

Original Research Article

Outcome analysis of a newly setup pediatric intensive care unit in a teaching hospital of northern India

Aparna Chakravarty*, Jagannath Mohapatra, Richa Garg, Shaurya Kumar

Department of Pediatrics, Hamdard Institute of Medical Sciences and Research, Jamia Hamdard, New Delhi, India

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*Correspondence:

Dr. Aparna Chakravarty,

E-mail: chakravarty_aparna@yahoo.co.in

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ABSTRACT

Background: Pediatric intensive care units (PICU) have brought about dramatic increase in the survival of critically ill children. The aim of pediatric intensive care is not just to save lives but also to maximise the quality of those lives. Evaluation of the outcome of an intensive care unit is necessary as a measure of quality improvement in patient care.

Methods: A retrospective observational study was done in a PICU of a teaching hospital between February 2017 to August 2018. Records of all admissions, transfer outs, discharges and deaths were collected along with age, sex, diagnosis, length of stay, and outcome.

Results: Mean age of the 601 patients admitted over a period of nineteen months was 4 years. 36% patients were between 1-5 year and 32% were infants. Major indication for admission to the PICU was respiratory (30%) followed by neurological illnesses (25%) and infections (22%). Increased length of stay (LOS) (>5 days) was seen in respiratory, neurological diseases and infections. A significant relation (p value <0.05) was found between outcome and patients admitted with sepsis and the group classified as others. Patients admitted with involvement of nephrology system had a significant relation with LOS (p value <0.05). The mortality rate was 2%.

Conclusion: The outcome analysis of our newly setup PICU is comparable with other studies in the Indian subcontinent. Active surveillance or audit of PICU admissions help capture lapses in management and bring a better outcome with available resources.

Keywords: Discharge, Length of stay, Mortality, Outcome, Pediatric intensive care unit, Sepsis

INTRODUCTION

Deaths in under-five children have been attributed to preventable and curable diseases such as acute respiratory infections, diarrheal diseases and malaria in the developing countries. Pediatric intensive care units (PICU) have brought about dramatic increase in the survival of critically ill children. PICU is an important component in any tertiary care centre. Studies have shown significant good outcome of both children and adults taken care in intensive care units.^{1,2}

Patients who require advanced airway, respiratory and hemodynamic support are admitted in the PICU, with the aim of having a better outcome than if admitted in the general pediatric wards.³ Management of critically ill children remains one of the most challenging subspecialties in pediatrics. PICU helps in intensified monitoring and urgent management of critically sick patients thereby decreasing the mortality. Intensified care is therefore offered to all critically sick patients.

Over the last three decades, pediatric intensive care has progressed immensely. These changes have resulted from better understanding of critical and complex illness, specialized training in pediatric critical care, centralisation of pediatric intensive services and new treatment modalities. Moreover, children with complex and chronic diseases who were not admitted in the past, are now offered intensive care.⁴⁻⁶

The aim of pediatric intensive care is not just to save lives but also to maximise the quality of those lives. However, this comes at a huge cost to all stakeholders- the hospital, health personnel and the patient.⁷ PICU outcomes are assessed by the indicators such as mortality and morbidity. Mortality indicators provide an opportunity to review factors that may have an impact on the delivery of care and patient outcome. Quality improvements are actioned as identified. Quality and efficiency of care in a critical care setting are associated with length of stay (LOS).^{8,9} PICU LOS is an important measure of resource use and economic utilization. Management of critical care resources is often difficult as there is a complex association between personnel and patient needs.¹⁰⁻¹³ Evaluation of the outcome of an intensive care unit is necessary to assess efficacy of management protocols and optimize resource allocation. Outcome analysis of PICU is assessed by the mortality and length of PICU stay. As a measure of quality improvement in patient care and 'audit' with the aim to modify practices if necessary, authors attempt to do this study.

METHODS

This retrospective observational study was done in the Pediatric Intensive Care Unit (PICU) of a tertiary care hospital in New Delhi, India from mid-February 2017 to August 2018. The PICU is functional since February 2017. Records of all patients admitted in the PICU, which admits pediatric patients <16 years from both medical and surgical specialties were analyzed.

