) patients in the non-survivor group, 31 (7.5%) were male and 8 (1.9%) were female (**Table 1**). The age range of the patients admitted to the emergency department due to cardio-vascular injury was 16-88 years. The mean age was 43.4±11.1 years (**Graph 2**).

Table 1. Analysis of patients presenting with cardiovascular injury

Cardiac injuries	**Survivor (n=60)**		**Non-survivor (n=28)**
Male/Female (n,%)	48 (54.5%) / 12 (13.6%)		22 (25%) / 6 (6.8%)
Stab wounds (n,%)	40 (45.4)		12 (13.6%)
Gunshot woundt (n,%)	17 (19.3%)		16 (18.1%)
Blunt trauma (n,%)	3 (3.4%)		-
Vascular injuries	**Survivor (n=312)**		**Non-survivor (n=11)**
Male/Female (n,%)	272(84.2%) / 40(12.3%)		9 (2.7%) /2 (0.6%)
Stab wounds (n,%)	175 (54.1%)		6 (1.8%)
Gunshot woundt (n,%)	127 (39.3%)		4 (1.2%)
Blunt trauma (n,%)	10 (3%)		1 (0.3%)
Total	**Survivor (n=372) (90.5%)**	**Non-survivor (n=39) (9.4%)**	**Total**
Male/Female (n,%)	320 (77.8%) / 52(12.6%)	31 (7.5%) / 8 (1.9%)	351(85.4%)/60(14.5%)
Stab wounds (n,%)	215 (52.3%)	18 (4.3%)	233(56.6%)
Gunshot woundt (n,%)	144 (35%)	20 (4.8%)	164 (39.9%)
Blunt trauma (n,%)	13 (3.1%)	1 (0.2%)	14 (3.3%)



Graphic 1. Cardiovascular life-threatening rate among patients consulted from the emergency department



Graphic 2. Age-gender distribution of patients presenting with cardiovascular injury

The most common injury sites were upper extremity (43.7%), lower extremity (25.7%), thorax (21.4%), abdomen-pelvic region (4.1%), head-neck (2.6%), multiple vascular injury (2.1%), respectively (**Table 2**). According to the frequency of the injured vessels, the most common injury was seen in the radial (18.8%) and ulnar (13.3%) arteries, while the least injured vessel was the iliac vein (0.9%) (**Table 3**).

Table 2. Analysis of patients by injury site

Site of injury	Survivors (n=372)	Non-survivors (n=39)
Head-neck (n,%)	10 (2.4%)	1 (0.2%)
Thorax (n,%)	60 (14.5%)	28 (6.8%)
Abdominal and pelvic region (n,%)	14 (3.4%)	3 (0.7%)
Upper extremity (n,%)	179 (43.5%)	1 (0.2%)
Lower extremity (n,%)	102 (24.8%)	4 (0.9%)
Multiple* (n,%)	7 (1.7%)	2 (0.4%)

* Multiple vascular injuries are 4 lower extremity + upper extremity, 4 abdominal-pelvic region + lower extremity, 1 head-neck + lower extremity injuries.

Table 3. Survival data by anatomical location of vascular injury

	Survivor (N=312)	Non-survivor (N=11)
Femoral artery	47	2
Femoral vein	15	2
Popliteal artery	18	-
Popliteal vein	6	-
Anterior tibial artery	9	-
Posterior tibial artery	7	-
Abdominal aorta	5	1
Inferior vena cava	3	1
Iliac artery	4	-
Iliac vein	2	1
Carotid artery	7	1
Jugular vein	3	-
Axillary artery	5	1
Subclavian vein	8	-
Brachial artery	31	-
Ulnar artery	43	-
Radial artery	61	-
Brachial vein	9	-
Cephalic vein	22	-
Multiple vascular injury	7	2

DISCUSSION

Cardiovascular injuries are among the few traumas encountered in emergency departments due to trauma. The rate of vascular injuries among all traumatic injuries is 3%, whereas cardiac injuries are only 1% (10,11). Despite these low rates, the mortality risk due to cardiac trauma among thoracic traumas is around 40%. In this descriptive study, we analyzed a small number of cardiovascular traumas with a high risk of morbidity and mortality. In the light of the data obtained, we shared our 5-year cardio-vascular injury experience of our clinic and our forensic findings for this patient group.

In our study, it was determined that the injuries in 22% of the emergency cases consulted by the cardiovascular surgery clinic by the emergency department were of a nature that would endanger the life of the person. In the study of Altun et al. (12), this rate was found to be 35%, which is in line with our study. Also, patients who applied to the emergency department due to cardiovascular injury were between the ages of 16-82 and the mean age was 43.4±11.1 years. In a study reported by Altundağ et al. (13), the cases evaluated due to cardiovascular injury range from 11 to 88 years of age. The mean age of the patients is 41.2±15.9 years. Our study is similar to this study in terms of age distribution and mean age. In our study, the male sex ratio was 85.4% (351/411) among the patients evaluated for cardiovascular injury. This rate is similar to the majority of studies conducted in our country. Many studies show that the majority of forensic cases receiving service from emergency services are men. In our country, it is seen that men are exposed to forensic injuries related to cardiovascular surgery at a much higher rate than women (14-17).

According to our study, the majority of injuries (56.6%) were caused by stab wounds, and the second most common cause of injury was gunshot wounds (39.9%). In another study parallel to our study, the most common cause of injuries was stab wounds with a rate of 43%, while

the second most common cause was gunshot wounds (18). Also, the thoracic region was found to be the most common location in fatal injuries with a rate of 6.8%, according to the site of injury. When evaluated in terms of cardiac injury, it is seen that the mortality rate among cardiac injuries is 31.8%. Studies have reported that this rate reaches up to 80% (10). Mortality data similar to ours were reported in the study of Manduz et al. (19). In the death series due to cardiac injuries performed by Uluçay et al. (13) between 2010-2012; It was reported that 3/4 of the cases died at the scene, and in the study conducted in İzmir, the majority of the cases (69.3%) died at the scene (18).

In our study, the most frequently injured place was the upper extremity in injuries that did not result in death, while the most frequently injured place was the thoracic region in cases that resulted in death. In the meta-analysis reported by Prichayudh et al. (20), it is seen that there are similar results in terms of injury site and frequency. It is possible to reduce mortality with early and appropriate intervention in extremity injuries. Despite intervention in the thoracic region, heart and great vessel injuries, the risk of mortality remains high. In conclusion, cardiovascular injuries are injuries with a high risk of mortality and morbidity depending on the location of the injury. It is obvious that the risk of mortality will decrease if an effective intervention is made at the right time for this particular patient group. For this, pre-hospital care services should be improved as well as increasing the efficiency of in-hospital services.

The most important limitations of our study are that it is single-centered, retrospective, and the number of patients is low. More comprehensive publications with larger numbers of patients are needed to support existing data.

CONCLUSION

Cardiovascular injuries are among the traumas with high mortality and morbidity. If these injuries are intervened early and effectively, serious reductions in mortality risks will be achieved. It is important that the cases consulted to cardiovascular surgery in the emergency department are forensic cases and that the forensic reports of these cases are carefully prepared. It should not be forgotten that it may cause physician liability, especially in cases where cases result in mortality, in cases where it is forgotten to notify the judicial authorities.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of University of Health Sciences, Bursa Yüksek İhtisas Training and Research Hospital Clinical Researches Ethics Committee (Date: 10.01.2022, Decision No: 2011-KAEK-25 2022/02-26).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

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