



Clinico-pathological profile of early deaths in PICU

Mauskar Anupama

Associate Professor Department of Pediatrics,

Rewatkar Neeta

Fellow – PICU Department of Pediatrics,

Khare Manisha

Professor- Department of Pathology From: Lokmanya Tilak Municipal Medical College and General Hospital Mumbai

ABSTRACT

Pediatric intensive care unit (PICU) is an important component of any tertiary care center. The practice of pediatric critical care is dynamic and evolving. Children admitted in PICU are at increased risk for adverse outcomes including cardiopulmonary arrest and mortality. Despite of extensive and full hearted efforts deaths do occur. Although the primary clinical diagnosis is accurate in most cases before death, the cause of death remains frequently unknown in many cases. Pediatric autopsy is therefore an important medical and quality assurance procedure for ascertaining the accurate cause of death. The present study was carried out in tertiary care teaching hospital to know about the clinic-pathologic profile of early PICU deaths and its discrepancy with postmortem findings using Goldman classification.

KEYWORDS : Early deaths, PICU, Clinico pathological correlation.

Introduction

Globally more than 8 million children die before they attain 5 years of age each year. Most of these deaths occur in developing countries, and surprising to know it is caused by preventable or treatable diseases. To act on such situation and many others, in 2000, world leaders assembled in New York and established a goal of reducing child mortality among children less than 5 years to one-third of its 1990 level by 2015. This goal was one of the Millennium Development Goal (MDG) to be achieved. Named as Millennium Development Goal 4.—(1) To attain this goal, one of the strategies like intensive care unit (ICU) was started at the tertiary care hospitals. The dramatic increase in survival of critically ill children was noticed with the advancement in intensive care facilities. Pediatric intensive care unit (PICU) is an important component of any tertiary care center. The practice of pediatric critical care is dynamic and evolving. Whether adult or pediatrics, severities of illness, assessments are critical for wide range of ICU management and administration is required involving generation of information.—(24) Not only the PICUs fulfilled their role in saving lives of those admitted to the PICU but also provided learning opportunities to resident doctors and other staff resulting in improved standards of care outside the PICUs as well. (5) There is limited time in which fast decision has to be made. Data from 5 PICUs show that 5413 (50%) of 10,825 admissions (2 years) were classified as urgent, defined as twelve hours or less. Children admitted a PICU are at increased risk for adverse outcomes and it varies from source of patient. (6) Despite of extensive and full hearted efforts deaths do occur. Although the primary clinical diagnosis is accurate in most cases before death, the cause of death was frequently unknown.

Pediatric autopsies therefore become an important aspect of PICU for ascertaining the accurate cause of death. (7, 8)

While practicing autopsies in early PICU deaths, discrepancy between clinical and pathological diagnosis was observed by many. (9, 10, 11)

Goldman and his colleagues in their study from the three centers proposed the scale classifying discrepancy in four classes (Class I: a discrepant diagnosis with a potential impact on survival; Class II: a discrepant major diagnosis but with equivocal or no impact on survival; Class III: a discrepant minor diagnosis that could have been

diagnosed before death; Class IV: a discrepant minor diagnosis that could not have been made before death). (12). The present study was carried out in tertiary care teaching hospital to know about the clinic-pathologic profile of early PICU deaths and its discrepancy with postmortem findings using Goldman's classification.

Materials and Methods:

Present cross sectional study was undertaken over a period of one year from January 2014 to December 2014 in the pediatric intensive care unit of a Tertiary Care Teaching Hospital. Institutional ethical committee approval was taken for the study. All the children between age group 1 month to 12 years presented to Pediatric Intensive care unit (PICU) and died within 24 hours of admission were included in study. Brought dead and the children who immediately died after coming to PICU without any investigation were excluded from study.

