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PREDICTORS AND CLINICAL OUTCOMES OF CARDIOPULMONARY RESUSCITATION AMONG PATIENTS WITH ACUTE CARDIOVASCULAR AND RESPIRATORY EMERGENCY

[*1]Syed Kashif Rizvi, [2]Maheer, [3]Muhammad Asad Nadeem, [4]Malnika, [5]Nousheen Gul, [6]Marleen Khilji, [7]Muzamil Ahmed , [8]Abdullah, [9]Sonia Khan, [10]Misha Fatima

[*1]Clinical Perfusionist, King Faisal Specialist Hospital & Research center, Saudi Arabia.
[2-3]Fourth year MBBS student, Al Tibri Medical College.
[4]Medical officer, District health quarter hospital , kharan.
[5]House officer, Al tibri medical college and hospital.
[6]Medical officer, Asian institute of medical sciences, Hyderabad, Pakistan.
[7]Third year MBBS student, Al tibri medical college.
[8]Surveillance officer, Liyari , DHO south.
[9]Associate professor ,Islam medical & Dental college.
[10]Second year Pre medical student, Karachi Pakistan.

Background: Cardiopulmonary arrest resulting from acute cardiovascular and respiratory emergencies is associated with high mortality despite advances in cardiopulmonary resuscitation (CPR). Identifying factors associated with successful resuscitation and survival is essential for improving patient outcomes.
Objectives: To determine the predictors of successful cardiopulmonary resuscitation and evaluate the clinical outcomes among patients with acute cardiovascular and respiratory emergencies.
Methodology: A retrospective observational study was conducted among 200 adult patients who underwent CPR following acute cardiovascular or respiratory emergencies at a tertiary care hospital. Demographic characteristics, comorbidities, causes of arrest, CPR-related variables and clinical outcomes were analyzed. Multivariable logistic regression was performed to identify independent predictors of return of spontaneous circulation (ROSC) and survival to hospital discharge.
Results: The mean age of the participants was 46 ± 14.2 years, and 62.0% were male. Hypertension (68.0%) and diabetes mellitus (50.5%) were the most common comorbidities, while acute myocardial infarction (35.0%) was the leading cause of cardiopulmonary arrest. ROSC was achieved in 52.5% of patients, 26.5% survived to hospital discharge, and 19.0% had favorable neurological outcomes. Younger age, witnessed arrest, shockable rhythm, CPR duration of less than 20 minutes, defibrillation and acute myocardial infarction were significant independent predictors of successful ROSC. Successful ROSC, shockable rhythm, shorter CPR duration and younger age independently predicted survival to hospital discharge.
Conclusion: Successful CPR outcomes were strongly influenced by patient age, arrest characteristics, initial cardiac rhythm and duration of resuscitation. Early recognition of cardiac arrest, prompt initiation of high-quality CPR, timely defibrillation and comprehensive post-resuscitation care are critical for improving survival and neurological outcomes among patients with acute cardiovascular and respiratory emergencies.

Keywords: Cardiopulmonary resuscitation; Cardiac arrest; Acute myocardial infarction; Respiratory emergencies; Defibrillation; Shockable rhythm

INTRODUCTION:

Cardiopulmonary arrest (CPA) remains one of the leading causes of mortality worldwide and is frequently encountered in emergency departments (EDs), intensive care units (ICUs) and coronary care units (CCUs). Cardiopulmonary resuscitation (CPR) is the cornerstone intervention for restoring spontaneous circulation following cardiac or respiratory arrest[1,2]. Despite advances in resuscitation science and widespread implementation of Advanced Cardiovascular Life Support (ACLS) guidelines, survival following CPR remains poor, particularly among patients with acute cardiovascular and respiratory emergencies[3]. Acute cardiovascular emergencies such as acute myocardial infarction (AMI), heart failure, malignant arrhythmias, cardiogenic shock and pulmonary embolism are among the most common causes of sudden cardiac arrest[4,5]. Likewise, respiratory emergencies including acute respiratory failure, chronic obstructive pulmonary disease (COPD) exacerbation, severe asthma, pneumonia, acute respiratory distress syndrome (ARDS) and respiratory sepsis frequently progress to cardiopulmonary arrest if not promptly managed. The outcome of CPR depends upon several patient-related and event-related factors. Important predictors include age, sex, pre-existing comorbidities, witnessed arrest, initial cardiac rhythm, duration of CPR, time to initiation of CPR, location of arrest, cause of arrest, mechanical ventilation status and use of defibrillation[6-8]. Shockable rhythms (ventricular fibrillation and pulseless ventricular tachycardia) are consistently associated with better survival compared with non-shockable rhythms such as a systole and pulseless electrical activity. Clinical outcomes after CPR are commonly assessed by return of spontaneous circulation (ROSC), survival to hospital admission, survival to hospital discharge, neurological recovery using the Cerebral Performance Category (CPC) score, duration of intensive care stay and in-hospital mortality[9,10]. Although numerous studies have evaluated CPR outcomes in developed countries, evidence from low- and middle-income countries remains limited where healthcare resources, response systems, post-resuscitation care differ considerably[11]. Identification of predictors associated with successful resuscitation help clinicians improve patient selection, optimize resuscitation strategies, allocate critical care resourcesa and enhance survival outcomes[12,13]. Therefore, this study aimed to determine the predictors of successful CPR and evaluate clinical outcomes among patients presenting with acute cardiovascular and respiratory emergencies.

METHODOLOGY

This study employed a retrospective cross-sectional design and was conducted at Dow university Hospital over a period of 24 months, from January 2024 to December 2025. The study setting included the Emergency Department, Intensive Care Unit, Coronary Care Unit. The study population consisted of adult patients aged 18 years and above who presented with acute cardiovascular or respiratory emergencies and underwent cardiopulmonary resuscitation within the hospital. Patients were eligible for inclusion if they experienced in-hospital cardiopulmonary arrest and required CPR due to acute cardiovascular or respiratory events. A total of 200 patients were enrolled using consecutive sampling until the required sample size was achieved. Data collection was performed by extracting information from hospital medical records using a pre-designed structured proforma. The variables recorded were categorized into demographic, clinical, arrest-related and outcome measures. Demographic data included age, gender and BMI. Clinical variables captured comorbidities such as hypertension, diabetes mellitus, coronary artery disease, chronic kidney disease, COPD and smoking history. Arrest-related parameters included the etiology of arrest, whether the event was witnessed, initial cardiac rhythm, duration of CPR, time to initiation of CPR, performance of defibrillation, requirement for mechanical ventilation and ICU admission. The primary outcome measures assessed were return of spontaneous circulation, survival to ICU

admission, survival to hospital discharge, neurological status at discharge assessed by the Cerebral Performance Category score and in-hospital mortality.

Ethical considerations

The study was approved by the institutional review Board of Dow university of Health sciences

Statistical Analysis

All collected data were entered and analyzed using IBM SPSS Statistics software, Version 22. Continuous variables were summarized and presented as mean ± standard deviation while categorical variables were reported as frequency and percentage.. Independent samples t-test was used to compare means of continuous variables between two groups. For categorical variables, associations were assessed using the Chi-square test and to determine independent predictors of key outcomes, multivariable logistic regression analysis was performed for ROSC and survival to hospital discharge. Variables that were clinically relevant or showed significance in univariate analysis were included in the regression model. A p-value of less than 0.05 was considered to indicate statistical significance for all analyses.

