Predictors and outcome of in-Hospital Cardiac Arrest Patients in Emergency Department Suez Canal University Hospitals

Abstract

Background: In-hospital cardiac arrest (IHCA) is defined as cessation of cardiac activity, confirmed by the absence of signs of circulation, in a hospitalized patient who had a pulse at the time of admission. The aim of the present study was to record the definitive predictors of in-hospital cardiac arrest, focusing on the relation between cause and outcome as well as the influence of location on survival. **Patients and methods:** This prospective observational study (cross sectional) was carried out in Emergency Department at Suez Canal University Hospital and included 223 patients experiencing In-hospital cardiac arrest at the Emergency Department (ED) ~~at Suez Canal University Hospital~~. **Results:** Our study showed ROSC rate of 27.4%, which is lower than those reported in other studies from the region. In our study, we found that the overall mean duration for CPR was 21 min (SD ± 10).We found that Pulse, RR, BP, Witnessed and ALS interventions at time of event were significant positive predictors to ROSC with patients while age, MEWS, Interval between collapse to start CPR and CPR duration were negative predictors to cognitive impairment with diabetic patients. **Conclusions**: IHCA can be predicted using different variable related to patients vital data, laboratories, radiological investigations and patient demographic data which helps in predicting and modifying the outcome in limited situations.

Keywords: cardiac arrest, mortality prediction

Aim or Purpose **:[1V]Comment**

IHCA **:[2V]Comment**

Subjects **:[3V]Comment**

IHCA **:[4V]Comment**

Return of spontaneous circulation (ROSC) **:[5V]Comment**

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INTRODUCTION:

In-hospital cardiac arrest (IHCA) is defined as cessation of cardiac activity, confirmed by the absence of signs of circulation, in a hospitalized patient who had a pulse at the time of admission.[1]

Despite the wide availability of detailed comprehensive cardiopulmonary resuscitation (CPR) guidelines as well as regular training programs prepared by different national and international societies, the reported rates of survival to discharge (STD) in different studies of in hospital cardiac arrest (IHCA) are low.[2-4]

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Two studies found that the quality of different in-hospital CPR parameters such as the chest compression depth and rate, did not conform with published guidelines even when performed by well-trained hospital staff.[5, 6] In another study, the location of patient in a critical care area, an initial shockable rhythm, and length of resuscitation were independently associated with STD.[7]

No single factor predicted any of those short-term outcomes. They were actually associated with multiple factors – including age, sex, race, ethnicity, preexisting conditions, event interval and duration to perform CPR, type of arrhythmia, hospital location, early defibrillation, and post resuscitation care.[8-12]

The consequences of CPR among survivors with prolonged hypoxemia are related to functional and cognitive decline, resulting in burdens on caregivers and reduced quality of life[8].

Lower rates of survival to discharge may result from the use of CPR in patients for whom it was not originally intended, such as the very elderly with multiple illnesses or the terminally ill.[13, 14, 15]

Many arrests are preceded by clinical deterioration that is either unrecognized or not managed effectively.[16]

Despite systematic research on the etiology and its influence on outcomes after cardiac arrest (CA) and the recommendations to prevent CA by recognizing clinical deterioration in sick patients, the incidence of IHCA has remained largely unchanged.[21-27]However, an increase in survival has been demonstrated in hospitals working with strategic improvements in the “chain-of-survival” (COS).[17,18]

Improvements of the cardiac arrest (CA) chain of survival(COS) have contributed to increased survival in many regions: early recognition of CA, immediate and good quality cardiopulmonary resuscitation (CPR), early defibrillation in cases of pulseless and shockable cardiac arrhythmias, and proper care of immediate survivors.[13, 19-23] The aim of the study was to improve the management process of IHCA in-hospital cardiac arrest by predictions of their outcome and understanding the causes at the emergency departmentED of Suez Canal university hospital.

PATIENTS and METHODS:

This prospective observational study (cross sectional) was carried out in ED Emergency Department at Suez Canal University Hospital and included 223 patients experiencing IHCAIn-hospital cardiac arrest at the Emergency Department (ED) at Suez Canal University Hospital.

