ORIGINAL ARTICLE

Association of Return of Spontaneous Circulation with the Duration of Cardiopulmonary Resuscitation in Patients Presenting to the Emergency Department of a Tertiary Care Hospital in Karachi, Pakistan – A Quasi-Experimental Study

Arsalan Mufti[1], Inayat Ali Khan[1], Zille Huma Mustehsan[2*], Nida Khaliq[3], Maria Mufti[4], Iftikhar Ali[5]

ABSTRACT

Objective: To determine the association between the duration of Cardiopulmonary resuscitation and the return of spontaneous circulation in cardiac arrest patients.

Study Design: A retrospective quasi-experimental study.

Place and Duration of Study: It was carried out over a 6-month period on cardiac arrest patients presenting to the Emergency Department from June to December 2020 at Ziauddin University Hospital Karachi, Pakistan.

Methods: A sample of 178 patients was selected through consecutive sampling. The patients were divided into two groups each consisting of 89 participants. The conventional group received cardio-pulmonary resuscitation for 20 minutes, while the interventional group had it for more than 20 minutes.

Results: The mean age was 59.49 years (SD ± 17.2), predominantly males. In the conventional group, 64 patients (36%) experienced recovery with a Return of Spontaneous Circulation, while in the interventional group, this was achieved in 37 patients (20.8%). Overall, among the 176 patients who received Cardio-pulmonary resuscitation, 56.7% (n = 101) achieved a Return of Spontaneous Circulation. Among these 101 patients with a Return of Spontaneous Circulation, the documented average duration of their Cardio-pulmonary resuscitation was approximately 12.17 ± 4.77 minutes, compared to 34.47 ± 7.22 minutes for patients who did not achieve a Return of Spontaneous Circulation ($P < 0.0001$). Similarly, the mean time of Cardio-pulmonary resuscitation initiation was statistically significantly different between the two groups ($P < 0.001$) using the Pearson Chi-Square test.

Conclusion: Increasing the duration of Cardio-pulmonary resuscitation does not benefit patients in terms of resuscitation, recovery, or survival. Cardio-pulmonary resuscitation lasting less than 20 minutes had a higher likelihood of achieving spontaneous circulation recovery compared to that lasting for more than 20 minutes. Initiation of Cardio-pulmonary resuscitation as early as possible had better chances of recovery and survival especially when initiated immediately after cardiac arrest.

Keywords: *Basic Cardiac Life Support, Cardiac Arrest, Cardiopulmonary Resuscitation, Return of Spontaneous Circulation.*

How to cite this: *Mufti A, Khan IA, Mustehsan ZH, Khaliq N, Mufti M, Ali I. Association of Return of Spontaneous Circulation with the Duration of Cardiopulmonary Resuscitation in Patients Presenting to the Emergency Department of a Tertiary Care Hospital in Karachi, Pakistan – A Quasi-Experimental Study. Life and Science. 2024; 5(3): 281-290. doi: http://doi.org/10.37185/LnS.1.1.693*

[1]*Department of Emergency*
Ziauddin Hospital Karachi, Pakistan
[2]*Department of Community Medicine*
NUST School of Health Sciences Islamabad, Pakistan
[3]*Department of Community Medicine*
Akhter Saeed Medical College Rawalpindi, Pakistan
[4]*Department of Physiology*
Federal Medical College Islamabad, Pakistan
[5]*Department of Research & Development*
University of Swabi, Pakistan

Introduction

Cardiopulmonary Resuscitation (CPR) represents a critical medical emergency technique in modern medicine.[1] In the aftermath of a cardiac arrest, immediate CPR significantly enhances the likelihood of survival by doubling or even tripling the chances. Sustaining blood flow, even if only partially, plays a crucial role in increasing the probability of a

Correspondence:
Dr. Zille Huma Mustehsan
Associate Professor, Community Medicine
NUST School of Health Sciences Islamabad, Pakistan
E-mail: zhmustehsan@gmail.com
Received: April 17, 2024; Revised: June 07, 2024
Accepted: June 18, 2024

successful resuscitation.[2] This temporary intervention is vital for keeping the brain oxygenated in patients experiencing cardiac arrest, showcasing a fascinating evolution with the goal of decreasing the arrest-to-treatment interval.[2,3]

Cardiovascular diseases stand as the leading cause of death worldwide. Sudden cardiac arrests (SCA) and sudden cardiac deaths (SCD) are believed to account for a substantial proportion of cardiovascular-related deaths.[4] Out-of-hospital SCA, with a fatality rate exceeding 90%, is a common cause of death.[5] However, this percentage is greatly dependent on the definition of these events. The survival of the patient depends mainly on how early treatment is initiated, and the duration of resuscitation efforts is a crucial indicator of vitality.[6,7]

