

## Complications & Outcome of Ventilated young infants upto 2 Months Age: Experience of a Tertiary Care Paediatric ICU

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### Abstract

**Background:** Mechanical ventilation, a lifesaving intervention in critical care unit is under continuous evolution in modern era. The management of children with invasive ventilation in developing countries with limited resources is challenging. The aim 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 Bangladesh. **Material & Methods:** This observational study was conducted in the Department of Intensive Care Unit of Bangladesh Shishu Hospital & Institute, Sher-e-Bangla Nagar, Dhaka; from January 2020 to December 2020. About 50 young infants up to 2 months age who required ventilation on various indications according to ICU protocol were the subject of this study. All infants were monitored for complications which was identified by daily clinical & radiological examination. Patient was followed up till death or extubation. Moreover, they were extubated when clinically stable both haemodynamically & neurologically. **Results:** Out of 50 critically 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 developed complication during ventilation & these were ET tube blocked 35%, re-intubation 20% and VAP 15%, pneumothorax 15%, accidental extubation 15% respectively. Regarding outcome, in 34% patients, the duration of ventilation was more than 5 days, 62% patients stayed in ICU more than 7 days. However, almost three fourth (74%) patients were dead and only 26% were survived during the study period. **Conclusion:** The prevalence of mortality in the ICU was high. Prolong ventilation (>5days) was important risk factor. Ventilator related complications developed in 40% patients.

Received: 23 May 2023

Revised: 07 July 2023

Accepted: 22 July 2023

Published: 31 August 2023

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

### INTRODUCTION

Paediatric intensive care medicine service is now on an advancing stage in Bangladesh.<sup>[1]</sup> The percentage of children receiving mechanical ventilation in intensive care units ranges from 17-64% in developed countries.<sup>[2,3,4,5]</sup> 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.<sup>[6]</sup> It is used to cut



down work of breathing to decrease the overall metabolic activity in the body e.g. cardiac conditions and circulatory failure. Despite significant advances in ventilatory support, it remains associated with high mortality and significant impairment in the patient's quality of life in PICU settings.<sup>[7,8,9]</sup> The mortality rates of mechanically ventilated children varied in different studies, as like Shaukat et al,<sup>[10]</sup> & Kendiril et al,<sup>[11]</sup> reported 63% and 58.3% survival rate of mechanically ventilated children from Pakistan and Turkey respectively. Singhal et al,<sup>[12]</sup> and Jeena et al,<sup>[13]</sup> observed a mortality rate of 18-35%. Hossain et al,<sup>[1]</sup> reported 70.6% mortality among critically ill ventilated neonates in Bangladesh Shishu Hospital. Gosh et al,<sup>[14]</sup> reported 13% to 55% mortality due to ventilator associated pneumonia. Several reports mention respiratory failure due to respiratory illnesses as most common reason for mechanical ventilation in paediatric patient as well as young infants upto 2 months age.<sup>[2,11,15]</sup> Age, weight clinical condition along with severity of illness has some influence on outcome of mechanical ventilation. Longer length of PICU stay and invasive procedures has led to an increase of nosocomial infection and high mortality with respiratory disorders.<sup>[11,16]</sup> The management of young infants with invasive ventilation in Bangladesh with limited resources is challenging day by day. To improve the outcome of mechanically ventilated children in PICUs, we need effective, organized and structured educational courses from basic concept to clinical application for all physicians and nurses involved in the care of critically ill children receiving mechanical ventilation. Keeping this in view and working under such circumstances, we design this study to find out

the complications & it's association with outcome among critically ill ventilated young infants admitted into Intensive Care Unit in a tertiary care hospital in Bangladesh.

## Objectives

To identify the complications and outcome among ventilated young infant patients.

