Section: Emergency Medicine

Original Research Article

STUDY OF FACTORS RELATED TO RESUSCITATION SUCCESS AND PROGNOSIS OF CARDIOPULMONARY ARREST CASES IN EMERGENCY DEPARTMENT

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Abstract

Background: Cardiac arrest is a sudden and unexpected event which may happen anytime and at any location, and thus survival hinges on prompt and proper intervention by trained personnel. Present study was aimed to study factors related to resuscitation success and prognosis of cardiopulmonary arrest cases in emergency department. **Material and Methods:** Present study was single-center, retrospective case-record based study, conducted in patients of age > 18 years, either gender, received cardiopulmonary resuscitation within the emergency department. **Results:** In present study, 350 patients received CPR were considered, among those 44 patients had Return of Spontaneous Circulation (ROSC) (12.75 %). Common diseases noted among patients receiving CPR were acute myocardial infarction (19.42 %), multi organ failure (16.81 %), poisoning (9.28 %), end stage renal disease (7.83 %) & head injury (6.09 %). Factors significantly related with Return of Spontaneous Circulation (ROSC) in present study were Witnessed Arrest (54.55 % ROSC vs 26.38 % unsuccessful CPR), Bystander performed CPR (25 % ROSC vs 31.88 % unsuccessful CPR), Time of arrival of the resuscitation team (1.84 ± 0.85 min vs 2.35 ± 1.43 min), collapse to start CPR < 10 minutes, airway not present before CPR, having no other co-mor¬bidity, no CPR history, First documented pulseless rhythm as non-shockable, & duration of resuscita¬tion <20 min. While age, gender, shift of staff, time spent for intubation, time of the first DC shock, time from arrest to announcing a CPR code was not statistically correlating with ROSC. Conclusion: Witnessed arrest, bystander performed CPR, early arrival of the resuscitation team, collapse to start CPR < 10 minutes, airway not present before CPR, having no other co-mor¬bidity, no CPR history, First documented pulseless rhythm as non-shockable, & duration of resuscita¬tion <20 min.are associated with a good outcome.

INTRODUCTION

Cardiac arrest is a sudden and unexpected event which may happen anytime and at any location, and thus survival hinges on prompt and proper intervention by trained personnel. Despite the reported decline in the mortality associated with cardiovascular diseases over the past three decades due to improvement in diagnosis and treatment, the case fatality rate of sudden cardiac arrest remains unchanged.[1]

Studies showed that patients' underlying diseases, age and gender, time since the onset of cardiac arrest, duration of CPR, existence of trained staff, needed supplies, and an efficient communication system, quality of resuscitation interventions, and an effective organization and leadership affect the outcome of CPR.[2] The number of successful cardiopulmonary resuscitation cases is one of the most important and most noteworthy features of the emergency, for example, the high rate of which confirms the success of the emergency.[3]

Rate of successful CPR has been reported to be as low as 2-6% also in some studies even for in-hospital cardiac arrests.[4] Other studies have reported widely variable successful CPR rates from 13%–59%. Survival to hospital discharge rate is a mere 0.42%.[5] With no regard to the main cause,

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cardiopulmonary arrest, even in successful cases, can cause a wide range of damages to vital organs, including the brain, and even can cause permanent disabilities.[6] Present study was aimed to study factors related to resuscitation success and prognosis of cardiopulmonary arrest cases in emergency department.

