Evaluating Outcome in Mechanically Ventilated Young Patients at a Pediatric Intensive Care Unit

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ABSTRACT
Aim: To evaluate outcome in mechanically ventilated young patients at a pediatric intensive care unit.

Material and methods: This Study was conducted in the Department of Paediatrics, Shaihida Islam Teaching Hospital Lodhran.

This study was conducted on 154 patients. The mean age of the patients was 4.44±2.61 years. Length of hospital stay 7.08±4.27 days. In our study 102 (66.2%) patients survived while 52 (33.8%) had expired. Outcome had significant association with type of cases and length of hospital stay.

RESULTS: The mean age of the patients was 4.44±2.61 years, length of hospital stay 7.08±4.27 days. In our study 102 (66.2%) patients survived while 52 (33.8%) had expired. Outcome had significant association with type of cases and length of hospital stay.

Conclusion: From our study we conclude that the expiry rate of the children admitted for mechanical ventilation was 33.8%.

Keywords: Mechanical ventilation, Pediatrics, Pediatric Intensive Care Unit, Critical illness.

INTRODUCTION
One of the most common reasons for admission to pediatric intensive care units (ICUs) is the need for mechanical ventilation (MV), which is often a lifesaving treatment 1. Nearly, 30% of patients have trouble weaning off MV, and such people have a greater mortality rate. Consequently, past research has analyzed the complications between the various weaning categories and the clinical outcomes 2. It is possible to prevent or reduce the severity of many MV problems 3. Patients are at increased risk of respiratory and/or circulatory distress during endotracheal intubation 4. Pre-oxygenation is crucial, and various methods have been proposed for individuals with the most severe condition, including noninvasive ventilation, and high flow administered through nasal cannula 5.

Sedation either with/without paralysis is usually necessary in the initial stages of MV, especially for patients in shock or with acute respiratory distress syndrome 6. The outcome may be affected by the sedative medicines used and the decisions made regarding their use 7. The short half-life of propofol encourages its usage, although there are issues with infusions that last too long. Because it decreases delirium, dexmedetomidine may be a useful substitute for conventional sedation 8. To prevent a patient from falling into a profound sedation state, it is crucial to keep a close eye on how sedated they are and to follow a sedation protocol that includes interrupting sedation on a daily basis 9.

In wealthy countries with an established field of pediatric intensive care medicine, the proportion of children getting MV in PICUs varies between 17-64 % 10. Despite its vital function, MV is linked to undesirable outcomes and can cause issues including shock, VAP, pulmonary bleeding, pneumothorax, atelectasis, and pharmaceutical side effects (such sedatives and analgesics) 10, 11. Children who require mechanical ventilation have a mortality rate of 40-60%, according to numerous research conducted at LRIC. Patients who required mechanical ventilation had a death rate of 30.5 %, and a complication rate of 9.4 %, according to a study conducted in the Intensive Care Unit at Pakistan’s Aga Khan University Hospital 12.

Better utilization of resources and clinical decisions for the few pediatric intensive care unit (PICU) facilities depends on patient characteristics and prognosis in patients requiring MV. But in our setting, this data on PICU MV is not handled appropriately. That is the reason, we set out to evaluate the long-term effects of mechanical ventilation on young children in our healthcare system.

MATERIAL AND METHODS
This observational study was conducted at the Department of Paediatrics, Shaihida Islam Teaching Hospital Lodhran in the duration from October, 2022 to March, 2023. We enrolled 154 critically ill patients admitted in Pediatric ICU presented for mechanical ventilation having age between 1 to 10 years of both genders through non probability consecutive sampling. Written consent form was signed by their parents/guardian to partake in the study. Demographic data like age, gender, indication for admission along with complications developed after MV, type of cases and outcome (survived or expired) were noted down on a predesigned proforma.

Sample size was calculated using WHO sample size calculator taking previous frequency of sepsis as an indication of admission 26.8, margin of error 7% and confidence interval 95%.

Data was analyzed using IBM SPSS 20. Mean and standard deviation were used for numerical variables while we used frequencies and percentages for nominal and ordinal categorical variables. Independent samples T test was applied for association between outcome and numerical variables while Chi Square test was applied for categorical variables keeping statistical significance at <0.05.

RESULTS
This study was conducted on 154 patients. The mean age of the patients was 4.44±2.61 years. The length of hospital stay in our study was 7.08±4.27 days. Regarding gender distribution there were 100 (64.9%) male and 54 (35.1%) female patients in our study. Regarding the type of cases presented 122 (79.2%) medical cases and 32 (20.8%) surgical cases.

Regarding the indication for mechanical ventilation, respiratory failure was the leading indication 35.10%, followed by neurological 29.20%, cardiovascular indications were 14.90%, neurosurgical indications were 11.7% and sepsis was 9.10%.

The major complication we observed was ventilation associated pneumonia 16.90% followed by pneumothorax 7.80% and atelectasis was 5.8%. Majority of the patients did not developed any complications (69.5%). Regarding the outcome, in our study 102 (66.2%) patients survived while 52 (33.8%) had expired.

