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ORIGINAL ARTICLE

PATTERN AND OUTCOME OF MEDICAL INTENSIVE CARE UNIT ADMISSIONS TO AYDER COMPREHENSIVE SPECIALIZED HOSPITAL IN TIGRAY, ETHIOPIA

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ABSTRACT

Introduction: *Provision of intensive care services is growing globally. The service is on the increase in Ethiopia, but is not well studied to date. The rationale of this study is to assess the admission pattern, length of hospitals stay, and treatment outcomes of patients admitted to a medical intensive care unit.*
Methods: *We reviewed the registries and clinical charts of patients admitted to Medical Intensive Care Unit of Ayder Comprehensive Specialized Hospital in Mekele, Tigray, during the period, November 2011 - February 2015.*
Results: *A total of 1,211 patients were admitted to Medical Intensive Care Unit during the study period. Males constituted a higher proportion (55.6%) than females (44.4%). The commonest admissions were patients with cardiovascular diseases (26%), followed by infectious diseases (20%) and neurological diseases (19.8%). The commonest specific causes of admission to the Unit were diabetic ketoacidosis and heart failure, constituting 16% each, followed by stroke (15.2%). The overall mortality was 27%. The commonest cause of death was stroke (17%), followed by septic shock (11%). older age, HIV positive, acute respiratory distress syndrome, septic shock and status epilepticus were independent predictors of death.*
Conclusion: *There is an epidemiologic transition from the once by far the commonest diseases like infectious diseases to non-communicable diseases like cardiovascular diseases. Non-communicable diseases need to receive due attention. Communicable diseases still cause a substantially high number of deaths, though over taken by non-communicable disease. Expansion of intensive care unit care is required in order to optimize critical patients.*
Key words: *Intensive care unit, admission pattern, hospital stay, Ayder, outcome.*

INTRODUCTION

In 1953, concept of intensive care unit (ICU) was first introduced in Europe and then expanded in the 60's (1-4). Currently, The ICU is where the highest number of deaths occur in most hospitals. In the United States (US) alone, there are around four million ICU admissions annually with an average proportion of deaths of 8 -19%, accounting for some 500,000 deaths. The US spent over 81 billion dollars in ICU care in 2005 alone, 13.7% in hospital costs and 4.1% in national health expenditure (5). These increased costs were largely associated with the length of stay in the ICUs. For these and many other reasons, there has been increased interest in studying the services and outcomes of ICU care (5).

In developing countries, resources are scarce and provision of ICU care is very challenging. In Ethiopia, ICU care has been introduced only a few decades ago. Tikur Anbessa Hospital established the first ICU in Ethiopia. The number of ICUs is increasing recently in government and private institutions across the country. However, the care delivered at the ICUs in the country has remained largely unstudied. This study aimed to assess the pattern of admission, length of stay and treatment outcomes in Ayder Comprehensive Specialized Hospital (ACSH) medical ICU. The results are compared with the current practice within Ethiopia and other settings. The information generated will serve as an input for other ICUs in the country to improve services and support institutions newly establishing ICUs.

PATIENTS AND METHODS

Across-section analytical study based on a record review of patients' registries and clinical charts was conducted in the Medical Intensive Care Unit (MICU) of ACSH during the period November 2011-February 2015. ACSH was established in 2008 with a total bed capacity of more than 400 and covering a catchment population of over 6 million. ACSH MICU has a bed capacity of eight and it is equipped with mechanical ventilators, defibrillators, perfusers, echocardiography and portable chest x-ray machines. The ICU serves for medical, surgical and obstetrics cases.

A total number of 1,237 patients were admitted from November 2011 to February 2015. Twenty six patients had incomplete data on the registries and their charts could not be located. A total of 1,211 (97.9%) of all ICU admissions $\geq$14 years of age were included in the study. Records of all patients seen consecutively during the study period were included in the study. Patient's daily registries from MICU were used to collect data in a form prepared for this purpose. The registry included the chart numbers of patients, date of admission, age, gender, address, admission diagnosis, length of stay, retroviral status and treatment outcome. In cases where data in the registries was incomplete or found ambiguous, patients' charts were obtained from the chart room

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to complete data to be collected. All data from the registry and the charts were collected by physicians (general practitioners and residents). Data was entered and analyzed using SPSS version 21. We conducted descriptive analysis including computation of frequency distributions and proportions and used tables, figures and summary statistics to describe study variables. Both bivariate and multivariate logistic regression analyses were used to assess the strength of association between dependent and independent variables. Bivariate analyses were conducted to see the frequency distribution and to test whether there is association between dependent variables and independent variable (treatment outcome). Factors significantly associated with the outcome at P value of 0.05 and less in bivariate analysis were identified and these as well as variables with p-value of less than 0.20 were included in the multivariate analysis. P-values 0.05 and less were considered statistically significant.