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Inclusion criteria:

Both sexes. , Both both medical and traumatic causes of cardiac arrest. , Patients patients arrested after successful resuscitation by more than 2 hours. and IHCA In-hospital cardiac arrest patients attending the emergency departmentED.

Exclusion criteria:

Pediatric patients<12 year old. , IHCAIn-hospital cardiac arrest occurring outside the emergency department. , Patients patients arrested outside the hospital and unwitnessed arrest. , Patients patients transferred from other hospitals after any surgical intervention. and/or Patients patients discharge on his demand, transferred to other hospitals or –escaped.

Experienced cardiac arrest and CPR done in emergency room was prospectively screened for inclusion in the study. Vital signs, clinical history, physical examination.

Data was collected in pre-organized data sheet by the researcher from patients fulfilling inclusion criteria. Patient was clinically assessed and managed as per the ABC protocol, after stabilizing the patient, questionnaire was filled by the researcher of the patient with cardiac arrest and CPR attempted.

Event Variables:

1. Immediate precipitating cause: lethal arrhythmia, myocardial ischemia/infarction, hypotension, respiratory depression, metabolic, other, or unknown. The immediate trigger may be uncertain.
2. Patient monitoring: yes or no
3. Resuscitation attempt: yes or no
4. Initial rhythm: Ventricular Tachycardia/Fibrillation (VT/VF), Pulseless Electrical Activity (PEA), A Systole, Brady arrhythmia.
5. Pre-arrest lab results: Arterial Blood Gases (ABG), Serum Lactate level, serum potassium level, Cardiac enzymes.
6. In case of traumatic arrest: initial radiological investigations as chest X-ray, pelvi-abdominal ultrasound and CT brain in case of head trauma.

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Fate at Emergency Room: Fate of the patient will be recorded whether:

1- Arrested despite attempts of resuscitation.
2- Return of spontaneous circulation but patients is comatose (GCS<3).
3- ~~Return of spontaneous circulation (~~ROSC~~)~~ and with good conscious level (GCS>8).
4- Arrested again after return of ~~spontaneous circulation (~~ROSC~~)~~.

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Criteria of DNR:

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- **Physiologically futile CPR**: CPR should not be performed when it would be physiologically futile; that is, when it would not work. CPR is not designed for use in patients whose medical condition makes resuscitation and mechanical ventilation ineffective.

- **Non- therapeutic CPR**: CPR is also not designed for use in patients for whom CPR is not therapeutic – that is, those patients in whom CPR cannot reverse the on-going dying process or will not provide therapeutic benefits that outweigh the harms or substantial burdens of CPR (“non-therapeutic CPR”). –By way of example, cardiopulmonary arrest is an expected terminal occurrence in patients with certain diseases or conditions who are nearing the end of their life span. In such cases, CPR may temporarily restore cardiac function but the patient’s overall condition will worsen and cardiopulmonary arrest will occur again as a natural and inevitable part of the dying process.

- Patient has a medical condition which can reasonably be expected to result in the imminent death.

- Patient is in a non-cognitive stare with no reasonable possibility of regaining cognitive functions.
- A person for whom cardiopulmonary resuscitation would be medically futile in that such resuscitation would likely be unsuccessful in restoring cardiac and respiratory function OR will only restore cardiac and respiratory function for a brief period of time so that the patient will likely experience repeated need for cardiopulmonary resuscitation over a short period of time OR that such resuscitation would be otherwise ~~futil~~futile.

Statistical analysis

Data was collected and coded then entered as a spread sheets using Microsoft excel for windows office 2010. Data analysis using Statistical Package of Social Science (SPSS) software program version 10.0 for analysis. Data was presented as tables and graphs; we used t-test to compare between quantitative data expressed as mean and standard deviation. Chi-square test was e used to compare between the qualitative data expressed as number and percent. P value is considered as significant when $p < 0.05$

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Results:

Table 1: Etiological causes among patients and their Triage levels (n=223).

