

**Original article:**

## Study of outcome of Ventilator associated pneumonia in tertiary care Hospital

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### Abstract:

**Introduction:** Critical care uses high quality antibiotics and various other method such as modern technique fumigation and different sterility methods to counter infection. It is indeed a paradox that the use of Hi-Tech medicine has brought in its wake the dangerous and all too frequent complication of nosocomial infections. This study is conducted to identify the prevalent organism and risk factors in ventilated patients who subsequently develop pneumonia as it seems to be the most common and the most dreadful of the hospital acquired infections.

**Methodology:** This Prospective study was carried out at Dr. D.Y.Patil Medical college, Pimpri, Pune over a period of two years in Paediatric intensive care and Neonatal intensive care unit . 50 Patients admitted in paediatric and neonatal intensive care unit aged between 1 day to 12 years, who had undergone mechanical ventilation during the period of two years were included in study. Patients who were admitted in NICU and PICU and had undergone mechanical ventilation during that period were enrolled as cases in this study.

**Results:** Out of the 14 cases in the age group of 0-1 month, 4 cases had VAP. Out of the 30 cases studied in the age group of 1-5 years, 5 cases had VAP. Out of the 6 cases in the age group of >5 years, 3 had VAP.

Out of the 50 cases studied 42 cases required 2-5 days of ventilation, 6 cases required 6-10 days of ventilation and 2 cases required >10 days of ventilation.

**Conclusion:** In present study common organism isolated in ET Tip culture in neonatal age group was Klebsiella pneumonia, followed by MRSA and MRSA with Citrobacter. Most common organism isolated in blood culture in positive case of pneumonia were MRSA. The most common sites involved in chest X ray in patients with ventilator associated pneumonia were right upper and lower zones.

### Introduction:

Care of critically ill patient in intensive care unit is the priority in modern era practice. Every effort has to be taken to reduce the mortality of such patient. One of the modern machines invented by man to tackle chronic illness is a mechanical ventilator which provides great help in managing critically ill patients. But, with the advancement of newer materials, new problems also arise. Ventilator associated pneumonia is one of the major issues with ventilator which the mankind is facing nowadays. Critical care uses high quality antibiotics and various other method such as modern technique fumigation and different sterility methods to counter infection. It is indeed a paradox that the use of Hi-Tech medicine has brought in its wake the dangerous and all too frequent complication of nosocomial infections. Data from the National Nosocomial Infection surveillance system (NNIS) of USA suggests nosocomial pneumonia as the second most common nosocomial infection in intensive care unit. This condition increases to two to three fold more in cases requiring invasive ventilation. Ventilator associated pneumonia is a form of nosocomial pneumonia that occurs in patients receiving mechanical ventilation for more than 48 hours.

The incidence of VAP is 9% to 70% in various studies, the average incidence is 20-25%. In other words one in four mechanically ventilated patients acquire VAP.<sup>(1)</sup>

Ventilator associated pneumonia (VAP) is defined as pneumonia occurring after 48 hours of endotracheal intubation and initiation of mechanical ventilation.<sup>(2)</sup>

This categorisation helps to predict the implicated pathogens and guides us in the initial empiric therapy with antibiotics, which is known as the epidemiological approach.<sup>(3)</sup>

Pneumonia acquired within 48 hours after hospital admission as a consequence of emergency intubation, aspiration due to decreased level of consciousness and coma, or cardiopulmonary resuscitation are excluded from definition of VAP.<sup>(4)</sup>

This study is conducted to identify the prevalent organism and risk factors in ventilated patients who subsequently develop pneumonia as it seems to be the most common and the most dreadful of the hospital acquired infections.

### **Methodology:**

This Prospective study was carried out at Dr. D.Y.Patil Medical college, Pimpri, Pune over a period of two years in Paediatric intensive care and Neonatal intensive care unit .

50 Patients admitted in paediatric and neonatal intensive care unit aged between 1 day to 12 years, who had undergone mechanical ventilation during the period of two years were included in study.

Patients who were admitted in NICU and PICU and had undergone mechanical ventilation during that period were enrolled as cases in this study.

