Factors Associated With In-Hospital Post-Cardiac Arrest Survival in a Referral Level Hospital in Uganda

Article *in* Anesthesia and Analgesia · July 2022

DOI: 10.1213/ANE.0000000000006132

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ORIGINAL CLINICAL RESEARCH REPORT

Factors Associated With In-Hospital Post–Cardiac Arrest Survival in a Referral Level Hospital in Uganda

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BACKGROUND: Cardiac arrest (CA) is still associated with high mortality and morbidity across all practice settings despite resuscitation attempts and advancements in its management. Patient outcomes vary and are affected by multiple factors. Nonetheless, there is a paucity of information on survival after CA and associated factors in low-resource settings such as East Africa where Uganda is located. This study set out to describe post-CA survival, associated factors, and neurological outcome at a hospital in Southwestern Uganda.

METHODS: This was a descriptive study in which we followed up with resuscitated CA patients from any of the selected hospital locations at Mbarara Regional Referral Hospital in Southwestern Uganda. We included all patients who were resuscitated after an index CA in the operating room (OR), intensive care unit (ICU), the pediatric ward, or accident and emergency (A&E) wards. Details of resuscitation were obtained from resuscitation team leader interviews and patient medical records. We followed up with patients with return of spontaneous circulation (ROSC) for up to 7 days after CA when neurological outcomes were measured using the age-appropriate Cerebral Performance Category (CPC) score. Factors affecting survival were then determined.

RESULTS: A total of 74 participants were enrolled over 8 months. Seven-day survival was 14.86%. Eight of the 11 survivors had a CPC score of 1 seven days after CA. Admission with trauma was associated with increased mortality with an adjusted hazard ratio (HR) of 4.06; 95% confidence interval (CI), 1.19–13.82. Compared to the A&E ward, HR for index CA in OR, ICU, and pediatric ward was 0.15; 95% CI, 0.05–0.45; 0.67; 95% CI, 0.32–1.40, and 0.65; 95% CI, 0.25–1.69, respectively. Compared to cardiopulmonary resuscitation (CPR) <10 minutes, the HR for CPR duration between 10 and 20 minutes was 2.26; 95% CI, 0.78–3.24 and for >20 minutes was 2.26; 95% CI, 1.12–4.56. Prevention of hypotension after ROSC was associated with decreased mortality with an HR of 0.23; 95% CI, 0.08–0.58.

CONCLUSIONS: Whereas 7-day survival of resuscitated CA patients at Mbarara Regional Referral Hospital (MRRH) was low, survivors had a good neurologic outcome. CA in the OR, CPR <20 minutes, and prevention of hypotension postarrest seemed to be associated with survival. (Anesth Analg 2022;135:1073–81)

KEY POINTS

- **Question:** What is the post–cardiac arrest survival rate at Mbarara Regional Referral Hospital?
- **Findings:** Seven-day survival was low at 14.86%. Survivors had a good neurologic outcome that depended on a patient's location of the index event, duration of resuscitation, and hemodynamic stability after the event.
- **Meaning:** Neurologic outcome of survivors is good, although there are measures that can be put in place to improve low survival after cardiac arrest.

GLOSSARY

A&E = accident and emergency; **CA** = cardiac arrest; **CI** = confidence interval; **CPC** = Cerebral Performance Category; **CPR** = cardiopulmonary resuscitation; **HIC** = high-income country; **HR** = hazard ratio; **ICU** = intensive care unit; **IHCA** = in-hospital cardiac arrest; **IRB** = institutional review board; **LMIC** = low- and middle-income country; **MRRH** = Mbarara Regional Referral Hospital; **MUST** = Mbarara University of Science and Technology; **OHCA** = out-of-hospital cardiac arrest; **OR** = operating room; **ROSC** = return of spontaneous circulation; **SD** = standard deviation; **STROBE** = Strengthening the Reporting of Observational Studies in Epidemiology; **VIF** = variance inflation factor

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Accepted for publication May 20, 2022.

The authors declare no conflicts of interest.

Funding: None.

DOI: 10.1213/ANE.0000000000006132

The authors declare no conflicts of interest.

Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's website (www.anesthesia-analgesia.org).

Reprints will not be available from the authors.

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Survival after in-hospital cardiac arrest (IHCA) varies widely from 0% to 42%, with higher rates reported among high-income countries (HICs) in the recent past.[2–4] The protocols used to guide successful IHCA resuscitation, especially in low- and middle-income countries (LMICs), are based on data extrapolated from IHCA studies done in HICs or out-of-hospital cardiac arrest (OHCA) studies whose evidence in supporting the current practices within the local clinical setting is low.[5] Resuscitation for OHCAs is usually performed by bystanders, as opposed to IHCA resuscitation in hospital environments with more sophisticated skills and equipment. Compared to HICs, LMICs such as Uganda have more limited expertise and resources for effective management of IHCA. A study conducted at Mbarara Regional Referral Hospital (MRRH) reported that nurses had inadequate knowledge and skills in cardiopulmonary resuscitation (CPR) before being trained.[6] IHCA patient populations already have clinically complex conditions for which they are being managed,[7] and their survival is affected by a myriad of factors. They include age, sex, comorbidities, admission diagnosis, witnessed event, response times, the cause of the CA, the time of the CA, the day of the week, the location within the hospital, and geographical region.[8–11]

Information solely on CA survival as an outcome is insufficient for prognostication, as survivors develop neurologic sequelae, which may affect the quality of life. Thus, it is pertinent that neurologic prognostication is performed for survivors and the outcome described. Prognostication also facilitates decision-making such as escalation or withdrawal of care[12] and, hence, the recommendation that it is done at least 72 hours after CA.[13] Some of these modalities include Cerebral Performance Category (CPC) score, blood biomarkers, N20 somatosensory evoked potential, status myoclonus, pupillary light reflex, and corneal reflex.[13–15] However, there is limited evidence to support their use.[13] The CPC score has been validated for neurologic prognostication of CA survivors[13,16] and can easily be applied in LMICs such as Uganda.

There is a need to document findings from the local setting to aid in the development of locally relevant resuscitation protocols, identification of high-risk patients, identification of potential system and training gaps, and further aid objective clinical decision-making such as withdrawal of care.[17] Therefore, we set out to describe survival after IHCA, delineate factors associated with survival or nonsurvival postresuscitation, and describe the CPC score of survivors on day 7 after CA at a regional referral hospital in Southwestern Uganda.

METHODS

This article adheres to the applicable STROBE guidelines. The study was approved by the Mbarara University of Science and Technology (MUST) institutional review board (IRB; study number: 05/03-19). Participant consent was waived by the IRB because of the possible psychological and emotional impact of a CA on those involved.

Study Design and Setting

The hierarchy of the health service provision sector in Uganda comprises a national referral hospital, regional referral hospital, general hospital, health center IV, health center III, health center II, and village health teams in descending order of complexity of cases managed (Supplemental Digital Content 1, Figure 1, http://links.lww.com/AA/D988). From this hierarchy, a regional referral hospital is designed to serve 2 million people offering general medical services such as pediatrics, internal medicine, general surgery, and obstetrics and gynecology, and specialized services, in some cases serving as teaching hospitals and research centers. The specialized services include otorhinolaryngology, orthopedics, psychiatry, ophthalmology, dentistry, intensive care, radiology, pathology, and specialized surgical and medical services.[18] Some of these specialized services are not offered in some regional referral hospitals due to the scarcity of human resource in those facilities.[18]