## MATERIAL AND METHODS

This observational study was conducted in the Department of Intensive Care Unit of Bangladesh Shishu Hospital & Institute, Sher-e-Bangla Nagar, Dhaka from January 2020 to December 2020. The study was carried out on patients who required ventilation on various indications according to ICU protocol after taking informed written consent from the patient's guardian/attendant. Fifty young infants up to 2 months age consecutively put on mechanical ventilation during the study period were enrolled. Informed written consent was taken confidentially from all patients who fulfilled the inclusion and exclusion criteria. Infants more than 2 months age, with congenital heart disease, congenital malformations & requiring surgical intervention were excluded from this study. Permission from ethical review committee of the hospital was taken. ABG, chest X-ray & other necessary investigations done before ventilation were recorded. Young infants were monitored clinically (Heart rate, Respiratory rate, Temperature, CRT) along with regular cardiac monitor and pulse Oximetry. The initial parameter (Rate, PIP, PEEP, FiO<sub>2</sub> Inspiratory time) was set according to need of patients condition and adjusted according to clinical variables, chest X-ray and ABG. Sedation was applied if indicated. After 2 hours

of ventilation ABG was done to adjust the parameters. Then subsequent parameters (PIP, PEEP, Rate of ventilation,  $FiO_2$ ) on mechanical ventilation were modified according to need of oxygenation and ventilation through  $SpO_2$  and blood gas analysis. Along with this, biochemical (Serum Electrolytes, Creatinine, Urea, CRP, Random blood sugar) and haematological profiles were checked according to patient's clinical condition. All infants were monitored for complications. Pneumothorax was identified by daily clinical examination & when suspected confirmed by chest radiographs. VAP was diagnosed when ventilation more than 48 hours with new & persistent infiltrate on chest X-ray. Patients were extubated when clinically stable both haemodynamically & neurologically, having self-respiration, maintaining oxygen saturation, normal chest X-ray & with low ventilator parameters or after gradual weaning. Patient was followed up till death or extubation. All the data were collected by researcher herself to avoid errors. After 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 35(68%) patients were belonged to age  $\leq 15$  days, gestational age  $> 34$  weeks was found in 42(84%) patients. Among them 20(54.1%) patients were  $> 2500$  gm. Majority patients were male patients 22(59.5%) in death group and 10(76.9%) in survival group [Table 1]. Most of the patients 26(52%) had sepsis, 21(42%) patients were low birth weight (LBW), 20(40%) had perinatal asphyxia with HIE, 12(24%) has pneumonia, 11(22%) were preterm. The rest number of patients had some other disease like RDS, IDM, meconium

aspiration syndrome, NMD, shock, hyponatremia, perinatal asphyxia, laryngomalacia, meningitis, jaundice respectively [Table-2]. Almost three fourth 37(74%) patients were dead and only 13(26.0%) were survived during the study period [Figure 1]. In the observation of ventilator related complications of the study patients, we found complications during ventilation in 20(40%) patients [Figure 2]. Some ventilator related complications followed in this study which were ET tube blocked, re-intubation and VAP were higher in death group than survival group but pneumothorax and accidental extubation lower in death group than survival group respectively [Figure 3]. 16(43.2%) patients were found duration of ventilation  $> 5$  days in death group and 1(7.7%) in survival group. Significant relation was found between the ventilated patients having duration of ventilation and outcome [ $p=0.04$ ,  $OR=9.14(1.0744-77.803)$ ]; [Table 3]. 25(67.6%) patients were found duration of ICU stay  $> 7$  days in death group and 6(46.2%) in survival group. The difference was not statistically significant ( $p>0.05$ ) between two groups [Table 4].

