ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCE

Cross Sectional Study on Mortality and Associated Factors in the Adult ICU of Myungsung Christian Medical Center, a Private Hospital in Addis Ababa, Ethiopia

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October 2020

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ABSTRACT

Background: Intensive Care Unit (ICU) is a special department of a tertiary hospital for patients with the most severe and life-threatening conditions. Critical care is a major challenge in developing countries where health needs often outstrip available resources. In these countries most of the critical health care facilities are still in their primordial stages of development. The mortality rate of patients admitted to the ICU is higher in Ethiopia than developed countries. There are no published data on mortality in ICU of private hospitals in Ethiopia.

Objectives: The objective of this study was to identify mortality and its associated factors in Myungsung Christian Medical Center, a private hospital in Addis Ababa Ethiopia.

Methods: A cross sectional study of adult patients admitted to the ICU at MCMC from January 2018 to December 2019 was conducted. There were a total of 743 patients in the study period. 47 patients were excluded due to incomplete outcome data and unavailable charts. 37 (10% of sample size) patients were used for the pilot study to prepare structured checklist. 366 final sample size was selected by simple random sampling. Data collectors were trained about the study. Data entry was done using EpiData software and exported to SPSS for data cleaning and statistical data analysis. Summary statistics, descriptive and analytic statistical procedures were performed. Ethical clearance was obtained from the Emergency Medicine and Critical Care department. A formal permission letter was taken to Myungsung Christian Medical Center and permission was granted.

Results: Out of 366 patients 220 (60.1%) were males and 144 (39.3%) were between the age of 36 – 60 years with a mean age of 50±19.18 years. Sepsis (24.3%), Stroke (16.1%) and Trauma (14.5%) were the leading causes of admission. 39% had Cancer, 34% had Hypertension and 21.9% had more than one chronic illness. 46.7% of the patients required mechanical ventilator

and 22.1% required vasopressors. From the 366 patients, 231 (63.1%) were transferred to ward, 105(28.6%) died, and 16(4.3%) were referred to another hospital. In bivariate logistic regression age of the patients (>60 years) (COR: 3.54 95% CI: 1.87, 6.68; P< 0.001), those with medical illness (COR: 2.21 95% CI: 1.35, 3.63 P=0.002), shock (COR: 4.61 95% CI: 2.63, 8.08; P<0.001), infection on admission (COR:3.05 95% CI: 1.91, 4.89; P<0.001), infection 48 hours after admission (COR:2.28 95% CI: 1.24, 4.16; P<0.001), mechanical ventilator (COR: 9.94 95% CI: 5.62, 17.59; P<0.001), use of vasopressor (COR: 10.18 95% CI: 5.82, 17.81; P<0.001), GCS≤8 (COR: 3.51 95% CI: 2.17, 5.69; P<0.001), surgery history within one month of admission (COR: 0.29 95% CI: 0.16, 0.51; P< 0.001) were significant at p-value <0.05. In multivariate logistic regression the age of patients > 60 years (AOR:3.13 95% CI: 1.14, 8.58; P=0.043), shock (AOR:3.74 95% CI: 1.22, 11.26; P=0.019), mechanical ventilator (AOR:13.28 95% CI: 5.22, 33.75; P<0.001), infection on admission (AOR:2.11 95% CI: 1.01, 4.39; P=0.046), use of vasopressor (AOR:3.86 95% CI: 1.50, 9.92; P=0.050), and GCS ≤ 8 (AOR:2.25 95% CI: 1.103, 4.591; P=0.026) were significantly associated (P value <0.05) with death at ICU after controlling for other variables.

Conclusion: According to this study, the mortality of patients in the adult ICU of MCMC, a private medical center in Addis Ababa is similar to the public hospitals. Age>60 years, presence of shock, use of mechanical ventilator and vasopressor, presence of infection and GCS ≤ 8 were significantly associated with mortality.

Key words: Ethiopia, Intensive Care Unit, Critical Care, Mortality, Adult

ACKNOWLEDGEMENT

I would like to thank my advisors for their input and thorough evaluation.

I would like to thank Dr. Finot Debebe and Dr. Negussie Deyessa for their help with my research.

I would like to thank my family and friends for the constant support.

I would also like to thank Myungsung Christian Medical Center, Addis Ababa University and Emergency and Critical Care Department for the opportunity to conduct this research.

