Original Article

Invasive Ventilation in NICU

To Share our Experience of Invasive Ventilation in NICU at Rehman Medical Institute, Peshawar- Pakistan

Abid Salahuddin, Anwar Zeb Jan, Shahzada Bakhtyar Zahid and Maria Aleem

ABSTRACT

Objective: Outcomes of neonatal invasive ventilation at Pediatric Unit - Rehman Medical Institute, Peshawar – Pakistan.

Study Design: Descriptive / cross sectional study

Place and Duration of Study: This study was conducted at the Neonatal ICU (NICU), Pediatric Unit Rehman Medical Institute from January 2015 to December 2016.

Materials and Methods: The total number of neonates ventilated during 2 years, were 45. All neonates ventilated were included in the study. Neonatal record of ventilated babies were taken from hospital data base.

Results: Out of 45 cases, 19 were premature babies, which contributed 12 % of the total neonatal admissions. Cases were described according to Spectrum of disease, duration of ventilation, and outcome based on risk factors and prematurity. 40 (89 %) were high risk cases with multiple co-morbidities. With the current approach, the results were variable. The variability can be due to the individual neonatal condition. In high risk cases 18 (45 %) cases were successfully extubated and discharged home. The rest 55 % cases met poor outcome because of multiple reasons, with prematurity being the most important cause. Among extreme preterm cases (ventilated) overall survival rate was 27.2%.

Conclusion: Prematurity, sepsis, MAS, HIE were the major indications for ventilation. However, early referral risk stratification, appropriate initiation of management and surfactant administration is associated with decrease mortality.

Key Words: Experience, Invasive ventilation, NICU, Outcome

Citation of articles: Salahuddin A, Jan AZ, Zahid SB, Aleem M. To Share our Experience of Invasive Ventilation in NICU at Rehman Medical Institute, Peshawar- Pakistan. Med Forum 2018;29(7):40-43.

INTRODUCTION

An estimated 15 million premature births were recorded according to national estimates of 184 countries in 2010.[1] Worldwide about 1 in 10 babies are born premature. Of these 15 million premature babies, about 1 million i.e. 1 in every 15 premature baby, die every year. The fact that prematurity is a leading cause of death in under 5, is true universal.[2] However, this situation is worse in low and middle income countries.[3] Pakistan stands eight in list of countries with highest rate of preterm births per 100 live births.[4]

Respiratory Distress Syndrome (RDS) is among one of top complications of prematurity and contributes significantly (21%) in respiratory complication after birth.[5,6] It is also a cause of major morbidities and mortality in premature babies.

Department of Pediatrics, Rehman Medical institute Peshawar.

Correspondence: Dr. Abid Salahuddin, Associate Professor of Pediatrics, Rehman Medical institute Peshawar.
Contact No: 03479345511
Email: abid.salahuddin@rmi.edu.pk

Received: January, 2018; Accepted: April, 2018

It not only causes respiratory compromise by itself but leads to other complications like cerebral hemorrhages, PDA, ROP etc.

The introduction of mechanical ventilation in the 1960s was one of the major new interventions in neonatology, which provided lifesaving support for infants with cardio respiratory failure. Along with other technologic advancements, such as administration of ante partum steroids, replacement of surfactant and continuous positive airway pressure (CPAP).[7] Mechanical ventilation has led to improved neonatal survival, especially for premature babies.[4]

Babies less than 32 weeks and especially 30 weeks gestation have (70-80) % chance of developing RDS. RDS has a natural course where it tends to get worse on 2nd to 3rd day before starts improving. However as this condition progresses, ventilation/perfusion (V/Q) mismatch worsens and it becomes difficult to reverse. That's why there is role of elective ventilation and many times surfactant administration electively. However though there is now increasing trend towards managing RDS non- invasively, invasive ventilation still remains an essential part of care in any NICU.[8]

The advent of surfactant therapy has decreased the morbidity and mortality from RDS by about 50%.[9] Infant mortality caused by RDS in the United Stated decreased from approx. 268 in 100,000 live births in

1985 to 17 in 100,000 live births in 2007.[4] Although preference is now on non-invasive modes of assisted ventilation as a primary support mechanism for premature babies. Invasive mechanical ventilation has its important role in INSURE approach as well as support for very sick babies. Earlier it was a standard practice to ventilate all babies less than 28 weeks and selected babies between 28 and 32 weeks. This is where insure comes in which include intubation - surfactant administration - extubation on to non-invasive means.

