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"Analysis of Mortality in PICU of A Tertiary Care Teaching Hospital, Telangana– An Introspection".

Dr. Shashikala.V[1], Dr. Ayesha Begum[2], Dr.C.Suresh Kumar[3]
[1]*Assistant Professor, Department Of Pediatrics, Niloufer Hospital For Women &Children, Osmania Medical College, Hyderabad, Telangana, India.*
[2]*Assistant Professor, Department Of Pediatrics, Niloufer Hospital For Women &Children, Osmania Medical College, Hyderabad, Telangana, India.*
[3] *Professor And Head, Department Of Neonatology, Superintendent, Niloufer Hospital For Women &Children, Osmania Medical College, Hyderabad, Telangana, India.*

Abstract
Background*: Paediatric critical care medicine is a challenging contemporary subspecialty. The development of paediatric intensive care has contributed to the improved survival of critically ill children.*
Aim: *To study andanalysethe deaths occurring over a period of one year in a Pediatric Intensive Care Unit (PICU) of a tertiary care teaching hospital.*
Methods: *A prospective observational cohort study of deaths in PICU was conducted over a period of one year. Data collected was demographic profile, co morbidities, length of stay,diagnosis,ICU therapies like use of inotropesand mechanical ventilation (MV).*
Results: *There were a total of 990 admissions to the PICU of which 233 died with a mortality rate of 23.5%. The mean age of deaths was 2.84years with 72% of deaths occurring under five years of age (excluding neonates).16% of deaths occurred within 24 hours of admission and 10% deaths had prolonged stay (>14days).Pneumonia constituted for almost one third of deaths followed by sepsis. Mechanical ventilation rate was only 34.8%.*
Conclusion: *By their very virtue,ICUs are resource intensive with respect to both technology and the need for skilled health care providers. A large percentage of hospital costs are attributed to the ICU. As the cost of health care increases, the need to manage the resources of the ICU as efficiently and effectively as possible increases in importance as well.*
Keywords:*Causes, length of stay, pediatric intensive care unit, mortality.*

I. Introduction

Jacob Javits, 1986 (United States Senator) rightly quoted that "In critical care, it strikes one that the issues are three: realism, dignity, and love."

The development of paediatric intensive care has contributed to improved survival rates in children with critical illnesses[1, 2].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[3].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[4-9].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.

Niloufer hospital for women and children has a thirteen bedded paediatric medical intensive care unit (PICU).Whenever a critically ill or a traumatic child presents to the Emergency Services Room, evaluation and management will be initiated by the Emergency Room team and then the PICU team will be immediately consulted for smooth transition and continuity of care. After stabilization, the patients will be moved to the PICU or to the pediatric surgical department. On recovery, children would be transferred to step down unit. The average number of patients admitted in the PICU ranges from 80 to 100 per month. Research on Intensive Care Unit (ICU) outcomes provides valuable inputs in developing more improved models for patient-centred outcomes, more robust predictions of resource use, better individual outcome prediction and alternative outcome predictions under different treatment paradigms[10]. We, therefore, analysed the data of our PICU to find out the demographic profile of the mortality cases which would help in proper resource allocation and better management of critically ill children.

II. Materials And Methods

A prospective observational cohort study was conducted in the PICU from January to December 2015 for a period of twelve months. We consecutively collected data from the case sheets of paediatric patients who succumbed to death. The following data were collected: age, gender; final diagnosis, co morbidities, treatment

characteristics and length of stay in hospital. Serial clinical and radiological assessments of patients included thorough physical examination, pulse oxymetry, arterial blood gas analysis and chest roentgenograms. Along with this the patients were investigated and treated for the primary diagnosis as per requirement of the case. ICU stay was calculated as the number of calendar days from ICU admission to discharge, and was considered prolonged if it exceeded 14 days. This cut-off point is consistent with other studies[11,12].

2.1Statistical Analysis:

Data was collected on a pre- designed structured proformaand entered into Excel sheet. SPSS version 19 was used for statistical analysis. Descriptive statistics like mean, median, standard deviation and proportions were calculated for all the variables .To study the association of outcome with other variables chi square test was usedand p value < 0.05 was considered significant.