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ABBREVIATIONS

AA: Addis Ababa

ACSH: Ayder Comprehensive Specialized Hospital

AOR: Adjusted odds ratio

ARDS: Acute respiratory distress syndrome

CI: Confidence Interval

CKD: Chronic Kidney Disease

CLD: Chronic Liver Disease

CNS: Central Nervous System

COPD: Chronic Obstructive Pulmonary Disease

COR: Crude odds ratio

DKA: Diabetic Ketoacidosis

DM: Diabetes Miletus

ETB: Ethiopian Birr

FMOH: Federal Ministry of Health

GC: Gregorian Calendar

GCS: Glasgow coma score

HAI: Hospital Acquired Infection

HIV: Human Immunodeficiency Virus

HTN: Hypertension

ICU: Intensive Care Unit

JUSH: Jimma University Specialized Hospital

MAP: Mean arterial blood pressure

MCMC: Myungsung Christian Medical Center

OPD: Out Patient Department

OR: Operation Room

SBP: Systolic Blood Pressure

SPHMMC: St. Paul's Hospital Millennium Medical College

SPSS: Statistical Product and Service Solutions

TASH: Tikur Anbessa Specialized Hospital

TBI: Traumatic Brain Injury

UK: United Kingdom

USA: United States of America

UTI: Urinary Tract Infection

WBC: White Blood Cells

1. INTRODUCTION

1.1 Background

Intensive care, also known as critical care, is a multidisciplinary and inter-professional specialty dedicated to the comprehensive management of patients having, or at risk of developing acute, life-threatening organ dysfunction.

Intensive care uses an array of technologies that provide support of failing organ systems, particularly the lungs, cardiovascular system, and kidneys. The primary goal of intensive care is to prevent further physiologic deterioration while the underlying disease is being treated and resolving.[1]

Myunsung Christian Medical Center (MCMC) is the one of the largest private hospitals in the capital of Ethiopia providing Intensive Care Unit (ICU). There are no studies identified on the mortality in private hospital ICUs in Addis Ababa Ethiopia.

1.2 Statement of the problem

Critical care in resource-poor settings has different challenges which include lack of drugs, equipment, supporting infrastructure, and trained personnel as well as late and severe presentations of disease secondary to poor access to appropriate care.[2] Intensive care unit is still evolving in developing countries like Ethiopia. The mortality rate of patients admitted to the ICU is higher in Ethiopia than developed countries.[3] According to studies done in the public hospitals of Ethiopia mortality in the ICU was as high 39%.[3; 4; 5; 6]

However, there are no studies done in the private hospitals in Ethiopia.

This study planned to contribute to the literature provision of intensive care facilities in Addis Ababa (A.A) particularly in the private hospitals and identify the mortality and its associated factors. It also planned to make recommendation to target the associated factors and in turn decrease the mortality.

1.3 Significance of the study

The identification of the mortality and associated factors in critically ill patients admitted to the MCMC ICU will help in prioritization of the problems and the resources. The associated factors of mortality will be subjected for further intervention. This will in turn help improve the care provided by addressing the factors therefore decreasing the mortality. This study has provided information about the characters and common diagnosis of patients admitted to the ICU, which will contribute to the literature provision of intensive care facilities in Addis Ababa. It has also identified associated factors of mortality. It has given recommendation to hospitals on how to improve the care.

2. LITERATURE REVIEW

2.1 World wide

In most developed countries, critical care is delivered almost solely in specialized units with sophisticated equipment and a high staff to patient ratio for the care of patients with multi-organ failure.[7] However, beyond this broad statement, recent studies highlight the fact that these units are diverse in their staffing, resources, and target patient populations, hampering the ability to compare data across ICUs.[8]

Absolute critical care services vary dramatically between countries with wide differences in both numbers of beds and volume of admissions. The number of intensive care unit beds per capita is not strongly correlated with overall health expenditure, but does correlate strongly with mortality. These findings demonstrate the need for critical care data from all countries, as they are essential for interpretation of studies, and policy decisions regarding critical care services.[8]

Data from multiple countries with relatively limited numbers of ICU beds suggest that ICU bed availability can affect patient mortality. The important difference in these studies is that they examine not just the patients who received intensive care, but also those who were deteriorating in some way and did not receive the higher level of care, as this avoids the problem of selection bias.[8]

A study conducted in Massachusetts, USA in 2017 showed the mortality rate to be 20%. Majority of the patients were males (62%) with a mean age of 63. The surgical admissions (53.5%) were more than medical admissions. It showed that increasing age, infection at ICU admission, being male, being in deep stupor or coma and admission from emergency were associated with mortality. However, it showed that the presence of cancer, previous admission to ICU and Chronic Kidney Disease (CKD) has no associating with increasing mortality.[9]

A study conducted in Ontario, Canada in 2007 concluded that among patients who are 50 years and older, women appear less likely than men to be admitted to an ICU. [10]

2.2 Africa

Many people living in resource-poor nations (most notably those of sub-Saharan Africa) struggle with access to fundamental resources (i.e. clean water, food, and electricity) and often lack primary medical care. This creates a disproportionately high prevalence of critically ill patients.[11] Critical care medicine as practiced in more developed nations is often not feasible in such settings, and research to improve cost-effectiveness and implementation in these environments is vital.[2] Critical care is a major challenge in developing countries where health needs often outstrip available resources and, unfortunately, most of the critical health care facilities are still in their primordial stages of development.[12]

