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RETROSPECTIVE EVALUATION OF POST-CPR PATIENTS IN INTENSIVE CARE AFTER IN-HOSPITAL CARDIAC ARREST

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Abstract

Introduction: The intensive care process begins with the return of spontaneous circulation after cardiac arrest. Depending on the severity of post-cardiac arrest syndrome, many patients may require multi-organ support, and the treatments applied have significant effects on neurological outcomes. Our study aimed to evaluate the neurological outcomes and intensive care mortality of patients with spontaneous circulation after in-hospital cardiac arrest.

Material/Method: Patients who developed in-hospital cardiac arrest between 2014 and 2020 were followed up in our anesthesia intensive care unit after spontaneous circulation returned were evaluated retrospectively. After CPR in our intensive care unit, we followed the patients up under our treatment protocol. Demographic data of the patients, Acute Physiology and Chronic Health Evaluation II (APACHE II) and Glasgow coma scores (GCS), length of stay in the ICU, and mortality were recorded through our intensive care database.

Results: We analyzed files of 49 patients with complete records. The mean age of the patients was 67.43 ±19.9 years, 46.9% (n:23) were female, and 53.1% (n:26) were male. The most common comorbidity was HT, with 36.6% (n:18). The mean APACHE II score was 28.52 ± 9.8. GCS was <8 at the time of hospitalization in 87.8% (n:43) of the patients. When the seventy-second hour GCS was evaluated, 75.4% (n:37) of the patients had a GCS <8, 20.3% (n:10) had a GCS of 9-12, and 4% (n:4) had a GCS of 13. The mean intensive care unit stay was 10.12±9.6 days. 55.1% (n:27) of the patients died. 44.9% (n:22) were discharged from the intensive care unit with a mean GCS of 12±3.4. 31.8% (n:7) of the patients were discharged with spontaneous tracheostomy breathing or a home ventilator.

Conclusion: In our study, the rate of discharge from the intensive care unit after in-hospital cardiac arrest was 44.9% , which is in conformance with the literature. There is a need for legal regulations, and national guidelines for transferring from tertiary intensive care to rehabilitation units for patients predicted to have a poor neurological prognosis after resuscitation and in a permanent vegetative state.

Keywords: In-hospital cardiac arrest, intensive care, mortality

Retrospective Evaluation of Post-CPR Patients in Intensive Care After In-Hospital Cardiac Arrest

Introduction

With the return of spontaneous circulation after cardiac arrest, the intensive care follow-up period of the patient begins. Post-cardiac arrest syndrome, which includes brain damage, myocardial dysfunction, and systemic ischemia/reperfusion response, develops due to cardiac arrest in patients undergoing cardiopulmonary resuscitation (CPR). Depending on the severity of this syndrome, many patients may require multi-organ support, and the treatment applied during the post-resuscitation care period has significant effects on neurological outcomes [(1)]. Post-cardiac arrest brain injury is the leading cause of death in patients resuscitated after cardiac arrest. Also, it is the leading cause of long-term disability in patients who survive the acute phase [(2)]. Care after cardiac arrest focuses on identifying the underlying cause, providing hemodynamic and respiratory support, and potentially applying neuroprotective strategies. Approaches such as targeted temperature management, lung-protective mechanical ventilation strategies, optimization of hemodynamic and metabolic parameters, and early percutaneous coronary reperfusion angiography improve survival and neurological outcomes [(3)]. The ultimate goal of selfless work during and after resuscitation is to achieve acceptable neurological survival. The 30-day survival/discharge rate after in-hospital cardiac arrest in Europe ranges from 15% to 34% [(4)]. However, some patients who survive cardiac arrest have neurologic deficits resulting from hypoxic-ischemic brain injury and reperfusion injury. Post-resuscitation care guidelines recommend measuring neurological function in cardiac arrest survivors for research using either the Cerebral Performance Categories (CPC) score or the modified Rankin Scale (mRS) [(5)]. The CPC score, a five-point scale ranging from good cerebral performance to brain death, is frequently used to evaluate neurological functions. While CPC-1 (complete recovery or mild disability) and CPC-2 (moderate disability but independent in activities of daily living) are associated with good clinical outcomes; CPC-3 (severe disability; dependent on

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activities of daily living), CPC-4 (permanent vegetative state), and CPC-5 (death) are considered poor clinical outcomes [6,7]. In our study, it was aimed to evaluate the neurological and cognitive outcomes at discharge and intensive care mortality of patients with spontaneous circulation after in-hospital arrest and admitted to the intensive care unit.

