CLINICAL PROFILE, MANAGEMENT AND OUTCOME OF PATIENTS DEVELOPING CARDIAC ARREST IN THE EMERGENCY MEDICINE DEPARTMENT OF MUHIMBILI NATIONAL HOSPITAL, DAR ES SALAAM

Ally Munir Akrabi, MBChB

MMed in (Emergency Medicine) Dissertation
Muhimbili University of Health and Allied Sciences
October, 2017

Muhimbili University of Health and Allied Sciences

Department of Emergency of Medicine

CLINICAL PROFILE, MANAGEMENT AND OUTCOME OF PATIENTS DEVELOPING CARDIAC ARREST IN THE EMERGENCY MEDICINE DEPARTMENT OF MUHIMBILI NATIONAL HOSPITAL, DAR ES SALAAM

By

Ally Munir Akrabi, MBChB

A Dissertation Submitted in (Partial)Fulfilment of the Requirement for Degree of Masters of Medicine in (Emergency Medicine) of

Muhimbili University of Health and Allied Sciences
October, 2017

CERTIFICATION

The undersigned certify that he has read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertationin titled**"*Clinical profile, Management and Outcome of Patients developing Cardiac Arrest in The Emergency Medicine Department of Muhimbili National Hospital Dares salaam -Tanzania*"** in (partial) fulfilment of the requirement for the degree of Master of Medicine (Emergency Medicine) of Muhimbili University of Health and Allied Sciences.

……

Dr. Hendry R. Sawe, MD, Mmed, MBA

(Supervisor)

…….

Date

DECLARATION AND COPYRIGHT

I, **Ally Munir Akrabi,** declare that this**dissertation** is my own original work and that it has not been presented and will not be any other University for a similar or any other degree award.

Signature ..... Date .....

This dissertation is copyright material protected under the Berne Convention, the Copyright Act 1999, and other international and national enactments, in that behalf or intellectual property. It may not to be reproduced by any means; in full or in part, except for short extracts in fair dealing, for research or private study, critical scholarly review or discourse with an acknowledgement, without written permission of the Director of Postgraduate studies on behalf of both the author and Muhimbili University of Health and Allied Sciences.

ACKNOWLEDGEMENT

I would like to thank The Almighty God for His provision of good health and guidance to complete this study.

I would also like to extend my sincere gratitude to my Supervisor Dr. Hendry R. Sawe, without his support and guidance this study could not have been possible, and without forgetting the assistance of Dr. Said Kilindimo, Dr. Brittany L. Murray, Dr. Ellen Weber and Dr. Teresa Kortz in reviewing my work and whose inputs made this study better.

Likewise I would also thank all study subjects and entire department staff who participated in the study directly or indirectly to provide valuable correct information into study.

DEDICATION

This work is dedicated to my family especially my wife whose constant encouragement and toleration throughout my study kept me going. Also to all the staff of the Emergency Medicine Department of Muhimbili National Hospital whose work is blessed for continuing to save lives of people and of whom this study may be beneficial.

ABSTRACT

Background: Cardiac Arrests in the Emergency Medicine Department of Muhimbili National Hospital is not uncommon occurrence and in most of these, cardiopulmonary resuscitations are done in order to revive these patients' lives. However little is known of their outcome in the department and beyond.

Aim of the Study: To describe the clinical profile, management and outcome of all patients who develop cardiac arrest while receiving care in The Emergency Department of Muhimbili National Hospital (ED-MNH) in Dar es Salaam.

Materials and Methods: This was a prospective cohort study of patients who developed cardiac arrest in the ED-MNH between August and December 2016. A structured case report forms were used to document the demographic, pre-ED course of illness, management in the ED, and outcome in the ED and overall hospital outcome of cardiac arrest patients. Data were summarized using descriptive statistics and analyzed using counts, proportions, median, interquartile ranges (IQR), 95% confidence interval (CI), relative risk (RR) and P-value.

Results: A total of 68 cardiac arrests patients were enrolled out of 9431 who attended the department during the data collection period. The incidence rate was 7/1000. The median age of cardiac arrest was 39 years and males were slightly higher (54.4%) than females. Sepsis was the commonest diagnosis for cardiac arrest patients accounting for 28.4%. Those who attained Return of Spontaneous Circulation (ROSC) and survived at ED were 13.2%, however none survived up to 7 days.

Conclusion and Recommendations: The study showed lower incidence of cardiac arrest at ED-MNH but whenever the arrest occurred, it had poor survival. Aggressive efforts are advocated to prevent the occurrence of cardiac arrest from critical patients. Further study is recommended with wider population size.

TABLE OF CONTENTS

CERTIFICATION i
DECLARATION AND COPYRIGHT ii
ACKNOWLEDGEMENT iii
DEDICATION iv
ABSTRACT v
LIST OF FIGURE vii
LIST OF TABLE vii
LIST OF ABBREVIATIONS viii
DEFINITION OF KEY TERMS x
1.INTRODUCTION 1
1.1Background 1
1.2Literature Review 4
2.CONCEPTUAL FRAMEWORK 7
3.PROBLEM STATEMENT 9
4.RATIONALE 10
5.RESEARCH QUESTION: 10
6.STUDY OBJECTIVES 11
7.STUDY METHODOLOGY 12
8. RESULTS 17
9. DISCUSSION 28
10. STUDY LIMITATIONS 31
11. CONCLUSION AND RECOMMENDATIONS 32
12. REFERENCES: 33
13. APPENDIX 36
13.1 QUESTIONNAIRE 36
13.2 Consent in participating in research: English version 42
13.3 Consent in participating in research: Swahili version 44
13.4 AHA ADULT CARDIAC ARREST MANAGEMENT ALGORITHM 46
13.5 AHA PAEDIATRIC CARDIAC ARREST MANAGEMENT 47
13.6 AHA PAEDIATRIC BRADYCARDIA WITH POOR PERFUSION (30) 48

LIST OF FIGURE

Figure 1: Flow chart of patients who developed cardiac arrest at the emergency department.....17

LIST OF TABLE

Table 1: Demographic characteristics of cardiac arrest ……18

Table 2: Pre-arrest ED-MNH presentation and initial management 19

Table 3: Mode of Arrival and Pre-arrest Vital signs 20

Table 4: Pre-arrest ED diagnosis and initial investigations and treatment.....21

Table 5: Management of cardiac arrest patients at ED-MNH 22

Table 6: Inhospital Survival of cardiac arrests 23

Table 7: Demographics and 24-hour survival 24

Table 8: Vital signs, Primary survey and 24-hour survival.....25

Table 9: Provisional diagnosis, management and 24-hour survival.....26

Table 10: CPR characteristics with 24-hour survival.....27

LIST OF ABBREVIATIONS

AHA	American Heart Association
ALT	Alanine Transaminase
AST	Aspartate Transaminase
ATP	Adenosine Triphosphate
AVPU	Alert, response Verbal to stimuli, response to Painful stimuli, Unconscious
BP	Blood Pressure
BS	Blood Smear
CI	Confidence Interval
CNS	Central Nervous System
CPR	Cardiopulmonary Resuscitation
CT scan	Computed Tomography Scan
CVS	Cardiovascular System
ECG	Electrocardiography/Electrocardiogram
ED	Emergency Department
FAST	Focused Assessment with Sonography in Trauma
FBP	Full Blood Picture
GCS	Glasgow Coma Scale
HEENT	Head, Eyes, Ears, Nose, Throat
HIV	Human Immunodeficiency Virus
HR	Heart Rate
ICU	Intensive Care Unit
INR	International Normalized Ratio
KCl	Potassium Chloride solution
LMIC	Low- and Middle-Income Countries
MNH	Muhimbili National Hospital
MRDT	Malarial Rapid Diagnostic Test
MRI	Magnetic Resonance Imaging
MUHAS	Muhimbili University of health and allied sciences
OHCA	Out of Hospital Cardiac Arrest

PA	Per Abdomen
PEA	Pulseless Electrical Activity
PT	Prothrombin Time
PTT	Partial Thromboplastin Time
RBG	Random Blood Glucose
ROSC	Return of Spontaneous Circulation
RR	Respiratory Rate
RS	Respiratory System
SPO2	Saturation of Oxygen
SPSS	Statistical package for the Social Sciences
SSA	sub-Saharan Africa
Temp	Temperature
UK	United Kingdom
US	Ultrasound
USA	United States of America
VBG/ABG	Venous Blood Gases/Arterial Blood Gases
VF/Vfib	Ventricular Fibrillation
VT	Ventricular Tachycardia
WHO	World Health Organization

DEFINITION OF KEY TERMS

Cardiopulmonary Resuscitation (CPR)is a procedure to restore spontaneous circulation by performing chest compressions with or without ventilations in a patient who has developed a cardiac arrest (1).

Emergency Medicine Department is a specialized department responsible for triaging, assessing, resuscitating, stabilizing and disposing acutely ill and undifferentiated patients (2).

Witnessed Cardiac arrest is a cardiac arrest that happens or is monitored by another person (1).

Defibrillation is an act of providing electricity with high energy to selected cardiac arrest patients in order to restore normal pacemaker activity of the heart (1).

Hyperkalemia is potassium level in blood >5.5 mmol/L .

Hypokalemia is potassium level in blood <3.5 mmol/L.

Acidosis is a state in the body where the arterial blood PH is <7.35 or venous blood PH <7.32.

Sepsis is a syndrome involving physiologic, biochemical and morphological dysfunction of an organ(s) caused by dysregulated host response to infection (3)

Hypovolemia is low volume of blood in the body causing low tissue perfusion and defined by a measured BP below 90/60 mmHg or mean arterial pressure below 65 mmHg.

Hypoxia is a state with low oxygen tension in the body measured by SPO2<90%.**Hypoglycemia** is a state in the body with a low glucose level in blood less than 3.0 mmol/L.

Hypothermia is low body core temperature of less than 36^{o} Celsius.

Tension pneumothorax is the accumulation of air in the pleural cavity which causes lung collapse and obstructing the venous return to the heart thus impairing oxygenation, ventilation and circulation.

Cardiac tamponade is accumulation of fluid in the pericardial space resulting in reduced ventricular filling and subsequent circulatory collapse.

Toxins are substances which when they come in contact with the body through ingestion, inhalation or contact with skin, may cause harmful effects to the body (such as organophosphate or chemicals). It can also be due to the overdose of drugs like opioids,

benzodiazepines, digitalis toxicity, cocaine or other substances like alcohol, chemicals, organophosphate and others.

Myocardial infarctionis ischemia and infarction to the heart muscle resulting from poor perfusion to it due to blockage of coronary arteries. Also known as myocardial infarction.

Pulmonary embolismis poor perfusion to the lungs resulting from blockage of pulmonary trunk or one of its arteries thus impairing gaseous exchange. Also known as pulmonary embolism**.**

1.INTRODUCTION

1.1 Background

Cardiac arrest is sudden cessation of mechanical activities of the heart with hemodynamic collapse, manifesting as generalized unresponsiveness, apnoea (or agonal breathing) and absence of pulse (1,4). The pathophysiology of cardiac arrest is variable and is shown to be related to cardiovascular, respiratory, metabolic, electrolyte abnormalities, neurologic disorders, infections, trauma, cancer and toxins (4–8). Cardiopulmonary resuscitation (CPR) is the immediate intervention recommended to patients who develop cardiac arrest consisting of manual chest compression by a bystander with or without assisted ventilation(1). CPR guidelines and recommendations have evolved significantly over the last decades and, to date, the standard of care involves to restore circulation(1).

In high-income countries, cardiac arrest is primarily documented in the pre-hospital setting commonly referred to as out-of hospital cardiac arrest (OHCA), with a rate of 34.7 to 62.3 per 100,000 person-years and a survival rate of 11% from studies done in North America, Europe, Asia, and Australia (9). Few studies have documented the rate of in-hospital cardiac arrest; the survival to hospital discharge is variable and dependent on a multitude of factors (4,7). In the Emergency Department (ED) the cardiac arrest incidence is 0.4% (10). The mortality rate among patients developing cardiac arrest in the ED is between 2.7 % and 3.1% (11). In hospital deaths due to cardiac arrest in developed countries, like the USA, are about 750,000 people per year suggesting that there is at least one cardiac arrest for every 10 beds among hospitalized patients (4).

The median ages for paediatric and adult cardiac arrests in high-income countries are 5 years and 71 years respectively (10,12). Among the common comorbidities of the cardiac arrest patients are sepsis, respiratory conditions, heart conditions, diabetes mellitus and renal failure(4,12). The pre-existing conditions of children usually are congenital heart diseases, lung or airway diseases, hematologic and neurologic conditions (17).

The reasons for admission are heart conditions, respiratory conditions, surgical conditions, trauma, and infections (10,12–14).