In a study done in Calabar teaching hospital located in Nigeria in 2012 the overall mortality was 32.9%. The mean age was 38.5 years and 87% of them were adults. There were 55% males. Most were admitted from the operating room. 61% of the admission were due to surgical while trauma and medical admission were 31% and 8% respectively. Admission from wards and mechanical ventilation were associated with increasing mortality.[13]

A retrospective cohort study done in western Kenya in 2015 showed that the mortality was 53%. The mean age was 29 with 70.4% adults and majority were male patients (61%). Majority of the patients were admitted from the operating room. The most common presenting diagnosis was acute respiratory failure. Sepsis accounted for 10% of admissions. The factors associated with high mortality were identified as age <10 and >50, sepsis, acute stroke, acute respiratory failure or mechanical ventilation and vasopressor support.[14]

In a study done in South Africa in 2017 the in-ICU mortality was 19.7%. The mean age was 38 years old with 55.3% of admissions being male. Majority of the admissions were from operation room (68.4%).[15]

2.3 Ethiopia

Ethiopia is considered as one of the developing countries in Africa. Most of the literature review shows that there is a high mortality rate in the ICU. All the studies were conducted in public hospitals.

A longitudinal study that was conducted in 2011 at Jimma University Specialized Hospital (JUSH) general ICU had a mortality of 37.7%. Majority of the patients were females (55.1%) with a mean age of 32.8 years. Cardiovascular (30.4%), Surgical (18.8%) and Respiratory infections (11.6%) were the common diagnosis that led to ICU admission. Most of the patients (78.3%) were admitted from the wards.[3]

A five-year retrospective study that was done in Medical ICU of Ayder Comprehensive Specialized Hospital (ACSH) in 2015 showed a mortality of 27%. Most of the patients were males (55.6%) with a mean age of 43.2 years. Cardiovascular (26.2%), infectious (20.3%) and neurologic diseases (19.8%) were the three commonest cause of admissions. The independent predictors of mortality in this study were older age, HIV positivity, ARDS, Septic shock and Status Epilepticus.[4]

In Addis Ababa, TASH medical ICU there was a 16-year retrospective study done in 2006 that showed mortality of 32%. Half of the cause of admissions were cardiovascular disease and acute infection. The male to female ratio was 1.4:1 with a mean age of 37 years.[5]

Another retrospective study conducted in TASH surgical ICU in 2011 mortality of 36.5%. The mean age was 37.5 years. It showed the highest admission was from cardiothoracic unit. Age of the patient (21-30 years), urgency of admission and post admission complications were significantly associated with mortality.[6]

In 2017 a 5-year retrospective study done in the medical ICU of another public hospital named St Paul Hospital Millennium Medical College showed a mortality rate of 39%. It also showed Diabetic Ketoacidosis (DKA) to be the leading cause of admission. Older age was significantly associated with mortality. It stated that the reason for substantial mortality rate was late admissions and limited care in the facility. It also stated that improving the ICU infrastructure and staffing with skilled personnel might improve the quality of care and decrease the mortality rate. [16]

3. OBJECTIVES

3.1 General objectives

- To identify the mortality and associated factors in adult ICU of MCMC

3.2 Specific objectives

- To describe the demographic characteristics of adult patients admitted to the ICU of MCMC
- To describe clinical profile of adult patients admitted to the ICU of MCMC
- To identify outcome of adult patients admitted to the ICU of MCMC
- To identify the associated risk factors of mortality in adult ICU of MCMC

4. METHODS

4.1 Study area and period

Addis Ababa is the capital and largest city of Ethiopia. The city is divided into 10 sub-cities and 116 Woredas. It has a population of 3,384,569 per the 2007 population census, with annual growth rate of 3.8%. Currently, there are 29 general hospitals in the city, out of which 7 have government ownership while the remaining 22 are under private and non-government organization properties.