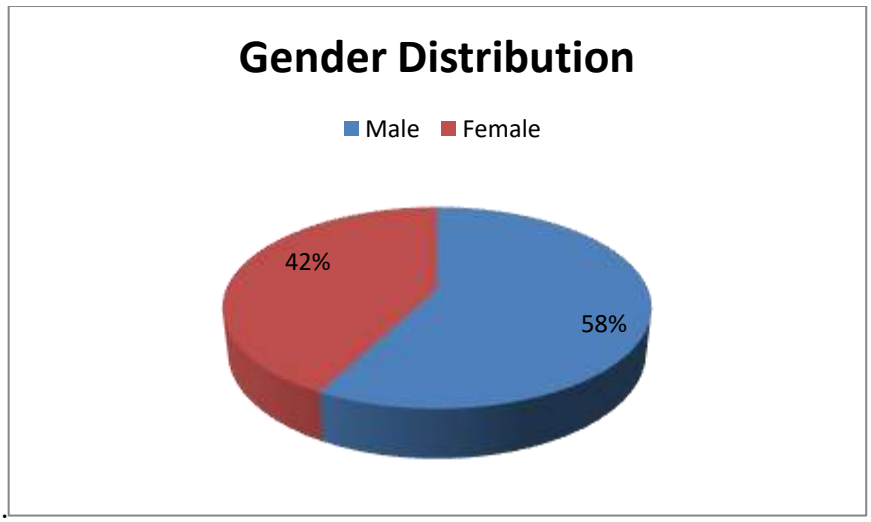
RESULTS

A total of 200 patients who underwent cardiopulmonary resuscitation (CPR) for acute cardiovascular or respiratory emergencies were included in the study. The mean age was 46 ± 14.2 years**,** indicating that most patients were adult. Nearly half of the participants (**44.0%**) belonged to the 41–60 years age group, followed by 34.0% aged 61–80 years, while only 13.0% were younger than 40 years and 9.0% were older than 80 years.

Table 1. Demographic Characteristics of the Study Population (n = 200)

Variable	Frequency (n)	Percentage (%)
Age (Mean ± SD)	**60.9 ± 14.2 years**	—
18–40 years	26	13.0
41–60 years	88	44.0
61–80 years	68	34.0
>80 years	18	9.0

The study population was predominantly male, with 124 (62.0%) males and 76 (38.0%) females, giving a male-to-female ratio of approximately 1.6:1**.** These findings suggested that acute cardiopulmonary emergencies requiring CPR occurred more frequently among adults and male patients.



Hypertension was the most common underlying medical condition, affecting 136 patients (68.0%), followed by diabetes mellitus in 101 patients (50.5%). Coronary artery disease was present in 39.0%, while 29.0% had pre-existing heart failure. Chronic obstructive pulmonary disease (COPD) was identified in 26.5% of patients, and 16.5% had chronic kidney disease. Additionally, 37.0% of participants reported a history of smoking

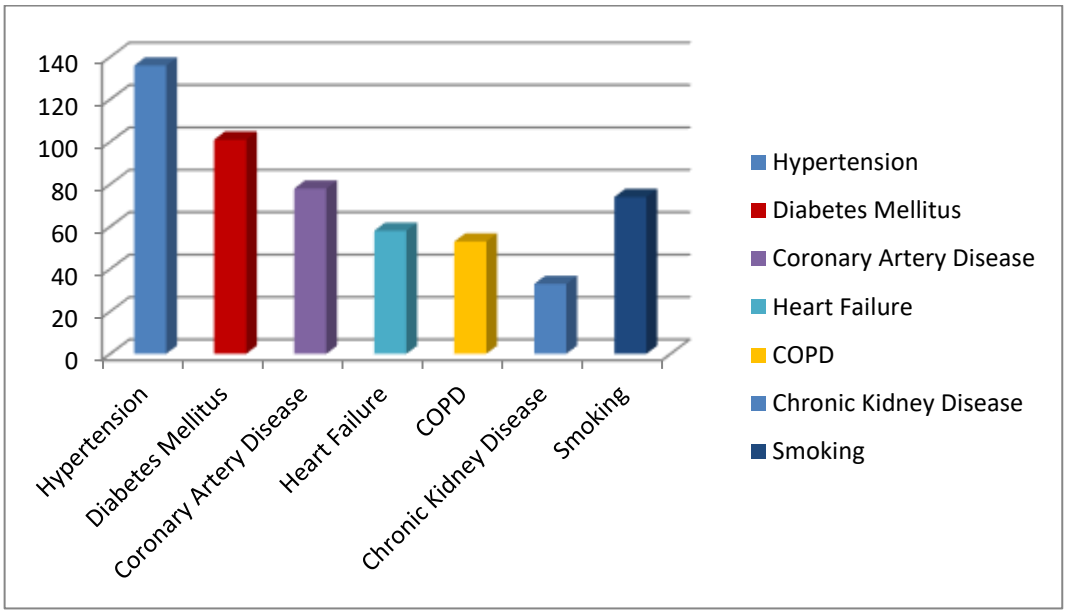


Figure 2 showed the common Medical condition linked with study participants

The high prevalence of cardiovascular risk factors reflect the significant burden of chronic diseases among patients experiencing cardiopulmonary arrest and suggests that multiple comorbidities may contribute to poorer resuscitation outcomes.