We observed a strong association between the outcome and type of cases, we observed that the surgical cases had higher rates of expiry as compared to the medical cases (P = 0.0001)
Longer hospital stay was significantly associated with the outcome, the longer duration at the hospital lead to higher rates of expiries (P = 0.001)

Table 1: Baseline characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Years)</td>
<td>4.44±2.61</td>
</tr>
<tr>
<td>Length of hospital stay (Days)</td>
<td>7.08±4.27</td>
</tr>
<tr>
<td>Gender</td>
<td>Male 100 (64.9%) Female 54 (35.1%)</td>
</tr>
<tr>
<td>Type of cases</td>
<td>Medical 122 (79.2%) Surgical 32 (20.8%)</td>
</tr>
</tbody>
</table>

Figure 1: Indication for MV

Indication for MV

- Respiratory failure 35.10%
- Cardiovascular 14.90%
- Neurological 29.20%
- Neurosurgical 11.70%
- Sepsis 9.10%

Figure 2: Complications

Complications

- None 69.50%
- Ventilation Associated Pneumonia 16.90%
- Pneumothorax 5.80%
- Atelectasis 7.80%

Table 2: Association of type of cases with outcome

<table>
<thead>
<tr>
<th>Type of cases</th>
<th>Total</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical</td>
<td>73.8%</td>
<td></td>
</tr>
<tr>
<td>Surgical</td>
<td>26.2%</td>
<td></td>
</tr>
<tr>
<td>Survived</td>
<td>102</td>
<td>0.0001</td>
</tr>
<tr>
<td>Expired</td>
<td>52</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Association of length of hospital stay with outcome

<table>
<thead>
<tr>
<th>Length of hospital stay (Days)</th>
<th>Outcome</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survived</td>
<td>102</td>
<td>6.27</td>
<td>3.781</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>Expired</td>
<td>52</td>
<td>8.67</td>
<td>4.797</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION

In developed nations where pediatric intensive care medicine is an established medical specialty, the proportion of infants receiving MV in PICUs ranges from 17 to 64 percent. The prevalence of MV use among Egyptian infants was 32.8%. In a study it was reported that, 32 percent of the 16 pediatric ICUs had only one functional mechanical ventilator, 38 percent had two, and the remaining units had between three and six.13

Despite its significance, mechanical ventilation (MV) is associated with poor outcomes and may result in complications such as shock, ventilator-associated pneumonia (VAP), pulmonary hemorrhage, pneumothorax, atelectasis, and adverse drug reactions (e.g. sedatives and analgesics). Numerous studies in LRIC have revealed that the mortality rate for mechanically ventilated children spans from 40 to 60%. In a study conducted at the PICU of Aga Khan University Hospital in Pakistan, the mortality rate among mechanically ventilated patients was found to be 30.5%, while the rate of complications was 9.4% (1). A report from Nepal indicated a mortality rate of 34.1%.14

Both ER and PICU are comparatively new concepts, and data regarding the status of PICU in different regions of Pakistan are limited. As the modern healthcare system evolves, there is a growing demand for critical care services and facilities. In a modern healthcare system, the PICU is an integral part of children’s hospitals and a reflection of the quality of pediatric medical treatment in the country. The pediatric intensive care services have demonstrated positive effects on the survival of children with potentially fatal illnesses. A PICU has multiple admission sources, including the operating room, emergency room, wards, and transfers from other institutions. The percentage of patients admitted to the PICU from the ER ranged from 20% to 68% in a few pediatric reports.14

We conducted this study on 154 patients admitted at pediatrics ICU. Mean age of the patients was 4.44±2.61 years. Majority patients were from male gender 64.9%. We observed that most of the cases presented for mechanical ventilation were medical cases 79.2% and only 20.8% were surgical, similar findings have been reported by a study which showed that majority of their presenting cases were medical.15

The outcome in our study was survival and expiry of the patients who were admitted for mechanical ventilation, in our study 102 (66.2%) patients survived while 52 (33.8%) had expired. A study conducted in Pakistan reported that the mortality rate in their findings was 20.3%.14 However the aforementioned study concluded that their mortality rate was higher than 50%.13 The length of hospital stay in our study was 7.08±4.27 days, several studies have reported that the mean length of hospital stay was 3.1, 4.5 and 5 days.15,16,17

Respiratory failure was the leading cause of admission for mechanical ventilation which accounted for 35.10% of the patients, neurological indication was 29.2% and cardiovascular indication accounted for 14.90% in medical cases. In surgical cases neurological indication accounted for 11.7% cases followed by sepsis 9.10%. The aforementioned Pakistani study also reported similar findings however in their study neurological illness was the leading cause for admission.14

Complications found in our study were ventilation associated pneumonia, pneumothorax and atelectasis, among these complications ventilation associated pneumonia was the most frequent complication which is also reported by various studies.13,16

CONCLUSION

From our study we conclude that the expiry rate of the children admitted for mechanical ventilation was 33.8%, we found a significant association between expiry rate with surgical cases and longer duration of hospital stay.

REFERENCES