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Evaluation of basic factors & outcomes in the cases admitted to pediatric intensive care unit

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Abstract
Infectious diseases contributed majority of 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 on admission and the quality of care of course. In this study, we aimed to identify the indication for PICU admission and outcome and to correlate the cause for poor outcome. Immediate outcome like death and intact neurological survival are measured. If the pattern of PICU cases and outcome is known, it will be easy for us to strengthen the facilities to manage those type of patients. In future we can reduce the mortality and improve the quality of care rendered to the public. Hence, based on above reported findings the present study was planned for evaluation of basic factors & outcomes in the cases admitted to pediatric intensive care unit.
The present study was planned in Department of Pediatrics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India. Total 50 paediatrics cases admitted to Pediatrics Intensive Care Unit were enrolled in the present study. All cases were 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.
The PICU is a special unit of health care delivery service for patients who are critical with potentially recoverable diseases. PICU requires a vast use of up-to-date equipments and highly skilled staffs and demands a tremendous amount of time and effort on behalf of the medical and nursing staff to treat and improve survival of the critically ill patients.

Keywords: PICU, pediatric intensive care unit, outcomes, etc

Introduction
Neonatal intensive care unit (NICU) is specialty unit cares for critically ill and high risk newborns. Common conditions cared for include prematurity and associated complications, congenital disorders such as congenital diaphragmatic hernia, or complications resulting from the birthing process.
A pediatric intensive care unit (commonly referred to the PICU) is an intensive care unit specializing in the care of critically ill infants, children, and teenagers. Typically, PICUs are directed by pediatric critical care physicians and staffed by doctors, nurses, and other medical personnel specifically trained and experienced in pediatric intensive care.
In Pediatric intensive care unit (PICU) patients are treated in this intensive care unit for life-threatening conditions such as asthma, influenza, diabetic ketoacidosis, or traumatic neurological injury. Surgical cases may also be referred to the PICU postoperatively if the patient has a potential for rapid deterioration or if the patient requires monitoring, such as spinal infusions or surgeries involving the respiratory system such as removal of the tonsils or adenoids. Some facilities also have specialized pediatric cardiac intensive care units, for patients with congenital heart disease. These units also typically cater for cardiac transplantation and postoperative cardiac catheterization patients if those services are offered at the hospital.
The practice of pediatric critical care has matured dramatically throughout the past 3 decades. Knowledge of the pathophysiology of life-threatening processes and the technologic capacity to monitor and treat pediatric patients suffering from them has advanced rapidly during this period. Along with the scientific and technical advances, of the pediatric intensive care unit (PICU), special needs of critically ill or injured children and their families can be met by pediatric specialists. All critically ill infants and children cared for in hospitals, regardless of the economical status, are entitled to receive the same quality of care.
In 1985, the American Board of Pediatrics recognized the subspecialty of pediatric critical care medicine and set criteria for subspecialty certification. The American Boards of Medicine, Surgery, and Anesthesiology gave similar recognition to the subspecialty. In 1990, the Residency Review Committee of the Accreditation Council for Graduate Medical Education completed its first accreditation of pediatric critical care medicine training programs. In 1986, the American Association of Critical Care Nurses developed a certification program for pediatric critical care, and in 1999, a certification program for clinical nurse specialists in pediatric critical care was initiated.
In view of recent developments, the Pediatric Section of the Society of Critical Care Medicine and the Section on Critical Care Medicine and Committee on Hospital Care of the American Academy of Pediatrics believe that the original guidelines for levels of PICU care from 1993 should be updated. This report represents the consensus of the 3 aforementioned groups and presents those elements of hospital care that are necessary to provide high-quality pediatric critical care. The concept of level I and level II

PICUs as established in the guidelines set forth in 1993 will be continued in this report. Individual states may have PICU guidelines, and it is not the intent of this report to supersede the already established state rules, regulations, or guidelines; however, these guidelines represent the consensus report of critical care experts.

