DOI: https://doi.org/10.53350/pjmhs2023175631

**ORIGINAL ARTICLE**

# A Research Study on Prompt Results and Physical Assessment of Mechanically Ventilated Children

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## ABSTRACT

**Objective:** There is alarming information on the usage of MV in PICUs from Asian nations. The goals of this research were to identify the patients' clinical profiles, traits, frequent causes of breathing problems, complications connected to ventilation problems, and ultimate outcomes. For admittance to the pediatric critical care unit, the criterion for mechanical ventilation (MV) is rigorous (ICU). It may be difficult to manage children in impoverished nations with minimal resources that need invasive ventilation.

**Methods:** The information gathered included epidemiological trends, ventilation indications, problems, duration of use of the ventilator, and results. From January 2022 to December 2022, a retrospective analysis of kids who needed ventilator support in the Liaqaut National Hospital, Karachi was conducted.

**Results:** The most frequent indications for ventilation in this research were impending respiratory arrest (34.6%) and a low Glasgow coma rating (17.8%). Of the 1172 patients who were brought to the PICU, 101 (8.6%) needed mechanical ventilation. 75% of the patients on mechanical ventilation were male, and 42% were newborns. We discuss the epidemiological patterns, prevalence, causes, and results of pediatric intensive care unit ventilator support cases. Planning better treatment plans in the future may assist improve outcomes, which can be achieved by analysis of this data. The average MV lasted 2.1 days. These kids had a 38.6% death rate.

**Conclusions:** In summary, there is little MV activity in our PICU. The most frequent justification for mechanical ventilation was respiratory failure.

**Keywords:** Respiratory Failure, Mechanically Ventilated, Pediatrics Intensive Care Unit.

## INTRODUCTION

Despite accounting for a relatively small percentage of hospital admissions, mechanical ventilation is a costly, labor-intensive, invasive technology that can save lives but is also linked to several complications. In developed nations, between 17 and 64 percent of children in PICUs are on mechanical ventilation. Mechanical ventilation has been continuously evolving as a result of the introduction of numerous new and cutting-edge ventilation techniques. [1,2] When compared to kids who don't need respiratory support, children who need MV have a higher mortality rate. [3] A ventilated patient's mortality is influenced by conditions that exist at the time ventilation is started, problems that arise during MV, and co-morbidities that are present. In order to design treatment plans and provide ventilated patients with high-quality care, intensivists need to be educated about the epidemiology of patients who require mechanical ventilation (MV) and the risk factors for death. [4] Data from underdeveloped nations, notably those in Asia, addressing the usage of MV in PICU are hard to come by. [5,6] This study's goal was to evaluate the demographics, frequency, indications, and problems associated with mechanical ventilation. It also describes the duration of their ventilation and their immediate prognosis in Liaqaut National Hospital, Karachi. This may help us understand people who need MV better, which may help us develop better treatment plans.

## METHODS

On a proforma, information was gathered and then put into an Excel sheet. The data analysis revealed a range of mechanical ventilation indications, problems connected to mechanical ventilation, and related co-morbidities.

Liaqaut National Hospital, Karachi, hosted this retrospective clinical research from January 2022 to December 2022. Four full-time intensivists, three senior pediatric residents, one nurse for every two patients, and one nurse for each ventilated kid provide assistance for our 10-bed PICU. The medical records of every child who had mechanical ventilation in a pediatric intensive care unit were examined, and information was gathered on each patient's basic demographics (age, gender, illness), justifications for MV, MV duration, PICU stay, MV problems, and patient prognosis. Both clinical and multiparameter cardiac monitors were used to monitor the patients. The decision to intubate was determined clinically after taking into account a number of additional parameters, such as arterial blood gas analysis, Glasgow Coma Scale less than 8, postoperative patients, refractory shock, apnea, cardiopulmonary arrest, and patients with refractory status epilepticus. The study group consisted of all patients who needed mechanical ventilation and were admitted to the PICU between the ages of one month and 15 years.

The qualitative characteristic, which was expressed as a number and percentage (n and%), was examined using Fisher's exact test. A p-value of 0.05 was required for statistical significance. The statistical evaluation was done using Stata 17. To assess the baseline characteristics, descriptive statistics were applied. The frequency and percentage values for each categorical variable were used to express them. The median and range were used to represent the continuous variables. Due to the non-normal distribution of all continuous variables, manual multiple comparison tests (rank sum test between any two groups) were used after a Kruskal-Wallis analysis of variance.

