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ORIGINAL ARTICLE

ADMISSION PATTERNS AND OUTCOMES IN THE MEDICAL INTENSIVE CARE UNIT OF ST. PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE, ADDIS ABABA, ETHIOPIA

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ABSTRACT

Introduction*: Knowledge of the characteristics and outcomes of critically ill patients admitted to Medical Intensive Care Unit helps with identification of priorities and the resources required improving care. The objective of this study was to examine admission patterns and outcomes in Medical Intensive Care Unit at St. Paul's Hospital Millennium Medical College.*

Methods: *A retrospective review of 1256 patients' case notes who were admitted to the Medical Intensive Care Unit at St. Paul's Hospital Millennium Medical College from 2007 to 2012 was carried out. The data was analyzed by Statistical Package for Social Sciences version 18.0 to obtain descriptive and inferential measurements. P values < 0.05 were considered significant for all tests.*

Results*: Diabetic ketoacidosis; 187(14.9%), was the leading cause of admission, followed by all Strokes; 103 (8.2%). Strokes were also the leading causes of death, accounting for 12.2% of total deaths. The overall mortality rate was 39 %.The deceased were older than the survivors by five mean age years, mean age (±SD) 41.9 (± 18.5) and 36.7(± 17.4) years, respectively.*

Conclusions: *Patients on diseases of non-communicable will continue to be a significant and increasing proportion of Intensive care unit patients in the study hospital. Mortality in the study is substantial and early admission of patients and availability of invasive monitors will help in reducing the mortality rate. Further, research is required to identify the contribution of each department on mortality in order to establish their own intensive care units that provide standard facilities to improve all aspects of care.*

Key Words*: SPHMMC, Pattern, Intensive care unit, Medical outcome.*

INTRODUCTION

Data regarding admission patterns and outcomes in the Medical Intensive Care Unit (MICU) are well documented in developed countries (1-3) but limited in developing countries. Assessment of the characteristics and outcomes of critically ill patients admitted to ICUs in low-income countries may help with the identification of priorities and resources required to improve care for patients who are likely become critically ill. As intensive care medicine is relatively young in developing countries, the provision of adequate and equitable care for patients in these regions, particularly sub-Saharan Africa, is one of the greatest challenges of 21st century health systems, as management of critically ill patients requires significant human, infrastructural, and financial resources typically limited in these countries (4,5).

In previous studies have found (6–11), in most developing countries including Ethiopia, where there are multiple financial constraints resulting from poor funding of health care in general, and the MICU in particular, there is often a limit to the availability and specialization of this form of care. Kwizera A. and colleagues (6) reported in a study of national Intensive Care Unit (ICU) bed capacity and MICU patient characteristics in a low-income country that the prevalence of critical illness in developing countries is disproportionately high in view of the disproportionately heavy burden of diseases such as HIV/AIDS, malaria, tuberculosis and trauma.

Yaseen A et al. (12) also observed that research on ICU outcomes provides valuable information on developing more improved models for patient-centered outcomes, better individual outcome prediction, and alternative outcome predictions under different treatment paradigms. Collection, analyses, and interpretation of relevant objective data on utilization of ICU beds will improve the plan for reducing the length of ICU stay and facilitate covering more patients who require this type of care(13).Analysis of hospital admissions is helpful to fill the information gaps on disease epidemiology that exist in the routine disease reporting system in developing countries. A recent review highlighted the paucity of knowledge regarding ICU care in the developing world (14).

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Most notably, in Ethiopia, Zenebe M and et al. (15) conducted a retrospective study in six bedded intensive care unit and found that acute infections and cardiovascular disease accounted for half of the entire ICU admissions, with infectious diseases accounting for 30%. It has also been observed that trends of admissions over the sixteen-year period showed a steady increase in relative frequency of acute complications of non-communicable diseases consisting of diabetes, acute myocardial infarction and stroke while infectious diseases showed interspaced peaks of admissions coinciding with epidemics.