Causes (n; % of total)	Triage				First Seen In	
	1	**2**	**3**	**4**	Resus Room	**Triage Room**
Trauma (20; 9%)	16	3	1	0	16	**4**
Cardiovascular (89; 40%)	60	10	10	9	60	**29**
Cancer (other than pulmonary and hepatic) (28; 13%)	18	8	2	0	18	**10**
Pulmonology (33; 14.8%)	22	11	0	0	22	**11**
Hepatic (37; 17%)	20	14	3	0	20	**17**
Kidney disease (10; 4.5%)	6	4	0	0	6	**4**
Toxicology (4; 1.8%)	2	2	0	0	2	**2**
Others (not diagnosed) (2; 0.9%)	2	0	0	0	2	**0**

Table 1 showed, 40% of patients presented due to CVDs, 17% due to hepatic causes, 14.8% due to pulmonary causes, and 13% due to cancer (Not Pulmonary or hepatic in origin), 9% due to trauma, 4.5% due to kidney diseases, 1.8% due to toxicology causes and 0.9% due to Unknown causes. Triage method used was **revised Swiss Emergency Triage Scale** (rSETS).

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Triage done Out of hospital by EMT (but no available data about the type of triage they use), on the other hand triage inside the hospital made by Emergency physician at medical and trauma triage areas using the above triage type.

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Table 2: Cardiac rhythm of the study patients (n=223).

Peri -arrest Rhythm	Percentage % Of total cases
Bradycardia	20(9.00%)
Tachyarrhythmia	203(91%)
Sinus Tachycardia	148(66.36%)
Supraventricular Tachycardia	24(10.76%)
Atrial Fibrillation	16(7.17%)
Ventricular Tachycardia	15(6.72%)

Table 2 showed, 91% of patients had tachyarrhythmia with sinus tachycardia as the most common rhythm (66.36%), while (10.76%) had supraventricular tachycardia, (7.17%) had atrial fibrillation, and (6.72%) had ventricular tachycardia.

Tachycardia: This is an irregularly fast heart rate (100 beats per minute or more)

Bradycardia :is a slower than normal heart rate (60-100 beat per minute).

Table 3: Baseline characteristics affecting Outcome of resuscitations

	ROSC N=62	NO ROSC N=161	P-value
Age (years)			
>65	21(33.9%)	101(62.7%)	
<65	41(66.1%)	60(37.3%)	**<0.001*[1]**
Sex			
Male	32(51.6%)	110(68.3%)	**0.715[1]**
Female	30(48.4%)	51(31.7%)	
Etiology			
Trauma (20)	6(9.7%)	14(8.7%)	
Cardiovascular (89)	40(64.5%)	49(30.4%)	
Cancer(Not pulmonary nor	1(1.6%)	27(16.8%)	
Hepatic) (28)	8(12.9%)	25(15.5%)	**<0.001*[2]**
Pulmonology (33)	3(4.8%)	34(21.1%)	
Hepatic (37)	3(4.8%)	7(4.3%)	
Kidney Disease (10)	1(1.6%)	3(1.9%)	
Toxicology (4)	0(0%)	2(1.2%)	
Others(not diagnosed)(2)			
ED length of stay before IHCA (hour)			
<6	30(48.4%)	83(51.6%)	
>6- 24	11(17.7%)	30(18.6%)	**0.226[1]**
>24	21(33.9%)	48(29.8%)	
Initial Rhythm			
Shockable VT/VF	10(16.1%)	12(7.4%)	**<0.001*[1]**
Non-Shockable PEA/Asystole	52(83.9%)	149(92.6%)	

MEWS total			
At Triage	4.08 ±2.23	4.17±2.30	**0.802[3]**
Half an hour Before IHCA	3.62±1.89	5.62±2.07	**0.016*[3]**

1. Chi square test; 2. Fisher exact test; 3. Independent t test.

*Statistical significant as $p<0.05$.

Table 3 showed, patients were divided into two groups according to outcome; ROSC group and no ROSC group. In the ROSC group, there was a higher percentage of cardiac arrest caused by cardiac etiology, compared with the no ROSC group (67.7% vs. 29.2%, p<0.001). There were no significant differences between the two groups in sex and ED length of stay before cardiac arrest. The MEWS at triage did not differ significantly between the two groups while half an hour before IHCA, it was significantly higher in the no ROSC group (5.62±2.07 vs. 3.62±1.89, p=0.016). ROSC group had significantly higher percentage of patients with shockable cardiac rhythm than no ROSC group (16.1% vs. 7.4%, p<0.001).

