ADMISSION PATTERN AND OUTCOME IN PAEDIATRIC INTENSIVE CARE UNIT OF TERTIARY LEVEL TEACHING HOSPITAL IN EASTERN NEPAL

Manoj Chaudhary[1], Hem Sagar Rimal[2], Ram Bhakta Subedi[3], Tara K Kafle[4]*

Affiliation

1. *Lecturer, Department of Paediatrics, Birat Medical College and Teaching Hospital, Nepal*
2. *Professor, Department of Paediatrics, Birat Medical College and Teaching Hospital, Nepal*
3. *Lecturer , Department of Paediatrics, Birat Medical College and Teaching Hospital, Nepal*
4. *Assistant Professor, Department of Community Medicine, Birat Medical College and Teaching Hospital, Nepal*

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Corresponding Author

Dr. Manoj Chaudhary
Lecturer
Department of Paediatrics
Birat Medical College and Teaching Hospital, Nepal
Email: drmanojkc497@gmail.com
ORCID No.: https://orcid.org /0000-0001-8404-7292

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ABSTRACT

Introduction

Paediatric Intensive Care Unit (PICU) is a relatively new concept with rapidly growing paediatric subspecialty in resource limited-countries. Introduced in Nepal in the 1980s, the first PICU was established in 1986 in Kanti Children's Hospital, Kathmandu with 4 beds. Later in BPKIHS in Eastern Nepal. Currently only a few dedicated PICU running in Nepal. Our PICU was started in 2021 with 8 beds in the private sector for the management of critically ill children.

Objectives

To study the admission pattern and outcome of the children at our paediatric intensive care unit.

Methodology

This was a Cross Sectional Descriptive study conducted at PICU of Birat Medical College Teaching hospital in Eastern Nepal. From August 2021 to July 2022, records of all possible admissions in PICU were reviewed. Demographic profile, diagnosis, outcome and duration of stay were analysed.

Result

Out of 260 analysed data, there were 156 (60%) males and 104 (40%) females. Age wise distribution was 101 (38.85%), 82 (31.5%), 38 (14.6%) and 39 (15%) for 1 months-1 year, 1-5 year, 5-10 year and 10-15 year respectively. Disease wise distribution was 129 (49%) respiratory, 49 (18.8%) neurological and 26 (10%) gastrointestinal, mostly infective causes like Pneumonia (78, 30%), Bronchiolitis (34, 13.1%), febrile convulsion (29, 11.2%) meningitis/encephalitis (19, 7.3%), Sepsis (12, 4.6%), dengue (6, 2.3%) other infections (19,6.3 %). In outcome, discharged (231,88.85%), DOPR (5,1.92%), LAMA (4,1.54%), Death (16,6.2%) and Referral (4,1.54%). Mortality was high (11, 38.6%) in under five years. Sepsis (4, 33.3%), Meningitis / encephalitis (3, 15.8%) and pneumonia (4, 5.1%) were the common causes. Mean duration of PICU stay was 2.73 days (median=2). Overall mortality rate was 6.2% (16). Sepsis, LOS and need of mechanical Ventilation were significant predictors of mortality.

Conclusion

Respiratory illnesses including infections were common causes of admission with low mortality (6.2%). Sepsis, Meningoencephalitis and pneumonia were common causes of death in our PICU. Sepsis, LOS and need of mechanical Ventilation were significant predictors of mortality.

KEYWORDS

PICU, Admission pattern, Outcome

INTRODUCTION

Paediatric intensive care unit (PICU) is an important component of any tertiary care centre for the management of critically ill children. PICU is a part of the hospital where critically ill paediatric patients who require advanced airway, respiratory, and hemodynamic support are managed to achieve a good outcome. The main purpose of the PICU is to prevent mortality by intensively monitoring and treating critically ill children who are considered at high risk of mortality.

