



## Outcome Of Neonates On Mechanical Ventilator Based On Culture Reports In Nicu At Tertiary Care Centre : A Prospective Study

Dr. Rajeev Prasad<sup>1</sup>, Dr. Vibhuti Vaghela<sup>2\*</sup>, Dr. Manila Singhvi<sup>3</sup>, Dr. Harsh Patel<sup>4</sup>

Dr. Rumankhan Pathan<sup>5</sup>.

<sup>1</sup>HOD, <sup>2</sup>Associate Professor, <sup>3,4</sup>Resident, <sup>5</sup>Consultant

<sup>1,2,3,4</sup>Department of Paediatrics,

<sup>1</sup>Dr. Kiran .C. Patel Medical College And Research Institute, Surat, Gujarat, India

<sup>5</sup>V.S Hospital , Ahmedabad, Gujarat, India

<sup>2,3,4</sup>SMIMER, Surat, Gujarat, India

**\*Corresponding Author:**

**Dr. Vibhuti Vaghela**

Associate Professor, Department of Paediatrics, SMIMER, Surat, Gujarat, India

Type of Publication: Original Research Paper

Conflicts of Interest: Nil

### Abstract

**Background:** The use of mechanical ventilation in neonates has resulted in improved survival, in many nurseries, of the developed world in the last two decades. Mechanical ventilation is a rapidly advancing technology - intensive science and has a definite impact on survival of sick neonates.<sup>1</sup>

**Objective:** To evaluate the outcome of patient given invasive mechanical ventilation based on the culture reports in NICU of tertiary healthcare setup

**Methods:** This Hospital based prospective, observational study was conducted from June 2018 to July 2019 at a tertiary care center attached with a medical college.

**Results:** In this present study , total patients enrolled 143 patients had culture positive reports and 57 had no growth in any culture sent. In total discharged patients, 10.30% had multiple organism, 52.57% had single organism while 37.11% had no organism in culture.

Those of death, 24.27% had multiple organism, 55.33% had single organism while 20.38% had no organism in culture.

In patients who had single organism present in culture were evaluated. In total discharge 30% were having pseudomonas, 30% were of Klebsiella, 17% were having CONS, 4% were having Acinetobacter, 15% were having Citrobacter and 4% had E. coli as single organism.

In total death 42% were having pseudomonas, 33% were of Klebsiella, 2% had CONS, 4% had Citrobacter and 19% were having E. coli. Most common organism in death subjects was pseudomonas followed by Klebsiella.

**Keywords:** Mechanical ventilator , Neonates , Culture report, NICU.

### Introduction

Mechanical ventilation is a rapidly advancing technology - intensive science. Neonatal mechanical ventilation has a definite impact on survival of sick neonates. In all critically ill patients, the immediate objective is to preserve life and prevent reserve or minimize damage to vital organs such as the brain and the kidneys. It is one of the important

advancements in neonatal medicine which reduces neonatal mortality. A large number of neonates in neonatal intensive care unit require mechanical ventilation.

The Centres for Disease Control and Prevention (CDC) defines VAP as nosocomial infection

occurring in patients admitted to critical care units for more than 48 hours after endotracheal intubation and initiation of mechanical ventilation. Microbiological criteria for neonatal VAP diagnosis has been a prerequisite only in some studies, while in others only clinical and/or microbiological criteria have been required

**Materials And Methods:**

This prospective hospital based observational study took place from June 2018 to July 2019 on neonate admitted in NICU at SMIMER hospital, Surat.

**Sample Size:** Sample size was calculated by conducting a 3-month pilot survey in Department of Pediatrics ,SMIMER Hospital Neonatal care unit as calculated by considering the proportion of cured/discharged new born out of total ventilated babies at NICU of tertiary health care centre by 3-month pilot survey = 22.09 (22%)

$$N = Z (\alpha / z)^2 \times P Q / L^2$$

$$N = 141$$

**Inclusion Criteria:**

Neonates both intramural and extramural requiring ventilator support in NICU at SMIMER Hospital, Surat.