The PICU is equipped with central oxygen supply and suction pumps, mechanical ventilator, infusion pumps, cardiac monitors, blood gas analyser, portable X-ray machine, defibrillator, ECG and EEG machine. The unit does not have invasive blood pressure monitoring, bedside ultrasonography/echocardiography, high frequency ventilation, cardiothoracic, neurosurgery and oncology facilities. The PICU is a separate unit manned by 2 trained nurses and 2 resident on-duty doctors and is under the direct supervision of 2 senior pediatricians. The PICU is supported by in-house laboratory providing services round the clock.

Records of all admissions, transfer outs, discharges and deaths were collected. The following data were extracted from the records- age, sex, diagnosis, duration of stay, use of mechanical ventilation and outcome of stay. Admissions were categorised according to the system

affected. They were classified as respiratory, neurology, gastrointestinal, poisoning, cardiology, sepsis, infections, nephrology, endocrinology, hematology. The category others included cases of drowning and trauma. Length of stay (LOS) in PICU was classified as <1 day, 1-5 days and >5 days. Outcome is recorded as transfer out to the pediatric wards, discharges, discharges against medical advice (DAMA) and death.

The data were collected in Microsoft Excel 2016 datasheet and the data was transferred and analysed into the Statistical Package for Scientific Solutions (SPSS) version 23.0.

Continuous variables are described by mean, standard deviation, percentage and range as appropriate. P-value <0.05 is considered statistically significant

RESULTS

During the study period of 19 months, a total of 601 patients were admitted to the 5 bedded PICU of a tertiary care hospital of Delhi, India. In the gender distribution, 380 (63 %) were males and 221 (37%) were females making a M:F ratio of 1.7:1. The age range was 1 month to 16 years and the mean age was 4 years. In the age distribution (Figure 1) 36% of patients were between 1-5 years, followed by 1 month- 1 year (32%), 5-10 years (20%) and more than 10 years (13%).

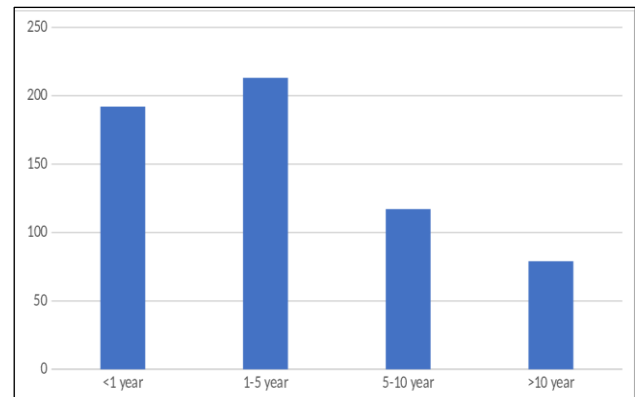


Figure 1: Age distribution.

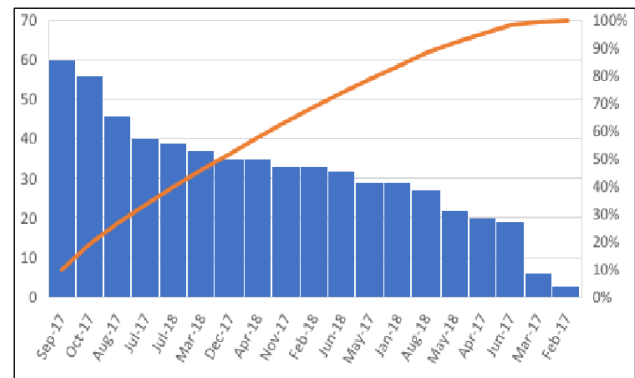


Figure 2: Monthly distribution of admission.

