ORIGINAL RESEARCH

Complications & Outcome of Ventilated Young Infants at a Tertiary Care PICU

¹Dr. Vineeta Awasthi, ²Dr. Devendra Kumar

¹Assistant Professor, Department of Obst. & Gynae, Naraina Medical College and Research Centre, Kanpur, India

²Assistant Professor, Department of Paediatrics, Naraina Medical College and Research Centre, Kanpur, India

Corresponding Author

Dr. Devendra Kumar

Assistant Professor, Department of Paediatrics, Naraina Medical College and Research Centre, Kanpur, India

Received Date: 25 August, 2024

Accepted Date: 27 September, 2024

ABSTRACT

Background: Mechanical ventilation, a lifesaving technique in critical care unit is under continual evolution in modern era. The care of children with invasive ventilation in poor nations with limited resources is tough. The purpose of the study is to find out complications & outcome of critically ill ventilated young infants up to 2 months age treated in Intensive Care Unit in a tertiary care hospital in India. Material & Methods: This observational study was conducted in the Department of Intensive Care Unit of SGRR Institute of Medical Sciences, Dehradun from January 2020 to December 2020. About 50 newborn infants up to 2 months age who required ventilation on various indications according to ICU protocol were the subject of this study. All newborns were monitored for problems which was found by daily clinical & radiological assessment. Patient was followed up to death or extubation. Moreover, they were extubated when clinically stable both haemodynamically & neurologically. Results: Out of 50 seriously ill patients, mortality rate was 74%. Mean age was 14±10.1 days, 84% patients were >34 weeks of gestational age and weight >2500 gm was 52%. Twenty (40%) patients suffered complication during ventilation & these were ET tube obstructed 35%, re-intubation 20% and VAP 15%, pneumothorax 15%, unintentional extubation 15% accordingly. Regarding outcome, in 34% patients, the duration of ventilation was more than 5 days, 62% patients stayed in ICU more than 7 days. However, approximately three fourth (74%) patients were dead and just 26% were survived within the study time. Conclusion: The prevalence of mortality in the ICU was high. Prolong ventilation (>5days) was key risk factor. Ventilator related problems developed in 40% individuals.

Keywords: Mechanical ventilation, Intensive Care Unit, Young infants, Complications.

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

INTRODUCTION

Paediatric intensive care medical service is now on an advancing stage in India.[1] The percentage of children using mechanical ventilation in intensive care units from 17-64% affluent ranges in countries.[2.3.4.5] Mechanical ventilation is becoming widespread in PICUs throughout the world as a central strategy, not only in the management of patients with acute and chronic respiratory failure but also as an adjuvant therapy of patients with normal healthy lungs e.g. patient with neurological disease or following general anaesthesia for elective procedures and operation.[6] It is used to cut down labor of breathing to lessen the overall metabolic activity in the body e.g. heart problems and circulatory failure. Despite major breakthroughs in ventilatory support, it is associated with high mortality and significant degradation in the patient's quality of life in PICU settings.[7,8,9] The mortality rates of mechanically ventilated children differed in different research, as like Shaukat et al,[10] & Kendiril et al,[11] reported 63% and 58.3% survival rate of mechanically ventilated children from Pakistan and Turkey respectively.

Singhal et al,[12] and Jeena et al,[13] observed a mortality rate of 18-35%. Hossain et al.[1] observed 70.6% mortality among critically sick ventilated newborns at India Shishu Hospital. Gosh et al,[14] found 13% to 55% mortality owing to ventilator related pneumonia. Several reports cite respiratory failure owing to respiratory diseases as most common reason for mechanical ventilation in paediatric patient as well as early infants up o 2 months age.[2,11,15] Age, weight clinical condition along with severity of disease has some influence on result of mechanical ventilation. Longer length of PICU stay and invasive treatments has led to an increase of nosocomial infection and high mortality with respiratory illnesses.[11,16] The management of newborn infants with invasive ventilation in India with inadequate

resources is challenging day by day. To enhance the outcome of mechanically ventilated children in PICUs, we require effective, planned and structured educational courses from basic concept to practical application for all physicians and nurses involved in the care of critically sick children undergoing mechanical ventilation. Keeping this in view and working under such circumstances, we design this study to find out the problems & it's association with outcome among critically ill ventilated young infants admitted into Intensive Care Unit in a tertiary care hospital in India.

OBJECTIVES

To investigate the problems and prognosis among ventilated young infant patients.

