Outcomes of Cardiopulmonary Resuscitation of Oncologic Patients in Emergency Department

Nurdan Acar[1], Adem Koksal[1], Mustafa E. Canakci[1], Muzaffer Bilgin[2] and Ugur Bilge[3]

[1]*Emergency Department, School of Medicine, Eskisehir Osmangazi University, Eskisehir, Turkey*
[2]*Department of Biostatistics, School of Medicine, Eskisehir Osmangazi University, Eskisehir, Turkey*
[3]*Department of Family Medicine, School of Medicine, Eskisehir Osmangazi University, Eskisehir, Turkey*

ABSTRACT

Objective: To evaluate the outcomes of cardiopulmonary resuscitation (CPR) of oncological cases versus non-oncological admitted to the emergency department as out-of-hospital cardiac arrest (OHCA) or in-hospital cardiac arrest (IHCA).

Study Design: Descriptive study.

Place and Duration of Study: Emergency Department (ED) of Eskisehir Osmangazi University Hospital, between January 2014 to January 2020.

Methodology: Victims over the age of 18 years who had OHCA and IHCA were inducted. The outcomes of 109 patients with an oncological diagnosis and 109 controls without cancer underwent CPR and were compared.

Results: The median age of the participants was 65 (58–76) years. Patients with an oncological diagnosis were more likely to have an IHCA [OR: 2.98 (95% CI: 1.68–5.30), p <0.001]. The IHCA and OHCA rates of patients without an oncological diagnosis were similar. Solid-organ malignancies were observed in 102 patients (93.6%). The initial rhythm of 88 patients (80.7%) in the oncological arrest group was asystole *versus* 77 patients (70.6%) in the control group. Pulseless electrical activity was observed in 17 patients (15.6%) in the study group and in 24 patients (22.0%) in the control group. Although the non-oncological group was found to have a longer stay. No statistically significant difference was found between the study and control groups regarding duration of stay in the intensive care unit. Only one patient (2.0%) with cancer was discharged in stable state as against 10 (21.3%) of non-oncological arrests [OR: 12.97 (95% CI: 1.59–105.93), p = 0.008].

Conclusion: The presence of cancer is not a favourable prognostic factor for the success of CPR.

Key Words: *Oncology, Cardiac arrest, IHCA, OHCA, Emergency department.*

How to cite this article: Acar N, Koksal A, Canakci ME, Bilgin M, Bilge U. Outcomes of Cardiopulmonary Resuscitation of Oncologic Patients in Emergency Department. *J Coll Physicians Surg Pak* 2022; **32(05)**:658-661.

INTRODUCTION

Resuscitation from out-of-hospital cardiac arrest (OHCA) is only successful in one-third of patients, and only approximately 9% of all patients are ultimately discharged from the hospital, many of whom are neurologically impaired.[1] The outcome of patients who experience in-hospital cardiac arrest (IHCA) is poor, with reported survival-to-hospital discharge rates of 9–25%.[2,3] The comorbidities associated with death after IHCA are active malignancy, congestive heart failure, chronic kidney disease, chronic obstructive pulmonary disease, and diabetes mellitus (DM).[4]

Correspondence to: Dr. Nurdan Acar, Emergency Department, School of Medicine, Eskisehir Osmangazi University, Eskisehir, Turkey
E-mail: nurdanergun@gmail.com
Received: January 09, 2021; Revised: December 13, 2021; Accepted: January 18, 2022
DOI: https://doi.org/10.29271/jcpsp.2022.05.658

The resuscitation of oncological patients performed in the emergency department (ED) is not a widespread issue. The evaluations in terms of which have cancer, emergency cardiac rhythms, return of spontaneous circulation (ROSC), and length of hospital stay have not been thoroughly evaluated.[1] Therefore, the aim of this study was to evaluate the outcomes of oncological and non-oncological cardiopulmonary arrest patients in the ED.

METHODOLOGY

This descriptive study was conducted retrospectively at the ED of a university hospital between January 2014 and January 2020. Patients aged 18 years and older who had OHCA or IHCA were included. OHCA was defined as out-of-hospital arrest patients who were brought to the ED with or without return of spontaneous circulation; whereas, patients who experienced cardiac arrest while in the ED were defined as IHCA. Patients who developed arrest after hospitalization were not included in the study. The study was approved by the Ethical Committee of the University. Do not resuscitate (DNR) status is not legal in Turkey where the study was conducted.

A total of 1052 patients underwent CPR in the ED within the

specified period. The patients were divided into two groups according to whether or not they had a cancer diagnosis. One hundred and nine patients (10.4%) had an oncological diagnosis, while 943 patients (89.6%) had no oncological diagnosis. The control group was selected based on age and gender by propensity score match (PSM). Since the number of oncological arrests was 109, PSM was performed at a ratio of 1:1 according to age and gender in the non-oncological arrest group. Thus, a total of 218 patients (109 oncological and 109 non-oncological patients) were included in the study.