Table 4: 28 day's mortality prediction after ROSC (n=62, 27.8%):

Predictors	n,(%)	<7 days	7-28 days	Survival to discharge
Total	62 (27.8%)	35(56.5%)	21(33.9)	**6(9.6%)**
Sex				
Male	32(51.6%)	20(57.1%)	8(38.1%)	**4(66.7%)**
Female	30(48.4%)	15(42.9%)	13(61.9%)	**2(33.3%)**
Age in years				
>65	21(33.9%)	12(34.3%)	8(38.1%)	**1(16.7%)**
<65	41(66.1%)	23(65.7%)	13(61.9%)	**5(83. 3%)**
Comorbidities				
No	6(9.7%)	1(2.9%)	2(9.5%)	**3(50%)**
Less than 3	40(64.5%)	22(62.9%)	16(76.2%)	**2(33.3%)**
More than 3	16(25.8%)	12(28.6%)	3(14.3%)	**1(16.7%)**
Duration of CPR (minute)	23±11			
<20 min	41(66.1%)	22(62.9%)	14(66.7%)	**5(83.3%)**
>20 min	21(33.9%)	13(37.1%)	7(33.3%)	**1(16.7%)**
GCS				
>8	21(33.9%)	10(28.6%)	7(33.3%)	**4(66.7%)**
<8	41(66.1%)	25(71.4%)	14(66.7%)	**2(33.3%)**
Lactate (mmol.L-1)				
<4 mmol.L	48(77.4%)	26(74.3%)	16(76.2%)	**6(100%)**
>4mmol.L	14(22.6%)	9(25.7%)	5(23.8%)	**0**

Heart Rate(Range)	(51-160)			
60-100	17(27.4%)	7(20%)	5(23.8%)	**5(83.3%)**
>100	45(72.6%)	28(80%)	16(76.2%)	**1(16.7%)**
MBP		80±13	81±16	**85±17**

Table 4; showed that of 62 patients who have ROSC, 6.9% survived to discharge, while 56.5% survived for less than 7 days, and the rest survived form 7 to 28 days before death. Survival rate were higher in males. 9.7% of cases had no comorbidities, 64.5% had less than 3 comorbidities, and 25.8% had more than 3 comorbidities. CPR duration less than 20 min was associated with better outcome. 66.1% of patients had GCS<8, and 71.4% died before 7 days, while only 4.9% of them survived to discharge. Elevated serum lactate more than 4 mmol was associated with worse outcome with more than 50% of cases not surviving until 7 days. Mean BP of 81±16 was associated with survival for more than 7 days, while 85±17 was associated with survival to discharge. ***The end point of survival is home discharge.***

Table 5: Assessing for the predictors associated with return of spontaneous circulation (N = 62).

	Unstandardized Coefficients		Standardized Coefficients	t	P value
	B	Std. Error	Beta		
(Constant)	-1.067	.529		-2.015	.052
Sex	-.018	.103	-.031	-.179	.859
Age	-.021	.006	.675	3.423	**.002**
Site of arrest	.032	.040	.115	.817	.420
Witnessed	1.096	.327	1.705	3.348	**.002**
ALS interventions at time of event	.105	.127	.140	-2.829	**.013**
Etiology	-.053	.050	-.144	-1.047	.302
Shockable rhythm	.861	.087	.902	-1.904	.062
MEWS	-1.105	.127	-1.514	-3.102	**.003**
Initial condition	.016	.068	.047	.240	.812
Pulse	1.022	.007	1.569	-3.067	**.004**
RR	.114	.046	.517	2.498	**.017**
BP	.208	.001	-.274	-.403	**.048**
S. lactate	-.001	.002	-.219	-.937	.055
PH	.008	.011	.017	.108	.861
S. potassium	.000	.001	.011	.092	.898
Interval between collapse to start CPR	-.651	.142	-1.011	3.887	**.001**
CPR duration	-1.431	.210	-1.508	4.817	**.001**

ANOVA model (F=8.152, p=0.001) and R2=0.602

Comment [19V]: You should add key for abbreviations used in the table as(PB, RR ,.....)