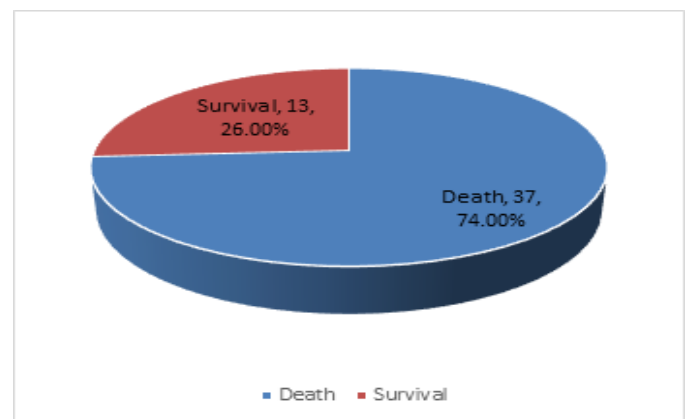
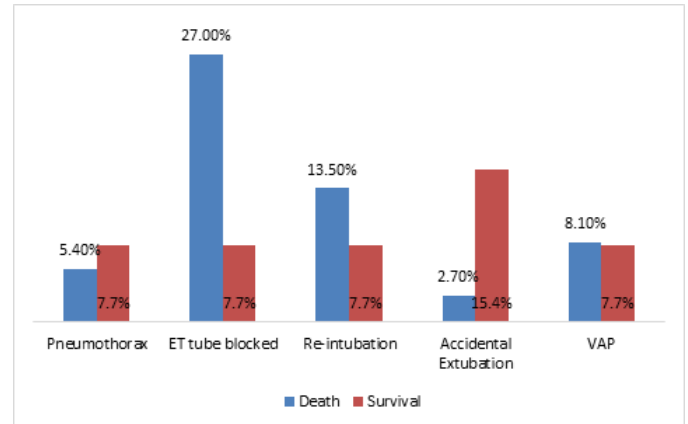
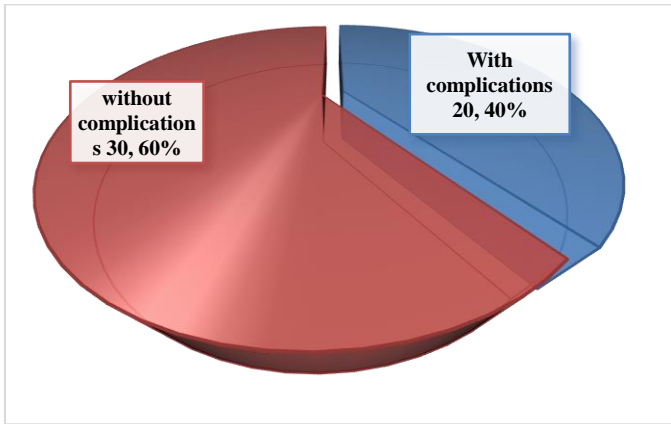


Figure 1: Outcomes of the study patients (N=50)



**Figure 2:** Observation of ventilator related complications of the study patients (N=50)

**Figure 3:** Ventilator related complications of the study patients(N=50)

**Table 1:** Demographical characteristics of the study patients(N=50).

Characteristics	n	%
Age (days)		
≤15	34	68.00
16-30	9	18.00
31-45	5	10.00
>45	2	4.00
Mean ± SD	14±10.1	
Gestational age (weeks)		
<34	8	16.00
>34	42	84.00
Weight (gm)		
<2500	24	48.00
>2500	26	52.00
Gender		
Male	32	64.00
Female	18	36.00
Ratio	1.78:1	

**Table 2:** Disease pattern in study patients (N=50)

Disease	n	%
Jaundice	1	2.00
Meningitis	1	2.00
Laryngomalacia	8	16.00
Hyponatremia	8	16.00
Shock	3	6.00

NMD	3	6.00
Meconium Aspiration Syndrome	3	6.00
IDM	4	8.00
RDS	4	8.00
Perinatal asphyxia	7	14.00
Pneumonia	12	24.00
Preterm	11	22.00
Perinatal asphyxia with HIE	20	40.00
Sepsis	26	52.00
LBW	21	42.00