Demographic information was recorded from the hospital information system. Oncological diagnosis (solid or hematological), metastasis status, cancer stage, place of arrest (in or out of hospital), CPR initial rhythm (pulseless electrical activity, asystole, ventricular fibrillation, or ventricular tachycardia), bedside ultrasonographic findings before and during CPR (enlargement of right heart structures, presence of cardiac activity, cardiac tamponade, and deep vein thrombosis) were recorded. The duration of CPR after ROSC was expressed in minutes, and the length of hospital stay (days) was also recorded.

Continuous data are presented as median [interquartile range] and the categorical data are presented as percentages (%). The Shapiro–Wilk test was used to investigate the suitability of the data for normal distribution. In the comparison of groups that are not normally distributed, the Mann–Whitney *U*-test was used for cases with two groups. In the analysis of the 2 × 2 tables; Fisher's exact test for the minimum expected count <5, Yate's Chi-squared test for the minimum expected count between 5–25, and Pearson's chi-squared test for the minimum expected count >25. Pearson's chi-squared test was used for R × C cross tables. SPSS Statistics 21.0 software (IBM Corp. Armonk, NY) was used to perform statistical analyses, with $p < 0.05$ considered statistically significant.

RESULTS

Demographic features, comorbidities, and cardiac arrest locations of the patients are shown in Table I. Oncological patients were more likely to have an IHCA [OR: 2.98 (95% CI: 1.68–5.30), p <0.001]. The IHCA and OHCA rates of patients without an oncological diagnosis were similar.

The types of malignancy were found as 102 solid (93.6%) and 7 hematological (6.4%). All the oncological arrests were stage 3 or 4 cancer according to the American Joint of Committee on Cancer's TNM classification system. The number of cancer patients with metastasis was 79 (72.5%). Initial cardiac rhythm, bedside ultrasound findings, ROSC, and CPR duration of the experimental and control groups are shown in Table II.

The hospitalisation and discharge status of patients are shown in Table II. The non-oncological group had longer hospital stays; however, no statistically significant differences were found between the oncological and non-oncological groups in terms of length of stay in the intensive care unit. Only one patient (2.0%) with cancer was discharged in stable state as against 10 (21.3%) of non-oncological arrests [OR: 12.97 (95% CI: 1.59–105.93), p = 0.008].

Table I: Demographic data, comorbidities, and location of the arrest.

	Study (n=109)	Control (n=109)	*p*
Age, year [IQR]	65.00[58.00-76.00]	65.00[57.50-76.00]	0.808*
Male gender n(%)	82 (75.2%)	82 (75.2%)	1.000ǂ
Comorbidities			
DM n(%)	17 (15.6%)	20 (18.3%)	0.718^
HT n(%)	30 (27.5%)	60 (55.0%)	<0.001ǂ
CAD n(%)	20 (18.3%)	55 (50.5%)	<0.001ǂ
Heart Failure n(%)	8 (7.3%)	22 (20.2%)	0.011^
Renal Failure n(%)	10 (9.2%)	16 (14.7%)	0.296^
COPD n(%)	17 (15.6%)	19 (17.4%)	0.855^
CVD n(%)	10 (9.2%)	15 (13.8%)	0.395^
Location			
In-Hospital n(%)	82 (75.2%)	55 (50.5%)	<0.001^
Out-of-Hospital n(%)	27 (24.8%)	54 (49.5%)	

**Mann-Whitney U, ǂ Pearson Chi-Square, ^Yate's Chi-Square tests were used; DM: Diabetes Mellitus, HT: Hypertension, CAD: Coronary artery disease, COPD: Chronic obstructive pulmonary disease, CVD: Cerebrovascular disease.*

Table II: Initial rhythms, point-of-care ultrasound, CPR features and outcome.