After obtaining informed consent from parents, the demographic details, history, clinical examination, laboratory investigation, clinical diagnosis and management were recorded in a case record form of children who fulfilled inclusion criteria. The clinical sign and investigation were further analyzed for prediction of outcome in the form of survival and death at admission, with the help of APACHE II scoring system. (13) Autopsy findings of the cases were also recorded. The discrepancy in pre and post mortem diagnosis was classified on the basis of Goldman classification. Further data was analyzed using MS excel and necessary test were applied.

Results: Total number children admitted in PICU from January 2014 to December 2014 were 708, of which 278 died leading to mortality of 39.26%. Out of all total deaths in PICU 60 patients died within 24 hours of PICU admissions, constituting 21.58% of total deaths. Out of total 60 early deaths, autopsies were performed in 44 (73.33%) and 16 early deaths were given death certificate with probable cause of death. Study subjects included 54.5% males and 45.5% females and maximum number of children (52.3%) were less than 12 months of age. Average age was approximately 2 years with minimum age of study subject was found to be 1 month.

Table1. Age and sex distribution of study subjects

Age group of study subjects	SEX		Total (%)
	Female	Male	
Less than 12 months	10	13	23(52.3)
1-5 years	8	8	16(36.3)
More than 5 years	2	3	5(11.4)
Total	20	24	44(100)

Maximum number of children suffered from respiratory illness 61.3 % followed by gastrointestinal illnesses 15.9%. Haemogram showed anemia in 59% of children. On arterial blood gas analysis metabolic acidosis was present in 36.4% children. Electrolyte analysis revealed hyponatremia in 31.8% and hypokalemia in 34.1% of children. Abnormal chest radiograph was found in 43.2% of children. Altered coagulations parameter was found in only 4 subjects.

APACHE II mortality prediction parameter was used to predict mortality after complete assessment of the study subjects it was seen that 85% mortality was predicted in 38.6% and 73% in 15.9% of study subject.

Maximum number of children (61.4%) died within 6 hours of admission. The duration of stay was more than 12 hours in 22.7% of children. Average duration of stay was 7.2 hours. (Table-2)

Table2. Duration of stay of study subjects

Duration of stay	Frequency	Percent (%)
Up to 6 hours	27	61.4
6 to 12 hours	7	15.9
More than 12 hours	10	22.7
Total	44	100.0

The autopsy analysis revealed involvement of respiratory system alone in 52.2%. Gastrointestinal system was affected in 4.5 % and 45.5% had more than one system involvement. Most common autopsy diagnosis in early death was Interstitial Pneumonitis 43.75% and Pneumonia 28.12%.

On application of Goldman's classification, class I discrepancy was observed in 25% subjects, Class II discrepancy in 45.5%, class III discrepancy in 25% and class IV discrepancy in 4.5% of subjects.

Discussion: Advances in pediatric sub specialties like pediatric intensive care is gaining scope but still mortality and morbidity is high. In the present study mortality of the patients admitted in the PICU was of 39.26% of which 21.58% were early deaths. The mortality was comparatively less when compared to the other study in Mumbai by Karande et al which stated mortality was 58%. Another study in India by Gandhi et al observed the death rate was 46.21%. But the study done Singhal et al in India showed only 18% mortality among the children admitted in ICU. Different studies in the nearby countries such as Pakistan, Nepal and Malaysia found mortality rate to be 14%, 12.9% and 8% respectively—. In other distant countries such as in China, overall mortality in this PICU was 6.5% (95% CI 5.6% - 7.4%) during January 2010 to December 2013. In other study by Halal in Brazil where they analyzed 1823 admissions, of which 188 ended in death, the observed mortality was 10.3%. Study in Iran by Ghaffari et al showed mortality rate was 6% -. These differences in mortality may be due to lot of factors such as accessibility to the PICUs, late referrals, untrained staff, limited resources, poor patient: nurse ratio, associated comorbidities, poor socio economic status and illiteracy. When considered deaths within 24 hours, among total admissions in PICU was 8.47%. In a study by Ghaffari et al. one third of patients died before 24 hours of admission stating high mortality -. Study in Turkey by Arslankoylu et al suggested similar mortality rate of 9.5% -. In the present study autopsy rate was 73.3% similar range was seen in different studies in Brazil by Cardoso 55% (24) and by

