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Clinical profile and short term outcome of neonates requiring assisted mechanical ventilation

Vedartham Ramesh

Associate Professor, Department of Pediatrics, Viswabharathi Medical College, RT Nagar, Penchikalapadu, Kurnool District, Andhra Pradesh, India.

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Abstract

Background: Neonates requiring assisted mechanical ventilation represent a vulnerable population with complex clinical profiles and significant healthcare needs. Understanding their clinical characteristics and short-term outcomes is essential for optimizing their management and improving overall neonatal care. **Objective:** This study aimed to investigate the clinical profile and short-term outcomes of neonates requiring assisted mechanical ventilation in a specific healthcare setting. **Methods:** A retrospective analysis was conducted on a cohort of neonates admitted to a tertiary care neonatal intensive care unit (NICU) over a specified period. Clinical data, including demographic information, underlying conditions, indications for mechanical ventilation, duration of ventilation, complications, and short-term outcomes, were collected and analyzed. **Results:** A total of [number] neonates were included in the study. The majority were preterm infants (gestational age <37 weeks), and a significant proportion had low birth weights. Respiratory distress syndrome and sepsis were the most common indications for initiating assisted mechanical ventilation. Complications such as pneumothorax, ventilator-associated pneumonia, and intraventricular hemorrhage were observed in a subset of neonates. Short-term outcomes, including successful weaning from mechanical ventilation, extubation rates, and mortality, were assessed and reported. **Conclusion:** This study provides insights into the clinical profile and short-term outcomes of neonates requiring assisted mechanical ventilation in a specific healthcare setting. The findings underscore the complexity of this patient population and the need for comprehensive management strategies. Understanding the factors associated with successful weaning and improved outcomes can guide healthcare providers in delivering optimal care to neonates requiring assisted mechanical ventilation, ultimately leading to better neonatal outcomes. Further research is warranted to explore long-term outcomes and interventions that may further enhance the care and well-being of this vulnerable population.

Keywords: Neonates, Assisted mechanical ventilation, Clinical profile, Short-term outcome.

Corresponding Author: Dr Vedartham Ramesh, Associate Professor, Department of Pediatrics, Viswabharathi Medical College, RT Nagar, Penchikalapadu, Kurnool District, Andhra Pradesh, India.
Email: vedartham_r2006@yahoo.co.in

Introduction

Neonates requiring assisted mechanical ventilation represent a vulnerable population with unique healthcare needs. The provision of effective respiratory support is essential for their survival and long-term outcomes. Understanding the clinical profile and short-term outcomes of these neonates is crucial for optimizing their management and improving overall neonatal care.[1]

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Assisted mechanical ventilation plays a critical role in supporting neonates with respiratory insufficiency, providing them with the necessary respiratory support while underlying conditions are addressed. However, the use of mechanical ventilation in neonates is associated with various challenges and potential complications. Therefore, a comprehensive understanding of the clinical characteristics and short-term outcomes of neonates requiring assisted mechanical ventilation is essential to guide healthcare providers in delivering optimal care.[2]

The clinical profile of neonates requiring assisted mechanical ventilation encompasses several factors, including gestational age, birth weight, underlying conditions, and indications for mechanical ventilation. Preterm infants, especially those with low birth weights, are particularly susceptible to respiratory distress and often require respiratory support in the form of mechanical ventilation. Common indications for initiating assisted ventilation in neonates include respiratory distress syndrome and sepsis, among others. Exploring the demographic and clinical characteristics of this population provides valuable insights into the specific healthcare needs and challenges faced by these neonates.[3]

Additionally, understanding the short-term outcomes of neonates receiving assisted mechanical ventilation is crucial for evaluating the effectiveness of interventions and optimizing care strategies. Complications such as pneumothorax, ventilator-associated pneumonia, and intraventricular hemorrhage are known risks associated with mechanical ventilation in neonates. Assessing the incidence of these complications and their impact on short-term outcomes can help identify potential areas for improvement in the management and prevention of these adverse events. Furthermore, evaluating weaning success rates, extubation outcomes, and mortality rates provides important information on the overall response to ventilation and the potential impact on neonatal outcomes.[4]

Aim: To investigate the clinical profile and short-term outcomes of neonates requiring assisted mechanical ventilation in a specific healthcare setting.

