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Clinical Study of paediatric cases admitted to paediatric intensive care unit (PICU)

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Abstract
Pediatric Intensive Care is commonly practised in India both at the pediatric super speciality and pediatric post-graduation level. However, there is a dearth of data on the clinical and etiological spectrum of PICU (Pediatric Intensive Care Unit) admissions from India, especially from post-graduation teaching institutes. Knowledge of this data, can help the paediatricians and the pediatric intensivists in tailor making the PICUs more adaptive for the Indian patients in general and the population they cater to, in specific. Hence the present study was planned for evaluation of Clinical Study of Paediatric Cases Admitted to Paediatric Intensive Care Unit.
The present study was planned in Department of Pediatrics, Government Medical College, Bettiah, West Champaran, Bihar. Total 100 cases admitted to the Paediatric intensive care unit (PICU) were enrolled in the present study. All cases admitted in PICU and treated as per the protocol. The clinical profile such as age, sex, history, co morbid conditions, condition on arrival, provisional diagnosis at arrival is noted. The duration of hospitalization and outcome is recorded with final diagnosis.
Demographic profile of our PICU patients showed similar characteristics as those of reported in different relevant studies with minor differences in few aspects. This can serve as the basis for developing dedicated and new protocols for the caregivers in an effort to improve the outcome of critical illness.

Keywords: paediatric intensive care unit, picu, paediatric cases, clinical outcomes, etc

Introduction
A pediatric intensive care unit (also paediatric), usually abbreviated to PICU, is an area within a hospital specializing in the care of critically ill infants, children, and teenagers. A PICU is typically directed by one or more pediatric intensivists or PICU consultants [1] and staffed by doctors, nurses, and respiratory therapists who are specially trained and experienced in pediatric intensive care. The unit may also have nurse practitioners, physician assistants, physiotherapists, social workers, child life specialists, and clerks on staff, although this varies widely depending on geographic location. The ratio of professionals to patients is generally higher than in other areas of the hospital, reflecting the acuity of PICU patients and the risk of life-threatening complications [2]. Complex technology and equipment is often in use, particularly mechanical ventilators and patient monitoring systems. Consequently, PICUs have a larger operating budget than many other departments within the hospital [3, 4].
Goran Haglund is credited with establishing the very first pediatric ICU in 1955; this PICU was located at Children's Hospital of Goteburg in Sweden [5]. The first PICU in the United States was created at the Children's Hospital of Philadelphia in 1967 by John Downes [5]. The PICU at Lurie Children's Hospital was also established in 1967, the same year as the unit at the Children's Hospital of Philadelphia. The establishment of these early units eventually led to hundreds of PICUs being developed across North America and Europe. This number is still increasing today.
There were a variety of factors that led to the development of PICUs. John Downes identified five specialties of medicine that aided in the development. These specialties included adult respiratory ICUs, neonatal intensive care, pediatric general surgery, pediatric cardiac surgery, and pediatric anesthesiology [5].
Between 1930 and 1950 the poliomyelitis epidemic had created a greater need for adult respiratory intensive care, including the iron lung. There were times when children would contract polio and would have to be treated in these ICUs as well [5]. This contributed to the need for a unit where critically ill children could be treated. Respiratory issues were also increasing in children because neonatal intensive care units were increasing the survival rates of infants. This was due to advances in mechanical ventilation. However, this resulted in children developing chronic lung diseases, but there was not a specific unit to treat these diseases [5]. Advancements in pediatric general surgery, cardiac surgery, and anesthesiology were also a driving factor in the development of the PICU. The surgeries that were being performed were becoming more complicated and required more extensive postoperative monitoring. This monitoring could not be performed on the regular pediatric unit, which led to Children's Hospital of Philadelphia's development of the first American PICU [5]. Advancements in pediatric anesthesiology resulted in anesthesiologist treating pediatric patients outside of the operating room. This caused pediatricians to obtain skills in anesthesiology in order to make them more capable of treating critically ill pediatric patients. These pediatric anesthesiologists eventually went on to develop run PICUs [5]
There are a variety of PICU characteristics that allow the healthcare providers to deliver the most optimal care possible. The first of these characteristics is the physical environment of the PICU. The layout of the unit should allow the staff to constantly observe the patients they are caring for. The staff should also be able to rapidly respond

to the patients if there is any change in the patient's clinical status [6].