	Study (n=109)	Control (n=109)	p
CPR Initial Rhythm			
Asystole n(%)	88 (80.7%)	77 (70.6%)	
PEA n(%)	17 (15.6%)	24 (22.0%)	0.291ǂ
VF n(%)	2 (1.8%)	6 (5.5%)	
VT n(%)	2 (1.8%)	2 (1.8%)	
Point-of-care Ultrasound			
No cardiac activity, n(%)	77 (70.6%)	72 (66.1%)	
Segmentary Contraction Loss, n(%)	15 (13.8%)	25 (22.9%)	
Right Heart Enlargement, n(%)	13 (11.9%)	8 (7.3%)	0.056ǂ
Cardiac Tamponade, n(%)	3 (2.8%)	0 (0.0%)	
Deep Venous Thrombosis, n(%)	1 (0.9%)	1 (0.9%)	
Pneumothorax, n(%)	0 (0.0%)	3 (2.8%)	
Defibrillation n(%)	13 (11.9%)	24 (22.0%)	0.071^
ROSC n(%)	49 (45.0%)	47 (43.1%)	0.785ǂ
CPR Duration minutes	35 (9-45)	40 (10-45)	0.685*
Deceased in ED, n (%)	60 (55.0%)	62 (56.8%)	0.785ǂ
Hospitalization in ICU, n (%)	49 (45.0%)	47 (43.1%)	
LOS (all patients), days [IQR]	2.00 [1.00–7.00]	6.00 [1.00-11.00]	0.066*
LOS (Deceased cases in hospital), days [IQR]	2.00 [1.00–7.00]	3.00 [1.00-9.00]	0.453*
Discharge after ICU stay, n (%)	1 (2.0%)	10 (21.3%)	0.008^

**Mann-Whitney U, ǂPearson Chi-Square, ^Yate's Chi-Square tests were used. CPR: Cardiopulmonary Resuscitation, PEA: Pulseless electrical activity, VF: Ventricular fibrillation, VT: Ventricular tachycardia, ROSC: Return of spontaneous circulation. ED: Emergency department, LOS: Length of stay, ICU: Intensive care unit, IQR: Interquartile range.*

DISCUSSION

The primary outcome was to evaluate the oncological cases in which resuscitation was performed in ED. Of the 1052 resuscitated cases, 109 (10.36%) were oncological cases. The IHCA and OHCA rates of patients without an oncological diagnosis were similar, but the majority of oncological patients were classified as IHCA. On the other hand, patients with cancer diagnoses are mostly brought when they are critically ill and cardiopulmonary arrest develops in the emergency department.

Bruckel *et al*. reported that the initial rhythms of cancer cases were mostly asystole and pulseless electrical activity in 62,931 adult cases of cardiac arrest.[5] Stankovic *et al*. found that age, female gender, and non-cardiovascular comorbidities were associated with non-shockable rhythm.[6] Hcybye *et al*. detected that pulseless electrical activity was associated with higher ROSC than was asystole, but no differences were found in long-term survival rates.[7] Various studies showed that the prognosis

of arrest cases with non-shockable rhythm is poor.[8-10] In this study, similar results were found in both the oncological patients and in controls. Although no statistically significant differences were found in the bedside ultrasound of patients, cardiac tamponade was found to be more frequent in oncologic patients, which may be a clinically significant finding.

Studies have recommended that non-end-stage cancer patients should be resuscitated with the same degree of effort as any patient without cancer.[11] In a meta-analysis by Fernando *et al*., the prognosis of cancer patients who have active cancer and comorbid conditions was reported to be poor.[4] Lee *et al*. found that the survival time of stage 4 cancer patients was shorter compared to those without cancer.[12] Oving *et al*. found that the risk of post-CPR survival decreases in the presence of severe comorbidity, including any malignancy.[13] Mortality rates in the study were higher and neurologic recovery rates were lower in cancer patients.

A study in Turkey found that although the survival rate was 27.8% in patients with non-metastatic cancer and the survival rate in patients with metastatic cancer was lower than that in patients with non-metastatic cancer, this difference was not statistically significant.[14] According to the results of a meta-analysis, overall survival after discharge was 6.2%, whereas survival was 9.5% in patients with localized disease and 5.6% in patients with metastatic disease.[15] In this study, all oncological patients who experienced cardiac arrest cases were found to have stage 3 or 4 cancer.

This study has several limitations. First, the study is retrospective and observational in design and only included data from a single centre. Second, all oncology patients who experienced cardiac arrest were found to have stage 3 or 4 cancer, according to TNM classification system. Data on patients in the early stages of cancer could not be included in the study because these cases had not yet been diagnosed. Third, some patients who had cardiac arrest may have undiagnosed cancer.

CONCLUSION

The presence of cancer is not a favorable prognostic factor for successful CPR. Non-shockable rhythm is more common in oncological arrests as periarrest rhythm. Even if reversible arrest causes are tackled (as per current CPR guidelines), spontaneous circulation return is less frequent, and these patients are discharged from the hospital less frequently.

ETHICAL APPROVAL:

The study was initiated after obtaining approval from the Non-Interventional Clinical Research Ethics Committee of Eskişehir Osmangazi University (Date: 05/12/2020, Decision No. 01). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

PATIENT'S CONSENT:

Patients consent is not required for this retrospectively designed study.

COMPETING INTEREST:

The authors declared no competing interests.

