Original Research Article

Journal of College of Medical Sciences-Nepal, Vol-20, No.3, Jul-Sep 2024
ISSN: 2091-0657 (Print); 2091-0673 (Online) Open Access
DOI: 10.3126/jcmsn.v20i3.70071

Prevalence and Associated Factors Affecting Outcomes of Adult Patients with Cardiac Arrest Who Receive Cardiopulmonary Resuscitation in Emergency Department of a Tertiary Hospital

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ABSTRACT

Background

Cardiopulmonary resuscitation (CPR) aims at restoring spontaneous circulation in a victim of cardiac arrest. This study intends to find out the demographic information of cardiac arrest patients, their outcomes and the possible factors that could affect the outcomes.

Methods

A hospital-based cross-sectional study was conducted at Dhulikhel Hospital to investigate cardiac arrest outcomes among patients aged over 14 years who either presented with or developed cardiac arrest in the Emergency Department. Data were documented and, then entered into Microsoft Excel and analyzed using SPSS. Descriptive statistics were used to summarize categorical and continuous variables, while a Chi-square test ($p < 0.05$) assessed associations between selected variables and CPR outcomes.

Results

The majority of patients were over 65 years old (31.9%), with the smallest group under 25 years (10.1%). Regarding gender distribution 34.8% were female. Trauma was present in 24.6% of cases, while 48.9% were witnessed by bystanders but none of them received CPR. Initial rhythm was predominantly asystole (87%). CPR lasted for 20-40 minutes in 47.8% of cases and over 40 minutes in 14.5%, averaging 24.1 minutes. 40.6% patients had ROSC after CPR while 59.4% had no Return of Spontaneous Circulation (ROSC). Statistically significant associations with CPR outcomes were found for sex, site of cardiac arrest, trauma, witnessed events, CPR duration, and intubation (p-value <0.05).

Conclusions

Our hospital experiences a high prevalence of cardiac arrest and has comparable ROSC rate. Statistically significant variables associated with outcomes of CPR were, sex, site of cardiac arrest, Trauma, Witnessed event, Duration of CPR and Intubation.

Keywords: ROSC; CPR; mortality; IHCA/OHCA; intubation.

INTRODUCTION

Cardiac arrest is defined as the cessation of cardiac mechanical activity and is confirmed by the absence of signs of circulation like absence of a detectable pulse, unresponsiveness and apnea or agonal respirations.[1] Cardiac arrest is a medical emergency in which prompt action can lead to survival of the patient. Basic life support (BLS) is the foundation for saving lives after cardiac arrest. The essential aspects of adult BLS include immediate recognition of cardiac arrest and activation of emergency response system, early cardiopulmonary resuscitation (CPR) and rapid defibrillation with an automated external defibrillator (AED).[2] CPR is a lifesaving intervention

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Article received: 2024-07-25. **Article accepted**: 2024-09-05.

which attempts to restore spontaneous circulation by performing manual chest compressions with or without ventilations and use of drugs or devices.[1,3,4] CPR is inherently inefficient that provides only 10-30% of normal blood flow to the brain even when following guidelines. This stresses the need of trained rescuers to deliver the highest –quality CPR possible.[4] After successful CPR, the patient shows signs of return of spontaneous circulation (ROSC) which include breathing- more than occasional gasp, coughing, body movement, palpable pulse or measurable blood pressure.[1] Cardiac arrest is one of the most lethal public health concerns worldwide.[4,5] Despite huge efforts to improve the management of cardiac arrest, most reports show the survival outcomes are very poor.[1] Globally there are >135 million cardiovascular deaths every year. The incidence of out-of-hospital cardiac arrest (OHCA) worldwide ranges from 20 to 140 per 100,000 people and survival ranges from 2 to 11%.[4] And with respect to in-hospital cardiac arrest (IHCA) and cardiopulmonary resuscitation, the overall incidence is 2.73 events per 1000 admissions[6], and the incidence has been increasing[7], with survival to discharge vary from 7 to 26%.[6] In the United States of America alone, > 500,000 people experience a cardiac arrest and the rate of survival is <15%.[4] Cummins and Graves had reviewed 44 studies regarding survival of patients who developed in-hospital cardiac arrest (IHCA) and received CPR; and the survival rates to hospital discharge were obtained to range from 3% to 27% following in-hospital cardiac arrest.[8] For patients suffering traumatic out-hospital cardiac arrest, the survival rates are reported to be marginal (0 to 2%).[9] The objective of this research is to evaluate various factors that affect the outcomes of patients with cardiac arrest who receive cardiopulmonary resuscitation in Emergency room.