### **Inclusion criteria:-**

The patients who are included in this study are :

- Those who are ventilated in our hospital for at-least 48 hours or more.
- Those who gave consent for the study.

### **Exclusion criteria:-**

- Patients who already have pneumonia before mechanical ventilation.
- The patients who were immunocompromised or having congenital anomaly
- Patients who had been intubated in some other hospital and then referred and admitted to our ICU.
- Patients who were extubated or expired before 48 hours of mechanical ventilation.

Patient admitted in NICU and PICU, Underwent mechanical ventilation due to life threatening illness other than pneumonia with on mechanical ventilation for  $\geq$  48 hours.

↓

ET Tip taken at the time of extubation for culture and sensitivity

↓

Chest X ray done after 48 hours of ventilation and repeated wherever required to look for pneumonia.

↓

Presence of co-morbid condition such as steroid, surgical intervention, H<sub>2</sub> blocker, CRF and re-intubation are noted.

**Results:**

Out of the 50 cases studied 12 cases (24%) had VAP. Incidence of Ventilator Associated Pneumonia was seen more in male children. Out of 50 cases 10% cases had cardiovascular problem, 42% cases had respiratory problem, 32% cases were having central nervous system problem and 16% cases were having other problems.

Out of the 14 cases in the age group of 0-1 month, 4 cases had VAP. Out of the 30 cases studied in the age group of 1-5 years, 5 cases had VAP. Out of the 6 cases in the age group of >5 years, 3 had VAP.

Out of the 50 cases studied 42 cases required 2-5 days of ventilation, 6 cases required 6-10 days of ventilation and 2 cases required >10 days of ventilation.

**Table 1: Association between age and Ventilator associated Pneumonia in study group**

Age	Ventilator associated pneumonia		Total
	Present	Absent	
0 – 1 month	4	10	14
1mth – 5 yrs	5	25	30
>5 yrs	3	3	6
Total	12	38	50

Chi-square = 3.27, P>0.05

Out of the 50 cases studied 42 cases required 2-5 days of ventilation, 6 cases required 6-10 days of ventilation and 2 cases required >10 days of ventilation.

**Table 2:- Association between number of days of ventilation and Ventilator Associated Pneumonia in the study group in the study group**

No of days of ventilation	Ventilator associated pneumonia		Total
	Present	Absent	
2-5 Days	9 (21.4%)	33	42
6-10 Days	2 (33.3%)	4	6
>10 Days	1 (50%)	1	2

Chi sq test= 1.18

P value= 0.55

Incidence of pneumonia on ventilation is more when patients were ventilated for longer duration of time, which account for 50% when ventilated for >10 days and only 21.4% when ventilated for 2 – 5 days. Incidence of pneumonia when ventilated for 6 – 10 days were 33.3% which is not significant.

**Table 3:- Association of risk factor according to age group with ventilator associated pneumonia**

	0 -1 mth(n=4)	1mth - 5 year(n=5)	>5 year(n=3)
steroid	0	3	2
surgical intervention	0	3	3
H2 blocker	0	5	3
CRF	0	0	2
Suctioning	4	5	3
Reintubation	2	2	1

Most common risk factor responsible for causing Ventilator associated pneumonia in the age group of 0 – 1 month was tracheal suctioning

Risk factors responsible for causing Ventilator associated pneumonia in the age group of 1 month to 5 years were H2 blocker and tracheal suctioning. Risk factors responsible for causing Ventilator associated pneumonia in the age group of > 5 years were surgical intervention, H2 blocker, and tracheal suctioning.

**Table 4:- Association of Clinical feature according to age group with ventilator associated pneumonia.**

Clinical feature	0 – 1 month	1 month – 5 years	> 5 years
Fever	1	2	2
Tachycardia	2	3	2
Retractions	4	5	2
Crepitations	4	3	1
Breathlessness	4	2	3
Increase oxygen requirement	3	3	1

Chi sq test= 2.9

P value = 0.9

Most common clinical features associated with Ventilator Associated Pneumonia in the age group of 0 – 1 month were crepitations, retractions and breathlessness.

Most common clinical features associated with Ventilator associated pneumonia in the age group of 1 month – 5 years were retractions.