The CPR as the management of cardiac arrest is done in almost all patients in high-income countries except those who consented or worse prognosis assessed by the providers (4,12,13). The duration of CPR is 20 minutes and more (12) and among the most immediate identifiable causes of cardiac arrest are hypotension, hypoxia, arrhythmia and electrolyte imbalance (12).

In Low- and Middle-Income Countries (LMICs) several studies of cardiac arrest focus mostly on hospitalized patients (7,15). The general incidence of cardiac arrest in these hospitals shows a rate of 0.3% in Taiwan (16) and 2.3% in Uganda (15). Very few studies in LMICs have reported on OHCA which they suggest that the rate is 6.4 per 100,000 to 41.8 per 100,000 (17,18).

The incidence of cardiac arrest in the ED in LMIC is not well documented, partly because the system is not developed and there is an overt lack of resources needed to care for cardiac arrest patients. In the ED the prevalence of cardiac arrest is variable and range from 0.04% to 1.94% (15,16) and the mortality rate among patients developing cardiac arrest in the ED for these LMIC is more than 41% (19).

In the LMIC the cardiac arrest studies have focused mainly on adults as compared to high-income countries where they have been conducted on children and adults. In Sub Saharan Africa, thecardiac arrest in adults occurs at lower age than high-income countries of between 50-60 years (7,15,19) . It is predominantly higher in males than females across the high, middle and low income countries(7,10,12,14–16,19). Among the common comorbidities in LMIC are hypertension, HIV/AIDS, heart conditions, diabetes mellitus, cancer and renal failure (7,15,16,20). Pre-arrest conditions are sepsis, cardiovascular conditions, trauma, renal and liver failure and diabetes mellitus(15,19,20).

In the LMIC the large proportion of these cardiac arrests do not undergo CPR either because of witnessed arrest, poor prognosis of the patients or limited resources for adequate resuscitation (15). The majority of cardiac arrests occur during the day and on the weekdays rather than during the night and the weekend and this applies in all countries (7,10,15,16). The duration of CPR is usually more than 20 minutes**,** same as for high and middle income countries (7,15,16).

The role of the emergency departments in the management of cardiac arrest patients is well defined in most of developed countries with well-established Emergency Medical Services (EMS) (19).

The studies of cardiac arrests from most of these centres suggest that there are several factors associated with ED survival including witnessed cardiac arrest by a skilful bystander, early initiation of CPR, short duration of CPR, rhythms that can be defibrillated, and early return of spontaneous circulation (ROSC) (4,7,20). On the contrary, poor survival has been associated with comorbid conditions especially cancer, renal failure, sepsis, age above 65 years, duration of CPR, unwitnessed arrest, and arrest occurring at night in the hospital (4,7,20). Emergency Departments in hospitals across the world have a unique position of providing early resuscitation to patients developing cardiac arrest on arrival to the hospital or while receiving care at the hospital (19,21,22). Patients who develop cardiac arrest in the ED are often resuscitated for a long time and many resources utilized for each cardiac arrest, including manpower, machines and medications (1,23).

Several guidelines have been published for management of patients with cardiac arrests (1). The American Heart Association (AHA) 2010 guidelines recommend the identification and treatment of the underlying cause of the cardiac arrest, especially when cardiac arrest complicates resuscitative efforts. These include managing hypoxia, hypovolaemia, severe acidosis, hyperkalaemia or hypokalaemia, hypoglycaemia, hypothermia, intoxication, cardiac tamponade, tension pneumothorax, pulmonary embolism and myocardial infarction(5).

In Tanzania, Emergency Medicine is a new specialty that is rapidly evolving. The first full capacity, public ED opened at MNH and established the only existing EM residency training program in country (2). Studies of in-hospital mortality at a tertiary hospital have shown that the rate of ED mortality is 0.74% and in hospital mortality is 8.2% (2). To the best of investigator's knowledge there are no studies documenting the burden of cardiac arrest in the EDs or acute care areas in Tanzania.

1.2 Literature Review

DEFINITION OF CARDIAC ARREST:

The global consensus definition for the terms used in cardiac arrest was reached in 1991 in Utstein Abbey, Norway and is referred to by scholars as the Utstein Style, which is essentially a set of guidelines for uniform reporting of cardiac arrest characteristics(1). According to Utstein, cardiac arrest is the cessation of cardiac mechanical activity as confirmed by the absence of pulse and agonal breathing (1). The exact mechanism of collapse in an individual patient is often impossible to establish since, for the vast majority of patients who die suddenly, cardiac activity is not being monitored at the time of their collapse. In monitored patients, the most common identified arrhythmias have been identified of which ventricular fibrillation and pulseless ventricular tachycardia account for 25-35% of cardiac arrests and PEA is responsible for about 25% of cardiac arrest events (21).

THE BURDEN OF CARDIAC ARREST:

The incidence of cardiac arrest varies across the world (14–16,22). In a systematic review by *Sandroni et al* investigating in-hospital cardiac arrest, the incidence of in-hospital cardiac arrest was reported as ranging from 1-5 cardiac arrests per 1000 hospital admissions in high-income countries (4). While high-income countries have a low incidence of cardiac arrest, in most low-income countries especially in Sub-Saharan Africa (SSA), the incidence is disproportionately higher as supported by a study in a tertiary public hospital in Uganda, which reported a cardiac arrest incidence of 23.4 per 1000 admissions (15).

The incidence of cardiac arrests in the ED is reported mostly in developed countries (4,23) and only handful of studies in SSA (7,15,17). In high-income countries, the cardiac arrests in the ED make up from 9.8% to 15.4% (14,24) of in-hospital arrests, while in SSA this ranges from 3.7-83.2% (7,15). In a study by *Ocen D et al* in Uganda focusing on prevalence, outcomes and associated factors of cardiac arrest in hospitalized patients, there were 2.3% incidence of in-hospital cardiac arrests, further highlighting the magnitude of the burden in SSA.(15). There is a general lack of studies addressing cardiac arrest in children in sub-Saharan Africa, but one study, by *L'opez-Herce et al*, shows a 26.9% incidence of arrests in the ED during a two year period (8).

The overall mortality rate of cardiac arrest occurring in the ED in the USA ranges from 3.1% in low volume and 2.7 % in high volume EDs respectively (11). In SSA, there are two studies which show that the overall mortality in the ED are 1.9% and 41.3% respectively (19,20). In Kenya, a study by Wachira BW and Tyler MD characterized adult, in-hospital cardiac arrest patients at a tertiary private hospital, cardiac arrests occurred during the nights were 30.5% and weekends were 37% (7).

CHARACTERISTICS OF CARDIAC ARREST:

The underlying conditions for cardiac arrests in high-income countries sepsis account for 5%, respiratory conditions 40-60%, heart conditions 60% , diabetes mellitus 30% and renal failure 24%(12,13,25). Males constitute 55%- 70% of cardiac arrest patients (10,12–14). Most cardiac arrest events occur in the intensive care unit (ICU and emergency departments (4,12,14). Among the immediate cardiac rhythms detected during cardiac arrest in in-hospital patients, pulseless electrical activity (PEA) was predominant rhythm followed by asystole, shockable rhythms (Vfib and pulseless VT) and last being unknown rhythms (12–14).

In LMIChypertension account for more than 40% among the underlying conditions of cardiac arrest patients, others are HIV/AIDS 45%, heart conditions 30%, diabetes mellitus 26%, renal failure 25% and cancer 14% (7,15,16). Among the presenting conditions are trauma more than 40%, sepsis 19%, renal failure and liver failure 13%, cardiovascular conditions 12% and diabetes mellitus complications 10% (15,19,20). Majority of the presenting illnesses occur at acute onset and the events occur mostly at ICUs, general wards and emergency departments (7,15,16). More than 60% of cardiac arrest patients are unstable at the time of presentation either by physical assessment or physiological parameters (7,15). The study in Kenya by *Wachira et al* show the rhythm at cardiac arrests are PEA more than 40%, asystole 35%, shockable rhythms 13% and unknown (undocumented) rhythms 10% (7).

MANAGEMENT OF CARDIAC ARREST:

In high-income countries the witnessed and monitored arrest account for 90% of the patients and the response time to initiation of CPR is less than a minute(12,13). The duration of CPR is more than 20 minutes, number of adrenaline doses are 3 and moreand availability of support services in resuscitation like defibrillations, extracorporeal membrane oxygenation (ECMO), central arterial catheterization and vasopressor infusion and mechanical ventilation attempted in about 25-50% of the cardiac arrest patients (12,16).

In LMIC the witnessed arrest account for 37% of the patients, half of those witnessed do not undergo CPR for no documented reason and the average response time to initiation of CPR is over 2 minutes (7,15). The average CPR duration is more than 20 minutes as in high-income countries (7,15). No documentation of adrenaline use or assisted resuscitation reported.

THE FACTORS AFFECTING CARDIAC ARREST AND ITS OUTCOME:

The outcome of the cardiac arrest patients has been shown to be influenced by several factors (4,20). In multicenter studies in the USA and Canada, survival to hospital discharge in children and adults following cardiac arrests is between 27% and 18% respectively and of these 65% of children and 73% of adults had good neurological outcome (18). Studies in SSA show survival to hospital discharge of more than 11% (7).

The outcome of cardiac arrest patients has been shown to be influenced by several factors which are witnessed arrest, duration of arrest, short CPR duration, and ROSC after first defibrillation (1,4,24) (4,12,25). In their 2001 study, *Dumot et al* found that a witnessed arrest was 4 times more likely to survive for 24-hour survival and survival to hospital discharge compared to a non-witnessed arrest ($p=0.005$). Day or evening arrests had almost twice the survival rate compared to nighttime arrests ($p=0.006$). Patients who received tracheal intubation pre-arrest had more than twice survival rate to hospital discharge compared to the unintubated patients ($p=0.001$). In addition, CPR duration of less than 15 minutes was associated with a 64% 24-hour survival rate in cardiac arrest patients and a 40.4% survival to hospital discharge ($p=0.001$) (20).

Factors associated with poor survival include: resuscitation time 29 minutes or more (5-18% survival to hospital discharge, p=0.001), defibrillation more than three times (10-16% survival, p=0.001), resuscitation with four or more adrenaline boluses (less than 40% survival to hospital discharge) (20).

The management of patients with cardiac arrest requires prompt recognition and early initiation of CPR, which is coordinated chest compressions and assisted ventilation and defibrillation when required to optimize perfusion (1,20). During CPR, it is vital to identify and manage all the reversible causes of cardiac arrest (5), according to AHA algorithm (appendix 14.1.4 and 14.1.5). Potential reversible causes include hypoxia, hypovolaemia, acidosis , hypoglycaemia, hyperkalaemia and hypokalaemia, hypothermia, toxins, cardiac tamponade, tension pneumothorax, myocardial infarction and pulmonary embolism(5,23,24).

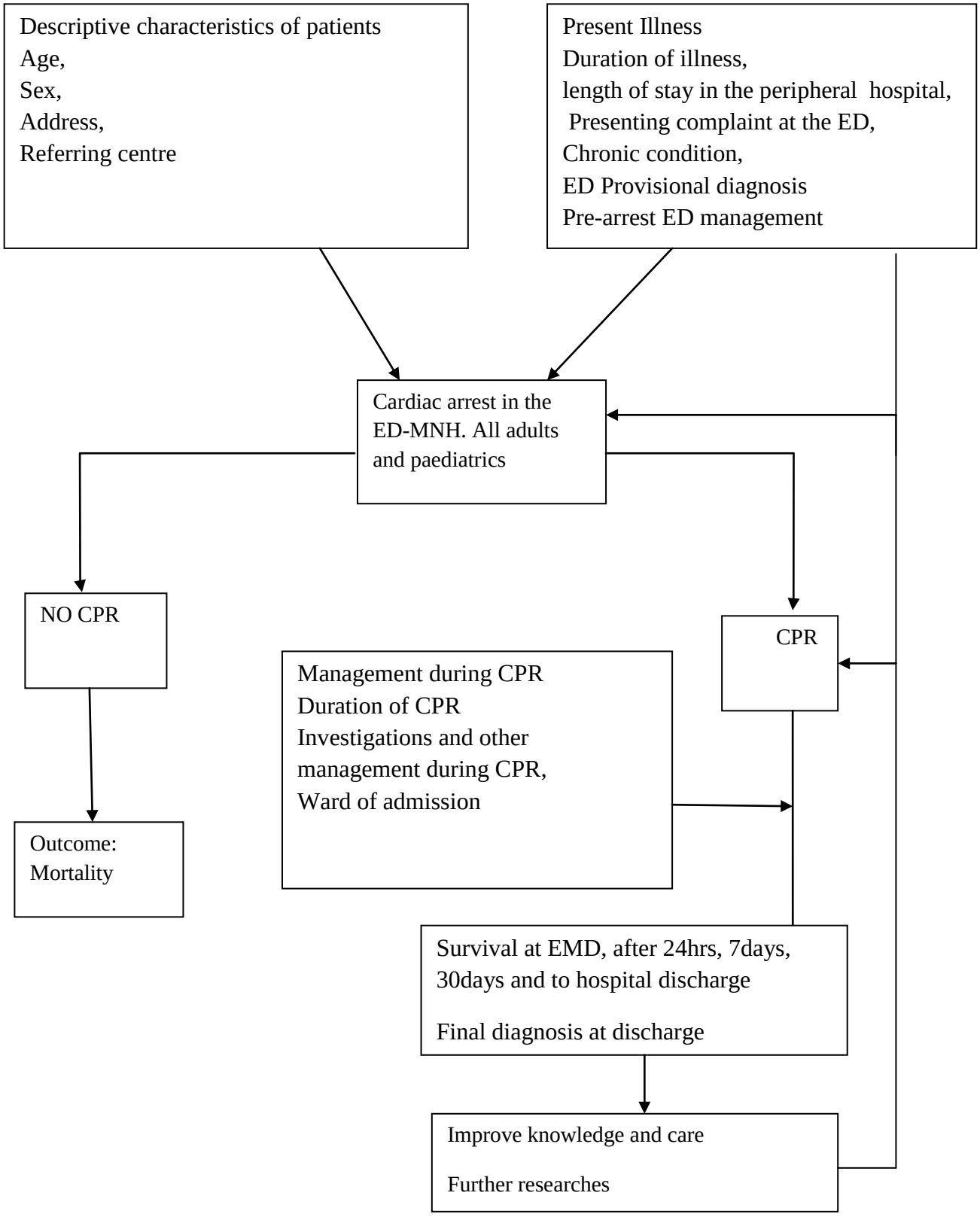
THE ROLE OF EMERGENCY DEPARTMENTS IN CARDIAC ARREST MANAGEMENT:

Emergency departments across the world provide an entry point to the hospital and hence provide an opportunity for early recognition and management for those who are at risk of developing cardiac arrests (25). In high-income countries, this role is well defined, contrary to LMIC such as Tanzania, where emergency medicine is a new specialty (2). Following the two year-operation of a new emergency department at a tertiary national hospital in Tanzania, hospital mortality has been reduced from 13.6% to 8.2% (2).

2. CONCEPTUAL FRAMEWORK

The study included all patients who developed cardiac arrest while receiving care at ED-MNH and information on their age, sex, address and referral were taken together with the duration of presenting illness, length of stay in the peripheral hospital and management including alternative medicine, chronic condition of the patient, presenting complaint(s) in the ED-MNH, history of underlying chronic condition and pre-arrest ED management. Information also included CPR if done or not, duration of CPR, its accompanying investigations and management and then ward of admission after ED survival or if there is mortality in the ED. For those admitted, survival was recorded at ED, after 24hours, 7days, 30days, and to hospital discharge.

The diagram in the next page summarizes the framework.



3. PROBLEM STATEMENT

In Low- and Middle-Income countries (LMIC), little is known about the incidence, risk factors or outcome of cardiac arrest. Two studies of cardiac arrest in LMICs focus on hospitalized patients (7,15). There are three studies on OHCA which are from South Africa, Ethiopia and Nigeria and they suggest that the incidence is higher than most of the high-income countries (14, 16, 26).

The role of ED in the management of cardiac arrest patients is well defined in most high-income countries with well-established EMS (19). The studies of cardiac arrests from most of these centres suggest that there are several factors which have been associated with ED survival of patients who develop ED cardiac arrests. In Tanzania, there are no studies documenting the clinical characteristics and factors associated with patients developing cardiac arrest, especially in the ED. This has led to lack of locally appropriate clinical protocols for cardiac arrest. Furthermore there is no standardized way of reporting factors associated with cardiac arrest which is useful in quality assessment of management of these patients prior to arrest. The establishment of a new ED at Muhimbili National Hospital provides an opportunity for understanding patient risk factors and the management of patients who develop cardiac arrest in the ED (2).

4. RATIONALE

The management of patients with cardiac arrest requires prompt recognition and early initiation of CPR . During CPR it is vital to identify and manage all the reversible causes of cardiac arrests.

The outcome of cardiac arrest patients can be improved significantly with immediate recognition of arrest and the proper management, through effective CPR and correction of all reversible causes of the arrest. In this study, a clear understanding of the underlying causes, factors associated with the arrest and how they impacted outcome were assessed to improve survival of cardiac arrest in the future.

The establishment of ED at MNH and the presence of undergraduate and residency training in emergency medicine have provided an opportunity for improvement in the management of patients with cardiac arrest at ED and within the hospital. Henceforth the results of this study would provide knowledge to healthcare providers on characteristics and outcome of cardiac arrest and would resourceful in developing and executing setting-appropriate clinical guidelines and protocols for cardiac arrest patients. Furthermore, it will be useful for hypothesis formulations for future researches on cardiac arrests in resource-limited settings.

5. RESEARCH QUESTION:

What were the clinical profile, management and outcome of patients who develop cardiac arrest in The Emergency Medicine Department of Muhimbili National Hospital?

6. STUDY OBJECTIVES

6.1 Broad objective

To describe the clinical profile, management strategies and outcome of patients developing cardiac arrest in The Emergency Medicine Department, Muhimbili National Hospital.

6.2 Specific objective

i. To determine the incidence of patients developing cardiac arrest while receiving care in the ED, MNH

ii. To describe clinical characteristics of patients developing cardiac arrest while receiving care in the ED, MNH

iii. To describe pre-MNH course of illness in patients developing cardiac arrest while receiving care in the ED, MNH

iv. To describe the ED management and disposition of patients developing cardiac arrest while receiving care in the ED, MNH

v. To determine the ED survival rate, the overall survival rate and factors associated with survival among patients developing cardiac arrest while receiving care in the ED, MNH

7 STUDY METHODOLOGY

7.1 Study design

This was a prospective cohort study of consecutive sample of adult and paediatric patients developing cardiac arrest while receiving care in the Emergency Medicine Department, Muhimbili National Hospital between August 2016 and July 2017.

7.2 Study setting

This study was conducted at the Emergency Medicine Department – Muhimbili National Hospital, Dar es Salaam. Muhimbili National Hospital is the only national and public super speciality hospital located in Dar es salaam, Tanzania. The hospital is also a training site for the only emergency medicine residency program in Tanzania. MNH serves as a national referral hospital and has a bed capacity of 1500 with weekly admissions of around 1,200 inpatients per week. The hospital has more than 300 doctors including specialists and super specialists, and more than 900 nurses and supporting staff. The ED is the only full-capacity public emergency department in Tanzania and specializes in providing emergency care and resuscitation, serving an average of 200 patients per day. Nearly all admissions to the hospital go through the emergency medicine department. The critical care unit (ICU) at the hospital has a 16 bed capacity and 8 beds in high dependency unit (HDU) which are very much limited for the 1500 hospital bed capacity as the recommended 12% of ICU to total hospital bed capacity by the Intensive Care Society(26).

7.3 Study population

i. Target population

Adult and paediatric patients who developed cardiac arrest while receiving care in the emergency department of a tertiary hospital in Tanzania.

ii. Accessible population

Adult and paediatric patients who developed cardiac arrest while receiving care in the Emergency Medicine Department of Muhimbili National Hospital.

iii. Study sample

Consecutive sample of adult and paediatric patients who developed cardiac arrest while receiving care in The Emergency Medicine Department of Muhimbili National Hospital and whose relatives or next of kin consented to participate in the study at the time the researcher or his assistant(s) were available to collect data.

7.4 Study subjects

7.4.1 Inclusion criteria

Adult patients who developed cardiac arrest while receiving care and paediatric patients with no pulse or heart rate less than 60 beats/min, unresponsive and apneic breathing while receiving care in The Emergency Medicine Department, Muhimbili National Hospital.

7.4.2 Exclusion criteria

i. All adult and paediatric patients who were brought into the ED-MNH already dead
ii. All adult and paediatric patients who were brought into ED-MNH with CPR going on to those patients.

7.5 Variables in the study

7.5.1 Independent variables:

i. Demographic data: Age, Sex, address
ii. Referral: self-referral vs hospital referral
iii. Length of stay in the referring hospital
iv. Management strategies in the referring hospital (If available)
v. Pre-ED-MNH course of illness: pre-existing illness or an acute illness
vi. Management strategies at ED: provisional diagnosis, date, day and time of the cardiac arrest, first documented rhythm after cardiac arrest, length of CPR, defibrillation done or not, investigation(s) done during CPR (If available)

7.5.2 Dependent variables

i. The admission ward for the resuscitated cardiac arrest patient
ii. Outcome: survival rate at ED and post-ED to hospital discharge.

7.6 Study sampling

This was a prospective consecutive sample of patients including adults and children who developed cardiac arrest while receiving care at The Emergency Medicine Department of Muhimbili National Hospital and whose relative or next of kin consented for their patients to be enrolled in the study.

7.7 Sample size

The minimum sample size calculations for Adult and paediatric patients developing cardiac arrest at ED-MNH based on a proportion of patients with who survived the cardiac arrest (extracted from a study in Kenya by Wachira et al) (7).

The sample size of this study was estimated from the formula below:

$n = Nz^2p\ (1-p) / [d^2(N-1) + z2p(1-p)]$

Whereby,

n= The sample size required

N= Total population estimated was 180 cardiac arrest patients over 5-month period

z = Confidence level which was 1.96 (95% Confidence Interval)

p = The proportion of survival from previous study by Wachira B et al. (2015) *"Characterization of in-hospital cardiac arrest in adult patients at a tertiary hospital in Kenya"* which is 11.1% (0.11)

d = The margin of error (which was 0.05)

$n= 180 \times 1.96^2 \times 0.11(1-0.11)/ [\ 0.05^2 \times (180-1) + 1.96^2 \times 0.11(1-0.11)]$

n= 63 cardiac arrests.

The minimum sample size required was therefore 63 patients who develop cardiac arrest at ED-MNH.

7.8 Sample Recruitment and Data collection

Patients were identified when CPR was announced in the ED after they developed cardiac arrest while they were receiving medical care. Information was obtained from relatives or patients' attendants on the demographics (age, gender), presenting complaints, pre-existing (chronic) conditions, the duration their presenting illnesses, if there was medical consultation done for their illnesses prior to the ED visit, any history of alternative therapy use for current illness, and their referral from other hospitals to MNH. Information was also obtained from electronic hospital chart WELLSOFT (Version 11, well soft Corporation, and Somerset, NJ, USA) on time of arrival, physical exam, provisional diagnosis, pre-arrest management, time of cardiac arrest and management during CPR, the site (ward) of disposition upon survival with additional help from the CPR-filled sheet. The doctor in charge of the patient was also interviewed and observation on the duration of CPR, the initial rhythm and the team leader of CPR. Information was filled on structured case report forms by the principal investigator and one trained research assistant. Those who attained ROSC at ED were followed up if they were alive or dead at 24 hours, 7 days, 30 days and hospital discharge. It was done through physically attending to the patient, phone call and/or reviewing the patient's clinical chart.

7.9 Data management and analysis

The data from the completed data collection sheet were entered and transferred into Excel spreadsheet 2007 version (Microsoft Corporation, Redmond, WA, USA). All information contained in the filled questionnaires were kept strictly confidential. The data were stored in protected computer files and paper records stored in locked filing cabinet. Only study staff had access to the information. Descriptive statistics were used to create frequency distribution tables of the cardiac arrest with demographic characteristics of the patients, referral patterns, duration of present illness, management strategies pre-ED and in the ED, comorbid condition, cardiac arrest management strategies, and outcome post-arrest and analyzed using counts, proportions, median, interquartile ranges (IQR), 95% confidence interval (CI), relative risk (RR). P values less than 0.05 was considered statistically significant.

7.10 Ethical consideration

Ethical clearance to conduct this study was obtained from MUHAS Senate of Research and Publication Committee of MUHAS including the waiver of consent. Permission to collect data was also sought from the director's office of Muhimbili National Hospital and Head of Department of Emergency Medicine. All patients with cardiac arrest in the ED were enrolled after obtaining a signed informed consent from parents or caretaker. The data were coded to hide patient's identity and stored in computer with password known by researchers only. The written forms were in a safe locker accessed by researchers only.

8. RESULTS

A total of 9431 patients presented to the ED-MNH during the study period, of whom 68 (0.7%) developed cardiac arrest and were enrolled in the study as shown in Figure 1.

