



Clinical Profile Of Mechanically Ventilated Children In Paediatric Intensive Care Unit: A Single-Centre Study

Dr. Mousin Mustafa¹, Dr. Vidushi¹, Dr. Mayank², Dr. Mohammad Irfan¹

¹Department of Paediatrics, Govt Medical College Jammu,

²Department of Medicine, PGIMER Chandigarh

***Corresponding Author:**

Dr. Mohammad Irfan Dar

Department Of Paediatrics, Govt Medical College Jammu

Jammu And Kashmir, India, 180001

Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Objective : Paediatric ventilation remains the most challenging and important issue in the field of paediatrics it is a life-saving modality that supports the cardiovascular and respiratory systems until the underlying disease is cured. This study aimed to evaluate the demographic profile, clinical aspects, indications and complications of Mechanical Ventilation and the outcome of the children in the PICU of a tertiary hospital in a developing country.

Methods and Results: Prospective evaluation of 167 mechanically ventilated paediatric patients was done in paediatric intensive care unit regarding the patient's age, gender, comorbid disease, aetiologies of admission, length of stay in the PICU, duration of Mechanical Ventilation, inotropic support, laboratory parameters and treatment outcomes, and mortality. One hundred and sixty seven patients (36.6%) admitted in paediatric ICU required Mechanical Ventilation and the median age was 1.6 years. Respiratory (56.29%) diseases were the most common reason for admission in PICU. The median duration of Mechanical Ventilation was 6 (1–29) days, with most patients receiving Invasive mode of ventilation support for more than 3 days (69.46%). Fifty one (30.54%) patients required Non Invasive ventilation support during their stay in the PICU.

Conclusion: Mechanical Ventilation is an indispensable treatment method in PICUs, it should not be forgotten that it carries the risk of morbidity and mortality in addition to the underlying disease. Therefore, the establishment of experienced teams in PICUs could make an important contribution to the prognosis of the patients.

Keywords: Critical Care, Mechanical ventilation, PICU

Introduction

Paediatric critical care is expanding quickly, making it easier to treat very complex cases in special paediatric units. However, paediatric ventilation remains the most challenging and important issue in the field of paediatrics. With the advancing technological developments, mechanical ventilation (MV) has become simple, easy, and accessible^[1]. In developed countries, the percentage of mechanically ventilated children in PICUs ranges from between 17 and 64%^[2]. The mortality rate is higher in children

who require Mechanical Ventilation than in those who do not require respiratory support^[3]. The mortality of a ventilated patient depends on the patient's clinical condition, complications during follow-up, and co-morbidities^[4].

Although patients receiving Mechanical Ventilation account for only a small proportion of hospitalizations, it is a life-saving modality that supports the cardiovascular and respiratory systems

until the underlying disease is cured^[5]. However, data on the indications, and outcomes of children treated with invasive Mechanical Ventilation (IMV) are still lacking. This study aimed to evaluate the demographic profile, clinical aspects, indications and complications of Mechanical Ventilation and the outcome of the children in the PICU of a tertiary hospital in a developing country.

Materials And Methods

A prospective evaluation of 167 mechanically ventilated paediatric patients (between 0 and 17 years of age) was performed in paediatric intensive care unit (PICU) of government medical college Jammu, Jammu and Kashmir from February 2022 to January 2023. Healthcare provision for children aged from 1 month to 17 years is provided in our PICU, which is equipped with 8 beds, 8 ventilators, and 1 isolation room. A total of 456 patients were hospitalized and followed up during the study period. Patients extubated within the first 6 hours were excluded from the study. We obtained informed consent from all parents before hospitalization and during all procedures. Institute Ethics Committee approval was received from Government medical college Jammu on February 17, 2023 (E-46059653-050.99-209536825).

A detailed form was used for data collection regarding the patient's age, gender, comorbid disease, aetiologies of admission, length of stay in the PICU, duration of Mechanical Ventilation, inotropic support, laboratory parameters and treatment outcomes, and mortality.