Table 5; the model ANOVA was significant and interprets 60.2% of factors associated with ROSC. Multiple logistic regression analysis was performed with sex, age, Site of arrest, Witnessed, ALS interventions at time of event, Immediate cause, Initial condition, Pulse, RR, BP, S. lactate, PH, S. potassium, Interval between collapse to start CPR and CPR duration as independent variables, and the incidence of ROSC as the dependent variable. From this analysis, Pulse, RR, BP, Witnessed and ALS interventions at time of event were significant positive predictors to ROSC with patients while age, MEWS, Interval between collapse to start CPR and CPR duration were negative predictors to cognitive impairment with diabetic patients.

DISCUSSION:

In our study, the ratio was lower than two thirds; it was about 40% of total studied population.

Around 60% of deaths are infection related to cancer patients, especially with underlying hematological malignancies, compared to 38% in our study which is the most common leading cause of death.[24]

VTE is the second-leading cause of death in cancer patients after cancer itself which is consistent with our study finding with 17%.[25]

Argiles et al. estimated that cachexia affects 50–80 % of cancer patients and accounts for up to 20 % of cancer deaths in controversy to our study in which cachexia represents only 2% of cancer leading cause of death.[26]

Organ invasion by neoplastic cells determines death- associated organ failure in 25% of cancer patients and causes respiratory failure, cardiac insuffiency, hepatic coma, and central nervous system and renal failure.[27]

Our study showed that the mortality from cardiovascular diseases was 38% for sudden cardiac death, 18% for acute myocardial infraction, 17% for heart failure, 16% for cerebrovascular accidents, 4% for fatal dysrhythmia, and, 5% and 2% for combined causes and peripheral arterial diseases respectively. This is consistent with a study by Wang et al.[28]

Furthermore, study has showed that early bystander CPR would increase the rate of initial shockable ECG rhythm. [29]

PEA or a systole was the first documented rhythm in 90.1% of episodes in the present study. This is very different from 67%non-VF/VT arrests in a study by Gwinnutt et al. or 79% in the Getwith the Guidelines Resuscitation registry study by Girotra et al. with 84,625 hospitalized patients.[21, 30] In this context, our findings seem representative for a larger population.

Another study has also shown that witnessed cardiac arrest as a predictor of survival, and bystander CPR, short down time to defibrillation, and ROSC before ED arrival are factors associated with higher STA rate in OHCA patients with shockable. [31]

Our study showed ROSC rate of 27.4%, which is lower than those reported in other studies from the region.

In another study, ROSC rate for only the in-hospital arrest subset was 40%.[134]

We found that Pulse, RR, BP, Witnessed and ALS interventions at time of event were significant positive predictors to ROSC with patients while age, MEWS, Interval between collapse to start CPR and CPR duration were negative predictors to cognitive impairment with diabetic patients.

Only few studies documented an association between age and survival after cardiac arrest, but others showed a significantly lower survival in older patients. These conflicting results may be due partially to differences in methodology and inclusion criteria: some studies included only adults but others also children.[32-36]

A recent large study based on the National Registry of Cardiopulmonary Resuscitation (NRCPR) database reported significantly higher survival rates to hospital discharge following cardiac arrest in children than in adults (27% vs. 18%; relative risk of death in children vs. adults, 0.89; 95% confidence interval 0.85–0.92).[33]

The mean age in the overall, ROSC, and STD groups was 56, 52, and 49 years respectively, indicating that younger age is associated with better outcomes post-CPR. Age as an independent prognostic factor on expected outcome may be helpful in counseling families during and following CPR.[33]

It is well documented that immediate initiation of CPR improves outcomes significantly. [33- 36]