The study hospital is one of the private hospitals in Ethiopia known as Myunsung Christian Medical Center (MCMC) or commonly known as the Korean Hospital. It has a total of 210 beds with approximately 32,964 admissions per year. It had a general ICU but was divided to medical and surgical since April 2019. Currently it has a total of 13 beds; 4 surgical, 8 medical and 1 isolation. There is availability of central venous catheters, vasopressors (norepinephrine, epinephrine, dopamine and others) and broad-spectrum antibiotics. Hemodialysis is available in the hospital with 16 machines in the dialysis unit and one machine in the ICU. There is a total of ten mechanical ventilators; 3 in the surgical ICU and 7 in the medical ICU. There is a limitation in ICU bed capacity so the hospital is usually forced to refer patients to other hospitals usually from the emergency department but sometime also from the wards. There is no formal ICU triage policy and admissions are generally “first come, first serve”. There is a total of 3 physicians and 29 nurses working for the ICU at MCMC. The surgical ICU is staffed by an anesthesiologist and 2 nurses during the day time. It is covered by either neurosurgical or surgical residents and 2 or 3 nurses during duty time. That makes the physician to patient ratio 1:4 and nurse to patient ratio 1:2. The medical ICU is staffed by 2 general practitioners and 4 or 5 nurses during the day time. The anesthesiologist that follows surgical patients will be consulted for intubation in the medical ICU during working hours. The physician to patient ratio is 1:4 and nurse to patient ratio is 1:2 during day time. It is covered by one general practitioner and 4 nurses during duty time. An anesthetist is consulted during duty time for intubation. The physician to patient ratio is 1:8 and nurse to patient ratio is 1:2 during duty time. Internists, Cardiologist, Gastroenterologist, Hematologist, Gynecologists, General Surgeons, Neurosurgeons as well as other specialist make rounds on patient basis.

The study was conducted from August 2019 to October 2020 G.C.

4.2 Study design

A two-year cross-sectional study was conducted to identify the mortality and associated factors in the adult ICU of MCMC, a private hospital in Addis Ababa.

4.3 Population

Source Population: patients admitted to MCMC from January 2018 to December 2019

Study population: adult patients admitted to the ICU of MCMC from January 2018 to December 2019

Inclusion criteria

- All patients 14 years old and above who were admitted to the adult ICU of MCMC from January 2018 to December 2019 GC

Exclusion criteria

- Charts with missing outcome data
- Charts that could not be found

4.4 Sample size determination

- The study design is cross sectional.
- The sample size formula for cross-sectional study design is given by the single population proportion formula denoted by:

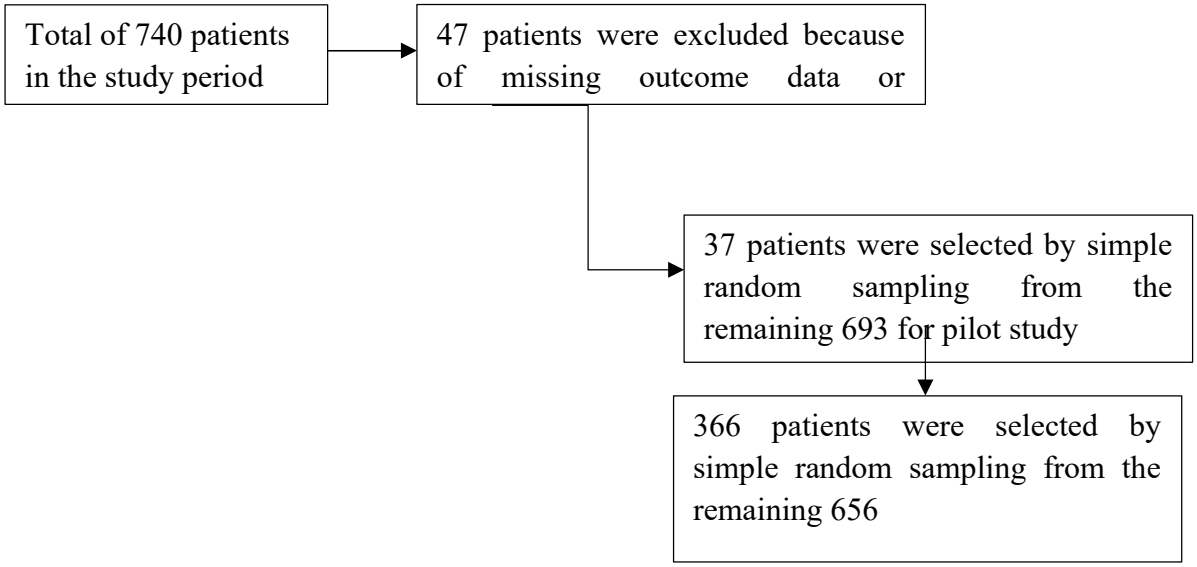
$$n = \frac{\left(Z\,{}^{\alpha}/_{2}\right)^{2} p(1-p)}{d^{2}}$$

- Here n is the minimum required sample size, Zα/2 is the value under standard normal table for a given confidence interval (1.96 for 95% CI), p is the best estimate of prevalence from a previous study (39% from a study conducted in SPMMC in 2017) and d is the margin of error (0.05).

$$n = \frac{(1.96)^{2} 0.39(1-0.39)}{0.05^{2}}$$

$$n = 365.56 \sim 366$$

- A simple random sampling procedure was used to select a sample of patients using Microsoft Excel. This assured every patient had an equal probability of being included in the sample and thus the information to be obtained from the sampled patients is not biased.



