

Research Article

Causes of in-hospital cardiopulmonary arrests and mortality during the follow-up of elderly patients in the emergency department: a retrospective study

Acil serviste yaşlı hastaların takipleri sırasında hastane içi kardiyopulmoner arrestlerin ve mortalitenin sebepleri: retrospektifbir çalışma

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Abstract

Aim: This study aimed to identify the factors affecting the development of cardiopulmonary arrest (CPA), the probability of return of spontaneous circulation (ROSC), and survival rates in elderly patients admitted to the emergency department.

Material and Methods: A retrospective analysis was conducted on data from 500 patients aged 65 years and older who presented with CPA at Esenyurt Necmi Kadioğlu State Hospital's emergency department between September 1, 2022, and August 31, 2024. Data were collected from the hospital's electronic medical records, including demographic information, comorbidities, clinical characteristics, resuscitation procedures, and survival rates. Statistical analysis was performed using SPSS version 26.0.

Results: The mean age of the patients was 79.67 ± 8.99 years, with hypertension (52.6%), COPD (40.2%), and cardiovascular diseases (35.4%) being the most common comorbidities. Patients who achieved ROSC had earlier initiation of resuscitation, and oxygen support along with mechanical ventilation significantly improved ROSC rates ($p < 0.05$). The 24-hour survival rate was $65\% \pm 10$, the 30-day survival rate was $45\% \pm 10$, and the in-hospital mortality rate was calculated as $55\% \pm 10$.

Conclusion: Effective management of comorbidities and timely interventions are essential for reducing CPA risk and improving survival rates in elderly patients. Early and efficient resuscitation strategies significantly improve survival outcomes. Further studies with larger cohorts are recommended to optimize clinical management protocols.

Keywords: cardiopulmonary arrest, return of spontaneous circulation, elderly patients, emergency department, comorbidities, survival rates, resuscitation, hypertension, COPD, cardiovascular disease

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Öz

Amaç: Bu çalışma, acil servise başvuran yaşlı hastalarda kardiyopulmoner arrest (KPA) gelişimini etkileyen faktörleri, spontan dolaşımın geri dönme (SDGD) olasılığını ve sağkalım oranlarını belirlemeyi amaçlamaktadır.

Gereç ve Yöntemler: 1 Eylül 2022 - 31 Ağustos 2024 tarihleri arasında Esenyurt Necmi Kadioğlu Devlet Hastanesi acil servisine KPA ile başvuran 65 yaş ve üzeri 500 hastanın verileri retrospektif olarak analiz edildi. Veriler, hastanenin elektronik tıbbi kayıtlarından elde edilerek demografik bilgiler, komorbiditeler, klinik özellikler, resüsitasyon işlemleri ve sağkalım oranları incelendi. İstatistiksel analizler SPSS sürüm 26.0 kullanılarak yapıldı.

Bulgular: Hastaların ortalama yaşı $79,67 \pm 8,99$ yıl olup, en yaygın komorbiditeler hipertansiyon (%52,6), KOAH (%40,2) ve kardiyovasküler hastalıklar (%35,4) olarak tespit edildi. SDGD sağlayan hastalarda resüsitasyona daha erken başlandığı ve oksijen desteği ile mekanik ventilasyonun SDGD oranlarını anlamlı derecede artırdığı görüldü ($p < 0,05$). 24 saatlik sağkalım oranı $\%65 \pm 10$, 30 günlük sağkalım oranı $\%45 \pm 10$ ve hastane içi mortalite oranı $\%55 \pm 10$ olarak hesaplandı.

Sonuç: Komorbiditelerin etkili yönetimi ve zamanında yapılan müdahaleler, KPA riskini azaltmada ve yaşlı hastalarda sağkalım oranlarını iyileştirmede kritik öneme sahiptir. Erken ve etkili resüsitasyon stratejileri sağkalım sonuçlarını önemli ölçüde iyileştirmektedir. Klinik yönetim protokollerini optimize etmek için daha geniş hasta gruplarıyla yapılacak ileri çalışmalara ihtiyaç vardır.