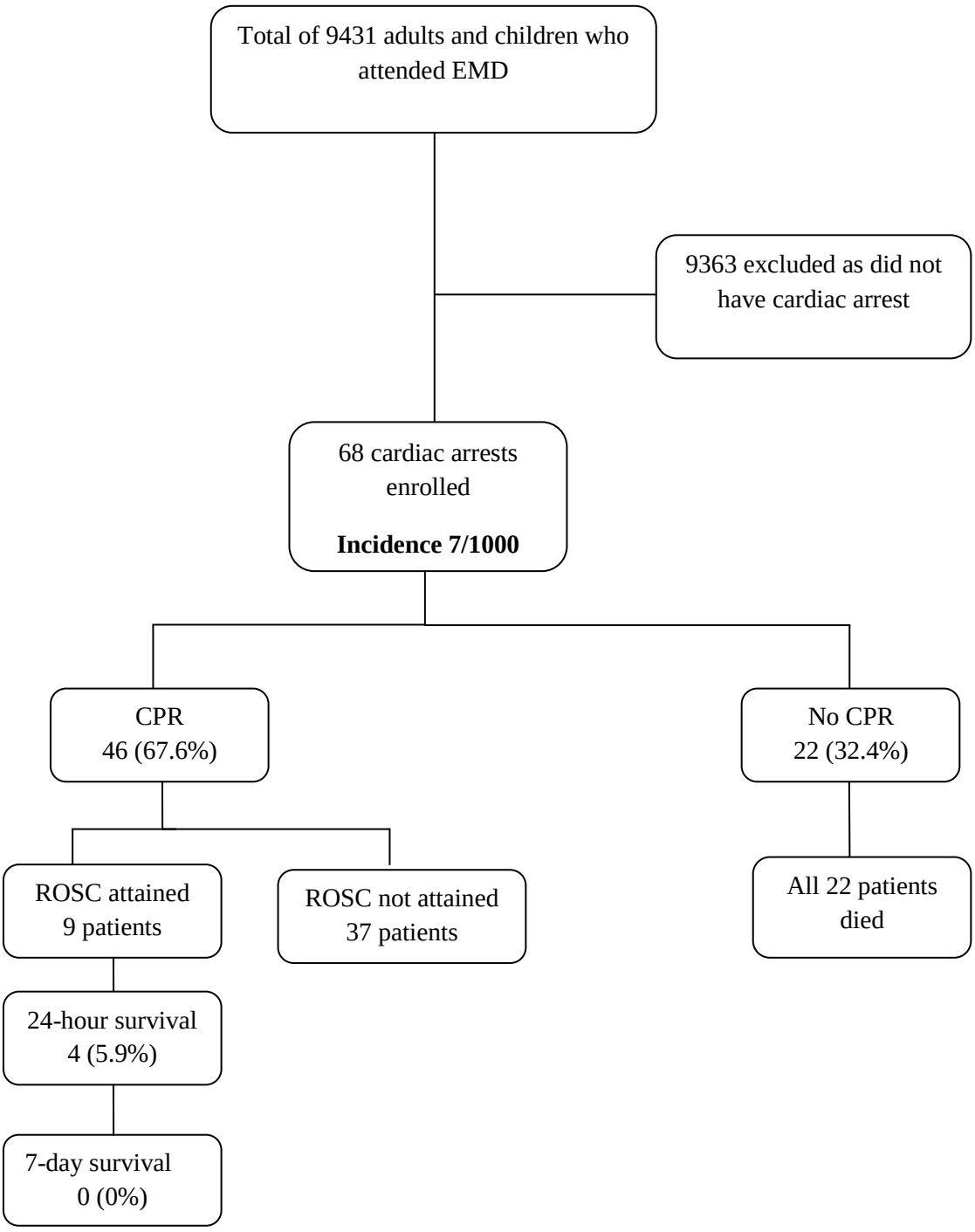


Figure 1: Flow chart of patients who developed cardiac arrest at the emergency department

8.1 Baseline characteristics of the study population

The median age at presentation was 39 (IQR 26-54), and overall 37 (54.4%) were male. Most patients 50 (73.5%) were hospital referral and of all the patients, 24 (35.8%) came from Kinondoni district in Dar es Salaam. Hypertension 9 (13.2%) was the most frequent reported co-morbid condition.

Table 1: Demographic characteristics of cardiac arrest

Characteristics	**Overall** N=68
Age (years)	
Median (IQR)	39 (26-54)
≤18 years	13 (19.1%)
>18 years	55 (80.9%)
Sex	
Male	37 (54.4%)
Address**	
Kinondoni	24 (35.8%)
Ilala	17 (25.4%)
Temeke	13 (19.4%)
Others	13 (19.4%)
Comorbid conditions	
Hypertension	9 (13.2%)
Heart failure	7 (10.3%)
Diabetes	5 (7.4%)
Renal failure	5 (7.4%)
HIV	2 (2.9%)
Tuberculosis	2 (2.9%)
Cancer	2 (2.9%)
Duration of illness (days)	
≤7	54 (79.4%)
>7	14 (20.6%)
Use of alternative therapy (herbal)	
Yes	18 (26.5%)
Referral	
Hospital	50 (73.5%)
Self	18 (26.5%)
Length of stay at the referring hospital (N=50)	
≤ 24 hours	8 (16.0%)
> 24 hours	42 (84.0%)

***1 deficit since the patient brought to the ED was unknown and the address was also unknown.*

8.2 Pre-arrest MNH patients' presentation

Of the patients who developed cardiac arrests, 43 (63.2%) were brought by ambulance from hospital referrals. Difficulty in breathing 26 (38.2%) was the most frequent reported chief complaint, while 11 (16.2%) patients had trauma as initial complaint. Most 43 (63.2%) patients were brought in an ambulance. 12 (17.6%) patients had a compromised airway on assessment.

Table 2: Pre-arrest ED-MNH presentation and initial management

Characteristics	**Proportion (95% CI)**
Mode of arrival (N=68)	
Ambulance	43 (63.2% CI 51.74—74.66%)
Private means	24 (35.3% CI 23.94—46.66%)
Police	1 (1.5% CI -1.39— 4.39%)
Chief complaint (N=68)	
Difficulty in breathing	26 (38.2% CI 26.65—49.75%)
Altered level of consciousness	22 (32.4% CI 21.28—43.52%)
General body weakness	17 (25% CI 14.71—35.29%)
Vomiting	12 (17.6% CI 8.55—26.65%)
Fever	11 (16.2% CI 7.44—24.96%)
Trauma	11 (16.2% CI 7.44—24.96)
Primary survey (N=68)	
Airway abnormal	12 (17.6% CI 8.55—26.65%)
Breathing abnormal	43 (63.2% CI 51.74—74.66%)
Circulation abnormal	24 (35.3% CI 23.94—46.66%)
Disability abnormal	35 (51.5% CI 39.62—63.38%)
Exposure abnormal	49 (72.1% CI 61.44—82.76%)

The abnormal vital signs at presentation to the ED-MNH

The Systolic blood pressure below 90 mmHg occurred more in adults 10 (18.2%) than that above 180 mmHg. Tachycardia occurred in 35 (63.6%) of adults and 8 (61.5%) in paediatrics. Modified early warning scores occurred in 35 (63.6%) of adults and 7 (53.8%) of paediatrics.

Table 3: Mode of Arrival and Pre-arrest Vital signs

Characteristics	Proportion (95% CI)
Vital Signs (abnormal)	
Systolic Blood Pressure (ADULTS) (N=55)	
≥ 180 mmHg	4 (7.3% CI 0.43—14.17%)
< 90 mmHg	10 (18.2% CI 8—28.4%)
Heart rate (ADULTS) (N=55)	
>90 beats/min	35 (63.6% CI 50.88—76.32%)
< 60 beats/min	3 (5.5% CI -0.53—11.53%)
Heart rate (PAEDIATRICS) (N=13)	
Tachycardia*	8 (61.5% CI 35.05—87.95%)
Bradycardia *	1 (7.7% CI -6.79—22.19%)
Respiratory rate (ADULTS) (N=55)	
> 22 breaths/min	34 (61.8% CI 48.96—74.64%)
<12 breaths/min	3 (4.4% CI -0.47—9.27%)
Respiratory rate (PAEDIATRICS) (N=13)	
Tachypnoea**	8 (61.5% CI 35.05—87.95%)
Bradypnoea	—
Axillary Temperature (N=60)	
>37.5 ^{0}C	9 (15% CI 5.97—24.03%)
<36 ^{0}C	3 (5% CI -0.51—10.51%)
SPO2 <95% (N=68)	27 (39.7% CI 28.07—51.33%)
MEWS ≥ 5 (N=55)***	35 (63.6% CI 50.88—76.32%)
PEWS ≥ 4 (N=13)***	7 (53.8% CI 26.7—80.9%)

**The heart rates in children were 80-180 beats per minute (<6months of age), 70-150 bpm (7months−1year), 70-120 bpm (1year−4years) and 60-90 bpm (5years−18years)*

***The respiratory rates for children were taken as <40 breaths per minute (<6months of age), <35/min (6months−1year), 20-30/min (1-4years) and 12-22/min (5 years−18 years).*

**** MEWS—Modified early warning signs (for adults). PEWS—paediatric early warning signs*

8.3 The ED diagnosis and the initial management

Sepsis was the most frequent pre-arrest diagnosis found in 19 (28.4%) of the patients. The patients with acidosis (PH<7.3), hypoglycaemia (RBG <3.0 mmol/L), hyperkalaemia (K>6.5 mmol/L), and hyperlactatenaemia, were 25/37 (67.6%), 15/66 (22.7%), 9/35 (25.7%), and 19/24 (79.2%) respectively. About 22(32.4%) received intravenous crystalloid bolus, 28(41.2%) received antibiotics and 53(77.9%) received oxygen therapy.

Table 4: Pre-arrest ED diagnosis and initial investigations and treatment

Characteristics	Proportion (95% confidence interval)
Provisional Diagnosis at ED prior to arrest (N=67)	
Sepsis	19 (28.4% CI 17.6—39.2%)
Renal failure	15 (22.4% CI 12.42—32.38%)
Pneumonia	14 (20.9% CI 11.16—30.64%)
Electrolyte imbalance	14 (20.9% CI 11.16—30.64%)
Trauma	12 (17.9% CI 8.72—27.08%)
Heart failure	11 (16.4% CI 7.53—25.27%)
Anaemia	11 (16.4% CI 7.53—25.27%)
Diabetes	8 (11.9% CI 4.15—19.65%)
Cerebrovascular accident	7 (10.4% CI 3.09—17.71%)
Cancer	7 (10.4% CI 3.09—17.71%)
Investigations (abnormal parameters)	
PH <7.3 (N=37)	25 (67.6% CI 52.52—82.68%)
RBG<3.0 mmol/L (N=66)	15 (22.7% CI 12.59—32.81%)
RBG>11.1 mmol/L (N=66)	25 (37.9% CI 26.2%—49.6%)
K^+<3.0 mmol/L (N=35)	4 (11.4% CI 0.87—21.93%)
K+ >6.5 mmol/L (N=35)	9 (25.7% CI 11.22—40.18%)
Hb <8 g/dL (N=29)	7 (24.1% CI 8.53—39.67%)
Lactate ≥2 mmol/L (N=24)	19 (79.2% CI 62.96—95.44%)
Creatinine >115 µmol/L(N=27)	18 (66.7% CI 48.92—84.48%)
WBC >12000 cells/µL (N=27)	13 (48.1% CI 29.25—66.95%)
Treatmentgiven pre-arrest (N=68)	
Intubation pre-arrest	4 (5.9% CI 0.3—11.5%)
Intravenous crystalloid bolus*	22 (32.4% CI 21.28—43.52%)
10% Dextrose or 50%Dextrose	12 (17.6% CI 8.55—26.65%)
Antibiotics	28 (41.2% CI 29.5—52.9%)
Blood transfusion	6 (8.8% CI 2.07—15.53%)
Oxygen therapy	53 (77.9% CI 68.04—87.76%)

**A fluid bolus is ≥ 2000mls in adults or ≥ 20ml/kg children.*

8.4 Management of cardiac arrest patients at ED-MNH

The patients of cardiac arrests who underwent CPR at the ED were 46 (67.6%). The daytime incidences CPR were higher 27 (58.7%), and the predominant rhythm recorded during the cardiac arrest was asystole 23 (50%). Hypoxia was a major reversible cause of arrest identified accounting for 20 (43.5%).