METHODS

A hospital-based cross-sectional study was conducted at Dhulikhel Hospital to investigate outcomes and factors associated with cardiac arrest among adult patients. The study population included all patients aged over 14 years who either presented with cardiac arrest upon arrival at the Emergency Department or developed cardiac arrest during their stay in the emergency department. This study spanned a duration of six months, during which all eligible patients were included, ensuring a comprehensive data set that captured all the cardiac arrest incidents at the hospital. Data collection was carried out using a pre-defined proforma, specifically designed to incorporate key variables aligned with the Utstein Resuscitation Registry—an internationally recognized template endorsed by the American Heart Association (AHA) for the consistent and standardized reporting of cardiac arrest cases worldwide. The registry includes detailed information on patient demographics, circumstances leading up to the cardiac arrest, the administration and timing of cardiopulmonary resuscitation (CPR), the use of medications during resuscitation efforts, and outcomes, such as survival rates, neurological status post-resuscitation, and return of spontaneous circulation (ROSC). By following this standardized approach, the study aimed to ensure that the results were comparable with global data on cardiac arrest, contributing to a broader understanding of resuscitation outcomes in different healthcare settings. The principal investigator, with permission from the hospital administration, gathered data from patient records. Variables collected included detailed demographic data (age, sex, pre-existing conditions), clinical characteristics at the time of the arrest (time of onset, witnessed versus unwitnessed arrest, initial rhythm), interventions performed during CPR (medications administered, timing of interventions, number of CPR providers involved), and the final outcomes. Once the data were collected, they were initially entered into Microsoft Excel for organization. The data set was then imported into SPSS for further statistical analysis. The analysis was divided into two key components: descriptive and inferential statistics. In the descriptive statistics phase, categorical variables (such as patient sex, type of cardiac arrest, medications administered) were summarized using frequency counts and percentages. Continuous variables (such as patient age, duration of CPR) were summarized by calculating the mean

and standard deviation. Graphical tools such as pie charts were used to visually present the distribution of key variables, providing a clear picture of the data. In the inferential statistics phase, the study aimed to explore associations between selected clinico-sociodemographic variables and the overall outcomes of CPR. A Chi-square test was employed to assess the relationship between these variables and outcomes (Survival or mortality in emergency department). p-value < 0.05, was considered statistically significant, indicating a meaningful association between the tested variables and CPR outcomes.

Table 1. Sociodemographic characteristics of the respondents. (n=69)

Variables	Frequency (%)
Age (Years)	
<25	7(10.1)
25-35	9(13.0)
35-45	10(14.5)
45-55	10(14.5)
55-65	11(15.9)
≥65	22(31.9)
Mean+SD = 53.61±8.342 years	
Sex	
Female	24(34.8)
Male	45(65.2)
Off hours	
No	30(43.5)
Yes	39(56.5)
IHC AOHCA	
IHCA	22(31.9)
OHCA	47(68.1)
Trauma	
No	52(75.4)
Yes	17(24.6)
Witnessed	
No	24(51.1)
Yes	23(48.9)
Initial rhythm	
Asystole	60(87)
PEA	4(5.8)
P-VT	2(2.9)
VF	3(4.3)
CPR duration (min)	
<20	26(37.7)
20-40	33(47.8)
>40	10(14.5)
Mean±SD = 24.09±14.097	
Use of drugs	
No	2(2.9)
Yes	67(97.1)
Intubation	
No	27(39.1)
Yes	42(60.9)
Defibrillation	
No	61(88.4)
Yes	8(11.6)
Repetition	
No	13(18.8)
Yes	56(81.2)

RESULTS

Table 1 presents the sociodemographic characteristics of the respondents. The total number of cardiac arrest victims including the study was 69. The majority (31.9%) were over 65 years of age, while the smallest group (10.1%) was under 25 years. The mean age was 53.61±8.34 years. Regarding gender, 34.8% of respondents were female, and 65.2% were male. Of the hospital visits, 56.5% occurred during off hours. 68.1% of cardic arrest cases were out of hospital. Trauma was reported in 24.6% of cases, while 48.9% were witnessed by bystanders but none of them received CPR. In terms of initial rhythm, 87% experienced asystole. The duration of CPR was 20-40 minutes for 47.8% of respondents, and over 40 minutes for 14.5%, with a mean duration of 24.09±14.10 minutes. Medications were used during CPR in 97.1% of cases, while 60.9% required intubation, 11.6% defibrillation, and 81.2% repetition of CPR (Table 1).