Countries reporting successful resuscitation of cardiac arrest patients have effective systems in place to assist and transport patients, effective hotline centers, well-equipped ambulances, and highly skilled and experienced pre-hospital care teams, which inevitably translate into better overall outcomes. In contrast, in most LMICs, basic life support training for lay persons is virtually non-existent and pre-hospital ambulance and paramedical care is limited even in urban settings, resulting in delayed response times. Most patients are transported to hospitals in private vehicles by non-medical personnel and do not receive even the most basic of life support care in the critical pre-hospital phase. Moreover, the effectiveness of any first-line care that may be administered is questionable. [34- 39]

The percentage of in-hospital resuscitation attempts over total cardiac arrests varies from 5% to 31%. This means that the majority of in-hospital patients who undergo cardiac arrest are not resuscitated because for them the cardiac arrest is simply the final event of the dying process. Early evaluation of patients during the course of their illness may prevent deterioration leading to cardiac arrest and could also help to identify those patients for whom resuscitation would not be appropriate. Clearly both the reported incidence and outcome of IHCA may depend on how criteria for resuscitation are applied.[39]

There is little consensus in existing literature on duration of CPR that is associated with optimal outcomes. Good outcomes have been reported with CPR duration of up to 10 min in patients undergoing an in-hospital cardiac arrest.[40]

Hoang et al. showed a mean CPR duration of 15 min (SD ± 10) in those patients surviving to discharge. In a large multicenter study of data from 435 hospitals, Vattanavanit et al. demonstrated that a median CPR duration of 25 min (IQR 25–28 min) correlated with the best rates of ROSC. [41-42]

In our study, we found that the overall mean duration for CPR was 21 min (SD ± 10); which is in agreement with other study by Moosaj EE, Umme Salama, et al.[33]

It has been documented that although there are some similarities in the clinical features between SARS and MERS, MERS progresses to respiratory failure much more rapidly with much higher mortality than SARS, and that older age and underlying illness is likely related to the mortality of MERS.[43]

In the present study, patients in deceased group were much older than survivors, and univariate and multivariate logistic regression analysis revealed age ≥ 65 years as a strong predictor for death of COVID-19 pneumonia.

Our analysis also revealed that underlying cardiovascular or cerebrovascular diseases contributed to high mortality of COVID-19 pneumonia.

We identified many predictors, age ≥ 65 years, preexisting concurrent cardiovascular or cerebrovascular diseases, Obesity, delayed mechanical ventilation and male factor for high mortality among the overall population of COVID-19 pneumonia patients.

We initially evaluated each variable that displayed statistical significance with $p < 0.05$ in difference between non-survivors and survivors using univariate analysis. Our analysis revealed that age ≥ 65 years, hypertension, cardiovascular or cerebrovascular diseases, white blood cell counts > 10× 109/L, neutrophils > 6.3 × 109/L, D-dimer ≥ 0.5 mg/L was associated with the death of patients with COVID-19 pneumonia .

This was consistent with the recent study by Du R-H, Liang L-R, Yang C-Q, et al.[44]

Our study showed that the most common leading cause of death in early trauma (<24hr) was traumatic brain in 54% of cases followed by 38% from hemorrhage, 1% from pulmonary embolism, 4%of cardiac related trauma and, 3% from respiratory related trauma. 27% with more than 2 combined causes while after the first 24 hr 52% of deaths related to complications as infection and multi organ failure, 21% due to traumatic brain injury, 10 % due to hemorrhage, 6% due to pulmonary embolism and cardiac insuffiency and, 5% due to respiratory failure. In 32% of cases there were more than two combined causes.

Our study was consistent with other study by Yucel et al.[45]. Younger patients are more likely to sustain trauma and these injuries, usually due to automobile accidents or falls from height. Our findings for injury mechanism and age were similar to those of previous studies.[46]

MacLeod et al. [47] found that increasing age was an independent and untreatable indicator for mortality. In our study there is association between increase age and trauma mortality.

Most authors have identified higher ISS as a risk factor for mortality in Trauma patients.[48-49]

Our univariate analysis showed that non-surviving patients had higher ISS and lower GCS scores than survivors.

In our study we found that elevated serum lactate on admission is related to higher mortality and need for transfusion of blood products.