Ethical clearance was obtained from Research and Publication Committee of ACSH and all applicable institutional regulations for ethical practice were followed in conducting the study. For the purposes of this study we considered 'survivors' as those who survived during ICU stay, including patients who improved and got discharged, transferred to wards and those who left against medical advice.

Those who passed away while in the ICU were categorized as non-survivors'. Due to the possible effect of one disease on multiple organ systems, cases were systematically grouped based on either the immediate reason for admission to the MICU or based on the approach applied in similar reports from within and outside Ethiopia. As a case in point ,tetanus was grouped under infectious rather than neurological diseases and all kinds of stroke were grouped under neurological diseases rather than cardiovascular.

RESULTS

The total number of patients admitted from November 2011 to February 2015 was 1,237. Twenty six patients had incomplete data on the registries and their charts could not be located. In this series, 1,211 (97.9%) of all ICU admissions had complete data and were included the study. The numbers of patients was similar in the three years of study, which was 398, 386, and 427 patients from November 2011-2012, 2013, 2014-February 2015, respectively. The mean (±SD) age of patients was 43.2 (±19.9); 80% of all the patients were less than 60 years of age. The distribution of retroviral infection was similar among males and female with 8.2% of all patients in both groups infected (Table 1).

Table 1. Gender and age Distribution Retroviral Infection Status, Medical Intensive Care Unit, Ayder Comprehensive Specialized Hospital, Mekele. November 2011-February 2015.

		Total number	Percent
Gender	Female	538	44.4
	Male	673	55.6
Age	<20	184	15.2
	20-40	443	36.6
	41-60	327	27.0
	61-80	223	18.4
	>80	34	2.7
Retroviral infection status	Reactive	99	8.2
	Non-reactive	394	32.5
	Unknown	718	59.3
Total		1211	100

Cardiovascular, infectious and neurological diseases were the three commonest diseases with 26.2%, 20.3% and 19.8% of occurrence, respectively (Table 2). The most common specific indication for ICU admission was diabetic ketoacidosis (DKA), constituting 194 (16.0%) of all admissions. Heart failure accounted for 193 (16%), all types of stroke for 185 (15.2%), myocardial infarction for 119 (9.8%) and septic shock for 61 (5%) of the admissions. Males had statistically significantly higher levels of DKA, tetanus and acute respiratory distress syndrome (ARDS) than females. There was no statistically significant difference in admission diagnosis between male and female gender groups.

Table 2. Pattern of admission Medical Intensive Care Unit, Ayder Comprehensive Specialized Hospital, Mekele. November 2011- February 2015.

Organ system	Number of patients	Percent
Cardiovascular diseases	317	26.1
Infectious diseases	246	20.3
Neurological diseases	240	19.8
Endocrine diseases	194	16.0
Respiratory diseases	105	8.6
Renal diseases	50	4.2
GI diseases	41	3.4
Poisoning	15	1.2
Hematology	3	0.2
Rheumatology diseases	0	0
Total	1211	100%

Heart failure with or without cardiogenic shock accounted for 61% of all cardiovascular diseases. Stroke was the commonest neurological disease constituting, 185 (15.2%) of all admissions and 77% of all neurological diseases. Hemorrhagic stroke was documented in 70.2% and ischemic stroke in 29.8% of the patients. Status epilepticus and Gullian Barre syndrome were seen in 30 and 19 patients, respectively. Septic shock was seen 58 patients and tetanus in 16 patients. The commonest respiratory diseases were asthma and ARDS and commonest gastrointestinal (GI) diseases were fulminant hepatitis and upper GI bleeding. Disseminated intravascular coagulation (DIC) most commonly due to snake bite was most frequently seen hematologic condition and acute renal failure (ARF) and chronic kidney disease (CKD), pre-dialysis or immediate post-dialysis, were most frequently observed renal disease. Organophosphate poisoning was accounted for 25% of all poisonings.

The mean (±SD) length of patients stay at the MICU was 4.1 (±4.2). The most frequent length of stay was one day. The mean length of stay of survivors (4.5days) was higher than non survivors which was 3.2 days with P-value of <0.0001. The maximum length of stay was 25days among non- survivors while it was 52 days in survivors. Tetanus and Gullian Barre Syndrome accounted for the longest days of hospital stay.

