

Demographic profile, outcome and mortality rate of mechanically ventilated children in pediatric intensive care unit

Dr. Nikitha V.¹, Dr. Beere Gowda YC.², Dr. Narendra RR.³

1. Dr Nikitha V, Junior Resident, Department of Paediatrics, Sri Devaraj Urs Academy of Higher Education & Research, Tamaka, Kolar, India. Mail ID: venkiteela.n@gmail.com
2. Dr Beere Gowda Y C, Professor, Department of Paediatrics, Sri Devaraj Urs Academy of Higher Education & Research, Tamaka, Kolar, India. Mail Id: beere999@gmail.com
3. Dr Narendra RR, Assistant Professor, Department of Paediatrics, Sri Devaraj Urs Academy of Higher Education & Research, Tamaka, Kolar, India. Mail Id: rrnarendral@gmail.com

Corresponding author:

Dr. Narendra RR
Assistant Professor
Department of Paediatrics
Sri Devaraj Urs Academy of Higher Education & Research
Tamaka, Kolar.
India.
Mail Id: rrnarendral@gmail.com

Abstract

Purpose: Mechanical ventilation helps in the decline of mortality rate in pediatric intensive care units (PICU) in many parts of the world but it has its associations with various complications and the outcome often unpredictable.

Aim: The aim of the study is to assess the demographic profile, frequency, indications, and complications of mechanical ventilation and to assess the outcome of ventilated patients.

Methods: This retrospective observational study was conducted in pediatric Intensive Care Unit (PICU), Department of Pediatrics, RL Jalappa Hospital and Research Center, Tamaka, Karnataka, during the period of 1 year from May 2021 to May 2022. Pediatric patients who were put on mechanical ventilation between the age of 1 month to 18 years were included in the study. Data of these children was collected including clinical biochemical parameters, indications of ventilation, complications, duration of ventilation and outcome. The patients were divided into two groups. Patients who remained successfully extubated and did not require re-intubation were grouped as survivors and who died during mechanical ventilation were grouped as non-survivors.

Results: During the study period 133 patients were admitted to PICU, out of them 48 patients required mechanical ventilation. Out of these 48 patients 49% were females and 51% were males. Commonest condition for initiating mechanical ventilation was worsening respiratory distress and GCS less than 8. Mortality rate of these patients was 29%.

Conclusion: Most common need for ventilated among the children was due to respiratory causes, and was also associated with higher mortality rate. Lesser duration of ventilation was

associated with reduced mortality. Most common ventilator associated complication observed was ventilator associated pneumonia (VAP). Most common complications associated with mortality were DIC and pulmonary hemorrhage

Keywords: Complications, Mortality, Mechanical Ventilation, outcome.

INTRODUCTION

Vital organs play a major role in one's survival. A damage to any of these organs is life threatening. Especially, in children admitted to hospital, it is very important to avoid damage to vital organs such as the brain and the kidneys. Intensive care medicine is concerned predominantly with the management of patients with acute life-threatening conditions.[1] With introduction of advanced means of ventilation, there is continuous evolution in mechanical ventilation. Mechanical ventilation is considered as a life-saving invasive technology which is expensive, requires professionals and is associated with various complications. [2] The percentage of children put on mechanical ventilation in the intensive care units is around 20-64% in developing countries. [3]

Though mechanical ventilation is used to prevent the life-threatening events occurring due to numerous diseases, it might result in many complications, physiological effects that increase with duration of the child on ventilator and in turn affects the mortality of the patient. [4]

This present study was designed to study clinical profile, indications, complications, duration of ventilation and mortality in mechanically ventilated neonates in intensive care unit in tertiary care center in order to efficiently manage and improve their survival.

Materials and Methods

This was a retrospective study conducted during May 2021 to May 2022 in the tertiary pediatric intensive care unit of our hospital. The study was proceeded after taking the institutional ethical clearance (DMC/KLR/IEC/125/2022-2023). Children from 1 month to 18 years were considered for the present study and children more than 30 days and less than 18 years who were mechanically ventilated in pediatric intensive care unit were included. Clinical data of the included patients like age, gender, diagnosis, complications, treatment, duration of ventilation, length of stay were gathered. The data was collected retrospectively between the period May 2021 to May 2022, using predetermined, internally validated proforma by reviewing the case sheets accessed from a comprehensive hospital information management system. All the treatment information was noted until discharge of the patient. PRISM scoring was calculated as a standard care procedure in our hospital, and PRISM scores of these patients were also gathered.