MATERIAL AND METHODS

Present study was single-center, retrospective case-record based study, conducted in Department of Emergency Medicine, Vydehi Institute of Medical Sciences and Research Institute, #82, Nallurhalli, Near ITPL bus stop, Whitefield, Bangalore, India. Study duration was of 1 year (January 2022 to December 2022). Study approval was obtained from institutional ethical committee

Inclusion Criteria

- Patients of age > 18 years, either gender, received cardiopulmonary resuscitation within the emergency department

Exclusion criteria

- Patients referred from other hospitals/ had out-of-hospital arrests, now deemed to be non-salvageable or brought dead
- Patients in whom prior consent was taken for "DO NOT RESUSCITATE"
- Patients with incomplete documentary evidence for cardiopulmonary resuscitation in the emergency department.
- Patients discharged against medical advice

As per institutes policy, resuscitation team consisted of 5-6 members at least two of whom are ACLS certified. In the emergency department a register is maintained for all patients undergoing cardiopulmonary resuscitation. Patient characteristics such as age, sex, and previous medical history, Cerebral Performance Categories score (CPC).(8) before cardiac arrest, location of cardiac arrest, bystander witnessed arrest, bystander CPR performed, first documented pulseless rhythm, time interval from collapse/arrival to start of CPR in minutes, CPR duration, time of arrest, initial cause of cardiac arrest and total ampoules of adrenalin used were noted from register.

The initial outcomes of CPR were categorized

- No Return of Spontaneous Circulation (ROSC),
- ROSC for more than or equal to 20 minutes or sustained ROSC.

Patients with sustained ROSC were then followed up and categorised as death in hospital or survival at discharge. Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Statistical analysis was done using descriptive statistics.

RESULTS

In present study, 350 patients received CPR were considered, among those 44 patients had Return of Spontaneous Circulation (ROSC) (12.75 %). Common diseases noted among patients receiving CPR were acute myocardial infarction ± cardiogenic shock (19.42 %), multi organ failure (16.81 %), poisoning (9.28 %), end stage renal disease (7.83 %), head injury (6.09 %), chronic lung disease (4.64 %), polytrauma (4.64 %) & stroke (4.64 %).

Table 1: Survival related to underlying disease

Disease	Number of cases (n=345)	Return of Spontaneous Circulation (ROSC) (n=44)
Acute MI ± cardiogenic shock	67 (19.42 %)	12 (27.27 %)
Multi organ failure	58 (16.81 %)	5 (11.36 %)
Poisoning	32 (9.28 %)	6 (13.64 %)
End stage renal disease	27 (7.83 %)	4 (9.09 %)
Head injury	21 (6.09 %)	3 (6.82 %)
Chronic lung disease	16 (4.64 %)	1 (2.27 %)
Polytrauma	16 (4.64 %)	2 (4.55 %)
Stroke	16 (4.64 %)	3 (6.82 %)
Chronic liver disease	14 (4.06 %)	1 (2.27 %)
Chronic heart disease + cardiomyopathy	13 (3.77 %)	1 (2.27 %)
Sepsis	13 (3.77 %)	2 (4.55 %)
Malignancies	10 (2.9 %)	1 (2.27 %)
Post cardio thoracic surgery	8 (2.32 %)	1 (2.27 %)
Burns	7 (2.03 %)	0
Pulmonary thromboembolism	6 (1.74 %)	0
Others	21 (6.09 %)	2 (4.55 %)

Factors significantly related with Return of Spontaneous Circulation (ROSC) in present study were Witnessed Arrest (54.55 % ROSC vs 26.38 % unsuccessful CPR), Bystander performed CPR (25 % ROSC vs 31.88 % unsuccessful CPR), Time of arrival of the resuscitation team (1.84 ± 0.85 min vs 2.35 ± 1.43 min), collapse to start CPR < 10 minutes, airway not present before CPR, having no other co-morbidity, no CPR history, First documented pulseless rhythm as non-shockable, & duration of resuscitation <20 min. While

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Age, gender, shift of staff, time spent for intubation, time of the first DC shock, time from arrest to announcing a CPR code was not statistically correlating with Return of Spontaneous Circulation (ROSC).