Castenalleo 60%. In study by Goldstein et al it was 73% which was similar to our study but still emphasis has to be on getting maximum postmortem done. This deficit may be due to culture and traditions. In present study male and females were distributed in 54.5% and 45.5% respectively with majority of study population falling in age group less than 12 months, with mean age being approximately 24 months. Similar findings were seen in Study by Haque in Pakistan in PICU, 314 children were admitted in PICU. Sixty-six percent (220) were male. The mean age was 24 months (ranging from 1 month to 14 years) and 37% (123/314) were less than one-year old. . In another study by Shah et al, 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%) as in present study followed by age group of 1-5 year (21.7%) . This may be due to similarities in demographic characteristics. The median age of the patients was 21 months, in study in Brazil by Cardoso et al letting study to be comparable. Study by Arsalankoylu stated that mean age for admissions was 76.5 months, 55.2% of the patients were male and 44.8% of them were female. - In the present study, study subjects suffered from illness of respiratory system in 61.3% which was in majority followed by gastrointestinal system with 15.9%. Similarly respiratory system involvement was in majority was seen in study by Haque in Pakistan where, the major diagnostic categories of medical patients were respiratory (10%), neurological (10%), and cardiac (8%) . In study by Shah et al where system involved were in order of Respiratory, central nervous system, GIT, CVS in terms of involvement Another study by Karande et al in Mumbai found out that pulmonary diseases accounted for the majority (68%) of cases, followed by nervous system (12%); and cardiovascular and skeletal muscle system diseases (10%, each); . This may be due to high prevalence of respiratory diseases in children. In present study major discrepancy in clinical and pathological diagnosis was found in 25 % of study subjects. Coradazzi et al. compared two periods (1972-1985 and 1992-1996) in a Brazilian university hospital, and they reported 27.1% and 20.6% rates of disagreement, respectively - this is similar to our study. While disagreements between clinical and pathological diagnoses occurred in 19 (6.6%) patients younger than 60 years of age and in 28 (9.7%) patients aged 60 or older, this may be due to differences in age structure of the study subjects. In study by Castenalleo autopsy provided valuable clinical information in 50% of the cases. There were major diagnostic errors in three patients (5%), that if detected before death would probably have improved survival. Another 14 cases (25%) showed missed clinical diagnoses related to the basic illness and the cause of death, whose premortem diagnosis would not have prolonged survival. There were no diagnostic discrepancies in 28 cases (50%). In study by Cardoso autopsy revealed unexpected findings in 73 study patients (72%), 33 of which were related to "major diagnoses" (Goldman's classes I or II), either causes of death or main underlying disease. In 12 patients (12%), the correct diagnosis, if known before death, might have led to a change in the patient's therapy or outcome (class I) . In a study by Pastores et al it was seen that there was a discrepancy rate of 26% between pre mortem clinical diagnoses and postmortem findings in cancer patients who died in a medical-surgical ICU at a tertiary care cancer center (9). In our study we missed major unexpected diagnosis in 11 (25%) subjects as shown in table 3. The discrepancy rate was similar to studies done by Cardoso and Pastores.

Conclusion: It can be concluded that performance of Autopsy is necessary for many reasons and the awareness amongst parents must be raised. Predominant age group affected was less than one year. This gives dent in our goal to decrease infant mortality rate in MDGs which needs to be improved. Children suffered from respiratory illness alone in 52.2 % suggesting a need of strengthening IMNCI training of health care workers which will lead to early diagnosis, early referral and timely management of respiratory illnesses in young infants. Input from the clinician can motivate the pathologist to find new, rare or unsuspected diseases. Regular clinico pathological meets should be encouraged in PICU setup.