Mbarara Regional Referral Hospital is the largest referral hospital in Southwestern Uganda. It doubles as an internship training center and a teaching institution for MUST medical school and other training institutions such as Mayanja Memorial hospital and Bishop Stuart University. It is a government-owned hospital located in Mbarara city, 270 km southwest of Kampala city. It was founded in 1940 with a 600-bed capacity originally set up to provide health services to patients from the districts of Mbarara, Bushenyi, Ntungamo, Kiruhura, Ibanda, and Isingiro. However, Mbarara Regional Referral Hospital also receives patients from neighboring districts such as Kabale, Masaka, Fort Portal, Mitooma, and Buhweju and neighboring countries such as Rwanda, the Democratic Republic of Congo, and Tanzania. The hospital provides general medical services; specialized services such as otorhinolaryngology, orthopedics, psychiatry, ophthalmology, dentistry, intensive care, radiology, and pathology; and specialized surgical and medical services. MRRH has a semiopen 8-bed ICU primarily managed by anesthesiologists and anesthesia trainees. The accident and emergency (A&E) ward managed by internal medicine, surgery, and emergency medicine department consultants and their respective trainees is an entry point for all in-patients except pediatric, obstetric, and gynecology patients. These patients are admitted to the pediatric, obstetric, and gynecology wards, respectively. At Mbarara Regional Referral Hospital, we do not have an organized resuscitation team on standby and so in the event of a CA, whichever health care provider is present joins and participates in the resuscitation. Codes are communicated by word of mouth or phone usually to the more senior doctor on call. Currently, there is no common method or standard way of communicating codes.

The study was conducted between May and December 2019 at select hospital locations, that is, the ICU, A&E, ORs, and the pediatric ward. These particular sites were chosen based on staffing levels, the likelihood of a CA being witnessed, and the probability of resuscitation being performed in those sites compared to other areas within the hospital. The choice for the follow-up duration was made to allow for neurological prognostication to be done on day 7. This from anecdotal data is the average time in-patients spend in the hospital and so would be a source of data on survival in the early hospitalization period. Also, according to Becker et al,[19] 7 days is the early hospitalization phase.

This prospective study described the survival and associated factors of resuscitated CA patients from any of the selected hospital sites mentioned above. These patients were recruited and followed up daily for 7 days after CA, until death or loss to follow-up, whichever occurred first.

Sample Size Consideration

We simulated a minimum sample size based on the 1-week survival of 23.7% from a study done at a tertiary hospital in Thailand that described post-CA survival.[20] With reference to the average number of CA events reported from health worker's experience in the 6 months preceding the study, we estimated survival of 22.4% at a sample size of 50 patients with a standard deviation (SD) of ±4, 60 patients with an SD of ±3 with an estimated survival of 21.55%, and 70 patients to obtain an estimated survival of 21.89% with an SD of ±2.58. We, therefore, aimed to enroll all patients aiming at higher numbers as increasing sample size showed better precision.

Inclusion and Exclusion Criteria

We included all in-patients who sustained an index CA event from any of the specified study locations for whom resuscitation was attempted. We excluded any CA events outside the specific in-hospital study locations, events in which there was no attempt at resuscitation and those in which the team leader of the resuscitation was not available to be interviewed.

Data Collection

Following ethical approval, the selected study locations were notified such that the health care providers in those locations informed the principal investigator or the trained research assistants about patients who met the eligibility criteria. The research assistants were trained nurses with over 10 years of experience who have worked in the emergency and ICU in the course of their practice. The study procedure illustrated in Figure 1 shows the patients recruited and enrolled for data collected according to the data collection tool (see Supplemental Digital Content 2, File 1, http://links.lww.com/AA/D989).

Information on the events surrounding the CA and resuscitation process was obtained by reviewing participant medical records and an interview-based questionnaire for the resuscitation team leader; 1 resuscitation team leader was interviewed per patient within 48 hours of the CA event. The information collected comprised age, sex, date of admission, day of the week, date and time of the CA, location of the CA, admission diagnosis, monitoring done and vital signs prearrest, investigations done, if the event was witnessed, response time, drugs used during resuscitation, health worker participation in resuscitation, duration of CPR, and the probable cause of the arrest. The probable causes were based on the 4(Hs)—hypotension, hypoxia, hypothermia, hypo/hyperkalemia, 4Ts—tamponade, tension pneumothorax, thrombus, and toxins,[21] and other conditions that did not fall in any of the mentioned categories. Information, such as patient demographics, investigations done, date of admission, admission diagnosis, and time and date of CA, was obtained from the patient's medical records.

We followed up survivors daily for 7 days after CA. During the follow-up period, we recorded the outcome status of the patient: alive or dead, vital signs, and registered complications or rearrest on each day. The neurologic state of those alive on day 7 after CA was described using the age-appropriate CPC score.