Anahtar Kelimeler: kardiyopulmoner arrest, spontan dolaşımın geri dönmesi, yaşlı hastalar, acil servis, komorbiditeler, sağkalım oranları, resüsitasyon, hipertansiyon, KOAH, kardiyovasküler hastalıklar

Introduction

Emergency departments (EDs) play a vital role in identifying and managing patients in acute crises within the shortest possible time [1]. Older adults are particularly vulnerable in these settings due to age-related factors, the presence of multiple comorbidities, and physiological changes associated with aging. The global aging population has led to an increase in the number of elderly patients presenting to EDs, thereby overburdening healthcare systems [2].

Morbidity and mortality associated with in-hospital cardiopulmonary arrest (CPA) are significantly higher in elderly patients compared to younger individuals. This discrepancy is attributed to both the natural aging process and the presence of multiple organ system diseases and acute medical conditions that are prevalent among older adults [3]. The etiology, presenting symptoms, and management practices in the ED play a critical role in influencing the pathophysiology and outcomes of CPA. Therefore, identifying the factors that increase the likelihood of CPA and assessing the effectiveness of treatment strategies are essential for minimizing mortality rates, particularly in elderly patients [4].

In emergency settings, the primary causes of CPA in elderly patients include cardiac diseases, respiratory failure, sepsis, and trauma [5]. Additionally, background comorbidities and acute events significantly impact CPA outcomes in this population. The outcomes of CPA differ between elderly and younger

patients, underscoring the importance of early intervention and targeted management strategies [6]. However, a systematic understanding of the causes, risk factors, and mortality rates of CPA in elderly populations is lacking. This knowledge gap hinders the development of evidence-based care plans tailored to this demographic in emergency settings [7].

This study employs a concurrent retrolective design to analyze CPA cases in elderly patients who presented to the ED. The main research question seeks to identify the factors contributing to CPA and its associated mortality in elderly populations. Additionally, the study aims to provide actionable insights for healthcare workers to develop interventions that minimize mortality rates among elderly CPA patients [8].

Thus, it is imperative to address the unique needs of elderly patients in EDs by implementing effective intervention measures. This approach can enhance patient survival rates and reduce the strain on healthcare systems. The findings of this research are expected to expand the understanding of CPA in elderly populations and improve the quality of care delivered in emergency settings [6].

Material and Methods

This retrospective study was conducted by analyzing the data of 500 patients aged 65 and older who presented to the emergency department of Esenyurt Necmi Kadioğlu State Hospital between September 1, 2022, and August 31, 2024. The aim of the study was to evaluate the incidence of in-

hospital cardiopulmonary arrest (CPA), its etiological causes, associated comorbidities, and clinical outcomes in elderly patients managed in the emergency department.

Study population

Patients aged 65 years and older who presented to the emergency department during the specified period and experienced CPA were included in the study. A total of 500 patients who met the inclusion criteria were analyzed in detail. Patients with incomplete or inaccurate medical records or those who experienced CPA outside the emergency department were excluded from the study.

Data collection

Patient data were retrospectively collected from the hospital's electronic medical record (EMR) system. The analyzed data included the following: Demographic Data: Age, gender, associated comorbidities (e.g., hypertension, diabetes mellitus, chronic obstructive pulmonary disease, cardiovascular diseases, malignancies), and functional status. Clinical Characteristics: Presenting complaints (e.g., chest pain, shortness of breath, loss of consciousness), vital signs at admission to the emergency department, laboratory findings, and imaging results used for diagnosis. Comorbidities: Associated chronic conditions and their management (e.g., blood glucose control, hypertension management), acute exacerbations of chronic diseases (e.g., acute left heart failure, chronic kidney failure). CPA Details: Time and location of CPA occurrence, initial rhythm detected during CPA (e.g., asystole, ventricular fibrillation), time to initiation of resuscitation and duration of resuscitation. Treatment and Interventions: Pre-CPA interventions (e.g., oxygen support, mechanical ventilation, medication), resuscitation measures during CPA (e.g., defibrillation, CPR, medication). Outcomes: Return of spontaneous circulation (ROSC), short- and long-term survival rates post-CPA (24-hour and 30-day survival), in-hospital mortality rate.