The first PICU was established in Europe by Goran Haglund in 1955 at Children's Hospital of Goteburg in Sweden and later in 1962 at Children's Hospital of Philadelphia in USA.[1] Paediatric critical care is well established and advanced in developed countries while it is a relatively new but a rapidly growing paediatric specialty in resource limited-countries.[3] In Nepal it was introduced in1980's and first PICU started in 1986 at Kanti Children's Hospital, Kathmandu with 4 beds and later in BPKIHS, Dharan in eastern Nepal. Currently there are only a few dedicated PICU in Nepal. Our PICU was started in 2021 with 8 beds with 2 Mechanical ventilators.

Most common reasons for admissions are acute medical conditions such as infections, respiratory diseases, neurological disorders as well as injuries and complex surgeries. Sepsis and septic shock are also common in PICU with prevalence of more than 8% worldwide and mortality rate of more than 24%.[3,4] More than 5 million patients are admitted in ICU in the United State of America (USA) per year for invasive monitoring, support of airway, breathing, circulation and stabilization of acute or life-threatening medical problems, comprehensive management of injury and / or illness.[3] Mc Crory et al (2017) reported a 2.3% mortality rate in united states and Rashma et al (2018) reported a 10.58% mortality in India and Gauri S. Shah et al (2014) 12.6% in Nepal.[5,6,9]

METHODOLOGY

This was a cross sectional observational prospective study conducted in paediatric intensive care unit (PICU), a tertiary level teaching hospital in eastern Nepal. This study has analysed data of one year from August 2021 to July 2022. Ethical clearance was obtained from the Institutional review Committee (IRC) of Birat Medical Teaching Hospital (BMCTH) Budhi Ganga, Morang. All children admitted in PICU were included for study except children whose medical records were not found and who did not give consent. In our study medical records of 260 children were reviewed. Baseline data of children such as name, age, sex, address, weight, length, diagnosis, treatment, supportive measures, duration of hospital stay and outcome were recorded from medical records and subsequently analysed.

Statistical Analysis: Data were entered in MS Excel 2013. Processing and statistical analyses were done using SPSS 26. For Descriptive statistics mean, median, standard deviation (SD), range, percentage were calculated while Pearson's Chi Square Test and binary logistic regression analysis for analytic statistics.

RESULT

During the study period of August 2021 to July 2022, we could able to analyse data of260 children. There were 156 (60%) male and 104 (40%) female and maximum number of children (183, 70.38%) wasbelow5 years of age, followed by age group of >10years (38, 14.6%) and 5-10 years (39,15%). Their ages ranged from 1 month to 15 years. Mostly the children were admitted from emergency 216 (83.1%) followed by outpatient department (19, 7.3%), ward (17, 6.5%) and operation theatre (8, 3.1%). Age wise distribution was 101 (38.85%), 82(31.5%), 38 (14.6%) and 39 (15%) for 1 months-1year, 1-5 year, 5-10 year and 10-15 year respectively.

Table 1: Age and Sex distribution and Mortality

Age Groups	Cases (%)	Male (%)	Female (%)	Improved (%)	Death (%)	LAMA (%)	Referral (%)	DOPR (%)
1-12 months	101(100)	62(61.39)	39(38.61)	93(92.1)	5(31.3)	0(0)	2(2)	1(1)
1-5 year	82(100)	54(65.85)	28(34.15)	73(89)	6(7.3)	1(1.2)	0	2(2.4)
5-10 year	39(100)	23(58.97)	16(40.03)	34(87.2)	2(5.1)	1(2.6)	1(2.6)	1(2.6)
>10 year	38(100)	17(44.74)	21(55.26)	31(81.6)	3(7.9)	2(5.3)	1(2.6)	1(2.6)
Total	260(100)	156(60)	104(40)	231(88.8)	16(6.2)	4(1.5)	4(1.5)	5(1.9)

Disease wise distribution was 129 (49%) respiratory, 49 (18.8%) neurological and 26 (10%) gastrointestinal, mostly infective causes like Pneumonia (78, 30%), bronchiolitis (34, 13.1%), febrile convulsion (29, 11.2%) meningitis / encephalitis (19, 7.3%), Sepsis (12, 4.6%), dengue (6, 2.3%) other infections (19, 6.3%).