Data Analysis

Data were entered into Microsoft Excel and imported into Stata 15 and *stset* for analysis. Variables with binary responses were coded 0 if "no" and 1 if "yes" while "male" gender was coded 1. We checked the proportional hazards assumption in stata based on Schoenfeld residuals and found that the χ^2 value for the estat phtest was 0.27 with 3 degrees of freedom. We had a *P* value of .96 meaning we could not reject the null hypothesis that the hazards in our regression model meet the proportional hazards assumptions. We then generated a table summarizing the patient characteristics. These characteristics comprised age, sex, comorbidities, time of day of CA (night or day), hospital location of the CA, day of the week (weekday

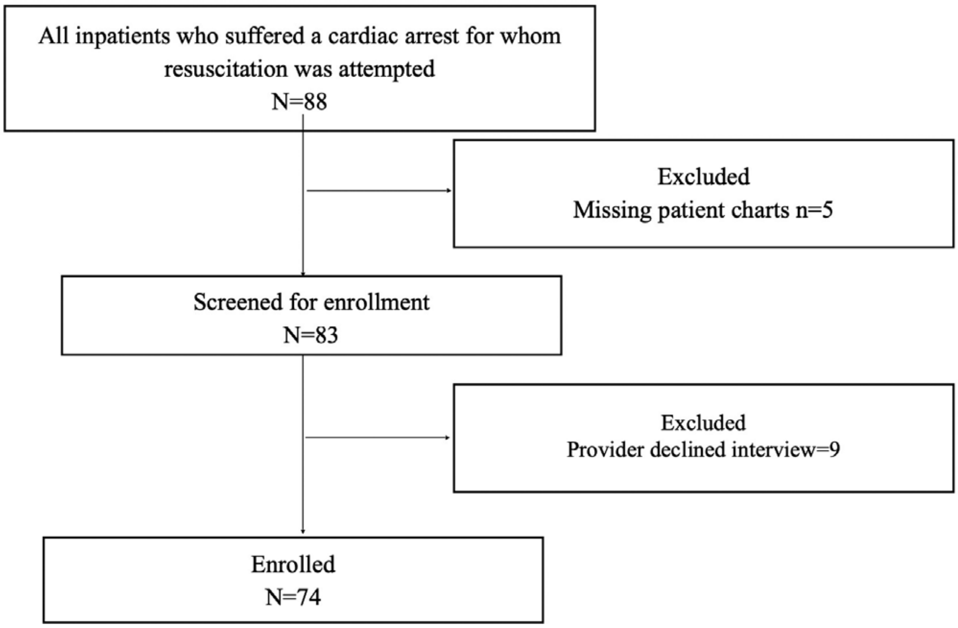

Figure 1. Patient flow during the data collection process from recruitment to enrollment.

versus weekend), the probable cause of the CA, and admission diagnosis. They are presented in Table 1 as frequencies, range, and median.

Seven-day survival over the period was illustrated using a Kaplan-Meier plot presented in Figure 2. We used cox regression to perform a univariable analysis of the following variables to assess their association with survival. These variables include: age, sex, the probable cause of the CA, hospital location of the CA, admission diagnosis, presence of comorbidities, day (weekday) and time of day of the CA event (day), whether the event was witnessed, response time, cadre of health care providers involved in the resuscitation, use of epinephrine during resuscitation, duration of resuscitation, rearrest after CA, postarrest hypotension, and vasopressor use –after CA. The crude hazard ratios (HRs) and their 95% confidence intervals (CIs) are presented in Table 2. We then included all variables whose *P* value was <.1 except the postarrest variables in a multivariable analysis. The postarrest variables were exempt from this rule as there were few variables in that category. We tested pairwise correlation coefficients among all the variables and measured the variance inflation factor (VIF). The mean VIF was 1.51 with the highest VIF being 2.40. The adjusted HRs were computed to determine measures of association and presented in Table 3. A *P* value of ≤.05 was considered statistically significant. We documented neurological assessment of the survivors on day 7 using the age-appropriate CPC score.