MATERIALS AND METHODS

This descriptive cross-sectional study was carried out at Neonatal ICU (NICU), Pediatric Unit Rehman Medical Institute from January 2015 to December 2016. A total of 45 neonates who were given invasive ventilation were included in the study. All neonates who were ventilated were included in the study. Neonatal record of ventilated babies were taken from hospital data base, admitted during the above mentioned time. 45 cases were collected and data were entered and analyzed using SPSS version 15.

RESULTS

Of the total admissions 196 (12%) babies were premature. Out of total admissions, 45(2.7 %) neonates were ventilated (Table 1). Out of 45 cases, 19 were premature babies, nearly 10 % of total premature admissions. Premature babies were further categorized according to their period of gestation and number in each category (Table 2). Nearly 42 % cases of ventilation were in premature babies. These were the babies with multiple co-morbidities which are all considered at high risk esp. when they are unwell enough to be ventilated. The other criteria that predispose a baby to high risk are; babies transferred in sub optimal conditions, those with congenital malformations, severe sepsis and babies with necrotizing enterocolitis, encephalopathy or with severe pneumonia. 40 (89 %) cases were high risk in our study. With the current approach, the results were variable. The variability can be due to the individual neonatal condition (Fig. 1). In high risk cases 18 (45 %) cases were successfully extubated and discharged home. The rest 55 % cases met poor outcome because of multitude of reasons. Half of all the cases were premature neonates.

Table No.1: Percentage of cases from within the hospital and referred cases (n=45)

Variable	No.	%
Within RMI cases from Obstetrical Unit	15	33.4
Referred Cases	30	66.6

All the cases in Medium risk category remained alive and were discharged. Out of 45 cases, 5 babies were ventilated for respiratory distress syndrome (RDS).

Table No.2: Frequency and percentage of preterm status of babies

Preterm status	Period of gestation	No. of cases (N = 19)
Late preterm	> 32 weeks	3 (15.7 %)
Very pre-term	28 – 32 weeks	5 (26.3 %)
Extreme pre-term	< 28 weeks	11 (57.8 %)

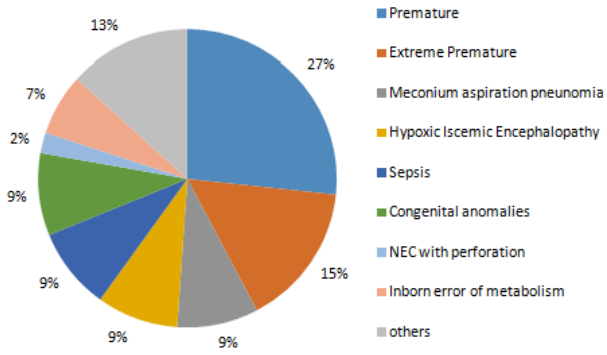

Figure No. 1: Spectrum of diseases in neonates who were ventilated.

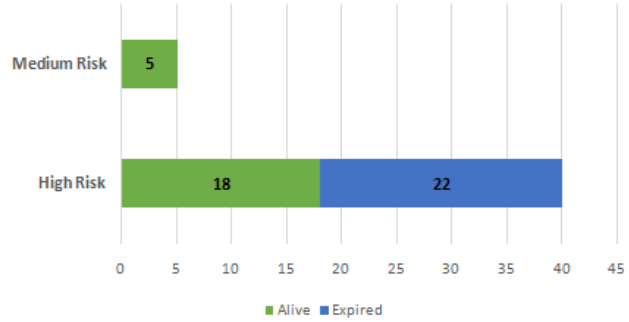

Figure No, 2: Outcome of risk in high and medium risk

Table No.3:Mortality in various premature babies

Preterm status	No. of cases (n=19)	No. of deaths	Cause
Late preterm >32 weeks	3 (15.7%)	1	IUGR and NEC
Very pre-term 28– 32 weeks	5 (26.3%)	2	Severe sepsis, DIC, IUGR & congenital heart diseases
Extreme pre-term <28 weeks	11 (57.8%)	8	Mostly sepsis, LBW and referred cases in sub optimal conditions