III. Results

At Niloufer hospital an average of 2000 cases per month were admitted in the emergency services room, of which majority of cases were shifted to step down unit and rest of thecritical cases stayed in the Emergency unit or shifted to PICU. Admission in the PICU was subjected to the availability of the vacancy.Over the one year study period, there were 990 admissions to the PICU, with 233 deaths and a mortality rate of 23.5%. 54.5% (127) were males and 45.5% (106) were females. The mean age of deaths was 2.84years (34.08 months).Descriptive analysis of age of deaths in PICU children is shown in Table 1.

Table 1: Descriptive statistics of age in the study group (n =233)

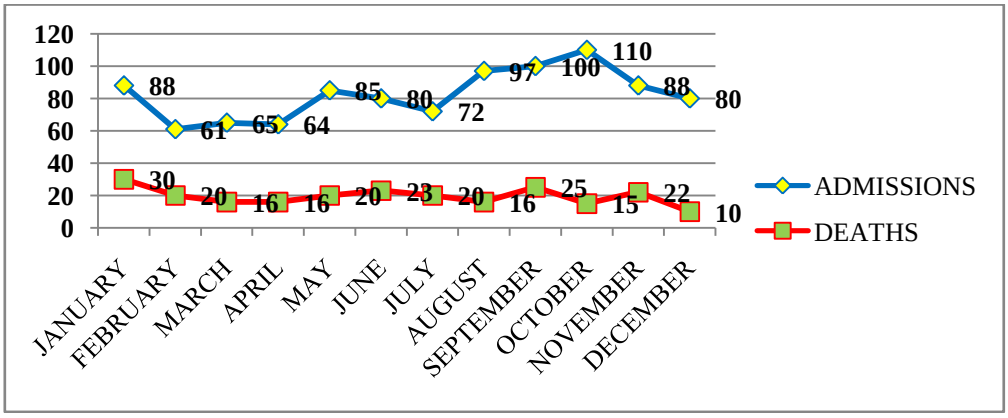
Statistics	Minimum	Maximum	Mean	Std. Deviation
Age (yrs)	.08	13.00	2.8486	3.44438

It was found that 51% deaths of total PICU deaths were infants and 21% belonged between 1 to 5 years age thus, under-fives constituted the major quota of PICU deaths (72%) in the study.

Table 2: Relationship between age and sex in the distribution of study cases

Age	Males	Females	Total
1 month - 1yr	70(55.1%)	48(45.3%)	118(51%)
1yr – 5 yr	26(20.5%)	23(21.7%)	49(21%)
5yr -10yr	25(19.7%)	24(22.6%)	49(21%)
>10yr	6 (4.7%)	11(10.4%)	17(7%)
Total	127 (100%)	106(100%)	233(100%)

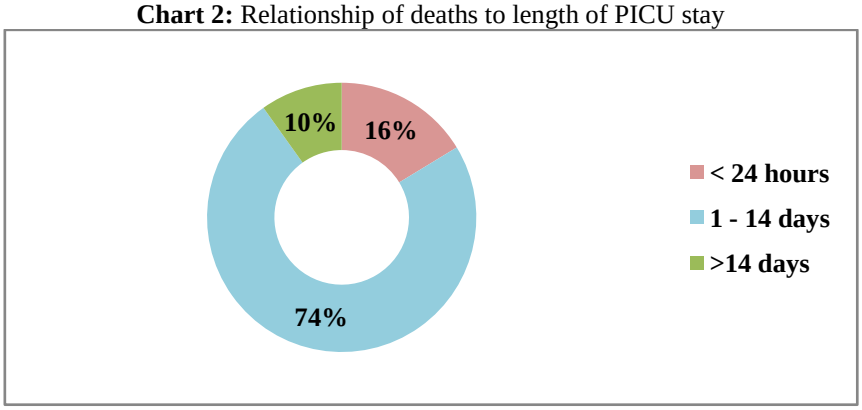
Chart 1: Distribution of Admissions & Deaths over one year period



There was a surge of admissions from August to October due to dengue epidemic.

