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Survival Outcomes and Neurological Prognosis at 72 Hours Following In-Hospital Cardiac Arrest

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Abstract

Background: In-hospital cardiac arrest (IHCA) remains a major cause of mortality and neurological disability despite advances in resuscitation science. Early return of spontaneous circulation (ROSC) and post-resuscitation neurological recovery are critical determinants of long-term survival. Evaluation of survival milestones and predictors of neurological outcomes within the first 72 hours is essential for optimizing clinical decision-making and resource allocation.

Objective: To assess survival rates to ROSC, 72-hour survival, and hospital discharge, and to evaluate neurological prognosis at 72 hours following resuscitation among adult patients with in-hospital cardiac arrest. The study also aimed to identify pre-arrest, intra-arrest, and post-arrest factors associated with survival and neurological outcomes.

Methods: A retrospective record-based cohort study was conducted in the Department of Emergency Medicine and Critical Care at Narayana Medical College, Nellore. A total of 108 adult patients who experienced IHCA and underwent cardiopulmonary resuscitation were included. Data were extracted from CPR records and medical case files. Survival outcomes were assessed at ROSC, 72 hours, and discharge. Neurological status was evaluated using the Cerebral Performance Category (CPC) score at 72 hours. Statistical analysis was performed using SPSS. Associations were examined using Chi-square and independent t-tests, and multivariate logistic regression identified independent predictors of favorable neurological outcome. A p-value <0.05 was considered statistically significant.

Results: ROSC was achieved in 64.8% of patients, 72-hour survival was 38.9%, and survival to discharge was 29.6%. Favorable neurological outcome (CPC 1–2) at 72 hours was observed in 11.1% of patients. Shockable rhythm, shorter CPR duration, absence of pre-arrest hypotension, and early initiation of post-resuscitation care were significantly associated with survival and good neurological outcome. Prolonged CPR duration and non-shockable rhythms independently predicted poor prognosis.

Conclusion: Survival and neurological recovery following IHCA remain limited. Early rhythm recognition, rapid resuscitation, and optimized post-arrest care are crucial determinants of improved outcomes.

Keywords: In-hospital cardiac arrest; Return of spontaneous circulation; Neurological prognosis; CPC score; Cardiopulmonary resuscitation; Survival outcomes.

Introduction

In-hospital cardiac arrest (IHCA) remains a significant cause of morbidity and mortality worldwide despite advancements in resuscitation science and critical care practices. The incidence of IHCA varies globally, with estimates ranging between 1 and 6 events per 1,000 hospital admissions [1]. Although prompt cardiopulmonary resuscitation (CPR) and adherence to Advanced Cardiac Life Support (ACLS) protocols have improved immediate survival rates, overall survival to hospital discharge remains modest, typically reported between 15% and 25% [2]. Beyond survival, neurological recovery following resuscitation represents a crucial determinant of long-term quality of life and functional independence.

Return of spontaneous circulation (ROSC) is the first critical milestone in resuscitation outcomes. However, achieving ROSC does not guarantee favorable neurological recovery. Post-cardiac arrest syndrome, characterized by cerebral hypoxia, myocardial dysfunction, and systemic inflammatory response, significantly influences survival and neurological prognosis [3]. Studies have shown that early identification of prognostic indicators during the first 24 to 72 hours post-resuscitation is essential for guiding clinical management and family counseling [4]. Neurological outcome following IHCA is commonly assessed using the Cerebral Performance Category (CPC) score, which categorizes patients based on functional neurological status [5]. Favorable neurological outcome is generally defined as CPC scores of 1 or 2, representing good cerebral performance or moderate disability, whereas CPC scores of 3 to 5 indicate severe disability, coma, or death. Despite advances in post-resuscitation care, the proportion of patients achieving favorable neurological outcomes remains low, often below 10% in many cohorts [6].