## RESULTS

42% of the ventilated patients were infants. Men made up seventy-five percent of the study's participants. The two primary factors that led to the onset of MV were an impending respiratory failure (34.6%) and a low Glasgow coma scale (17.8%). Other causes were shocked (13.8%), status epilepticus (10.9%), and ALI/ARDS (acute lung injury/acute respiratory distress syndrome). The primary underlying cause of respiratory failure and bronchopneumonia was the need for invasive ventilation. Patients in our research were classified into four main groups according to the need for mechanical ventilation: Children with neurological disorders (31.6%), respiratory disorders (40.6%), heart problems (19.8%), and miscellaneous conditions (7.9%) made up Group A. Fig. 1 shows the distribution of the research groups. 1172 patients in all were admitted to the PICU throughout the course of the three-year study project, and 101 (8.6%) of them needed invasive mechanical ventilation.

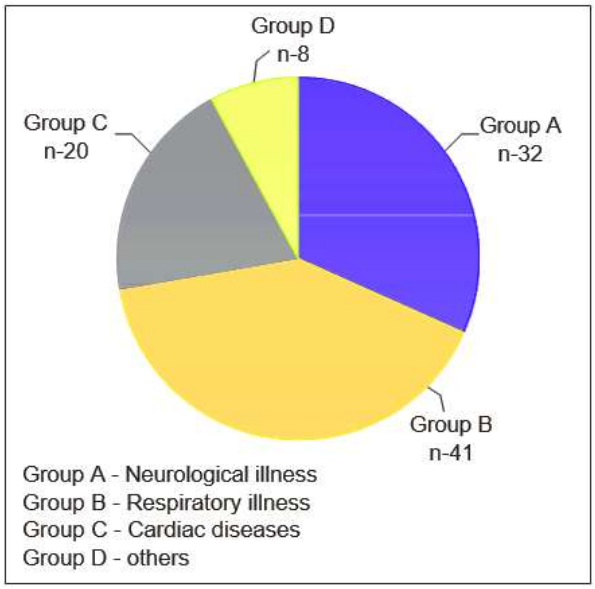

Figure 1: Participants' Groups Distribution

Six patients had ventilator-associated pneumonia, three had pneumothorax, one had upper lobe collapse, and one had spontaneous extubation. Another significant problem seen in our research was pneumothorax in three patients. Children on mechanical ventilation exhibited linked co-morbid disorders in 67% of cases. In our investigation, multiorgan dysfunction and congenital heart disease were the two main co-morbid disorders.

Table 3 lists the lengths of mechanical ventilation and inotrope use as well as hospital stays for the different research groups. In groups A and B, the median number of days requiring mechanical ventilation was 6.6 days. Compared to the other groups, Group B's ventilation time was longer. Our cohort's severely sick mechanically ventilated patients had a 38.6% death rate, with group B having the highest rate. As more failing organs were present, the fatality rates rose. The average length of hospital stays for groups A, B, C, and D were 15.7, 15.8, and 11.4 days, respectively.

Table 1: MV Patients' Clinical and Demographic Characteristics

| | Features | MV Patients no | % |
|---|---|---|---|
| | Male | 76 | 75.2 |
| | Female | 25 | 24.7 |
| | ≥ 1 year | 59 | 58.4 |
| | < 1 year | 42 | 41.6 |
| Aetiology of MV | | | |
| | Comorbidities | 68 | 67.3 |
| | Cardiovascular | 11 | 10.9 |
| | Sepsis | 28 | 27.7 |
| | Pneumonia | 28 | 27.7 |
| | Neurological | 30 | 29.7 |
| Complications | | | |
| | Spontaneously extubated | 1 | 0.9 |
| | Pneumothorax | 3 | 2.9 |
| | Upper lobe atelectasis | 1 | 0.9 |
| | Ventilator-associated pneumonia | 6 | 5.9 |
| Outcome | | | |
| | Tracheostomy | 3 | 2.9 |
| | LAMA | 11 | 10.9 |
| | Death | 39 | 38.6 |
| | Extubated | 48 | 47.5 |