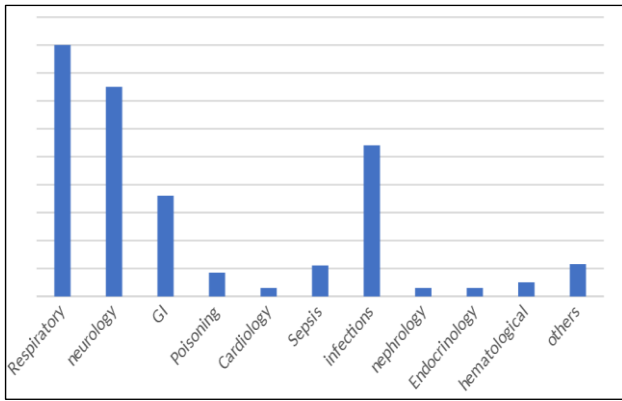


Figure 3: Frequency distribution- system wise.

Out of the 601 patients admitted, on an average 32 patients per month were admitted with the maximum (10%) being in the month of September 2017.

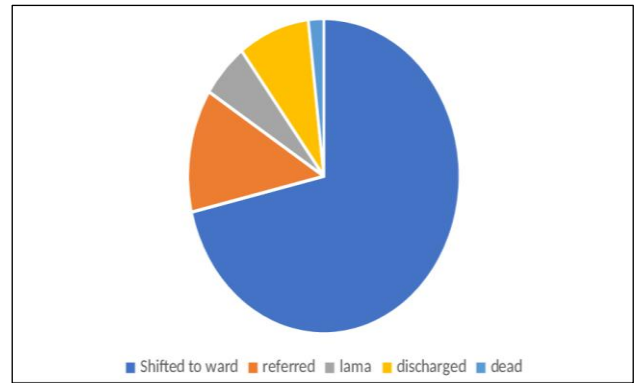


Figure 4: Outcome.

There is an increase in admission rate from 1% to 6 % during same months - March 2017 and March 2018. (Figure 2).

Table 1: Comparison of systems involved during admission to PICU with LOS and Outcome.

System Involved	Total (%)	LOS			p value*	Outcome					p value*
		<1 day	1-5 days	>5 days		Shifted	Referred	lama	Dead	Discharge	
Respiratory	180(30)	18	146	16	0.75	143	13	11	2	11	0.22
Neurology	150(25)	16	121	13	0.92	112	16	13	2	7	0.23
GI	72(12)	7	61	4	0.46	51	12	1	3	5	0.11
Poisoning	17(3)	2	14	1	0.9	11	1	1	0	4	0.14
Cardiology	6(1)	0	6	0	0.46	2	2	1	0	1	0.19
Sepsis	22(4)	4	18	0	0.23	13	4	4	1	0	0.03
Infections	108(18)	15	82	11	0.58	88	11	1	3	5	0.08
Nephrology	6(1)	0	3	3	<.05	4	1	0	0	1	0.85
Endocrinology	6(1)	1	3	2	0.09	4	1	0	0	1	0.85
Hematological	10(2)	1	7	2	0.47	5	4	1	0	0	0.04
Others	23(4)	5	16	2	0.29	11	1	1	0	10	<0.01
Total	601	69	478	54		445	66	34	11	45	

*p values were calculated for the systems involved with the LOS and Outcome. LOS length of stay. PICU Pediatric Intensive Care Unit. lama Left Against Medical Advice

Table 2: Comparison of age-groups with LOS and Outcome.

Outcome	Age				Total (%)	P value
	<1 year	1-5 years	5-10 years	>10 years		
Shifted	147	157	84	57	445(74)	
Referred	20	18	16	12	66 (11)	
LAMA	12	17	2	3	34 (6)	0.127
Dead	2	6	1	2	11 (2)	
Discharged	16	10	14	5	45(7)	
Total (%)	197(33)	208(35)	117(19)	79(13)	601	
LOS						
< 1 day	20	23	13	13	69 (11)	
1-5 days	160	169	92	57	478 (79)	0.692
>5 days	17	16	12	9	54 (9)	
Total	197(33)	208(35)	117(19)	79(13)	601	

*p values were calculated for the age-groups with the LOS and Outcome. LOS length of stay.

Major indication for admission to the PIC was respiratory (30%) followed by neurological illnesses (25%) and infections (18%). 4% had sepsis while cardiovascular, renal and endocrine diseases had the least admission rates (1-2%).¹⁷ (3%) patients required mechanical ventilation during the study period.