Regarding the outcomes of CPR in 59.4% patients there was no ROSC while ROSC occured for one

Table 2. Outcomes of respondents.

Outcomes	Frequency (%)
No ROSC	41(59.4)
ROSC for 15 minutes	2(2.9)
ROSC for 25 minutes	2(2.9)
ROSC for 35 minutes	1(1.4)
ROSC for 40 minutes	1(1.4)
ROSC for 45 minutes	2(2.9)
ROSC for 50 minutes	1(1.4)
Survival	19(27.5)
Outcomes	
No ROSC	41(59.4)
ROSC with in one hour	9(13.1)
Survival	19(27.5)

hour or less in 13.1% cases while in 27.5% patients survived till the exit from emergency room (Table 2).

The pie chart showed the overall outcomes of CPR in patients. This showed that 40.6% patients had ROSC after CPR while 59.4% had no ROSC (Figure 1).

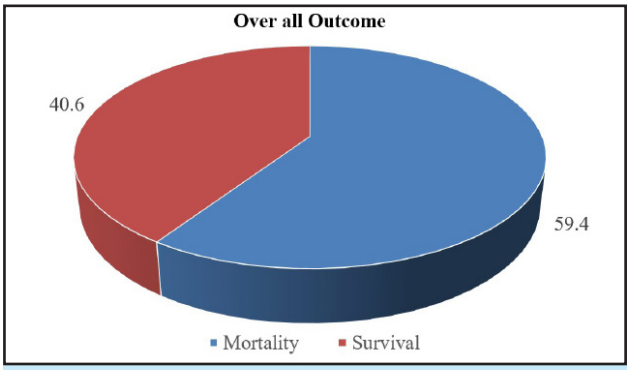

Figure 1. Over all outcomes of CPR.

Table 3 showed the association between overall outcomes of CPR with selected clinicosociodemogrphic variables. This showed that the variables that were statistically significantly associated with outcomes of CPR were sex, IHCA/OHCA, trauma, witnessed event, duration of CPR, intubation (p-value <0.05).

DISCUSSION

We carried out an observational study on the cardiac arrest patients to assess prevalence and outcomes of CPR and the factors associated with the outcomes. The majority (31.9%) were over 65 years of age with mean±SD age was 53.61±8.34 years. Among all the patients in gender, 34.8% were female. Among all hospital visits patients, 56.5% occurred during off hours, 68.1% of cardic arrest cases were out of hospital. Trauma was reported in 24.6% of cases. In terms of initial rhythm, 87% experienced asystole. The duration of CPR was 20-40 minutes with mean±SD as 24.09±14.10 minutes. Medications were used during CPR in 97.1% of cases, while 60.9% needed intubation, 11.6% defibrillation, and 81.2% required repeated CPR. In comparison to existing research 40.6% patients had ROSC after CPR while 59.4% had no ROSC. Study conducted by Ocen D showed that cardiac arrest occurred in 2.3% (190) of the 8,131 hospital admissions. The majority (63.2%) of the cases were unwitnessed, and only 35 patients

Table 3. Association between overall outcomes of CPR with selected clinicosociodemogrphic variables.