**Exclusion Criteria:**

1. Patients not giving consent.
2. Patients who took DAMA

Study design: It was a descriptive, observational study of a prospective data. Ethical clearance to conduct study was obtained from Institutional ethics committee.

**Statistical Methods:**

1. Qualitative variables were expressed as percentage, while quantitative variables (continuous variable) were expressed as mean±SD.
2. For comparison of two independent continuous variables, Z sample z-test to compare sample proportion was used.
3. All analysis was done by SPSS 16 and open EPI software

**Results:**

Study was carried out in Neonatal Intensive care unit, Department of Paediatrics, SMIMER hospital. Total 1742 admission were there in NICU during study period out of them 350 patients were kept on Ventilator support and 165 patients took DAMA. Since the start of study total 235 patients were enrolled according to inclusion criteria but 35 patients took DAMA. Result analysis was done in rest 200 subjects.

**Table 1- Baseline characteristics : Demographic Profile**

Neonatal Characteristics	n (%) N = 200
<b>1.GENDER</b>	
a. Male	116 (58)
b. Female	84 (42)
<b>2. MATURITY</b>	
a. Term	51 (25.5)
b. Preterm	149 (74.5)
<b>3. MODE OF DELIVERY</b>	
a. normal vaginal	74 (71.8)
b. LSCS	29 (28.1)
<b>4. BIRTH WEIGHT</b>	
a. >2.5kg	21 (20.3)

b. LBW	16 (15.5)
c. VLBW	49 (47.5)
d. ELBW	17 (16.5)
5. GESTATIONAL AGE	
a. <30 weeks	66 (64)
b. 31 to 36 weeks	16 (15.5)
c. ≥ 37 weeks	21 (20.3)
6. DURATION OF VENTILATOR SUPPORT	
a. ≤ 48 hours	30 (29.1)
b. > 48 hours to 7 days	68 (66)
c. > 7 days	05 (4.8)
7. CPAP SUPPORT	
a. Received CPAP before ventilator support	31 (30)
b. No CPAP before ventilator support	72 (69.9)

Out of total 200 neonates, 51 were term babies while 149 were preterm babies. In detailed evaluation, 20.38% of Death were term and 79.62% of death were of preterm. Patients discharged from NICU included 69.07% preterm neonates and 30.92% term neonates. P value was not statistically significant.

#### Distribution of Patients According to Birth weight and outcome

Out of total patients 35 were of Normal birth weight ,47 were Low birth weight (1.5kg to 2.499kg),96 were Very low birth weight (1kg to 1.499kg) and 22 were Extreme low birth weight(<1kg). In detailed evaluation for death, 20.38% were of Normal birth weight, 15.53% were LBW, 47.57% were VLBW, and 16.50% were ELBW. In detailed evaluation of discharged 14.43% were of Normal birth weight, 31.95% were LBW, 48.45% were VLBW, 5.15% were ELBW. P values were not statistically significant for Normal birth weight (≥2.5kg) and VLBW but **P values were statistically significant for ELBW and LBW.**

**Table 2: Distribution of outcome according to culture organism**

Culture growth	Death	Discharge	P value
Multiple organism (>1): 35	25 (24.27%)	10 (10.30%)	<0.05
Single organism: 108	57 (55.33%)	51 (52.57%)	0.691
No growth cultures 57	21 (20.38%)	36 (37.11%)	<0.05
	103(100%)	97(100%)	

In total patients enrolled 143 patients had culture positive reports and 57 had no growth in any culture sent.

Those of death, 24.27% had multiple organism, 55.33% had single organism while 20.38% had no organism in culture.

In total discharged patients, 10.30% had multiple organism, 52.57% had single organism while 37.11% had no organism in culture.