The American Heart Association (AHA) estimates that the survival rate for cardiac arrest is approximately 50% when Cardio-pulmonary resuscitation is carried out during the initial 3–5 minutes.[8] However, the survival rate drops by 7–10% for every minute defibrillation is delayed.[9] Even with advancements in CPR techniques since Kouwenhoven introduced chest compressions in 1960, the survival rate has not changed significantly. Cerebral ischemia begins within 4 minutes following cardiac arrest, and delaying CPR for more than 6 minutes results in a decline in the brain's capacity to restore cerebral ATP, leading to decreased cerebral blood flow.[10,11] Physicians often struggle to determine the relevant interval of resuscitation and when to cease efforts. Large-scale international research programs, such as the National Cardiac Arrest Audit (NCAA) in the UK and Trauma Register DGU® in Germany, aim to collect authentic data to address this conundrum. However, standard protocols remain inadequate to accurately explain this argument.[12,13]

Numerous studies report survival rates ranging from 7-26% following “in-hospital cardiac resuscitation”.[14] Cooper et al. conducted a ten-year review of inpatient cardiac resuscitation and observed that although the initial survival rate was 38.6% immediately after CPR, it significantly declined to 24.7% at 24 hours, 15.9% at discharge, and 11.3% at 12 months.[15] Comparable findings were reported by other researchers as well.[16,17]

Elements impacting post-cardio-pulmonary resuscitation survival after “In Hospital Cardiac resuscitation” include advancing age, gender, time of CPR initiation, general health, underlying conditions, quality of Cardiopulmonary resuscitation, presence of skilled healthcare staff, and efficient communication. Studies indicate a negative correlation between Cardio-pulmonary resuscitation outcomes and length of time, with better outcomes observed in younger patients, witnessed arrests, and prompt CPR initiation.[8] The end result of cardiac arrest relies on the timely initiation of effective CPR, critical interventions like early defibrillation, effective chest compressions, and advanced life support. Features such as witnessed cardiac arrest, bystander CPR, and shockable initial cardiac rhythm are positive indicators for a successful outcome when resuscitated up to 47 minutes.[18]

Literature supports a strong affiliation between the duration of CPR and Return of Spontaneous Circulation (ROSC), showing a significant rise in survival when the time limit of established CPR exceeds 30 minutes. Prolonged CPR in resuscitation rooms, with a mean duration of 25 minutes increases the tendency to achieve ROSC and survival to discharge.[19] However, opinions differ regarding the advantage of implementing prolonged CPR, with some studies suggesting a drop in survival rates after 10 minutes.[8,20] Cessation of efforts based on a traditional time limit for resuscitation can result in the loss of subjects with ultimately favorable neurological outcomes.

This study aimed to assess the association of ROSC with the duration of CPR in patients presenting to the emergency department, providing data to support the development of future resuscitation algorithms and guidelines at national and international levels. As we contemplate the optimal duration of CPR, it is crucial to acknowledge its association with oxygen-deprived brain injury and low survival outcomes.

Presently, there are no specific guidelines on when to discontinue CPR, emphasizing the need for individualized decisions based on the patient's condition and comorbidities. This study encourages a reevaluation of the limits of CPR, fostering a nuanced understanding of its duration in diverse clinical scenarios.

Methods

This is a quasi-experimental study which has a retrospective design. It was carried out for six months on patients presenting with cardiac arrest (CA) in the Emergency Department of Ziauddin University Hospital Karachi, Pakistan from June 2020 to December 2020. Ethical approval was obtained from the Research and Ethics Committee of Ziauddin University, Karachi on dated: 05th May 2020 vide letter no: 1920220AMEM and informed consent was sought from the patients' families.

The sample size was calculated using open EPI, considering previously reported survival rates of CPR < 30 minutes at 27.4% and ≥ 30 minutes at 9.9%, with 80% power, a 95% confidence interval, and a 5% level of significance.[21] A total of 176 participants (88 in each group) were included in the study. Patients of both genders aged ≥18 years presenting to the Emergency Department (ED) with cardiac arrest and willing to provide consent were included in the study via consecutive sampling. Those with out-of-hospital cardiac arrest (CA) presenting in the ED after 20 minutes of CA and terminally ill patients, e.g., with advanced metastatic cancer, end-stage disease that cannot be cured or adequately treated, or progressive shock, were excluded. Patients' family members provided detailed medical histories, including age, location of cardiac arrest (CA) (either in the Emergency Department (ED) or out-of-hospital (OHCA), and past medical history, including smoking, diabetes mellitus (DM), hypertension (HTN), ischemic heart disease (IHD), and trauma. Each patient's electrocardiogram (ECG) was checked to determine if they had ventricular fibrillation (VF), ventricular tachycardia (VT), pulseless electrical activity (PEA), or asystole as their initial rhythm.