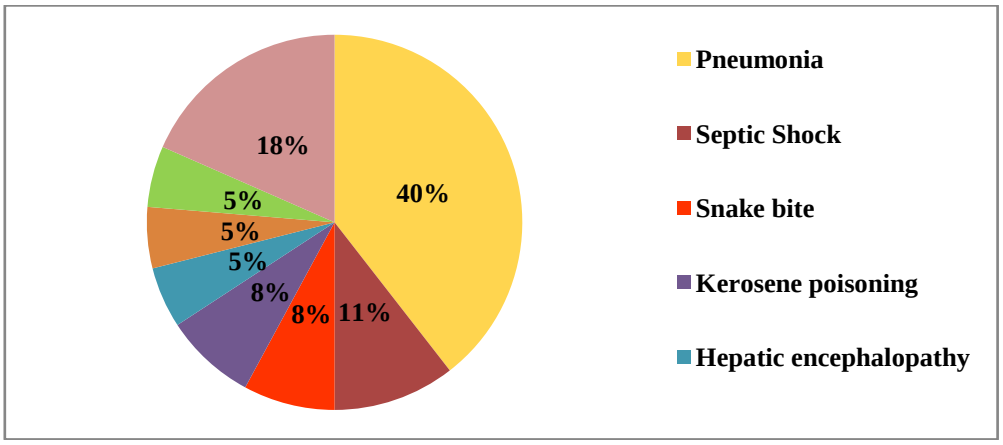
The mean duration of PICU stay in the mortality (study) group was 5.9 days, ranging from 2 hours to 30days.Of the 233 deaths, 15.5% of cases presented in gasping state to the Emergency Services Room. Mechanical ventilation rate was 34.8% (81 cases) and inotropic support was required in 81% (188 cases).Out of 233 deaths, 38 (16%) cases died within 24 hours of admission into PICU reflecting very poor status at admission itself and 23(10%) caseshad prolonged stay (> 14days)before they succumbed to death.

Chart 2: Relationship of deaths to length of PICU stay



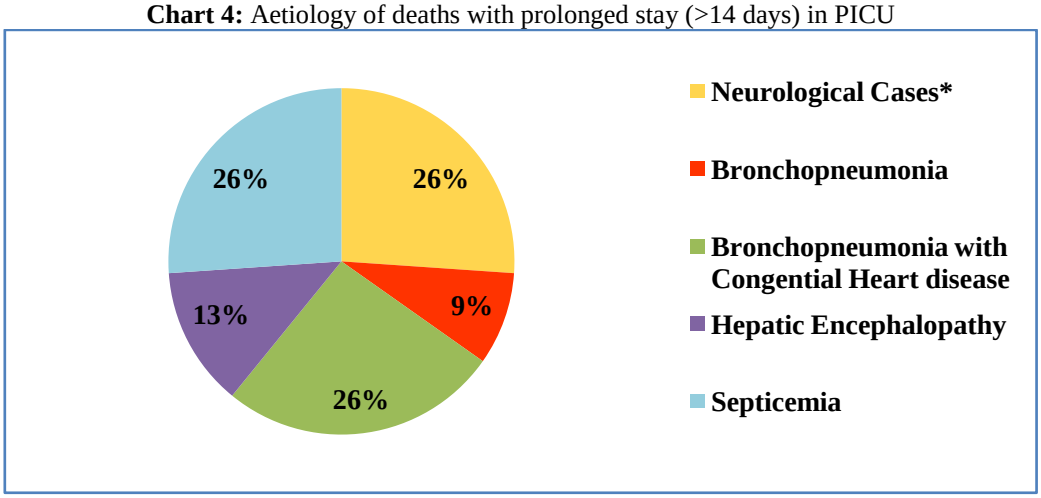
Out of 38 cases which died within 24 hours, 16 (42%) were females and 22 (58%) were males and pneumonia constituted 40% of deaths.17 (45%) cases were infants and15 (39%) cases were 1 to 5 years old and 6(16%) cases were more than 5years.