Several pre-arrest, intra-arrest, and post-arrest variables have been associated with survival and neurological recovery. Pre-arrest factors such as age, comorbid conditions, and baseline neurological status influence the likelihood of meaningful recovery [7]. Intra-arrest factors including initial cardiac rhythm, duration of CPR, time to defibrillation, and quality of chest compressions are critical determinants of outcome [8]. Shockable rhythms such as ventricular fibrillation and pulseless ventricular tachycardia are consistently associated with higher survival rates compared to non-shockable rhythms such as asystole and pulseless electrical activity [9]. Additionally, prolonged CPR duration is strongly correlated with poor neurological outcome due to sustained cerebral hypoperfusion [10]. Post-resuscitation care plays a vital role in neurological preservation. Targeted temperature management, hemodynamic optimization, early coronary angiography when indicated, and controlled ventilation strategies have been shown to improve outcomes in selected patients [11]. Biomarkers such as serum lactate, along with neurophysiological assessments and imaging studies, provide supplementary information for prognostication during the early post-arrest period [12,13]. The present study was conducted at Narayana Medical College, Nellore, to assess survival outcomes and neurological prognosis at 72 hours following resuscitation among adult patients experiencing in-hospital cardiac arrest. Furthermore, the study aimed to identify demographic characteristics and pre-arrest, intra-arrest, and post-arrest factors associated with survival and favorable neurological outcome. By analyzing these determinants, this study seeks to contribute to improved risk stratification and optimization of post-cardiac arrest management in tertiary care settings.

Materials and Methods

Study Design

This retrospective record-based cohort study was conducted to evaluate survival outcomes and neurological prognosis at 72 hours among adult patients who experienced in-hospital cardiac arrest (IHCA). The study assessed early post-resuscitation survival and identified clinical factors associated with favorable neurological recovery following successful cardiopulmonary resuscitation (CPR).

Study Setting and Duration

The study was conducted in the Department of Neurology in collaboration with the Department of Emergency Medicine and Critical Care at Narayana Medical College, Nellore, India, a tertiary care teaching hospital equipped with dedicated neurocritical care and advanced cardiac life support facilities. Consecutive eligible patients admitted during the predefined study period were identified through hospital medical records and included in the analysis.

Study Population

A total of 108 consecutive adult patients aged more than 18 years who experienced in-hospital cardiac arrest and underwent cardiopulmonary resuscitation according to the American Heart Association (AHA) guidelines were included in the study. Cardiac arrest was defined as the sudden cessation of cardiac mechanical activity confirmed by the absence of a palpable pulse and apnea or agonal breathing requiring immediate initiation of CPR.

Inclusion and Exclusion Criteria

Adult patients aged more than 18 years who experienced in-hospital cardiac arrest and received standardized cardiopulmonary resuscitation were included. Patients with out-of-hospital cardiac arrest, those younger than 18 years, individuals with documented do-not-resuscitate (DNR) or do-not-intubate (DNI) orders, and patients who developed cardiac arrest during surgical procedures were excluded from the study.

Data Collection

Data were retrospectively extracted from standardized cardiopulmonary resuscitation records, hospital case files obtained from the Medical Records Department, laboratory databases, intensive care records, and neuroimaging reports using a structured data collection form. Demographic information including age and gender was recorded. Clinical variables included pre-existing comorbidities such as hypertension, diabetes mellitus, coronary artery disease, chronic kidney disease, respiratory disorders, hypotension, renal dysfunction, and other significant medical illnesses. Information regarding the location of cardiac arrest, initial documented cardiac rhythm (shockable or non-shockable), duration of cardiopulmonary resuscitation, time to defibrillation when indicated, and achievement of return of spontaneous circulation (ROSC) was documented. Post-resuscitation variables including requirement for mechanical ventilation, vasopressor or inotropic support, renal replacement therapy, targeted neuroprotective interventions, and intensive care unit admission were also recorded.

