



Outcomes of Patients with Cardiac Arrest in the Emergency Department at Shar Teaching Hospital, Sulaimaniyah, Iraq

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Abstract

Background and objectives: Cardiac arrest is a major cause of mortality and morbidity worldwide. Thus, we aimed to investigate the outcomes of patients with cardiac arrest in the Emergency Department at Shar Teaching Hospital, Sulaimaniyah, Iraq.

Methods: In this cross-sectional study, 200 patients with cardiac arrest were enrolled from January 1st, 2022, to January 1st, 2023 Shar Teaching Hospital, Emergency department, in Sulaimaniyah, Iraq. The patients' sociodemographic and clinical data were collected, including the arrest location, type of arrhythmia, and result (return of spontaneous circulation or death).

Results: The main cause of admission as a cardiac arrest was medical (88.5%), surgical (6.0%), and trauma (5.5%). Most patients (56.5%) were in-hospital cardiovascular arrest, the common type of rhythm was asystole (73%), and 7.5% of patients were returned to spontaneous circulation by cardiopulmonary resuscitation. The in-hospital cardiac arrest significantly ($p=0.05$) had a better outcome than out-hospital cardiovascular arrest, as 10.6% was the return of spontaneous circulation by cardiopulmonary resuscitation, and 89.4% was dead. The type of rhythm during cardiac arrest was highly significantly ($p<0.001$) associated with the outcome of cardiopulmonary resuscitation. Ventricular tachycardia (100%) and ventricular fibrillation (62.5%) had a good return of spontaneous circulation, while pulseless electrical activity and Asystole rhythm had a low return of spontaneous circulation (8.1% and 0.7%, respectively).

Conclusions: In-hospital cardiac arrest had a preferable outcome than out-hospital as its survival rate is higher, and ventricular tachycardia/ventricular fibrillation had a high return of spontaneous circulation by cardiopulmonary resuscitation.

Keywords: Arrhythmia, Cardiac arrest, Cardiopulmonary resuscitation, Medical emergency, Patient outcome

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Introduction

Cardiac arrest (CA) is an abrupt cessation of the heart's mechanical activity that results in insufficient blood flow, as seen by the absenteeism of a palpable central pulse, apnea, loss of blood pressure, and spontaneous breathing.¹ The prevention of mortality related to sudden CA is primarily dependent on life-saving interventions.² The management of a CA requires activating the emergency response system, performing cardiopulmonary resuscitation (CPR), and using an external defibrillator to shock the heart.³ Until a definitive intervention can be initiated, vital organs can be given a boost in blood flow using CPR, which involves chest compressions and maintaining an airway. Return of spontaneous circulation (ROSC) is attained if the procedure is carried out effectively. For an average adult, rescuers should manually compress the chest to a depth of at least 2 inches and at a rate of 100-120/min by rescuers.^{4,5} Return of the pulse and maintenance of it for >20 min are considered to be ROSC. Good outcomes are not always reached after CPR. In >30% of patients receiving CPR, normal blood flow is likely to be restored.⁶ National CA databases have reported rates of in-hospital cardiac arrest (IHCA) to be 1.2-10 per 1000 admissions, while the UK National Cardiac Arrest Audit, from 2011-2021, documents an incidence of 1-1.6 per 1000 admissions.⁷ Most CA patients in a hospital are treated in the emergency department (ED), whether they are IHCA occurring outside of the hospital or severely ill patients brought to the ED who are arrested while receiving initial care there. Many variables affect how CPR is done in the ED, including the age and gender of the patient, as well as several clinical and CPR-specific traits, including the etiology of the CA, the initial rhythm recorded after the arrest, the clinical environment, the response time, and the length of CPR.^{8,9} One or more links in the chain of survival are necessary to