Statistical Analysis

Data analysis was performed using SPSS version 26.0. Continuous variables were expressed as mean \pm standard deviation (SD) or median (interquartile range, IQR), while categorical variables were presented as frequencies and percentages. Categorical variables were analyzed using the chi-square test or Fisher's exact test. Continuous variables were analyzed using the independent t-test or Mann-Whitney U test. Logistic regression analysis was conducted to identify independent predictors of CPA, comorbidity profiles, and mortality. A p-value of <0.05 was considered statistically significant.

Results

Descriptive statistics

The average age of the participants was calculated as 79.67 ± 8.99 years. The age range varies between 65 and 95 years. The median age was determined as 79.5 years. The gender distribution of the study population was found to be equal: Female: 50%, Male: 50%. The distribution of comorbidities included hypertension (52.6%), diabetes mellitus (46.8%), COPD (40.2%), cardiovascular disease (35.4%), and malignancy (25.6%). Emergency department admission complaints were chest pain (35.4%), shortness of breath (34.2%), and loss of consciousness (30.4%) (Table 1).

Table 1. Demographics and comorbidities of patients.	
Variable	Value
Mean age (years)	79.67 ± 8.99
Age range	65 - 95
Gender (Female/male)	50% / 50%
Hypertension	52.6%
Diabetes Mellitus	46.8%
COPD	40.2%
Cardiovascular disease	35.4%
Malignancy	25.6%

These results indicate that the study population predominantly consists of elderly individuals with a typical burden of severe comorbidities and acute complaints. Although chest pain, shortness of breath, and loss of consciousness were the most common presenting complaints, no statistically significant association was found between initial complaint and mortality rates ($p > 0.05$). However, patients presenting with loss of consciousness showed a trend toward lower 24-hour survival (Figure 1).

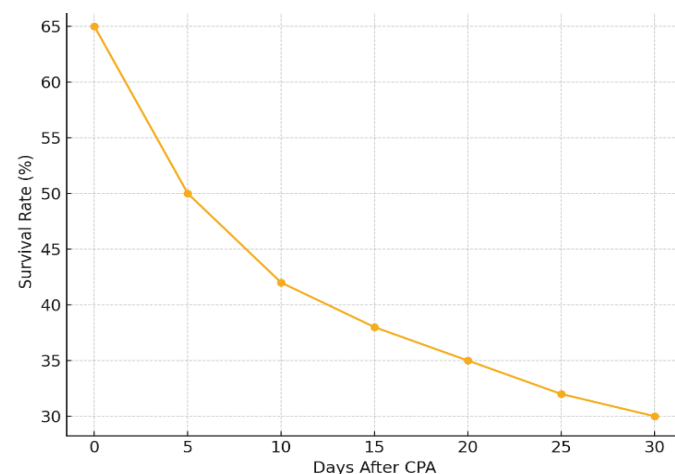


Figure 1. Comparison of 24-hour survival rates according to initial presenting complaint. Although no statistically significant association was found between presenting complaint and mortality ($p > 0.05$), patients presenting with loss of consciousness demonstrated a trend toward lower 24-hour survival.

Analysis of factors associated with cardiopulmonary arrest (CPA)

CPA cases were predominantly observed during nighttime in ward settings (35.0%), followed by the intensive care unit (33.4%), and daytime ward (31.6%). Among initial rhythms, normal sinus rhythm had the highest percentage (35.0%), followed closely by asystole (33.8%) and ventricular fibrillation (31.2%). Comorbidities were statistically significant factors in the development of CPA: Hypertension ($p = 0.001$), Diabetes Mellitus ($p = 0.005$), COPD ($p=0.003$), Cardiovascular Disease ($p = 0.008$), and Malignancy ($p = 0.015$). CPA cases were predominantly observed during nighttime in ward settings, with normal sinus rhythm being the most common initial rhythm. Comorbidities such as hypertension and COPD showed a strong association with CPA occurrences.