Flow Chart 1: Sampling procedure

4.5 Study variables

4.5.1 Outcome variables

- Mortality in the adult ICU of MCMC

4.5.2 Independent variables

- Socio-demographic characteristics of patients admitted to the ICU
    - Age
    - Sex
- Chronic Illness
    - Hypertension
    - Diabetes Mellitus
    - Chronic Kidney Disease (CKD)
    - Chronic Obstructive Pulmonary Disease (COPD)
    - Chronic Liver Disease (CLD)
    - Cancer
    - Other chronic illnesses
- Location before admission to the ICU (Emergency, ward or other hospital)
- Use of mechanical ventilation
- Presence of infection at admission
- Infection acquired 48 hours after admission
- Use of Vasopressor support
- Mental status of the patient at admission
- Antibiotics use within one month of admission to the adult ICU
- Surgery within one month of ICU admission
- Acute stroke
- Urethral Catheterization
- Time of death
    - Duty time
    - Working hour

4.6 Operational definition

Adult: in MCMC age of 14 and above are considered adults

Vasopressor Support: the use of drugs that constrict blood vessels and/or increase the contractility of the heart to maintain SBP of ≥ 90 or MAP of 65

Diagnosed Infection: patients who have White Blood Cell (WBC) count of >12000 or <4000, chest X-ray evidence of Pneumonia, urine analysis evidence of urinary tract infection (UTI), clinical evidence like fever, cough, urinary symptoms during their stay in the ICU or when they are admitted

Mental Status of the patient: the level of consciousness was assessed by the Glasgow coma score (GCS). GCS ≤ 8 was taken as comatose

Length of stay of the patients in the ICU: Time from admission to outcome

4.7 Data Collection Method

Different ways of improving the quality of the data to be collected was applied in this study. Some of these are as follows.

- The checklist was filled by data collectors who are nurses at the hospital.
- Data collectors received training prior to data collection; training was carried out for 2 hours providing the collectors with the overview of the objective and relevance of the study as well as confidentiality information.
- The checklist was pretested in 10% of the sample size outside the sample that was included in the study. This helped validate the appropriateness of the contents, and revisions was done per the pre-testing of the checklist.
- A supervisor checked each checklist for completeness.
- The data was entered in a designed checklist in EpiData to check the consistency and skip patterns of the questions automatically by the software during data entry.

Thus, these methods provided a reliable database containing high quality data.

4.8 Data Analysis

4.8.1 Chi-square test of association

To examine whether the outcome variable (Mortality) has an association with each categorical independent variable, chi-square (χ^2) test of association was carried out. Before chi-square test of association was conducted, those who left against medical advice and referred to another hospital were excluded. The null hypothesis, H_0, states there is no statistical association between mortality and each qualitative variable while the alternative hypothesis, H_A, states there is a statistical association between the two qualitative variables.

4.8.2 Binary Logistic Regression

Since the outcome variable (Mortality) is binary, binary logistic regression model was fitted. When binary logistic regression was conducted, those who left against medical advice and referred to another hospital were excluded.

The functional form of the binary logistic regression model is follows.

Here is the probability of a patient being dead, the ’s are the independent variables and ’s are the parameters associated with each independent variable.

4.9 Ethical consideration

Written ethical approval to conduct the study was obtained from the Emergency and Critical Care Department of Addis Ababa University College of Heath science for approval.

Approval was also obtained from MCMC by a formal written request.

The data was entered by the chart numbers so that confidentiality is protected.

All data obtained were only used for this study purpose.

4.10 Dissemination plan

The finding of this study will be disseminated to Addis Ababa University College of Health Science, FMOH, and MCMC. It will be presented in a symposium and conferences. Publication of the study will be considered at the end.

5. RESULTS

5.1 Characteristics of patients

There was a total of 740 patients in the study period. 47 patients were excluded due to missing outcome data or unavailable charts. 366 study patients were selected by simple random sampling.

Among the 366 patients 220(60.1%) were male and 144(39.3%) were between 36-60 years of age with a mean age of 50.38±19.18 years.

Majority of the patients were admitted from the emergency 179(48.9%) followed by OR 98(26.8%) and Ward 76(20.8%).

Table 1: Characteristics of Patients admitted to the adult ICU, MCMC Hospital, Addis Ababa 2018-2019

Variable	Frequency	Percentage
Sex		
Male	220	60.1
Female	146	39.9
Age {Mean(±SD)}	50.38 (±19.18)	
15-35 Years	103	28.1
36-60 Years	144	39.3
>60 Years	119	32.5
Location before admission to ICU		
Emergency Room	179	48.9
Operation Room	98	26.8
Ward	76	20.8
Dialysis and OPD	13	3.5

5.2 Clinical Profile

89 (24.3%) patients were admitted with the diagnosis of sepsis (chest focus, urosepsis...) followed by Surgical 71(19.4%), Stroke 59(16.1%) and Trauma 53(14.5%). Majority of the patients were categorized as medical (59%).