Missing Data

We did not have any missing data for the measurement of 7-day survival. However, only 1 patient in the study had missing data for one of the intra-arrest factors, that is, the cadre of the health worker who participated in resuscitation and hence was excluded from the analysis of this objective.

RESULTS

A total of 74 patients were enrolled over the entire study period.

Patient Characteristics

The characteristics of the patients are presented in Table 1. The minimum age of the patients was 3 hours and the maximum age was 85 years with a median age of 40 years. A total of 49 patients representing 66.2% of the study patients were men. There were 20 (27.03%) patients admitted with a respiratory pathology, while 17 (22.97%) were admitted with trauma. The respiratory pathologies comprised conditions, such as pneumonia, acute exacerbation of asthma, and other noninfectious conditions. Hypoxia and hypotension were the most frequent probable causes documented in 46 (63.01%) and 34 (46.58%) patients, respectively. The comorbidities comprised conditions, such as hypertension, diabetes mellitus, cardiac disease, sickle cell anemia, human immunodeficiency virus infection, and congenital anomalies. However, the patients with comorbidities were too few to be considered in the regression analysis.

CA Survival

The trend of survival is illustrated in Figure 2 attached. Forty-six of the 74 (62.16%) participants had ROSC, 29.73% survived to 24 hours while only 11 (14.86%) of the patients enrolled were alive 7 days after CA. Nine of the 11 survivors on day 7 after CA were patients recruited from the OR.

Table 1. Sociodemographic and Clinical Characteristics of Study Participants, N = 74

Characteristic	n (%)
Age, median (minimum, maximum)	40 (3 h, 85 y)
Sex, male, n (%)	49 (66.2)
Reason for hospital admission, n (%)	
Gastrointestinal	8 (10.81)
Trauma	17 (22.97)
Respiratory	20 (27.03)
Renal	2 (2.7)
Obstetric/gynecological	6 (8.11)
Neurological	7 (9.46)
Cardiovascular	7 (9.46)
Sepsis with unknown focus	7 (9.46)
Comorbidities present, n (%)[a]	21 (28.38)
CA event on a weekday, n (%)	57 (77.03)
Time of CA, 0800–1959 h, n (%)	46 (62.16)
Location of CA, n (%)	
ICU	31 (41.89)
Theater	17 (22.97)
A&E	15 (20.27)
Pediatric ward	11 (14.86)
Probable causes	
Hypotension	34 (46.58)
Hypoxia	46 (63.01)
Hypo/hyperkalemia	6 (8.22)
Hypothermia	4 (5.48)
Tamponade	2 (2.74)
Drug overdose	5 (6.85)
Myocardial infarction	3 (4.11)
Other causes[b]	19 (26.03)

Abbreviations: A&E, accident and emergency; CA, cardiac arrest; CPR, cardiopulmonary resuscitation; ICU, intensive care unit.

[a]Conditions such as hypertension, diabetes mellitus, cardiac disease, sickle cell anemia, human immunodeficiency virus infection, and congenital anomalies.

[b]Other causes comprised raised intracranial pressure and anemia.

Factors Associated With Survival of CA

From the univariate analysis, the factors significantly associated with survival were: index CA in the ICU (crude HR, 0.5; CI, 0.26–0.94), index CA in the OR (crude HR, 0.11; CI, 0.05–0.28), participation of at least 1 anesthesia provider (crude HR, 0.51; CI, 0.31–0.86), and prevention of hypotension after CA (crude HR, 0.45; CI, 0.22–0.92). Table 2 shows the crude HRs after the univariate analysis.

Mortality was associated with respiratory pathology at admission (crude HR, 4.75; CI, 1.56–14.43), trauma at admission (crude HR, 5.82; CI, 1.90–17.90), duration of CPR >10 minutes, 10 to 20 minutes (crude HR, 2.09; CI, 1.14–3.83), and >20 minutes (crude HR, 2.81; CI, 1.29–5.31), and participation of at least 1 emergency medicine trainee or physician in the resuscitation (crude HR, 1.96; CI, 1.06–3.64).