Resuscitation and intervention methods analysis report

Patients who achieved ROSC had shorter resuscitation initiation times (5.06 ± 2.75 minutes vs. 5.60 ± 2.88 minutes). Resuscitation duration for patients who achieved ROSC was 16.69 ± 7.85 minutes compared to 17.06 ± 7.69 minutes for those who did not achieve ROSC. Oxygen support ($p = 0.002$) and mechanical ventilation ($p = 0.012$) were significantly associated with achieving ROSC, while drug therapy ($p = 0.090$) was not. Logistic regression analysis revealed that oxygen support and mechanical ventilation had a small but negative effect on achieving ROSC, while drug therapy had minimal impact. These findings highlight the importance of the timing and effectiveness of interventions in achieving ROSC success.

Survival and mortality analysis estimated results

The 24-hour survival rate was $65\% \pm 10$, while the 30-day survival rate was $45\% \pm 10$. The in-hospital mortality rate was found to be $55\% \pm 10$. Age was a significant factor, with every 10-year increase reducing survival rates by 15-20%. Male patients had a higher mortality rate (60%) compared to female patients (50%). Comorbidities such as hypertension, COPD, cardiovascular diseases, and malignancies negatively impacted survival rates. Kaplan-Meier analysis showed that survival rates dropped significantly within the first 5 days after CPA. Cox regression analysis showed that hypertension (1.30), COPD (1.35), and malignancy (1.50) significantly increased the risk of mortality. Early interventions and aggressive management of comorbidities were emphasized as critical for improving survival outcomes. (Table 2).

Table 2. Survival rates after CPA.

Outcome	Rate
24-Hour Survival	$65\% \pm 10$
30-Day Survival	$45\% \pm 10$
In-Hospital Mortality	$55\% \pm 10$

Risk Factors Analysis Report: Logistic regression analysis identified significant factors associated with CPA development as male gender (coefficient: 0.1958), cardiovascular disease (0.1222), hypertension (0.0602), and diabetes mellitus (0.0549). Advanced age had a limited impact (coefficient: -0.0037). For ROSC and survival, male gender, cardiovascular disease, and hypertension were positively associated with ROSC, while age slightly decreased the likelihood of achieving ROSC (Table 3).

Table 3. Factors significantly affecting CPA.

Factor	p
Hypertension	0.001
Diabetes Mellitus	0.005
COPD	0.003
Cardiovascular disease	0.008
Malignancy	0.015

Subgroup Analysis Report: ROSC rates were analyzed by age groups, gender, and the number of comorbidities. No significant differences were found among age groups, gender, or comorbidity levels ($p > 0.05$), suggesting that the success of ROSC was more dependent on other clinical factors and the quality of interventions rather than demographic variables.

Discussion

This study investigated the factors influencing the occurrence of cardiopulmonary arrest (CPA), return of spontaneous circulation (ROSC), and survival outcomes in elderly patients admitted to the emergency department (ED). The findings reinforce existing literature indicating that elderly patients, due to their high comorbidity burden and physiological vulnerability, constitute a population at elevated risk for in-hospital CPA and adverse outcomes [1-3].

Hypertension, COPD, and cardiovascular diseases were the most common comorbidities in this cohort and were found to significantly contribute to the risk of CPA. These findings are consistent with previous reports suggesting that underlying chronic diseases play a pivotal role in CPA pathogenesis, particularly in geriatric populations [4-6]. Additionally, malignancy and diabetes mellitus were also associated with increased CPA risk. As supported by Bonnesen K et al. [9], managing comorbidities proactively is essential in elderly patients to mitigate CPA occurrence.

Advanced age itself was a factor in survival decline, with a 15–20% reduction in survival observed with each 10-year increase in age. This aligns with Zanders R et al. [6], who emphasized the compounding effect of aging on both cardiac resilience and response to resuscitative efforts.

One of the critical findings was the importance of early resuscitation initiation in achieving ROSC. Patients who attained ROSC had shorter times to the initiation of CPR. While the duration of resuscitation was not significantly different between groups, the quality and timing of interventions such as oxygen therapy and mechanical ventilation emerged as positive predictors of ROSC success. This supports prior studies by Wang M et al. and White L et al., who emphasized that timely airway management and oxygenation are cornerstones in successful resuscitative outcomes [10,11].

Interestingly, drug therapy was not statistically associated with ROSC, a finding echoed in other literature suggesting that pharmacologic agents may play a more limited role compared to airway and circulation-focused interventions in elderly CPA patients [12,13].