An Advanced Cardiovascular Life Support (ACLS)-certified emergency physician treated each patient for cardiac arrest with high-quality cardiopulmonary resuscitation (CPR) following the American Heart Association (AHA) guidelines.[22] The CPR method involved 30:2 chest compressions (pushing strong and rapidly at 100/min with minimal breaks), administering oxygen, attaching an ECG, and examining the rhythm. If the rhythm was not shockable, CPR was continued for 2 minutes.

Epinephrine 1 mg IV injections were given every 3–5 minutes, and 8–10 breaths per minute were administered with constant compressions. If the rhythm was shockable, such as VT/VF, defibrillation with 120 J–200 J biphasic (or 360 J monophasic) was performed, followed by another 2 minutes of CPR. Intravenous injection of 1 mg epinephrine was repeated every 3–5 minutes. Consideration was given to using an advanced airway (endotracheal tube, supra-glottic airway) and ventilating at a rate of 8–10 breaths per minute while maintaining continuous compressions.

If VF/VT persisted, the rhythm was checked every 2 minutes, and CPR was continued for the next 2 minutes after defibrillation. After the third cycle, an intravenous injection of amiodarone, 300 mg (with the option to repeat once with 150 mg in 5 minutes), was administered, and reversible causes were investigated. Patients in the study were categorized into two groups based on the duration of CPR they received:

Conventional Group: In this group, cardiac arrest (CA) patients were treated according to the standard hospital protocol, involving CPR for at least 20 minutes as per the Advanced Cardiovascular Life Support (ACLS) guidelines. The decision to discontinue CPR in this group was made by an ACLS-certified emergency physician.

Interventional Group: In this group, CA patients were subjected to the standard hospital protocol with an extended duration of CPR, specifically CPR lasting more than 20 minutes and up to 45 minutes, in accordance with the ACLS guidelines. This extension was applied if Return of Spontaneous Circulation (ROSC) was not achieved within the initial 20 minutes of CPR. CPR was administered to cardiac arrest patients who met the inclusion criteria, and the following criteria determined group assignment: If ROSC was achieved within the first 20 minutes of CPR; the patient was placed in the conventional group. If ROSC was not achieved within the first 20 minutes of CPR, the patient was placed in the interventional group, and CPR was continued for up to 45 minutes. The decision to cease CPR at a specified time was made by the team leader, an ACLS-certified physician in the emergency department. Individual subjects were not isolated for varying durations of CPR during the research. Following CPR, outcomes in both groups were observed, and the results were recorded in the attached proforma.

Data Analysis

Data analysis was conducted using SPSS version 22®. Descriptive statistics mean and standard deviation for numerical data and frequency and percentages were calculated for categorical data. Associations between categorical variables were determined using a Pearson Chi-square test or Fischer exact test where appropriate while mean differences were computed using student independent t-test with significance level 2-sided set at <0.05.

Results

The mean age of the study population was 59.49 (SD ± 17.2) years, ranging from 26 to 92 years. Further stratification into groups revealed that the majority, 73 (41%), fell in the 49 to 68 years age range, followed by 48 (27%) in the 18 to 48 years range. More than half, 91 (51.1%) of the patients were male. The mean time to initiate CPR following cardiac arrest was 7.29 (SD ± 7.1) minutes, and the average duration of Cardio-pulmonary resuscitation given was 30.2 (SD ± 37.1) minutes.

Most patients experienced cardiac arrest in the emergency department (ED) 91 (51.1%), while 57 (48.9%) were brought to the emergency with cardiac arrest that occurred outside the hospital (OHCA). Of the total, 35 (19.7%) patients had a history of smoking, while the remaining 143(80.3%) were non-smokers. Similarly, 72 (40.4%) were diabetic, and 146 (82%) were hypertensive. Those with a history of ischemic heart disease (IHD) numbered 72 (40.4%). The incidence of trauma due to falls at the time of cardiac arrest was 6 (3.4%).

ECG performed for all patients presenting with cardiac arrest showed that 101 (56.7%) had asystole, 38 (21.3%) had a pulseless electrical rhythm, 33 (18.5%) had ventricular tachycardia, and 6 (3.4%) had ventricular fibrillation. Out of the total 178, 101 (56.7%) patients recovered and were labeled as having ROSC (recovery of spontaneous circulation), while 77 (44.3%) did not recover and were declared dead as shown in Figure.1.