With 100 % survival rate, these babies were discharged without complications. As for duration of ventilation is concerned, for all the babies with good survival outcome. A total of 78 days of ventilation was done with mean of 4.5 days. While, in expired babies mean ventilation time was 2.7 days. In 22 expired cases, in 17 cases ventilator status was determined for PH and Oxygen saturation. Only 1 case showed signs of respiratory acidosis, while 5 had sub optimal oxygen saturation even with maximum ventilator support (Fig. 2). Half of all the cases were premature neonates (Table 3)

DISCUSSION

This study was done in a busy NICU of a tertiary care hospital where it has not only got its own high delivery rate but is also a referral center for the whole region. We had total 1639 admissions in study period of which our study group that is the ventilated babies in NICU is 45 (2.7%), among these 30 (66.6%) were referred from outside. In our study group we had babies with wide spectrum of diseases and having multiple morbidities.

In our study group 42% babies required ventilation primarily for Respiratory distress syndrome. This is comparable to the percentage given in the studies done in developing countries.[10,11] Disease pattern which we found interest of our patients is similar to what has been published in other studies i-e sepsis, meconium aspiration syndrome and hypoxic ischemic encephalopathy being on the top.[4,12]

As most of the babies have more than one morbidity especially when they are seriously ill is difficult to assess their survival for any one particular disease. So in order to check our outcome based on co-morbidities we grouped study population into Moderate and High Risk groups. Criteria for high risk group was already identified in Figure 1. Those babies which were electively ventilated for RDS and surfactant therapy were categorized as Moderate Risk group. When we compare this group with similar patients reported by the study done in Shifa hospital with the survival rate of 41% (52), our outcome was 100% although our number are very small i-e 11%.[5,13] As far as High Risk group is concerned we couldn't find any study done in developing countries presenting the survival outcome of patients similar to our High Risk group. However there is a study done on babies with meconium Aspiration Syndrome (both ventilated and non-ventilated) showing survival rate of 21%.[14] In our High Risk group we had survival rate of 45 %.

Association between low birth weight, prematurity and poor survival has been shown by many studies.[5,13,14] Among extreme preterm(ventilated) with weigh less than 1000gm. our overall survival rate was 27.2%. Outcome of these extreme low birth weight babies presented in other studies has been 5.9% (non-ventilated) and 14.28% (ventilated) respectively.[5,13] Moreover, neonates who survived did not develop complications related to ventilation, which is significant because other studies show that neonate who were ventilated developed complication like ateltctasis, pneuothorax, bronchopulmonary dysplasia and pulmonary haemorrhage.[15,16] Late preterm babies with the gestational age >32 weeks usually don't require ventilation unless they are very sick. In this group only one baby expired unfortunately after developing NEC with perforation. In the gestational age between 28-32 weeks among babies who expired one had severe sepsis and DIC while other had complex congenital heart disease.

Overall in premature group which include both Moderate and High Risk babies our survival rate is 42%. These results are encouraging keeping in view that neonatal ventilation was recently started in our unit.

Though we don't have a lot of numbers, we wanted to see how prepared we are for babies who require prolong ventilator support. Overall we have done about 78 days of ventilation in babies who survived as compared to 34.5 days, in babies who could not make it. On average there had been about 4.5 days of ventilation per patient.

Ventilation is a mechanism mainly to support breathing while babies overcome their other co-morbidities. Oxygen saturation and CO_2 levels can be considered as reliable indicator for effective ventilation.[10] Unfortunately we could get record of only 17 out of 22 babies (who expired). Out of 17 babies only one showed sign of respiratory acidosis, while 5 had oxygenation issues. So in majority of cases who died ventilatory support doesn't seems to be a major issue.

Success of ventilation or neonatal care as a whole is not just dependent on the equipment and expertise of that unit but involve almost a cultural change. Where ante-natal high risk babies are picked up and efforts are made to refer these mothers antenataly and deliver these babies in hospital with appropriate neonatal care.

We should have designated ambulances and trained transport staff, readily available. Parents are more educated and compliant with the treatment, and financial support should be available for those who cannot afford.

