RESEARCH ARTICLE

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Comparison of Traumatic and Non-Traumatic Cardiopulmonary Arrest Patients

Travmatik ve Non-Travmatik Kardiyopulmoner Arrest Hastaların Kıyaslanması

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ABSTRACT

Aim: *This study aimed to evaluate the demographic characteristics, laboratory findings, and clinical processes of patients admitted to the emergency department with cardiopulmonary arrest due to traumatic and non-traumatic causes, and to identify factors associated with mortality.*

Materials and Methods: *In this retrospective, single-center study, patients admitted to a tertiary emergency department with a preliminary diagnosis of cardiopulmonary arrest were included. Patients were classified into traumatic and non-traumatic groups according to the etiology of arrest. Demographic data, time of admission, arrest etiology, intensive care unit admission status, laboratory parameters (arterial blood gas pH value and serum lactate level), and length of stay were obtained from the hospital automation system.*

Results: *A total of 434 patients were included in the study. Of these, 342 patients (78.8%) died in emergency department, while 92 patients (21.2%) were admitted to the intensive care unit. The mean age of non-survivors was significantly higher than that of survivors (p=0.033). Intensıve care unit mortality was found to be 76.1%. In patients who died, admission blood pH values were significantly lower (p=0.016), and lactate levels were significantly higher (p=0.011). No statistically significant association was found between mortality and arrest etiology (traumatic vs. non-traumatic) (p>0.05). No significant differences were observed in arterial blood pH and lactate levels at admission between medical and traumatic patients admitted to the intensive care unit (p>0.05).*

Conclusion: *Advanced age, low arterial pH, and elevated lactate levels were identified as important prognostic factors associated with mortality in patients admitted to the emergency department with cardiopulmonary arrest. Whether the etiology of the cardiopulmonary arrest was traumatic or non-traumatic did not show a statistically significant difference in mortality.*

Keywords: *Cardiopulmonary arrest, emergency department, trauma*

ÖZET

Amaç: *Bu çalışmada, acil servise travmatik ve non-travmatik nedenlerle kardiyopulmoner arrest olarak kabul edilen hastaların demografik özelliklerinin, laboratuvar bulgularının ve klinik süreçlerinin değerlendirilerek mortalite ile ilişkili faktörlerin belirlenmesi amaçlandı.*

Gereç ve Yöntemler: *Bu retrospektif, tek merkezli çalışmaya üçüncü basamak bir acil servise kardiyopulmoner arrest ön tanısı ile kabul edilen hastalar dahil edildi. Hastalar arrest etiyolojisine göre travmatik ve non-travmatik nedenli olarak sınıflandırıldı. Demografik veriler, başvuru zamanı, arrest etiyolojisi, yoğun bakım yatış durumu, laboratuvar parametreleri (arteriyel kan gazı pH değeri ve serum laktat düzeyi) ile acil serviste bekleme süreleri hastane otomasyon sistemi üzerinden elde edildi.*

Bulgular: *Çalışmaya toplam 434 hasta dahil edildi. Hastaların 342'si (%78,8) acil serviste ölürken, 92'si (%21,2) yoğun bakıma yatırıldı. Ölen hastaların yaş ortalaması sağ kalan hastalara göre anlamlı derecede daha yüksek bulundu (p=0,033). Yoğun bakım mortalitesi %76,1 olarak saptandı. Ölen hastalarda başvuru anında ölçülen kan pH değerinin anlamlı derecede düşük (p=0,016) ve laktat düzeyinin anlamlı derecede yüksek olduğu (p=0,011) gözlendi. Arrest etiyolojisinin travmatik veya non-travmatik olması ile mortalite arasında istatistiksel olarak anlamlı ilişki saptanmadı (p>0,05). Yoğun bakıma yatan hastalarda kabul anında alınan kan pH ve laktat düzeylerinde medikal ve travmatik grup arasında anlamlı fark olmadığı görüldü (p>0,05).*

Sonuç: *Acil servise kardiyopulmoner arrest nedeniyle kabul edilen hastalarda ileri yaş, düşük pH ve yüksek laktat düzeyleri mortalite ile ilişkili önemli prognostik faktörlerdir. Arrest etiyolojisinin travmatik veya non-travmatik olması mortalite üzerinde istatistiksel olarak anlamlı bir fark göstermemiştir.*

Anahtar Kelimeler: *Acil servis, kardiyopulmoner arrest, travma*

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INTRODUCTION

Cardiopulmonary arrest (CPA) is defined as the cessation of hemodynamic activity due to the loss of cardiac electrical activity, resulting in impaired cerebral perfusion and sudden loss of consciousness (1). Out-of-hospital cardiopulmonary arrest is one of the leading causes of mortality and is increasingly recognized as a major public health problem (2,3). While the majority of CPA cases admitted to the emergency department are of medical origin, traumatic cardiopulmonary arrest (TCA) represents only a small proportion of these cases (4). Studies comparing traumatic and non-traumatic CPA cases have reported similar survival rates between the two groups (5,6).