Table 2: System distribution and Outcome

Systems	Total (%)	Improved (%)	LAMA (%)	DOPR (%)	Referral(%)	Death(%)
Respiratory	129(100)	120(93)	2(1.6)	2(1.6)	0(0)	5(3.9)
Central Nervous	49(100)	40(81.6)	0(0)	3(6.1)	2(4.1)	4(8.2)
Gastrointestinal	26(100)	23(88.5)	0(0)	0(0)	2(7.7)	1(3.8)
Infectious Disease	20(100)	16(80)	0(0)	0(0)	0(0)	4(20)
Cardiovascular	7(100)	6(85.7)	1(14.3)	0(0)	0(0)	0(0)
Renal	7(100)	6(85.7)	1(14.3)	0(0)	0(0)	0(0)
Poisonings	6(2.3)	5(1.9)	0(0)	0(0)	0(0)	1(0.4)
Others	16(100)	15(93.8)	0(0)	0(0)	0(0)	1(6.2)
Total	260(100)	231(88.8)	4(1.5)	5(1.9)	4(1.5)	16(6.2)

Table 3: Disease distribution and Mortality

Diseases	Total (%)	Improved(%)	LAMA(%)	DOPR(%)	Referral(%)	Death(%)
Pneumonia	78(100)	72(92.3)	2(2.6)	0(0)	0(0)	4(5.1)
Bronciolitis	34(100)	33(97.1)	0(0)	0(0)	0(0)	1(2.9)
Febrile convulsion	29(100)	24(82.8)	0(0)	3(10.4)	1(3.4)	1(3.4)
Meningitis/ Encephalitis	19(100)	16(84.2)	0(0)	0(0)	0(0)	3(15.8)
Sepsis	12(100)	8(6.7)	0(0)	0(0)	0(0)	4(33.3)
Intestinal obstruction	12(100)	9(75)	0(0)	0(0)	2(16.7)	1(8.3)
Bronchial Asthma	10(100)	10(100)	0(0)	0(0)	0(0)	0(0)
Poisonings	10(100)	9(90)	0(0)	0(0)	0(0)	1(10)
COVID-19	6(100)	6(100)	0(0)	0(0)	0(0)	0(0)
Congenital heart Disease	5(100)	5(100)	0(0)	0(0)	0(0)	0(0)
Others	45(100)	39(86.8)	2(4.4)	2(4.4)	1(2.2)	1(2.2)
Total	260(100)	231(88.8)	4(1.5)	5(1.9)	4(1.5)	16(6.2)

In outcome, discharged (231, 88.85%), Discharge on patient request (DOPR) (5, 1.92%), leave against medical advice (LAMA) (4, 1.54%), Death (16, 6.2%) and Referral (4, 1.54%). Mortality was high (11, 38.6%) in under 5 years. Sepsis (4, 33.3%), Meningitis / encephalitis (3, 15.8%) and pneumonia (4, 5.1%) were the common causes of mortality.

Table 4: Overall outcome of patients

Outcome	No of patients	Percentage
Improved	231	88.85
DOPR	5	1.72
Death	16	6.2
LAMA	4	1.54
Referral	4	1.54
Total	260	100

Age, Sex, System and Diseasewise mortality are shown in Tables1, 2 and 3. Overall Outcome is shown in Table 4. Children who received mechanical ventilator were 26 (10%). Mean duration of PICU stay was 2.73 days [median 2]. Out of 16 deaths, 10 (62.5%) death occurred within 1 day (24 hour) of admission while 5 (31.25%) deaths within 2-7 days and 1(6.25%) over more than 7 days of PICU stay; on adjusting length of stay was statistically significant between survival and death. Mortality among those who stayed for less than seven days was greater than those stayed more than 7 days. Factors affecting the outcome of children admitted to the PICU (survivors and non-survivors) are shown in Table 5.