Correct staffing is the next vital component to a successful PICU. The nursing staff is highly experienced in providing care to the most critical patients. The nurse to patient ratio should remain low, meaning that the nurses should only be caring for 1-2 patients depending on the clinical status of the patients. If the patient's clinical status is critical, then they will require more monitoring and interventions than a patient that is stable [6].

In most cases, the nurses and physicians are caring for the same patients for a long period of time. This allows the providers to build rapport with the patients, so that all of the patient's needs are fulfilled. The nurses and physicians must work together as a collaborative team to provide optimal care. The successful collaboration between nurses and physician has resulted in lower mortality rates not just in PICUs, but all intensive care units [6].

As medicine has matured over time, the development of the pediatrics intensive care unit has expanded to maintain a level one and a level two PICU. Among these two different levels, they are able to provide critical care and stabilization for each child before transferring to a different acuity [7].

In the level one PICU, health care team members must be capable of providing a wide variety of care that typically involves intensive, rapidly changing, and progressive approach. In the level two PICU, patients will present with less complex acuity and will be more stable [7].

Respiratory issues including acute respiratory distress syndrome (ARDS), asthma, apnea, sepsis, trauma (may include abuse), congenital heart defects, mechanical ventilation, and complications of diabetes ketoacidosis. Gastrointestinal conditions include gastrointestinal perforations, cancer / chemotherapy, organ transplants (kidney, heart), seizures, and poisoning [8].

As a PICU nurse, extended knowledge and certifications may be required. Recognition and interpretation are two of the many required skills for a PICU nurse [7]. This allows nurses to be able to detect any changes in the patient's condition and to respond accordingly. Other skills may include route of administration, resuscitation, respiratory and cardiac interventions, preparation and maintenance of patient monitors, and psycho-social skills to ensure comfort of patient and family.

There are a variety of certificates that are required for registered nurses to acquire in order to work in the PICU. One of these certifications is the Critical Care Registered Nurse (pediatric) certificate. This certificate allows nurses to care for critically ill pediatric patients in any setting, not just the PICU [9]. Other certificates include cardiopulmonary resuscitation, pediatric basic life support, and pediatric advance life support.

The patients in the PICU are the most critically ill children in the hospital setting. There are times where these children do not have the best outcomes, which may result in permanent deficits or even death. There are times where nothing more could have been done to improve the outcome for these patients. However, there are times where care could have differed and the end result may have been better.

There are a variety of factors that have led to poor outcomes in PICU patients. The main factor that leads to inadequate care for PICU patients is improper health assessment by the healthcare providers. This may include not observing a change in the patient's clinical status, delayed resuscitation efforts, delayed decision making, or a combination of any of these factors. If any of these factors do occur, it may result in permanent deficits in the most critical patients [10].

Measures may be taken to prevent improper assessments from occurring. Proper education on how to conduct a proper assessment and how to recognize a critically ill pediatric patient can improve patient outcomes. This includes being able to recognize signs of deteriorating clinical status and perform proper triage of patients [10]. This education is not only for the PICU staff, but also for emergency medical services, the emergency department staff, and staff of the pediatric unit.