Data Tool

The primary outcomes of the study were survival at 72 hours following cardiac arrest and neurological prognosis at 72 hours after successful resuscitation. Secondary outcomes included return of spontaneous circulation and survival to hospital discharge. Neurological status was assessed using the Cerebral Performance Category (CPC) score, where a CPC score of 1 or 2 was considered a favorable neurological outcome and a CPC score of 3 to 5 was considered an unfavorable neurological outcome. Additional neurological assessment included Glasgow Coma Scale (GCS), pupillary light reflex, brainstem reflexes, and neuroimaging findings whenever available.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee of Narayana Medical College, Nellore. Written informed consent for the use of anonymized clinical data for research purposes was obtained from the patients' legally authorized representatives before inclusion in the study. Strict confidentiality was maintained throughout the study by assigning unique identification numbers to all participants, and no personally identifiable information was disclosed during data collection, analysis, or publication.

Statistical Analysis

All collected data were entered into Microsoft Excel for data cleaning and coding before being analyzed using the Statistical Package for the Social Sciences (SPSS) software. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Associations between clinical variables and survival or neurological outcomes were evaluated using the Chi-square test or Fisher's exact test for categorical variables and the independent sample t-test for continuous variables. Variables that showed statistical significance in univariate analysis were entered into multivariate logistic regression analysis to identify independent predictors of favorable neurological outcome at 72 hours. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were calculated, and a p-value of less than 0.05 was considered statistically significant.

Results

A total of 108 adult patients with in-hospital cardiac arrest (IHCA) who underwent cardiopulmonary resuscitation were included in the study.

Table 1: Baseline Demographic Characteristics

Variable	**Total (n=108)**
Mean Age (years)	59.8 ± 14.2
Age >60 years	58 (53.7%)
Male	68 (63.0%)
Female	40 (37.0%)

The mean age of patients was 59.8 ± 14.2 years, with more than half (53.7%) aged above 60 years. A male predominance (63.0%) was observed. Advanced age was frequently associated with poorer survival outcomes. These findings indicate that elderly males constitute a significant proportion of IHCA cases.

Table 2: Pre-Arrest Clinical Characteristics

Variable	**Frequency (%)**
Hypertension	62 (57.4%)
Diabetes Mellitus	48 (44.4%)
Prior Heart Failure	36 (33.3%)
Hypotension Pre-Arrest	41 (38.0%)
Respiratory Insufficiency	52 (48.1%)

Hypertension (57.4%) and diabetes (44.4%) were common comorbidities. Pre-arrest hypotension was present in 38.0% and respiratory insufficiency in 48.1%, both significantly associated with reduced 72-hour survival ($p = 0.02$). These comorbid conditions likely contributed to compromised physiological reserve prior to arrest.