From the multivariable analysis, an index CA in the OR (adjusted HR, 0.15; CI, 0.05–0.45) and prevention of hypotension (adjusted HR, 0.22; CI, 0.08–0.58) were associated with survival while admission with trauma (adjusted HR, 4.06; CI, 1.19–13.82) and duration of resuscitation >20 minutes (adjusted HR, 2.26; CI, 1.12–4.56) were associated with mortality. The findings from the multivariable analysis are displayed in Table 3.

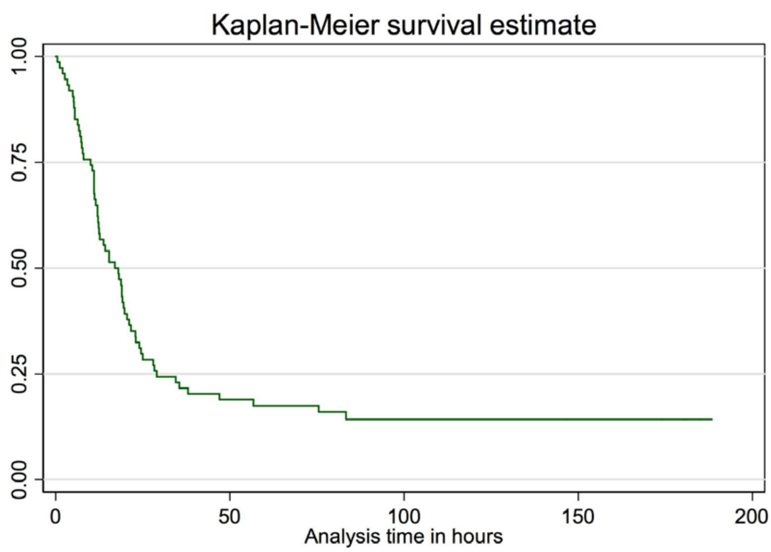

Figure 2. Kaplan Meier curve showing survival over 7 days. The x-axis is time in hours, while the y-axis shows probability of survival.

Neurologic Outcome on Day 7 After CA

On day 7 after CA, 9 patients had a favorable CPC score of 1 to 2. Eight of these patients were recruited from the OR and the remaining patient recruited from the ICU.

DISCUSSION

The majority of patients in the study were young men admitted with trauma-associated injuries or a respiratory condition. We documented hypoxia and hypotension as the commonest probable causes of CA. Our study survival rates at 24 hours and 7 days after CA were 29.73% and 14.85%, respectively, with survivors having a good neurological outcome. Survival

Table 2. Univariable Analysis Factors Affecting Survival

Variable	Crude hazard ratio	95% CI	*P* value
Prearrest factors			
Age, y			
Below 18	1		
18–49	1.07	0.60–1.92	.81
50 and above	1.46	0.75–2.82	.27
Sex, male	1.66	0.97–2.83	.06
CA on weekday	0.68	0.39–1.19	.18
Comorbidities present	1.34	0.79–2.29	.28
Reason for admission			
Trauma	5.82	1.90–17.90	.02
Respiratory pathology	4.75	1.56–14.43	.01
Renal cause	1.12	0.12–10.0	.92
Obstetric/gynecological cause	0.85	0.19–3.80	.83
Neurologic cause	2.77	0.78–9.89	.12
Cardiovascular cause	3.48	1.00–12.14	.05
Sepsis of unknown focus	3.56	1.01–12.59	.05
Location of CA			
A&E	1		
ICU	0.50	0.26–0.94	.03
OR	0.11	0.05–0.28	<.00
Pediatric ward	0.59	0.27–1.32	.20
Intra-arrest			
CA witnessed	1.49	0.36–6.12	.56
Participation in resuscitation			
Nurse	1.44	0.86–2.38	.16
Junior house officer	1.66	0.96–2.85	.07
Residents[a]	1.0	0.60–1.65	1.00
Specialist[a]	0.83	0.42–1.64	.60
Anesthesia provider[b]	0.51	0.31–0.86	.01
Emergency medicine	1.96	1.06–3.64	.03
Others	0.97	0.35–2.66	.95
No drug administered during resuscitation	1.65	0.78–3.50	.19
Used epinephrine	0.63	0.34–1.14	.13
Duration of CPR			
<10 min			
10–20 min	2.09	1.14–3.83	.02
>20 min	2.81	1.29–5.31	<.00
After arrest			
Postarrest SBP			
Hypotensive	1		
Absence of hypotension	0.45	0.22–0.92	.03
Rearrest			
No	1		
Yes (1 or more)	0.91	0.55–1.51	.71
Vasopressor used after CA	1.2	0.66–2.43	.60