Table 2. Primary Diagnosis Leading to Cardiopulmonary Arrest (n = 200)

Cause	Frequency (n)	Percentage (%)
Acute Myocardial Infarction	70	35.0
Heart Failure	36	18.0
Cardiogenic Shock	21	10.5
Cardiac Arrhythmia	19	9.5
Acute Respiratory Failure	26	13.0
Pneumonia/ARDS	18	9.0
Pulmonary Embolism	10	5.0

Acute myocardial infarction (AMI) was the leading cause of cardiopulmonary arrest, accounting for 35.0% of cases. Heart failure was the second most common cause (18.0%), followed by acute respiratory failure (13.0%) and cardiogenic shock (10.5%). Cardiac arrhythmias contributed to 9.5% of arrests, while pneumonia or acute respiratory distress syndrome (ARDS) accounted for 9.0%. Pulmonary embolism was the least frequent etiology, occurring in 5.0% of patients.
Overall, cardiovascular emergencies constituted the majority of arrest events, emphasizing the importance of rapid recognition and management of acute cardiac conditions to prevent progression to cardiac arrest

Table 3. CPR Characteristics (n = 200)

Variable	Frequency (n)	Percentage (%)
Witnessed Arrest	148	74.0

Unwitnessed Arrest	52	26.0
Shockable Rhythm	51	25.5
Non-shockable Rhythm	149	74.5
Defibrillation Performed	48	24.0
Mechanical Ventilation	118	59.0
CPR Duration <20 min	91	45.5
CPR Duration ≥20 min	109	54.5

Most cardiopulmonary arrests (74.0%**)** were witnessed, allowing immediate initiation of CPR. However, only 25.5% of patients presented with a shockable rhythm (ventricular fibrillation or pulseless ventricular tachycardia), whereas 74.5% had non-shockable rhythms (asystole or pulseless electrical activity).Defibrillation was performed in 24.0% of patients, consistent with the proportion presenting with shockable rhythms. Mechanical ventilation was required in 59.0% of patients, reflecting the severity of illness. Slightly more than half of the patients (54.5%**)** required prolonged CPR (≥20 minutes), while 45.5% achieved either ROSC or termination of resuscitation within 20 minutes.

Table 4. Clinical Outcomes after CPR (n = 200)

Outcome	Frequency (n)	Percentage (%)
Return of Spontaneous Circulation (ROSC)	105	52.5
ICU Admission	90	45.0
Survival to Hospital Discharge	53	26.5
Good Neurological Outcome (CPC 1–2)	38	19.0
In-hospital Mortality	147	73.5

Successful return of spontaneous circulation (ROSC) was achieved in 105 patients (52.5%)**.** Following successful resuscitation, 90 patients (45.0%) required admission to the intensive care unit for post-cardiac arrest management. Despite successful initial resuscitation, only 53 patients (26.5%) survived to hospital discharge.

A favorable neurological outcome (CPC grades 1–2) was observed in 38 patients (19.0%)**,** indicating that only a minority survived with good neurological function. Overall, the in-hospital mortality rate remained high at 73.5%**,** highlighting the poor prognosis associated with cardiopulmonary arrest despite modern resuscitation efforts.

Table 5. Multivariable Logistic Regression Analysis for Successful ROSC

Predictor	AOR	95% CI	P-value
Age <60 years	2.15	1.22–3.78	0.008
Witnessed Arrest	3.52	1.95–6.36	<0.001
Shockable Rhythm	4.91	2.58–9.33	<0.001
CPR Duration <20 min	5.24	2.88–9.52	<0.001
Defibrillation	2.74	1.39–5.37	0.003
Acute MI	1.76	1.01–3.06	0.044

Multivariable logistic regression identified several independent predictors of successful ROSC. Patients younger than 60 years had more than twice the odds of achieving ROSC compared with older patients (AOR = 2.15, p = 0.008). Witnessed cardiac arrest was strongly associated with successful resuscitation (AOR = 3.52, $p < 0.001$), emphasizing the importance of early recognition and prompt initiation of CPR.