Chart 3: Diagnosis for Deaths which occurred within 24 hours



*Others include cases of Scorpion sting(1), DKA(1), Pyomeningitis (1), Dengue Shock syndrome(1), VME(1), AML(1) and Dilated Cardiomyopathy (1).
Of the 23 deaths that required prolonged stay, 11(48%) were males and 12(52%) females. 65% of these cases were infants. Neurological cases, children with congenital heart disease with pneumonia and sepsis each accounted for 26% (6) of cases requiring prolonged stay.

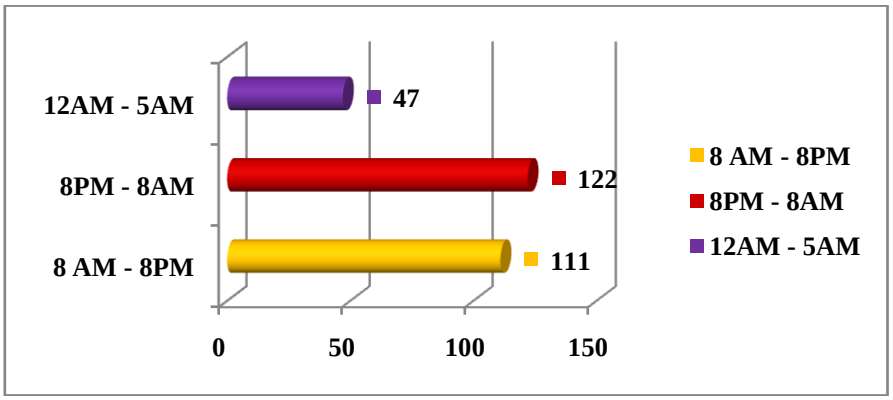
Chart 4: Aetiology of deaths with prolonged stay (>14 days) in PICU



Neurological cases include ADEM (1), Stroke (1), TBM (1), IC Bleed (1), Refractory Status Epilepticus (2).

Analysis of deaths occurring in relation to time, 111(48%) deaths occurred in morning and evening shifts (8AM -8PM) and 122 (52%) deaths occurred in night shift (8PM - 8AM). Out of 122 deaths in the night, 47 (38.5%) deaths occurred during 12AM to 5AM. This early morning deaths accounted for 20% of total deaths. It was also shown that 57(24%) deaths occurred in weekends (Saturday and Sunday) because most of the cases admitted during these days were in poor condition.

Chart 5: Analysis of Deaths in relation to time of death



Analysis of the causes of PICU Mortality:Pulmonary causes which included bronchopneumonia, bronchiolitis, lobar pneumonia with effusions and hydropneumothorax were broadly classified under pneumonia which constituted for almost one third of deaths. Congenital heart diseases which were complicated either by pneumonia or congestive cardiac failure or cardiogenic shock constituted for 15% of deaths. Therefore it stands as a major comorbid condition in the PICU deaths. Infections resulting in septicaemia and meningitis still constitute for 13% of total deaths. All the cases were on broad spectrum antibiotics and when required even onanti-fungal medication, indicating that these cases were either of non-bacterial origin or resistant bugs or child was brought in the end stageMODS. Hepatic encephalopathy constituted 14 cases, only one case was acute on chronic liver disease and rest of 13 cases were acute liver failure and all these cases received herbal medication and were admitted in terminal stages. Poisonings constituted 11 cases which included snake bite (4), Toddy ingestion (2), Kerosene poisoning (2), Scorpion Sting (1), OP poisoning (1) and Corrosive alkali poisoning (1).