**Table 3:** Relation between duration of ventilation and outcome (n=50)

Duration of ventilation (days)	Death (n=37)	Survival (n=13)	Odds ratio (95% CI)	P value
	n (%)	n (%)		
>5	16 (43.2)	1 (7.7)	9.14(1.0744- 77.803)	0.04
<5	21 (56.8)	12 (92.3)		

**Table 4:** Relation between duration of ICU stay and outcome (n=50)

Duration of ICU stay (days)	Death (n=37)	Survival (n=13)	Odds ratio (95% CI)	P value
	n (%)	n (%)		
>7	25 (67.6)	6 (46.2)	2.43 (0.66-8.82)	0.177
<7	12 (32.4)	7 (53.8)		

## DISCUSSION

The study showed high mortality which is due to many of the sick neonates were 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 contributed by the damages that already occurred in utero or at birth or during transport to Intensive Care Unit. A total 50 patients were selected for the study. Maximum 35(68%) patients were belonged to age  $\leq 15$  days, gestational age  $>34$  was found highest number 42(84%) patients. Similar result obtained by Hossain et al.<sup>[1]</sup> Most of them 20(54.1%) patients were  $>2500$ gm. Majority patients were male. Male female ratio was 1.78:1. We observed, 17(34%) patients had duration of ventilation  $>5$  days, 31(62%)

patients were found with duration of ICU stay  $>7$  days. Similarly, a study observed about half of the patients stayed more than 7 days in the PICU and hospital setting (69.5% and 44.7%).<sup>[17]</sup> However, almost three fourth 37(74%) patients were death and only 13(26.0%) were survived during the study period. Hossain et al,<sup>[1]</sup> in Bangladesh found 75.5% mortality and Mathur et al,<sup>[18]</sup> 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 developed countries overall mortality were less than 2%.<sup>[2]</sup> In actual, mortality depends on the case mix, expertise of the personnel, hygiene of the environment, facilities and equipment, infrastructure, and the economic policies of the country.<sup>[19]</sup>



Disease pattern for which the infants were transferred 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 asphyxia with HIE, 12(24%) has pneumonia, 11(22%) were preterm. The rest number of patients had some other diseases like RDS, IDM, meconium aspiration syndrome, NMD, shock, hyponatremia perinatal asphyxia, laryngomalacia, meningitis, jaundice respectively. Mortality in the study carried out by Hossain et al,<sup>[1]</sup> low birth weight (54.1%) is smaller, neonatal sepsis (56.8%) is higher 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 commonest indication of ventilation in the study. Some ventilator related complications followed in this study were ET tube blocked, re-intubation and VAP were higher in death group than survival group but pneumothorax and accidental extubation lower in death group than survival group respectively. These were compared to lower rate found in Hossain et al,<sup>[1]</sup> & Mathur et al.<sup>[18]</sup> Special attention should be given to reduce these preventable complications. Ventilator associated pneumonia was present in a very low rate 8.1% in death group and 7.7% in

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survival group in this study. The study in Peru with 19.5% nosocomial infection mostly consisted of VAP and UTI but reported nosocomial infections increased hospital stay and the mortality rate in PICU.<sup>[20,21,22]</sup> As described in some reports,<sup>[23]</sup> resource admission included internal and interhospital admission of patients was not related to mortality. But in another report, the mortality was doubled in patients admitted from wards when compared with the emergency room patients.<sup>[24]</sup>

## Limitations of the Study

This observational study was conducted in only one selected hospital in Dhaka city, so the results of the study may not reflect the exact picture of the country. As well as small sample size was also a limitation of the present study due to covid-19 pandemic situation.

## CONCLUSIONS

The prevalence of mortality in the ICU was high. Prolong ventilation (>5 days) was important risk factor. Ventilator related complications developed in 40% patients. A favorable outcome requires repeated monitoring of ventilator & biochemical parameters & meticulous management of those abnormalities.

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Source of Support: Nil, Conflict of Interest: None declare