Abbreviations: A&E, accident and emergency; CA, cardiac arrest; CPR, cardiopulmonary resuscitation; ICU, intensive care unit; OR, operating room; SBP, systolic blood pressure.

[a]From obstetrics and gynecology, internal medicine, and surgery departments.

[b]This comprised the anesthetic officer (with a diploma training in anesthesia), anesthesiologist, or anesthesia trainee on duty.

Table 3. Multivariable Analysis of Factors Affecting Survival

Variable	Adjusted hazard ratio	95% CI	*P* value
Prearrest			
Sex, male	1.22	0.62–2.43	.56
Location of CA			
ICU	0.67	0.32–1.40	.29
OR	0.15	0.05–0.45	<.00
Pediatric ward	0.65	0.25–1.69	.38
Reason for admission			
Trauma	4.06	1.19–13.82	.03
Respiratory	3.05	0.93–10.02	.07
Renal	1.20	0.13–10.02	.87
Obstetric/gynecological cause	1.57	0.13–11.28	.59
Neurologic cause	1.44	0.31–8.03	.61
Cardiovascular cause	1.64	0.40–6.84	.49
Sepsis of unknown focus	1.87	0.50–6.00	.35
Intra-arrest			
Participation of			
Anesthesia provider	0.71	0.39–1.28	0,26
Emergency specialist	1.43	0.74–2.67	.30
Duration of CPR			
<10 min	1		
10–20 min	1.59	0.78–3.24	.21
>20 min	2.26	1.12–4.56	.02
Postarrest			
Postarrest SBP			
Hypotension	1		
Absence of hypotension	0.22	0.08–0.58	<.00
Rearrest; ≥1	2.11	0.70–6.35	1.18
Vasopressor use after CA; yes	1.28	0.36–4.54	.70

Abbreviations: CA, cardiac arrest; CI, confidence interval; CPR, cardiopulmonary resuscitation; ICU, intensive care unit; OR, operating room; SBP, systolic blood pressure.

probability was increased by index CA in the OR and hemodynamic optimization after CA in contrast to a lower probability in patients with a duration of CPR for >20 minutes or admission following trauma-associated injuries.

Similar to other findings, patients admitted with trauma-associated injuries or a respiratory condition accounted for the most hospital admissions.[22,23] This might provide evidence for hypoxia and hypotension being documented as the most common probable CA causes. However, it is worth noting that noninvasive blood pressure and/or pulse oximetry monitoring are the most readily available monitoring modalities used at the facility. According to Mchomvu et al,[23] the majority of patients in Subsaharan Africa are critically ill at the time of admission to health facilities and, thus, predisposed to CA. There is evidence to suggest that young men are more likely to be involved in trauma such as road traffic accidents.[24,25] In addition, men in the study area also have poor health-seeking behaviors and often seek medical care when critically ill and at risk of CA.

Our survival rates were lower than those reported from more advanced health care systems in countries, such as Thailand and Norway.[2,20,26,27] However, the 24-hour survival in this study was higher than the 1.6% reported from a tertiary hospital in Uganda in which all CA events irrespective of attempts at resuscitation were considered. The patients in that study were not followed up beyond 24 hours after the CA event.[28]