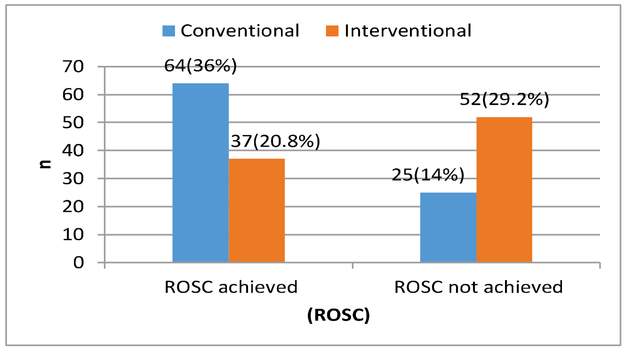

Fig.1: Comparison between conventional and interventional groups for Return of Spontaneous Circulation (ROSC)

Table-1 presents the background characteristics of the study participants, categorized by intervention types (Conventional and Interventional). The distribution across age groups showed a relatively balanced representation in both groups and no difference between the groups was observed (*P* =0.714). Similar results were observed for gender (*P* =0.764). About the location of cardiac events, a slightly higher proportion of interventional cases occurred in the Out-of-Hospital setting compared to the Conventional one, though the difference is not statistically significant (*P* = 0.134). The frequency of smoking is described, showing no significant difference between both groups (*P* = 0.451). The distribution of participants with and without DM and IHD was found to be comparable between both groups (*P* = 0.647). However, a significant difference is observed in the distribution of hypertension between the two groups (*P* = 0.003), with a higher proportion in the Conventional group. The ECG patterns indicated no significant differences in the distribution of ventricular fibrillation (VF), ventricular tachycardia (VT), pulseless electrical activity (PEA), and asystole between Conventional and Interventional groups. The outcomes show a statistically significant difference in ROSC between the Conventional and Interventional groups (*P*=0.001), with a higher proportion of participants achieving ROSC in the Conventional group.

Table-2 presents a cross-tabulation of background

Table-1: Association between characteristics of study participants and the return of spontaneous circulation (ROSC)

Variable	Statistic	n (%)
Age (years)	Mean age 59.49 (SD ± 17.20)	178 (100)
Time of CPR (minutes)	Mean Time 7.29 (SD±7.10)	178 (100)
Duration of CPR (minutes)	Mean duration 30.2 (SD±37.10)	178 (100)
Age group (years)	18 to 48 Years	48 (27)
	49 to 68 Years	73 (41)
	69 to 88 Years	53 (29.8)
	>89 Years	4 (2.2)
Gender	Male	91 (51.1)
	Female	87 (48.9)
Location	Out-of-hospital cardiac arrest (OHSC)	87 (48.9)
	Emergency Department	91 (51.1)
Smoking	Yes	35 (19.7)
	No	143 (80.3)
Diabetes Mellitus(DM)	Yes	72 (40.4)
	No	106 (59.6)
Hypertension (HTN)	Yes	146 (80)
	No	32 (18)
Ischemic heart disease (IHD)	Yes	72 (40.4)
	No	106 (59.6)
ECG Pattern	Ventricular fibrillation (VF)	6 (3.4)
	Ventricular tachycardia (VT)	33 (18.5)
	Pulseless electrical activity (PEA)	38 (21.3)
	A-Systole	101 (56.7)
Trauma	Yes	6 (3.4)
	No	172 (96.6)
Recovery of spontaneous circulation (ROSC)	Yes	101 (56.7)
	No	77 (43.3)

SD: Standard deviation; ECG: Electrocardiogram

characteristics with the Recovery of Spontaneous Circulation (ROSC) and Table-3 presents the factors associated with the Recovery of Spontaneous Circulation. Patients aged 18 to 48 years exhibited a significantly higher ROSC rate of 33 (18.5%) compared to other age groups, and the association between age group and ROSC was statistically significant (P = 0.001). No significant difference was observed in ROSC rates between male and female patients. Patients who experienced cardiac arrest outside the hospital (OHSC) showed similar ROSC rates compared to those in the emergency department (ED). Similarly, comparable ROSC rates were observed between smokers and non-smokers. On the other hand, patients with diabetes mellitus (DM) had a significantly higher ROSC rate compared to those without diabetes (P = 0.001). No significant difference in ROSC rates was observed between patients with and without hypertension, while those with ischemic heart disease (IHD) had a significantly lower ROSC rate compared to those without IHD. No significant differences in ROSC rates were observed among different electrocardiogram (ECG) patterns (*P* = 0.187). Mean differences were calculated for time intervals, including the duration from collapse to the initiation of CPR, and the time of CPR administered following the cardiac arrest. Both variables, mean time of CPR initiation and duration of CPR were statistically significantly different between the two groups (*P*<0.0001) by using the Pearson Chi-square test.

