## ORIGNIAL ARTICLE

# ADMISSION PATTERN AND OUTCOME IN A PEDIATRIC INTENSIVE CARE UNIT OF GONDAR UNIVERSITY HOSPITAL

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## ABSTRACT

***Introduction:*** *Knowledge of the characteristics and outcomes of critically ill children admitted to pediatric intensive care unit in low-income countries may help with the identification of priorities and the resources to improve the care of critically ill patients. The objective of this study was to describe the pattern of admission and outcome of patients who received intensive care.*

***Methods:*** *A cross-sectional study of all children 30 days to 14 years of age admitted to the pediatric the pediatric intensive care unit of Gondar University hospital was undertaken from August 2013 to July 2016. The data were collected from the health management information system documentation logbook and all retrieved charts of patients that were admitted to the intensive care unit during the study period.*

***Results****: A total of 330 (80%) of the patient charts were available for review; 197 (59.7%) of the patients were males and the rest 133(40.3%) were females, a male: female ratio of 1.5:1. The median age at admission was six years (range 30 days -14 years.). Neurologic disorders (31.1%), infections (13.3%), and renal disorders (11.2%) were the three commonest causes for admission. The median duration of stay in the intensive care unit, regardless of outcome, was three days. The overall proportion of deaths among this series of patients was 30.9% and 51% of the deaths occurred in the first 24 hours.*

***Conclusion****: The mortality at the pediatric intensive care unit was high. The largest number of deaths occurred within 24 hours of admission. Neurologic disorders and infections were main causes of death.*

***Key Words****: - Pattern, Death, Low resource setting, Pediatric intensive care unit, Outcome*

## INTRODUCTION

A pediatric intensive care unit (PICU) is a unit of in a hospital, where most critical children receive pediatric care. When compared to other units providing care in a hospital, a PICU has a higher professional: patient ratio and is better equipped with advanced monitoring systems and devices supporting dysfunctional organs. Establishment of PICUs will immensely help in decreasing in hospital deaths as shown in studies demonstrating its benefits and the quality of care provided in a given hospital (1-3).

An evaluation of the outcomes and hospital morbidity pattern is an important measure to guide improvements in patient care. In intensive care units (ICUs), the success of care can best be measured by the outcomes such as survival or death among those admitted to the unit by using indicators such the proportion of deaths (4,5).

Despite the disproportionately high burden of critically ill children in low income countries data on critical care is lacking. In Ethiopia, data on children admitted and treated in PICU is limited (6).

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This study will provide a baseline data for future reviews and call the attention of health workers and planners to give due attention to improving the outcome of care in critically ill children.

This study aims to assess the pattern and outcome of children managed at the pediatric intensive care unit of a tertiary teaching hospital,

## PATIENTS AND METHODS

***Study area and period***

The study was conducted at the Gondar University Comprehensive Specialized Hospital PICU, which is located 765 km northwest of Addis Ababa, the capital city of Ethiopia. The Department of Pediatrics and Child Health of the Hospital has seven major wards with 108 beds on various units: emergency admission unit, neonatal ICU, PICU, under five medical admission unit, above five years medical admission unit, hemato-oncology unit, and pediatric surgical admission unit. The PICU was established in 2013 and currently has a six-bed capacity, one mechanical ventilator, and it is equipped with patient monitoring systems. The Unit is run by pediatricians and well-trained ICU nurses.

***Study Design and Population***

This was a cross-sectional study with data collected from patient records of children admitted to PICU from August 2013 to July 2016. All pediatric patients 30 days to 14 years of age and admitted to the PICU of the Hospital constituted the study population. Admission data and the outcome were retrieved from all available patient charts and the documentation logbook of the PICU in the by using pre-tested data retrieving form, which contained demographic data, diagnosis, outcome, length of outcome, and use of ventilators.

The data were entered onto and analysed using SPSS Version 20. The Chi-square test was used to test for statistical significance and the significance level was set at a P-value of <0.05.

The study was done after getting ethical approval from School of Medicine and administrative clearance from the hospital Chief Clinical Director and the Department of Pediatrics and Child Health.

## RESULTS

Three hundred and thirty (80%) of the clinical charts of patients were available for review. Patient characteristics are summarized in Table 1. Of the 330 patients, 197 (59.7%) were males giving a male: female ratio of 1.5:1. The median age at admission was six years (range 30 days -14 years). Their age ranged from one month to 15 years and 138 (41.8%) were under the age of five years.