CONCLUSION

Prematurity, sepsis, MAS, HIE were the major indications for ventilation. However early referral appropriate initiation of management and surfactant administration is associated with decrease mortality. Risk stratification is as necessary as time in referral. Communication between primary health care units and tertiary care centers should be strong so that we can overcome the area where we lack behind. Even though our mortality is significantly higher than developed countries it is possible and strongly recommended to

start mechanical ventilation to reduce the neonatal mortality in developing countries with limited resources. We to move forward and develop our expertise in advance services like Nitric Oxide and ECMO. We also need to work on improving prenatal care and transport services.

Author's Contribution:

Concept & Design of Study:	Abid Salahuddin
Drafting:	Anwar Zeb Jan
Data Analysis:	Shahzada Bakhtyar Zahid, Maria Aleem
Revisiting Critically:	Anwar Zeb Jan, Abid Salahuddin
Final Approval of version:	Abid Salahuddin

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. Lee AC, Katz J, Blencowe H, Cousens S, Kozuki N, Vogel JP, et al. National and regional estimates of term and preterm babies born small for gestational age in 138 low-income and middle-income countries in 2010. Lancet Glob Health 2013;1(1):e26–36.
2. World Health Organization. Preterm birth [Internet]. [cited 2018 Jul 4]. Available from: http://www.who.int/news-room/fact-sheets/detail/preterm-birth
3. Lassi ZS, Middleton PF, Crowther C, Bhutta ZA. Interventions to Improve Neonatal Health and Later Survival: An Overview of Systematic Reviews. Bio Med 2015;2(8):985–1000.
4. Mannan MA, Jahan N, Iqbal S, Ferdous N, Dey S, Farhana T, et al. Short Term Outcome of Preterm Neonates Required Mechanical Ventilation. Chattagram Maa-O-Shishu Hosp Med Coll J 2017; 15(2):9–13.
5. Khan EA, Hashmey I. Surfactant use in premature neonates <37 weeks gestation: Experience and outcome at a tertiary care hospital. JPMA J Pak Med Assoc 2015;65(5):486–90.
6. Walsh BK, Daigle B, DiBlasi RM, Restrepo RD. AARC Clinical Practice Guideline. Surfactant Replacement Therapy: 2013. Respir Care 20131; 58(2):367–75.
7. Committee on fetus and newborn. Respiratory Support in Preterm Infants at Birth. Pediatr 2014;133(1):171–4.\
8. Dargaville PA, Aiyappan A, Cornelius A, Williams C, De Paoli AG. Preliminary evaluation of a new technique of minimally invasive surfactant therapy. Arch Dis Child - Fetal Neonatal Ed 2011;96: F243–8.
9. Polin RA, Carlo WA, Committee On Fetus And Newborn. Surfactant Replacement Therapy for Preterm and Term Neonates With Respiratory Distress. Pediatr 2014;133(1):156–63.
10. Khushdil A, Waqar T, Ahmed Z. Outcome of neonates ventilated in nicu of a tertiary care hospital and factors associated with poor outcome.
11. Iqbal Q, Younus MM, Ahmed A, Ahmad I, Iqbal J, Charoo BA, et al. Neonatal mechanical ventilation: Indications and outcome. Indian J Crit Care Med Peer-Rev Off Publ Indian Soc Crit Care Med 2015;19(9):523–7.
12. Malik FR, Amer K, Ullah M, Muhammad AS. Why our neonates are dying? Pattern and outcome of admissions to neonatal units of tertiary care hospitals in Peshawar from January, 2009 to December, 2011. JPMA J Pak Med Assoc 2016;66(1):40–4.
13. Hussain S, Tarar SH. Neonatal Mortality Of Low Birth Weight Neonates Born In A Tertiary Care Teaching Hospital In Pakistan. Malays J Paediatr Child Health 2017;21:25–35.
14. Anwar Z, Butt TK, Kazi MY. Mortality in meconium aspiration syndrome in hospitalized babies. J Coll Physicians Surg Pak 2011;21(11): 695–9.
15. Jeng M-J, Lee Y-S, Tsao P-C, Soong W-J. Neonatal air leak syndrome and the role of high-frequency ventilation in its prevention. J Chin Med Assoc 2012;75(11):551–9.
16. Torres-Castro C, Valle-Leal J, Martínez-Limón AJ, Lastra-Jiménez Z, Delgado-Bojórquez LC. Pulmonary complications associated with mechanical ventilation in neonates. Bol Méd Hosp Infant México Engl Ed 2016;73(5):318–24.