Material-Method

After the approval of the local ethics committee of Dokuz Eylul University, numbered 2021/25 07, all patients who developed in-hospital cardiac arrest between 2014 - 2020 were followed up in our anesthesia intensive care unit after spontaneous circulation returned were evaluated retrospectively. Fifteen patients admitted to the intensive care unit after cardiac arrest were excluded due to a lack of data. Demographic data of patients from DEU Intensive Care database and patient follow-up cards, *Acute Physiology and Chronic Health Evaluation II* (APACHE II), hospitalization, seventy-second hour and discharge *Glasgow Coma Score* (GKS), duration of stay in intensive care, time of discharge from intensive care neurological status and mortality were recorded. Post-CPR patients admitted to our intensive care unit are followed according to the European Resuscitation Council and European Intensive Care Association 2015 post-resuscitation care guidelines. For post-resuscitation temperature management, 35.5°C is targeted. External coolers provide temperature management; hyperthermia is not allowed during the first 72 hours. Invasive hemodynamic monitoring and dynamic fluid response methods are used to optimize hemodynamics, and fluid therapy is regulated. Mean arterial pressure >65mmHg and >0.5 mL/kg/h urine output are targeted. In the management of mechanical ventilators, a lung-protective mechanical ventilation strategy targeting normoxia and normocarbia is followed, accompanied by arterial blood gas and end-tidal CO_2 monitoring. The blood glucose level is maintained at 140-180 mg/dL. Antiepileptic drugs are not routinely used, but patients with clinical seizure activity after resuscitation are treated with levetiracetam. *Statistical Package for Social Sciences for Windows 26.0* (SPSS) package program was used to analyze the data obtained as a result of the research. The normal distribution of the data was evaluated with the Shapiro Wilkson test. While evaluating the data, the mean was given as a standard deviation in descriptive statistical analysis. Chi-square test was used to evaluate categorical data, and t-test was used for independent samples to evaluate continuous parametric variables. A statistically significant value of $p<0.005$ was accepted.

Results

Forty-nine patients were included in our study. The mean age of the patients was 67.43 ±19.9 years, and 46.9% (n:23) were female, and 53.1% (n:26) were male. When the patients' comorbidities were examined, HT was the most common with 36.6% (n:18), and HT+DM was the second most common with 22.4% (n:11). There was malignancy in 16% (n:8) of the patients. No comorbidity was found in 16.3% (n:8) of the patients. The mean APACHE II score of the patients after ICU admission was 28.52 ±9.8. **(Table 1)**

Table 1. Demographic data of the patients

Demographic data	n=49
Age	67,43±19,9
Gender n (%)	
Female	23 (46.9%)
Male	26 (53.1%)
APACHE II* score	28,52±9,8
Comorbidity	
Hypertension	18 (36.6%)
Diabetes Mellitus + Hypertension	11 (22.4%)
Malignancy	8 (16%)
COPD	2 (4.1%)
Cirrhosis	2 (4.0%)
Other (OSAS- HB S)	2 (4.0%)
No comorbidity	8 (16%)

** Acute Physiology and Chronic Health Evaluation II*

In 87.8% (n:43) of the patients, GCS was below <8 at the time of hospitalization. When the seventy-second hour GCS was evaluated, 75.4% (n:37) of the patients had a GCS <8, 20.3% (n:10) had a GCS of 9-12, and 4% (n:4) had a GCS of 13. and above were detected. The patients' mean intensive care unit stay was 10.12 ± 9.6 days. 55.1% (n:27) of the patients died, and 44.9% (n:22) of the patients were discharged from the intensive care unit with a GCS of 12 ±3.4. The mean duration of intensive care stay of 27 patients who died was 8.52 ±10.8 days. During the intensive care follow-up, 2% (n:1) of patients were diagnosed with brain death. GCS was 13 and above in 54.6% (n:12) of the patients discharged from the intensive care unit, and the CPC score at discharge was evaluated as 1-2. GCS was 12 and below in 45.4% (n:10) of the patients discharged from the intensive care unit, and the CPC score at discharge was evaluated as 3-4. Tracheostomy was performed in 31.8% (n:7) of the patients discharged from the intensive care unit. The mean intensive care unit stay of 7 patients discharged from the intensive care unit with a tracheostomy was

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18.57 ±7.6 days. When the relevance between the age and gender of the patients in our study group and intensive care mortality was evaluated, no statistically significant association was found. In addition, it was found that gender did not affect neurological outcomes at discharge in surviving patients. The APACHE II score of the discharged patients was 32.3±10.3, and the APACHE II score of the discharged patients was 23.6±6.8, significantly higher (p=0.002). The hospitalization GCS of the patients who died was 3.3±1.5, and the hospitalization GCS of the discharged patients was 5.5±3.5, significantly lower (p=0.004). Similarly, the seventy-second hour GCS of the patients who died was 3.4±1.6, and the seventy-second hour GCS of the discharged patients was 7.7±3.9, significantly lower (p=0.001). **(Table 2)**