Majority of patients were admitted for 1-5 days (80%) followed by <1 day (11%) and >5 days (9%). Analysis of the outcome of the patients admitted showed that majority (71%) were shifted to the ward while 76 patients (13%) were referred. 34 patients (6%) were discharged against medical advice (DAMA) and 11 patients (2%) died.

Comparison of LOS and outcome was done (Table 1) with the system involved at the time of admission. Increased LOS (>5 days) was seen in respiratory and neurological diseases and infections. A significant relation (p value <0.05) was found between outcome and patients admitted with sepsis and the group classified as others. Patients admitted with involvement of nephrology system had a significant relation with LOS (p value <0.05). When different age-groups were compared with LOS and outcome (Table 2), there was no significant relation seen.

DISCUSSION

Pediatric critical care medicine has improved the survival of sick children. Positive outcome of PICU are now seen from the Indian subcontinent and neighbouring countries.¹⁴⁻¹⁶ This study was attempted as an effort to improve quality in a newly established PICU. The 5-bedded PICU was started in February 2017 and over a period of 19 months, 601 patients were admitted (379 patients in a year). This is comparable with other studies in the country.¹⁷ The admission rate increased by 5% over a period of 12 months. This reflects the need of a PICU facility in a hospital. Highest admission rate was seen in September of 2017. Follow up observation can further show the monthly trend of admissions. This is a first-time observation as no previous study has been made on a newly established PICU. Our results show that most of the patients were of the age group <5 years (69%) of which 32% were infant and 63% patients were male which is similar to other studies.¹⁸ Pediatric age group <5 years remains vulnerable for critical illnesses. In this study, majority of the admissions were respiratory diseases (30%) followed by neurological disorders (25%) and infections (22%). These findings are similar to studies in the Indian subcontinent.^{18,19} While other studies showed cardiovascular and post cardiac surgery to be the most common causes for admission.^{20,21} This reflects that admissions in PICUs can vary depending on the locally prevalent diseases and PICUs should have adequate resources including staff and treatment protocols to manage the most prevalent conditions. Outcome analysis of the PICU was made involving the parameters- shifted out, discharged, referred, DAMA and mortality. Majority

(71%) of the patients were shifted out while 13% patients were referred as the hospital lacked subspecialty departments. 6% of patients were discharged against medical advice which were patients who could not afford further treatment due to financial constraints.

Overall mortality in our study was 2%. This is comparable to the mortality rate (2.6%) of a five-bed PICU in Hong Kong.²² Various studies reported mortality in the range of 2.1-35%.¹⁸⁻²³ The wide range of mortality may be due to varied reasons, delayed referral to an intensive care unit could be one of the many reasons. Bed occupancy in a PICU is an important tool to analyse the effective working of a PICU. Though increased LOS can deprive many sick children of intensified care. We analysed the LOS in our study. Majority of the children had a stay of 1-5 days (80%). A significant relation with LOS was seen with patients admitted with nephrology conditions and the group classified as others. This data is from the initial 1.5 years of starting the PICU, follow up data will help us with more conclusive results.

Limitations of this study is a retrospective analysis of patients admitted. A proper assessment of the severity scoring using tools like Pediatric Risk of Mortality (PRISM) and Pediatric Index of Mortality (PIM) could not be done. The department at the time of study did not have all subspecialty treatment facility and therefore patients were referred. The population is not truly representative of the existing social demographics as it is a private sector hospital.

CONCLUSION

It can be concluded that PICU is an integral part of any pediatric department. The demographic profile of children admitted in PICU in our study and the outcome is comparable to other studies in Asia. In India, a PICU unit in every outreach medical facility is essential for initial stabilisation and management of sick patients. Integration of pediatric subspecialty services is required for enabling comprehensive health care under the same roof. Active surveillance or audit of PICU admissions help capture lapses in management and bring a better outcome with available resources. Given the limitations of the study, a multicentric study on PICU outcome analysis of the private as well as public sector will give a better conclusion.

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Ethical approval: The study was approved by the Institutional Ethics Committee Jamia Hamdard taken.

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