Most common clinical feature associated with Ventilator associated pneumonia in the age group of > 5 years were fever tachypnea retractions and breathlessness.

The test is not significant

Out of the 12 positive cases of Ventilator Associated Pneumonia most common organism grown in blood culture was MRSA. There were 6 cases of Ventilator associated Pneumonia where blood culture came negative.

**Table 5: Association between VAP and outcome in study group**

VAP	Outcome		Total
	Expired	Recovered	
Present	7	5	12
Absent	2	36	38
Total	9	41	50

**Chi-square = 0.76, P>0.05**

Out of the 12 VAP patients 5 recovered and 7 patients expired which is not significant. There were two patients who didn't have VAP and died.

**Discussion:**

The study was conducted to determine the incidence, clinical pattern of Ventilator Associated Pneumonia and organism causing it. The risk factors and outcome of patients with Ventilator Associated Pneumonia were also studied. The incidence of Ventilator Associated Pneumonia in the current study was 24% which is almost in accordance with the study conducted by Daljit Singh at Dayanand Medical College And Hospital Ludhiana in Punjab.<sup>(5)</sup> (20%) A recently published study at northern part of India have shown an incidence rate of 17.5%.<sup>(6)</sup> Two more studies from India by P.K.Patra et – al at PGI Chandigarh in 2007 and H. Sharma et – al in Chandigarh in

2009 have shown contrastingly high Ventilator Associated Pneumonia rates of 32.5% and 20%.<sup>(7),(8)</sup> respectively. The incidence of Ventilator Associated Pneumonia in children is as low as 2.3 per 1000 ventilator days in paediatric medical ICU'S in USA.<sup>(9)</sup> This is according to the data from hospital enrolled in the National Care And Safety Network.

The most common risk factor in the current study is tracheal suctioning during ventilation (12/12) 100% , followed by H<sub>2</sub> blocker (8/12) 66.6%, surgical intervention (6/12) 50%, steroid (5/12) 41.6%, re intubation (5/12) 41.6% and CRF (2/12) 16.6%. Male child (8/12) 67% showed an increase risk for ventilator associated pneumonia in the current study. A study conducted by R. Deep Akash at T.N. Medical college showed an increase duration of ICU stay (82.10%) followed by malnourishment (64.2%).<sup>(10)</sup> Huang W. Y. et – al showed that use of steroid was the significant risk factor in developing Ventilator Associated Pneumonia which was 34.4% . The common risk factors for developing VAP in this study were central venous catheterization which was (75%) followed by transfusion (68.8%)<sup>(11)</sup> A meta-analysis done at Nanging Medical Hospital China found that Re-Intubation was the most common risk factor in 2013,<sup>(12)</sup> (31.9%) . Alexis et al<sup>(13)</sup> showed that the primary risk factors for developing Ventilator Associated Pneumonia in PICUs included transfusion (32%) followed by steroid (30%). Tripathi et al<sup>(14)</sup> showed that re-intubation (18/30), (60%) is a critical risk factor in neonates with Ventilator Associated Pneumonia, and Srinivasan et al<sup>(9)</sup> reported that female gender, post-surgical and use of enteral feed as the most important risk factor. A study conducted by Lorente et – al<sup>(15)</sup> showed that out of 440 patients, closed suctioning were done in 210 patients and in 233 patients open suctioning were done. The closed tracheal system did not decrease VAP incidence.

Chest retraction (11/12) crepitation (8/12), and breathlessness (8/12) were the most common clinical features for developing Ventilator Associated Pneumonia in the current study. Other clinical features included fever (5/12), increase oxygen requirement (7/12) and tachycardia (7/12).

All patients diagnosed as VAP had fulfilled the Clinical infectious Pulmonary Score (CIPS) criteria having score more than six. CDC criteria for diagnosis of VAP had also been used for diagnosing ventilator associated pneumonia in this study. According to this criteria patients having VAP had fever, increase in oxygen requirement and tachycardia. X – ray findings suggestive of VAP were also present in every positive VAP patients. Using this clinical criteria has made it easy for the practitioner to diagnose pneumonia in ventilated patients. In a study conducted by Fabregas et – al<sup>(16)</sup> showed that chest radiograph and two of the three clinical criteria (leucocytosis, fever and purulent secretions) had a sensitivity of 69% and specificity of 75%.