**Table1:** Patient characteristics children admitted to Gondar University Hospital pediatric intensive care unit.

| Variables | Admission n (%) | Death n (%) |
|---|---|---|
| **Sex (n= 330)** | | |
| Male | 197 (59.7%) | 67 (34%) |
| Female | 133 (40.3%) | 35 (26.3%) |
| **Age in months (n=330)** | | |
| 1-12 | 66 (20.0%) | 26 (25.5%) |
| 13-24 | 25 (7.6%) | 8 (7.8%) |
| 25-59 | 47 (14.2%) | 15 (14.7%) |
| 60-131 | 109 (33%) | 29 (28.4%) |
| 132-180 | 83 (24.8%) | 24 (23.5%) |
| **Length of hospital stay** | | |
| ≤24 | 63 (19.1%) | 54 (53.5%) |
| 25-48 | 49 (14.8%) | 18 (17.5%) |
| 49-72 | 53 (16.1%) | 10 (9.9%) |
| 73-168 | 113 (34.2%) | 16 (15.8%) |
| 169-336 | 36 (10.9%) | 2 (2%) |
| 337-672 | 8(2.4%) | 1 (1%) |
| ≥672 | 1(0.3%) | 0 (0%) |
| **Reasons for admission** | | |
| Respiratory | 33 (10.0%) | 13 (12.7%) |
| Cardiovascular | 31 (9.4%) | 16 (15.7%) |
| Infectious | 44 (13.3%) | 22 (21.6%) |
| Neurology | 104 (31.5%) | 24 (23.5%) |
| Trauma | 14 (4.2%) | 2 (2%) |
| Hemato-oncology | 12 (3.6%) | 6 (5.9%) |
| Endocrine/metabolic | 27 (8.2%) | 3 (2.9%) |
| Renal | 37 (11.2%) | 6 (5.9%) |
| Gastrointestinal | 17 (5.2%) | 9 (8.8%) |
| Poisoning | 10(3%) | 1 (1%) |

The three most common reasons for admission were neurologic 104 (31.1%), infectious 44 (13.3%) and renal 37 (11.2%) disorders. Among the neurologic disorders the commonest diseases were complicated acute bacterial meningitis (37.5%), Guillain-Barre syndrome (17.3%), followed by cerebral malaria and status epilepticus (15.4%). Most of the infectious causes were complicated meningitis (12.1%), and severe sepsis with shock (9.4%).

Infectious diseases, severe diabetic ketoacidosis (DKA) (8.2%), congestive heart failure (7.6%), and acute glomerulonephritis (AGN) with complications (6.7%) constituted the highest number of admissions (**Table 2**). Direct admission from emergency pediatric outpatient department (OPD) constituted 163 (49.4%) of the patients 156 (47.3%) were and transferred from the wards.

**Table 2:** Top five causes of admission among children admitted to Gondar University Hospital pediatric intensive care unit.

| Diagnosis | Admission (%) | Death (%) | Case fatality rate |
|---|---|---|---|
| Complicated meningitis | 40 (12.1%) | 11 (10.7%) | 27.5% |
| Severe sepsis | 37 (11.2%) | 19 (18.6%) | 51.3% |
| Severe DKA | 27 (8.2%) | 3 (2.9%) | 11.1% |
| Congestive heart failure | 25 (7.6%) | 11 (10.7%) | 44.0% |
| Complicated AGN | 21 (6.4%) | 4 (3.9%) | 19.0% |

Majority of the children 278 (84.2%) stayed in the ICU for less than seven days. The median duration of stay in the PICU regardless of outcome was 3 days. Overall, 30.9% of the admitted patients died in hospital.

Among those who died, 67 (65.7%) were males. Among those who died, 34% were males and 26.3% females (p=0.28) (**Table 3**).

**Table 3:** Socio-demographic variable and outcome following admission among children admitted to Gondar University Hospital pediatric intensive care unit.

| Characteristics | Outcome n (%) | | P-Value |
|---|---|---|---|
| | Survived | Died | |
| **Sex** | | | |
| Male | 197 (74.7) | 67 (25.3) | P=0.28 |
| Female | 133 (67.2) | 65 (32.8) | |
| **Age in months** | | | |
| 1-12 | 40 (60.6) | 26 (39.4) | P=0.51 |
| 13-24 | 17 (68) | 8 (32) | |
| 25-59 | 31 (67.4) | 15 (32.6) | |
| 60-131 | 80 (73.4) | 29 (26.6) | |
| 132-180 | 57 (70.4) | 24 (29.6) | |
| **Length of stay** | | | |
| ≤24 | 9 (14.3) | 54 (85.7) | P< 0.05 |
| 25-48 | 31 (63.3) | 18 (36.7) | |
| 49-72 | 43 (81.1) | 10 (18.9) | |
| 73-168 | 97 (85.8) | 16 (14.2) | |
| 169-336 | 34 (94.4) | 2 (5.6%) | |
| 337-672 | 7 (87.5) | 1 (12.5%) | |
| ≥672 | 1 (100) | 0 (0%) | |
| **Diagnostic condition** | | | |
| Respiratory | 20 (60.6) | 13 (39.4) | P< 0.05 |
| Cardiovascular | 15 (48.4) | 16 (51.6) | |
| Infectious | 22 (50) | 22 (50) | |
| Neurologic | 80 (76.9) | 24 (23.1) | |
| Trauma | 12 (85.7) | 2 (14.3) | |
| Hemato-oncology | 6 (50) | 6 (50 | |
| Endocrine/metabolic | 24 (88.9) | 3 (11.1) | |
| Renal | 31 (83.8) | 6 (16.2) | |
| Gastrointestinal | 9 (50) | 9 (50) | |
| Poisoning | 9 (90) | 1 (10) | |