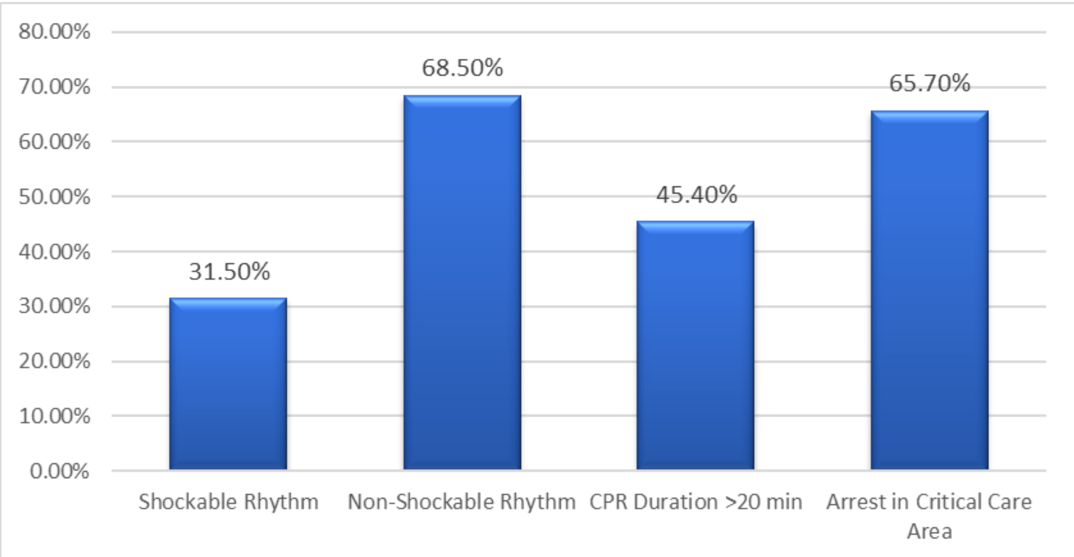

Figure 1: Intra-Arrest Variables

Shockable rhythms were observed in 31.5% of patients and were strongly associated with improved 72-hour survival ($p = 0.001$). Prolonged CPR duration (>20 minutes) significantly predicted poor survival ($p < 0.001$). Arrests occurring in monitored critical care areas had better survival outcomes ($p = 0.04$).

Table 3: Survival Outcomes

Outcome	**Frequency (%)**
ROSC Achieved	70 (64.8%)
Survived at 72 Hours	42 (38.9%)
Survived to Discharge	32 (29.6%)

ROSC was achieved in 64.8% of patients. However, survival declined to 38.9% at 72 hours and 29.6% at discharge. This highlights the progressive attrition in survival following initial resuscitation.

Table 4: Neurological Outcome at 72 Hours (CPC Score)

CPC Category	Frequency (%)
CPC 1–2 (Favorable)	12 (11.1%)
CPC 3–5 (Unfavorable)	96 (88.9%)

Only 11.1% of patients achieved favorable neurological outcome (CPC 1–2) at 72 hours. The majority (88.9%) had severe disability, coma, or death. Favorable CPC was significantly associated with shockable rhythm ($p = 0.002$) and CPR duration <20 minutes ($p < 0.001$). Neurological prognosis remains poor despite ROSC.

Table 5: Independent Predictors of Favorable Neurological Outcome

Variable	Adjusted Odds Ratio (AOR)	95% CI	p-value
Shockable Rhythm	4.2	1.8–9.6	0.001
CPR Duration <20 min	5.1	2.2–11.4	<0.001
Absence of Pre-Arrest Hypotension	2.6	1.1–6.3	0.03
Early Post-Resuscitation Care	2.9	1.2–6.8	0.02

Shockable rhythm (AOR 4.2; $p = 0.001$) and shorter CPR duration (AOR 5.1; $p < 0.001$) were the strongest independent predictors of favorable neurological outcome. Absence of pre-arrest hypotension and timely post-resuscitation care also significantly improved prognosis. These findings emphasize the importance of early rhythm recognition and rapid resuscitative response.

Discussion

The present study evaluated survival outcomes and neurological prognosis following in-hospital cardiac arrest (IHCA) and identified key determinants influencing both survival and functional recovery. The ROSC rate of 64.8% observed in our cohort aligns with previously reported tertiary care data; however, survival declined to 38.9% at 72 hours and 29.6% at discharge, reflecting the well-recognized post-resuscitation attrition phenomenon. Girotra et al. [14] similarly reported that although ROSC rates may exceed 60%, discharge survival often remains below 30%, highlighting the ongoing challenge of sustaining recovery beyond the immediate resuscitation phase. Advanced age was common in our cohort, with more than half of patients above 60 years. Increasing age has consistently been associated with reduced survival after IHCA. Andersen et al. [15] demonstrated a progressive decline in survival probability with advancing age, though selected elderly patients may still achieve meaningful neurological recovery. These findings emphasize that while age influences prognosis, it should be considered alongside other clinical variables.