226 of 366 patients (61.7%) had a chronic illness. Out of these 80 (35.4%) of them had more than one chronic illness, 57(25.2%) of them had Cancer and 50(22.1%) of them had Hypertension.

Out of the 366 patients 50 (13.7%) had electrolyte imbalance and 110(30%) had a GCS ≤ 8 at admission. 65(17.8%) of the patients had shock with 42 (64.6%) of them having septic shock.

Among the patients in the study 196 (53.6%) had a documented infection. Out of the 196, 144 (73.4%) had infection on admission from these 89 (61.8%) had chest focus infection. 52 (26.5%) of the patients in the study had infection 48 hours after admission.

Table 2: Clinical Profile of Patients admitted to the adult ICU, MCMC Hospital, Addis Ababa 2018-2019

Variables	Frequency	Percentage
Admission Diagnosis		
Sepsis (chest, urinary focus..)	89	24.3
Surgical	71	19.4
Stroke	59	16.1
Trauma	53	14.5
Metabolic	30	8.2
Cardiac disorders	19	5.2
CNS disorders	15	4.1
Malignancy Complication	12	3.3
OBGYN	10	2.7
Pulmonary Disorders	8	2.3
Category of illness		
Medical	216	59
Surgical	150	41
Electrolyte imbalance	50	13.7
Shock	**65**	**17.8**
Septic Shock	42	64.6
Mental Status (GCS ≤ 8)	110	30
Chronic Illness	**226**	**61.7**
More than one chronic Illness	80	35.4
Cancer	57	25.2
Hypertension	50	22.1
Others (like COPD, CLD)	21	9.4
Diabetes Mellites	18	7.9
Infection	**196**	**53.6**
Within 48 hours of admission	144	73.4
48 hours after admission	52	26.6

5.3 Management and outcome of patients

Among the patient in the study, 171 (46.7%) were on mechanical ventilator while 83(22.6%) were on vasopressors. Majority of the patients in the study (72.7%) were given antibiotics during their stay in the ICU. 153 (41.8%) patients had surgery prior to admission or during their stay in ICU with majority being neurosurgical 99 (64.7%). Most of the patients in the study 283 (77.3%) were catheterized.

The mean ICU length of stay was 6.55±7.89 days.

Among the total study subjects 231(63.1%) were transferred to ward, 105 (28.6%) died, 16 (4.3%) were referred to another hospital. 63 (60%) of total deaths occurred during duty time.

Table 3: Management and Outcome of Patients admitted to the adult ICU, MCMC Hospital, Addis Ababa 2018-2019

Variables	Frequency	Percentage
Mechanical ventilator	171	46.7
Vasopressor Use	**83**	**22.6**
Dopamine	37	44.6
Norepinephrine	24	28.9
Dopamine plus Norepinephrine	13	15.7
Others (like dobutamine)	4	4.8
Dopamine plus Epinephrine	3	3.6
Epinephrine	2	2.4
Antibiotic Use	266	72.7
Surgery	**153**	**41.8**
Neurosurgery	99	64.7
General surgery	32	20.9
Other (like ENT, thoracotomy)	13	8.5
Gynecological surgery	9	5.9
Urethral catheterization	283	77.3
Outcome		
Transfer to ward	231	63.1
Death	105	28.6
Referred to another hospital	16	4.4
Against medical advice	11	3
Discharge	3	0.8
Time of Death		
Working Hour	42	40
Duty time	63	60

5.4 Associated factors

In bivariate logistic regression model, each variable was tested and those variables with p value less than 0.25 were entered in to multivariate logistic regression model. Multivariate logistic regression was conducted after checking the model fitness test called Hosmer and Lemeshow. The p-value of the Hosmer-Lemeshow test of model goodness of fit was 0.64 thus, the assumption is fulfilled since the p-value was greater than 0.05.

In multivariate logistic regression, the age of patients, medical admission, shock, mechanical ventilator, infection on admission, use of vasopressor, and mental status were significantly associated with death at ICU after controlling for other variables at p-value < 0.05.

However, sex, location before admission to ICU, previous ICU admission, having a chronic illness, electrolyte imbalance, infection 48 hours after admission, surgery history within one month of admission and urethral catheterization were not significantly associated with death in multivariate logistic regression.