Table 5: Factors affecting outcome of children admitted to PICU

Characteristics	Survival (%) 230(100)	Death(%) 16(100)	Test
Sex			
Male	138(56.1)	10(4.1)	$\chi^2 = 0.843$
Female	92 (37.4)	6(2.4)	
Age Group			
1-12 months	92(37.4)	5(2.0)	
1-5 year	73(29.7)	6(2.4)	$\chi^2=0.850$
5-10 year	34(13.8)	2(0.8)	
>10 year	31(12.6)	3(1.2)	
Length of Stay(days)			
≤1	75(30.5)	10(4.1)	$\chi^2<0.001$
2-7	150(61.0)	5(2.0)	
>7	5(2.0)	1(0.4)	
MV Received			
Yes	12(4.9)	12(4.9)	$\chi^2<0.001$
No	218(88.6)	4(1.6)	
Infection			
Yes	153(62.2)	12(4.9)	$\chi^2=0.485$
No	77(31.3)	4(1.6)	
Pneumonia			
Yes	70(28.5)	3(1.2)	$\chi^2 = 0.323$
No	160(65.0)	13(5.3)	
Sepsis			
Yes	8(3.3)	4((1.6)	$\chi^2<0.001$
No	222(90.2)	12(4.9)	

The Sepsis, length of hospital stay (LOS) and need of mechanical ventilation (MV) were significant factors affecting outcome of the children while sex and age were not statistically significant. Table 6 presents the significant survival predictors of patients admitted to the PICU using a binary logistic regression analysis. It revealed that sepsis, length of hospital stay (LOS) and need of mechanical ventilation (MV) were statistically significant predictors of mortality in the PICU (p value <0.05).

Table 6: Significant Predictors of survival of children admitted to the PICU using binary logistic regression analysis

Variables	Exp(B)	CI	P-value
Sepsis	0.031	0.03-0.379	0.007
MV	214.572	28.544-1612.988	0.001
LOS			0.017
<24 our	0.007		0.033
1-7 days	69.172	0.812-5894.218	0.062
>7days	4.828	0.087-266.493	0.442
Age			0.421
1-12 months			
1-5 year	3.461	0.492-24.631	0.221
>5 year	2.831	0.416-19.274	0.288

DISCUSSION

Paediatric intensive care unit (PICU) is a special unit mainly concerned with the care of patients with critical illness and demands a wide knowledge to achieve good outcomes. [3] PICU results can be assessed on the basis of outcomes such as death or survival by means of indicators such as mortality rates. With Advances in paediatric sub-specialties, survival of children improved and mortality reduced in PICU.

In our study, most of the children (183, 70.38%) were under 5 years of age with male 156 (60%) and female 104 (40%) with male to female ratio 1.5:1 Which is comparable with the study by Anwarul Haque et al with most children (62.5%) under 5 years of age with majority of male patients (60.9%) and study from Nepal by Gauri S. Shah et al [2014] with male 63% and female 37%.[8,9] Similar Study by Shruti Jain et al (2018) showed Male 60.9% and female 39.1% and also study by Susan Hasan Mausa et al also found that 58% were male and 42% were female.[10,11] In this study respiratory system illness (129, 49.6%) like pneumonia and Bronchiolitis ; which could be a reflection of disease prevalence under five years of age was commonest cause of PICU admission. Central nervous system illness (49, 18.8%) and gastrointestinal disease (26, 10%) were other common causes of admission. These findings were comparable with study by Susan Mausa et al with respiratory system, central nervous system, and gastrointestinal diseases (47.2%, 14.8 %, 10.8%) requiring PICU admission respectively and study by Gauri S. Shah et al with respiratory illness (33%) like pneumonia and bronchiolitis and central nervous system illness (18.6%).[11,9]

Infectious diseases like pneumonia (78, 30%), Bronchiolitis (34, 13.1%), febrile convulsion (29,11.2%), meningitis/ encephalitis (19, 7.3%), sepsis (12, 4.6%), dengue (6, 2.3%)

and other infections (19, 6.3%) were common cause of admission which is similar to the study by G shah et al showed that commonest cause of PICU admission was infections such as respiratory illness (33%), central nervous system infection (18.6%) and infectious disease (11.3%). [9] Sahoo B et al also reported infectious diseases (20.7%) were the leading causes of admission in the PICU. [13]

