



Admission Patterns and Outcome in a Pediatric Intensive Care Unit in Nepal

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Authors' contributions

This work was carried out in collaboration between all authors. Authors GSS, AT, LS designed, conducted the study, analyzed the data and prepared the manuscript. Authors BKS and OPM were involved in data analysis, preparation and critical revision of manuscript. All authors read and approved the final manuscript.

Original Research Article

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ABSTRACT

Aims: To study the admission patterns and outcome of children in a Pediatric Intensive Care Unit (PICU) in Nepal.

Methods: Demographic profile, diagnosis, treatment, supportive measures and outcome of children admitted to the PICU of B P Koirala Institute of Health Sciences from April 2011 to March 2012 were reviewed.

Results: 230 children were admitted to the PICU with male to female ratio of 1.7:1. Diagnoses included respiratory diseases (n=76, 33%), central nervous system diseases (n=43, 18.6%), infectious diseases (n=26, 11.3%), surgical problems (n=18, 7.8%), gastrointestinal diseases (n=17, 7.4%), cardiovascular diseases (n=15, 6.5%), poisonings (n=11, 4.8%), renal (n=9, 3.9%), hematological (n=3, 1.3%) and others (n=12, 5.4%). Out of 230 admitted children, 29 (12.6%) died, 19 (8.2%) left against medical advice and 5 (2%) were referred to other centers. Forty-one (17.8%) children received mechanical ventilation, among which 23 (56%) improved, 14 (34.1%) died and 4 (9.7%) children were taken away by caretakers against medical advice.

Conclusion: Respiratory, central nervous system and infectious disease were the

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common reasons for admission. Children with infectious diseases and need for mechanical ventilation had higher mortality. Therefore, these patients require early referral and timely institution of therapy for better outcome; and intensive care facilities should be expanded to decrease child mortality.

Keywords: Global health; critical care; PICU.

1. INTRODUCTION

Pediatric intensive care unit (PICU) is an important component of any tertiary care center. Approximately 4 million ICU admissions per year occur in the United States with mortality rate reported ranging from 8-19% [1-3]. ICU is one of the sites where medical errors are most likely to occur because of the complexity of the diseases, and patients are vulnerable to experience adverse outcomes due to multiple interventions [4-7].

The major causes of death in developing countries in under-five children are preventable and curable diseases like acute respiratory infections, diarrheal diseases and malaria [8]. To decrease morbidity and mortality due to vaccine preventable diseases, government of Nepal has implemented National Immunization Program in all the districts of the country which includes vaccines for Tuberculosis, Poliomyelitis, Diphtheria, Pertussis, Tetanus, Hepatitis B, *Hemophilus influenza b*, Measles and Japanese encephalitis [9]. However, due to financial and other logistic constraints, the government of Nepal has still not been able to include important vaccines like pneumococcal, mumps, rubella, chickenpox in the national program.

With the advancement in intensive care facilities, there is a dramatic increase in survival of critically ill children [3,10]. Previous studies have shown significant positive impact of ICU physicians on the outcome in both children and adults [10,11]. Pediatric intensive care is a relatively new field in Nepal. There are only few PICUs in Nepal and most of them are located within the capital city Kathmandu. PICU of BP Koirala Institute of Health Sciences (BPKIHS) was one of the first to be established in Nepal. There is lack of trained professionals, resources and research in this emerging field in Nepal. We, therefore, analyzed the data of our PICU to find out the pattern of diseases and outcome at our centre which would help in proper resource allocation and better management of critically ill children.

2. MATERIALS AND METHODS

This is a retrospective study where the records of patients admitted in the PICU of BPKIHS over one year period were analyzed. BPKIHS is the largest tertiary care teaching hospital in eastern Nepal with a three bedded PICU equipped with central oxygen supply and suction lines, infusion pumps, conventional mechanical ventilator, in-house blood gas analyzer, portable X-ray machine, defibrillator, patient care monitors and ECG machine. However, we do not have facilities for invasive blood pressure monitoring, intra-cranial pressure monitoring, bedside ultrasonography/echocardiography, plasmapheresis and high frequency ventilation, cardiothoracic surgery and neurosurgery. There are 2 resident doctors on duty supported by 2 trained nurses. The residents on-duty are also responsible for looking after the 12 bedded neonatal unit under the supervision of 2 senior pediatricians.

