STUDY AND OUTCOME OF MECHANICALLY-VENTILATED PAEDIATRIC PATIENTS IN INTENSIVE CARE SETUP IN TERTIARY CARE HOSPITAL

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ABSTRACT

BACKGROUND

Mechanical ventilation is one of the modality of treatment in critically ill children and can be lifesaving in many cases if done with meticulous care. It is associated with complications, which adversely influence patient's outcome. This study done to evaluated clinical profile, mortality and morbidity pattern in mechanically ventilated patients in PICU.

MATERIALS AND METHODS

A retrospective cross-sectional study was conducted in PICU of Smt. Kashibai Navale Medical College and General Hospital, Narhe, Pune. All the ventilated patients in PICU from January 2015 to June 2016 were studied.

RESULTS

Total 102 patients were studied, majority were boys 71 (69%). Mean age was 22.6 months. Average duration of ventilation was 4.16 day. The commonest indication of ventilation was bronchopneumonia. Prolonged ventilation was associated with poor outcome. Most common complication was nosocomial infection 42%. Mortality was 57%.

CONCLUSION

Ventilation is associated with morbidity and mortality, early diagnosis of complications and effective treatment definitely decreases the morbidity.

KEYWORDS

Mechanical Ventilation, PICU, Morbidity, Mortality.

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BACKGROUND

With the advancement in intensive care facilities, there is a dramatic increase in survival of critically-ill children. Previous studies have shown significant positive impact of Intensive Care Unit (ICU) physicians on the outcome in children and adults.[1,2] ICU is also one of the sites where medical errors are most likely to occur because of the complexity of the diseases and patients are vulnerable to experience adverse outcomes due to multiple interventions. Hence, it is obligatory for the intensivists to scrutinise the events occurring in the PICU for improving the quality care of the critically-ill children.[3,4,5] In the context of intensive care management, outcome analysis coupled with demographic status and clinical details have become a challenge for the modern day intensivist. Paediatric ventilation is an important component of any tertiary care centre. Mechanical ventilation is expensive, labour intensive and is associated with adverse effects leading to death. With the major advances in the field of mechanical ventilation with the introduction of several new models, its use is becoming simple and easy and is growing very fast in the paediatric critical care. Indications and outcome about the children receiving mechanical ventilation are lacking.[6,7,8] It is a lifesaving intervention to support the cardiorespiratory status until the underlying disease is cured. Invasive mechanical ventilation is under continuous evolution with introduction of various new modes of ventilation. Although lifesaving, it is associated with complications especially if ventilator care is prolonged and also with the drawback of limited resources in intensive care units of developing countries. The percentage of mechanical ventilation in Paediatric Intensive Care Unit (PICU) ranges from 30-64%.[9,10] Very less data is available from developing countries regarding the use of mechanical ventilation in PICU. This study was done to assess the indications, complications and immediate outcome of children receiving mechanical ventilation in a PICU of a tertiary care hospital from a developing country. It is also intended to provide an assessment of the baseline status at the present time and could be used for comparison with future studies and also serve as a yardstick to compare the current status against the results of other paediatric intensive care units.

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Aims and Objectives

To study of clinical profile and morbidity-mortality pattern in paediatric-ventilated patient in tertiary care hospital.