enhance CA outcomes.¹⁰ Early access is the first link, which prioritizes asking for help as soon as possible for individuals at risk of CA and those with CA signs. The second link emphasizes how crucial it is for a bystander to start CPR as soon as possible, as it can raise the chance of surviving CA by a factor of 2-4.¹¹ The third link is early defibrillation, which has high survival rates (50-70%) when administered during the first 3-5 minutes.¹² With a high mortality rate, out-of-hospital cardiac arrest (OHCA), which is the stoppage of cardiac activity that takes place outside of a hospital setting, is a predominant cause of global death.¹³ The reported range for OHCA survival in high-income nations is 4.3-11%.¹⁴ About <50% of patients who are first positively resuscitated survive to leave the hospital with an initial success rate of 25%.¹⁵ Shockable rhythms, including ventricular fibrillation (VF), pulseless ventricular tachycardia (VT), and non-shockable rhythms, like asystole and pulseless electrical activity (PEA), can occur during CA. How OHCA patients are managed depends on the CA rhythm during resuscitation which is unsteady and alters naturally or as a result of treatments like defibrillations and chest compressions.^{16, 17} Around 1/3 of the survivors, despite advancements in CPR, were those without ROSC in the prehospital setting. Thus, many OHCA cases are taken to the ED with no prehospital ROSC.¹⁸ So this study aims to find outcomes of OHCA and IHCA patients with CA with the efficiency and skillfulness of the EM team about the outcome of prehospital CA.

Patients and methods

In this cross-sectional study, 200 cases with CA (cessation of cardiac mechanical activity, confirmed by the absence of signs of circulation) were enrolled from 1st July 2022 to 1st July 2023 at Shar Teaching Hospital using a convenience sampling method. Shar Teaching Hospital is a tertiary Teaching



hospital situated in Sulaymaniyah province of Iraq. It was established in 2014 and it includes all the specialties of medical and surgical departments. It has a total of 400 ward beds and 50 emergency department beds. Patients who had an OHCA (cessation of cardiac mechanical activity, confirmed by the absence of signs of circulation and that which occurs prior to presentation to the hospital) and IHCA (cessation of cardiac mechanical activity, confirmed by the absence of signs of circulation *in persons who occupied a hospital bed*) aged >14 years were enrolled; however, patients who had already died (ex-rigor mortis) were excluded. A standard, validated questionnaire was used to collect patients' sociodemographic data (age, gender, and residency) and clinical data, including the cause of CA which was categorized into 3: 1) medical causes (referring to diseases), 2) surgical causes (referring to intraoperative or postoperative cardiac arrest), 3) traumatic causes (referring to patients presenting after a trauma i.e., motor vehicle accident, fall from height... etc), the location of arrest (OHCA or IHCA), type of arrhythmia (VT, VF, PEA, or Asystole), and result (ROSC or dead). Rhythm detection was done by ECG of defibrillators upon presentation for OHCA patients and at the time of collapse for IHCA patients. The outcome of the patients was determined 40 minutes to 1 hour after starting CPR. Regaining and maintaining spontaneous circulation for at least 12 hours was regarded as survival.

This study was approved by the ethical committee of the Kurdistan Higher Council for Medical Specialties (KHCMS) and Shar Teaching Hospital, Sulaimaniyah, Iraq. Patient consent was not obtained because the study was done in the Emergency Department. Statistical Package for Social Science (SPSS, USA, version 25), including Chi-square, was used to determine the correlation between variables. A p-value was

set as highly significant ($p \leq 0.001$), significant ($p \leq 0.05$), very highly significant ($p \leq 0.000$), and non-significant ($p \geq 0.05$).

Results

The mean age of studied patients was 63.93 ± 18.23 years (14 to 90 years). Most patients (36.5%) aged 60-75 years, followed by >75 years (34.5%), then 40-59 years (19.5%) and <40 years (10%). Most patients were females (52%), and 48% were males. The majority's residency was urban (70%), and 30% was rural. The most predominant cause of admission as a CA was medical (88.5%), followed by surgical (6.0%), and then trauma (5.5%). Most patients (56.5%) were IHCA, and 43.5% were OHCA, as presented in Table (1).

Table (1): Sociodemographic variables of the patients with cardiac arrest.

Variable	Number	%
Age (Years)		
<40	20	10.0
40-59	39	19.5
60-75	72	36.0
>75	69	34.5
Gender		
Female	104	52.0
Male	96	48.0
Residency		
Urban	140	70.0
Rural	60	30.0
Cause of admission		
Medical	177	88.5
Surgical	12	6.0
Trauma	11	5.5
Location of CA		
In-hospital cardiac arrest	113	56.5
Out-of-hospital cardiac arrest	87	43.5

In respect of the type of rhythm during CA, the majority was asystole (73%), then PEA (18.5%), followed by VF (8.0%), and then VT (0.5%). Only 7.5% of patients were ROSC by CPR, and the rest (92.5%) died, as shown in Table (2).