Table 3: Causes of Mortality in PICU

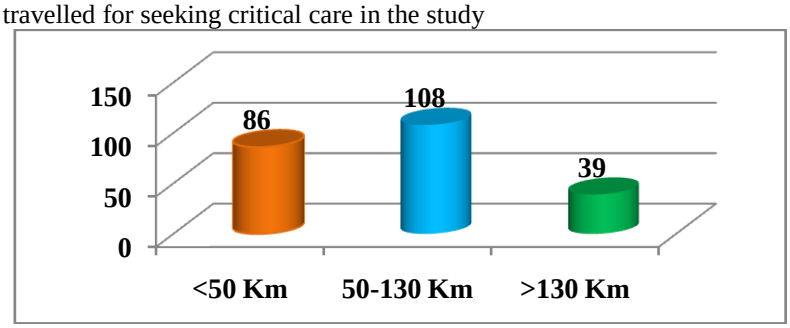
Causes*	Frequency	Percent (%)
Pneumonia	68	29
Congenital Heart Disease	34	15
Septicemia	29	12
Meningitis	26	11
Hepatic Encephalopathy	14	6
VME	12	5
Poisonings	11	4.7
Dengue Shock Syndrome	10	4.3
Refractory Status Epilepticus	9	3.8
Complicated Gastroenteritis	8	3.4
Renal Failure	6	2.6
IC Bleed	7	3
GBS	4	1.7
DKA	4	1.7
TB Meningitis	4	1.7
Others♦	24	10.3

*Children had more than one diagnosis

♦Others include EHBA, IEM, RHD, Hematological causes, ADEM etc.

In the study, it was observed that the maximal and minimal distance travelled was 10 & 415 Kilometres respectively. Substantial numbers of cases were referred from neighbouring districts like Nalgonda (16%), Mehboobnagar (15%) and Medak (7%) indicating the lack of critical care services in these areas.

Chart 6: Distance travelled for seeking critical care in the study



IV. Discussion

In the present study the mortality rate of PICU was 23.5% which was in par with the mortality rates reported in developing countries that varied from 9.8-35%[13-16]. Often these patients arrived late with multiple complications leading to mortality despite the best available therapy. A study conducted byCampos Mino et al. in 2012 showed 13.29 % mean mortality rate in PICU in Latin American countries; 5.2% in Cuba,25% in Honduras, 4% in Spain and 6% in Portugal[17]. A study conducted in Argentina revealed a lower mortality of 2.6%[18].Gemke in a multi center study showed mean7.1% mortality rate (range1-10%) in PICU patients. One of the reasons of variant rate of mortality related the different severity of disorders[5].

The mean age of deaths was 2.84years (34.08 months) in the present study which was very similar (3 years) in Sands study[19] and it varied between 8 months to 2.6 years in other studies[17,20, 21].In the present study, 51% of total PICU deaths were infants a similar figure (68%) was shown in the study conducted byGhaffariet al[21]; but infant deaths accounted for only 27.9 % in Sands study[19]. However, it is expected that mortality rate is more common in infant than older children[17, 22].

The commonest condition leading to death was pneumonia (29%) which was similar to the study conducted in Nepal in 2014[23].But a study from Greece revealed neurological causes (23%) and sepsis as major causes of death with pneumonia accounting for only 11% cases[24].In the present study congenital heart disease were seen in 11.58% of cases, similar to the study conducted by Ghaffariet al[21] which revealed 11% of deaths had congenital heart disease. Naghib'sstudy [25] presented that 28% had congenital heart disease. Sands et al. [19]showed infections and trauma, each with 19.6% were common aetiology of death in PICU, however as trauma cases would be shifted to surgical department, the present study did not have any trauma cases enrolled.
Duration of stay is important because serious cases succumb early and in the present study, 71% of total deaths occurred in first 7 days which was also revealed in other studies[21,26,27].In the present study, 10% of patients had prolonged stay and a very similar figure (11%) was identified in a prospective study conducted on prolonged study by YaseenArabi et al[28]. Prolonged ICU stay can adversely affect the health status by increasing the risk of infection, complications and possibly, mortality[29]. The present study also revealed prolonged stay was associated with significant mortality (Chi-square statistic is 35.8369; *p*-value is < .05).

Mechanical ventilation was only 34.8% which was in the lower range of reference values of 31.5-67%[30-34]. This reflects on severe dearth of ventilators when compared to the patient load dealt in PICU of one of the biggest government tertiary care teaching hospital in South India. The fate of other small PICUs canwell be comprehended.

V. Conclusion

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 nursing staff and patient ratio is 1:4 indicating the urgency of recruitment of nursing staff by the government.There is also a need for optimizing an efficient distribution and use of ICU beds.