Pediatric critical care is ideally provided by a PICU that meets level I specifications. The level I PICU must provide multidisciplinary definitive care for a wide range of complex, progressive, and rapidly changing medical, surgical, and traumatic disorders occurring in pediatric patients of all ages, excluding premature newborns. Most, but not all, level I PICUs should be located in major medical centres or within children's hospitals. It is also recognized that in the appropriate clinical setting and as a result of many forces including but not limited to the presence of managed care, the insufficient supply of trained pediatric intensivists, and geographic and transport limitations, level II PICUs may be an appropriate alternative to the transfer of all critically ill children to a level I PICU [1].

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 [2].

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 [2]. 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 may result in emotional stress and/or occupational burnout of the staffs. For patients that do get discharged from the unit, often times they are not free of chronic conditions or disabilities. 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 of 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 [3]. If the plan of care does not match the family's beliefs, then it must be the modified 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.

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 respond rapidly to the patients if there is any change in the patient's clinical status [4].

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 [4].

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 [4].

As medicine has matured over time, the development of the pediatrics intensive care unit has expanded to maintain a level I and a level II PICU. Among these two different levels, they are able to provide critical care and stabilization for each child before transferring to a different acuity [5].

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 [5].

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. In this study, we aimed to identify the indication for PICU admission and outcome and to correlate the cause for poor outcome. Immediate outcome like death and intact neurological survival are measured. If the pattern of PICU cases and outcome is known, it will be easy for us to strengthen the facilities to manage those type of patients. In future we can reduce the mortality and improve the quality of care rendered to the public. Hence based on above reported findings the present study was planned for evaluation of basic factors & outcomes in the cases admitted to pediatric intensive care unit.

Methodology

The present study was planned in Department of Pediatrics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India. Total 50 paediatrics cases admitted to Pediatrics Intensive Care Unit 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

Pediatric Intensive Care is commonly practised in India both

at the pediatric superspeciality 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, specially 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.

In spite of the modern health-care facilities and several health programs rolled out by the governments and policy makers every year, the current global situation of the under-five mortality rate is alarming. About 5.9 million children under age five died in 2015, i.e., 16,000 every day. These are the figures given by global health observatory data, WHO [6].

By providing basic pediatric intensive care services such as intravenous access and fluid resuscitation, basic antibiotic support, oxygen and non-invasive ventilator support (continuous positive airway pressure) one can save the lives of million children every year in rural areas of developing countries. The main goal of pediatric intensive care unit (PICU) is to significantly decrease the mortality. These interventions are low cost and easy to implement in developing countries on a large scale to decrease mortality. The acquisition of technologies, training of human resources, and re-evaluation of care processes should be employed according to the demographic characteristics and morbidity of the population.

Evaluation of the results of medical interventions can better quantify the efficacy of different treatments, making possible to take better decisions, to standardize conduct and to optimize resource utilization [7, 8]. This becomes more relevant to the extent that it is unclear what impact ICU stays have on patients' physiological and cognitive functions. Assessment of the level of patients' cognitive and functional impairment after a period of significant stress and of their potential need for help to re-enter the family and social environments can both be of help to better understanding the repercussions of acute disease or trauma and of medical care [9].

While there are many studies of health condition and instruments for measuring quality of life in adults [10], few instruments have been validated for use with children. The majority of these only measure the degree of incapacity with questions on recovery or development.

