

MORTALITY REVIEW OF CHILDREN ADMITTED IN PEDIATRIC INTENSIVE CARE UNIT OVER ONE YEAR IN A TERTIARY CARE HOSPITAL

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ABSTRACT

Introduction

Childhood mortality is still high in developing countries. This can be reduced with good preventive and curative services especially with critical care. The treatment of critically ill children must be focused for better outcome. The pediatrics deaths audit and review provide feedback to health workers and to the institution. The outcome measures of critical care medicine include mortality, morbidity and disability rate.

Objectives

The aim of this study is to review the causes and mode of death in children and length of PICU (pediatric intensive care unit) stay.

Methodology

A retrospective study was conducted of the patients who were admitted and died within the period of 16 July 2019 to 15 July, 2020 at PICU of Kanti Children Hospital (KCH). Variables recorded were patient's demography, diagnosis, co- morbidities, complications, length of PICU stay (LOS), mode and time of death. Data were tabulated into MS Excel and analyzed using SPSS version 23.

Result

Out of 718 admitted children, 99 (13.78%) died with male to female ratio of 1.8:1. The maximum death (75%) was observed in less than five year of age and most of them were from outside the Kathmandu valley. The leading causes of death were pneumonia (28%), sepsis (20%) and congenital heart diseases (21%). The common complications seen were disseminated intravascular coagulation (DIC), multi-organ dysfunction syndrome (MODS), acute kidney injury (AKI) (5.1%) and acute respiratory distress syndrome (ARDS) (6.1%) and co- morbidities were congenital heart disease (CHD) (18.2%) and global developmental delay (GDD) (9.1%). Mechanical ventilation was needed in 80.8%. Most of the cases (86%) died despite active treatment and (75%) during off hours (4pm-9am).

Conclusion

Pneumonia, sepsis and CHD were the main reason of death and most of them were from outside the valley.

KEYWORDS

Co- morbid, modes of death, pneumonia, sepsis



INTRODUCTION

The childhood mortality in least developed countries like Nepal has been decreasing significantly through good preventive measures like good immunization coverage, nutritional supplementation, improved breast feeding practices etc. More than half of under-five child deaths are due to diseases like respiratory infections, diarrheal diseases and malaria that are preventable and treatable through simple and affordable interventions. Strengthening health systems to provide such interventions to all children will save many children.^{1,2} To reduce further childhood mortality, it is imperative to improve curative services especially critical care of the children. The demand for intensive care services for children and global burden of critical illness is hard to estimate, but 10-20 % of children who present to primary care services are severely ill and need referral for hospital care.³ The improvement of intensive care service must be focused for better outcome in the treatment of critically ill children.

The case fatality rate varies depending on the pattern of diseases and the level of treatment and available facilities in PICU. The reported mortality rates in intensive care unit varied from 3.5- 8.6% in developed world.^{4,5} Some centers in developing countries reported 10.5%-25% mortality rates.^{6,7} To improve the quality service of the hospital, it is necessary to review the outcome of the patients periodically. Death of a child at the PICU may occur after failure of cardiopulmonary resuscitation (CPR), withholding of life sustaining limitation (LSL) treatment or due to brain death.^{8,9} The aim of pediatrics deaths audit and review in hospitals and health facilities is to determine patterns of morbidity, mortality, modifiable factors and interventions to improve the quality of care and outcomes in health care facilities.¹⁰ The outcome measures of PICU include mortality, length of stay (LOS), long-term result such as health status, disability and morbidity.¹¹

In this study we tried to find out the causes of death, time of death (office hr/off hr), LOS and mode of death of the patients admitted in PICU.

METHODOLOGY

This is retrospective descriptive study. After the permission from IRB (institutional review board), the data was collected from patient's file in pre-designed Performa. Children, aged 1 month to fourteen years who expired during 16th July 2019 to 15th July 2020 in PICU of KCH, were included in this study. Those patients who left against medical advice (LAMA) and who died after being transferred out from the PICU were not included in this study. Demographic variables like name, age, sex, date of admission, hospital number, cast, address were recorded in the Performa. History, physical findings and relevant laboratory reports were retrieved. The final diagnosis, complications, drug used were also recorded. The cause of death, time of death (office hr/ off hr), mode of death, duration of mechanical ventilation and LOS had been recorded. Modes of death was categorized as (a) death during treatment (DT) or failed CPR, when the patient died despite use of all available life support measures, (b) DNR (do not resuscitate) or life support limitation (LSL) means

withdrawal of life-sustaining treatment which was decided after counseling the prognosis of the disease to the care taker and (c) brain death (BD) i.e. irreversible loss of all intracranial neurological functions. The three essential findings in brain death are coma, absence of brainstem reflexes, and apnea. Assessment of brainstem reflexes includes midposition to fixed dilated pupil, absent oculocephalic and corneal reflexes and absent gag reflex on oropharyngeal suctioning.¹²

The data was tabulated in MS Excel and analyzed using SPSS version 23 (SPSS Inc, Chicago, IL, USA). The absolute frequencies and percentages were calculated and for continuous data the median and interquartile range (IQR) were used. The causes of death, complications, LOS, mode and time of death were analyzed.