In any hospital, the ICU care unit has the highest mortality rate of any unit. For this reason, there has been ample interest in measuring ICU outcomes and patterns of admission both in terms of mortality and resource utilization. There is little information about ICU patient disease pattern and outcome in the study setting. Therefore, this study examined patterns of medical admissions and characteristics of patients in the medical intensive care unit of St. Paul's Hospital Millennium Medical College, and evaluated the outcomes of the care.

PATIENTS AND METHODS

A Hospital based retrospective study was conducted from January 01, 2013 to July 31, 2013 on patients who were admitted to the MICU of SPHMMC from September 11, 2007 to September 10, 2012. The hospital is located in Addis Ababa, the capital city of Ethiopia, and is a tertiary care teaching hospital that serves a catchment population of more than five million. It is the third largest public Hospital in the nation, built by the Emperor Haileselassie in 1961 with the help of the German Evangelical Church. In 2007 it became a Medical College, its core services including the provision of medical care, teaching and research.

The hospital provides extensive outpatient and a limited inpatient treatment service with 364 beds, mostly dedicated to acute care. The hospital MICU was opened in late 2006 with the help of foreign donations (German donors). The MICU is a six-bed general intensive care unit, currently staffed by three full-time ICU doctors (two Internists and an Anesthesiologist) and 10 trained ICU nurses. In terms of the admission facilities and physical capacity in the hospital, the MICU is limited and obviously insufficient to cope with the number of patients being admitted. All patients who were admitted to the medical MICU of SPHMMC during the study period and whose case notes were available in the hospital registration archive were included. Case notes were classified according to year of admission.

Hence, a total of 1722 patients' notes were found during the six-year period in the intensive care unit logbook. However, 1256 patient case notes were used for review, the remaining 466(27.0%) were not included in the analysis due to incomplete data, immediate death without medication, immediate referral and other related reasons.

The data collection format included socio-demographics of the respondents, the reason for admission, duration of hospital stay, nursing care given, immediate cause of death, and follow-up (where they develop in the hospital or present from the outset). The format also included outcome variables such as discharge with improvement, transfer to other wards, referral to other hospitals, and death. These outcome variables were examined alongside primary diagnosis using data from a review of patient case notes and then sorted using a National Health Management Information System (HMIS) disease classification (16).

Patient case notes with incomplete information were excluded from the study. The data obtained was entered into SPSS version 18.0. All comparisons for continuous variables between the major groupings used an independent two -tailed student *t*-test, for significance of associations between the predictor and outcome variables in the continuous variables. Categorical or nonparametric data are presented as n(%) for those not normally distributed and continuous data as mean ± SD unless otherwise indicated. P-values less than 0.05 were considered statistically significance for all tests. Before starting data collection, a letter of support was obtained from the SPHMMC Ethical Review Committee, written consent was obtained from hospital administration, and confidentiality of the information was ensured using codes rather than subject names were registered in the data collection format.

RESULTS

Demographics and Admission Characteristics: Of the 1256 (73.0 %) case notes of patients available for review, 647 (51.5%) were men, making the male to female ratio 1.1 to 1. Patient age ranged from 14 to 88. The mean age of the patients was 38.79 years (± 17.98), with over 70% of all patients under the age of 50. On average, female patients were five years younger than their male counterparts,36.2 and 41.3 years, respectively ($p<0.001$). The magnitude of the differences in the means was very small (eta squared=0.018). 34% of the patients were admitted to wards before they were admitted to the MICU. Furthermore, analysis of outcomes showed that 726(58%) patients were transferred to the ward and 2(0.2%) patients were discharged to their home directly from the ICU. Twenty patients (1.6%) were referred to another tertiary care Hospital and 15(1.2%) patients each absconded and left against medical advice. 493(39%) deaths were registered during the study period.

The highest number of admissions came from the age group of less than or equal to 27 years, 457(36.4%). The patients were predominantly from Addis Ababa, totaling 780 (62.1%), (not shown).