Various indications requiring mechanical ventilation support were analyzed .Duration of ventilation was divided into two groups , less than 72 hours and more than 72 hours based on a study done at a government hospital in Chennai. [5] A complication to mechanical ventilation was considered if it was not present before and occurred during ventilation .Ventilator associated pneumonia was considered when clinical and laboratory findings of

pneumonia was present at or after 48 hours of initiation of ventilation. Other complications occurring unrelated to ventilation were taken as associated complications like shock, disseminated intravascular coagulopathy, pulmonary hemorrhage.

Statistical analysis:

Data was entered as frequencies and analyzed using Microsoft excel version 2203. Incidence was computed in the form of percentages. Categorical data was represented in the form of tables. Data was analyzed using statistical package for social sciences (SPSS) version 22.0. Categorical data was represented in the form of frequencies and percentages. The chi square test or Fischer exact test was used as test of significance for qualitative data. The p-value of <0.05 was considered statistically significant after assuming all the rules of statistical tests.

Results

Out of 133 patients admitted to PICU, 48 of them were intubated. Among them 51 % were males and 49 % were females.

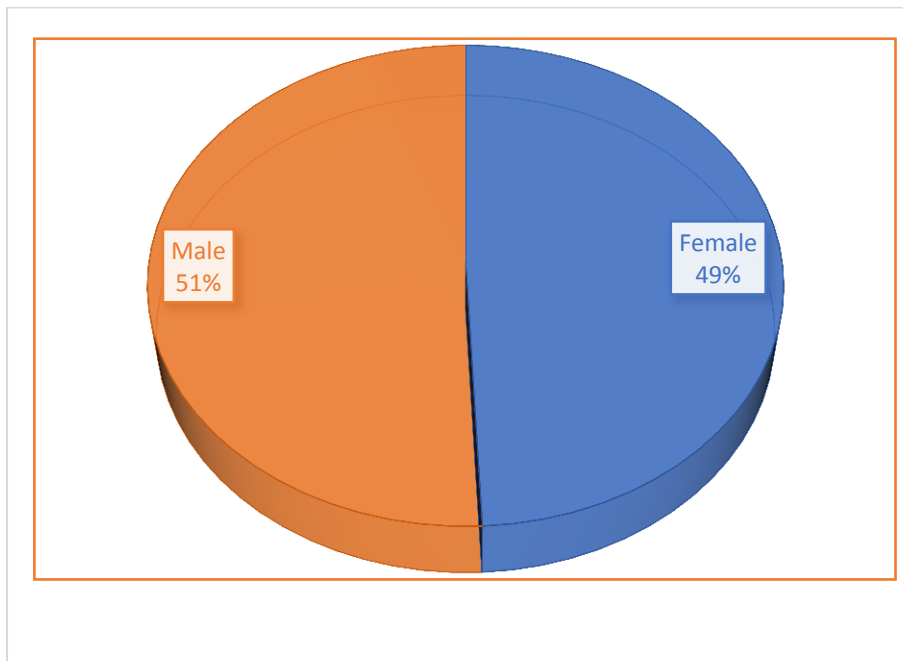


Fig 1. SHOWING GENDER DISTRIBUTION OF TH INTUBATED PATIENTS

Average age of the children intubated was 40+/-46 months. The value of standard deviation is more because of the wide range of age groups in the inclusion criteria. Because of this wide range of age groups, they are further classified into following groups based on the normal range of respiratory rate.

Table 1 showing categorization of age groups among the intubated patients

AGE GROUP	NO OF PATIENTS INTUBATED	PERCENTAGE OF INTUBATED PATINETS
1-12 months	18	37%
1- 3 years	12	25%
4-5 years	5	10%
6-12 years	6	12%

13-18 years	7	14%
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There were many indications for ventilation, the indications were grouped under 3 categories based on the system of involvement.58% of the patients were intubated for the respiratory cause, 31% for neurologic cause and 10% for circulatory cause. Specific indications under these categories is as follows:

Table 2 showing various pathological conditions of children that required ventilation during our study

Respiratory causes	Number of patients intubated
Bronchopneumonia	14
Bronchiolitis	1
Aspiration pneumonia	6
ARDS	4
Respiratory muscle paralysis secondary to toxicity	3
Neurologic causes	0
Refractory seizures	7
GCS<8	8
CIRULATORY CAUSES	0
Shock	1
Congestive cardiac failure	2
Congenital heart defects	2

TABLE 3 SHOWING CATEGORISATION OF INDICATIONS FOR INTUBATION , BASED ON THE SYSTEM INVOLVED

N=48	No of cases	percentage
Respiratory	28	58%
Neurologic	15	31%
Circulatory	5	10%