All patients in the unit were treated according to the written standard operating protocol. Relevant investigations including total and differential blood counts, hemoglobin, blood sugar, electrolytes, urea, creatinine, and blood gas were done at admission and subsequently whenever required. The PICU is supported by a lab which provides services round the clock. Cerebrospinal fluid analysis for cell counts, protein, sugar, gram and culture sensitivity was done in all children with suspected central nervous system infection. Empiric antibiotics were started as per the protocol wherever indicated, and it was subsequently changed depending upon the culture and sensitivity pattern. Vasopressors (dopamine and/or dobutamine and epinephrine) were used when needed. Seizures were controlled with anti-epileptic drugs (midazolam, diazepam, phenytoin, valproate) and raised intracranial pressure was managed by administering mannitol or 3% hypertonic saline.

3. RESULTS

A total of 230 children were admitted during the one year period. Age and gender distribution of the admitted patients are shown in Table 1.

Table 1. Age and gender distribution and mortality of children admitted to PICU

Age groups	Cases n (%)	Male n (%)	Female n (%)	Death n (%)
0-1month	31(13.5)	23(10.0)	8(3.5)	3(1.3)
1 month-1 year	72(31.3)	44(19.1)	28(12.2)	12(5.2)
1-5 years	50(21.7)	32(14.0)	18(7.8)	6(2.6)
5-10 years	36(15.5)	21(9.1)	15(6.5)	4(1.7)
>10 years	41(17.8)	25(10.8)	16(7.0)	4(1.7)
Total	230(100)	145(63)	85(37)	29(12.6)

There were 145 (63%) males and 85 (37%) females. Maximum number of patients belonged to the age group of 1 month–1 year (31.3%) followed by age group of 1-5 year (21.7%). Maximum deaths 12 (5.2%) occurred in the age group 1 month to 1 year.

Table 2 shows the outcome of patients in relation to systems involved. Respiratory illness (n=76, 33%), central nervous system disease (n=43, 18.6%) and infectious diseases (n=26, 11.3%) were the common diseases requiring PICU admissions in this analysis. Admissions also included surgical (n=18, 7.8%), gastrointestinal (n=17, 7.4%), cardiovascular (n=15, 6.7%), poisonings (n=11, 4.8%), renal (n=9, 3.9%), hematological (n=3, 1.3%) and other diseases (n=12, 5.4%). Twenty nine (12.6%) out of the 230 admitted children died and maximum deaths (7.8%) occurred in the age group 1 month to 5 years.

Nineteen (8.2%) children left against medical advice and 5 (2.1%) children were referred to other centers for treatment.

Mortality analysis in relation to different diseases is presented in Table 3. Pneumonia (n=7), infections (n=5, staphylococcal sepsis and late onset sepsis), acute gastroenteritis with severe dehydration (n=4) and acyanotic congenital heart diseases (n=4) were the major causes of death in this study.

Common respiratory illnesses included pneumonia (n=44, 57.9%), bronchial asthma (n=12, 15.7%) and acute bronchiolitis (n=11, 14.45%). Acute febrile encephalopathy (n=24, 55.7%) followed by seizure disorders (n=6, 13.9%) and tubercular meningitis (n=4, 9.3%) were the

common central nervous system diseases requiring PICU care. Other conditions requiring PICU admissions included acute gastroenteritis (n=13, 76.4%), acyanotic congenital heart diseases (n=8, 53.3%), and organophosphorous poisoning (n=4, 36.3%).

Table 2. Distribution and outcome in relation to systems involved

Systems involved	Total n (%)	Improved n (%)	Expired n (%)	LAMA n (%)	Referral n (%)
Respiratory	76(33.0)	63(27.4)	8(3.4)	5(2.1)	-
Central nervous system	43(18.6)	33(14.4)	1(0.4)	8(3.4)	1(0.4)
Infectious diseases	26(11.3)	20(8.7)	5(2.4)	-	1(0.4)
Surgical	18(7.8)	17(7.4)	-	-	1(0.4)
Gastrointestinal	17(7.4)	8(3.4)	4(1.7)	4(1.7)	1(0.4)
Cardiovascular	15(6.5)	10(4.3)	4(1.7)	-	1(0.4)
Others	12(5.4)	9(4.0)	3(1.3)	-	-
Poisonings	11(4.8)	10(4.3)	1(0.4)	-	-
Renal	9(3.9)	7(3.0)	1(0.4)	1(0.4)	-
Hematological	3(1.3)	-	2(0.8)	1(0.4)	-
Total	230(100)	177(76.9)	29(12.6)	19(8.2)	5(2.1)