Pattern of disease admission: From the total 1,256 cases notes reviewed, the most common reasons for admission to the MICU of SPHMMC were diseases of the Circulatory System, 334(26.6%), followed by Infectious and Parasitic diseases, 247(19.6%), and Endocrine, Nutritional and Metabolic diseases, 203 (16.2%). HIV/AIDS related and Sepsis were the major subcategories among the Infectious and Parasitic diseases category accounting for 45 (3.6 %) and 42(3.3%) patients in Moreover, Diabetic Ketoacidosis is the single most common subcategory, 187(14.9%), of Endocrine, Nutritional and Metabolic diseases (Table 1). Diseases of the Circulatory System, along with Infectious and Parasitic Diseases and Endocrine, Nutrition and Metabolic Diseases, all together accounted for more than half of the entire intensive care admissions.

In the Circulatory System disease category, the major subcategory was Stroke, 103(8.2%), followed by Unspecified Diseases of the Circulatory System, 81(6.4%), AMI 66(5.3%), NYHA class IV Stage C 65(5.2%), and Hypertension related diseases, 19(1.5%) of the admis-

Table 1. Patients Reason of Admission to the Medical Intensive Care Unit, St. Paul's Hospital Millennium Medical College, 2007 – 2012

HMIS code*	Reasons for admission	Number	Percent
0900		**334**	**26.6**
0999	NYHA class IV Stage C	65	5.2
0999	AMI	66	5.3
0904	All Stroke	103	8.2
0901	Hypertension and Related Diseases	19	1.5
1000	**Diseases of the Respiratory system**	**81**	**6.4**
1004	Acute Respiratory Distress Syndrome	60	4.8
1099	Unspecified Diseases of the Respiratory System	21	1.7
1100	**Diseases of the Digestive system (DS)**	**118**	**9.4**
1101	Upper GI Bleeding (UGIB)	15	1.2
1102	Generalized Peritonitis Secondary to Various Causes	26	2.1
1107	Intestinal Obstruction	37	2.9
0400	**Endocrine, Nutritional and Metabolic diseases**	**203**	**16.2**
0401	Diabetic Ketoacidosis(DKA)	187	14.9
0100	**Infectious and Parasitic diseases**	**247**	**19.7**
0101	Severe Complicated Malaria	18	1.4
0107	Meningitis	20	1.6
0111	Acute Flaccid Paralysis Secondary to GBS	15	1.2
0120	HIV/AIDS Related	45	3.6
0123	Pneumonia	39	3.1
0132	Tetanus	36	2.9
0139	Sepsis	42	3.3
1800	**Injury, Poisoning and Certain Other Consequences of External Causes**	**103**	**8.2**
1801	All injury	37	2.9
1803	All Type Poisoning	66	5.3
0600	**Diseases of the Nervous System**	**33**	**2.6**
0601	Status Epileptics	33	2.6
9000	**Miscellaneous Conditions**	**29**	**2.3**

- Health Management Information System

NYHA=	New York Heart Association	DKA =	Diabetic Ketoacidosis
AMI =	Acute Myocardial Infarction	GBS =	Gullian Barre Syndrome
UGIB =	Upper Gastro- Intestinal Bleeding	DVT =	Deep Venous Thrombosis

When the average age of the two genders was compared within specific diseases, females were found to be significantly younger in case of Meningitis, HIV/ AIDS related problems, Sepsis, and Status Epileptics, (Table 2). In all other diseases, there was no significant age difference.

The fifteen most common specific diseases accounted for 73% of all admissions. Among these, Diabetic Ketoacidosis was the leading cause of admission followed by all strokes and Unspecified Diseases of Circulatory System, each accounting for 14.9, 8.2 and 6.4 % of all admissions, respectively. The mean number of patients seen in each year was 209 (± 60.7) with median of 227.

Table 2. Sex and Age Distribution of the Fifteen Major causes of Medical Intensive Care Unit Admissions, St. Paul's Hospital Millennium Medical College, 2007 – 2012.