This study is one of few from low-resource settings to describe the neurologic outcome of survivors in the short-term period of 7 days after CA with results similar to findings by Wachira and Tyler[4] and Reynolds et al.[29] These CA survivors comprised mostly of patients enrolled from the OR where there is timely response mostly by anesthesia providers. Anesthesia providers in low-resource areas are more often better skilled in resuscitation. The OR environment also favors earlier detection of CAs, is often better equipped compared to the ward areas, and has a much higher health worker-patient ratio. Challenges in managing critically ill and CA patients abound in the LMIC hospital environment and affect IHCA survival. Among these are a shortage of adequately trained staff, absence of organized rapid response teams, limited access to acute and critical care services, inadequate resuscitation and monitoring equipment, and drugs such as oxygen and sundries.[30] The knowledge of training in and adherence to resuscitation protocols has been noted to increase the likelihood of survival,[31,32] and yet our hospital environment is limited in these. These challenges are likely a big contributor to the number of CA events and low survival rates. Regarding other factors affecting survival, mortality following CA is higher in patients admitted with trauma as it independently predisposes them to cardiovascular failure despite adequate resuscitation.[33,34] A prolonged duration of CPR leads to more detrimental end-organ damage despite judicious resuscitation and post-CA care, resulting in decreased likelihood of survival.[33] On the contrary, hemodynamic optimization through the prevention of hypotension following ROSC increases the probability of survival.[35–37]

This study provides more data on the intermediate survival rate and neurological outcomes of IHCA patients in a low-income country. Our study provided evidence for factors affecting IHCA survival, which are mainly attributed to knowledge, skills, and equipment. It is in the OR that these 3 are most likely to intersect hence higher rates for patients recruited from the OR. Some of the limitations included: first, we excluded nonresuscitated patients from whom we might have obtained more information about CA events such as patient demographics, comorbidities, and the reason for the hospital admission. These would likely inform which patients are critically ill and are more predisposed to getting CA. Second, we lacked the investigative capacity to confirm the causes of CA. Third, we had a small sample size of patients, and so the study findings should be viewed in that regard. Fourth, our study did not assess for quality of CPR.

In conclusion, 7-day survival following IHCA in this setting is low though survivors had a good neurologic outcome at 7 days. The reason for admission, location of the patient within the hospital at the time of arrest, duration of CPR, and prevention of hypotension postarrest were correlated with CA survival.

We propose that the health care workers are equipped with knowledge and skills in CPR through advanced cardiac life-support training and the formation of surveillance and rapid response teams. We further recommend that adequate monitoring and resuscitation equipment be provided to facilitate CPR within the different hospital locations. Since hypoxia was among the most prevalent probable causes of CA documented, we recommend that the oxygen supply's efficiency is improved and that sufficient oxygen delivery equipment be made accessible.

Notes

Witnessed arrest: one that is observed or an arrest that is recorded on a medical monitor to which the patient is connected.[1]

Index cardiac arrest (CA): The first CA event within the select hospital locations irrespective of whether the event was witnessed.

Cardiopulmonary resuscitation (CPR) was defined as any attempt at resuscitation involving chest compressions.

Survival was defined as return of spontaneous circulation (ROSC) for at least 20 minutes after CPR.

Prearrest factors comprised variables present before the patient had a CA.

Intra-arrest factors comprised mainly activities performed during resuscitation while postarrest factors comprised activities performed after ROSC.

The resuscitation team leader referred to the health care provider who had the most information regarding the patient: in intensive care unit (ICU) and the operating room (OR)—this comprised the anesthetic officer (with a diploma training in anesthesia), anesthesiologist, or anesthesia trainee on duty, on accident and emergency (A&E)—the junior house officer, the internal medicine, emergency medicine, or general surgery trainee or specialist on duty and on the pediatric ward—the nurse, pediatric trainee, or the pediatrician on duty.

Hypotension: systolic blood pressure <90 mm Hg, mean arterial pressure <65 mm Hg, or systolic or diastolic blood pressure <the 50th percentile for height for patients <12 years.

ACKNOWLEDGMENTS

We acknowledge the First Mile scholarship program for the scholarship awarded to Dr Rachel Aguma Alum during her residency. We acknowledge the support of the research assistants, the Department of Anaesthesia and Critical Care at Mbarara University of Science and Technology (MUST), the Faculty of Medicine MUST, MRRH administration, the research ethics committee at MUST, and the MUST internal examiner who reviewed this manuscript.

DISCLOSURES

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