Table 2: Relationship Between Related Factors and Outcome of CPR

Variables Resuscitation	Outcome		P Value
	Return of Spontaneous Circulation (ROSC)	Unsuccessful	
Age (years)	65.14 ± 13.81	68.79 ± 12.15	0.62
Gender			0.13
Male	17 (38.64 %)	188 (54.49 %)	
Female	27 (61.36 %)	157 (45.51 %)	
Shift			0.21
Morning	16 (36.36 %)	115 (33.33 %)	
Evening	18 (40.91 %)	109 (31.59 %)	
Night	9 (20.45 %)	93 (26.96 %)	
Between shifts	1 (2.27 %)	28 (8.12 %)	
Location of cardiac arrest			0.043*
Out-of-Hospital	9 (20.45 %)	144 (41.74 %)	
Witnessed Arrest	24 (54.55 %)	91 (26.38 %)	
Bystander performed CPR	11 (25 %)	110 (31.88 %)	
Time of arrival of the resuscitation team, min	1.84 ± 0.85	2.35 ± 1.43	0.027*
Collapse to start CPR			0.035*
< 10 minutes	38 (86.36 %)	162 (46.96 %)	
≥10 minutes	6 (13.64 %)	183 (53.04 %)	
Airway present before CPR			0.024*
Yes	9 (20.45 %)	129 (37.39 %)	
No	35 (79.55 %)	216 (62.61 %)	
Time spent for intubation, (seconds)	26.83 ± 12.29	28.62 ± 13.55	0.072
Time of the first DC shock (min)	5.23 ± 1.57	8.14 ± 2.18	0.053
Having other co-morbidity			0.02*
Yes	7 (15.91 %)	271 (78.55 %)	
No	37 (84.09 %)	74 (21.45 %)	
Time from arrest to announcing a CPR code, min	0.67 ± 1.61	1.24 ± 1.80	0.283
CPR history			0.012*
Yes	3 (6.82 %)	117 (33.91 %)	
No	41 (93.18 %)	228 (66.09 %)	
First documented pulseless rhythm			0.045*
Non-shockable	29 (65.91 %)	211 (61.16 %)	
Shockable	15 (34.09 %)	134 (38.84 %)	
Duration of resuscitation, min	18.3 ± 9.77	31.26 ± 11.27	0.003*

DISCUSSION

Prognostic factors associated with survival after in-hospital cardiac arrest are an important focus of ongoing research.2 Patients admitted to hospital have increasingly complex conditions and present unique challenges when managing in-hospital cardiac arrest. Clinicians have to rapidly process many factors related to preadmission status (including age, sex, comorbidities) and factors related to the arrest itself (whether the arrest was witnessed or monitored, initial rhythm) to determine the effectiveness of ongoing cardiopulmonary resuscitation.[7]

The outcome of cardiac arrest and cardiopulmonary resuscitation (CPR) is dependent on critical interventions, particularly early defibrillation, effective chest compressions, and assisted ventilation. According to Cooper *et al.*,[8] the survival rate had an inverse relationship with increased age and duration of CPR. The chance of CPR success was lower during night shifts however, and patients' gender and rapid starting of basic life support (BLS) were associated with the outcome of CPR.

Afshin Goodarzi *et al.*,[9] studied 1000 cases of resuscitations, 220 cases (22%) had the return of spontaneous circulation and there was 5.2% survival to discharge (STD). Logistic regression test showed that age < 50 years (P = 0.022), primary rhythm (P = 0.012), resuscitation duration (P = 0.001), post resuscitation Glasgow Coma Scale (GCS) (P = 0.001), and cardiac arrest with witness or under monitoring (P = 0.031) had a significant relationship with patient discharge after resuscitation. Therefore, these indices can be used to predict hospital discharge range after resuscitation. According to Fisher's exact test, only post-resuscitation GCS and resuscitation duration had a significant relationship with CPC level (P < 0.001).

Tekin FC *et al.*,[10] noted that ROSC decreased by 21% with a 1-mg increase in the amount of adrenaline used, by 98% with a 1 mmol/L increase in HCO3 (std) value, by 27% with a 1 mmol/L increase in BE (B) value, and by 15% with a 1 mmol/L increase in lactate value. In terms of short-term survival, we found that a 1 mmol/L increase in

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lactate value reduced the probability of survival by 12%, and a 1 mEq/L increase in K value decreased the probability by 29%. With regard to the probability of survival in the medium term, we determined that the growth in age by 1 year decreased the probability by 4%, and the increase in K value by 1 mEq/L decreased the probability by 35%.