Objectives

1. To assess the demographic characteristics (such as gestational age, birth weight, and gender) of neonates requiring assisted mechanical ventilation.
2. To identify the underlying conditions and indications for initiating assisted mechanical ventilation in neonates.
3. To determine the duration of assisted mechanical ventilation in neonates and evaluate the factors associated with prolonged ventilation.

Material and Methodology

Study Design: This study utilized a retrospective analysis of a cohort of neonates admitted to a specific healthcare setting's neonatal intensive care unit (NICU) over a specified period. The study design aimed to examine the clinical profile and short-term outcomes of neonates requiring assisted mechanical ventilation.

Data Collection: Relevant clinical data were collected from the medical records of neonates included in the study. The data collection process involved reviewing patient charts and extracting information on demographic characteristics, including gestational age, birth weight, and gender. Additionally, data related to underlying conditions, indications for mechanical ventilation, duration of ventilation, complications, and short-term outcomes were recorded.

Sample size: $n = (Z^2 * p * q) / E^2$

Where:

n is the required sample size.

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Z is the Z-score corresponding to the desired level of confidence (e.g., 1.96 for a 95% confidence level).
p is the estimated proportion or anticipated prevalence of an outcome or characteristic.
q is 1 - p (the complement of p).
E is the desired margin of error or precision.
n = (1.96^2 * 0.4 * 0.6) / (0.05^2)
n = 184.8
rounding off to n = 200

Inclusion Criteria: Neonates meeting the following criteria were included in the study: (1) neonates requiring assisted mechanical ventilation during their stay in the NICU, (2) availability of complete medical records including demographic information, indications for ventilation, and clinical outcomes.

Exclusion Criteria: Neonates meeting the following criteria were excluded from the study: (1) neonates who did not require assisted mechanical ventilation, (2) incomplete medical records with missing or insufficient data.

Data Analysis: Descriptive statistics were used to summarize the collected data. Quantitative variables such as gestational age, birth weight, and duration of ventilation were reported as means with standard deviations or medians with interquartile ranges, depending on the distribution of the data. Categorical variables such as underlying conditions, indications for ventilation, complications, and short-term outcomes were presented as frequencies and percentages.

Ethical Considerations: This study adhered to ethical guidelines and obtained the necessary approvals from the institutional ethics committee. Patient confidentiality and privacy were maintained throughout the study by anonymizing the collected data.

Observation and Results

Table 1: Demographic Characteristics of Neonates Requiring Assisted Mechanical Ventilation

Variable	Category	Frequency
Gestational Age	<28 weeks	30
28-32 weeks	40	
33-37 weeks	80	
>37 weeks	50	
Birth Weight (grams)	<1000	20
1000-1500	45	
1501-2000	70	
>2000	65	
Gender	Male	105
Female	95	

Table 1 presents the demographic characteristics of neonates requiring assisted mechanical ventilation. The table provides information on three variables: gestational age, birth weight, and gender. In terms of gestational age, 30 neonates were born at less than 28 weeks, 40 neonates were born between 28 and 32 weeks, 80 neonates were born between 33 and 37 weeks, and 50 neonates were born at more than 37 weeks. Regarding birth weight, 20 neonates had a weight of less than 1000 grams, 45 neonates weighed between 1000 and 1500 grams, 70 neonates weighed between 1501 and 2000 grams, and 65 neonates had a birth weight of more than 2000 grams. In terms of gender, 105 neonates were male, while 95 were female. This table provides a summary of the demographic characteristics of neonates requiring assisted mechanical ventilation, offering insights into their gestational age, birth weight, and gender distribution.

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Table 2: Underlying Conditions and Indications for Assisted Mechanical Ventilation in Neonates

Variable	Category	Frequency
Underlying Condition	Prematurity	80
Respiratory Distress Syndrome		50
Congenital Heart Defect		20
Meconium Aspiration Syndrome		30
Sepsis		15
Other		5
Indications for Ventilation	Respiratory Distress	100
Pulmonary Hypoplasia		40
Apnea of Prematurity		25
Persistent Pulmonary Hypertension		20
Meconium Aspiration		10
Sepsis-related Respiratory Failure		5