Table-2: Comparison between the conventional and interventional groups

Variable		**Groups**		
		Conventional n (%)	**Interventional n (%)**	***P*-value**
Age group (years)	18 to 48 Years	22 (12.4)	26 (14.6)	0.714
	49 to 68 Years	37 (20.8)	36 (20.2)	
	69 to 88 Years	27 (15.2)	26 (14.6)	
	>89 Years	3 (1.6)	1 (0.6)	
Gender	Male	44 (24.7)	45 (25.3)	0.764
	Female	47 (26.4)	42 (23.6)	
Location	OHSC	38 (21.3)	49 (28.7)	0.134
	ED	51 (27.5)	40 (22.5)	
Smoking	Yes	20 (11.2)	15 (8.4)	0.451
	No	69 (38.8)	74 (41.6)	
DM	Yes	38 (21.3)	34 (19.1)	0.647
	No	51 (28.7)	55 (30.9)	
HTN	Yes	81 (45.5)	65 (36.5)	0.003
	No	8 (4.5)	24 (13.5)	
IHD	Yes	37 (20.8)	35 (19.70)	0.879
	No	52 (29.2)	54 (30.3)	
ECG Pattern	VF	2 (1.1)	4 (2.2)	0.853
	VT	16 (9)	17 (9.6)	
	PEA	19 (10.7)	19 (10.7)	
	A-Systole	52 (29.2)	49 (27.5)	
Trauma	Yes	2 (2.2)	4 (4.4)	0.406
	No	87 (97.7)	85 (95.5)	
ROSC	Yes	64 (36)	37 (20.8)	0.001
	No	25 (14)	52 (29.2)	
Time of CPR initiation (Mean± SD)		5.51±6.09	09±7.61	0.001
Duration of CPR (Mean± SD)		13.63±4.3	46.87±5.2	0.001

Discussion

There is a dearth of research studies on patients with cardiac arrest, and very few, if any, have been permitted in the institutional setup. This study was proposed to explore the impact of CPR duration on the ROSC in cardiac arrest patients. Cardiac arrest is described by an abrupt cessation of breathing and cardiac function. If not treated immediately, insufficient blood supply to the brain and other organs can lead to a person losing consciousness or even death. The act of sustaining blood flow, even if only partially, plays a crucial role in increasing the probability of successful resuscitation.[23] This study examined 176 records of patients who underwent CPR in the emergency department. In this study more than half of the patients were male.

The mean age of the patients was 59.49 (SD ± 17.2) years. The mean time to initiate CPR following cardiac arrest was 7.29 (SD ± 7.1) minutes, and the average duration of CPR given was 30.2 (SD ± 37.1) minutes. Most patients experienced cardiac arrest in the emergency department (51.1%), while 48.9%

Table-3: Factors associated with Recovery of Spontaneous Circulation (ROSC)

Variable		Return Of Spontaneous Circulation (ROSC) Achieved n (%)	Not achieved n (%)	*P*-value
Age group (years)	18 to 48 Years	33 (18.5)	15 (8.4)	0.001[b]
	49 to 68 Years	50 (28.1)	23 (12.9)	
	69 to 88 Years	18 (10.1)	35 (19.7)	
	>89 Years	0 (0)	04 (2.2)	
Gender	Male	47 (26.4)	44 (24.70)	0.176[a]
	Female	54 (30.3)	33 (18.5)	
Location	OHSC	43 (24.2)	44 (24.7)	0.619[a]
	ED	58 (32.6)	33 (18.5)	
Smoking	Yes	20 (11.2)	15 (8.4)	1.000[a]
	No	81 (45.5)	62 (34.8)	
DM	Yes	52 (29.2)	20 (11.2)	0.001[a]
	No	49 (27.5)	57 (32)	
HTN	Yes	82 (46.1)	64 (36)	0.845[a]
	No	19 (10.7)	13 (7.3)	
IHD	Yes	34 (19.1)	38 (21.3)	0.045[a]
	No	67 (37.6)	39 (21.6)	
ECG Pattern	VF	5 (2.8)	1 (0.6)	0.187[b]
	VT	20 (11.2)	13 (7.3)	
	PEA	25 (14)	13 (7.3)	
	A-Systole	51 (28.7)	50 (28.1)	
Trauma	Yes	3 (1.6)	3 (1.6)	0.734[b]
	No	98 (55.0)	74 (41.5)	
Time of CPR initiation (Mean+ SD)		4.36±1.13	9.30±1.67	<0.0001[a]
Duration of CPR (Mean+ SD)		12.17±4.77	34.47±7.22	<0.0001[a]

[a]*Fischer's exact test,* [b]*Pearson Chi-square test*

were brought to the emergency with cardiac arrest that occurred outside the hospital (OHCA). Of the total, 35 (19.7%) patients had a history of smoking, while the remaining 143 (80.3%) were non-smokers. Similarly, 72 (40.4%) were diabetic, and 82% were hypertensive. Those with a history of ischemic heart disease (IHD) numbered 72 (40.4%).