Table 2. Comparison of APACHE II, GCS and ICU mortality Discussion

	Intensive Care Mortality		p
	Discharge	**Died**	
APACHE II	23,6±6,8	32,3 ±10,3	0,002
GCS at the time of hospitalization	5,5±3,5	3,3 ±1,5	0,004
GCS 72nd hour	7,7±3,9	3,4±1,6	0,001

* t test on independent groups

Survival after in-hospital cardiac arrest is low. Our study found out that the rate of discharge from the intensive care unit after in-hospital cardiac arrest is 44.9%. In Europe, 30-day survival/ discharge from hospital after in-hospital cardiac arrest ranges from 15% to 30% [4]. In our study, when the relationship of the age of the patients with mortality was evaluated, no significant difference was found. Contrary to our study, Hirlekar G et al. [8] reported 30-day survival as 28% for patients aged 70-79, 20% for patients aged 80-89%, and 14% for over 90 years. In conclusion, they reported that with increasing age among the elderly, the 30-day survival rate after in-hospital cardiac arrest is lower. We attribute the difference in our results to the low number of cases.

Recent studies report that women have a significantly worse health-related quality of life after cardiac arrest than men [9, 10]. Sandroni et al. [11] reported that one year after cardiac arrest, women's rate of achieving a good quality of life was 50% lower than men. Women were less likely to return to work after cardiac arrest than men. In our study, it was found that gender did not affect neurological outcomes at discharge. However, since the patients discharged from the intensive care unit are not followed up for a long time, whether gender affects health-related quality of life cannot be evaluated.

It is recommended to use multimodal neurological prognostic factors after 72 hours in the follow-up of patients followed in the intensive care unit after CPR [12]. However, there may be minor neurological damage due to earlier recognition of in-hospital cardiac arrests than out-of-hospital arrests and shorter times from cardiac arrest to initiation of CPR and return of spontaneous circulation [13]. On the other hand, the patient's comorbidities in in-hospital cardiac arrests may have adverse effects on neurological outcomes. These conditions may cause the clinician to have difficulties evaluating the neurological prognosis. In our clinic, neurological prognosis follow-up is performed after 72 hours with neurological examination and radiological imaging following the removal of confounding factors (sedative agents, targeted temperature therapy, severe electrolyte, acid-base disturbance). Neuron-specific enolase (NSE) level is not measured in our hospital, and EEG is used only in selected patients. In our study, more than half of the patients discharged from the intensive care unit had a GCS of 13 and above, and the CPC score was evaluated as 1-2 at the time of discharge. However, 45% of those discharged did not achieve an excellent neurological survival (mean GCS 9.2 ±2.8), and the CPC score was evaluated as 3-4 at the time of discharge. Similar to our study, it has been reported that the permanent vegetative status varies between 30% and 50% in countries where withdrawal of life-sustaining therapy is not routinely applied [4]. Patients with a CPC score of 3-4 need rehabilitation after cardiac arrest. Rehabilitation programs are recommended to provide neurological, cognitive, and cardiac rehabilitation for patients who survived cardiac arrest and provide psychosocial support to patients and their family members. In this way, it is predicted that functional improvements can be achieved by reducing the burden of care on the patient's family and society [12]. After completing intensive care treatment in our country, uncertainties regarding how and where the rehabilitation of this group of patients will continue. The fact that patients in permanent vegetative conditions have to be cared for in tertiary intensive care beds from time to time prevents the efficient use of our limited resources. There is a need for national guidelines on these patients' neurological, cardiac, and cognitive rehabilitation after intensive care treatment.

Our study aimed to overview the mortality and post-treatment neurological and cognitive status of in-hospital cardiac arrests in our intensive care unit. The limitations of our study include the retrospective and single-centered nature of our research, the low number of cases, and the lack of long-term follow-up after discharge from the intensive care unit. In addition, only the patients' data in the study group after they were admitted to the intensive care unit were evaluated, and the data during the hospitalization in the ward were ignored.

Conclusion

Despite all treatment modalities after in-hospital cardiac arrest, patients with poor neurological outcomes are encountered. There is a need for legal regulations, and national guidelines for

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transferring from tertiary intensive care to rehabilitation units for patients predicted to have a poor neurological prognosis after resuscitation and in a permanent vegetative state.

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