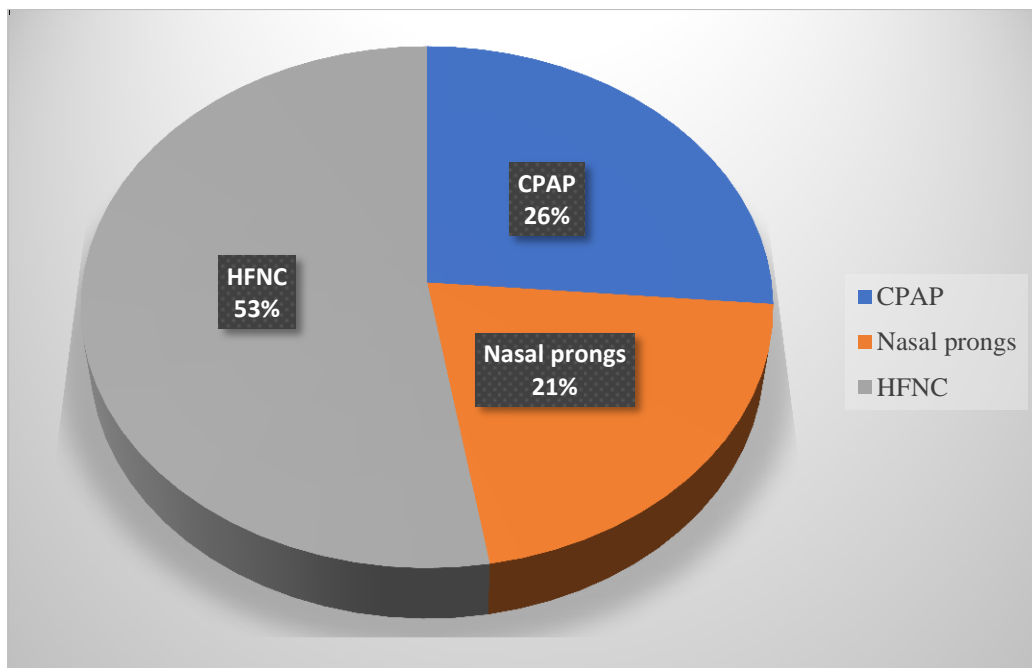


Fig 2. SHOWING WEANING METHOD USED WHEN CHILD WAS EXTUBATED FROM HFNC

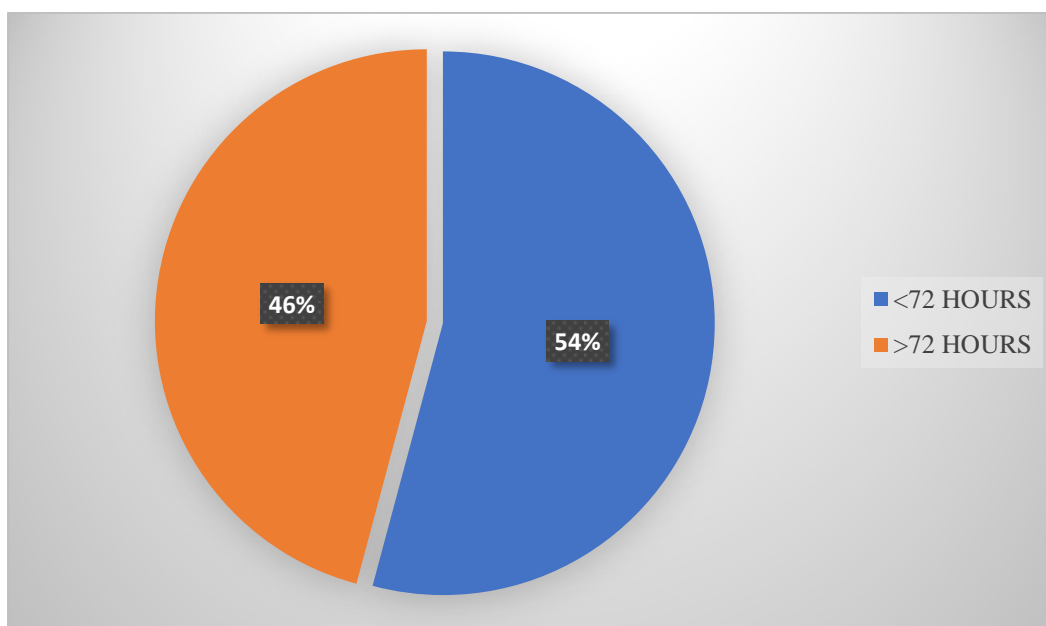


Fig 3. SHOWING DURATION OF VENTILATION AMONG THE STUDY POPULATION

Table- 4 Showing Distribution of Outcome to Demographic and Clinical Data of the Patients

