

Morbidity Pattern and Outcome of Mechanically Ventilated Children in a Paediatric Intensive Care Unit of a Rural Medical College

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Abstract

Introduction: A mechanical ventilation is an important lifesaving intervention in pediatric critical care. The outcome varies with various factors including age, disease, duration, type of ventilation, and adequacy of care.

Aim: To study the morbidity pattern and outcome of mechanically ventilated children in a paediatric intensive care unit (PICU) of a rural medical college.

Materials and Methods: Clinical profile, diagnosis, duration of ventilation and outcome of children received mechanical ventilation in the PICU of Government Theni Medical College for 1 year were reviewed.

Results: A total of 56 children were ventilated in the PICU with female to male ratio of 1:1.7. Indications for ventilation include central nervous system causes ($n = 17$, 30.3%) status epilepticus ($n = 9$, 16.23%), septic shock ($n = 13$, 23.21%), cardiovascular diseases ($n = 10$, 17.85%) meningoencephalitis ($n = 4$, 7%), severe pneumonia ($n = 6$, 10.7%) bronchiolitis ($n = 2$, 3.5%) snake bite ($n = 2$, 3.5%), diabetic keto acidosis ($n = 2$, 3.5%), others ($n = 3$, 5.3%). Among 56 ventilated children, 25 (44.6%) improved and 31 (55, 3.5%) died. Children ventilated for bronchiolitis, myocarditis had 100% survival rate.

Conclusion: Status epilepticus, septic shock, cardiovascular diseases, meningoencephalitis, severe pneumonia were the common reasons for ventilation. Effective organized early intervention and follow-up improve outcome.

Key words: Children, Mechanical ventilation, Paediatric intensive care, Septic shock, Status epilepticus

INTRODUCTION

Paediatric ventilation is an important component of any tertiary care center. Respiration is defined as the process of gas exchange within the lungs.¹ Ventilation is defined as the movement of air in and out of the lungs. Mechanical ventilation is expensive, labour-intensive and is associated with adverse effects lead to death.² With the major advances in the field of mechanical ventilation with the introduction of several new modes, its use is becoming simple and

easy and is growing very fast in the pediatric critical care. Indications and outcome about the children receiving mechanical ventilation in rural set up are lacking.³⁻⁵

The aim of our study is to bring out the morbidity pattern and outcome in children receiving mechanical ventilation in a rural medical college.

MATERIALS AND METHODS

This is a retrospective study where the records of children received mechanical ventilation in the paediatric intensive care unit (PICU) of Government Theni Medical College for 1 year were reviewed. Government Theni Medical College is a tertiary care teaching hospital in South Tamilnadu, India, with an eight bedded PICU equipped with central oxygen supply, suction lines, infusion pumps, conventional

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mechanical ventilator, portable X-ray machine, defibrillator, patient care monitors and electrocardiogram machine. All patients in the unit were treated according to the written standard operating protocol. Relevant investigations including total and differential blood counts, hemoglobin, blood sugar, electrolytes, urea, creatinine, and blood gas were done at admission, and subsequently, whenever required. The common mode used in the conventional mechanical ventilation was synchronized intermittent mandatory Ventilation with pressure support. The initial settings were according to need of child and adjusted according to clinical variables, chest X-ray, and arterial blood gas analysis. All children were monitored for complications. All patients were weaned from mechanical ventilation when the clinical condition has improved and after passing spontaneous breathing trial. All children were monitored for signs of clinical deterioration after extubation for 1 day in intensive care unit. The data about the age, sex, diagnosis, and outcome were analyzed.

RESULTS

A total of 56 children were mechanically ventilated during the 1-year period. Age and gender distribution of the ventilated children are shown in Table 1.

There were 35 (63%) males and 21 (37%) females. A maximum number of patients belonged to the age group of 1 month to 1 year (62.5%) followed by age group of 1-5 year (19.6%). Maximum deaths 16 (28.57%) occurred in the age group 1 month – 1 year. Disease wise indication for mechanical ventilation is given in Table 2.