Working in the PICU result may in emotional stress and/or occupational burnout of the staff. For patients that do get discharged from the unit, often times they are not free of chronic conditions or disabilities [5]. There are other factors that lead to stressful work conditions for the staff of the PICU. The staff often work for long periods of time in order to stabilize the most critically ill pediatric patients. They must collaborate with other members the healthcare team in order to develop the best plan of care. Once a plan of care is developed, then the staff must communicate the plan with the patient's family in order to see if it matches their beliefs [5]. If the plan of care does not match the family's beliefs, then it must be modified the plan causing more stress on the staff. All of this causes the staff a great deal of stress and each member of the unit must develop their own coping mechanisms in order to prevent burnout.

Pediatric Intensive Care is commonly practised in India both at the pediatric super speciality and pediatric post-graduation level. However, there is a dearth of data on the clinical and etiological spectrum of PICU (Pediatric Intensive Care Unit) admissions from India [1], especially from post-graduation teaching institutes. Knowledge of this data, can help the paediatricians and the pediatric intensivists in tailor making the PICUs more adaptive for the Indian patients in general and the population they cater to, in specific. Hence the present study was planned for evaluation of Clinical Study of Paediatric Cases Admitted to Paediatric Intensive Care Unit.

Methodology

The present study was planned in Department of Pediatrics, Government Medical College, Bettiah, West Champaran, Bihar. Total 100 cases admitted to the Paediatric intensive care unit (PICU) were enrolled in the present study. All cases admitted in PICU and treated as per the protocol. The clinical profile such as age, sex, history, co morbid conditions, condition on arrival, provisional diagnosis at arrival is noted. The duration of hospitalization and outcome is recorded with final diagnosis.

All the patients were informed consents. The aim and the objective of the present study were conveyed to them. Approval of the institutional ethical committee was taken prior to conduct of this study.

Results & Discussion

The paediatric critical and emergency medicine has been evolved as a sub speciality in paediatrics over the years and the care and researches in this field dramatically reduced the mortality in so many diseases like dengue. Admission criteria for PICU admissions are institution dependent, based on the available facilities, bed strength. The trend is continuously changing from period to period. Infectious

diseases contributing majority admissions in the past especially in developing countries like India. But now non-communicable diseases are also in rise. Mortality is proportional to the underlying nature of the disease, physiological status in arrival and the quality of care of course.

Modern paediatric intensive care is characterised by increased sophistication resulting in spiralling costs. There is a need to accurately define prognosis, so that physicians can be guided in clinical decision making, including the appropriateness of therapy. Auditing the PICU is thus an integral component in health planning and management [11]. Moreover, the impact of new technologies and medical intervention can be assessed in a more objective fashion. Studies in developing countries like India and Pakistan have reported significant variability between PICUs in age and percentage of morbidity and mortality. PICUs with higher mortality rates maybe caring for patients with more severe illnesses and vice versa. However, lower mortality rates do not necessarily translate into better long-term outcomes [12].

The neonatal morbidity and mortality, infant morbidity and mortality and under - 5 morbidity and mortality along with life expectancy at birth are very important indicators of health status of a population. Pediatric and neonatal intensive care are emerging specialties in India .Intensive care units are very important in the management of critically ill children. The profile of neonates admitted in PICU is different as compared to neonatal ICU (NICU) .The pediatric intensive care unit (PICU) is a part of the hospital where critically ill pediatric patients requiring advanced airway, respiratory, and hemodynamic supports are treated with the aim of achieving an outcome better than if the patients were admitted into other parts of the hospital [13-14]. The care of these critically ill children is very challenging. The main purpose of the PICU is to prevent mortality by intensively monitoring and treating critically ill children who are at very high risk of mortality. This comes at a huge cost both to the hospital, the patient, and the care givers [13, 15]. ICU care is offered to patients whose condition is potentially reversible and who have a good chance of surviving with intensive care support. Many hospitals in India treat newborns in pediatric ICUs (PICU). Neonates admitted to PICU are usually out born babies with severe illnesses. But the concept of NICU or SNCU and PICU is fast catching up at grass root levels i.e. in almost all the district hospital and most of the Community health centers of India.