Kaki AM *et al.*,[11] noted mean age of patient was 40 ± 31 years. The immediate survival rate was 64%, 43% at 24 h, and 30% at discharge. The death rate was 70%. Respiratory type of arrest, time and place of arrest, short duration of arrest, witnessed arrest, the use of epinephrine and atropine boluses, and shockable arrhythmias were associated with higher 24‐h survival rates. A low survival rate was found among patients with cardiac types of arrest, and those with a longer duration of arrest, pulseless electrical activity, and asystole. Comorbidities were present in 3786 patients with cardiac arrest and contributed to a poor survival rate ($P < 0.001$).

Pereira ADL *et al.*,[12] studied 41 patients, overall sustained Return of Spontaneous Circulation (ROSC) rate was 56.1% and the survival rate at discharge was 14.63%. Statistically significant factor related to sustained ROSC was younger age of the patient. Those requiring a lesser duration of CPR were found to be more likely to survive. In out-of-hospital cardiac arrests, bystander initiated CPR was not documented in a single case.

In study by Joshi MA,[13] main outcome measures were; (following CPR) return of spontaneous circulation, survival for 24 h, survival from 24 h to 6 weeks or discharge, alive at 1‐year. For survivors, an assessment was made about their cerebral performance and overall performance and accordingly graded. All these data were tabulated. Totally 419 arrests were reported in the hospital, out of which 413 were in‐hospital arrests. Out of this 260 patients were considered for resuscitation, we had about 27 survivors at the end of 1‐year follow‐up (10.38%).

Sedigheh Miranzadeh *et al.*,[14] studied 250 cases of CPR, 238 (95.2%) were unsuccessful and 12 (4.8%) survived to hospital discharge. Only 2.6% of patients who were resuscitated in medical units survived to hospital discharge, whereas this rate was 11.4% in the emergency department. Only 45 (18%) patients were defibrillated during resuscitation; in 11 patients, defibrillation was performed between 15 to 45 minutes after the initiation of CPR. The mean time from initiation of CPR to the first DC shock was 13.93 ± 8.88 minutes. Moreover, the mean duration of CPR was 35.11 ± 11.42 minutes. The survival rate was higher in the morning shift and lower during the time of shift change (9.4% vs. 0). The duration of CPR and speed of arrival of the CPR team were identified as factors that predicted the outcome of CPR.

Sepsis or septic shock, the male gender, acidosis, and asystole rhythm can be determinants of mortality in patients with chronic diseases who undergo CPR. It is necessary for one to test the application of the checklist or data from other hospitals and score the predictive factors to make the determination of the success of CPR easier.[15]

The majority of the out‐of‐hospital cardiac arrest (OHCA) patients did not receive CPR before hospital arrival. Cardiac arrest occurring outside of hospital was significantly associated with lower survival rates which suggest the urgent need for public education to improve knowledge and skills of bystander for prompt response to manage cardiac arrest cases.[16]

The resuscitation team should consists of physicians and clinical staff who are qualified in providing airway and establishing venous access, cardiac chest compression, drug delivery, and the use of defibrillation.[17] Various studies show that the timely and effective presence of the rescuers, including the resuscitation physician as a leader, is essential in increasing the survival rate of the patients and the success of resuscitation.[18,19]

CONCLUSION

The outcome of cardiac arrest and cardiopulmonary resuscitation (CPR) is dependent on critical interventions Witnessed arrest, bystander performed CPR, early arrival of the resuscitation team, collapse to start CPR < 10 minutes, airway not present before CPR, having no other co-morbidity, no CPR history, First documented pulseless rhythm as non-shockable, & duration of resuscitation <20 min.are associated with a good outcome.

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