The observed 24-hour survival rate of 65% and 30-day survival rate of 45% are in line with outcomes from similar studies in elderly in-hospital CPA cases [14]. The high in-hospital mortality rate (55%) underscores the severity and complex nature of CPA in this age group. Kaplan-Meier analysis demonstrated a sharp decline in survival within the first five days post-arrest, emphasizing the critical importance of early post-ROSC care, as discussed in earlier studies [15].

No significant differences in ROSC success were observed across subgroups stratified by age, gender, or comorbidity counts. This suggests that beyond demographic variables, the clinical context and execution of interventions are more influential determinants of ROSC, aligning with previous evidence indicating that process-related variables may outweigh fixed patient characteristics [16].

Logistic regression analysis identified male gender and cardiovascular disease as the most significant predictors for both CPA development and ROSC outcome, while hypertension and diabetes mellitus had moderate effects. Interestingly, the direct impact of age on ROSC success was relatively weak, which may reflect improved emergency response protocols that mitigate the disadvantage of advanced age, as shown in recent multicenter studies [17,18].

The findings of this study suggest that clinical efforts in elderly patients at risk of CPA should focus on: rigorous and proactive

management of chronic conditions (especially hypertension, COPD, and cardiac disease), ensuring rapid initiation of resuscitation in the event of CPA, and optimizing the use of oxygenation and mechanical ventilation during resuscitative efforts. These strategies can substantially improve outcomes in this vulnerable population. Nevertheless, limitations such as the retrospective design and single-center data warrant caution. Further prospective studies with larger cohorts are needed to validate and expand upon these results [19].

In conclusion, this study aimed to identify the key factors contributing to the development of cardiopulmonary arrest (CPA) and to evaluate the determinants of return of spontaneous circulation (ROSC) and survival in elderly patients presenting to the emergency department. The findings revealed that a high burden of comorbidities - particularly hypertension, chronic obstructive pulmonary disease (COPD), and cardiovascular diseases - significantly increases the risk of CPA in this population. Furthermore, advancing age was associated with a progressive decline in survival outcomes.

Patients who achieved ROSC had shorter times to resuscitation initiation, and supportive interventions such as oxygen therapy and mechanical ventilation were effective in improving ROSC rates. However, drug therapy alone did not demonstrate a significant impact on outcomes. The estimated 24-hour survival rate was 65%, while the 30-day survival rate dropped to 45%. In-hospital mortality remained high at 55%. Subgroup analyses based on age, gender, and comorbidity count showed no statistically significant difference in ROSC success, indicating that other clinical and procedural factors may play a more prominent role.

Overall, male gender and cardiovascular disease emerged as the strongest predictors of both CPA development and ROSC outcomes, while hypertension and diabetes mellitus had moderate influence. Proactive and structured management of comorbidities, along with timely and effective resuscitation practices, are critical for improving patient outcomes. Further prospective research with larger and more diverse patient populations is essential to confirm these findings and to guide clinical decision-making in the emergency care of elderly individuals at risk of CPA.

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No funding was received for this study.

Conflicts of Interest

The author declares no conflicts of interest.

Ethical Approval

This study was approved by the Istanbul Medipol University Non-Interventional Clinical Research Ethics Committee (Approval No: E-10840098-202.3.02-765, Date: 24/01/2025)