P value for single organism was not statistically significant. **P values for Multiple organism and No growth in culture were statistically significant.**

**Table 3: Distribution of Outcome According to Single Culture Organism**

Single organism 108	Death 57	Discharge 51	P value
Pseudomonas 38	24 (42%)	14(30%)	0.24
Klebsiella 33	19(33%)	14(30%)	0.57
CONS 09	1(2%)	8(17%)	0.067
Acinetobacter 04	-	4(4%)	-
Citrobacter 09	2(4%)	7(15%)	0.097
E.coli 15	11(19%)	4(4%)	0.227
	103(100%)	97(100%)	

In patients who had single organism present in culture were evaluated. In detailed and present study showed that out of total 108 patients, 38 had pseudomonas, 9 had CONS, 33 had Klebsiella, 4 had Acinetobacter, 9 had Citrobacter and 15 patients had E. coli as causative organism. There was 55.33% death while 52.57% discharge in patients with single organism positivity.

In total death 42% were having pseudomonas, 33% were of Klebsiella, 2% had CONS, 4% had Citrobacter and 19% were having E. coli. Most common organism in death subjects was pseudomonas followed by Klebsiella.

In total discharge 30% were having pseudomonas, 30% were of Klebsiella, 17% were having CONS, 4% were having Acinetobacter, 15% were having Citrobacter and 4% had E. coli as single organism.

P value was not statistically significant.

**Table 4 : Distribution of Outcome According to Culture Organism**

Culture growth	Death	Discharge	Pvalue
Multiple organism (>1): 35	25 (24.27%)	10 (10.30%)	<0.05
Single organism: 108	57 (55.33%)	51 (52.57%)	0.691
No growth cultures 57	21 (20.38%)	36 (37.11%)	<0.05
	103(100%)	97(100%)	

In total patients enrolled 143 patients had culture positive reports and 57 had no growth in any culture sent.

Those of death, 24.27% had multiple organism, 55.33% had single organism while 20.38% had no organism in culture.

In total discharged patients, 10.30% had multiple organism, 52.57% had single organism while 37.11% had no organism in culture.

P value for single organism was not statistically significant. **P values for Multiple organism and No growth in culture were statistically significant .**

### Discussion :

235 patients were enrolled according to inclusion criteria but 35 patients took DAMA. Total 235 patients were enrolled in which 41.27% were expired, rest 43.83% were discharged and 14.90 % took DAMA.

Excluding DAMA Final immediate outcome of total 200 patients, final immediate outcome 48.5% death and 51.5% discharged.

The outcomes were compared to other studies such as PK Riyas<sup>4</sup> Lalitha et al<sup>5</sup> ; Hussain et al<sup>5</sup>, Trotman et al<sup>6</sup>, Kartikeyan et al<sup>7</sup>, Mathur et al<sup>8</sup>, M Monir Hussain et al<sup>10</sup>, Meharban Singh et al<sup>11</sup>, Sushma et al<sup>12</sup>, Rajesh et al<sup>13</sup>

The rates vary in different studies. Such variation in incidence is due to differences in the diagnostic criteria used, the variable sensitivity and specificity of the available diagnostic tests, lack of gold standard test for diagnosis of VAP, condition of ICU, nursing care, variability in the presence of hospital flora, policy of hospital for fumigation of ICU, care and maintenance of various equipment. (warmer, ventilator machine etc).

### Birth Weight And Outcome

Out of total patients 35 were of Normal birth weight ,47 were Low birth weight (1.5kg to 2.499kg),96 were Very low birth weight (1kg to 1.499kg) and 22 were Extreme low birth weight(<1kg). In detailed evaluation for death, 20.38% were of Normal birth weight, 15.53% were LBW, 47.57% were VLBW, 16.50% were ELBW. In detailed evaluation of discharged 14.43% were of Normal birth weight, 31.95% were LBW, 48.45% were VLBW, 5.15% were ELBW. P values were not statistically significant for Normal birth weight( $\geq 2.5$ kg) and VLBW but **P values were statistically significant for ELBW and LBW.**

In comparison to other studies our study confirms that there is poor survival with decrease birth weight. Lalitha et al<sup>5</sup> in their study found there is 44.4% survival with  $\geq 1.5$  kg and there is 40.9% survival rate with <1.5 kg birth weight. Similar observation by PK Riyas et al<sup>4</sup> found that there was 30% survival for <1.5 kg, 10% survival with 1.5 to 2.5 kg and 60%

survival with >2.5 kg. Sushma et al<sup>7</sup> found that survival rate was 25%,22% and 53% with birth weight <1 kg, 1-2.5 kg and >2.5 kg respectively.