Table 4: Associated factors of Mortality in Patients admitted to the adult ICU, MCMC Hospital, Addis Ababa 2018-2019

Variable	Bivariate Logistic Regression		Multivariate Logistic Regression	
	COR (95% CI)	P-Value	AOR (95% CI)	P-Value
Age				
>60	3.54 (1.87, 6.68)	**<0.001**	3.13 (1.14, 8.58)	**0.043**
36-60	1.87 (0.99, 3.55)	0.683	1.37 (0.55,3.42)	0.615
15-35	1		1	
Sex				
Male	1.39 (0.87, 2.23)	0.124	1.46 (0.75, 2.84)	0.245
Female	1		1	
Location prior to admission				
Emergency room	1.28 (0.25, 6.58)	0.76	0.55 (0.06, 4.83)	0.595
WARD	3.24 (0.61, 17.08)	0.165	1.13 (0.13, 10.14)	0.912
Operation room	0.23 (0.03, 1.36)	0.154	0.082 (0.006, 1.069)	0.056
Others (HD, OPD, LW)	1		1	
Previous ICU Admission				
Yes	1.86 (0.99, 3.51)	0.053	1.403 (0.54, 3.63)	0.487
No	1		1	
Chronic illness				
Yes	1.48 (0.91, 2.40)	0.107	1.55 (0.68, 3.51)	0.295
No	1		1	
Category of illness				
Medical	2.21 (1.35, 3.63)	**0.002**	1.29 (1.11, 1.78)	**0.015**
Surgical	1		1	
Electrolyte imbalance				
Yes	1.84 (0.99, 3.41)	0.053	1.05 (0.44, 2.54)	0.900
No	1		1	
Shock				
Yes	4.61 (2.63, 8.08)	**<0.001**	3.74 (1.22, 11.26)	**0.019**
No	1		1	
Mechanical ventilator				
Yes	9.94 (5.62, 17.59)	**<0.001**	13.28 (5.22, 33.75)	**<0.001**
No	1		1	
Infection on admission				
Yes	3.05 (1.91, 4.89)	**<0.001**	2.11 (1.01, 4.39)	0.046
No	1		1	
Infection after 48 hours				
Yes	2.28 (1.24, 4.16)	**0.007**	0.62 (0.27, 1.44)	0.271
No	1		1	
Use of vasopressor				
Yes	10.18 (5.82,17.81)	**<0.001**	3.86 (1.50, 9.92)	**0.050**
No	1		1	
Mental status				
GCS≤8	3.51 (2.17, 5.69)	**<0.001**	2.25 (1.103, 4.591)	**0.026**
GCS>8	1		1	
Surgery				
Yes	0.29 (0.16, 0.51)	**<0.001**	0.69 (0.21, 2.31)	0.546
No	1		1	
Acute stroke				
Yes	0.753 (0.41, 1.350)	0.343		
No	1			
Urethral catheterization				
Yes	2.08 (1.12, 3.83)	0.192	1.04 (0.38, 2.86)	0.934
No	1		1	

6. DISCUSSION

The mean age in this study is 50.3±19.18 years. The mean age was 32 and 43 years in Jimma and Ayder respectively.[3; 4] In TASH, which is a public hospital located in Addis Ababa, the mean age was 37 years.[5; 6] However, in the study conducted in Massachusetts the mean age was 63 years.[9] The mean age in this study conducted in MCMC, which is a private hospital is higher than the studies conducted in the public hospitals in Ethiopia.

Most of the patients were males (60.1%) in this study. It is similar to the study done in TASH, Ayder Hospital, Nigeria, South Africa and Kenya.[4; 5; 13; 14; 15] This goes with the study conducted in Ontario that concluded among patients who are 50 years and older, women appear less likely than men to be admitted to an ICU.[10]

This study was conducted in a general ICU. There were more medical (59%) admission than surgical admissions. This is like the study conducted in JUSH which was also in a general ICU.[3] This could be because MCMC has a wide range of medical subspecialist like nephrologist, hematologist and cardiologist available in the hospital.

The commonest cause of admission in study were sepsis (chest focus, urosepsis...). This is different from the studies of Nigeria, South Africa, USA, and Kenya which had more surgical admissions even though they were conducted in a general ICU.[9; 13; 14; 15] Even though, the study conducted in Jimma was in a general ICU the common cause of admission was cardiovascular disease. [3] Since the studies conducted in Ayder, TASH and SPHMMC were conducted in medical ICU the common cause of admission was cardiovascular disease, infectious disease and DKA respectively.[4; 5; 14] In this study 61.7% of the patients had chronic medical illness. This could contribute to the increased number of sepsis for the cause of admission in this study.

This study showed that the mortality was 31%. Higher mortality rates among patients admitted to the ICU have been described in other studies. A study done in TASH showed an overall mortality of 32% which is close to this study even though this study was conducted in a private hospital.[5] Another study conducted in SPHMMC showed a 39% mortality, which is higher. It was mentioned that the high mortality was due to late admissions and limited care in the facility.[4] The study conducted in Massachusetts USA showed a mortality of 20% which is significantly lower. [9] This could be because of the better critical care service in developed countries. The studies conducted in Africa showed mixed results; Mortality in Nigeria, South

Africa and Kenya were 32.9%, 19.7% and 53% respectively. [13; 14; 15] The reason for the high mortality in this study could be because the common admission diagnosis was sepsis and 47% of them had septic shock.