Statistical Analysis

SPSS statistical software 20.0 for Windows (Armonk, New York: IBM Corp.) was used for statistical analyses. Numbers, frequencies (%), ratios, medians, and standard deviation values were used in the descriptive statistics of the data. The distribution of variables was checked by using the Kolmogorov-Smirnov test. The χ^2 test was used to compare categorical variables, and the Fischer test was used when chi-square conditions could not be met.

Results

A total of 456 patients were admitted to the PICU during the 1-year study period. One hundred and

sixty seven patients (36.6%) who required Mechanical Ventilation were included in study.

The median age was 1.6 (0.5–6.5) years, with most of the patients being male (59.8%). The median duration of PICU stay was 12 (2–114) days, and 69.8% had PICU stay longer than 7 days.

Respiratory (56.29%) diseases were the most common, followed by neurological diseases (31.14%) as the most common reasons for admission to the PICU in ventilated patients.

The median duration of Mechanical Ventilation was 6 (1–29) days, with most patients receiving Invasive mode of ventilation support for more than 3 days (69.46%). The indication for intubation was mostly respiratory failure (58%). A total of 51 (30.54%) patients required Non Invasive ventilation support during their stay in the PICU. NIV was the initial ventilation method for 31 patients, but they were intubated because they could not tolerate NIV.

Univariate analyses were done on mechanically ventilated patients. There was a statistically significant relationship between aetiologies of admission and mortality, IMV duration, inotropic agent requirement, continuous renal replacement therapy. We found that indications of IMV were statistically significant in terms of mortality. Accordingly, the mortality rate was found to be significantly higher in patients who were intubated due to circulatory failure. In addition, the analysis showed that prolonged duration of MV (>3 days) was significantly associated with IMV-related complications and prolonged length of stay in NIV failure

Discussion

Although the incidence of mechanically ventilated children in different intensive care units varies between 17 and 64%, it is one of the most important tools of critically ill care^[12,7].

In our study, the incidence of paediatric admissions to the PICU requiring Mechanical Ventilation was 30.4%. As its more widespread use has therefore proven, the indications and management strategies of MV vary not only with underlying diseases but also with PICU size and location, time of year, and patient population served. This heterogeneity makes it difficult to establish guidelines worldwide, and all

PICUs must define a protocol based on their own experienced teams, consultant teams, a variety of treatment modalities, and patient profiles.

The median age was 19 months, comparable to other tertiary PICUs^[5]. In the literature, male predominance is reported in general, similar to our study, with a male rate of 59.8%^[4,8]. Similar to our study, Kendirli *et al.*^[9] found that the most common cause of MV in PICUs was respiratory disease. However, neurologic diseases have been reported as the most common cause of Mechanical Ventilation in some studies in the literature^[8]. The most likely explanation for this could be due to the differences in diseases prevalent at the time and region of the study and the variation in patient populations in different studies.

Respiratory diseases were the major underlying cause of ventilated children in our PICU, followed by neurological diseases. Similarly, as a result of many studies, respiratory system diseases were reported as the most common reason for MV in intensive care units^[10].

Although MV is a life-saving method, it should not be forgotten that complications related to MV could occur. While the complication rate was 9.2% in a cohort study conducted in a developing country, it was 20.1% in our study^[12]. It has been shown in the literature that this rate can go up to 42.8%^[9]. Complications have been shown to prolong the duration of IMV, and studies reported that these complications are considerably reduced in patients followed by clinicians experienced in respiratory support with MV^[13,14].

The mortality rates of mechanically ventilated children in the literature could reach up to 63%. Shaukat *et al.*^[15] reported a mortality rate of 63% in a developing country, but this rate drops to <2% in PICUs in developed countries^[16]. Various advantages such as access to health services, availability of trained and experienced doctors and nurses in PICUs, technological advantages, and access to paediatric surgery branches can be counted as making this huge difference in the mortality rates of MV children. The care of the ventilated paediatric patient requires a comprehensive understanding of the clinical condition, follow-up, and management of underlying diseases.

The most important limitation of our study is the small number of patients since our study was conducted with data obtained from a single centre.