MATERIALS AND METHODS

In this retrospective study, all the patients who were admitted in PICU from June 2015 to June 2016 requiring the mechanical ventilation were included. Our critical care unit is 8 bedded, which is looked after by paediatrician (senior consultant). In this study, we have included children between 1 month to 12 years of age. Our annual PICU admissions are around 500-600 cases of which around 102 cases require mechanical ventilation. We reviewed the medical records of all children who received mechanical ventilation in a paediatric intensive care unit. Children were monitored clinically by regular cardiopulmonary cerebral assessment along with cardiac monitor and pulse oximetry. The decision to intubate was based on clinical grounds and in some cases by other parameters such as if the patient had GCS <8, apnoea, shock, severe hypoxia in some postoperative cases in view of difficulty in weaning from general anaesthesia. Some patients were electively intubated for midazolam drip in status epilepticus. All the patients were evaluated based on the need of mechanical ventilation, the morbidities and mortalities associated with ventilation and the outcome by using preformed proformas. The various indications for mechanical ventilation were analysed. The duration of invasive ventilation was divided as <72 hours and >72 hours based on a study done in Haryana, which had 72 hours as the maximum duration of invasive ventilation.[11] A nosocomial infection was defined as infection not present or incubating prior to admittance to the hospital, but occurring 48 hours after admittance in PICU. It included infections such as Ventilator-Associated Pneumonia (VAP), urinary tract infection, sepsis, gastroenteritis, surgical site infection and meningitis. Ventilator-Associated Pneumonia (VAP) was considered when clinical and laboratory findings of pneumonia were present at or after 48 hours of mechanical ventilation. Upper lobe collapse was defined as a triangular opacity with loss of lung volume, crowding of ribs, tracheal shift to same side and elevation of hemidiaphragm.

Selection Criteria- Inclusion Criteria for Subjects-

All the patients in PICU who require mechanical ventilation in Smt. Kashibai Navale Medical College and General Hospital, Narhe, Pune, were included in the study group who were between 1 month to 12 years of age. Indication of ventilation were as follows-

1. Respiratory failure- Apnoea/respiratory arrest, inadequate ventilation, inadequate oxygenation (Pao_2/Fio_2 <300 for acute lung injury or <200 for respiratory distress syndrome), chronic respiratory insufficiency with FTT.
2. Cardiac insufficiency/shock- eliminates work of breathing and reduces oxygen consumption.
3. Neurologic dysfunction- Central hypoventilation /frequent apnoea, GCS less than 8 and inability to protect airway.

Exclusion Criteria- Children <1 month.

Statistical Analysis

The categorical variables were expressed as frequency and percentage. The quantity variables were expressed as mean + standard deviation. Descriptive statistics were used to evaluate baseline characteristics. The group comparisons for the categorical variables were analysed using Chi-square test and within group comparisons of quantitative variables were analysed using independent t-test. The p value of less than 0.05 was considered as statistically significant. The statistical analysis was carried out using statistical software SPSS 19.

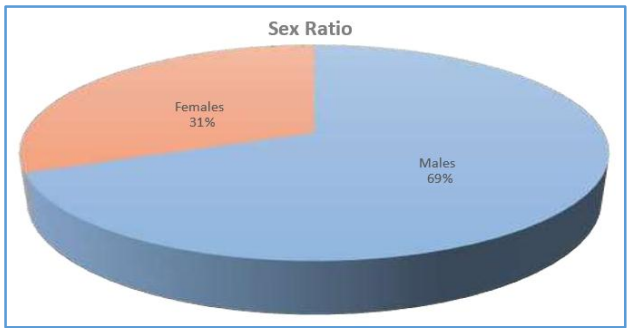
RESULTS

In this study, total 102 patients were included out of which 71 (69%) were males, 31 (31%) were females (Graph 1). Mean age group that needed maximum ventilator support was 1 to 5 years with incidence of 40.18% with a mean age of 22.6 months (Graph 2). Synchronised intermittent mandatory ventilation mode with pressure support (SIMV+PS) mode was used in all the ventilated patients. The mean duration of ventilation was 4.16 days in a range of 1 to 23 days. Thirty-two percent of the patients were ventilated for <24 hrs. (Table 1). The indications for ventilation were respiratory conditions (61%), CNS (central nervous system) conditions 20%, CVS (cardiovascular system) conditions 10%, other condition 7% (Table 2). The most common indication of ventilation was bronchopneumonia 48%, followed by meningitis and congenital heart diseases each 10%, pleural effusion/empyema and status epilepticus each 7% (details of the condition given in Table 3, 4). Severe anaemia was seen in 26% of mechanically-ventilated patients on admission. Complication were present in 34% of patients in PICU such as sepsis, ventilator-associated pneumonia, urinary tract infection, pneumothorax, post-extubation stridor, central line related complication such as thrombosis, etc. Most common complications associated with ventilation was nosocomial infections 42%, upper lobe collapse 25%, air leak syndrome 14%, mechanical failure were 7%, others 7% (endotracheal/tracheostomy related difficulty in weaning from ventilation).