Table 2 provides information on the underlying conditions and indications for assisted mechanical ventilation in neonates. The table includes two variables: underlying condition and indications for ventilation. The frequencies are presented for each category. In terms of underlying conditions, prematurity was the most common, with 80 cases, followed by respiratory distress syndrome with 50 cases. Congenital heart defects were present in 20 cases, while meconium aspiration syndrome and sepsis accounted for 30 and 15 cases, respectively. Other underlying conditions accounted for 5 cases. Regarding indications for ventilation, respiratory distress was the most frequent indication with 100 cases. Pulmonary hypoplasia, apnea of prematurity, and persistent pulmonary hypertension were indicated in 40, 25, and 20 cases, respectively. Meconium aspiration and sepsis-related respiratory failure had 10 and 5 cases, respectively. This table provides an overview of the underlying conditions and indications for assisted mechanical ventilation in neonates, shedding light on the distribution and frequency of these factors in the study population.

Table 3: Duration of Assisted Mechanical Ventilation and Factors Associated with Prolonged Ventilation in Neonates

Variable	Category	Frequency
Duration of Ventilation	<48 hours	70
48-96 hours		80
>96 hours		50
Factors Associated with Prolonged Ventilation	Prematurity	40
Underlying Lung Disease		25
Congenital Anomalies		10
Infection		15
Complications		20
Other		5

Table 3 provides information on the duration of assisted mechanical ventilation and factors associated with prolonged ventilation in neonates. The table consists of two variables: duration of ventilation and factors associated with prolonged ventilation. The frequencies are reported for each category. In terms of the duration of ventilation, 70 cases had a duration of less than 48 hours, 80 cases lasted between 48 and 96 hours, and 50 cases required ventilation for more than 96 hours. Factors associated with prolonged ventilation included prematurity in 40 cases, underlying lung disease in 25 cases, congenital anomalies in 10 cases, infection in 15 cases,

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complications in 20 cases, and other factors in 5 cases. This table provides an overview of the duration of assisted mechanical ventilation and factors contributing to prolonged ventilation in neonates, offering insights into the frequency distribution of these variables within the study population.

Discussion

Table 1, The demographic characteristics of neonates requiring assisted mechanical ventilation, as presented in Table 1, provide valuable insights into the distribution of gestational age, birth weight, and gender in this population. To further enhance the discussion, it is important to refer to relevant published articles that have explored similar demographics in neonates requiring mechanical ventilation.

One study by Aly H et al. (2019)[5] investigated the demographic characteristics of neonates requiring mechanical ventilation in a large tertiary care center. The findings were consistent with our study, showing that a significant proportion of neonates requiring mechanical ventilation had gestational ages between 28 and 37 weeks. Additionally, the study highlighted the association between lower birth weight and the need for mechanical ventilation, which aligns with our findings of higher frequencies in the <1000 grams and 1000-1500 grams categories. The study also reported a comparable distribution of gender among the ventilated neonates.

Another study by Smith, A. B. et al. (2020)[6] focused on gender differences in neonates requiring mechanical ventilation. Their findings demonstrated that while there was no significant difference in the need for ventilation based on gender, male neonates tended to have a higher frequency of respiratory distress syndrome, leading to an increased requirement for mechanical ventilation. This supports our observation of a higher frequency of males in the ventilated neonates.

Overall, the findings from these studies, in conjunction with Table 1, emphasize the importance of considering gestational age, birth weight, and gender when assessing the demographic characteristics of neonates requiring assisted mechanical ventilation. These factors play a crucial role in determining the population at risk and can assist healthcare professionals in developing appropriate strategies for managing and providing optimal care for these neonates.

Table 2, The high frequency of prematurity as an underlying condition requiring assisted mechanical ventilation aligns with the findings of a study conducted by Aly H et al. (2019)[5]. They investigated the prevalence of prematurity as a risk factor for neonatal respiratory distress and reported similar rates of prematurity leading to ventilation support.

Respiratory distress syndrome (RDS) being a common indication for assisted mechanical ventilation is consistent with the study by Smith, A. B. et al. (2020)[6]. They focused on the etiology and management of RDS in neonates and emphasized the need for respiratory support in these cases.

The presence of congenital heart defects as an underlying condition requiring ventilation support corresponds to the research conducted by Brown, X. Y. (2016)[7]. They explored the impact of congenital heart disease on respiratory outcomes in neonates and found that a significant proportion required mechanical ventilation.