Table 5: Management of cardiac arrest patients at ED-MNH

Characteristics	Proportions (95% Confidence interval)
Patients who underwent CPR (N=68)	46 (67.6% CI 56.48—78.72)
Reasons for not doing CPR (N=22)	
Poor prognosis of patient	11 (50% CI 29.11—70.89%)
Limited resources for resuscitation and ICU care	7 (31.8% CI 12.34—51.26%)
Moribund-anaesthetist regarded patient not fit for surgery	3 (13.6% CI -0.72—27.92%)
Unwitnessed arrest	1 (4.5% CI -4.16—13.16%)
Time of Cardiac arrests (N=68)*	
Daytime	39 (57.4% CI 46.65—69.15%)
Night	29 (42.6% CI 30.85—54.35%)
Duration of management before cardiac arrest (minutes)	
Median (IQR)	101.5 (64—240)
Initial rhythm during cardiac arrest (N=46)	
Asystole	23 (50% CI 37.84— 62.16%)
Pulseless electrical activity	18 (39.1% CI 25—53.2%)
Not documented/Not known	4 (8.7% CI 0.56—16.84%)
Ventricular Fibrillation	1 (2.2% CI -2.04—6.44%)
CPR duration (minutes)	
Median (IQR)	12.5 (7-19.5)
Team leader (N=46)	
Specialist	20 (43.5% CI 29.17—57.83%)
Resident	21 (45.7% CI 31.3—60.1%)
Registrar	4 (8.7% CI 0.56—16.84%)
Number of adrenaline used for those who underwent CPR (N=46)	
≤ 4	35 (76.1% CI 63.78—88.42%)
> 4	5 (10.9% CI 1.89—19.91%)
No adrenaline use	6 (13% CI 3.28—22.72%)
Identified cause of cardiac arrest in CPR patients (N=46)	
Hypoxia	20 (43.5% CI 29.17─57.83%)
Hyperkalaemia	18 (39.1% CI 25—53.2%)
Acidosis	14 (30.4% CI 17.11—43.69%)
Hypovolaemia	12 (26.1% CI 13.41—38.79%)
Hypoglycaemia	10 (21.7% CI 9.79—33.61%)
Hypokalaemia	2 (4.3% CI -1.56—10.16%)
Pneumothorax	1 (2.2% CI -2.04—6.44%)
Ward Disposition (N=68)	
Mortuary	59 (86.8% CI 78.75—94.85%)
ICU	8 (11.8% CI 4.13—19.47%)
Theatre	1 (1.5% CI -1.39—4.39%)

* *Daytime hours 8.00am−8.00pm. Night hours 8.01pm−7.59am*

8.5 Survival of cardiac arrest patients

The cardiac arrest patients who attained Return of Spontaneous Circulation (ROSC) were 9 (13.2%), 24-hour inhopital survival was 5.9% and none survived after 7 days.

Table 6: In hospital Survival of cardiac arrests

Survival	Proportion
Survival at ED	9 (13.2%)
24-hour hospital survival	4 (5.9%)
7-day hospital survival	0 (0%)

8.6 Association between demographic characteristics and 24-hour survival

Age below 18 years had relative risk of 1.41 (p=0.757). The relative risk of male gender 7.58, among the comorbid conditions, hypertension had a relative risk of 0.67 (p=0.78), duration of illness less than 7days had relative risk of 0.78 (p=0.822), difficulty in breathing relative risk 0.18 (p=0.239)

Table 7: Demographics and 24-hour survival

Factor	**24 hour survival**			**Relative Risk**	**P value**
	Yes	**No**	**Total**	**(95% CI)**	
Age (years)					
≤18	1 (7.7%)	12 (92.3%)	13	1.41 (0.16-12.49)	0.757
>18	3 (5.5%)	52 (94.5%)	55		
Male	4 (10.8%)	33 (89.2%)	37	7.58(0.42-135.51)	0.169
Comorbid conditions					
Hypertension	—	9 (100%)	9	0.67(0.04-11.46)	0.780
Diabetes	—	5 (100%)	5	1.19 (0.07-19.48)	0.905
Heart failure	—	7 (100%)	7	0.86 (0.05-14.56)	0.917
Renal failure	—	5 (100%)	5	1.19 (0.07-19.48)	0.905
HIV	—	2 (100%)	2	2.48 (0.17-36.31)	0.507
Tuberculosis	—	2 (100%)	2	2.48 (0.17-36.31)	0.507
Cancer	—	2 (100%)	2	2.48 (0.17-36.31)	0.507
No comorbidity	3 (10%)	27 (90%)	30	3.8 (0.42-34.71)	0.237
Duration of illness					
≤7 days	3 (5.6%)	51 (94.4%)	54	0.78 (0.09-6.92)	0.822
>7 days	1 (7.1%)	13 (92.9%)	14		
Chief complaint					
Difficulty in breathing	—	26 (100%)	26	0.18 (0.01-3.16)	0.239
Altered level of consciousness	3 (13.6%)	19 (86.4%)	22	6.27 (0.69-56.92)	0.103
General body weakness	1 (5.9%)	16 (94.1%)	17	1.00 (0.11-8.99)	1.000
Vomiting	—	12 (100%)	12	0.49 (0.03-8.50)	0.622
Fever	1 (9.1%)	10 (90.9%)	11	1.73 (0.20-15.12)	0.621
Trauma	1 (9.1%)	10 (90.9%)	11	1.73 (0.20-15.12)	0.621
Mode of arrival					
Ambulance	3 (7.0%)	40 (93%)	43	1.67 (0.18-15.22)	0.647
Private means	1 (4.2%)	23 (95.8%)	24		

8.7 Abnormal vital signs and primary survey with 24-hour survival

Systolic blood pressure in adults above 180 mmHg had relative risk of 6.38 (p=0.095), and tachycardia and tachypnoea in children both had relative risk 1.71 (p=0.027). Temperature above 37.5^{0}C had relative risk 6.56 (p=0.044).

Table 8: Vital signs, Primary survey and 24-hour survival

Factor	24 hour survival			Relative Risk	P value
	Yes	No	Total	(95% CI)	
Vital Signs (abnormal)					
SBP (ADULTS)					
≥ 180 mmHg	1 (25%)	3 (75%)	4	6.38(0.73- 56.06)	0.095
< 90 mmHg	1 (8.3%)	9 (91.7%)	10	2.25 (0.23-22.46)	0.490
Heart rate (ADULTS)					
>90 beats/min	2 (5.7%)	33 (94.3%)	35	1.14 (0.11-11.83)	0.911
< 60 beats/min	—	3 (100%)	3	1.89 (0.12-30.62)	0.653
Tachycardia (PEADIATRICS)	1 (12.5%)	7 (87.5%)	8	1.71 (1.06-2.77)	0.027
Bradycardia (PEADIATRICS)	—	1 (100%)	1	2.17 (0.13-36.84)	0.593
Respiratory rate (ADULTS)					
> 22 breaths/min	2 (5.9%)	32 (94.1%)	34	1.23 (0.12-12.80)	0.859
<12 breaths/min	—	3 (100%)	3	1.89 (0.12-30.620	0.653
Tachypnoea (PEADIATRICS)	1 (12.5%)	7 (87.5%)	8	1.71 (1.06-2.77)	0.027
Temperature					
>37.5 ^{0}C	2 (22.2%)	7 (77.8%)	9	6.56 (1.05-40.87)	0.044
<36 ^{0}C	—	3 (100%)	3	1.83 (0.12-28.45)	0.665
SPO2 <95%	—	27 (100%)	27	0.17 (0.01-2.98)	0.223
Primary survey					
Airway abnormal	—	12 (100%)	12	0.49 (0.03-8.50)	0.622
Breathing abnormal	2 (4.7%)	41 (95.3%)	43	0.58 (0.09-3.88)	0.573
Circulation abnormal	—	24 (100%)	24	0.20 (0.01-3.57)	0.274
Disability abnormal	3 (8.6%)	32 (91.4%)	35	2.83 (0.31-25.85)	0.357
Exposure abnormal	4 (8.2%)	45 (91.8)	49	3.60 (0.20-63.84)	0.383

8.8 Association between provisional diagnosis, management and 24-hour survival
Among the provisional diagnosis, sepsis had relative risk of 2.58 (p=0.325), acidosis (PH<7.3) had relative risk of 0.57 (p=0.622). Intravenous fluid bolus had relative risk of 2.09 (p=0.445).

Table 9: **Provisional diagnosis, management and 24-hour survival**

Factor	**24 hour survival**			**Relative Risk**	**P value**
	Yes	**No**	**Total**	**(95% CI)**	
Provisional Diagnosis at ED prior to arrest					
Sepsis	2(10.5%)	17 (89.5%)	19	2.58 (0.39-17.02)	0.325
Renal failure	1 (6.7%)	14 (93.3%)	15	0.18 (0.13-10.52)	0.884
Pneumonia	–	14 (100%)	14	0.41 (0.02-7.15)	0.539
Electrolyte imbalance	1 (7.1%)	13 (92.9%)	14	1.29 (0.14-11.44)	0.822
Trauma	1 (8.3%)	11 (91.7%)	12	1.56 (0.18-13.70)	0.691
Heart failure	–	11 (100%)	11	0.54 (0.03-9.33)	0.670
Anaemia	–	11 (100%)	11	0.54 (0.03-9.33)	0.670
Diabetes	1(12.5%)	7 (87.5%)	8	2.50 (0.29-21.24)	0.401
Cerebrovascular	–	7 (100%)	7	0.86 (0.05-14.56)	0.917
accident	–	7 (100%)	7	0.86 (0.05-14.56)	0.917
Cancer	1(12.5%)	3 (100%)	3	1.83 (0.12-28.45)	0.665
Investigation (abnormal parameters)					
PH <7.3	1 (4%)	24 (96%)	25	0.57 (0.06-5.22)	0.622
RBG<3.0 mmol/L	1 (6.7%)	14 (93.3%)	15	1.18 (0.13-10.52)	0.884
RBG>11.1 mmol/L	2 (8%)	23 (92%)	25	1.72 (0.26-11.47)	0.573
K^+<3.0 mmol/L	–	4 (100%)	4	1.44 (0.09-23.20)	0.795
K^+>6.5 mmol/L	–	9 (100%)	9	0.67 (0.04-11.46)	0.780
Hb <8 g/dL	2 (28.6%)	5 (71.4%)	7	3.14 (0.54-18.37)	0.204
Lactate ≥2 mmol/L	1 (5.3%)	18 (94.7%)	19	0.86 (0.10-7.76)	0.893
Creatinine >115 µmol/L	2 (11.1%)	16 (88.9%)	18	2.78 (0.42-18.29)	0.288
WBC >12000 cells/µL	1 (7.7%)	12 (92.3%)	13	1.41 (0.16-12.49)	0.757
Treatment					
Intravenous crystalloid bolus**	2 (9.1%)	20 (90.9%)	22	2.09 (0.31-13.88)	0.445
10% Dextrose or 50% Dextrose	1 (8.3%)	11 (91.7%)	12	1.56 (0.18-13.70)	0.691
Antibiotics	3 (10.7%)	25 (89.3%)	28	4.29 (0.47-39.11)	0.197
Blood transfusion	1 (16.7%)	5 (83.3%)	6	3.44 (0.42-28.19)	0.249
Oxygen therapy	3 (5.7%)	50 (94.3%)	53	0.85 (0.10-7.58)	0.884

8.9 Association of CPR characteristics with 24-hour survival

Daytime CPR had a relative risk of 0.70 (p=0.713). The relative risk for unknown rhythm during CPR was 10.50 (p=006). CPR duration less than 15 minutes had relative risk of 4.22 (p=0.323). Hypoxia had a relative risk of 1.30 (p=0.784).

Table 10: CPR characteristics with 24-hour survival

Factor	24 hour survival			Relative Risk	P value
	Yes	No	Total	(95% CI)	
Time of CPR					
Daytime	2 (7.4%)	25 (92.6%)	27	0.70 (0.11-4.57)	0.713
Night	2 (10.5%)	17 (89.5%)	19		
Initial rhythm during cardiac arrest (N=46)					
Asystole	1 (4.3%)	22 (95.7%)	23	0.33 (0.04-2.97)	0.325
Pulseless electrical activity	1 (5.6%)	17 (94.4%)	18	0.51 (0.06-4.61)	0.556
Not documented/Not known	2 (50%)	2 (50%)	4	10.50 (1.98-55.79)	0.006
Ventricular fibrillation	—	1 (100%)	1	2.56 (0.20-32.92)	0.472
CPR duration (min)					
≤ 15	4 (12.9%)	27 (87.1%)	31	4.22 (0.24-73.42)	0.323
>15	0 (0%)	14 (100%)	14		
Team leader					
Specialist	1 (5%)	19 (95%)	20	0.42 (0.05-3.71)	0.432
Resident	2 (9.5%)	19 (90.5%)	21	1.14 (0.18-7.42)	0.889
Registrar	1 (25%)	3 (75%)	4	3.42 (0.45-25.68)	0.233
Number of adrenaline used during CPR					
≤ 4	2 (5.7%)	33 (94.3%)	35	0.83 (0.05-15.31)	0.902
> 4	—	5 (100%)	5		
No adrenaline use	2 (33.3%)	4 (66.7%)	6	6.67 (1.44-38.83)	0.035
Identified cause of cardiac arrest in CPR patients					
Hypoxia	2 (10%)	18 (90%)	20	1.30 (0.20-8.45)	0.784
Hyperkalaemia	1 (5.6%)	17 (94.4%)	18	0.52 (0.06-4.61)	0.556
Acidosis	2 (14.3%)	12 (85.7%)	14	2.29 (0.36-14.63)	0.383
Shock	2 (16.7%)	10 (83.3%)	12	2.83 (0.45-17.95)	0.269
Hypoglycaemia	—	10 (100%)	10	0.37 (0.02-6.42)	0.722
Severe anaemia	1 (25%)	3 (75%)	4	3.50 (0.47-26.32)	0.105
Hypokalaemia	—	2 (100%)	2	1.67 (0.11-24.26)	0.709
Pneumothorax	—	1 (100%)	1	2.56 (0.20-32.92)	0.472

9. DISCUSSION

The incidence of cardiac arrest in our emergency department was less than one percent, seven in every one thousand patients, which is higher than previously documented in the high and middle-income countries (10,16). Over three quarters of those developing cardiac arrests were adult aged 18 years and above, with more than half being male patients. Our finding of male predominance, is consistent with studies done in Uganda, Kenya and the UK (7,14,15).