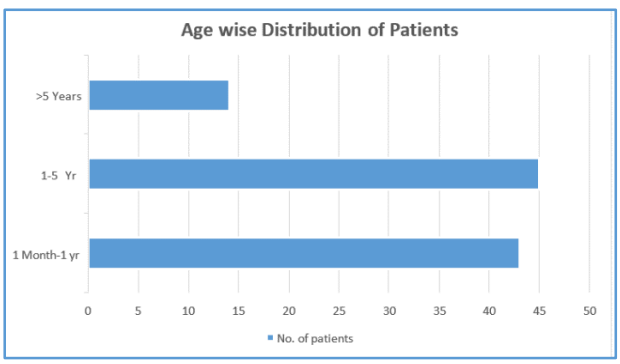
Ventilator-associated pneumonia was most common nosocomial infection accounting for 56%. In this study, we observed that children who required prolonged ventilator support of >72 hours had a longer duration of hospital stay as well as more complications. This observation was statistically significant (with p value <0.005) (Table 5, 6).

Out of total ventilated patients, mortality was 57%. Out of total 60 deaths, males were 42 (59%) and females were 18 (58%). PICU-related deaths due to complications were seen in only 7 patients. The most common cause of death

was nosocomial infections, sepsis with secondary HLH (hemophagocytic lymphohistiocytosis), VAP and meningitis.



Graph 1. Sex Ratio



Graph 2. Age Distribution

Duration of Ventilation (in Days)	Number of Patients	Percentage
1	33	32
2	10	9
3	19	17.75
4	6	5.60
5	8	7.47
6	7	6.54
7	4	3.73
8	4	3.73
9	1	0.93
10	3	2.80
11	4	3.73
12	2	1.86
16	1	0.93
21	1	0.93
23	1	0.93

Table 1. Duration of Ventilation

Total Cases	RS (Respiratory System)	CNS (Central Nervous System)	CVS (Cardiovascular System)	Others
102	63	21	10	8

Table 2. Indication of Ventilation

Name of Condition	Number of Ventilated Patients
Bronchopneumonia	49
Pleural effusion/empyema	7
Foreign body aspiration	3
Bronchiolitis	2
Asthma	1
Pneumothorax	1
Total	**63**

Table 3. Different Respiratory Conditions Requiring Ventilation

Central Nervous System (CNS) Conditions	Number of Patients
Meningitis	10
Status epilepticus	7
Encephalitis	2
CNS tumours	2

Table 4. Different Central Nervous Conditions Requiring Ventilation

Mechanical Ventilation Duration	Duration of Hospital Stay (Days)			Total
	<7 days	7-14 days	>14 days	
<72 hours	37 (52.1%)	33 (45.2%)	2 (2.7%)	73
>72 hours	4 (11.4%)	18 (51.4%)	13 (37.1%)	35
Total				**108**

Table 5. Duration of Mechanical Ventilation and Duration of Hospital Stay

P=0.002.

Mechanical Ventilation Duration	Complications				
	VAP (Ventilator Associated Pneumonia)	Upper Lobe Collapse	Post Extubation Stridor	Others	Total Numbers
<72 hours		3 (50%)	2 (33%)	1 (16%)	6
>72 hours	15 (51%)	6 (27%)	1 (3.44%)	6 (20.6%)	29
	15	9	3	7	35

Table 6. Duration of Ventilation and Complications

P=0.00001.