The strongest predictor was the presence of a shockable rhythm, which increased the likelihood of ROSC nearly five-fold (AOR = 4.91, $p < 0.001$). Similarly, CPR lasting less than 20 minutes

significantly improved the odds of ROSC (AOR = 5.24, $p < 0.001$). Patients who underwent defibrillation also had significantly better outcomes (AOR = 2.74, $p = 0.003$). Acute myocardial infarction was associated with a modest but statistically significant increase in the probability of ROSC (AOR = 1.76, $p = 0.044$).

Table 6. Multivariable Logistic Regression Analysis for Survival to Hospital Discharge

Variable	AOR	95% CI	P-value
Successful ROSC	6.94	3.54–13.61	<0.001
Shockable Rhythm	3.84	1.95–7.55	<0.001
CPR Duration <20 min	4.38	2.19–8.76	<0.001
Age <60 years	2.21	1.12–4.35	0.021
Mechanical Ventilation	0.56	0.31–0.97	0.039

Successful ROSC emerged as the strongest independent predictor of survival to hospital discharge, with patients achieving ROSC having nearly seven times greater odds of survival than those without ROSC (AOR = 6.94, $p < 0.001$). A shockable initial rhythm remained a significant predictor of survival (AOR = 3.84, $p < 0.001$), reinforcing the favorable prognosis associated with ventricular fibrillation and pulseless ventricular tachycardia.

Patients who required less than 20 minutes of CPR were more than four times as likely to survive to discharge (AOR = 4.38, $p < 0.001$), while patients younger than 60 years also demonstrated significantly higher survival rates (AOR = 2.21, $p = 0.021$). In contrast, the need for mechanical ventilation was associated with reduced survival (AOR = 0.56, $p = 0.039$), suggesting that patients requiring ventilatory support had more severe underlying illness and poorer overall prognosis.

Overall**,** these findings indicate that early recognition of arrest, prompt initiation of high-quality CPR, identification of shockable rhythms, timely defibrillation and shorter resuscitation duration are the key determinants of successful resuscitation and improved survival among patients with acute cardiovascular and respiratory emergencies.

DISCUSSION

Cardiopulmonary resuscitation (CPR) is a critical, time-sensitive emergency intervention aimed at maintaining circulation and oxygenation during cardiac arrest until definitive treatment can be provided[14,15]. Cardiac arrest remains one of the leading causes of mortality worldwide and is commonly precipitated by acute cardiovascular and respiratory emergencies such as acute myocardial infarction, heart failure, cardiogenic shock, acute respiratory failure[16]. The immediate initiation of high-quality CPR, coupled with early defibrillation for shockable rhythms and advanced life support significantly influences the likelihood of achieving return of spontaneous circulation (ROSC) and improving survival outcomes.

The present study evaluated the predictors and clinical outcomes of cardiopulmonary resuscitation (CPR) among patients presenting with acute cardiovascular and respiratory emergencies. The findings demonstrated that cardiopulmonary arrest predominantly affected older adults, with a mean age of 46± 14.2 years, and males constituted nearly two-thirds of the study population. This demographic distribution is consistent with the higher prevalence of cardiovascular disease, chronic respiratory illness and associated risk factors among elderly male patients. Age-related physiological decline, the accumulation of comorbidities and reduced cardiopulmonary reserve may contribute to poorer tolerance of cardiac arrest and lower survival rates[17]. Furthermore, the predominance of male patients may reflect the greater burden of ischemic heart disease and smoking-related respiratory disorders reported in men.

Chronic comorbid conditions were highly prevalent among the study participants particularly hypertension , diabetes mellitus , coronary artery disease and heart failure[18,19]. These findings indicated that patients experiencing cardiopulmonary arrest frequently have multiple underlying cardiovascular risk factors that may compromise myocardial function and reduce the effectiveness

of resuscitation. The coexistence of chronic kidney disease, chronic obstructive pulmonary disease (COPD) and smoking history further increases the likelihood of adverse cardiovascular events and poor post-resuscitation recovery[20]. The presence of multiple comorbidities has been consistently associated with increased mortality following cardiac arrest due to impaired physiological reserve and a greater susceptibility to multi-organ dysfunction.