	Female		**Male**		
Diseases	**Mean Age (±SD) Yrs**	**n (%)**	**Mean Age (± SD) Yrs**	**n (%)**	**P-value**
Overall (1256)	**36.3(17.4)**	**609(48.5)**	**41.1(18.2)**	**647(51.5)**	**0.021***
NYHA class IV Stage C	38.6(18.7)	42(64.6)	41.6(21.1)	23(35.4)	0.558
AMI	58.7(12.2)	16(24.3)	53.8(16.1)	50(75.7)	0.207
All Stroke	55(15.2)	46(44.7)	57.4(14.7)	57(55.3)	0.429
Other diseases of the CS	45.5 (19.3)	39(48.2)	47.4(18.1)	42(51.8)	0.655
Acute Respiratory Distress Syndrome	32.8(14.8)	33(55.0)	38.6(16.0)	27(45.0)	0.148
Intestinal Obstruction	34.5(18.8)	8(21.6)	46.1(17.5)	29(78.4)	0.110
Other Diseases of DS	35.8(15.0)	19(47.5)	44.1(19.8)	21(52.5)	0.148
Diabetic Ketoacidosis (DKA)	36.6(18.6)	85(45.5)	35.4(14.9)	102(54.5)	0.641
Meningitis	18.7(1.2)	3(15.0)	35.4(16.1)	17(85.0)	**0.001***
Human Immunodeficiency Virus	32.7(6.4)	29(64.4)	38.4(9.6)	16(35.6)	**0.023***
Pneumonia	41.6(21.2)	17(43.6)	39.8(17.5)	22(56.4)	0.771
Sepsis	32.9(13.3)	28(66.7)	56.0(14.0)	14(33.3)	**0.012***
All Injury	30.6(9.2)	5(13.5)	31.3(9.7)	32(86.5)	0.885
All Type Poisoning	24.9(12.6)	38(57.6)	28.2(12.0)	28(42.4)	0.289
Status Epileptics	25.6(7.2)	14(42.4.)	41.3(23.1)	19(57.6)	**0.011***

*Significant at p- value < 0.05

Among the fifteen most common causes of admissions: NYHA class IV Stage C, HIV, Sepsis and respiratory distress occur more frequently in women, and there was a statistically significant difference observed between the sexes with respect to HIV/AIDS related illness and Sepsis. Conversely, AMI, All Stroke, DKA, Meningitis and status epileptics occur more frequently in men, in which the difference is more pronounced in the case of Meningitis and Status Epileptics (Table 2).

The circulatory system diseases admitted to MICU have been increasing steadily over the years while Endocrine, Nutritional & Metabolic diseases and Infectious & Parasitic disease admission declined sharply by 65 and 33 percent between the year 2010 and 2012, respectively, but the decline has been steeper in the Endocrine, Nutritional and Metabolic disease category (Figure 1). Circulatory System diseases and Endocrine, Nutritional and Metabolic disease admissions as a percentage of total MICU admissions have increased from 6% in 2007 to 25 % in 2012 and from 4% in 2007 to 28 % in 2012, respectively.