Nearly three quarter of our patients were referrals from lower level health facilities, from which we observed that the big majority of our patients had stayed in these facilities for more than 24 hours prior to referral. This fact highlights the possibility of delay in recognition of critically ill patients who might have benefited from earlier referral or might not have needed a referral to MNH due to poor prognosis or irreversible condition. While our study was not set up to look into these factors, a future analysis of this delay might be important in helping to expedite care of these patients or defer treatment for those who might not benefit from referrals. The median ED stay for our patients was found to be one hour and forty minutes before cardiac arrest, further highlighting the acuity of illness of our patient population.

Most of the patients (63%) in our study who were referred from other hospitals were brought by ambulances as they provide mainly interfacility transport. Those who were brought from their homes mostly used private means. A study in Ethiopia showed that only 21.5% of the patients who were referred to the tertiary public hospital ED were transported by ambulance (20). This is a health challenge in many low-income countries as the emergency medical services are not established to respond to pre-hospital emergencies.

Hypertensive disorders were the most frequent reported comorbidity among our study population, a similar pattern to the one observed in Uganda and Kenya (7,15). The diagnosis of hypertension and heart failure among our group were 13.2% and 10.3% respectively.

Patients with hypertension and heart failure comorbidities had reduced chance of 24-hour survival (33% and 14%) respectively although the study was not powered to detect a difference in these risk factors.

These cardiac arrest patients presented mainly with acute onset of symptoms, this was corresponding to the study in Uganda of which the acute illness predominated the presentation at 74.3% (15) perhaps it reflected the low use of herbal medicine in our study since the communities around use herbal remedies widely.

Among the symptoms presented by the patients who later developed cardiac arrests were difficulty in breathing (38.2%) followed by altered level of consciousness (32.4%). More than 60% of adults presented with Modified Early Warning Signs Score (MEWS) of 5 or more and more than half of children presented with 4 or more scores in the emergency department pre-arrest for which urgent and aggressive interventions would be needed, which is similar to the study in Kenya (7,27,28). In addition, it was found in our study that patients who presented with pre-arrest higher body temperature had more than 550% chance of 24- hour survival than others. The patients who presented to the ED-MNH were too sick or critically ill that more than half of them had two or more abnormalities in their primary surveys that needed urgent comprehensive resuscitation.

Sepsis was a major cause of cardiac arrest in these patients and had better 24-hour survival, followed by renal failure and pneumonia which both had reduced 24-hour survival, although the result was not statistically significant. In Uganda and high income countries the same diagnosis showed poor inhospital survival (4,11,18).

Among the point-of-care pre-arrest investigations done in the department, acidosis, hyperkalaemia and hyperlactataemia appeared be associated with reduced survival although the study, although this was not statistically significant. Patients with low haemoglobin of 8 or less had more than eight times 24-hour survival benefit. Our study also found that treatments given pre-arrest were intravenous crystalloid boluses, intravenous dextrose, antibiotics and blood transfusion but none were associated with a 24-hour survival, except for oxygen therapy which had reduced survival.

More than half of the patients with cardiac arrests underwent CPR, reasons for non-CPR being presentation at a critical irreversible stage and limited resources, among others. The study in Uganda showed 50% did not undergo CPR with no reason and/or were considered brain dead (15). The daytime cardiac arrests were higher than night time but their 24-hour survival were poor. Similar trends were found in Uganda and Kenya tertiary hospitals (7,15).

Having non-documented or unknown rhythms during CPR had more than ten times 24-hour survival benefit compared to other rhythms. Studies in Kenya and North America also showed improved survival with unknown rhythms (22).

The median duration of CPR in the ED-MNH was twelve and a half minutes which was a bit less than in high income countries, where the median duration of CPR ranged between 18 and 25 minutes (22). Furthermore the CPR duration of less than 15 minutes had a non-statistical significance of improved 24-hour survival of more than 400% than those resuscitated for more than 15 minutes corresponding to the study by "*Dumot et al"* which found that CPR less than 15 minutes had 64% chance of 24-hour survival while CPR above 29 minutes had lower than 18% chance of survival (22). Likewise we found that those who consumed 4 or more of adrenaline boluses had survival of 19% while that by "*Dumot et al*" showed survival of 11%. Hence a longer duration of CPR and more doses of adrenaline indicates a patient is less likely to survive, as the longer CPR goes on, the more acidotic and refractory to treatment patients become (23).

The identified causes of cardiac arrests were hypoxia, hyperkalaemia, acidosis, shock, hypoglycaemia, severe anaemia, hypokalaemia, and pneumothorax which could be reversed. Even during CPR and correcting the cause hyperkalemia and hypoglycaemia showed reduced 24-hour survival.

Lastly, the cardiac arrest in our setting show poor outcome as all cardiac arrest survivors died within seven days. This alarms the health providers in the ED to prevent cardiac arrest at all possible ways to unstable patients at risk of cardiac arrests. However some patients with multiple comorbidities and very advanced age have poor prognosis even in high-income countries (4). Only about two-third of the patients with cardiac arrests underwent CPR and 45% of them had no access for ICU care because of limited beds for resuscitation. This calls for the expansion of critical care services for the public tertiary hospital according to the standard capacity (26). The study in a private tertiary hospital in Kenya showed the outcome of CPR outcome to hospital discharge of 11.1% with good neurological outcome which nearly conform to the same range of survival as of the high-income countries (4,7). Likewise the ED-MNH survivalof 13.2% from CPR shows a good starting effort which has to be carried forward to hospital discharge through researches, training and protocols.

10. STUDY LIMITATIONS

Limitations of the study were small sample size of the study which could have contributed to the lack of significance of the hypothesis tests. The data were bound to be collected within 5 months while most studies of cardiac arrests were done for one year and above. Also the data collected were not uniform due to low purchase capabilities of the patients and relatives for investigations, breakdown of the arterial blood gas machine which was analysing the investigations, inadequate information entry by the health providers and crowding of patients in the department. In addition, the treatments given at the referring hospitals were not included in the study because of the non-uniformity of documentation. The blood pressures of children were not taken since there are wide variations in their measurements by age.

11. CONCLUSION AND RECOMMENDATIONS

The overall rate of cardiac arrest at ED-MNH is less than 1%, with two thirds of these patients receiving a full code CPR. Despite this, the overall hospital outcome of cardiac arrest patients remains very poor. Future studies should focus on prevent critically unstable patients from developing cardiac arrests and in-hospital factors affection outcomes of cardiac arrest patients.

Recommendations

1. More studies with larger sample size need to be undertaken
2. Early referrals within 24 hours of critically ill patients by lower level hospitals
3. Aggressive management of unstable patients presenting to the ED-MNH in order to prevent cardiac arrests
4. More ICU beds equipped with necessary resuscitation kits and ventilators is advocated
5. Further studies to investigate for postcardiac arrest care is recommended.

12. REFERENCES:

1. Jacobs I, Nadkarni V, Bahr J, Berg RA, Billi JE, Bossaert L, et al. Cardiac arrest and cardiopulmonary resuscitation outcome reports: update and simplification of the Utstein templates for resuscitation registries. Resuscitation. 2004 Dec;63(3):233–49.
2. Sawe HR, Mfinanga JA, Mwafongo V, Reynolds TA, Runyon MS. Trends in mortality associated with opening of a full-capacity public emergency department at the main tertiary-level hospital in Tanzania. Int J Emerg Med [Internet]. 2015 Dec [cited 2016 Feb 5];8(1). Available from: http://www.intjem.com/content/8/1/24
3. Mervyn Singer, et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). JAMA. 2016;315(8):801–10.
4. Sandroni C, Nolan J, Cavallaro F, Antonelli M. In-hospital cardiac arrest: incidence, prognosis and possible measures to improve survival. Intensive Care Med. 2007 Feb 5;33(2):237–45.
5. Neumar RW, Otto CW, Link MS, Kronick SL, Shuster M, Callaway CW, et al. Part 8: Adult Advanced Cardiovascular Life Support: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation. 2010 Nov 2;122(18_suppl_3):S729–67.
6. Robert E O'Connor. Cardiac Arrest - Critical Care Medicine - MSD Manual Professional Edition [Internet]. [cited 2016 Mar 18]. Available from:

http://www.msdmanuals.com/professional/critical-care-medicine/cardiac-arrest/cardiac-arrest

7. Wachira BW, Tyler MD. Characterization of in-hospital cardiac arrest in adult patients at a tertiary hospital in Kenya. Afr J Emerg Med. 2015 Jun;5(2):70–4.
8. Jesu´s Lo´pez-Herce et al. Factors associated with mortality in pediatric in-hospital cardiac arrest: a prospective multicenter multinational observational study. Intensive Care Med. 2013;(39):309–218.
9. Berdowski J, Berg RA, Tijssen JGP, Koster RW. Global incidences of out-of-hospital cardiac arrest and survival rates: Systematic review of 67 prospective studies. Resuscitation. 2010 Nov;81(11):1479–87.
10. Ahn JY, Lee MJ, Kim H, Yoon HD, Jang HY. Epidemiological and Survival Trends of Pediatric Cardiac Arrests in Emergency Departments in Korea: A Cross-sectional, Nationwide Report. J Korean Med Sci. 2015;30(9):1354.

11. Kocher KE, Haggins AN, Sabbatini AK, Sauser K, Sharp AL. Emergency Department Hospitalization Volume and Mortality in the United States. Ann Emerg Med. 2014 Nov;64(5):446–57.e6.
12. Vinay M. Nadkarni, Gregory Luke Larkin, Mary Ann PeberdyMary Ann Peberdy, Scott M. Carey, William Kaye, Mary E. Mancini, et al. First Documented Rhythm and Clinical Outcome From In-Hospital Cardiac Arrest Among Children and Adults. JAMA. 2006 Jan 4;295(1):50–7.
13. Bergum D, Nordseth T, Mjølstad OC, Skogvoll E, Haugen BO. Causes of in-hospital cardiac arrest – Incidences and rate of recognition. Resuscitation. 2015 Feb;87:63–8.
14. Nolan JP, Soar J, Smith GB, Gwinnutt C, Parrott F, Power S, et al. Incidence and outcome of in-hospital cardiac arrest in the United Kingdom National Cardiac Arrest Audit. Resuscitation. 2014 Aug;85(8):987–92.
15. Ocen D, Kalungi S, Ejoku J, Luggya T, Wabule A, Tumukunde J, et al. Prevalence, outcomes and factors associated with adult in hospital cardiac arrests in a low-income country tertiary hospital: a prospective observational study. BMC Emerg Med [Internet]. 2015 Dec [cited 2016 Feb 4];15(1). Available from: http://www.biomedcentral.com/1471-227X/15/23
16. Chen C-T, Chiu P-C, Tang C-Y, Lin Y-Y, Lee Y-T, How C-K, et al. Prognostic factors for survival outcome after in-hospital cardiac arrest: An observational study of the oriental population in Taiwan. J Chin Med Assoc. 2016 Jan;79(1):11–6.
17. Stein C. Out-of-hospital cardiac arrest cases in Johannesburg, South Africa: a first glimpse of short-term outcomes from a paramedic clinical learning database. Emerg Med J. 2009 Sep 1;26(9):670–4.
18. Vedanthan R, Fuster V, Fischer A. Sudden Cardiac Death in Low- and Middle-Income Countries. Glob Heart. 2012 Dec;7(4):353–60.
19. Ugare G, Ndifon W, Bassey L, Oyo-Ita A, Egba R, Asuquo M, et al. Epidemiology of death in the emergency department of a tertiary health centre south-south of Nigeria. Afr Health Sci [Internet]. 2013 Feb 1 [cited 2016 Feb 4];12(4). Available from: http://www.ajol.info/index.php/ahs/article/view/85090
20. Hunchak C, Teklu S, Meshkat N, Meaney C, Puchalski Ritchie L. Patterns and predictors of early mortality among emergency department patients in Addis Ababa, Ethiopia. BMC Res Notes [Internet]. 2015 Dec [cited 2016 Feb 19];8(1). Available from: http://www.biomedcentral.com/1756-0500/8/605