Table 3. Common diseases -on different age groups, Medical Intensive Care Unit, Ayder Comprehensive Specialized Hospital, Mekele. November 2011 - February 2015

Age of patients	Common diseases	Number of patients	Percentages
<20	Diabetic ketoacidosis	61/184	33.3
	Congestive heart failure	36/184	19.5
20-40	Diabetic ketoacidosis	86/443	19.9
	Congestive heart failure	60/443	14
41-60	Stroke	74/327	22.8
	Myocardial infarction	57/327	17.8
61-80	Stroke	67/223	30
	Myocardial infarction	38/223	17
>80	Stroke	13/34	39
	Myocardial infarction	5/34	14.7

The overall death in the MICU was 27.5%. More females died than males, 30.7% v 25% (X^2=4.8, P= 0.027). The proportion of deaths was 44.4%, 19%, and 29.8% for HIV, HIV negative and for unknown status, respectively (P value <0.0001). The number of deaths increased with increasing age. The proportion of patients who died was lowest (14.1%) among those under 20 years of age and highest (38.2%) among those over 80 years of age.

The proportion in those 21-40, 41-60, and 61-80 years was 25.7%, 31.8% and 34.1% respectively, (P<0.0001). The most common cause of death in the MICU was all types of stroke which caused 17% of all deaths, followed by septic shock (11%), heart failure without cardiogenic shock (8.6%), myocardial infarction (7.8%) and cardiogenic shock (7.5%) (Table 4). The above specific cases were responsible for >50% of all deaths in MICU. Case fatality ratio was highest in ARDS (63%), septic shock (58%), hepatic encephalopathy (acute and chronic) 50% and cardiogenic shock (48%). Tetanus has 18.8% case fatality.

In a multivariate analysis, the independent predictors of death were increased age, HIV positivity and diagnosis of admission of ARDS, septic shock and status epilepticus (Table 5).

Table 4. Case fatality ratio, Medical Intensive Care Unit, Ayder Comprehensive Specialized Hospital, Mekele. November 2011- February 2015

	Number of Patients Admitted	Case Fatality Ratio (%)
Septic shock	61	58
Cardiogenic shock	52	48
Hemorrhagic stroke	130	37.5
Pneumocystis carinii pneumonia	16	31.2
Ischemic stroke	55	27
Severe malaria	17	23.6
Myocardial infarction	123	23
Congestive heart failure, excluding cardiogenic shock)	141	22
Asthma	34	5.9
Diabetic ketoacidosis	194	3.7

Table 5. Predictors of death, Medical Intensive Care Unit, Ayder Comprehensive Specialized Hospital, Mekele. November 2011 - February 2015

		Adjusted Odds Ratio	95% Confidence Interval	P-value)
Sex	Male	1.00		0.64
	Female	1.10	(O.57,1.68)	
Age	<20	1.00		
	21-40	1.82	(1.13, 2.92)	0.04
	41-60	2.50	(1.54, 4.06)	0.02
	61-80	2.89	(1.74, 4.80)	0.01
	>80	3.96	(1.75, 8.49)	0.001
Retroviral status	Non-reactive	1.00		
	Unknown	1.75	(0.45, 4.48)	0.18
	Reactive	1.46	(1.01, 2.17)	0.04
Diagnosis	Acute respiratory distress syndrome	8.65	(1.34,55.66)	0.02
	Septic shock	6.01	(1.24, 29.96)	0.02
	Status epilepticus	8.57	(1.06, 57.90)	0.04

DISCUSSION

The number of cases who need ICU admission is believed to be higher than the actual number of patients admitted to the unit. But as mentioned in the result, the number of patients admitted to the unit each year was similar over the three years of study. This could be partially because of utilization of the ICU by surgical and gynecological cases and unavailability of bed when medical case arrives. The other reason could be the long length of stay (up to 52 days) of patients, which contributes to the shortage of beds. Tetanus and GBS patients in particular have the highest number of days of stay and establishing other supportive units for such cases could help in minimizing the ICU stay.

The mean age (43 years) was higher than that of a similar study done previously in Tikur Anbessa Specialized Hospital, which reported by a mean age of 37 years (7). This could be due to the increase in life expectancy of the population. In contrast, it is lower than what is seen in developed countries, a difference that could be a reflection over 90% of which is less than 50 years of age (8). However, age distribution similar to our series was seen in other African countries (9). More males were admitted to our MICU than females. The reasons could be due to the preponderance of males in using health facilities as is also seen in all hospital admissions in documented by previous studies in Ethiopia (10,11). This, however, is contrasts the trend among the general population in which females slightly outnumber males (100:98) (8).