Table (2): Clinical features of the patients with cardiac arrest (CA).

Variable	Number	%
Type of rhythm during CA		
Asystole	146	73.0
Pulseless electrical activity	37	18.5
Ventricular fibrillation	16	8.0
Ventricular tachycardia	1.0	0.5
Outcome of cardiopulmonary resuscitation		
Return of spontaneous circulation	15	7.5
Dead	185	92.5

Results revealed that IHCA had better outcomes than OHCA since 10.6% were ROSC by CPR, and 89.4% were dead. In contrast, only 3.4% of the OHCA were ROSC, and 96.6% were dead. The difference between the outcomes of CPR and CA location was significant ($p=0.05$), as seen in Table (3).

Table (3): Comparison between the location of cardiac arrest and the outcome of CPR.

Arrest location	Number	Outcome of cardiopulmonary resuscitation Number (%)		p-value
		Return of spontaneous circulation	Dead	
In hospital cardiac arrest	113	12 (10.6)	101 (89.4)	0.05*
Out-of-hospital cardiac arrest	87	3.0 (3.4)	84 (96.6)	
Total	200	15 (7.5)	185 (92.5)	

*: Significant difference

Moreover, in this study, the type of rhythm during CA was highly significantly ($p<0.001$) associated with the outcome of CPR. Also, VT (100%) and VF (62.5%) had good ROSC. On the other hand, PEA and Asystole rhythm had low ROSC levels (8.1%

and 0.7%, respectively), as exhibited in Table (4).

Table (4): Comparison between the type of rhythm during cardiac arrest and the outcome of cardiopulmonary resuscitation.

Type of rhythm	Number	Outcome of cardiopulmonary resuscitation Number (%)		p-value
		Return of spontaneous circulation	Dead	
Asystole	146	1.0 (0.7)	145 (99.3)	<0.001 **
Pulseless electrical activity	37	3.0 (8.1)	34 (91.9)	
Ventricular fibrillation	16	10 (62.5)	6.0 (37.5)	
Ventricular tachycardia	1.0	1.0 (100.0)	0.0 (0.0)	
Total	200	15 (7.5)	185 (92.5)	

**: Highly significant difference

Discussion

Emergency medical services (EMS) response time is one of the prehospital aspects related to the survival rate of patients, especially OHCA, and shorter EMS response time can increase the survival rate.¹⁹ Additionally, knowledge, skill, responsiveness, and performance of the CA team in the EM department are crucial in the outcome, especially for IHCA. However, revised CPR recommendations should be raised, including more requirements for personal protective equipment (PPE) during CPR and isolation rooms when necessary.²⁰ So, this study is designed to compare some variables of CA cases in the EM department regarding their location of arrest (OHCA/IHCA), type of arrhythmia (VT, VF, PEA, or asystole), and outcome (ROSC/dead). To our knowledge, this is the first research to describe the patients' responses to CPR and ROCS in IHCA and OHCH in Iraq. Thus, the mean age of patients was 63.93 ± 18.23 years and most of them (36.5%) were aged 60-75 years, which means that aged people are more



vulnerable to CA, although CA was also reported among young people. This outcome agreed with other global data that found the mean age of CA patients was 67.1 ± 15.3 , 71.2 ± 14.6 , 62.4 ± 15.6 , and 66 years (median age).¹⁹⁻²² Interestingly, it was stated that age was not a good interpreter of findings and that progressive age is related to IHCA outcomes.²² On the other hand, most of the patients in this study were females (52%) and from urban areas (70%). This outcome does not agree with another study that mentioned that the prevalence of males with CA was predominant. In this regard, Chien et al. reported 70.4%, Huang et al. found 72.3%, Tsai et al. identified 78%, and Lee et al. saw 65.8%.^{19,21,23,24} These variations might be related to sample size, environmental conditions, genetic factors, and lifestyle. In this manner, Ng et al. found that females who predominantly received CPR significantly less frequently had ROSC at the scene or in the EM department with less survival-to-admission and discharge rates.²⁵ The leading causes of admission as a CA were medical (88.5%), surgical (6.0%), and trauma (5.5%). In this respect, Bergum et al. found that cardiac causes (60%) were the main factor in IHCA.²⁶ Also, it was found that IHCA patients had a substantial survival rate if the EM team recognized the causes of arrest.²⁷ On the other hand, pre-arrest co-existing is usually related to unpleasant OHCA results.²⁸ Furthermore, most patients (56.5%) were IHCA, and they had significantly ($p=0.05$) better outcomes than OHCA patients, as 10.6% were ROSC by CPR and 89.4% were dead. These outcomes are in agreement with other studies that have worked on CA cases of any cause.^{29,30} On the contrary, Rusnak et al. showed that cardiogenic shock cases with IHCA had significantly more mortality at 30 days than OHCA cases. This is mainly related to the fact that IHCA cases had higher shockable rhythms (71.7%), shorter time to ROSC (10 vs 15 minutes), and less