The incidence of trauma due to falls at the time of cardiac arrest was 3.4%. Of the total, 82% were hypertensive. Those with a history of ischemic heart disease (IHD) numbered 72 (40.4%). In this study, patients were divided into two groups. The conventional group comprised patients who achieved ROSC within the first 20 minutes of CPR. If ROSC was not achieved within the initial 20 minutes, the patient was categorized into the interventional group, where CPR was continued for up to 45 minutes. Based on the cross-tabulation analysis of background characteristics, ROSC, and mean differences in the duration from collapse to the initiation of CPR, as well as the time of CPR provided between the conventional and interventional groups, hypertension significantly differed between the two groups. Elevated blood pressure harms arteries, leading to potential blockages that hinder blood supply to the heart muscle. In a broad sense, pre-arrest comorbidity has been linked to decreased survival and inferior neurological outcomes. Nevertheless, discrepancies among individual studies pose challenges for direct comparisons. Despite the variability in study methodologies and reported results, there seems to be a consistent association indicating that pre-arrest comorbidity generally correlates with lower survival rates and worse neurological outcomes after out-of-hospital cardiac arrest (OHCA).[24,25]

Considering the methodological design of this study and patients' allocation into two groups, the ROSC, and mean differences in the duration from collapse to the initiation of CPR, as well as the time of CPR, provided between the conventional and interventional groups, were significantly different. One of the key predictive elements concerning CPR outcomes is the duration and timing of administered CPR. The success rate of CPR is associated with the conditions surrounding cardiopulmonary arrest, such as whether it occurs in a hospital or outside, whether it is witnessed or not and similar factors, moreover, trained personnel offering basic life support, and there whether there is access to expert medical assistance. In contrast to cardiac arrests that occur outside of a hospital setting, the period between the collapse and the commencement of CPR is typically briefer for in-hospital cases.[26]

Our study demonstrated a more favorable ROSC rate (56.7%) as compared to a study conducted in Malaysia, where the ROSC rate was reported as 30.2%.[27] A research conducted by Goldberger et al. observed that out of more than sixty-four thousand persons experiencing cardiac arrest within a hospital setting, the return of spontaneous circulation in approximately half of the patients, took place with an average time of around 12 minutes. Another study also showed ROSC achievement in about half of its participants.[28] In our own study, the mean duration of CPR was 30.2 (SD±37.10) minutes. However, there are various prognostic factors that influence the attainment of ROSC and the overall outcome of CPR.[8]

We also examined the background characteristics of patients who experienced successful Return of Spontaneous Circulation (ROSC) compared to those who did not. Age and diabetes were identified as factors associated with ROSC status. The mean duration of CPR in patients who achieved ROSC was 12.17±4.77 minutes, while in patients who did not achieve ROSC, the mean CPR duration was 34.47±7.22 minutes. This suggests that the most favorable outcomes with CPR were typically observed in the first 15 minutes, and CPR lasting more than 30 minutes usually resulted in a poorer outcome. Our findings align reasonably well with the studies mentioned earlier.[16,29] Generally, most studies indicate that longer CPR durations are associated with poorer outcomes. Our study aligns with this observed trend.

Analyzing survival rates at various time intervals after achieving ROSC is crucial. Studying the impact of CPR duration on survival is challenging due to numerous confounding factors and variations among patients.[30] Many participants in our study had multiple existing health conditions, and we overlooked the abrupt shifts in patients' health conditions preceding their cardiac arrest. It is important to note the noteworthy limitations of our study, including its retrospective design and sample variation. We did not perform post-stratification analysis to examine the duration effect under different conditions, and there are uncertainties regarding the measured time intervals. A significant limitation is the disparity in the onset of CPR between the two groups which may have impacted the outcomes. Additionally, since this study is conducted at a single center, caution should be exercised in generalizing the results to broader populations. Further prospective studies with a larger sample size are needed to validate our findings.

Conclusion

In the present analysis, we have determined that prolonging the duration of CPR does not yield significant benefits for patients in terms of resuscitation, recovery, or survival. Notably, CPR administered for less than 20 minutes showed a higher likelihood of achieving spontaneous circulation recovery compared to CPR lasting more than 20 minutes. Additionally, initiating CPR at the earliest possible moment emerged as a secondary key factor, proving more advantageous for patients. The chances of recovery and survival were notably better when CPR commenced immediately after the occurrence of cardiac arrest. The optimal duration of resuscitation should be determined at the bedside, taking into account the complete clinical context. Moreover, more comprehensive studies are necessary to explore and achieve improved outcomes.