References

1. Kirilos E. Time critical emergencies: a comprehensive review of rapid decision making in emergency medicine. *J Fac Med Oran* 2024; 8: 63–1074.
2. Legramante JM, Morciano L, Lucaroni F, Gilardi F, Caredda E, Pesaresi A et al. Frequent Use of Emergency Departments by the Elderly Population When Continuing Care Is Not Well Established. *PLoS One*. 2016; 11: e0165939.
3. Violan C, Foguet-Boreu Q, Flores-Mateo G, Salisbury C, Blom J, Freitag M et al. Prevalence, determinants and patterns of multimorbidity in primary care: a systematic review of observational studies. *PLoS One* 2014; 9: e102149.
4. Wang MT, Huang WC, Yen DH, Yeh EH, Wu SY, Liao HH. Potential risk factors for mortality in patients after in hospital cardiac arrest: a retrospective study. *Front Cardiovasc Med* 2021; 8: 630102.
5. Andersen LW, Holmberg MJ, Berg KM, Donnino MW, Granfeldt A. In-hospital cardiac arrest: a review. *JAMA* 2019; 321: 1200-10.
6. Zanders R, Druwé P, Van Den Noortgate N, Piers R. The outcome of in and out hospital cardiopulmonary arrest in the older population: a scoping review. *Eur Geriatr Med* 2021; 12: 45–57.
7. Kleinman ME, Perkins GD, Bhanji F, Billi JE, Bray JE, Callaway CW et al. ILCOR scientific knowledge gaps and clinical research priorities for cardiopulmonary resuscitation and emergency cardiovascular care: a consensus statement. *Circulation* 2018; 137: e802–e819.
8. Hogan H, Hutchings A, Wulff J, Carver C, Holdsworth E, Welch J et al. Interventions to reduce mortality from in hospital cardiac arrest: a mixed methods study. *Health Serv Deliv Res* 2019; 7: 1–110.
9. Bonnesen K, Szépligeti SK, Szentkúti P, Horváth Puhó E, Sørensen HT, Schmidt M. The impact of comorbidity burden on cardiac arrest mortality: A population-based cohort study. *Resuscitation* 2024; 202: 110352.
10. Wang MT, Huang WC, Yen DH, Yeh EH, Wu SY, Liao HH. The Potential Risk Factors for Mortality in Patients After In-Hospital Cardiac Arrest: A Multicenter Study. *Front Cardiovasc Med* 2021; 8: 630102.
11. White L, Melhuish T, Holyoak R, Ryan T, Kempton H, Vlok R. Advanced airway management in out-of-hospital cardiac arrest: A systematic review and meta-analysis. *Am J Emerg Med* 2018; 36: 2298-306.
12. Panchal AR, Bartos JA, Cabañas JG, Donnino MW, Drennan IR, Hirsch KG et al. Part 3: Adult Basic and Advanced Life Support 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation* 2010; 122: S729–S767.
13. Delorenzo A, Nehme Z, Yates J, Bernard S, Smith K. Double sequential external defibrillation for refractory ventricular fibrillation out-of-hospital cardiac arrest: A systematic review and meta-analysis. *Resuscitation* 2018; 135: 124-9.
14. Chan PS, Nallamothu BK, Krumholz HM, Spertus JA, Li Y, Hammill BG, Curtis LH; American Heart Association Get with the Guidelines–Resuscitation Investigators. Long-term outcomes in elderly survivors of in-hospital cardiac arrest. *N Engl J Med* 2013; 368: 1019-26.
15. Neumar RW, Nolan JP, Adrie C, Aibiki M, Berg RA, Böttiger BW et al. Post-cardiac arrest syndrome: epidemiology, pathophysiology, treatment, and prognostication. A consensus statement from the International Liaison Committee on Resuscitation. *Circulation* 2008; 118: 2452–83.
16. Chan PS, Tang Y; American Heart Association's Get With the Guidelines®-Resuscitation Investigators. Risk-Standardizing Rates of Return of Spontaneous Circulation for In-Hospital Cardiac Arrest to Facilitate Hospital Comparisons. *J Am Heart Assoc* 2020; 9: e014837.
17. Andersen LW, Bivens MJ, Giberson T, Giberson B, Mottley JL, Gautam S et al. The relationship between age and outcome in out-of-hospital cardiac arrest patients. *Resuscitation* 2015; 94: 49-54.
18. Okubo M, Komukai S, Andersen LW, Berg RA, Kurz MC, Morrison LJ. Duration of cardiopulmonary resuscitation and outcomes for adults with in-hospital cardiac arrest: Retrospective cohort study. *BMJ* 2024; 384: e076019.
19. Yonis H, Andersen MP, Mills EHA, Winkel BG, Wissenberg M, Køber L. Duration of resuscitation and long term outcome after in hospital cardiac arrest: A nationwide observational study. *Resuscitation* 2022; 179: 267-73.

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