Overall mortality in our study was 6.2% (16) which is comparable to the study in India by Bavari VL et al [2019] with mortality (5.8%) and study in China by Wu, Yanlan [2014] with mortality (6.5%).[14,15] Mortality of our PICU is lower than the previous study by Gauri S. Shah et al [2014] and Prakash Joshi et al [2018] in Nepal which was 12.6% and 18.5% respectively.[7,9] In similar study from India N Anand et al [2019] and Rashma et al (2018) reported mortality was 10.22% and 10.58% respectively.[6] The mortality reported by other authors varies from 6.7% to 33.1%. [16,18,19]

In our study maximum deaths 5 (31.3%) occurred in children of age less than 1 year which is similar to the report by Rady from Egypt [2014] with highest mortality in infants below 1 year of age (43.9%).[19] Mabrouka A et al from Libya [2017] also reported 70% mortality among infants up to one-year-old. [20] Age less than 12 months is one indicator of poor outcome in PICU. [20] Infants are more vulnerable to infection. This is due to lack of immunity, lack of awareness of sanitation, proper hygiene, nutrition in developing countries and not completion of immunization during infancy period. Infectious causes (52%) are the leading cause of mortality within the first year of life. [WHO 2013]

The commonest cause of mortality in our study was sepsis (4, 33.3%) which is similar to the study by Md Safiul Hoque et al from Bangladesh [2012] fatality rate higher for septicaemia (33.3%). [23] The study of epidemiology of sepsis in the Valencian Community,1995-2004 by Juan Carlos Andreu Ballester et al showed a mortality rate of 42.5%. [21] In a similar study by Mabrouka A et al from Libya [2017] sepsis was the commonest leading cause of death (23.3%) and Punchak, Maria et al from Mozambique reported highest mortality among patients with sepsis (59%). [22,24] Humayun et al study showed that case fatality was highest for septicaemia (65.1%). [25]

In our study, 26 (10%) needed mechanical ventilation. Among them 14 (53.85%) survived and 12 (46.15%) died which is statistically significant indicator of mortality. In similar study by Gauri S. Shah et al 41 (17.8%) children received mechanical ventilation, among them 23 (56%) survived, 14 (34.1%) died and 4 (9.75) left against medical advice and need of mechanical ventilation adversely affected the outcome.[9] The high mortality of ventilated children in our PICU is due to severity of disease, delay in referral and lack of trained medical staffs.

The Length of hospital stay (LOS) in the PICU is an index of severity of morbidity, though this cannot be interpreted in isolation. Morbidity is defined as the health related quality of life in or out of hospital. [21] It is affected by previous health status and residual disability. In our study mean duration of PICU stay was 2.73 days [median 2 (2, 5)] similar to the study by Anwarul Haque and Surraiya Bano with average length of stay 3.2 (ranging from 1 to 49) days and the study by Khilnani et al with mean duration of stay 4.52 ± 2.6 days.[8,16] Out of 16 deaths, 10 (62.5%) death occurred within 1 day (24 hour) of admission while 5 (31.25%) deaths within 2-7 days and 1 (6.25%) over more than 7 days of PICU stay. Mortality among those who stayed for less than seven days was greater than those stayed more than 7 days. Although many studies agree that there is a correlation between length of hospital stay and the outcome of paediatric patients, [26, 27] there are conflicting findings as to how length of hospital stay affects outcome. El-Nawawy in his study found greater mortality in paediatric patients with shorter LOS in the ICU while Marcin et al in their study found greater mortality in patients with longer LOS. [26,27]

In our study, sepsis, need of mechanical ventilation and length of hospital stay were the statistically significant predictors of survival outcome in the PICU. These findings are similar with the study by El-Nawawy and Marcin et al. [26,27]

CONCLUSION

Respiratory illnesses (49.6%) including infections were common causes of admission with low mortality (6.2%). Sepsis, Meningoencephalitis and pneumonia were common causes of death in our PICU. Sepsis, length of hospital stay and need of mechanical Ventilation were significant predictors of mortality.

RECOMMENDATIONS

For the improvement of PICU outcome
Early referral of sick children to tertiary care centre.
Training of medical staffs.
Establishment of well facilated pediatric intensive care unit.

LIMITATIONS OF STUDY

This is a single centre study in private set up and there was low sample size.

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CONFLICT OF INTEREST

There is no conflict of interest.

FINANCIAL DISCLOSURE

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