N=48	recovered	death	P value
Gender			
Male	15(31%)	10(20%)	0.120

Female	19(39%)	4(8.3%)	
Age group			
Infants	8(16.6%)	6(12.5%)	0.06
Paediatric age group	26(54%)	8(16%)	
Need for inotropes			
NO	22(45%)	2(4.1%)	0.042
YES	12(25%)	12(25%)	
Ventilation duration			
<72 hours	21(43%)	5(10%)	0.01
>72 hours	13(27%)	9(18.7%)	
Indication for ventilation			
Respiratory	20(41%)	8(16.6%)	0.03
Neurologic	10(20%)	5(10.4%)	
Circulatory	4(8.3%)	1(2%)	

Our study showed that the lesser duration of ventilation (<72 hours) has better survival rate with a significant p value of 0.03 and respiratory causes being the commonest need for ventilation and also had increased mortality as shown in Table 4

Table 5 showing complications in the ventilated patients and their association with mortality

Complication	Survivors	Non survivors	P value
Shock	38%	71%	0.06
DIC	35%	66%	0.02
Sepsis	44%	21%	0.10
Pulmonary hemorrhage	2%	85%	0.02
Pneumothorax	11%	7%	0.07
Ventilator associated pneumonia	2%	7%	0.07

The main complications associated with mortality in our study were DIC and pulmonary hemorrhage with significant p value of 0.02 as shown in Table 5.

PRISM score of all the ventilated patients in our study was more than 15 and for the non-survivors the score was more than 30. This indicates delayed presentation of the patients to the emergency care after the complications have set it , as earlier presentation to the hospital could have improved the outcome of the patients significantly.

DISCUSSION

In this one year of the study period, 48 (36%) patients required ventilation, which was similar to the study done by Dharmaraj et al who had 56 patients ventilated. The percentage of mechanically ventilated cases in the PICUs in developing countries ranges from 14-60%. [6-8] Comparison of demographic profile and sample size of few similar studies is given in Table-6.

Table 6 showing comparison of our study with previous studies

Study	Study design	Sample size	Median age in months	Age range	Male: Female
Present study	Prospective	48	46	35 days to 17 years	1.09:1.0
Fathima et al ⁹	Retrospective	111	32	---	1.5:1.0
Kendirli et al ¹⁰	Retrospective	306	36	6 to 80 months	1.02:1.0
Mukhtar et al ¹¹	prospective	72	<48 months	1 to 13 years	1.25:1.0

The commonest indication for intubation was respiratory failure in our study which is supported by some studies where they observed respiratory failure as commonest indication in 64.8 cases and in other study, they noticed respiratory failure as an indication in 51.4% cases. [9,10,11] This is also supported by study done by Farias et al [12]. The mean duration of ventilation in the study was 2.16±1.2 days, in comparison, the ventilation days were 2.8±1.1 days in another study which is in contrast to the median ventilation days of 4.5 days in the study by Jeena et al. [13] Nosocomial pneumonia was encountered in 3 out of 48 ventilated children (6%) in the present study, lower than that observed by Farias et al (17.5%) where the incidence was 21%.

Mortality in the ventilated children in the study was 29 % which was a little lower when compared to the study observations made by Fairas, Jeena and Wesley et al reported the mortality rates as 36.8%, 38% and 35% respectively.[14] Where as it is similar to study done by Vijaykumar et al, which showed mortality rate of 27%. [15].

In developed countries the mortality rate among the mechanically ventilated children in the paediatric intensive care units is less than 2%. [16] but lower mortality doesn't indicate better long-term outcomes. However, we need to improve the standard of care, immediate recognition of risk-factors associated with mortality and aggressive management with trained

professionals as an important indication to reduce the mortality rates. Also, early presentation of the patients to the emergency care is also equally important.

The study has some limitations, as it a retrospective study, it became difficult to give precise details on death in some cases. As it was done in a single hospital, it could not represent rest of out- hospital mortality rate.

Conclusion:

Despite adequate measures and meticulous work of trained professional, the overall mortality among ventilated children still remains high, mainly among infants. In this study, we observed delayed presentation of the patients to the emergency care as one of the major contributing factors as the PRISM score was high for most the patients at admission. Results also concluded that most common need for ventilated among the children was due to respiratory causes, and was also associated with higher mortality rate.

Lesser duration of ventilation was associated with reduced mortality and the most common ventilator associated complication observed was ventilator associated pneumonia (VAP). Most common complications associated with mortality were DIC and pulmonary hemorrhage. Our role as physicians does not end with cannulating the patient alone. Meticulous monitoring for complications and constant care is required for favorable outcome.

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