In recent years, it has been shown that early metabolic parameters may play an important role in predicting prognosis in patients with CPA (7,8). In particular, biochemical markers reflecting tissue perfusion and hypoxia, such as arterial blood gas pH and serum lactate levels, have been reported to be associated with mortality. Elevated lactate levels and the presence of metabolic acidosis are considered indicators of systemic hypoperfusion and are associated with resuscitation failure (7,8).

Emergency departments represent a critical component of the chain of survival, as they are responsible for the management of critically ill patients whose diagnoses have not yet been clarified, including trauma cases and acute medical emergencies (9,10). The aim of this study was to evaluate the demographic characteristics, clinical course, and metabolic parameters at admission of patients admitted to a tertiary emergency department with traumatic and non-traumatic CPA and to determine the factors associated with in-hospital mortality.

MATERIALS and METHODS

The study was initiated after obtaining ethical approval from the Kayseri City Hospital Non-Interventional Clinical Research Ethics Committee (Decision No: 461, Date: May 27, 2025). All stages of the study were conducted in accordance with the principles of the Declaration of Helsinki.

Study Design and Patient Selection

This retrospective, single-center observational study was designed to evaluate the clinical and laboratory data of patients admitted to the emergency department of a tertiary care hospital with a preliminary diagnosis of cardiopulmonary arrest. All adult patients who were admitted to the emergency department due to traumatic or non-traumatic cardiopulmonary arrest were included in the study. The study period was determined as one year, between April 1, 2024 and April 30, 2025.

Inclusion and Exclusion Criteria

Patients who were admitted to the emergency department with a preliminary diagnosis of cardiopulmonary arrest, in whom arrest due to traumatic or non-traumatic causes could be determined based on clinical evaluation and available medical records, who underwent cardiopulmonary resuscitation in the emergency department, and in whom return of spontaneous circulation (ROSC) was achieved followed by in-hospital clinical follow-up were included in the study. Patients who were brought to the emergency department as dead and did not undergo cardiopulmonary resuscitation, those with incomplete clinical or laboratory data, cases in which the etiology of arrest could not be determined, and patients in whom ROSC could not be achieved in the emergency department and therefore could not be clinically followed were excluded from the study. In addition, pediatric patients (<18 years) were not included in the study, as cardiopulmonary arrest cases of presumed medical origin in this age group are routinely referred to the pediatric emergency department in the study center.

Data Collection

Demographic characteristics of the included patients (age, sex), admission time, arrest etiology (traumatic or non-traumatic), emergency department length of stay, intensive care unit (ICU) admission status, and laboratory parameters (arterial blood gas pH value and serum lactate level) were retrospectively obtained from the hospital information management system.

Outcome Measures

The primary outcome of the study was defined as in-hospital mortality. Secondary outcomes included ICU admission status and ICU mortality.

Statistical Analysis

Statistical analysis of the data was performed using SPSS (Statistical Package for the Social Sciences) for Windows version 21.0. Descriptive statistics were presented as frequency, percentage, mean, and standard deviation. The normality of continuous variables was assessed using histograms, Q–Q plots, and the Shapiro–Wilk test, while homogeneity of variances was evaluated using Levene's test. Pearson's chi-square test was used to compare categorical variables. Student's t-test and/or the Mann–Whitney U test were used to compare age between independent groups. A p-value <0.05 was considered statistically significant within a 95% confidence interval.