Pre-arrest physiological instability significantly impacted outcomes. Pre-arrest hypotension and respiratory insufficiency were associated with reduced 72-hour survival in our study. Sandroni et al. [16] highlighted that compromised hemodynamic status prior to arrest limits cerebral perfusion reserve, predisposing to severe hypoxic injury. Chan et al. [17] similarly observed that pre-existing organ dysfunction predicts poorer survival and neurological recovery. These findings underscore the importance of early identification and stabilization of high-risk inpatients. Intra-arrest variables exerted the strongest influence on survival and neurological outcomes. Shockable rhythms were independently associated with favorable neurological prognosis (AOR 4.2; $p = 0.001$). Meaney et al. [18] reported significantly higher survival rates in patients with ventricular fibrillation or pulseless ventricular tachycardia compared to non-shockable rhythms. Shockable rhythms typically represent primary cardiac etiologies amenable to rapid defibrillation, explaining their better outcomes.

Duration of CPR was the most powerful predictor of neurological recovery in our cohort. CPR lasting less than 20 minutes independently predicted favorable CPC outcome (AOR 5.1; $p < 0.001$). Reynolds et al. [19] demonstrated that the probability of neurologically intact survival decreases sharply with prolonged resuscitation, particularly beyond 20–30 minutes. Goldberger et al. [20] further emphasized that extended CPR duration is rarely associated with meaningful recovery. These findings highlight the critical importance of early recognition, prompt response, and high-quality chest compressions. Arrests occurring in critical care areas were associated with better survival, likely due to continuous monitoring and rapid code team activation. Andersen et al. [21] reported that monitored hospital settings significantly reduce no-flow time, improving outcomes. Neurological recovery remained limited, with only 11.1% achieving favorable CPC scores at 72 hours. This proportion is consistent with registry data indicating favorable neurological outcomes in approximately 8–15% of IHCA cases [22]. Sandroni et al. [23] emphasized that early neurological evaluation within 72 hours is essential for prognostication but should be interpreted cautiously to avoid premature decision-making. Post-resuscitation care also influenced outcomes. Early hemodynamic optimization and ventilatory support were associated with improved neurological prognosis. Callaway et al. [24] highlighted the importance of comprehensive post-cardiac arrest care, including oxygenation control and targeted management of secondary brain injury. Multivariate analysis in our study confirmed that shockable rhythm, shorter CPR duration, absence of pre-arrest hypotension, and timely post-resuscitation care independently predicted favorable neurological outcome, consistent with registry-based analyses by Holmberg et al. [25].

Strengths: Provides institution-specific data from a tertiary care centre in India with structured survival milestones and standardized neurological assessment using CPC score. Comprehensive analysis of pre, intra, and post-arrest variables with multivariate regression strengthens validity.

Limitations: Retrospective single-centre design with possible documentation bias and limited generalizability. No long-term neurological follow-up and variability in post-resuscitation care. Larger prospective multicentre studies are needed.

Conclusion

This study evaluated survival milestones and neurological prognosis at 72 hours following in-hospital cardiac arrest and identified key determinants influencing outcomes. Although return of spontaneous circulation was achieved in a considerable proportion of patients, survival significantly declined by 72 hours and hospital discharge, and favorable neurological recovery remained limited. Shockable initial rhythm and shorter duration of cardiopulmonary resuscitation emerged as the strongest independent predictors of favorable neurological outcome, while pre-arrest hypotension and prolonged resuscitation were associated with poor prognosis. These findings fulfill the primary objectives of estimating survival rates at defined milestones and identifying pre-arrest, intra-arrest, and post-arrest factors associated with survival and neurological recovery. The results emphasize that early rhythm recognition, rapid initiation of high-quality CPR, and optimized post-resuscitation care are critical for improving neurologically intact survival following IHCA. Institutional strategies focusing on early warning systems, code team efficiency, and standardized post-arrest protocols may enhance outcomes in tertiary care settings.

Declaration

Funding: None

Conflict of Interest: None declared

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