AUTHORS' CONTRIBUTIONS:

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

1. Yan S, Gan Y, Jiang N, Wang R, Chen Y, Luo Z, *et al*. The global survival rate among adult out-of-hospital cardiac arrest patients who received cardiopulmonary resuscitation: A systematic review and meta-analysis. *Crit Care* 2020; **24(1)**:61. doi: 10.1186/s13054-020-2773-2.
2. Shao F, Li CS, Liang LR, Qin J, Ding N, Fu Y, *et al*. Incidence and outcome of adult in-hospital cardiac arrest in Beijing, China. *Resuscitation* 2016; **102**:51-6. doi: 10.1016/j.resuscitation.2016.02.002.
3. Andersen LW, Holmberg MJ, Berg KM, Donnino MW, Granfeldt A. In-hospital cardiac arrest: A review. *JAMA* 2019; **321(12)**:1200-10. doi: 10.1001/jama.2019.1696.
4. Fernando SM, Tran A, Cheng W, Rochwerg B, Taljaard M, Vaillancourt C, *et al.* Pre-arrest and intra-arrest prognostic factors associated with survival after in-hospital cardiac arrest: Systematic review and meta-analysis. *BMJ* 2019; **367**:l6373. doi: doi.org/10.1136/bmj.l6373.
5. Bruckel JT, Wong SL, Chan PS, Bradley SM, Nallamothu BK. Patterns of resuscitation care and survival after in-hospital cardiac arrest in patients with advanced cancer. *J Oncol Pract* 2017; **13(10)**:e821-30. doi: 10.1200/JOP.2016.020404.
6. Stankovic N, Hoybye M, Holmberg MJ, Lauridsen KG, Andersen LW, Granfeldt A. Factors associated with shockable *versus* non-shockable rhythms in patients with in-hospital cardiac arrest. *Resuscitation* 2021; **158**:166-74. doi: 10.1016/j.resuscitation.2020.11.022.
7. Hoybye M, Stankovic N, Lauridsen KG, Holmberg MJ, Andersen LW, Granfeldt A. Pulseless electrical activity *vs*. asystole in adult in-hospital cardiac arrest: Predictors and outcomes. *Resuscitation* 2021; **165**:50-7. doi: 10.1016/j.resuscitation.2021.05.036.
8. Hessulf F, Karlsson T, Lundgren P, Aune S, Stromsoe A, Sodersved Kallestedt ML, *et al*. Factors of importance to 30-day survival after in-hospital cardiac arrest in Sweden - A population-based register study of more than 18,000 cases. *Int J Cardiol* 2018; **255**:237–42. doi: 10.1016/j.ijcard.2017.12.068.
9. Adielsson A, Djarv T, Rawshani A, Lundin S, Herlitz J. Changes over time in 30-day survival and the incidence of shockable rhythms after in-hospital cardiac arrest - A population-based registry study of nearly 24,000 cases. *Resuscitation* 2020; **157**:135-40. doi: 10.1016/j.resuscitation.2020.10.015.
10. Nadkarni VM, Larkin GL, Peberdy MA, Carey SM, Kaye W, Mancini ME, *et al.* First documented rhythm and clinical outcome from in-hospital cardiac arrest among children and adults. *JAMA* 2006; **295(1)**:50-7. doi: 10.1001/jama.295.1.50.
11. Yeung SCJ, Escalante CP. Circulatory oncologic

emergencies. In: Kufe DW, Pollock RE, Weichselbaum RR, *et al*., editors. Holland-Frei Cancer Medicine. ed. 6th, Hamilton (ON): BC Decker; 2003. Available from: http://www.ncbi.nlm.nih.gov/books/NBK12624/ [Accessed on 04/20/2022].

12. Lee MR, Yu KL, Kuo HY, Liu TH, Ko JC, Tsai JS, *et al*. Outcome of stage IV cancer patients receiving in-hospital cardiopulmonary resuscitation: A population-based cohort study. *Sci Rep* 2019; **9(1)**:9478. doi: 10.1038/s41598-019-45977-4.
13. Oving I, van Dongen LHPI, Deurholt SC, Ramdani A, Beesems SG, Tan HL, *et al*. Comorbidity and survival in the pre-hospital and in-hospital phase after out-of-hospital cardiac arrest. *Resuscitation* 2020; **153**:58-64. doi: 10.1016/j.resuscitation.2020.05.035.
14. Parlakgumuş A, Nursal TZ, Yorgancı K. Outcomes of cardiopulmonary resuscitation in a surgical intensive care unit. *J Med Surg Intensive Care Med* 2010; **2**:40-4. doi: 10.5152/dcbybd.2010.03.
15. Reisfield GM, Wallace SK, Munsell MF, Webb FJ, Alvarez ER, Wilson GR. Survival in cancer patients undergoing in-hospital cardiopulmonary resuscitation: A meta-analysis. Resuscitation 2006; **71(2)**:152-60. doi: 10.1016/j.resuscitation.2006.02.022.