RESULTS

Mean Age: 34.95 ± 47.07 months

Table 1: Demographic characteristics of deceased patients

S.N.	Characteristics	Number (n=99)	Percent
1.	Age Range		
	Up to 1 year	55	55.6
	1-5 years	23	23.2
	5-10 years	12	12.1
	> 10 years	9	9.1
2.	Sex		
	Female	35	35.4
	Male	64	64.6
3.	Address		
	Inside Kathmandu valley	12	12.1
	Outside Kathmandu valley	87	87.9

A total of 718 children were admitted in the PICU during the study period among which the highest number (55) of death was seen in less than one year of age and more than 75 percent death occurred in less than five year of age with male to female ratio of 1.8:1 and almost 87.9 % cases were from outside the Kathmandu valley. The mean age of the study population was 34.95 ± 47.07 months. (Table1)

Table 2: Clinical characteristics of deceased patients with mode of death and time of death

S.N.	Characteristics	Number (n=99) (%)	LOS (Median, IQR)	Mode of death		Time of death	
				DT (n=86)	LSL (n=13)	Office hours (n=24)	Off hours (n=75)
	Primary Diagnosis						
1	Pneumonia	28 (28.3)	2 (1-4)	25	3	9	19
2	Sepsis/ septic shock	20 (20.2)	2 (1-8)	17	3	5	15
3	CHD with Pneumonia	11 (11.1)	2 (1-6)	11	0	4	7
4	Leukemia/Lymphoma	8 (8.1)	4.5 (2.25-9.75)	5	3	1	7
5	Meningitis/ AES	7 (7.1)	5 (2-20)	7	0	0	7
6	CHD with sepsis	5 (5.1)	1 (1-25)	4	1	0	5
7	hepatitis, WD, HE	5 (5.1)	8 (4.5-13)	4	1	1	4
8	Tuberculosis	3 (3)	2	3	0	1	2
9	CHD, CCF	2 (2)	4.5	2	0	1	1
10	Others	10 (10.1)	1.5 (1-4)	8	2	2	9

N.B: LOS: Length of stay, SD: Standard deviation, DT: Death during treatment, LSL: Life support limitation, CHD: Congenital heart disease, AES: Acute encephalitis syndrome, WD: Wilson's disease, HE: Hepatic encephalopathy, CCF: Congestive cardiac failure



Table 3: Co-morbidities of deceased patients

S.N	Co-morbidity	Number	Percent
1	CHD	18	18.2
2	GDD	9	9.1
3	CMV infection	3	3.0
4	Down's Syndrome	2	2.0
5	Obesity	1	1.0
6	Burn	1	1.0
7	No co-morbidity	38	38.4

N.B: CHD: Congenital Heart disease, GDD: Global developmental delay, CMV: Cytomegalo virus.

Table 4: Complications of deceased patients

S.N.	Complications	Number	Percent
1	DIC/MODS	10	10.1
2	ALF	6	6.1
3	Shock/ ARDS	6	6.1
4	AKI/ ARF	5	5.1

N.B: DIC: Disseminated intravascular coagulation, MODS: Multi organ dysfunction syndrome, ALF: Acute liver failure, ARDS: Acute respiratory distress syndrome, AKI: Acute kidney injury, ARF: Acute renal failure.

Table 2 depicts the clinical characteristics of deceased patients. The leading causes of death were pneumonia, sepsis and congenital heart diseases. Pneumonia was present in 28% followed by sepsis 20% and congenital heart disease. Regarding mode of death out of 99 deceased, 86 cases died despite treatment and 13 cases died with life support limitation or DNR. No cases was reported as brain death as mode of death. Among the total death 75% cases died during off hours and 24% case died during office hour. Meningitis, AES and CHD cases had longer length of stay (LOS) in comparison to pneumonia.

The common co-morbid conditions were CHD and GDD which are depicted in Table 3. The common complications of primary diagnosis were DIC, MODS, AKI and ARDS which are depicted in Table 4.