MATERIAL AND METHODS

The study was done out on patients who required ventilation on various indications according to ICU procedure after getting informed written consent from the patient's guardian/attendant. Fifty young infants up to 2 months age consecutively put on mechanical breathing during the study period were enrolled. Informed written consent was taken confidentially from all patients who fulfilled the inclusion and exclusion criteria. Infants greater than 2 months age, with congenital cardiac disease, congenital abnormalities & requiring surgical intervention were excluded from this study. Permission from ethical review committee of the hospital was taken. ABG, chest X-ray & other required studies done before ventilation were documented. Young infants were monitored Respiratory clinically (Heart rate. rate. Temperature, CRT) combined with regular cardiac monitor and pulse Oximetry. The starting

parameter (Rate, PIP, PEEP, FiO2 Inspiratory time) was set according to demand of patients condition and adjusted according to clinical factors, chest Xray and ABG. Sedation was applied if indicated. After 2 hours of ventilation ABG was done to modify the parameters. Then successive parameters (PIP, PEEP, Rate of ventilation, FiO2) on mechanical ventilation were varied according to necessity of oxygenation and ventilation through SpO2 and blood gas analysis. Along with this, biochemical (Serum Electrolytes, Creatinine, Urea, CRP, Random blood sugar) and haematological profiles were evaluated according to patient's clinical status. All newborns were monitored for problems. Pneumothorax was discovered by daily clinical assessment & when suspected confirmed by chest radiography. VAP was identified when breathing more than 48 hours with fresh & persistent infiltration on chest X-ray. Patients were clinically extubated when stable hoth haemodynamically & neurologically, having selfrespiration, sustaining oxygen saturation, normal chest X- ray & with low ventilator settings or after gradual weaning. Patient was followed up to death or extubation. All the data were collected by avoid mistakes. After researcher herself to collection, data editing and clearing was done manually and prepared for data entry and analysis by using SPSS-25 & MS Excel-2016.

RESULTS

Among the study population 44 (62.8%) patients were belonged to age \leq 15 days, gestational age>34 weeks was found in 52(74.2%) patients. Among them 34(48.5%) patients were>2500gm. Majority patients were male patients 36(51.4%) in death group and 15(74.2%) in survival group [Table 1].

 Table 1: Demographical characteristics of the study patients (N=70).

| Characteristics | Ν | % | | |
|-------------------------|--------|------|--|--|
| Age(days) | | | | |
| ≤15 | 44 | 62.8 | | |
| 16-30 | 13 | 18.5 | | |
| 31-45 | 8 | 11.4 | | |
| >45 | 5 | 7.1 | | |
| Mean±SD | 15±9.2 | | | |
| Gestational age (weeks) | | | | |
| <34 | 18 | 25.7 | | |
| >34 | 52 | 74.2 | | |
| Weight(gm) | | | | |
| <2500 | 34 | 48.5 | | |
| >2500 | 36 | 51.4 | | |
| Gender | | | | |
| Male | 42 | 60.0 | | |
| Female | 28 | 40.0 | | |
| Ratio | 1.78:1 | | | |

Most of the patients 28(40%) had sepsis, 23(32.8%) patients were low birth weight (LBW), 22(31.4%) had perinatal asphyxia with HIE, 14(20%) has pneumonia, 13(18.5%) were preterm. The rest number of patients had some other d i s e a s e l i k e R D S , I D M , m e c o n i u m aspiration syndrome, NMD, shock,

hyponatremia, perinatal asphyxia, laryngomalacia, meningitis, jaundice respectively[Table-2].

Table 2: Disease pattern in study patients (N=70)

| Disease | Ν | % |
|------------------------------|----|------|
| Jaundice | 2 | 2.8 |
| Meningitis | 2 | 2.8 |
| Laryngomalacia | 9 | 12.8 |
| Hyponatremia | 9 | 12.8 |
| Shock | 4 | 5.7 |
| NMD | 4 | 5.7 |
| Meconium Aspiration Syndrome | 4 | 5.7 |
| IDM | 5 | 7.1 |
| RDS | 5 | 7.1 |
| Perinatal asphyxia | 8 | 11.4 |
| Pneumonia | 14 | 20.0 |
| Preterm | 13 | 18.5 |
| Perinatal asphyxia with HIE | 22 | 31.4 |
| Sepsis | 28 | 40.0 |
| LBW | 23 | 32.8 |

21(44.6%) patients were found duration of ventilation >5 days in death group and 6(26.0%) in survival group. Significant relation was found between the ventilated patients having duration of ventilation and outcome [p=0.05, OR=10.11(2.0745-78.804)];[Table3].

| Ī | Duration of | Death (n=47) | Survival (n=23) | Odds ratio(95% CI) | P value |
|---|-------------------|--------------|-----------------|----------------------|---------|
| | ventilation(days) | n (%) | n (%) | | |
| | >5 | 21 (44.6) | 6(26.0) | 10.11(2.0745-78.804) | 0.05 |
| | <5 | 26 (55.3) | 17 (74.9) | | |

30(63.8%) patients were found duration of ICU stay >7 days in death group and 11(47.8%) in survival group. The difference was not statistically significant (p>0.05) between two groups [Table 4].