RESULTS

A total of 434 patients were included in the study. Of these, 342 (78.8%) died in the emergency department, while 92 (21.2%) were admitted to the intensive care unit

(ICU). The mean age of the entire patient population was 67.09±16.87 years. The mean age of patients who died (67.99±17.23 years) was statistically significantly higher than that of patients admitted to the ICU (63.77±15.09 years) (t=2.138; p=0.033). In terms of sex distribution, 60.6% of the patients were male and 39.4% were female, and no statistically significant relationship was found between sex and mortality (χ^2=3.036; p=0.081) (Table 1). Evaluation according to age groups demonstrated that mortality increased with advancing age, and a statistically significant association was found between age groups and mortality (χ^2=13.130; p=0.011). Mortality rates were 78.9% and 87.8% in the 61–80 and 81–100 age groups, respectively. Although no statistically significant relationship was found between admission time to the emergency department and mortality (χ^2=5.781; p=0.056), mortality was observed to be higher among patients admitted between 16:00 and 23:59. According to the cause of admission, the majority of patients were admitted due to medical reasons (93.3%), whereas trauma-related admissions accounted for 6.7%, and no significant difference was found between the cause of admission and mortality (χ^2=0.161; p=0.688) (Table 1). Among the 92 patients admitted to the ICU, 70 (76.1%) died, while 22 (23.9%) were discharged after treatment. Of the ICU patients, 68.5% were male and 31.5% were female, and no statistically significant relationship was found between sex and ICU mortality (χ^2=0.314; p=0.575). Although the mean age of patients who died (65.15±15.18 years) was higher than that of survivors (59.36±14.24 years), this difference was not statistically significant (t=1.584; p=0.117). Similarly, no significant association was found between age groups and ICU mortality (χ^2=3.681; p=0.277) (Table 2). No statistically significant relationship was found between ICU mortality and admission time to the emergency department (χ^2=0.347; p=0.841). When evaluated according to the cause of admission, mortality was 74.1% in medically related cases and 100% in trauma cases; however, this difference was not statistically significant (χ^2=2.381; p=0.123) (Table 2). In terms of laboratory parameters, the mean blood pH value in deceased patients (7.10±0.18) was significantly lower than in survivors (7.21±0.16) (t=-2.465; p=0.016). Similarly, the mean blood lactate level in deceased patients (10.03±4.98 mmol/L) was significantly higher than in survivors (7.03±3.88 mmol/L) (t=2.584; p=0.011). The mean emergency department length of stay before ICU admission was calculated as 180.58±291.85 minutes, and no statistically significant difference was found between deceased and surviving patients in terms of length of stay (t=0.413; p=0.681). When evaluated categorically, no

Table 1. Comparison of data according to emergency department outcomes

Variables Gender	General Data (n/%/mean/min-max)	Survivals* (n/%/mean/min-max)	Deceased (n/%/mean/min-max)	Statistical Value**
Male	263 (60.6)	63 (68.5)	200 (58.5)	X^2=3.036, p=0.081
Female	171 (39.4)	29 (31.5)	142 (41.5)	
Age (mean)	67.09±16.87	63.77±15.09	67.99±17.23	*t*=2.138, p=0.033 df (432)
Age Range				
0-20	10 (2.3)	0 (0)	10 (100)	X^2=13.130, p=0.011
21-40	22 (5.1)	6 (27.3)	16 (72.7)	
41-60	89 (20.5)	28 (31.5)	61 (68.5)	
61-80	223 (51.4)	47 (21.1)	176 (78.9)	
81-100	90 (20.7)	11 (12.2)	79 (87.8)	
Admitted Time				
08.00-15.59	161 (37.1)	44 (27.3)	117 (72.7)	X^2= 5.781, p=0.056
16.00-23.59	179 (41.2)	31 (17.3)	148 (82.7)	
00.00-07.59	94 (21.7)	17 (18.1)	77 (81.9)	
Reason for Admitted				
Medical	405 (93.3)	85 (21)	320 (79)	X^2= 0.161, p=0.688
Trauma	29 (6.7)	7 (24.1)	22 (75.9)	
Total	**434 (100)**	**92 (21.2)**	**342 (78.8)**	

**Survivors constitute the group of patients admitted to the intensive care unit from the emergency department.*
**Descriptive statistics (frequency, percentage) were used, and categorical variables were compared using the Chi-square test. Independent groups were compared using the Student's t-test and/or the Mann–Whitney U test. Results were presented as mean ± standard deviation or frequency (percentage), and a p value < 0.05 was considered statistically significant at the 95% confidence interval.*