Acknowledgment: None

Conflict of Interest: The authors declare no conflict of interest

Grant Support and Financial Disclosure: None

REFERENCES

1. Hinkelbein J, Kerkhoff S, Adler C, Ahlbäck A, Braunecker S, Burgard D, et al. Cardiopulmonary resuscitation (CPR) during spaceflight-a guideline for CPR in microgravity from the German Society of Aerospace Medicine (DGLRM) and the European Society of Aerospace Medicine Space Medicine Group (ESAM-SMG). Scandinavian journal of trauma, resuscitation and emergency medicine. 2020; 28: 108. doi: 10.1186/s13049-020-00793-y
2. Berg DD, Bobrow BJ, Berg RA. Key components of a community response to out-of-hospital cardiac arrest. Nature Reviews Cardiology. 2019; 16: 407-16. doi: 10.1038/s41569-019-0175-4
3. Medicherla CB, Lewis A. The critically ill brain after cardiac arrest. Annals of the New York Academy of Sciences. 2022; 1507: 12-22. doi: 10.1111/nyas.14423
4. Pan H, Hibino M, Kobeissi E, Aune D. Blood pressure, hypertension and the risk of sudden cardiac death: a systematic review and meta-analysis of cohort studies. European journal of epidemiology. 2020; 35: 443-54. doi: 10.1007/s10654-019-00593-4
5. Reinier K, Rusinaru C, Chugh SS. Race, ethnicity, and the risk of sudden death. Trends in cardiovascular medicine. 2019; 29: 120-6. doi: 10.1016/j.tcm.2018.07.001
6. Amacher SA, Bohren C, Blatter R, Becker C, Beck K, Mueller J, et al. Long-term survival after out-of-hospital cardiac arrest: A systematic review and meta-analysis. Jama cardiology. 2022; 7: 633-43. doi: 10.1001/jamacardio.2022.0795
7. Koivunen M, Tynkkynen J, Oksala N, Eskola M, Hernesniemi J. Incidence of sudden cardiac arrest and sudden cardiac death after unstable angina pectoris and myocardial infarction. American Heart Journal. 2023; 257: 9-19. doi: 10.1016/j.ahj.2022.11.009
8. Cheema MA, Ullah W, Abdullah HMA, Haq S, Ahmad A, Balaratna A. Duration of in-hospital cardiopulmonary resuscitation and its effect on survival. Indian heart journal. 2019; 71: 314-9. doi: 10.1016/j.ihj.2019.09.002
9. Bircher NG, Chan PS, Xu Y, American Heart Association. Delays in cardiopulmonary resuscitation, defibrillation, and epinephrine administration all decrease survival in in-hospital cardiac arrest. Anesthesiology. 2019; 130: 414-22. doi: 10.1097/ALN.0000000000002563
10. Daniele SG, Trummer G, Hossmann KA, Vrselja Z, Benk C, Gobeske KT, et al. Brain vulnerability and viability after ischaemia. Nature Reviews Neuroscience. 2021; 22: 553-72. doi: 10.1038/s41583-021-00488-y
11. Kohlhauer M, Panel M, Des Roches MV, Faucher E, Daou YAZ, Boissady E, et al. Brain and myocardial mitochondria follow different patterns of dysfunction after cardiac arrest. Shock. 2021; 56: 857-64. doi: 10.1097/SHK. 000000000 0001793
12. Seewald S, Wnent J, Gräsner JT, Tjelmeland I, Fischer M, Bohn A, et al. Survival after traumatic cardiac arrest is possible—a comparison of German patient-registries. BMC emergency medicine. 2022; 22: 158. doi: 10.1186/s12873-022-00714-5
13. Merchant RM, Topjian AA, Panchal AR, Cheng A, Aziz K, Berg KM, et al. Part 1: executive summary: 2020 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation. 2020; 142: S337-57. doi: 10.1161/CIR.0000000000000918
14. Girotra S, Nallamothu BK, Tang Y, Chan PS, Investigators AHAGWTGR. Association of hospital-level acute resuscitation and postresuscitation survival with overall risk-standardized survival to discharge for in-hospital cardiac arrest. JAMA Network Open. 2020; 3: e2010403. doi: 10.1001/jamanetworkopen.2020.10403
15. Cooper S, Janghorbani M, Cooper G. A decade of in-hospital resuscitation: outcomes and prediction of survival? Resuscitation. 2006; 68: 231-7. doi: 10.1016/j.resuscitation. 2005.06.012
16. Miranzadeh S, Adib-Hajbaghery M, Hosseinpour N. A prospective study of survival after in-hospital cardiopulmonary resuscitation and its related factors. Trauma monthly. 2016; 21: e31796. doi: 10.5812/ traumamon.31796
17. Andersen LW, Holmberg MJ, Løfgren B, Kirkegaard H, Granfeldt A. Adult in-hospital cardiac arrest in Denmark. Resuscitation. 2019; 140: 31-6. doi: 10.1016/j.resuscitation. 2019.04.046
18. Olasveengen TM, Mancini ME, Perkins GD, Avis S, Brooks S, Castrén M, et al. Adult basic life support: 2020 international consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommendations. Circulation. 2020; 142: S41-91. doi: 10. 1161/CIR.0000000000000892
19. Raza A, Arslan A, Ali Z, Patel R. How long should we run the code? Survival analysis based on location and duration of cardiopulmonary resuscitation (CPR) after in-hospital cardiac arrest. Journal of community hospital internal medicine perspectives. 2021; 11: 206-11. doi: 10.1080/