Conclusion

In conclusion, although MV is an indispensable treatment method in PICUs, it should not be forgotten that it carries the risk of morbidity and mortality in addition to the underlying disease. Therefore, the establishment of experienced teams in PICUs could make an important contribution to the prognosis of the patients. It is also intended that our study could improve the understanding of patients requiring MV and contribute to the literature in the development of therapeutic strategies.

References

1. Farias JA, Frutos F, Esteban A, Casado Flores J, Retta A, Baltodano A, *et al.* What is the daily practice of mechanical ventilation in pediatric intensive care units? A multicenter study. *Intensive Care Med.* 2004;30:918–25.
2. Wolfler A, Calderoni E, Ottonello G, Conti G, Baroncini S, Santuz P, *et al.* Daily practice of mechanical ventilation in Italian pediatric intensive care units: a prospective survey. *Pediatr Crit Care Med.* 2011;12:141–6.
3. Vincent JL, Akça S, De Mendonça A, Haji-Michael P, Sprung C, Moreno R, *et al.* SOFA Working Group The epidemiology of acute respiratory failure in critically ill patients. *Chest.* 2002;121:1602–9.
4. Sahoo B, Jain MK, Thakur B, Mishra R, Patnaik S. Demographic profile and outcome of mechanically ventilated children in a tertiary care hospital of a developing country. *J Nepal Paediatr Soc.* 2018;38:14–8.
5. Citale SV, Behera MK. Study and outcome of mechanically ventilated paediatric patients in intensive care setup in tertiary care hospital. *J Evid Based Med Healthc.* 2017;4:2218–22.
6. Pollack MM, Patel KM, Ruttimann UE. PRISM III: an updated Pediatric Risk of Mortality score. *Crit Care Med.* 1996;24:743–52.
7. Khemani RG, Markovitz BP, Curley MAQ. Characteristics of children intubated and mechanically ventilated in 16 PICUs. *Chest.* 2009;136:765–71.
8. Dharmaraj S, Panneerselvam R. Morbidity pattern and outcome of mechanically ventilated

- children in a paediatric intensive care unit of a rural medical college. *Int J Sci Stud*. 2016;4:27–29.
9. Kendirli T, Kavaz A, Yalaki Z, Oztürk Hişmi B, Derelli E, Ince E. Mechanical ventilation in children. *Turk J Pediatr*. 2006;48:323–7.
10. Anitha GF, Lakshmi S, Shanthi S, Darlington CD, Vinoth S. Clinical profile of children mechanically ventilated in a pediatric intensive care unit of a limited resource setting. *Int J Contemp Pediatr*. 2016;3:542–5.
11. Payen V, Juvet P, Lacroix J, Ducruet T, Gauvin F. Risk factors associated with increased length of mechanical ventilation in children. *Pediatr Crit Care Med*. 2012;13:152–7.
12. Mukhtar B, Siddiqui NR, Haque A. Clinical characteristics and immediate-outcome of children mechanically ventilated in PICU of Pakistan. *Pak J Med Sci*. 2014;30:927–30.
13. Kristensen K, Andersen EA, Andersen MH, Buchvald FF, Christensen H, Heslet L, et al. A three year population based survey of paediatric mechanical ventilation in east Denmark. *Dan Med Bull*. 2002;49:67–9. Erratum : *Dan Med Bull* 2012;59:A4456.
14. Farias JA, Alía I, Retta A, Olazarri F, Fernández A, Esteban A, et al. An evaluation of extubation failure predictors in mechanically ventilated infants and children. *Intensive Care Med*. 2002;28:752–7.
15. Shaukat F, Maqbool S, Jaffari SA, Malik A. Mechanical ventilation in children-a challenge. *Proc SZPGMI*. 2000;14:44–52.
16. Randolph AG, Meert KL, O’Neil ME, Hanson JH, Lockett PM, Arnold JH, et al. The feasibility of conducting clinical trials in infants and children with acute respiratory failure. *Am J Respir Crit Care Med*. 2003;167:1334–40.