Age > 60 was associated with a 3x more risk of death than age ≤ 35 in this study. The study conducted in ACSH, Mekelle also showed older age to be associated with mortality.[4] This is also like the study conducted in the USA and the study conducted in western Kenya that showed age > 50 to be associated with mortality.[9; 14] This could be because as age increases, patients are more susceptible to various severe diseases. However, the study conducted in the surgical ICU of TASH in 2011 showed mortality to be high in 21-30 years old.[6] This might be because the patients were surgical patients.

Shock, vasopressor use and presence of infection at admission were also associated with mortality in this study. Medical admission was associated with 29% more risk of death than surgical admissions. Similar to this study, the study conducted in Mekelle in 2015 showed septic shock to be associated with mortality.[4] Sepsis and vasopressor use were associated with mortality in the study conducted in Western Kenya.[14] This could be because sepsis and septic shock are associated with high mortality.

Use of mechanical ventilation at any time during ICU stay showed a significant increase in mortality. The study conducted in Mekelle showed ARDS to be associated with mortality.[4] Most ARDS patients require mechanical ventilation for their management. The study in western Kenya also showed mechanical ventilation to be associated with mortality.[14] This can be explained by more critical patients requiring mechanical ventilation and vasopressors.

Patients with coma (GCS ≤ 8) were 2 times more likely to die according to this study. A study conducted in the USA showed deep stupor or coma to be associated with increased mortality.[9] This could be because patients with low GCS tend to have poor outcome.

Even though male sex, emergency admissions, acute stroke and ICU acquired infections were associated with increased risk of mortality in other studies, this wasn't the case in this study. This could be because of the difference in the demography.

7. LIMITATIONS

The limitation of this study is that it is a retrospective design and single center study.

Additionally, there were limitations due to medical record availability and clinical documentation.

8. CONCLUSION

This study is the first to outline critical care outcomes and mortality at a private hospital in Ethiopia. Even though private hospitals are considered to have better resources than public hospital, this study showed that the mortality is still high. Sepsis and respiratory failure were associated with mortality in this study.

9. RECCOMENDATIONS

- Protocols for sepsis at a hospital as well as national level
- Protocol for ventilator management at a hospital as well as national level
- Training of the clinicians treating the ICU patients on ventilator and sepsis management
- Another prospective study to address other confounding factors as well as to study the factors that have been shown to be associated with mortality in depth

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17.ANNEX

Checklist

1. ID NUMBER _____

2. Age _____

3. Date and length of stay

Date of Admission to ICU	
Date of Outcome in ICU	
ICU length of stay	

4. Chronic Medical Illness

Hypertension	
DM	
CKD	
COPD	
CLD	
Cancer	
Other, specify	
More than one	

5. Admission Diagnosis

_____

6. Mechanical Ventilation

   - ☐ Yes
   - ☐ No

   Duration of Mechanical Ventilation _____

7. Infection

8. Antibiotic use

Infection during Admission	□ Yes □ No If yes, site □ Chest □ Urinary □ CNS □ Others _____
Infection 48 hours after admission	□ Yes □ No If yes, site □ Chest □ Urinary □ CNS □ Others _____ Duration after admission to ICU to acquire infection _____
Within one month prior to admission to ICU	□ Yes □ No
During current admission	□ Yes □ No

9. Vasopressor

   □ Yes

   □ No

   Duration on vasopressor _____

10. Mental status at admission

    □ GCS > 8

- ☐ GCS ≤ 8

11. Surgery

Within one month of admission to ICU	☐ Yes ☐ No
After admission to ICU	☐ Yes ☐ No

12. Acute Stroke

- ☐ Yes
- ☐ No

CT finding present

- ☐ Yes
- ☐ No

Urethral catherization

- ☐ Yes
- ☐ No

13. Outcome

- ☐ Death
  - Cause of death _____
  - Time of death _____
- ☐ Transfer to ward
- ☐ Discharge
- ☐ Went against medical advice
- ☐ Referral to another hospital

ASSURANCE OF PRINCIPAL INVESTIGATOR

I the undersigned resident agree to accept all responsibilities for the scientific, ethical and technical conduct of the research project and provision of required progress reports as per the terms and conditions of the Research and Publication Directorate and /or Department of Emergency and Critical Care Medicine, AAU

Name of the Resident: Dr. Selam Habtu

Date._____ Signature _____

APPROVAL OF THE FIRST ADVISOR

Name of the first advisor: Professor Aklilu Azazh

Date._____ Signature _____

APPROVAL OF THE SECOND ADVISOR

Name of the second advisor: Dr. Temesgen Beyene

Date._____ Signature _____