In addition to improvement in resource utilization, Regionalization can also be recommended as a way to improve the care of critically ill or injured adults and children. Regionalization is the tendency to form de-centralized regions. Regionalization can effectively put limited resources together to maximize the effectiveness and availability of these resources to a greater number of patients.

These facts highlight the necessity to strengthen the existing health care system and develop facilities for proper transportation and treatment of critically ill children.

References

[1]. Thorburn K, Baines P, Thomson A, Hart CA (2001) Mortality in severe meningococcal disease. Arch 2Dis Child 85:382–385.
[2]. Tilford JM, Roberson PK, Lensing S, Fiser DH (1998) Differences in pediatric ICU mortality risk over time.Crit Care Med 26:1737- 1743.
[3]. Downes JJ. Development of paediatric critical care medicine –how did we get here and why? In: Evidence. Wheeler D, Wong H, Shanely T (eds). Paediatric critical care medicine: basic science and clinical evidence. London: Springer: 2007. p.3-32.
[4]. Pollack MM, Alexander SR, Clarke N, Ruttimann UE, Tesse- laar HM, Bachulis AC. Improved outcomes from tertiary center pediatric intensive care: a statewide comparison of tertiary and nontertiary care facilities. Crit Care Med. 1991; 19: 150-159.
[5]. Gemke RJ, Bonsel GJ. Comparative assessment of pediatric intensive care: a national multicenter study. Pediatric Intensive Care Assessment of Outcome (PICASSO) Study Group. Crit Care Med. 1995; 23: 238-245.
[6]. Pearson G, Shann F, Barry P, Vyas J, Thomas D, Powel C et .al. Should pediatric intensive care be centralised? TrendversusVictoria. Lancet.1997; 349: 1213-1237.
[7]. Tilford JM, Simpson PM, Green JW, Lensing S, Fiser DH. Volume-outcome relationships in pediatric intensive care units.Pediatrics.2000; 106: 289-294.
[8]. Ruttimann UE, Patel KM, Pollack MM. Relevance of diagnostic diversity and patient volumes for quality and length of stay in pediatricintensive care units. PediatrCrit Care Med. 2000; 1: 133-139.
[9]. Watson R, Hartmann M. Volume and Outcome in PediatricCriti- 11.cal Care: How much is enough? In: Vincent JL, editor. Yearbook of Intensive Care and Emergency Medicine. Berlin Heidelberg: Springer – Verlag; 2003.
[10]. Rosenberg AL, Hofer TP, Hayward RA et al. Who bounces back? Physiologic and other predictors of intensive care unitreadmission. Crit Care Med 2001; **29:** 511–518.
[11]. Wong DT, Gomez M, McGuire GP, Kavanagh B. Utilization of intensive care unit days in a Canadian medical-surgical intensive care unit. Crit Care Med 1999; **27:** 1319–1324.
[12]. Heyland DK, Konopad E, Noseworthy TW, Johnston R, Gafni A. Is it 'worthwhile' to continue treating patients with a prolonged stay(>14 days) in the ICU?An economic evaluation. Chest 1998; **114:** 192–198.
[13]. Kapil D, Bagga A. The profile and outcome of patients admitted to a pediatric intensive care unit. Indian J Pediatr. 1993;60:5-10.
[14]. Haque a, Bano S. Improving outcome in pediatric intensive care unit in academic hospital in Pakistan. Pakistan J Med Sci.2009;25:605-8.
[15]. Singhal D, Kumar N, Puliyl JM, Singh SK, Srinivas V. Prediction of mortality by application of PRISM score in intensive care unit. Indian Pediatr. 2001;38:714-9.
[16]. Jeena PM, Waseley AG, Coovadia HM. Admission patterns and outcomes in a pediatric intensive care unit in South Africa over a 25-year period (1971-1995). Intensive Care Med. 1999;25:88-94.