About 31 (55.35%) out of the 56 ventilated children died and maximum deaths occurred in the age group 1 month to 1 years. Outcome analysis in relation to different diseases is presented in Table 3.

DISCUSSION

The most common system disorder needing mechanical ventilation was central nervous system in our study. Like this study, Wolfler *et al.* reported neurological cause as the most common reason for mechanical ventilation³ However, several other studies found that respiratory failure due to respiratory illness as the most common indication for mechanical ventilation.⁶⁻⁸ The explanation for this change in pattern was the increased use of non-invasive ventilation through high-flow nasal cannula in the previous studies. It holds good in our setup also, as we also used high-flow nasal canula for respiratory illness as an initial support. Like several published reports, synchronized intermittent mandatory ventilation was commonly used as initial mode on mechanical

Table 1: Age and gender distribution and outcome of children received mechanical ventilation

Age groups	n (%)			Improved (%)
	Cases	Male	Female	
1 month to 1 year	35 (62.5)	24 (42.8)	11 (19.6)	16 (28.57)
1-5 years	11 (19.6)	6 (10.7)	5 (9)	7 (12.5)
>5 years	10 (17.85)	5 (9)	5 (9)	2 (3.5)
Total	56 (100)	35 (62.5)	21 (37.5)	25 (44.6)

Table 2: Disease pattern of ventilated children

Disease	N (%)
Respiratory	9 (16.23)
Pneumonia	6 (10.7)
Bronchiolitis	2 (3.5)
CCAM	1 (1.7)
CNS	17 (30.3)
Meningitis/encephalitis	4 (7)
Status epilepticus	9 (16.23)
Developmental delay	4 (7)
Snake bite	2 (3.5)
DKA	2 (3.5)
Cardiovascular	10 (17.85)
CHD	8 (14.28)
Myocarditis	1 (1.7)
PPHN	1 (1.7)
Septic shock	13 (23.2)
Others	3 (5.3)

CCAM: Congenital cystic adenomatoid malformation, CNS: Central nervous system, DKA: Diabetic keto acidosis, CHD: Congenital heart disease, PPHN: Persistent pulmonary hypertension of the newborn

Table 3: Disease pattern and outcome of ventilated children

Disease	N	Outcome (%)
Respiratory	9	5 (55.5)
Pneumonia	6	3 (50)
Bronchiolitis	2	2 (100)
CCAM	1	0
CNS	17	7 (41.1)
Meningitis/encephalitis	4	2 (50)
Status epilepticus	9	4 (44.4)
Developmental delay	4	1 (25)
Snake bite	2	1 (50)
DKA	2	1 (50)
Cardiovascular	10	4 (40)
Congenital heart disease	8	3 (37.5)
Myocarditis	1	1 (100)
PPHN	1	0
Septic shock	13	5 (33.3)
Others	3	2 (66.6)

CCAM: Congenital cystic adenomatoid malformation, CNS: Central nervous system, DKA: Diabetic keto acidosis, PPHN: Persistent pulmonary hypertension of the newborn

ventilation.^{9,10} However, the trends are toward increased use of volume target ventilation in the mechanical ventilator.

The mortality rate of ventilated children in this study 55.35%. It is closer to survival rate of Shaukat *et al.* and Kendirli *et al.* in Pakistan and Turkey, respectively, in the

past.¹¹ There are several reasons for this major difference in the mortality rate of mechanically ventilated children. Several advantages including higher number of post-operative cases in their PICUs, trained staff, availability of respiratory therapist for ventilatory management, early presentation of illness are known for established PICUs in developed countries.¹²

CONCLUSION

Septic shock and neurological causes were observed to be leading indications for mechanical ventilation in the present study. To improve the outcome of mechanical ventilated children, we need early intervention (starting from early referral to tertiary care) organized approach and continuous care.

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