Table 2. Evaluation of data for patients admitted to the Intensive care unit

Variables Gender	General Data (n/%/mean/min-max)	Survivals* (n/%/mean/min-max)	Deceased (n/%/mean/min-max)	Statistical Value**
Male	63 (68.5)	14 (22.2)	49 (77.8)	X^2=0.314, p=0.575
Female	29 (31.5)	8 (27.6)	21 (72.4)	
Age (mean)	63.77±15.09	59.36±14.24	65.15±15.18	*t*=1.584, p=0.117 df (90)
Age Range				
21-40	6 (6.5)	2 (33.3)	4 (66.7)	X^2=3.681, p=0.277
41-60	28 (30.4)	10 (35.7)	18 (64.3)	
61-80	47 (51.1)	8 (17)	39 (83)	
81-100	11 (12)	2 (18.2)	9 (81.8)	
Admitted Time				
08.00-15.59	44 (47.8)	10 (22.7)	34 (77.3)	X^2=0.347, p=0.841
16.00-23.59	31 (33.7)	7 (22.6)	24 (77.4)	
00.00-07.59	17 (18.5)	5 (29.4)	12 (70.6)	
Reason for Admitted				
Medical	85 (92.4)	22 (25.9)	63 (74.1)	X^2=2.381, p=0.123
Trauma	7 (7.6)	0 (0)	7 (100)	
Laboratory Value				
pH	7.13±0.18 (6.78-7.49)	7.21±0.16 (6.78-7.48)	7.10±0.18 (6.86-7.49)	*t*= -2.465, p=0.016. df (90)
Lactate (mmol/L)	9.31±4.89 (1-21)	7.03±3.88 (1.5-21)	10.03±4.98 (1-15)	*t*=2.584, p=0.011. df (90)
Waiting Time (min/mean)	180.58±291.85 (60-2860)	158.09±81.08 (64-2860)	187.65±331.85 (60-411)	*t*=0.413, p=0.681. df (90)
Waiting Time (min)				
0-60	1 (1.1)	1 (100)	0 (0)	X^2=3.715, p=0.446
61-120	36 (39.1)	7 (19.4)	29 (80.6)	
121-180	31 (33.7)	8 (25.8)	23 (74.2)	
181-240	15 (16.3)	4 (26.7)	11 (73.3)	
>240	9 (9.8)	2 (22.2)	7 (77.8)	
Total	**92 (100)**	**22 (23.9)**	**70 (76.1)**	

**Survivors constitute the group of patients admitted to the intensive care unit from the emergency department.*
**Descriptive statistics (frequency, percentage) were used, and categorical variables were compared using the Chi-square test. Independent groups were compared using the Student's t-test and/or the Mann–Whitney U test. Results were presented as mean ± standard deviation or frequency (percentage), and a p value < 0.05 was considered statistically significant at the 95% confidence interval.*

significant association was found between length of stay and mortality (χ^2=3.715; p=0.446) (Table 2).

The arterial blood pH and lactate levels at emergency department admission were compared between patients admitted to the intensive care unit due to medical and traumatic causes. The mean blood pH was 7.13±0.18 in the medical group and 7.12±0.18 in the trauma group, with no statistically significant difference observed between the groups (t=0.57, p=0.995). Similarly, the mean blood lactate level was 9.37±4.95 mmol/L in the medical group and 8.52±4.32 mmol/L in the trauma group, also showing no significant difference (t=0.44, p=0.661). Figure 1 graphically illustrates the distribution of patient admissions and ICU admissions by month. Although an increase in patient volume was observed during certain periods, this distribution was not statistically analyzed.

DISCUSSION

Age is one of the most important demographic variables determining prognosis in both traumatic and non-traumatic cardiopulmonary arrest cases. It has been reported that patients with TCA are generally younger, whereas non-traumatic (medical) arrest cases are more frequently observed in the elderly population (11–19). In a study conducted by Collie et al., the mean age of trauma

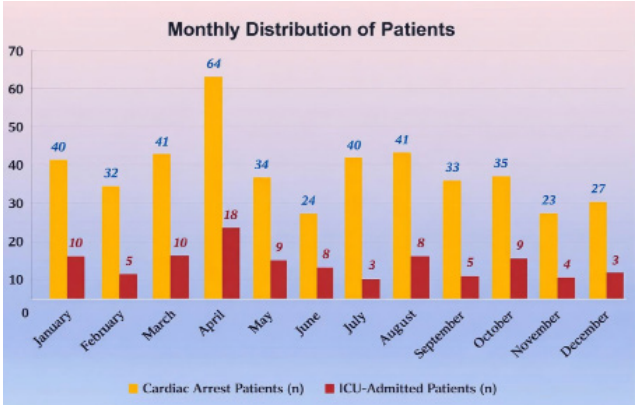

Figure 1. Monthly distribution of patient admissions and intensive care unit (ICU) admits

patients who experienced in-hospital cardiopulmonary arrest (IHCA) was reported as 55 years (14). Similarly, in a study across Asia focusing on traumatic IHCA, Lee et al. reported a mean patient age of 57 years (16). Previous studies have demonstrated that advanced age significantly increases mortality, particularly in non-traumatic arrests. Registry data from the European Resuscitation Council indicate that survival to hospital discharge among in-hospital cardiopulmonary arrest patients aged over 65 years ranges between 6% and 11% (15).