Table 5: Need for life support treatment and inotropes and LOS

S.N.	Characteristics	Number (n=99)	Percent
1.	Requirement of ventilator support		
	Yes	80	80.8
2.	Duration of ventilator support		
	< 1 days	34	34.3
	1-3 days	21	21.2
	4-10 days	15	15.2
	> 10 days	10	10.1
3.	Requirement of inotropes		
	Yes	63	63.6
4.	Length of Stay in PICU		
	< 24 hours	21	21.2
	1-5 days	47	47.5
	5-10 days	13	13.1
	> 10 days	18	18.2

Out of 99 deceased cases, 80 (80.8%) cases were kept in mechanical ventilation and 63 cases (63.6%) needed inotropes support, 34 cases died within 24 hour of mechanical ventilation. Only 10 cases were kept more than 10 days of ventilator support (table 4).

DISCUSSION

Total admissions in PICU of Kanti Children Hospital over the last one year were 718 children with 99 deaths (mortality rate of 13.78%) which are in accordance with various published studies. We postulate that one probable reason of low mortality in this study could be due to exclusion of LAMA (Left against Medical Advice) cases 32(4.45%) and DOR (discharge on request) cases 6 (0.8%). Most of these patients left the hospital either due to financial constraint or parents' perception that the child would not survive from current illness. Among the total admission 7(0.9%) patients were referred to other hospital for further treatment. In this study the highest mortality (55%) was found in infants with male to female ratio of 1.8:1, most of which (87%) were from outside the Kathmandu valley. It is in accordance to the study done by Shrestha A K et al who reported the mortality rate of 22.3%, male to female ratio of 1.8:1 and LAMA (left against medical advice) cases of 8.1% and among total admission 80.6% cases were from outside the Kathmandu valley⁷. In contrast the study done by burns J P et al and Kalraiya A et al reported as mortality rate of 2.39% and 4.92% with male: female ratio of 2:1 respectively.^{13,14} Siddiqui N R et al reported 12.9% mortality rate with male to female ratio of 1.6:1 and this was similar to our study.¹⁵ The leading causes of death were pneumonia, sepsis and congenital heart diseases. Pneumonia was 28% followed by sepsis 20% and congenital heart diseases 18.1%. Among total death cases 21% cases died within 24 hour of PICU admission and 18% cases died after 10 days of PICU admission. Death of almost a quarter of cases within 24 hour of PICU admission signifies either a lack of timely referral or severe disease at presentation. Hence promotion of early referral from periphery can help reduce mortality in the PICU. Cases with diagnosis of AES and congenital heart disease stayed for a longer duration. Common complications of primary diagnosis were DIC, MODS, AKI and ARDS and co-morbid conditions were CHD and GDD. Similar study done by Rashma RP et al reported that the mortality pattern was cardiopulmonary arrest 29%, sepsis 19%, Pneumonia 16%, MODS 14%, Liver disease 7%, inborn error of metabolism 6%, ARDS 6%, 3% ARF.¹⁶ Out of 99 deceased cases, 86 cases died during treatment and 13 cases died with life support limitation or DNR. No cases were reported to be having as brain death.

Among the total death 75% case died during off hours and 24% case died during office hour. A study done in Turkey by Ayar et al also reported that off-hours without 24 hours attendance of senior staff, was associated with higher mortality¹⁷. Hence a higher rate of mortality found in our study might also have been attributed to the absence of senior staffs during off-hours. Similar study done by Hao T K et al reported that the mode of death was failed cardiopulmonary resuscitation and active discontinuation of support in 87% and no case of brain death.¹⁸ Khositseth A et al reported that out of 110, forty-seven patients died during



treatment (DT), 60 died with life support limitation (LSL) and 3 had brain death (BD). The three common complications leading to death were multi-organ failure, septicemia with septic shock and respiratory failure.¹⁹

Out of 99 deceased cases 80 (80.8%) cases were kept in mechanical ventilation and 63 cases (63.6%) needed inotropic support. Among them 34 cases died within 24 hour of mechanical ventilation and 10 cases were kept more than 10 days of ventilator support. This was nearly similar to study done by Sangeeth S et al who had reported that out of 209 deaths, approximately one-third cases (n = 58; 27.8%) died within 24 hours of admission.²⁰ This reflects either a poor health seeking behavior of parents or very late referral from peripheral health centers.

LIMITATION OF THE STUDY

This is a retrospective study, so some information might be lost. The outcome of patients who transferred out from PICU, left against medical advice and discharged on request were not included in this study.

CONCLUSION

Mortality was highest among infants. The leading causes of deaths in our study was Pneumonia and sepsis, both of these being infectious causes leads to signify the importance of hand hygiene while caring for infants. Almost a quarter of children died within 24 hours of PICU admission which signifies the consequences of severe disease at presentation and late referral. So a timely referral system must be developed to reduce mortality in the PICU.

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CONFLICT OF INTEREST

None

FINANCIAL DISCLOSURE

None

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