DISCUSSION

Modern paediatric intensive care is characterised by increased sophistication resulting in spiralling costs. There is a need to accurately define prognosis, so that physicians can be guided in clinical decision making, including the appropriateness of therapy. Auditing the PICU is thus an integral component in health planning and management.[12,13] Moreover, the impact of new technologies and medical intervention can be assessed in a more objective fashion. Studies in developing countries like India and Pakistan have reported significant variability between PICUs in age and percentage of morbidity and mortality. PICUs with higher mortality rates maybe caring for patients with more severe illnesses and vice versa. However, lower mortality rates do not necessarily translate into better long-term outcomes.[13] In this present study, we have encountered a wide spectrum of cases requiring inotropic support and various critical care treatment modalities such as renal and hepatic support. Male preponderance (63%) was reported by Dharmaraj S et al is similar to this study 69%.[14] Maximum number of ventilated patients were in the age group of 1 to 5 years, which was seen in a study conducted by Wolfler et al,[9] Shuakat et al quoted in his study that SIMV mode was most widely used mode of ventilation, which is in high congruency with the present study.[15] In the present study, 32% of the patients were ventilated for <24 hrs., which was similar to a result published by Farias et al being 35% for <12 hrs. or more. Kendirli et al in their study observed respiratory failure as the indication in 64.8% with most common being bronchopneumonia, which was similar to the result of high respiratory failure (61%) due to bronchopneumonia (48%) for mechanical ventilation in the study conducted above.[12] Anaemia is common problem in critically-ill children admitted to the PICU. There are several possible causes for the anaemia of critical illness, including chronic anaemia, overt and occult blood loss, underlying disease treatment causing bone marrow suppression and iatrogenic bleeding for investigations. Bateman et al quoted that 33% patients had severe anaemia on admission to PICU, which correlated with a value 27% in this study.[16] In this study, the prolonged ventilation was associated with increased duration of hospital stay and increased rate of complications, which is similar to the study conducted by Shirly et al.[10]

During PICU stay, nosocomial infection is a critical problem. This could be due to blood stream infection from central venous catheters (mostly placed in the femoral vein) and ventilator-associated pneumonias. Vijayakumar et al found in his study that most common complication was nosocomial infection accounted for 11%, which is similar to this study accounting for 42%, which is slightly higher.[13] This variability in development of nosocomial infection could be due to noncompliance with infection control measures.

In our study, the mortality was 57% in the age group of 1 to 5 years, which was reported by Vijaykumar et al where mortality was 43.5%.[13] In this study, the baseline ABG of patients have not been studied because ABG could not be done prior to intubation in all the patients due to either patient's condition or due to mechanical problem. In this study, we recognised several reasons for higher mortality in the ventilated children such as lack of adequate nursing staff in the PICU with the nurse to patient ratio 1:3 when compared to the required 1:1 ratio. Patients were referred from faraway places and were admitted in poor status on admission. Several reports have shown that full-time trained critical care specialists in both adult and paediatric ICUs improve the quality of care and are associated with lower mortality and morbidity rates.[17] Lack of trained paediatric intensivists, respiratory therapist services and regular trainings on mechanical ventilation were also identified as drawbacks in our setup.

CONCLUSION

Mechanical ventilation is under continuous evolution with introduction of various new modes of ventilator support. Mechanical ventilation are being used more often nowadays because of advanced technology and facility availability in PICU. Although lifesaving, it is associated with complications especially if ventilator care is prolonged. Respiratory infection was most common indication of ventilation and nosocomial infection is most common complication noted in this study. Despite the limitations of a greater percentage of critically sick children arriving late, the mortality was 57%. Clinician's job does not end with intubation and connecting the patient to ventilator support alone as invasive ventilation is not a treatment per se. The underlying disease requiring this invasive respiratory support should be identified and treated with good nursing care and meticulous management by treating clinician.

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