21. Philip J Podrid et al. Pathophysiology and etiology of sudden cardiac arrest [Internet]. [cited 2016 Mar 17]. Available from: http://www.uptodate.com/contents/pathophysiology-and-etiology-of-sudden-cardiac-arrest
22. Morrison LJ, Neumar RW, Zimmerman JL, Link MS, Newby LK, McMullan PW, et al. Strategies for Improving Survival After In-Hospital Cardiac Arrest in the United States: 2013 Consensus Recommendations: A Consensus Statement From the American Heart Association. Circulation. 2013 Apr 9;127(14):1538–63.
23. Sasson C, Rogers MAM, Dahl J, Kellermann AL. Predictors of Survival From Out-of-Hospital Cardiac Arrest: A Systematic Review and Meta-Analysis. Circ Cardiovasc Qual Outcomes. 2010 Jan 1;3(1):63–81.
24. Tunstall-Pedoe H, Bailey L, Chamberlain DA, Marsden AK, Ward ME, Zideman DA. Survey of 3765 cardiopulmonary resuscitations in British hospitals (the BRESUS Study): methods and overall results. BMJ. 1992 May 23;304(6838):1347–51.
25. Dumot JA, Bursal DJ, Sprung J, Waters JH, Mraovic B, Karafa MT, et al. Outcome of Adult Cardiopulmonary at a Tertiary Referral Center Including Results of "Limited" Resuscitations. Arch Intern Med. 2001 Jul 23;
26. UK_Intensive_care.pdf [Internet]. [cited 2017 Nov 2]. Available from: http://www.md.ucl.ac.be/didac/hosp/architec/UK_Intensive_care.pdf
27. Attachment 4 - MEWS.pdf [Internet]. [cited 2017 Jun 19]. Available from: http://www.heartofengland.nhs.uk/wp-content/uploads/MEWS.pdf
28. paediatric early warning scoring policy - paediatricearlywarningscoringpolicy.pdf [Internet]. [cited 2017 Jul 10]. Available from: http://www.tamesidehospital.nhs.uk/documents/paediatricearlywarningscoringpolicy.pdf
29. The 2015 ILCOR/AHA/ERC advanced life support guidelines (ACLS) | First10EM [Internet]. First 10 EM. 2015 [cited 2016 Apr 12]. Available from: https://first10em.com/2015/10/21/acls-2015/
30. Part 12: Pediatric Advanced Life Support | ECC Guidelines 2015 [Internet]. CPR & First Aid: Emergency Cardiovascular Care. [cited 2016 Apr 12]. Available from: https://eccguidelines.heart.org/index.php/circulation/cpr-ecc-guidelines-2/part-12-pediatric-advanced-life-support/

13. APPENDIX

13.1 QUESTIONNAIRE

INCLUSION CRITERIA: All patients who develop cardiac arrest while in care at the Emergency Medicine Department of Muhimbili National Hospital and whose relative or next of kin have consented to participate in the study during the study period of September to December 2016.

1. **Demographics:**

Admission number ……

Age ……..

Estimated body weight (children) ……..

Gender: Male ☐ Female ☐

Address ……

Telephone number (Next of kin) ……... Date ……

Referral: (self or hospital referral)……

Referral from:…….

2. **Pre-ED MNH patient experience of medical care:**

i. When did the patient fall sick? ……

ii. Use of alternative therapy YES ☐ NO ☐

iii. Admission at peripheral hospital/health centre? YES ☐ NO ☐

iv. IF YES above, how many days? ☐

v. Treatment given while admitted:
……
……

vi. Referral diagnosis (If more than one indicate):..... ……

vii. Reason for referral:…….....
.....

viii. Does the patient have any chronic condition?
……..

ix. Use of medication for the condition? ……
……

……

3. Present illness at ED-MNH and Management Strategies:

i. When has the patient arrived at ED-MNH? Date and Time.....

ii. What is the mode of arrival? .....

iii. What is the chief complaint(s) presented by the patient at ED?
……

……
…….....

iv. Is the patient intubated on arrival from referring centre? YES ☐ NO ☐

ii. Vital signs (on arrival)

BP ☐ HR ☐ RR ☐ Temp. ☐ SPO2 ☐

RBG ☐

iii. Physical examination findings

Primary survey	Normal	Abnormal	IF abnormal, specify
Airway	☐	☐	.....
Breathing	☐	☐	.....
Circulation	☐	☐	.....
Disability (AVPU/GCS)	☐	☐	.....
Exposure	☐	☐	..……..

Provisional diagnosis at ED prior to cardiac arrest:

i)..... ii).....

iii).....

Investigations

A. Bedside RESULT

i. ☐ MRDT

.....

ii. ☐ VBG .....

iii. ☐ Urine dipstick .....

iv. ☐ Ultrasound/FAST .....

v. ☐ ECG/Cardiac monitor .....……

B. Laboratory RESULT

☐ FBP Hb..... WBC.....Neut.....Lymph.....Mon.....Eos.....Bas.....Plt.....

☐ Blood grouping ABO group ..... Rh.....

☐ Creatinine+Urea Creat .....Urea .....

☐ Serum electrolytes Na+.....K+.....Cl-……

☐ Others.....

Blood culture .....

☐ BS for Malaria .....

☐ Liver function test ALT.....AST.....Bil total..... Bil direct.....

PT..... PTT..... INR .....

☐ Others …….....

.....

C. Radiology RESULTS

i. ☐ Plain abdominal X-ray (erect/supine) .....

ii. ☐ Chest Xray .....

iii. ☐ Formal abdominal US .....

iv. ☐ CT scan/MRI .....

D. Pre-arrest ED Treatment and Procedures: If None indicate

☐ IV fluid Type..... Amount.....

☐ Antimalarial Type..... Amount.....

☐ Antibiotic Type 1..... Amount .....

2..... Amount .....

3..... Amount .....

Blood Transfusion Type..... Amount.....

Others.....

.....

.....

E. First documented rhythm after cardiac arrest: tick where appropriate

i. ☐ Asystole
ii. ☐ Pulseless electrical activity (PEA)
iii. ☐ Ventricular fibrillation (Vfib)
iv. ☐ Pulseless ventricular tachycardia (VT)
v. ☐ Not known/Not documented

F. Management strategies after cardiac arrest at ED-MNH

Time CPR started .....

CPR YES ☐ NO ☐

If No, Why?

……..…….

Team leader of CPR: Specialist ☐ Resident ☐ Registrar ☐ Intern ☐

For those done CPR:

When was CPR stopped? Time ……

Defibrillation done? YES ☐ NO ☐

How many times? ……..

Investigations done during CPR:

RBG result .....

VBG result PH.....PCO2.....HCO3..... K+..... lactate.....

Hb.....

Ultrasound result Cardiac tamponade ☐ Tension pneumothorax ☐

Management done:

Ventilation: by ambubagging ☐ Intubation ☐

Adrenaline: Amount ..... Frequency: .....

Amiodarone: Amount.....

IVfluids: Type..... Amount.....

Dextrose: Strength..... Amount.....

KCl: Amount.....

Calcium Gluconate/calcium chloride: amount.....

Insulin with dextrose: YES ☐ NO ☐

Sodium bicarbonate: amount.....

Frusemide: amount.....

Salbutamol nebulisation: YES ☐ NO ☐

Blood transfusion: Amount.....

PROCEDURES: Needle decompression ☐ Chest tube ☐
pericardiocentesis ☐

OTHERS: .....

.....

How many episodes of CPR done when the patient stayed at ED after attaining ROSC?.....

What was the identified cause of cardiac arrest?

.....

4. **Outcome of CPR at ED?** Died ☐
   ROSC ☐ Time of ROSC .....

Disposition

Where was this patient disposed to?

i. Ward ☐
ii. Theatre ☐
iii. ICU (adult) ☐
iv. Ward 1 (medical ICU) ☐
v. Paediatric ICU ☐
vi. Mortuary ☐
vii. Transferred to another hospital ☐

Outcome after 24 hours

Alive ☐ Dead ☐

Outcome after 7 days

Alive ☐ Dead ☐

Outcome after 30 days

Alive ☐ Dead ☐

Outcome at hospital discharge

Alive ☐ Dead ☐

Final diagnosis at Hospital discharge: .....

13.2 Consent in participating in research: English version

STUDY TITLE: THE CLINICAL PROFILE, MANAGEMENT STRATEGIES AND OUTCOME IN THE EMREGENCY MEDICINE DEPARTMENT OF MUHIMBILI NATIONAL HOSPITAL, DAR ES SALAAM, TANZANIA

Introduction

Greetings, my name is Dr Ally Munir Akrabi, a second year resident in the Department of Emergency Medicine at Muhimbili University of Health and Allied Sciences (MUHAS).
I am conducting a study with the above title as part of my study program. I hereby request your participation and cooperation in my study once I or my research assistant approaches you. Your decision to or not to participate will have no effect on the care and management or harm to your patient or beloved one. Please ask questions if there is anything about this study you do not understand.

Aim of the study

The purpose of this study is to describe the clinical profile, management and outcome of patients who develop cardiac arrest in the department.

Benefits

There will be overall benefit after knowing the results and its implication to the hospital. There will be no payment for participation in the study.

Risks

There is no risk in participating in this study.

What does this study involve?

This study involves the research assistant or principal investigator asking structured questions to the informant or relatives and filling the responses in the prepared questionnaire. Also information about the patient will be obtained from the patients file.

Consent

Your consent for your patient to be involved in the study is completely voluntary and agreeable by signing the consent form. If you are not free you are allowed not to consent and this will not affect the care and management offered to your patient you brought for treatment. You may choose to stop taking part in this study at any time for any reason.

Confidentiality

The information you provide is highly valued and will be kept strictly confidential. The study information will be stored in protected computer files and in paper records stored in locked filing cabinet. Only study staff will have access to the information.

Access of information

By signing this form, you allow the research team to use the information and give it to others involved in the research. The research team includes the researcher, facilitators plus others working on this study at MUHAS and MNH.

For further information, questions or queries, you can contact:

1. The Principal Investigator,
   Dr. Ally Munir Akrabi
   Department of Emergency Medicine,
   MUHAS,
   P. O. Box 65001,
   Dar es Salaam, Tanzania.
   Tel: +255 763 375000
   Email: allymunna@yahoo.com

2. Dr. Hendry Sawe

Department of Emergency Medicine,
MUHAS/MNH,
P. O. Box 6500,
Dar es Salaam, Tanzania.
Tel: +255 754 885658
Email: hendry_sawe@yahoo.com

3. Prof. Said Aboud,
   Director of Research and Publications,
   MUHAS,
   P.O. Box 65001,
   Dar es Salaam, Tanzania.
   Tel no; 2150302-6, 2152489.

Signature:

I, _____ have read/been told the contents of this form. My questions have been answered. I agree to participate in this study.

Signature of participant _____

Date of signed consent _____

13.3 Consent in participating in research: Swahili version

STUDY TITLE: THE CLINICAL PROFILE, MANAGEMENT STRATEGIES OF PATIENTS WHO DEVELOP CARDIAC ARRES IN EMERGENCY MEDICINE DEPARTMENT, MNH, DAR ES SALAAM, TANZANIA

FOMU YA RIDHAA YA KUSHIRIKI KATIKA UTAFITI

Utangulizi

Jina langu naitwa Dkt. Ally Munir Akrabi, mwanafunzi wa udaktari bingwa wa magonjwa ya dharura (Emergency Medicine) katika Chuo Kikuu Cha Afya na Sayansi Shirikishi Muhimbili (MUHAS). Ninaomba ushiriki wako kwa niaba ya mwanao katika utafiti huu endapo mimi ama msaidizi wangu atakapokufuata ili kukuuliza taarifa muhimu za mgonjwa wako.

Madhumuni ya utafiti:

Utafiti huu unalenga kujua aina ya wagonjwa ambao moyo wao umesimama ghafla kutokana na kuumwa sana ndani ya idara yetu ya dharura.

Ushiriki katika utafiti:

Mgonjwa yeyote aliyeko idarani akipatiwa tiba na punde moyo kusimama au kufariki.

Hatari:

Hatutarajii kuwepo na athari/hatari yeyote itokanayo na ushiriki katika utafiti huu.

Faida za utafiti:

Kwa kutoa ridhaa ya mgonjwa wako kushirikishwa katika utafiti huu, tutaweza jua ni sababu zipi na hatari zipi zinaweza kupelekea mgonjwa moyo kusimama/kufa, tiba zinazoweza kuokoa mgonjwa, na hatma za wagonjwa hawa baada ya tiba ya dharura.

Usiri:

Taarifa zote zitakazokusanywa katika utafiti huu zitakuwa siri, hivyo ushiriki wako hautajulikana na mtu. Taarifa hizi zitajulikana kwenye timu ya watafiti tu.

Malipo:

Kwa kushiriki kwenye utafiti huu, hautalipwa wala hautalipa chochote.