In contrast, survival rates in selected traumatic arrest cases among younger populations may reach up to 10% (5). Similarly, studies comparing elderly and younger patients experiencing out-of-hospital cardiopulmonary arrest have reported significantly higher mortality rates among elderly patients (11,12). In the present study, mortality was markedly increased in the advanced age group, supporting the role of age as a strong prognostic predictor of survival independent of arrest etiology, consistent with the existing literature.

The relationship between sex, mortality, and trauma has been well described in traumatic cardiopulmonary arrest cases. Studies based on major trauma registry systems have reported that 70–85% of TCA patients are male (5,14). Consistent with the literature, male predominance was observed in the traumatic arrest group in our study. In addition, the overall incidence of cardiopulmonary arrest was higher among male patients, which has also been reported in previous studies (1,3,4,19-21). This finding may be attributed to the higher prevalence of ischemic heart disease among males compared to females.

Low arterial pH values and elevated serum lactate levels are important indicators of prolonged tissue hypoxia and inadequate systemic perfusion and are closely associated with early mortality following cardiopulmonary arrest (22,23). Previous studies have demonstrated significantly lower pH levels and higher lactate levels in patients experiencing out-of-hospital cardiopulmonary arrest compared to those with in-hospital arrest (1,8). Metabolic acidosis at admission has been shown to be strongly associated with poor clinical outcomes in arrest patients (7,8,22). In traumatic arrest cases, tissue perfusion impairment due to hypovolemic shock and massive blood loss may lead to early metabolic acidosis, whereas in medical arrests, prolonged hypoxia and circulatory failure contribute to anaerobic metabolism (24). In the present study, the significantly lower admission pH values observed in deceased patients suggest that metabolic acidosis may be associated with mortality in both traumatic and medical arrest groups. These findings support the prognostic value of early metabolic parameters, regardless of arrest etiology. The high mortality rate observed among patients admitted to the ICU supports the determining role of post-resuscitation syndrome and multiple organ dysfunction in clinical outcomes following arrest (25). Furthermore, the absence of a significant relationship between emergency department length of stay and mortality suggests that clinical outcomes after arrest may be more closely related to the patient's physiological reserve and metabolic status at admission rather than treatment duration alone.

This study has several limitations. First, its retrospective nature, the relatively small population of the traumatic group, and its single-center design may limit the generalizability of the findings. The classification of arrest etiology as traumatic or non-traumatic based on patient records may have introduced bias in etiological evaluation. Additionally, important clinical variables that may affect prognosis, such as resuscitation duration, initial rhythm, presence of witnessed arrest, and prehospital interventions, were not evaluated. Furthermore, pediatric patients (<18 years) could not be included in the study, as cardiopulmonary arrest cases of presumed medical origin in this age group are routinely referred to the pediatric emergency department at the study center. Therefore, larger prospective multicenter studies are needed to support these findings.

Conclusion

In this study, advanced age, low admission pH value, and high serum lactate levels were found to be significantly associated with in-hospital mortality in patients admitted to the emergency department with traumatic and non-traumatic cardiopulmonary arrest. The etiology of arrest, whether traumatic or non-traumatic, was not found to have a statistically significant effect on mortality. At the time of emergency department admission, arterial blood pH and

lactate levels were compared between patients requiring intensive care due to medical and traumatic causes. No significant differences were observed between the groups, indicating that the severity of metabolic disturbances is comparable at admission in both medical and traumatic patients. These findings underscore the importance of early recognition and management of physiological instability, regardless of the underlying etiology and suggest that early metabolic parameters evaluated in the emergency department may have prognostic importance and may contribute to clinical decision-making processes in predicting patient management strategies and intensive care requirements.

Ethics Committee Approval: This study was approved by the Kayseri City Hospital Non-Interventional Clinical Research Ethics Committee with its decision dated on May 27, 2025 (Approval No: 2025/461). Since the study was conducted on a retrospective basis, written informed consent could not be obtained from the participants. However, the study was carried out in accordance with the principles of the Helsinki Declaration.

Conflict of Interest: The authors declare no conflict of interest in this study.

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