Variables	Overall outcomes of CPR		Chi-square	p-value
	Death	Survival		
Age (Years)				
<25	3(42.3)	4(57.1)	3.22	0.937
25-35	6(66.7)	3(33.3)		
35-45	8(80)	2(20)		
45-55	5(50)	5(50)		
55-65	6(54.5)	5(45.5)		
>65	13(59.1)	9(40.9)		
Sex				
Female	10(41.7)	14(58.3)	4.81	0.028
Male	31(68.9)	14(31.1)		
Off hours				
No	17(56.7)	13(43.3)	0.167	0.687
Yes	24(61.5)	15(38.5)		
IHCAOHCA				
IHCA	4(18.2)	18(81.8)	22.77	<0.001
OHCA	37(78.7)	10(21.3)		
Trauma				
No	27(51.9)	25(48.1)	4.92	0.027
Yes	14(82.4)	3(17.6)		
Witnessed				
No	11(45.7)	13(54.3)	5.534	0.019
Yes	16(73.5)	7(26.5)		
Initial Rhythm				
Asystole	38(63.3)	22(36.7)	3.26	0.35
PEA	1(25)	3(75)		
P-VT	1(50)	1(50)		
VF	1(33.3)	2(66.7)		
Duration of CPR				
<20	10(38.5)	16(61.5)	10.23	0.006
20-40	26(78.8)	7(21.2)		
>40	5(50)	5(50)		
Use of drugs				
No	2(100)	0.00%	1.4027	0.236
Yes	39(58.2)	28(41.8)		
Intubation				
No	25(92.6)	2(7.4)	20.24	<0.001
Yes	16(38.1)	26(61.9)		
Defibrillation				
No	38(62.3)	23(37.7)	1.8	0.179
Yes	3(37.5)	5(62.5)		
Repetition				
No	17(70.8)	7(29.2)	1.988	0.159
Yes	24(53.3)	21(46.7)		

(18.4%) received CPR. Out of 468 patients, 128 (27.4%) achieved return of spontaneous circulation (ROSC), and 35 (7.5%) survived to discharge. The average age for ROSC was 52 years and 49 years for survival to discharge. Key predictors for ROSC included age ≤ 49, witnessed arrest, collapse-to-CPR time ≤ 30 minutes, and receiving 1–4 shocks during CPR. Predictors of survival to discharge were age ≤ 52, bystander resuscitation, and initial rhythms of pulseless electrical activity or ventricular fibrillation. [10] Out of 236 patients, 25.8% achieved return of spontaneous circulation (ROSC), 15.7% survived upon admission, and 4.2% were discharged alive. Among 74.1% of witnessed out-of-hospital cardiac arrests (OHCA), only 17.5% received bystander CPR. Factors linked to better outcomes included cardiac arrest in the emergency department (p<0.001), an initial rhythm of ventricular fibrillation (p=0.003), defibrillation (p=0.024) and intravenous adrenaline administration (p=0.001).[11] This research showed that the statistically significant variables associated with outcomes of CPR were, sex, IHCAOHCA, truma, Witnessed, Duration of CPR, Intubation. A study conducted by Sharma et al., in India showed that the return of spontaneous circulation (ROSC) was achieved in 43.82% of events, with 30.85% surviving to discharge. Mortality was strongly associated with prolonged CPR (p < 0.00001). Poorer outcomes were linked to events occurring out of hours (p = 0.0029), ICU admissions (p = 0.03), use of inotropes (p = 0.003), and patients on ventilators (p = 0.0018). Another study showed that among 544 patients, 40.1% achieved return of spontaneous circulation (ROSC) and 5.1% survived to discharge. Ventricular tachycardia/ ventricular fibrillation (VT/VF) was the initial rhythm in 3.9% of cases. One of the factors associated with lower ROSC rates included arrests occurring during the midnight shift (OR 0.403, 95% CI 0.252–0.642). Initial VT/VF rhythms (OR 0.135, 95% CI 0.030–0.601) were linked to higher survival, while patients with a deteriorating disease course had significantly lower hospital survival (OR 3.902, 95% CI 1.619–9.403).[12] Another study among 156 patients showed that 67.3% achieving sustained ROSC after CPR. Of these, 18.0% were discharged alive. Sustained ROSC was more likely in patients experiencing IHCA during the day shift (OR: 4.11) and those with ECG monitoring prior to arrest (OR: 6.38). Higher adrenaline doses and longer CPR duration reduced the odds of sustained ROSC.

CONCLUSIONS

Our hospital experiences a high prevalence of cardiac arrest and has comparable ROSC rate. Sustained ROSC was more likely in daytime cardiac arrest and with prior ECG monitoring (shockable rhythm). Longer CPR durations and repetition of CPR decreased the chances of sustained ROSC. Statistically significant variables associated with outcomes of CPR were, sex, IHCA/OHCA, Trauma, Witnessed event, Duration of CPR and Intubation.

Conflict of interest: None

Funding: None

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Citation: Pradhan A, Shrestha R, Shrestha AP, Basnet S, Shrestha SK. Prevalence and Associated Factors Affecting Outcomes of Adult Patients with Cardiac Arrest Who Receive Cardiopulmonary Resuscitation in Emergency Department of A Tertiary Hospital. JCMS Nepal. 2024; 20(3): 292-97.