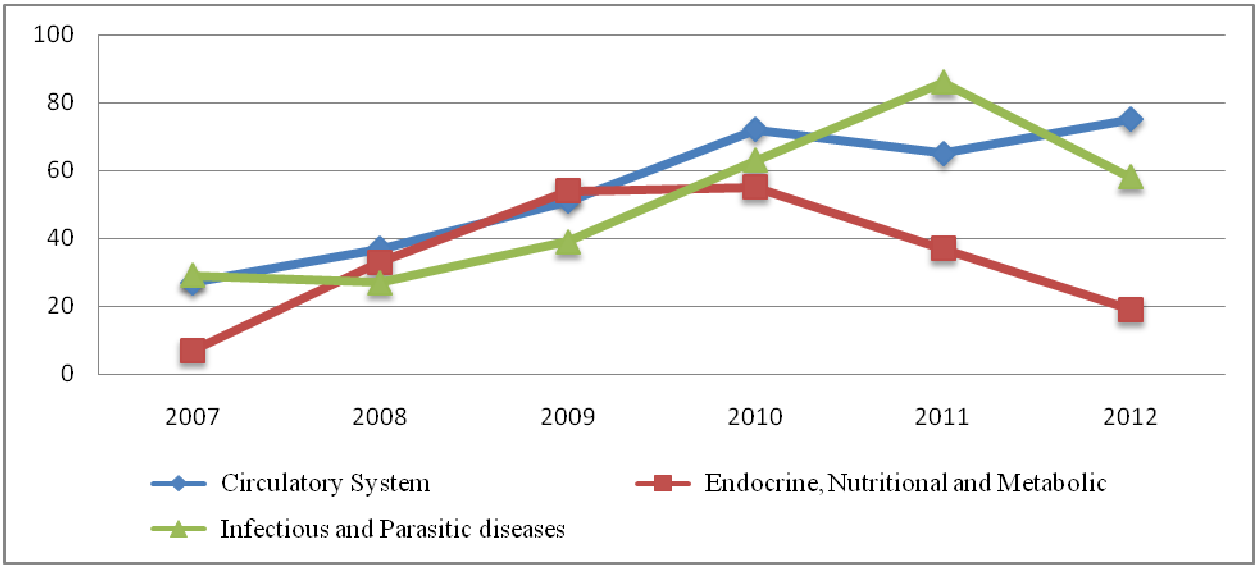

Fig.1. Trends of Admissions on the most common Diseases to *Medical Intensive Care Unit, St. Paul's Hospital Millennium Medical College*, 2007–2012

Outcome: The overall mortality of the MICU was 39 %. The highest mortality rate (45.8%) was observed in 2010; the lowest mortality rate (27.7%) was observed in 2008. Out of 1256 MICU admissions, 272 patients (48.6 %) died within 2 days of admission. There was a statistically significant difference between age groups in Diabetic Ketoacidosis, all Injury, Status Epileptics and all other Obstetric diseases with respect to their outcome. Proportionally, more patients in the age group (≥45 years) died compared to young (≤27years) patients, 47.9% versus 30.6% (P<0.001),(Table 3).

The top fifteen causes of admissions that accounted for 73% of total admissions were responsible for 77% of all deaths. All Strokes, the second major cause of admission, are the leading cause of death accounting for 12.2% of total deaths. The deceased were older than the survivors by five mean age years, mean age (±SD) 41.9 (± 18.5) and 36.7 (±17.4) years, respectively. Mortality increased with increasing age groups, 30.6%, 40.5% and 47.9% for those less than 28, 28 – 45 and greater than 45 years of age, respectively (P<0.001).

There was no significant sex difference in terms of outcome of the patients' disease characteristics despite female deaths occurring at a younger mean age than males, 38.3 versus 40.2 (P=0.488). Among the top fifteen causes of admission, all strokes had the highest case fatality proportion (58.3%) followed by Intestinal Obstruction (56.7%), Severe Pneumonia (56.4%) and other diseases (55.2%), whereas DKA has the lowest case fatality ratio (14.4%). When all causes were considered, severe complicated malaria, generalized peritonitis secondary to various causes and all DVT have the highest case fatality rate (>50%), (not shown).

It was also observed that there was no significant association between sex of the patients on the fifteen most common causes of admission with respect to the case fatality rate. The mean length of stay in the MICU was 4.4days (± 5.1) with median of 3 days. 66% of patients were either discharged or deceased on or before the fourth day, with one day being the most frequent stay. The mean hospital stay for those who died was shorter than survivors, with 3.52 versus 4.97, respectively. 55% of the deceased stayed 2 or fewer days in the MICU.

Table 3. Outcomes of the Top Fifteen Causes of Admission to Medical Intensive Care Unit, St. Paul's Hospital Millennium Medical College, 2007 –2012

Diseases	Specific cause of death (as % of total death)	Total	Case Fatality Rate (%)			
			≤ 27	28 – 45	≥ 45	P-value
NYHA class IV Stage C	30(6.1)	46.2	31.8	55.6	52.0	0.246
AMI	17(3.4)	25.8	20.0	31.3	24.4	0.827
All Stroke	60(12.2)	58.3	40.0	63.6	57.9	0.622
Other dis. of CVS	40(8.1)	49.4	53.3	52.2	46.5	0.858
Acute Respiratory Distress Syndrome	29(5.9)	48.3	50.0	40.0	57.1	0.600
Intestinal obstruction	21(4.3)	56.8	62.5	54.5	55.6	0.932
Other diseases DS	18(3.7)	45.0	28,6	53.8	53.8	0.309
Diabetic Ketoacidosis	27(5.5)	14.4	15.0	5.3	24.0	**0.022***
HIV/AIDS Related	24(4.9)	53.3	36.4	62.5	0.0	0.098
Pneumonia	22(4.5)	56.4	61.5	38.5	69.2	0.258
Sepsis	22(4.5)	52.4	50.0	53.8	53.3	0.976
Other obstetric cond.	21(4.3)	45.7	28.0	65.0	100.0	**0.025***
All injury	16(3.2)	43.2	54.5	45.5	100.0	**0.019***
All Type Poisoning	20(4.1)	30.3	27.3	38.9	25.0	0.646
Status Epileptics	13(2.6)	39.4	25.0	36.4	83.3	**0.043***
Other Diseases	16(3.2)	55.2	50.0	40.0	72.7	0.303
	493(100)	39.3	30.6	40.5	47.9	0.002*