Table 3. Mortality according to disease/conditions

Diseases/conditions	No. of cases	Death n=29 (%)
Pneumonia	44	7(23.14)
Aspiration pneumonia	4	1(3.4)
Bacterial meningitis	19	1(3.4)
<i>Staphylococcal</i> sepsis	9	3(10.34)
Late onset neonatal sepsis	8	2(6.9)
Acute gastroenteritis with severe dehydration	13	4(13.79)
Acyanotic congenital heart disease	8	4(13.79)
Diabetic ketoacidosis	7	2(6.9)
Dapsone poisoning	7	1(3.4)
Post-infectious glomerulonephritis	3	1(3.4)
Drowning	2	1(3.4)
Aplastic anemia	1	1(3.4)
Iron deficiency anemia	1	1(3.4)

Forty one children (17.8%) received mechanical ventilation, of which 23 (56%) survived, 14 (34.1%) died and 4 (9.75) left against medical advice. Out of 189 non-ventilated children, 154 (81.4%) improved, 15 (7.9%) died and 15 (7.9%) left against medical advice.

4. DISCUSSION

Advances in pediatric sub-specialties including the critical care medicine have improved the survival of sick children. Many diseases which were fatal previously are now treatable due to development of new technologies. Although PICU was first established in 1950 in Sweden, it is still in infancy in Nepal [12]. During the last two decades, it has become an advanced medical discipline well recognized for its services in the west and then slowly spread out in other parts of the world [13]. Few positive experiences of PICU from neighboring countries have been described including India and Malaysia [14,15].

In this analysis, 31.3% patients were infants and majority of them were male (63%); a finding similar to that of Haque and Bano and others [16,17]. Respiratory illness (33%) like pneumonia, bronchiolitis were the commonest indications for admission in our set up and it could be a reflection of disease prevalence under five years of age. This may be decreased by incorporating pneumococcal vaccine in national immunization program, which has not been incorporated in the schedule so far. Central nervous system infections and other infections such as staphylococcal septicemia and neonatal sepsis were the next two common diseases which affected the children and required PICU admissions. Thus taken together, infection was the commonest pathology causing diseases in children requiring intensive care admissions. Kapil and Bagga [16] reported septicemia (14.8%) as the commonest indication for admission in their series while a study from Pakistan found post-cardiac surgery (34%) to be the most common condition [17]. It shows that pediatric intensive care admissions vary within the same region of different countries and one should be aware of the prevalent conditions to develop the facilities and prepare treatment protocols accordingly.

Overall mortality in this study was 12.6%. The reported mortality varied from 9.8-35% in different series by other authors [16,18-20]. The commonest condition leading to death was pneumonia (n=7, 23.14%) followed by sepsis (n=5, 17.24%), acute gastroenteritis with severe dehydration (n=4, 13.79%) and acyanotic congenital heart diseases (n=4, 13.79%). The need for ventilation adversely affected the outcome indicating that these patients were in advanced stage of disease and needed life supporting measures. Pneumonia, sepsis, gastroenteritis and meningitis are preventable and potentially curable diseases. Lack of effective primary health and immunization, poor sanitation and hygiene and skilled manpower are the primary causes of death in resource limited countries. So to decrease deaths due to such diseases, government should strengthen the existing immunization policy and promote programs on sanitation and hygiene along with proportionate expansion of the critical care facilities.

In our PICU, children are managed by resident postgraduate doctors, skilled nursing staff and supervised by senior consultants round the clock. Often these patients arrived late with multiple complications leading to mortality despite the best available therapy. Poverty, illiteracy, lack of proper transportation facilities and lack of resources further adds to the challenge of managing sick children in developing countries. Pearson et al have suggested that the availability of full time trained pediatric intensivist can deliver high quality care with much higher efficiency than general pediatrician [21]. People working in PICU in developing countries face many problems like lack of resources, knowledge and the support system. Still, lives of many children can be saved by judicious use of available facilities like oxygen, fluids, antibiotics and careful goal-oriented monitoring of patients. A trained paediatric intensivist may help by working closely with general paediatricians, training residents and nurses in advanced procedures, developing and updating unit protocols taking into consideration the existing human, logistic and financial resources. The intensivist may also be helpful for training peripheral units on stabilization and transportation of sick children. These facts highlight the necessity to strengthen the existing health care system and develop facilities for proper transportation and treatment of critically ill children.

5. CONCLUSION

Respiratory and central nervous system diseases including infections were the predominant conditions leading to PICU admissions in our setting. Most of the children who died suffered

from preventable and curable disease. This highlights the importance of addressing critically ill children and expanding intensive care facilities in the region.

CONSENT

Not applicable.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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