The mean length of stay in the MICU was slightly lower than that of Tikur Anbessa Specialized Hospital (4.2 versus 4.8) (7). The length of stay was similar to some hospitals in U.S (length of stay was 4.3) (12), but lower than studies from Austria and Switzerland (7.6 in survivors and 11.7 in non-survivors) (13) and higher than Scandinavian countries (1.9 in non-survivors) (14). It was statistically significantly higher in survivors than non-survivors in our study and the other previous studies done locally (7). In contrast, studies in developed nations showed higher length of stay in non-survivors than survivors (P< 0.0001) (12-14). The reason why non-survivors have shorter stay in our patients and those reported by other studies from developing countries could be due delays in seeking care at health facilities.

The commonest admission in our study were cardiovascular cases followed by infectious and neurological diseases. This concurs with findings of the previous study in Addis Ababa in which infectious diseases were by far the commonest before 20 years, but cardiovascular cases were increasing over the course of years and overtaking infectious diseases as number one reason for admission (7). In the developed countries, cardiovascular cases are by far the commonest admissions to ICU (12-15). DKA was the commonest admission in this study. This is similar to the previous study in the country (7). The high number of DKA cases in developing countries, including in our series, could be due to lack of awareness among the population , poor glycemic control, deficient nearby health facilities, and lack of follow up.

In contrast to the reports from the other parts of the world, in which ischemic stroke constitutes 85% of all strokes (16), hemorrhagic stroke constitutes more than 70% of all stroke cases in this study. The reason could partially due to the high prevalence of unknown, uncontrolled and poorly controlled hypertension in our population. Myocardial infarction was similar to Tikur anbessa's study; comprising 9.8% of all admissions (7). Severe malaria has lower admission (1.4%) and case fatality ratio (23%) in this study than Tikur Anbessa (9.3% of all admission with CFR of 52.9%) (7). This could be due to the referral pattern, better prevention and control of malaria, enhanced supply of medi-

cations and improved treatment in the previous two decades. Tetanus was also less common (1.3%) than Addis Ababa (4%) (7), But it was the commonest neurological diseases in the Nigerian study (16). The case fatality ratio of tetanus was lower (18.8%) in this study than the Addis Ababa (49%) (7) and Lagos (44%) (17)
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The overall proportion of death (27%) in this study was lower than Addis Ababa's study of 32% (7). The overall mortality was lower than llorin (37%) (17)and Lagos (67%) in Nigeria (18), but higher than Tunisia (22%) (9). The mortality is much higher than developed nations like 17% in France (9), 9.5% in Austria and Switzerland (13) and 9.1% in Scandinavians (14). The number of deaths increased with increasing age similar to the Addis Ababa study (7). ARDS, septic shock and status epilepticus were independently associated with the risk of death. Stroke was the commonest cause of death; this is in contrast to Addis Ababa's study where severe and complicated malaria was the leading cause of death. There was higher case fatality ratio of septic shock (58% versus 54% in Addis Ababa) (7) and much higher than developed countries (15-30%) (16).

This could be due to delays in care seeking among the patients, lack of protocol of management, lack of medications (e.g. norephinephrine) and other possible reasons. The commonest admission in this study (DKA) had CFR of 3.7%, which is lower than 10.8% of Addis Ababa's study and other studies elsewhere in African, but similar to what has been reported from western countries (4%) (16). The lower proportion of deaths from DKA in our set up could be due to increasing awareness among physicians and nurses in DKA management over the years. The CRF of myocardial infarction was similar to reports by other studies in Ethiopia (7). ARDS had the highest CFR (63%); which is higher than worldwide figure of about 50% (16).

***Conclusion and recommendations*:** This study confirmed the rising hospital prevalence of cardiovascular diseases. It showed an epidemiologic transition from the once by far commonest infectious diseases to non-communicable diseases like cardiovascular diseases, stroke and DKA. Non-communicable diseases need receive high attention and much is needed to create awareness about the condition among the general population. There is a decline in death at the MICU in the country, but it is still high as compared to the developed countries. Intensive training of health workers and management with better medications are needed to reduce death at the MICU. Even though communicable diseases are now being overtaken by non-communicable diseases, they still cause a substantially high number of deaths and need due attention. Expansion of ICU care to the other wards is required in order to optimize critical patients care and create more space for cardiovascular and other chronic medical problems cases whose number is on the rise.

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