Diagnosis was significantly associated with the outcome (OR=1.2; 95% of CI 1.06-1.28). The commonest cause of death was sepsis 16 (18.6%), followed by complicated meningitis and congestive heart failure, each accounting for 11 (10.7%) of the deaths.
The number of deaths was highest in the older age groups; 53 (52%) of patients who died were above the age of 5 years (p=0.51).

Among children who died, 65 (63.7%) of the patients were transferred from the inpatient wards (p<0.01), but there was no independent association on logistic regression. Of the all deaths, 54 (53.5%) occurred in the first 24 hours of admission. Death among patients staying for less than one day was 85.7% (P-value <0.05; OR=1.02; 95% of CI 1.02-1.03). showing a strong association between length of stay and outcome.

Of the 330 patients, 33 (10%) were ventilated mechanically. Children 5-10 years required more frequent mechanical ventilation (n=15, 45%) than the other age groups. Among patients on mechanical ventilation 20 (60.6%) died.

## DISCUSSION

The presence of specialty ICU is essential to improve the survival of sick children in low resource countries like Ethiopia, where the burden of critical illnesses is large and likely to be increasing due to the increased urbanization, emerging epidemics and accesses to hospitals (7,8). The development of specialty pediatric ICU is in its early stages in Ethiopia. It is a good step to evaluate the effectiveness of this fragile, highly costly and demanding health care system in the given institutions to improve outcomes and make a strong plan for improvement of the process itself.

In this analysis, the majority (59.7%) of children admitted to the PICU were males and above five years of age contributing more than half (57.8%) of the admission. This is different from studies done in in other similar setting, which show the predominance of under-five children (9-11). The difference could be due to the predominance of neurologic disorders in our series like Guillain-Barré syndrome (GBS) and cardiovascular disorders like rheumatic heart disease and post infectious glomerulonephritis (12). This shows that pediatric intensive care admissions vary among different regions in different settings and one should be aware of the prevalent conditions to develop the facilities and prepare relevant treatment protocols.

The proportion who died in our study was 30.9%, which is higher than that reported PICU deaths (4% - 40%) from different studies in different regions of the world (6,9,10,13-15). The high proportion of deaths in our setting could be explained by the fact that this is tertiary center, which accepts referrals from distant locations resulting in delayed presentation. Death was highest (51.9%) among children above five years of age, which is different from other studies. This is mainly explained by the high number of admissions from this age group. However, age was nor statistically significant associated with death (P=0.92) in our study.

The number of deaths in ICU varies depending on the case mix, age, length of hospital stay, and the level of organization of the unit (16). Various studies show different results regarding the association between length of stay and outcome of patients (17,18). In our study, the median length of hospital stay is three days and there was a significant correlation between short length of hospital stay and the occurrence of death (P < 0.01). Among all deaths, 51% occurred within 24 hours of stay. This probably means that delayed recognition and delayed transfer to the PICU of patients who were seriously sick at admission wad the most likely cause of death. The higher proportion of death (63.7%) among patients transferred from the inpatient wards and that from the pediatric emergency department (42.4%) supports this argument.

Inadequate staffing with little experience, limited resources, and delays in provision of care, as in many other sub-Saharan African countries, contribute to the high number of deaths in our setting. In our PICU, children are primarily managed by pediatric residents receiving postgraduate training and skilled nursing staff under the supervision of senior consultants. Oftentimes, most of our patients arrive late with multiple complications carrying a high risk of death despite possible intensive therapy.

As the main function of ICUs, provision of adequate support of respiratory and other organ dysfunctions is one of the most common critical care delivery systems. Of the total number of patients in our series, 10% were mechanically ventilated and this figure is relatively low as compared to what has been reported by other studies (6,19,20).

Possible biases arising from incompleteness of patients records should be considered in the interpretation of the results of this study. In conclusion, the highest number of admissions into the PICU was due to neurologic disorders followed by infectious diseases and renal disorders.

The proportion of cases who died in the PICU was high, and the highest number of deaths occurred within 24 hours of admission, Causes of death included sepsis, complicated meningitis and cardiovascular disorders. Early transfer of critically ill children to PICU and timely management is critically important.

An upgrading of the PICU services through equipment, trained personnel and staffing will improve the outcome of children admitted to the Unit.

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