The corresponding numbers for the Clinical Pulmonary Infection Score (CPIS) had a sensitivity and specificity of 77% and 42% respectively. Fahm et – al<sup>(17)</sup> found that CIPS had a sensitivity of 30% and specificity of 80% in diagnosing VAP as compared to quantitative bronchoalveolar lavage fluid culture. Diagnosing Ventilator Associated Pneumonia, using clinical criteria, is often not accurate because fever occurred in many condition and colonization of respiratory tract by gram negative bacilli is very common in ventilated patients even in the absence of pneumonia.<sup>(4)</sup> Most common organism isolated from tip of the tube responsible for causing VAP, in the current study was klebsiella pneumonia (7/12) (58.3%), followed by MRSA (2/12) (16.6%), acinetobacter spp and MSSA (1/12) (8.3%) each, and MRSA with Citrobacter (1/12) (8.3%) . Most common organism seen in blood culture in positive cases of ventilator associated pneumonia was MRSA (4/12) 33.3% followed by acinetobacter (1/12) 8.33% and pseudomonas (1/12) 8.3% . Blood culture showed no growth in 6 (50%) of the positive VAP patients. According to

the current study 50% of the cases with positive ventilator associated pneumonia were having negative blood culture and it suggests that there is no association of VAP with blood culture.

Also, studies comparing blood culture reports with occurrence of ventilator associated pneumonia have not been recorded. A study conducted at medical college Baroda by P. Modi Payal Department of microbiology showed (22/62) 35.5% cases positive with Klebsiella pneumonia in their ET Tube culture, followed by Acinetobacter Spp in (16/62) 25.8% and E Coli in (5/62) 8.1% in cases of Ventilator Associated Pneumonia.<sup>(18)</sup> Study done by Deng et-al<sup>(19)</sup> showed Klebsiella spp 22.6% (33/146) as the most common organism causing VAP, followed by Acinetobacter Baumannii 17.8% (26/146) and Pseudomonas Aeruginosa 12.3% (18/146). Tripathi et-al<sup>(14)</sup> and Yuan et-al<sup>(20)</sup> showed Klebsiella spp (32.8%) followed by E. Coli (23.2%) and Acinetobacter spp (17.8%) as common organisms in their study. Ajef et-al<sup>(21)</sup> showed E.Coli and Klebsiella isolated 21.4% each in neonates with VAP.

The criteria for diagnosing Ventilator Associated Pneumonia taken in the current study were ET tube culture and sensitivity, chest X ray and clinical features. ET tube culture showing growth of organism and chest X ray showing features of pneumonia were important criteria. Findings of clinical features have already been discussed. Endotracheal aspirate culture of  $10^3 - 10^6$ cfu/ml were considered significant for the diagnosis of VAP in the current study. ET Tube culture showed mono – microbial growth in 37/50 (74%), poly – microbial growth in 1/50 (2%) and 11/50 (22%) showed no growth in the current study. However chest X ray infiltrate may also be due to causes other than pneumonia and invasive procedure such as brush border sampling and bronchoscopy increases the specificity of diagnosis.<sup>(22)</sup>

A study conducted at medical college Baroda by P. Modi Payal Department of microbiology where ET Tube culture and sensitivity was taken as the diagnostic criteria and according to their study endotracheal aspirate culture  $>10^6$ cfu/ml was considered significant for diagnosis of VAP. 54/125 (43.2%) cases showed mono – microbial growth, 4/125 (3.2%) showed poly – microbial growth and 67/125 (53.6%) showed no growth.

#### **Conclusion:**

In present study common organism isolated in ET Tip culture in neonatal age group was Klebsiella pneumonia, followed by MRSA and MRSA with Citrobacter. Most common organism isolated in blood culture in positive case of pneumonia were MRSA. The most common sites involved in chest X ray in patients with ventilator associated pneumonia were right upper and lower zones.

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