20009666.2021.1877396
20. Riva G, Ringh M, Jonsson M, Svensson L, Herlitz J, Claesson A, et al. Survival in out-of-hospital cardiac arrest after standard cardiopulmonary resuscitation or chest compressions only before arrival of emergency medical services: nationwide study during three guideline periods. Circulation. 2019; 139: 2600-9. doi: 10.1161/ CIRCULATIONAHA.118.038179
21. Debaty G, Lamhaut L, Aubert R, Nicol M, Sanchez C, Chavanon O, et al. Prognostic value of signs of life throughout cardiopulmonary resuscitation for refractory out-of-hospital cardiac arrest. Resuscitation. 2021; 162: 163-70. doi: 10.1016/j.resuscitation.2021.02.022
22. Panchal AR, Bartos JA, Cabañas JG, Donnino MW, Drennan IR, Hirsch KG, et al. Part 3: adult basic and advanced life support: 2020 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation. 2020; 142: S366-468. doi: 10.1161/CIR.0000000000000916
23. Neth MR, Idris A, McMullan J, Benoit JL, Daya MR. A review of ventilation in adult out-of-hospital cardiac arrest. Journal of the American College of Emergency Physicians Open. 2020; 1: 190-201. doi: 10.1002/emp2.12065
24. Majewski D, Ball S, Finn J. Systematic review of the relationship between comorbidity and out-of-hospital cardiac arrest outcomes. BMJ open. 2019; 9: e031655. doi: 10.1136/bmjopen-2019-031655
25. Hannen LEM, Toprak B, Weimann J, Mahmoodi B, Fluschnik N, Schrage B, et al. Clinical characteristics, causes and predictors of outcomes in patients with in-hospital cardiac arrest: results from the SURVIVE-ARREST study. Clinical Research in Cardiology. 2023; 112: 258-69. doi: 10.1007/s00392-022-02084-1
26. Hayashi T, Matsushima M, Bito S, Kanazawa N, Inoue N, Luthe SK, et al. Predictors associated with survival among elderly in-patients who receive cardiopulmonary resuscitation in Japan: an observational cohort study. Journal of general internal medicine. 2019; 34: 206-10. doi: 10.1007/s11606-018-4747-5
27. Embong H, Isa SAM, Harunarashid H, Abd Samat AH. Factors associated with prolonged cardiopulmonary resuscitation attempts in out-of-hospital cardiac arrest patients presenting to the emergency department. Australasian emergency care. 2021; 24: 84-8. doi: 10.1016/j.auec. 2020.08.001
28. L Lang DS. Covariates of Return of Spontaneous Circulation (ROSC) in Adults. University of San Diego; 2019. Available at https://www.proquest.com/openview/f85b5bad72b99bd 1268d6d3cfd6505ed/1?pq-origsite=gscholar& cbl=18750 &diss=y
29. Rohlin O, Taeri T, Netzereab S, Ullemark E, Djärv T. Duration of CPR and impact on 30-day survival after ROSC for in-hospital cardiac arrest - A Swedish cohort study. Resuscitation. 2018; 132: 1-5. doi: 10.1016/j.resuscitation. 2018.08.017
30. Twohig CJ, Singer B, Grier G, Finney SJ. A systematic literature review and meta-analysis of the effectiveness of extracorporeal-CPR versus conventional-CPR for adult patients in cardiac arrest. Journal of the Intensive Care Society. 2019; 20: 347-57. doi: 10.1177/ 1751143719832 162

Authors Contribution

AM: Idea conception, study designing, data collection, data analysis, results and interpretation, manuscript writing and proofreading
IAK: Idea conception, study designing, data collection, data analysis, results and interpretation
ZHM: Study designing, data analysis, results and interpretation, manuscript writing and proofreading
NK: Data collection, data analysis, results and interpretation
MM: Data collection, data analysis, results and interpretation
AM: Data collection