| Duration of | Death (n=47) | Survival (n=23) | Odds ratio (95%CI) | P value |
|----------------|--------------|-----------------|--------------------|---------|
| ICU stay(days) | n (%) | n (%) | | |
| >7 | 30 (63.8) | 11(47.8) | 3.44(0.67-9.823) | 0.178 |
| <7 | 17 (36.1) | 12(52.1) | | |

DISCUSSION

The study demonstrated significant mortality which is attributable to many of the ill neonates was ventilated as a last attempt at the eleventh hours of life. As all the neonates were out born. High case fatality of ventilated neonates may also be influenced by the damages that already occurred in utero or at birth or during transport to Intensive Care Unit. A total 50 patients were recruited for the investigation. Maximum 35(68%) patients were belonged to age \leq 15 days, gestational age >34 was detected largest number 42(84%) patients. Similar result obtained by Hossain et al.[1] Most of them 20(54.1%) patients were >2500gm. Majority patients were male. Male female ratio was 1.78:1. We observed, 17(34%) patients had length of ventilation >5 days, 31(62%)patients were detected with duration of ICU stay >7 days. Similarly, a study reported almost half of the patients stayed more than 7 days in the PICU and hospital setting (69.5% and 44.7%).[17] However, over three fourth 37(74%) patients were died and only 13(26.0%) were survived within the study period.

Hossain et al,[1] in India showed 75.5% mortality and Mathur et al,[18] in India found 74% mortality among the ventilated neonate. In this study among the ventilated infants 86% were neonates and they were out born. In industrialized countries overall mortality were less than 2%.[2] In fact, mortality depends on the case mix, expertise of the workers, hygiene of the environment, facilities and equipment, infrastructure, and the economic policies of the country.[19] Disease pattern for which the infants were moved to ICU and subsequently needed mechanical ventilation were 26(52%) patients had sepsis, 21(42%) patients were low birth weight (LBW), 20(40%) had perinatal asphysia with HIE, 12(24%) has pneumonia, 11(22%) were preterm. The rest number of patients had several other diseases including RDS. IDM, meconium aspiration syndrome, NMD, shock, hyponatremia perinatal hypoxia, laryngomalacia, meningitis, jaundice correspondingly. Mortality in the study carried out by Hossain et al,[1] low birth weight (54.1%) is smaller, newborn sepsis (56.8%) is greater and perinatal

asphyxia (13.5%) is lower than the study. Kulkarni et al. observed impending respiratory failure (34.7%) and respiratory distress with underlying pneumonia (26.08%) to be the main indication of ventilation in the study. Some ventilator related complications tracked in this study were ET tube obstructed, reintubation and VAP were greater in death group than whereas survival group pneumothorax and unintentional extubation lower in death group than survival group correspondingly. These were compared to lower rate found in Hossain et al,[1] & Mathur et al.[18] Special effort should be taken to reduce these preventable consequences. Ventilator linked pneumonia was present in a very low rate 8.1% in death group and 7.7% in survival group in this study. The study in Peru with 19.5% nosocomial infection largely consisted of VAP and UTI but reported nosocomial infections increased hospital stay and the mortality rate in PICU.[20,21,22] As reported in various reports, [23] resource admission encompassed internal and interhospital admission of patients was not connected to death. But in another investigation, the mortality was doubled among patients admitted from wards as compared with the emergency department patients. [24]

CONCLUSIONS

The prevalence of mortality in the ICU was high. Prolong ventilation (>5 days) was key risk factor. Ventilator related problems developed in 40% individuals. A satisfactory outcome involves regular monitoring of ventilator & biochemical parameters & attentive management of any anomalies.

REFERENCES

- Hossain MM, Shirin M, Mamun MAA, Hasan MNA, Sahidullah M. Predictors of mortality in ventilated neonates in Intensive Care Unit. India J Child Health.2009;33(3):77-2.
- Farias JA, Frutos F, Esteban A, Flores JC, Retta A, Baltodano A, et al. What is the daily practice of mechanical ventilation in paediatric intensive care units?IntensiveCareMed.2004;30(5):918-925.
- 3. Wolfler A, Calderoni E, Ottonello G, Conti G,Baroncini S, Santuz P, et al. Daily practice of mechanical ventilation in Italian paediatric intensive careunit.PediatrCritCareMed.2011;12(2):141-146.
- Randolph AG, Meert KL, O'Neil ME, Hanson JH, Luckett 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(10):1334-1340.
- 5. Khemani RG, Markovitz BP, Curley MAQ.Characteristicsofchildrenintubatedand mechanically ventilated in 16 PICUs. Chest. 2009;136(3):765-771. doi: 10.1378/chest.09-0207.
- Dave H, Kumar V, Tandon K, Tandon R. Mechanical Ventilation practices in a Paediatric Intensive Care Unitlocatedatruraltertiarycareteachinghospitalof Gujarat – A retrolective descriptive study. J Pediatr CritCare.2017;4(3):27-33.
- 7. Wilkinson JD, Pollack MM, Glass NL. Mortelity associated with multiple organ system failure and

sepsis in paediatric intensive care unit. J Paediatr. 1987;111:324-328.