Table 2: Mechanical Ventilation (MV) Indications

| Indications | No | % |
|---|---|---|
| Increased ICP | 4 | 3.9 |
| Pulmonary Edema | 5 | 4.9 |
| Imminent Arrest | 5 | 4.9 |
| ARDS/ALI | 7 | 6.9 |
| Status Epilepticus | 11 | 10.9 |
| Shock | 14 | 13.8 |
| Low GCS | 18 | 17.8 |
| Respiratory failure | 35 | 34.6 |

Table 3: Mortality rate in the intensive care unit (ICU), length of stay, and duration of mechanical ventilation

| Parameters | Death Rate | % | ICU LOS | Median Range | Inotropes Duration | Median Range | MV Duration | Median Range |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| A | 11 | 28.2 | 11 | 1 – 60 | 3 | 1 – 10 | 4 | 1 – 40 |
| B | 13 | 33.3 | 12 | 1– 75 | 4 | 1 – 10 | 6 | 1 – 21 |
| C | 13 | 33.3 | 6 | 1 – 35 | 1 | 10-Jan | 1.5 | 1 – 13 |
| D | 2 | 5.1 | 12.5 | 2– 19 | 5.5 | 2 – 6 | 2 | 1 – 6 |
| p-value | 0.064 | | 0.128 | | 0.177 | | 0.001 | |

## DISCUSSIONS

The research was limited by the patients' absence of severe scoring, which might have resulted in a skewed satisfactory result in the form of a low fatality rate. According to a study, over the course of a year, 111 patients were ventilated, compared to 102 and 56 patients who had been ventilated in earlier studies. [7] In contrast to previous research, where the prevalence of MV, encompassing non-invasive ventilation, was 23%, our study's incidence of MV, including this kind of ventilation, was 11.5%. [8,9] The range of PICUs' mechanical ventilation rates for pediatric patients is between 14 and 60%. [10-12] According to one research, 52% of children in PICUs in Sri Lanka got MV, however, other studies revealed that the prevalence of MV was 30% and 34.6%, respectively. [13-16] According to different research, 21.6% of kids at an Indian government tertiary care hospital required mechanical ventilation every year. The early start of non-invasive ventilation and the lack of a cardiac critical care unit may have contributed to the low incidence of MV in our research. In this research, imminent respiratory failure with an underlying cause of bronchopneumonia was the most frequent reason for starting MV (34.6%). [17] Several studies conducted in Brazil and India found that respiratory failure was often the cause of the onset of MV. However, some studies discovered that neurological disease was the most frequent cause of MV in their PICUs. [18-21] The most plausible reason for these discrepancies is that the causes of PICU admissions vary by country and rely on the diseases that are common in that area. Children in PICUs who are mechanically ventilated often have complications. [22-24]

Our cohort's complication rate was 10.8% compared to a study's 9.2% estimate. [25] Our research determined that upper lobe atelectasis was the most frequent consequence, followed by ventilator-associated pneumonia. In earlier research, VAP was noted in 32%, 27.4%, 17.5%, and 10.7% of the subjects. [26-28] In contrast to the studies described above, the incidence of ventilator-associated pneumonia in the current research was substantially lower at 5.9%. In this investigation, group A had the most documented complication. In a few reported examples, mechanical ventilation lasted for 4-6 days. [29,30] In our PICU, mechanical ventilation lasted a median of four days. More than 10 days of ventilator support were needed by 11.8%. Group B had the longest average stay in the PICU. In the study population, co-morbidity was present in 67.3% of cases. Similar to prior research,

congenital heart disease was the main co-morbid condition in our investigation. [31] In their research, an inquiry found a co-morbidity of 41.3%. [32] In our research, the death rate for patients on mechanical ventilation was 38.6%, which is close to another study's observation of a mortality rate of 36.9%. [33] A study found the highest mortality rate of up to 58.3% [34] as opposed to the lowest only 4.5%. [35] Less than 2% of patients in PICUs who were mechanically ventilated died overall in wealthy nations 2. Groups B and C had the highest death rates (33.3%), followed by group A (28.2%), however, this difference was statistically insignificant (p=0.064).

## CONCLUSIONS

Consequence in these individuals was pneumonia related to the ventilator. In this investigation, a favorable result in the form of a low death rate is remarkable.The most frequent cause of MV was respiratory failure, and its low frequency was likely caused by the admission of fewer seriously sick kids owing to the lack of super-specialists.

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