* Significant at p- value < 0.05; Other dis. of CVS = Other diseases of cardiovascular system,

DISCUSSION

Diseases of the cardiovascular system were the most common reason for MICU admission and associated with the highest mortality rates. There is also evidence that patients in intensive care units had a high prevalence of cardiovascular diseases, severe infections and thrombotic complications, and almost all MICU patients suffered from the systemic inflammatory response syndrome (17,18). The outcome in the MICU is mostly dependent on the severity of illness at the beginning of intensive care admission and the clinical management of the patients in the unit.

This study also indicated that the overall MICU mortality rate was 39% which may be due to lack of equipment and investigative facilities, patient's factors and other related factors that should be assessed by further investigations. The mortality rate in this study is higher than the finding from Port Harcourt in Rivers State, Nigeria, (13),and Addis Ababa University Tikur Anbessa Specialized Hospital,(15), much higher than reported by high income regions of the world (3), and between 8-19% in the United States(19), but is comparable to the report from the study done in Uganda ICUs, (6), and lower than the study done in Tanzania (20).

The present study also showed that the case fatality ratio of severe pneumonia was, higher than the report of from the other hospital (Tikur Anbessa) in Ethiopia(15), whereas DKA had a similar low case fatality ratio. It is also important to note that the reported decreases in infection rates in some developed countries have emerged parallel to significant investment in arranging preventive measures.

It was found that elderly patients admitted to the MICU are at increased risk of morbidity and mortality as compared with younger patients. The analysis of clinical characteristics of the patients based on their age groups revealed a higher morbidity and mortality rate in patients older than 45 years, as has been found in other similar studies (21). Many investigations (22–24) revealed that age alone is not associated with poor prognosis in intensive care. Other factors, including patient selection criteria, primary disease, co-morbidity, severity of illness and complications in critical care, significantly influence outcome (25).

Survivors had a statistically significant longer length of stay in MICU than non-survivors which is in agreement with other studies in developing countries (26, 27) but contrary to studies in developed countries which reported non-survivors staying longer than survivors (7,11). This

difference in survival is probably due to a combination of factors including severity of patient's health status, poor pre-hospital care, lack of emergency medical services, and lack of appropriate diagnostic and therapeutic facilities including drugs for the care of these patients in the hospital and the ICU.

A close follow-up of high-risk patients and an optimal stabilization of their condition before intervention should be done to improve the outcome of these patients and decrease the morbidity and the mortality. Physicians in the MICU should understand tools for assessing severity of illness and prognosis of critically ill patients. Specifically, developing specific MICU policies or protocols including upgrading services to a level appropriate for a tertiary health care facility is necessary.

Limitations of this study include its retrospective nature with the consequence that it could not provide the same level of evidence as a prospective survey. Particularly, due to the concise format of medical records, only limited data could be retrieved for this audit. Furthermore, inability to include all case notes due to loss of the documents, incomplete data and the fact that the data does not include youngsters' age less than fourteen years.

Conclusions:-Patients on diseases of non- communicable will continue to be a significant and increasing proportion of ICU patients' admission in the study hospital. Mortality in this study is also substantial, and for this, each department should establish their own intensive care units and provide standard facilities in order to improve all aspects of patients care including; in promoting the emergence of critical care specialists. This will fulfill a long felt need and will definitely improve the quality of care received by critically ill patients in the hospital.

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