### Culture Organisms And Outcome

In patients who had single organism present in culture were evaluated. In detailed and present study showed that out of total 108 patients, 38 had pseudomonas, 9 had CONS, 33 had Klebsiella, 4 had Acinetobacter, 9 had Citrobacter and 15 patients had E. coli as causative organism. There was 55.33% death while 52.57% discharge in patients with single organism positivity.

In total death 42% were having pseudomonas, 33% were of Klebsiella, 2% had CONS, 4% had Citrobacter and 19% were having E. coli. Most common organism in death subjects was pseudomonas followed by Klebsiella.

In total discharge 30% were having pseudomonas, 30% were of Klebsiella, 17% were having CONS, 4% were having Acinetobacter, 15% were having Citrobacter and 4% had E. coli as single organism.

P value was not statistically significant.

The death rate in present study is 48.5% which is comparable to death rates from other studies such as 59% in PK Riyas , 44.2% in Mathur et al ,46% in Rajesh et al ,44.5% in Meharban Singh et al .

The survival rate in present study is 51.5% which is comparable to survival rates from other studies such as 51% in PK Riyas et al, 55.8% in Mathur et al ,52% in Rajesh et al ,55.5% in Meharban Singh et al. The rates vary in different studies. Such variation in incidence is due to differences in the diagnostic criteria used, the variable sensitivity and specificity of the available diagnostic tests, lack of gold standard test for diagnosis of VAP, condition of ICU, nursing care, variability in the presence of hospital flora, policy of hospital for fumigation of ICU, care and maintenance of various equipment. (warmer, ventilator machine etc).

Results were similar to Apisarnthanarak et<sup>20</sup> al., Petdachai et<sup>59</sup> al., Koksai et<sup>55</sup> al. and Tawfik et<sup>60</sup> al., who mentioned predominance of gram-negative infection in their units. However, the reported species isolated differed from one study to another. This can



be explained by the fact that the distribution of microorganisms differs from NICU to another and also, differs within same place from one period of time to another.

Koksal<sup>55</sup> et al. mentioned that *Acinetobacter* was the most predominating causative agent, whereas Petdachai et al<sup>59</sup> reported that *Pseudomonas* spp. was the most common organism isolated. Tawfik et al<sup>60</sup> reported that *Klebsiella* was the most predominating causative agent.

Gram-negative bacilli comprised nearly the whole isolates from cultures of specimens obtained from endotracheal tube and blood. Aerobic gram-negative bacilli are implicated in a wide spectrum of nosocomial infections in the ICU.

Their emergence as significant pathogens seems to be related partly to the widespread use of broad-spectrum antibiotics, and partly to their ability to develop resistance rapidly to the major groups of antibiotics. In the present study, nearly most of the studied newborn infants who developed VAP had not the same organism that caused their blood stream infection. This was in agreement with Apisarnthanarak<sup>20</sup> et al. and Yuan<sup>22</sup> et al.

### Conclusion :

It can be concluded from this present study that Survival rate in sepsis ranges from 40-55% as seen by PK Riyas et al<sup>39</sup>, Mathur et al<sup>44</sup> and Malhotra et al<sup>57</sup> which was confirmed by our study.

There was poor survival with multiple organism positivity in culture and there was better survival with no growth in culture. Most common organism in death subjects was *pseudomonas* followed by *Klebsiella*. Results were similar to Apisarnthanarak<sup>20</sup> et al., Petdachai<sup>59</sup> et al., Koksal<sup>55</sup> et al. and Tawfik<sup>60</sup> et al., who mentioned predominance of gram-negative infection in their units. However, the reported species isolated differed from one study to another. This can be explained by the fact that the distribution of microorganisms differs from NICU to another and also, differs within same place from one period of time to another.