Presence of hemorrhagic shock is a predictor of poor outcome in trauma patients, and the volume of hemorrhage is associated with outcome.[50] As the amount of blood loss increases, so do resuscitation requirements and physiologic derangements, including hypotension and acidosis. Hypotension noted in the field or during ED evaluation is associated with mortality. [51]

In the present study, we observed a significantly higher frequency of hypotension among the non-surviving BMT patients, and univariate analysis revealed that non-survivors also had higher frequencies of need for transfusion of blood and blood products.

The majority of papers report a relatively good functional outcome in survivors from IHCA. At discharge the NRCPR database [5] reports 85.1% of patients having CPC 1 or 2 (patient conscious and alert with minimal or moderate disability) in comparison with 91.4% on admission.

In a study of 827 patients [52] after a median of 15 months after discharge, 75% of survivors were independent in daily life and 83% were cognitively intact. Poor functional outcome was significantly associated with age over 70 years but was not correlated with duration of CPR or severity of coma after the arrest. In contrast with these positive results other investigators reported that 44% of survivors after IHCA had poorer CPC function 2 months after CPR compared with their function before the event.[53]

In the current study, the MEWS at triage did not differ significantly between the two groups while half an hour before IHCA, it was significantly higher in the no ROSC group (5.62±2.07 vs. 3.62±1.89, $p=0.016$). ROSC group had significantly higher percentage of patients with shockable cardiac rhythm than no ROSC group (16.1% vs. 7.4%, $p<0.001$).

In agreement with Wang et al [106] study in which The MEWS at triage was significantly differ between the two groups. Peri-arrest MEWS was lower in the survival-to-discharge group (4.41±2.28 vs. 5.82 ± 2.84, $p=0.053$).

One national cardiac arrest study done in the United Kingdom led to development of a predictive model to predict the survival-to-discharge outcome following IHCA, which included factors such as age, prior length of stay, reason for admission, arrest location, and arrest rhythm. [54]

Of strength of our study is that MEWS could describe detailed changes in vital signs. The results of our study showed that increased peri-arrest MEWS increases the mortality of IHCA, and is independent of arrest rhythm, cardiac arrest cause, and comorbidities. We used peri-arrest vital signs to prove the patient's physiological reserve before cardiac arrest. Peri-arrest MEWS enabled us to identify patients who had less physiological reserve and it could be considered as a decision-making tool contributing to patient outcome.

Studies have demonstrated how advancing age is associated with decreased likelihood of survival to hospital discharge, whereas others argued that it does not exert any significant effect on the outcome of CPR. [33,34]

In most of the previous studies about IHCA, sex does not seem to be associated with survival. Nevertheless, one study [163]found out that female sex could be a factor for survival after adjustments are done for cardiac rhythm age, reason, and site of arrest.

Sex has not been found to be a prognostic factor in 28 days mortality predication after ROSC in our study.

Mortality was 39% for post-arrest patients that had an initial lactate < 5 mmol.L-1, on the other hand mortality was as high as 92% for patients who had an initial lactate > 10 mmol.L-1.[55] Therefore, lactate could be a factor that affects the poor outcomes of the patients.

In our study we found that prolonged CPR more than 20 min is associated with poor outcomes with mortality of 33.9% compared to 66.1% for CPR less than 20 min. Other studies indicate that bad patient outcome is related with the longer duration of resuscitation which is consistent with other studies.[56]

The presence of comorbid diseases is related with morbidity. It also affects the functional status and life quality of patients adversely. In their study Fabbri et al. found that pre-arrest comorbidities were associated with decreased chances of survival. [57] In another study Chakravarthy et al. showed that in CA patients the best survival rate (64%) was among those who had none or 1 comorbidity.[58] When patients had 2 comorbidities, the chance to survive was 9.6%, whereas no patient survived if they had 2 or more comorbidities.[58]And finally, Andrew et al. concluded that patients' current comorbidities could help to assess and predict the situations of CA patients.[59]

CONCLUSIONS:

IHCA can be predicted using different variable related to patients vital data, laboratories, radiological investigations and patient demographic data which helps in predicting and modifying the outcome in limited situations. Our study focused on the predictors to guide patient plan of management and quality of life which will reflect in decreasing mortality rates.

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