Table 1

Parameters	No. of Cases
Sex:	
Males	53
Females	47
Age:	
Less than 1 years	22
1 to 3 years	38
4 to 5 years	22
5 years & more	18
System Involved:	
CVS	18
CNS	35
Abdomen	26
Respiratory	16
Oral	4
Skin	1
Ventilation:	
Ventilated	15
Non Ventilated	85
Outcome:	
Discharge	28
Death	72

Another recent study, from Canada, described the frequency, characteristics and outcomes of children who require early unplanned admission to PICU within 24hours of hospitalization and found the majority of admissions being infants and respiratory issues being the chief indication for PICU admission. Approximately half of them requiring a significant intervention after admission and a mortality rate of 50% [16]. A study from Pakistan also found that similar age group was affected the most and primary diagnoses requiring admission had an almost equal distribution between medical (46%) and surgical (54%) cases [17]. A 16 year epidemiological profile review of a Brazilian PICU, in the early 21st century concluded that mortality is higher in malnourished infants and that sepsis was the most common cause of death [18]. Another research studied the clinical profile of long-stay patients (LSPs) in the PICU and found that majority of them are younger and those that requirechronic care device [19].

According to the World Health Organization, the major causes of death in under-five-year-old children in developing countries (Thorburn, *et. al*., 2001) [20] are preventable and curable. Improving outcome is possible by well-equipped and well-staffed intensive care units, since dramatic decreases in mortality and morbidity have been documented by such measures. (Tilford, *et. al*., 1998) [21] Intensive care could reduce mortality rates by 15% to 60% (Pollack, *et. al*., 1997) [22] and many studies have demonstrated its unquestionable benefit (Gemke and Bonsel, 1995) [23]. Well-equipped intensive care units staffed with intensivists have shown better outcomes (Pearson, *et. al*., 1997 [24] Tilford, *et. al*., 2000) [25] The development of pediatric intensive care has contributed to

improved survival rates in children with critical illnesses (Bellomo, *et. al*., 2000) [26]. The goal of PICU is the surveillance and support of vital organ function in critically ill or injured children who are at risk for organ dysfunction (Filler, 2001) [27]. There are references that support better outcome of PICU patients in tertiary centres, which led to the development of a centralized system of PICUs worldwide.

Collection, analysis, and interpretation of relevant objective data on the utilization of ICU beds will help plan for reducing the length of ICU stay and facilitate covering more patients who require this care.The establishment of PICU has tremendously improved the success rate in saving critical patients. In a hospital containing PICU patients and those who have potential to deteriorate into critical conditions will be sent to PICU for intensive treatment and monitoring. Hence this study will help in determining the etiology, treatment and outcome of all the children in the PICU.

Inotropic support started only after full fluids resuscitation and was performed under international guidelines 33. Mechanical ventilation is a unique PICU therapy and together or not with inotropic use, in some studies, is considered too as an index of PICU efficiency. Different studies have proved that full-time trained critical care specialists in both adult and paediatric ICUs improve the quality of care and are associated with lower mortality and morbidity rates [28-33].

The mortality rate compared to developing countries somewhat less, thanks to the advanced ventilators and protocols available here. People working in PICU in developing countries face many problems like lack of resources, knowledge and the support system. 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. Nightingale provided the definition of nursing as “helping the patient to live” and thus the role of Nurses in PICU cannot be overemphasized.

Majority of the patients were medical emergencies as compared to western PICU, where majority of admission is from operating room. limitation of this study is that study duration is only one year and total number of patients were also less but this is only due to newly functioning PICU but as the time passes and care will increase more number of patient get admitted here. This study was a reflection of public sector which represents a more realistic picture.

Conclusion

Demographic profile of our PICU patients showed similar characteristics as those of reported in different relevant studies with minor differences in few aspects.This can serve as the basis for developing dedicated and new protocols for the caregivers in an effort to improve the outcome of critical illness.

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