[17]. Campos-Mi˜no S, Sasbón JS, von Dessauer B. Pediatric intensive care in Latin America. Med Intensiva 2012; 36(1):3-10.
[18]. Eulmesekian PG, Perez A, Minces PG, Ferrero H. Validation ofpediatric index of mortality 2 (PIM2) in a single pediatric intensive care unit of Argentina. PediatrCrit Care Med 2007; 8(1):54-57.
[19]. Sands R, Manning JC, Vyas H, Rashid A. Characteristics of deaths in paediatric intensive care: a 10-year study. NursCrit Care 2009SepOct; 14 (5): 235-40.
[20]. Devictor DJ, Nguyen DT. Forgoing life sustaining treatments in children: a comparison between Northern and Southern European pediatric intensive care units.PediatrCrit Care Med. 2004;5(3):211–5.
[21]. JavadGhaffari, Ali Abbaskhanian, ZeinabNazari.Mortality Rate in Pediatric Intensive Care Unit (PICU): A Local CenterExperience.International Journal of Pediatrics (Supplement 4), Vol.2, N.3-2, Serial No.8, August 2014.pp 81 -88.
[22]. Friedrich JO, Wilson G, Chant C. Long-term outcomes and clinical predictors of hospital mortality in very long stay intensive care unit patients: a cohort study. Crit Care 2006; 10(2):R59.
[23]. Gauri S. Shah, Basant K. Shah, Anil Thapa, Lokraj Shah, O. P. Mishra.Admission Patterns and Outcome in a Pediatric Intensive Care Unit in NepalBritish Journal of Medicine & Medical Research. 2014;4(30): 4939-4945.
[24]. Volakli E, Sdougka M, Tamiolaki M, Tsonidis C, Reizoglou M, GialaM.Demographic profile and outcome analysis of pediatricintensive care patients HIPPOKRATIA 2011, 15, 4: 316-322.
[25]. Naghib S, van der Starre C, Gischler SJ, Joosten KF, Tibboel D. Mortality in verylongstaypediatric intensive care unit patients and incidence of withdrawal of treatment. Intensive Care Medicine 2010; 36(1):131-36.
[26]. Mink RB, Pollack MM .Resuscitation and withdrawal of therapy in pediatric intensive care.Pediatrics 1992; 89(5):961–63.
[27]. Vernon DD, Dean JM, Timmons OD, Banner W, Jr, Allen-Webb EM. Modes of death in thepediatric intensive care unit: withdrawal and limitation of supportive care. Crit Care Med. 1993;21(11):1798–802.
[28]. YaseenArabi,S.Venkatesh, Samir Haddad, Abdullah Al Shimemeri, Salim Al Malik. A prospective study of prolonged stay in the intensive care unit: predictors and impact on resource utilization.International Journal for Quality in Health Care.2002;14(5): 403 – 410.
[29]. Gilio AE, Stape A, Pereira CR, Cardoso MF, Silva CV, Troster EJ. Risk factors for nosocomial infections in a critically ill pediatric population: a 25-month prospective cohort study. Infect Control HospEpidemiol 2000; **21:** 340–342.
[30]. Tan GH, Tan TH, Goh DY, Yap HK. Risk factors for predicting mortality in a paediatric intensive care unit. Ann Acad Med Singapore. 1998; 27: 813-818.
[31]. Seferian EG, Carson SS, Pohlman A, Hall J. Comparison of resource utilization and outcome between pediatric and adult intensive care unit patients. PediatrCrit Care Med. 2001; 2 :2-8.
[32]. Brady AR, Harrison D, Black S, Jones S, Rowan K, Pearson G, et al. Assessment and optimization of mortality prediction tools for admissions to pediatric intensive care in the United kingdom. Pediatrics. 2006; 117: e733-742.
[33]. Bertolini G, Ripamonti D, Cattaneo A, Apolone G. Pediatric risk of mortality: an assessment of its performance in a sample of 26 Italian intensive care units.Crit Care Med. 1998; 26: 1427-1432.
[34]. Martinot A, Leteurtre S, Grandbastien B, Duhamel A, Leclerc F. Characteristics of patients and use of resource in French pediatric intensive care units. Le groupe francophone de Reanimation eturgencespediatriques. Arch Pediatr.1997; 4: 730-736.