Regarding the etiology of cardiopulmonary arrest, acute myocardial infarction (35.0%) was identified as the leading cause, followed by heart failure (18.0%), acute respiratory failure (13.0%), cardiogenic shock (10.5%) and cardiac arrhythmias (9.5%). These findings emphasize that cardiovascular emergencies remain the principal cause of in-hospital cardiac arrest while severe respiratory disorders also contribute substantially to arrest events[21]. Prompt recognition and early management of acute myocardial infarction, heart failure, and respiratory failure may therefore reduce progression to cardiopulmonary arrest and improve patient outcomes.

The resuscitation characteristics observed in this study further highlight factors influencing CPR success. Nearly three-quarters of cardiac arrests were witnessed, allowing for rapid initiation of resuscitation. However, only one-quarter of patients presented with a shockable rhythm, whereas the majority exhibited non-shockable rhythms such as asystole or pulseless electrical activity, which are generally associated with poorer prognosis. More than half of the patients required prolonged CPR lasting 20 minutes or longer reflecting the severity of illness and complexity of resuscitation efforts. Mechanical ventilation was required in most patients, indicating a high burden of respiratory compromise and critical illness[22].

The clinical outcomes following CPR demonstrated that return of spontaneous circulation (ROSC) was achieved in 52.5% of patients while only 26.5% survived to hospital discharge. Although over half of the patients initially responded to resuscitation, the substantial reduction in survival from ROSC to discharge highlights the challenges associated with post-cardiac arrest syndrome, recurrent cardiovascular instability, neurological injury and multi-organ failure. Furthermore, only 19.0% of patients achieved a favorable neurological outcome, emphasizing that neurological preservation remains a major challenge despite successful restoration of circulation[23,24]. The overall in-hospital mortality rate of 73.5% reflects the severity of acute cardiovascular and respiratory emergencies and underscores the need for comprehensive post-resuscitation care.

Multivariable logistic regression identified several independent predictors of successful ROSC. Younger age, witnessed cardiac arrest, shockable initial rhythm, shorter CPR duration (<20 minutes), defibrillation and acute myocardial infarction were all significantly associated with improved resuscitation success. Among these variables, shorter CPR duration and shockable rhythm demonstrated the strongest associations with ROSC suggesting that rapid recognition of arrest and timely initiation of advanced life support substantially improve the likelihood of restoring spontaneous circulation. Early defibrillation remains particularly important in patients with ventricular fibrillation or pulseless ventricular tachycardia, as prompt electrical therapy significantly enhances survival[25].

Similarly, successful ROSC was identified as the strongest predictor of survival to hospital discharge followed by shockable rhythm, shorter CPR duration and younger age. Conversely, the requirement for mechanical ventilation was independently associated with lower survival, reflecting the greater severity of underlying respiratory and cardiovascular dysfunction in these patients[26]. These findings emphasize that both patient-related factors and event-related characteristics play critical roles in determining short-term survival after cardiopulmonary arrest.

Overall, the present study demonstrates that outcomes following cardiopulmonary resuscitation are influenced by a combination of demographic characteristics, underlying comorbidities, etiology of arrest and resuscitation-related factors[27]. Strategies aimed at early identification of high-risk patients, prompt recognition of cardiac arrest, rapid initiation of high-quality CPR, immediate defibrillation when indicated and optimized post-resuscitation critical care may substantially improve survival outcomes among patients with acute cardiovascular and respiratory emergencies.

These findings also reinforce the importance of multidisciplinary emergency response systems and adherence to current resuscitation guidelines to enhance patient outcomes in hospital settings.

CONCLUSION

This study demonstrated that cardiopulmonary resuscitation in patients with acute cardiovascular and respiratory emergencies achieved a return of spontaneous circulation in approximately half of the patients (52.5%), while 26.3% survived to hospital discharge. Successful ROSC, shockable rhythm, younger age and shorter CPR duration independently predicted survival to hospital discharge, whereas the need for mechanical ventilation was associated with poorer survival. These findings emphasize the importance of early recognition of cardiopulmonary arrest, rapid initiation of high-quality CPR, prompt rhythm assessment, timely defibrillation and effective post-resuscitation critical care**.** Hospitals should continue strengthening emergency response systems, CPR team training and adherence to current resuscitation guidelines to improve patient outcomes. Future prospective multicenter studies with larger sample sizes and long-term neurological follow-up are recommended to validate these predictors and optimize resuscitation strategies across diverse healthcare settings.

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