Table 1: Demographic Details

Parameters	No. of Cases
Sex	
Males	27
Females	23
Total	50
Age	
Less than 1 years	22
1 to 3 years	38
4 to 5 years	22
5 years & more	18
Total	50

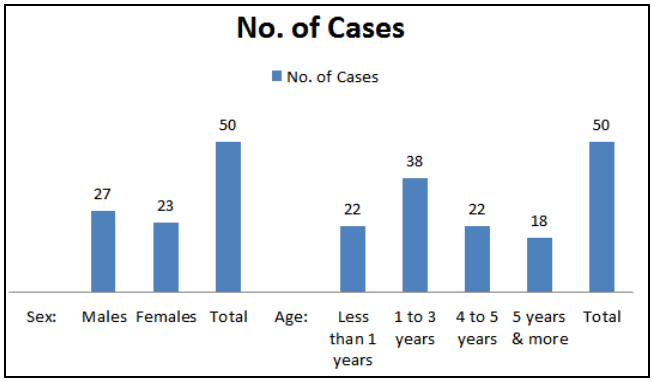

Fig 1: Demographic Details

Table 2: Evaluation of Cases

Parameters	No. of Cases
System Involved	
CVS	9
CNS	17
Abdomen	13
Respiratory	9
Oral	3
Skin	2
Ventilation	
Ventilated	10
Non-Ventilated	40
Total	50
Outcome	
Discharge	13
Death	37
Total	50

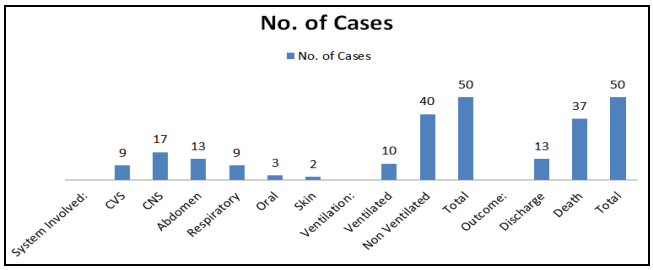

Fig 2: Evaluation of Cases

Neurological causes was found to be the most common cause of admission (18%), this is because acute encephalitis syndrome is common in this region leading to large number of death. Khurshid *et al.* [11] of Pakistan also showed mortality due to neurological illness are more common. Overall mortality was 13.8%, with age related mortality being highest (32.1%) in 1-5 years in AIIMS study [12]. Mortality due to fulminant hepatic failure was 10% in our study compared to the Khilani *et al.* 2 (10.8%) which was very much similar. PICU's main goal is the reduction in mortality, yet special consideration should be given to mortality studies; reports on mortality rates alone, without risk adjustment, could make their results misinterpreted [13] Based on our study, it appears that Pediatric Intensive Care in our center is somewhat similar to the western world in terms of severity of illness and prediction of mortality, PRISMIII adjusted mortality, average days of ventilation required and length of PICU stay. Most of our data falls within the range of data of Pediatric critical care study

group [14]. Our overall mortality rate appears to be less than that of other developing countries.

Other important tropical infectious diseases that required admission included cerebral malaria, pulmonary tuberculosis and tubercular meningitis, dengue hemorrhagic fever. Almost same finding found by garner *et al*. [15]. Inotropic support started only after full fluids resuscitation and was performed under international guidelines. 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 [16, 21].

The knowledge of clinical spectrum and epidemiological profile of critically ill children plays a significant role in the planning of health policies that would mitigate various factors related to the evolution of diseases prevalent in these sectors. Descriptive epidemiology focuses on identifying and reporting the pattern and frequency of events related to the health of a population 3. This process also determines the general characteristics of disease under study and identifies the most vulnerable population subgroups.

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.

The present study highlights neurological, respiratory and gastrointestinal disorders to be the leading cause of admissions in PICU, catering to the needs of critical care of the in-patients from Pediatric Medicine and in-patients of pediatric age from other specialities and super specialties.

Further well planned, systematic and large-scale studies in this field is needed by using standardized methodologies, to estimate the leading causes of admission, morbidity and mortality in the PICU with the representation from different regions of India, to provide an effective PICU care in reducing the mortality and morbidity of critically ill patients, giving the desirable outcome.

Conclusion

The PICU is a special unit of health care delivery services for patients who are critical with potentially recoverable diseases. PICU requires a vast use of up-to-date equipments and highly skilled staffs and demands a tremendous amount of time and effort on behalf of the medical and nursing staffs to treat and improve survival of the critically ill patients.

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