Ukiwa na swali au tatizo lolote, unaweza kuwasiliana na wafuatao:

1. Mkuu wa Utafiti
Dr. Ally Munir Akrabi,
Idara ya Magonjwa ya Dharura na Mahututi (Emergency Medicine),
MUHAS,
S.L.P 65001,
Dar es Salaam, Tanzania.
Simu: +255 763 375000
Barua pepe: allymunna@yahoo.com

2. Dr. Hendry R Sawe
Idara ya Magonjwa ya dharura na Mahututi,
MUHAS/MNH,
S.L.P 65001,
Dar es Salaam, Tanzania.
Tel: +255 754 885658
Barua pepe: hendry_sawe@yahoo.com

3. Prof. Said Aboud
Mkurugenzi wa utafiti,
MUHAS,
S. L. P. 65001,
Dar es Salaam, Tanzania
Simu: 2150302-6, 2152489.

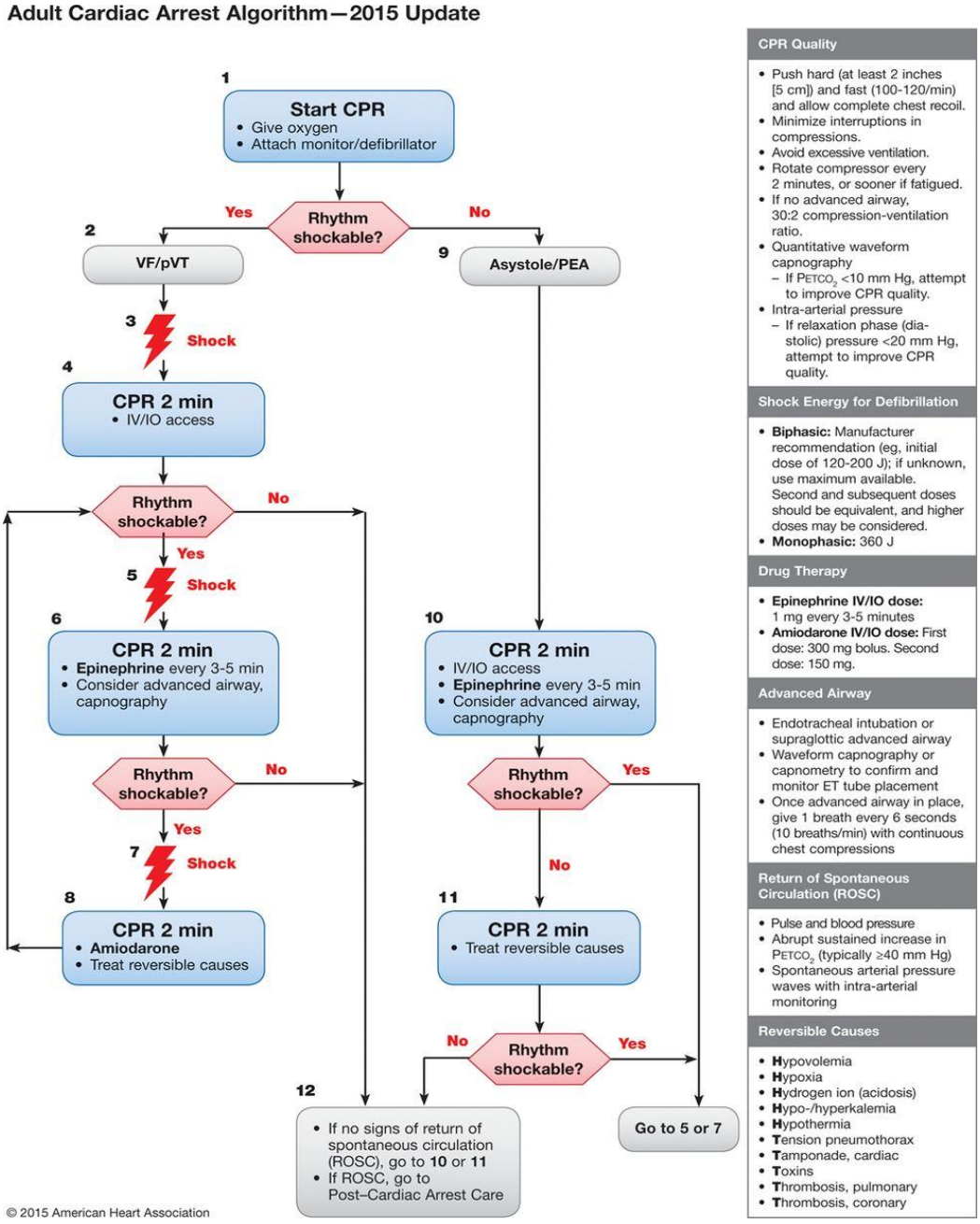
Kuweka sahihi ya makubaliano:

Mimi, _____, nimesoma/nimesomewa maelezo yote yaliyomo kwenye fomu hii na nimeelewa. Maswali yangu yamejibiwa vizuri na niko tayari kushiriki.

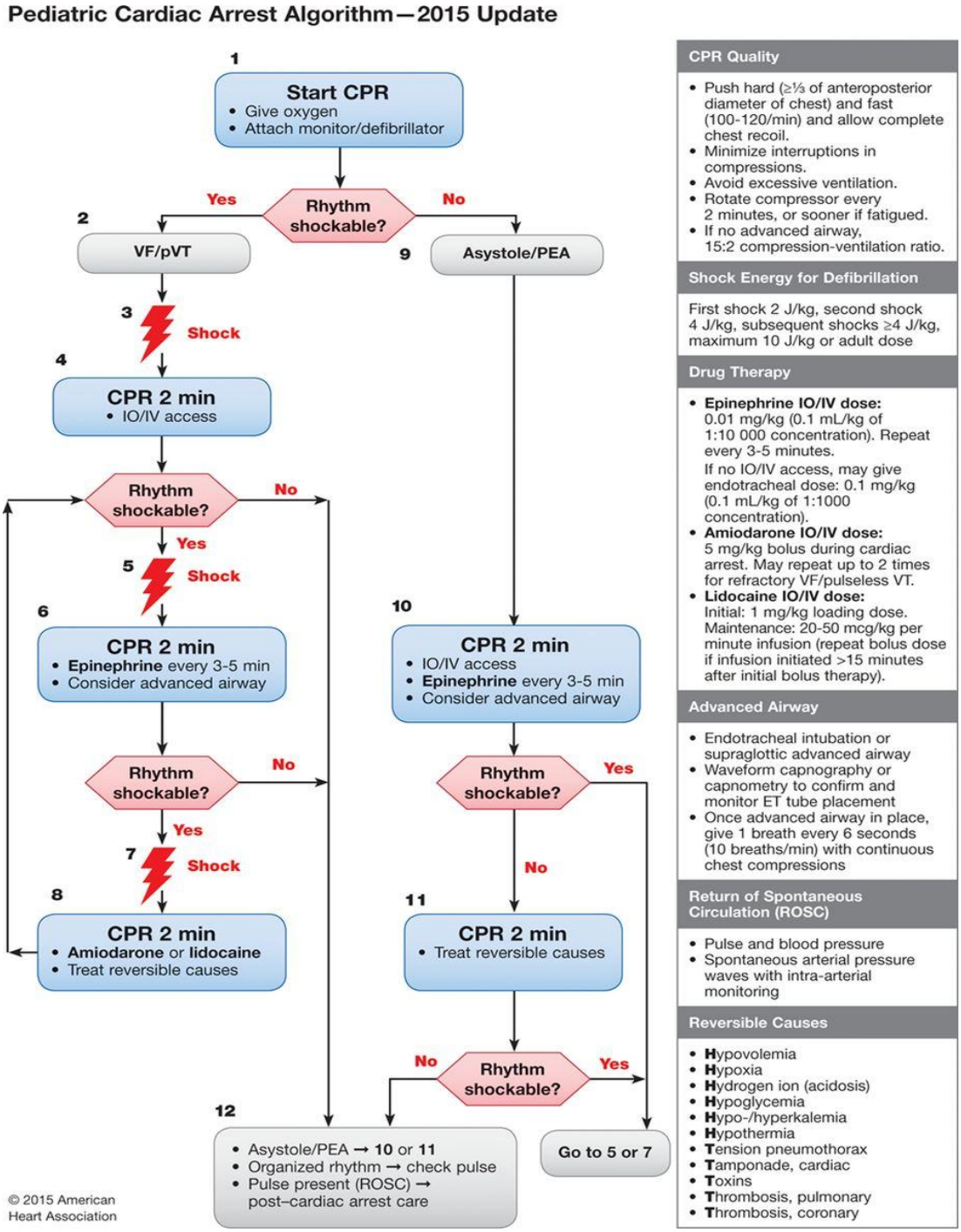
Sahihi ya mshiriki _____

Sahihi ya Mtafiti _____Tarehe _____

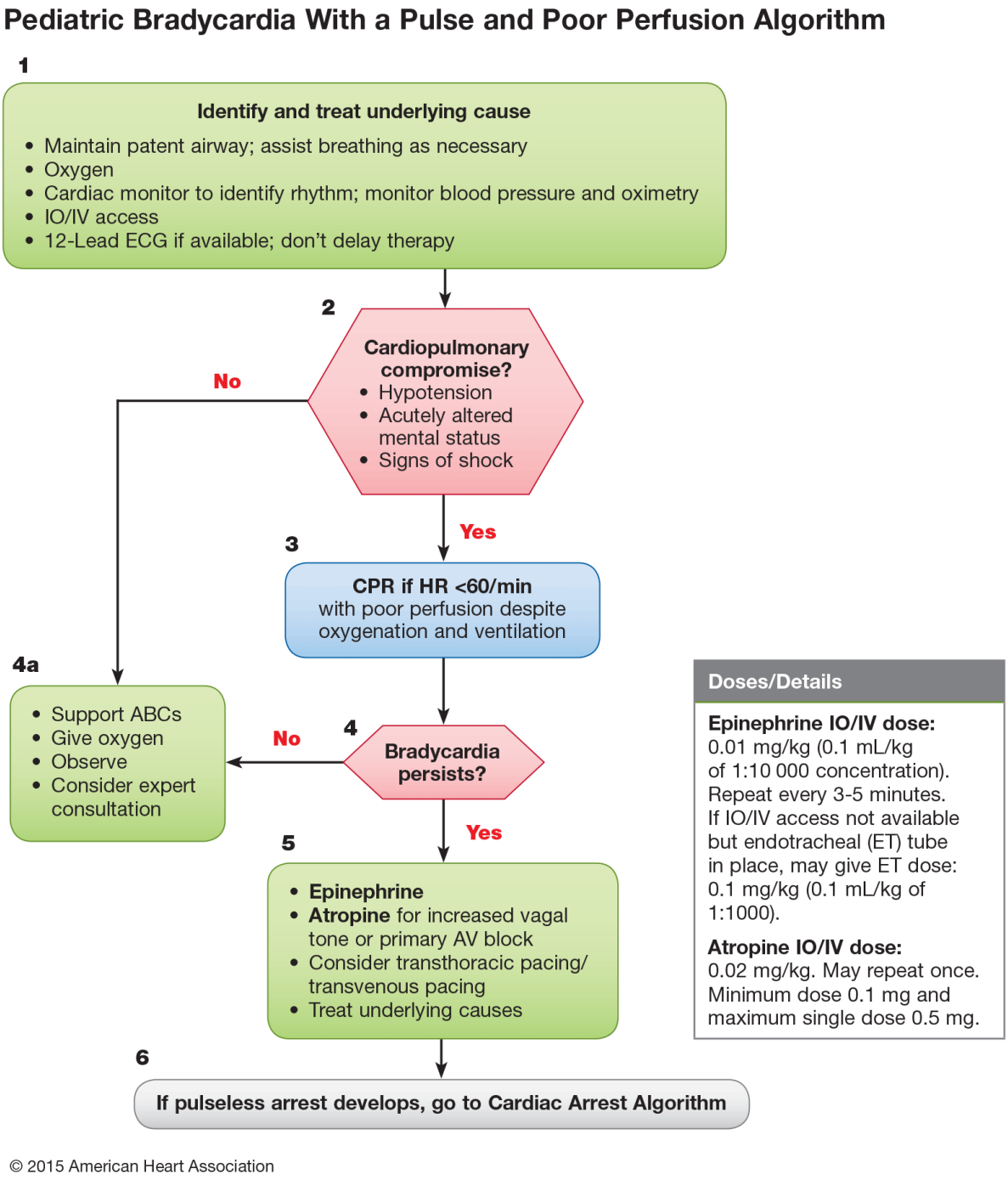
13.4 AHA ADULT CARDIAC ARREST MANAGEMENT ALGORITHM(29)



13.5 AHA PAEDIATRIC CARDIAC ARREST MANAGEMENT ALGORITHM (29)



13.6 AHA PAEDIATRIC BRADYCARDIA WITH POOR PERFUSION (30)



© 2015 American Heart Association