Table 3: Shows Class I Discrepant diagnosis in 11 study subjects

S/N	Clinical Diagnosis	Autopsy Diagnosis
1	Septic shock with respiratory failure	Interstitial pneumonitis with pulmonary hemorrhage leading to respiratory failure and shock
2	Intrapulmonary hemorrhage with ARDS with respiratory failure	Bronchiolitis with hemothorax with parasitic granulomatous hepatitis with respiratory failure
3	Acute gastroenteritis with hypovolemic shock	Interstitial pneumonitis with encephalitis
4	Late HDN with pulmonary hemorrhage with sepsis with DIC	ARDS with interstitial pneumonitis
5	Meningoencephalitis with DSS	Shock with sub massive hepatic necrosis & acute tubular necrosis
6	Late HDN with pulmonary hemorrhage with sepsis with DIC	ARDS with interstitial pneumonitis
7	Pneumonia with respiratory failure	Disseminated Tuberculosis, multiple areas of caseous necrosis in Liver, spleen, lungs, kidney, Adrenals. AFB seen in all tissues.
8	ARDS	B/L Pulmonary hemorrhage. Large cells with numerous uniform size vacuoles in cytoplasm seen in liver, bone marrow, lungs, s/o Lysosomal storage disorder. Niemen pick type IB
9	Acute flaccid paralysis, GBS or Myasthenia Gravis or Mitochondrial myopathy with Hepatitis	Altered liver echotexture, mono/polymer infiltrates, and micro vesicular steatosis and cirrhosis s/o Fatty Acid oxidation defects.
10	Pneumonia with respiratory failure	Fungal septicemia Aspergillosis
11	Meningoencephalitis	Pyogenic meningitis with empyema with Pneumonia and pericardial effusion

Acknowledgement: We wish to thank our dean Dr Suleman Merchant and head of the department Dr Mamta Manglani for permitting us to publish this manuscript.

References:

- Bhutta ZA, Black RE. Global Maternal, Newborn, and Child Health — So Near and Yet So Far. *N Engl J Med*. 2013 Dec 5; 369(23):2226–35.
- Pollack MM, Ruttimann UE, Glass NL, Yeh TS. Monitoring patients in pediatric intensive care. *Pediatrics*. 1985 Nov; 76(5):719–24.
- Pollack MM, Ruttimann UE, Getson PR. Accurate prediction of the outcome of pediatric intensive care. A new quantitative method. *N Engl J Med*. 1987 Jan 15; 316(3):134–9.
- Yeh TS, Pollack MM, Ruttimann UE, Holbrook PR, Fields AI. Validation of a physiologic stability index for use in critically ill infants and children. *Pediatr Res*. 1984 May; 18(5):445–51.
- Govil YC. Pediatric intensive care in India: Time for introspection and intensification. *Indian Pediatr*. 2006; 43(8):675.
- Ebrahim S. Outcomes of children receiving in-hospital resuscitation [Internet]. University of Toronto; 2009 [cited 2015 Oct 11]. Available from: <https://tspace.library.utoronto.ca/handle/1807/18286>
- Blosser SA, Zimmerman HE, Stauffer JL. Do autopsies of critically ill patients reveal important findings that were clinically undetected? *Crit Care Med*. 1998 Aug; 26(8):1332–6.
- Newton D, Coffin CM, Clark EB, Lowichik A. How the pediatric autopsy yields valuable information in a vertically integrated health care system. *Arch Pathol Lab Med*. 2004 Nov; 128(11):1239–46.
- Pastores SM, Dulu A, Voigt L, Raoof N, Alicea M, Halpern NA. Premortem clinical diagnoses and postmortem autopsy findings: discrepancies in critically ill cancer patients. *Crit Care*. 2007; 11(2):R48.
- Kotovicz F, Mauad T, Saldiva PHN. Clinico-pathological discrepancies in a general university hospital in São Paulo, Brazil. *Clinics*. 2008; 63(5):581–8.
- Coradazzi AL, Morganti ALC, Montenegro MRG. Discrepancies between clinical diagnoses and autopsy findings. *Braz J Med Biol Res*. 2003; 36(3):385–91.
- Goldman L, Sayson R, Robbins S, Cohn LH, Bettmann M, Weisberg M. The value of the autopsy in three medical eras. *N Engl J Med*. 1983 Apr 28; 308(17):1000–5.
- Ihnsook J, Myunghee K, Jungsook K. Predictive accuracy of severity scoring system: a prospective cohort study using APACHE III in a Korean intensive care unit. *Int J Nurs Stud*. 2003 Mar; 40(3):219–26.
- Karande S, Murkey R, Ahuja S, Kulkarni M. Clinical profile and outcome of acute respiratory failure. *Indian J Pediatr*. 2003 Nov; 70(11):865–9.
- Gandhi J, Sangareddi S, Varadarajan P, Suresh S. Pediatric index of mortality 2 score as an outcome predictor in pediatric Intensive Care Unit in India. *Indian J Crit Care Med Peer-Rev off Publ Indian Soc Crit Care Med*. 2013; 17(5):288–91.
- Singhal D, Kumar N, Puliyel JM, Singh SK, Srinivas V. Prediction of mortality by application of PRISM score in intensive care unit. *Indian Pediatr*. 2001 Jul; 38(7):714–9.
- Haque A, Bano S. Clinical profile and outcome in a paediatric intensive care unit in Pakistan. *J Coll Physicians Surg Pak*. 2009; 19(8):534.
- Shah G, Shah basant, Thapa A, Shah lokraj, Mishra O. Admission Patterns and Outcome in a Pediatric Intensive Care Unit in Nepal. *British Journal of Medicine & Medical Research*. 2014; 4(30):4939–45.
- Goh AY, Lum LC, Abdel-Latif ME. Impact of 24 hour critical care physician staffing on case-mix adjusted mortality in paediatric intensive care. *Lancet Lond Engl*. 2001 Feb 10; 357(9254):445–6.
- Wu Y. Risk factors for death in pediatric intensive care unit of a tertiary children's hospital in Guangzhou city [Internet]. The University of Hong Kong (Pokfulam, Hong Kong); 2014 [cited 2015 Oct 11]. Available from: <http://hub.hku.hk/handle/10722/206970>
- Halal MG dos S EI, Barbieri E, Filho RM, Trotta E de A, Carvalho PRA. Admission source and mortality in a pediatric intensive care unit. *Indian J Crit Care Med Peer-Rev off Publ Indian Soc Crit Care Med*. 2012; 16(2):81–6.
- Ghaffari J, Abbaskhanian A, Nazari Z. Mortality Rate in Pediatric Intensive Care Unit (PICU): A Local Center Experience. *Int J Pediatr*. 2014; 2(3.2):81–8.
- Arslankoylu AE, Bayrakci B, Oymak Y. Admission time and mortality rates. *Indian J Pediatr*. 2008; 75(7):691–4.
- Cardoso MP, Bourguignon DC, Gomes MM, Saldiva PHN, Pereira CR, Troster EJ. Comparison between clinical diagnoses and autopsy findings in a pediatric intensive care unit in São Paulo, Brazil. *Pediatr Crit Care Med J Soc Crit Care Med World Fed Pediatr Intensive Crit Care Soc*. 2006 Sep; 7(5):423–7.
- Castellanos Ortega A, Ortiz Melón F, García Fuentes M, Prieto Valderrey F, Santidrián Miguel JP, Mazorra Macho F. [The evaluation of autopsy in the pediatric intensive unit]. *An Esp Pediatr*. 1997 Mar; 46(3):224–8.
- Goldstein B, Metlay L, Cox C, Rubenstein JS. Association of pre mortem diagnosis and autopsy findings in pediatric intensive care unit versus emergency department versus ward patients. *Crit Care Med*. 1996 Apr; 24(4):683–6.