commonly received targeted temperature management (12.8%) than OHCA cases.³¹ Moreover, Andersen et al. found that most patients had a CA at home (68%) and a non-shockable initial rhythm (77%).²² These variations might be caused by the study design, which included solely CA patients in the ED or outpatient clinic, whereas IHCAs in the ICU were not included in the study. Missing monitoring in the general ward and the outpatient clinic is a risk factor for worse outcomes in IHCA.³² Moreover, the common type of rhythm was asystole (73%), and the minor cause was VT (0.5%). In this regard, Nordseth et al. presented CA rhythms were found to be PEA (60%), followed by VF/VT (24%), and then asystole (16%).³³ Whereas Bergum et al. stated that the initial cardiac rhythm was PEA (48%), followed by asystole (23%), and then combined VF/VT (27%) and survived to hospital discharge was 25%.²⁶ Similarly, Lee et al. showed that asystole (60.8%) was the common cause, then VT/tachycardia (20.8%) and PEA (18.3%) with 11.2% survival to discharge.¹⁹ However, another study on OHCA patients found that rearrests were more common among patients with initial VF/VT, and 38.4% had prehospital ROSC.³⁴ Additionally, Our finding is also in agreement with Meaney et al.'s study, where they reported Asystole (39%) as the most common first detected rhythm followed by PEA (37%), VF (17%) and lastly VT (7%).³⁵ Most people who experience CA do not survive. At the same time, among survivors, there is a risk of neurologic dysfunction, brain injury, disorders of consciousness, neurocognitive deficits, changes in quality of life, as well as physical and psychological well-being. In this study, we found that only 7.5% of patients were ROSC by CPR (10.6% in IHCA and 3.4% in OHCA), and the rest died. Another study mentioned that 30.6% of the included patients had sustained ROSC, and 9.6% survived hospital discharge.²² The



overall survival of patients is differentially affected by the components of the chain of survival. Consequently, in the current study, the type of rhythm during CA was highly significantly ($p < 0.001$) associated with the outcome of CPR as VT (100%) and VF (62.5%) had good ROSC. In comparison, PEA and asystole rhythm had low ROSC (8.1% and 0.7%, respectively). Several earlier researches have evaluated the connections between OHCA patients' treatment results and alterations in their CA rhythms.^{33,36} According to Skogvoll et al. patients with CA who had VFs or VTs were more unstable than those who experienced PEAs or asystole, and they tended to reach sustained ROSC later than those who experienced PEAs or asystole.¹⁷ Increased PEA to ROSC rates, as demonstrated by Nordseth et al. may increase CA patients' overall survival rates.³³ Additionally, an increase in survival rate has been demonstrated in hospitals working with strategic improvements in the "chain of survival".²⁶

Conclusions

In the Sulaimaniyah population, age, gender, and residency are linked to the incidence of cardiac arrest (CA), primarily caused by medical conditions. In-hospital cardiac arrests (IHCA) had better outcomes than out-of-hospital cardiac arrests (OHCA), with higher survival and lower mortality rates. The type of heart rhythm during CA influenced outcomes, with VT/VF showing high ROSC rates from CPR, though lower than some other countries.

Limitations:

Study limitations included lack of data regarding the past medical history of the patients, missing CPR time and ROSC duration, and the lack of analysis on CPR witness, and long-term outcomes. Accurate clinical outcomes were not fully evaluated.

Conflicts of interest: There is no conflict of interest.

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