- Khilnani P, Sarma D, Zimmerman J. Epidemiologyand peculiarities of pediatric multiple organ dysfunction syndrome in New Delhi, India. Intensive CareMed.2006;32(11):1856-62.doi:10.1007/s00134-006-0373-5.
- Bateman ST, Lacroix J, Boven K, Forbes P, Barton R, Thomas NJ, et al. Anemia, blood loss, and blood transfusions in North American children in the intensive care unit. Am J Respir Crit Care Med. 2008;178(1):26-33.doi:10.1164/rccm.200711-1637OC.
- Mukhtar B, Siddiqui NR, Haque A. Clinical Characteristics and Immediate-Outcome of Children Mechanically Ventilated in PICU of Pakistan. Pak J MedSci.2014;30(5):927-30.doi: 10.12669/pjms.305.5159.
- Kendirli T, Kavaz A, Yalaki Z, Oztürk Hişmi B, Derelli E, Ince E. Mechanical ventilation in children. Turk J Pediatr. 2006;48(4):323-7.
- Singhal D, Kumar N, Puliyel JM, Singh SK, Srinivas V. Prediction of mortality by application of PRISMscore

inintensivecareunit.IndianPediatr.2001;38(7):714-9.

- Jeena PM, Wesley AG, Coovadia HM. Admission patterns and outcomes in a paediatric intensive care unit in SouthAfrica over a25-yearperiod (1971-1995). Intensive Care Med. 1999;25(1):88-94. doi: 10.1007/s001340050792.
- HaqueA, AhmedSA, RafiqueZ, AbbasQ, Jurair H, Ali SA. Device-associated infections in a paediatric intensive care unit in Pakistan. J Hosp Infect. 2017;95(1):98-100. doi: 10.1016/j.jhin.2016.10.021.
- Harel Y, Niranjan V, Evans BJ. The current practice patterns of mechanical ventilation for respiratory failure in pediatric patients. Heart Lung.1998;27(4):238-44. doi: 10.1016/s0147-9563(98)90035-8.
- Angus DC, Linde-Zwirble WT, Lidicker J, Clermont G, Carcillo J, Pinsky MR. Epidemiology of severe sepsis in the United States: analysis of incidence, outcome, and associated costs of care. Crit Care Med. 2001;29(7):1303-10.doi:10.1097/00003246-200107000-00002.
- 17. Hajidavalu FS, Sadeghizadeh A. Mortality rate and risk factors in pediatric intensive care unit of Imam Hosse in Children's Hospital in Isfahan: Aprospective cross sectional study. Adv Biomed Res. 2023;12:92.
- Mathur NB, Garg P, Mishra TK. Predictors of fatality in neonates requiring mechanical ventilation. Indian Pediatr.2005;42:645-51.
- Abdelatif RG, Mohammed MM, Mahmoud RA, Bakheet MA, Gima M, Nakagawa S. Characterization and outcome of two pediatric intensive care units with different resources. Crit Care Res Pract. 2020;2020:5171790.
- 20. Kulkarni V, Manasa BM. A retrospective study on clinical profi le and outcome of respiratory cause of Ventilation in children with age group between I month To 5 Years in Pediatric intensive care unit of a tertiary centre hospital. J Pediatr Crit Care. 2017;4(2):28-3.
- 21. Petdachai W. Ventilator associated pneumonia in a newborn intensive care unit. Southeast Asian J Trop Med Public Health. 2004;35:724-29.
- 22. Becerra MR, Tantaleán JA, Suárez VJ, Alvarado MC, Candela JL, Urcia FC. Epidemiologic surveillance of

nosocomial infections in a Pediatric Intensive Care Unitofadevelopingcountry.BMCPediatr.2010;10:1 9.

- Solomon LJ, Naidoo KD, Appel I, Doedens LG, Green RJ, LongMA, et al. Pediatric index of mortality3—An evaluation of function among ICUs in South Africa. Pediatr Crit Care Med. 2021;22:813 21.
- 24. El Halal MG, Barbieri E, Filho RM, Trotta Ede A, Carvalho PR. Admission source and mortality in a pediatric intensive care unit. Indian J Crit Care Med. 2012;16(2):81-6.doi:10.4103/0972-5229.99114.
- 25. HP Singh, DC Shetty, A Kumar, R Chavan, DD Shori, J Mali. A molecular insight into the role of inflammation in the behavior and pathogenesis of odontogenic cysts. Annals of medical and health sciences research 3 (4), 523-528.