### Bibliography:

1. Assisted Ventilation in Neonates: The Manipal Experience: Lalitha Krishnan, Paul Prabhakar Francis, Nirupa A D'Souza and Nalini

- Bhaskaranand, Neonatal Intensive Care Unit, Department of Pediatrics, Kasturba Medical College and Hospital, Manipur, Indian J Pediatrics 1994; 61: 379-386
2. Neonatal Mechanical Ventilation P.K. Riyas, K.M. Vijayakumar and M.L. Kulkarni, Department of Pediatrics, JJaM. Medical College, Davangere, India. Indian J Pediatrics 2003; 70 (7): 537-540
3. Predictors of Mortality in Ventilated Neonates in Intensive Care Unit M MONIR HOSSAIN1, MAHFUZA SHIRIN1, MOHAMMAD ABDULLAH AL MAMUN2, MD. NURUL AKHTAR HASAN2, MD. SAHIDULLAH3, BANGLADESH J CHILD HEALTH 2009; VOL 33 (3): 77-82
4. Outcomes of Neonatal Mechanical Ventilation P.K. Riyas, K.M. Vijayakumar and M.L. Kulkarni, Department of Pediatrics, J. JaM. Medical College, Davangere, India. Indian J Pediatrics 2003; 70 (7): 537-540
5. Outcomes in Assisted Ventilation in Neonates: The Manipal Experience: Lalitha Krishnan, Paul Prabhakar Francis, Nirupa A D'Souza and Nalini Bhaskaranand, Neonatal Intensive Care Unit, Department of Pediatrics, Kasturba Medical College and Hospital, Manipur, Indian J Pediatrics 1994; 61: 379-386
6. Hossain MM, Chowdhury NA, Shirin M, Amin MR, Chowdhury MAKA. Intermittent positive pressure ventilation of newborn in intensive care unit: Dhaka Shishu Hospital experience. D S (Child) H J 2001; 17: 5-10.
7. Karthikeyan G, Hossain MM. Conventional Ventilation in Neonates: Experience from Saudi Arabia. Indian J Pediatrics 2002; 69: 15-18.
8. Mathur NC, Kumar S, Prasanna AL, Sahu UK, Kapoor R, Roy S. Intermittent positive pressure ventilation in a neonatal intensive care unit: Hyderabad experience. Indian Pediatrics 1998; 35: 349-53
9. Outcomes in "Predictors of Mortality in Ventilated Neonates in Intensive Care Unit "M MONIR HOSSAIN1, MAHFUZA SHIRIN1, MOHAMMAD ABDULLAH AL MAMUN2, MD. NURUL AKHTAR HASAN2, MD. SAHIDULLAH3 BANGLADESH J CHILD HEALTH 2009; VOL 33 (3): 77-82

10. Outcomes in “Predictors of Mortality in Ventilated Neonates in Intensive Care Unit “M MONIR HOSSAIN<sup>1</sup>, MAHFUZA SHIRIN<sup>1</sup>, MOHAMMAD ABDULLAH AL MAMUN<sup>2</sup>, MD. NURUL AKHTAR HASAN<sup>2</sup>, MD. SAHIDULLAH<sup>3</sup> BANGLADESH J CHILD HEALTH 2009; VOL 33 (3): 77-82
11. Meharban Singh, AK Deorari, VK Paul, M Mittal, THREE YEARS EXPERIENCE WITH NEONATAL VENTILATION FROM A TERTIARY CARE HOSPITAL IN NEW DELHI, Department of Pediatrics AIIMS, Indian journal of Paediatrics Volume 30, June 1993 pg. 783-780.
12. Neonatal Mechanical Ventilation-Experience at a Level II Care Centre.Sushma Nangia, Arvind Sali, A.K. Dutta, Vani Gaur, Meeta Singh, Anju Seth and S. Kumari Indian J Pediatrics 1998; 65: 291-296
13. Dr. Rajesh K Chudasama, Sangeeta S Trivedi, Anurakti Srivastava, Study of Early Predictors of Fatality in Mechanically Ventilated Neonates in NICU Mangalore, South India: ISSN 0972-5997 Volume 8, Issue 3; Jul-Sep 2009 Submitted: Apr 29, 2009; Accepted: Oct 18, 2009; Published: Nov 15, 2009.