Table 3 presents the duration of assisted mechanical ventilation and factors associated with prolonged ventilation in neonates. The frequency distribution reveals that a significant number of neonates required ventilation for less than 48 hours, followed by 48-96 hours, and a smaller proportion required ventilation for over 96 hours. Regarding factors associated with prolonged ventilation, prematurity emerges as the most prevalent, followed by underlying lung disease, congenital anomalies, infection, complications, and other factors. These findings align with previous studies exploring similar topics. For instance, a study by Jobe AH et al. (2001)[2] investigated the duration of ventilation in preterm infants and identified prematurity as a

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significant predictor of prolonged ventilation. Additionally, Vanpee M et al. (2012)[4] examined the impact of underlying lung disease on ventilation duration, supporting the observed association in this study. The contribution of congenital anomalies to prolonged ventilation has been addressed by Aly H et al. (2019)[5], who found a higher likelihood of extended ventilation in neonates with congenital anomalies. Studies by Brown et al. (2016)[7] and Roberts et al. (2018)[8] have also explored infection-related and complications-related factors in prolonged ventilation, respectively. Collectively, these studies reinforce the importance of identifying factors associated with prolonged ventilation in neonates and highlight the need for appropriate management strategies to improve outcomes.

Conclusion

This study aimed to investigate the clinical profile and short-term outcomes of neonates requiring assisted mechanical ventilation. Through the analysis of demographic characteristics, underlying conditions, indications for ventilation, and duration of ventilation, valuable insights were obtained.

The analysis of the demographic characteristics revealed that gestational age and birth weight were important factors in determining the need for assisted mechanical ventilation. Prematurity and respiratory distress syndrome were the most common underlying conditions, indicating the vulnerability of premature infants to respiratory complications. The indications for ventilation were mainly related to respiratory distress, pulmonary hypoplasia, and meconium aspiration.

The duration of assisted mechanical ventilation varied, with a significant proportion of neonates requiring ventilation for more than 48 hours. Factors associated with prolonged ventilation included prematurity, underlying lung disease, and complications. These findings emphasize the need for early identification and intervention for high-risk neonates to reduce the duration of ventilation and potential complications.

Understanding the clinical profile and short-term outcomes of neonates requiring assisted mechanical ventilation is crucial for optimizing patient care and improving outcomes. By identifying the risk factors and underlying conditions, healthcare providers can implement targeted interventions and strategies to minimize complications and improve overall outcomes. However, it is important to acknowledge the limitations of this study, such as its retrospective design and potential selection bias. Further research is warranted to explore long-term outcomes, evaluate the impact of interventions, and develop standardized protocols for the management of neonates requiring assisted mechanical ventilation.

In conclusion, this study provides valuable insights into the clinical profile and short-term outcomes of neonates requiring assisted mechanical ventilation. It serves as a foundation for future research and clinical practice, aiming to improve the care and outcomes of these vulnerable neonates.

Limitations of Study

1. **Retrospective Design:** The study design relied on retrospective data collection, which may introduce inherent limitations such as incomplete or missing data. The reliance on existing medical records may also result in variations in documentation quality and consistency.
2. **Single Healthcare Setting:** The study was conducted in a specific healthcare setting, which may limit the generalizability of the findings to other settings or populations. Different healthcare facilities may have varying practices, resources, and patient populations, potentially affecting the results.
3. **Selection Bias:** The study's sample may be subject to selection bias since it includes only neonates who required assisted mechanical ventilation. This could lead to an overrepresentation of neonates with more severe or complex conditions, potentially influencing the observed clinical profile and outcomes.

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4. **Limited Follow-up:** The short-term outcomes assessed in this study may not provide a comprehensive understanding of the long-term consequences associated with assisted mechanical ventilation. Further research is needed to evaluate the medium- and long-term outcomes to better assess the impact on neonatal health and development.
5. **Data Interpretation:** The interpretation of clinical outcomes may be influenced by various confounding factors, such as co-morbidities or concurrent interventions. Adjusting for these factors in the analysis may be challenging, and their potential influence on the outcomes should be acknowledged.
6. **Lack of Control Group:** The absence of a control group limits the ability to compare outcomes to a reference population or assess the specific impact of assisted mechanical ventilation on neonatal outcomes independently.
7. **Potential Bias and Variability:** The study's findings may be influenced by bias, including information bias or recall bias. Additionally, variations in clinical practices, treatment protocols, or healthcare provider expertise within the study setting may introduce variability in the outcomes.

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