

Original Article: A Clinical Study of Pattern of Microbiological Colonization of Endotracheal Tube Aspirate on Mechanically Ventilated Patients

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Abstract: ***Introduction:** Nosocomial infection is a critical issue among intubated patients which is responsible for significant morbidity and mortality of these patients. One of the most important types of this infection is pneumonia which commonly occurs in relation to endotracheal tube and mechanical ventilation named ventilator associated pneumonia. .study presents the most common microorganisms colonized from endotracheal tube of hospitalized patients in our setup and their antibiotic sensitivity pattern. **Methods:** 100 patients who are admitted in emergency medical ward of Hamidia Hospital and then subsequently intubated and assisted by mechanical ventilation due to insufficient self ventilation are taken for study .Samples for microbiological cultures were taken after 48 hours of intubation by mucous extractor under all aseptic precautions and then sent to Microbiology laboratory for culture and sensitivity test. **Results:** our study showed pseudomonas is most common organism isolated followed by klebsiella and staphylococcus aureus and most of the organism were sensitive to piperacillin-tazobactam and meropenem. **Discussion:** prevalence of Ventilator associated pneumonia in our setup was observed as 25%.The bacteriology of positive sputum culture is caused predominantly by pseudomonas aeruginosa in 17% followed by klebsiella 6% and staphylococcus aureus 2%.*

Keywords: ventilator associated pneumonia, clinical pulmonary infection score, tracheal secretion, endotracheal tube, antibiotic sensitivity

1. Introduction

Infections are the most important and leading cause of mortality and morbidity among the patients admitted in ICU. Nosocomial infections is a critical issue among intubated patients which is responsible for significant morbidity and mortality of these patient. One of the most important types of this infection is pneumonia which commonly occurs in relation to the endotracheal tube and mechanical ventilation named ventilator associated pneumonia. Patients with mechanical ventilation have an increased risk for respiratory tract infection because the tube which has been inserted in trachea reduces the clearance of bacteria and increases the leakage of secretion around the cuff of tube and disable the ciliary tract by damaging it. Nosocomial infection is a frustrating and budget consuming issue and due to increased time of hospitalization it imposes a heavy burden on health care resource.

2. Aims and Objectives

- To study types of microorganisms in intubated patients [>48 hour] in emergency medical ward of Hamidia Hospital Bhopal.
- To study microbiological antibiotic sensitivity in intubated patients [>48 hour] in emergency medical ward.
- To propose a proper empirical antibiotic therapy in intubated patients according to prevalence of microbiological organisms in emergency medical ward.

3. Material and Method

It was Observational Cross– Sectional study of 1 year period. 100 patients who were admitted in emergency medical ward of Hamidia Hospital Bhopal and then subsequently intubated and assisted by mechanical ventilation due to insufficient self ventilation were taken for study.Samples for microbiological cultures were taken after 48 hour of intubation by mucous extractor under all aseptic technique and then sent to Microbiology laboratory for culture and antibiotic sensitivity test.

Inclusion Criteria

Patients intubated for >48 hour in emergency medical ward due to insufficient self ventilation.

Exclusion Criteria

- Patients who already had any respiratory tract infection or any other disease related to respiratory system.
- Patients who are intubated for <48 hour.

A total of 100 patients who were kept on mechanical ventilator were randomly selected.. All necessary measures were taken for prevention of hospital-acquired infections.

Ventilator associated pneumonia was diagnosed on clinical grounds based on the modified Clinical Pulmonary Infection Score (CPIS) system originally developed by Pugin and others, giving 0–2 points each for fever, leukocyte count, oxygenation status, quantity and purulence of tracheal secretions, type of radiographic abnormality and result of sputum culture and Gram stain. The Ventilator associated pneumonia group was classified into two groups, early-onset type (within 48–96 h) and late-onset type (>96 h). Once the

clinical suspicion was established, empirical antibiotic therapy was initiated based on guidelines prescribed by the American Thoracic Society. Patients were routinely screened by arterial blood gas (ABG) analysis every 12 hourly and appropriate steps were taken to correct any change.

4. Clinical Pulmonary Infection Score (CPIS)

Clinical Pulmonary Infection Score (CPIS)	
Parameter	Score
Temperature (*C)	
>36.5 and <38.4	0
>38.5 and <38.9	1
>39.0 or <36.5	2
White Blood Cell Count	
>4,000 and <11,000	0
<4,000 or >11,000	1
<4,000 or >11,000 & band forms>50%	2
Tracheal secretions	
Scanty	1
Purulent	2
Pao2/Fio2	
>240, ARDS or pulmonary contusion	0
<240 and no ARDS	2
Chest Radiograph	
No infiltrate	0
Diffuse or patchy infiltrate	1
• Localised infiltrate	

5. Result

The most common microorganism isolated from endotracheal tube in our set up is pseudomonas aeruginosa followed by klebsiella and s.aureus. Moreover, most of the microorganisms were sensitive to and piperacillin-Tazobactam and meropenem.

6. Discussion

Prevalence of ventilator associated pneumonia in our setup is observed as 25%. The bacteriology of positive sputum culture is caused predominantly by pseudomonas aeruginosa in 17% followed by klebsiella 6% and s.aureus 2%.

It is analysed in our study that those requiring prolonged ventilator support had a significantly higher incidence of ventilator associated pneumonia (P-value, 0.003) of the 25 patients who developed ventilator associated pneumonia, 9 patients developed early-onset (14.8%) ventilator associated pneumonia and 16 patients developed the late-onset type (41.0%). In our study it is also found that purulent secretions associated with positive sputum culture (p value< 0.001).

In the study of our set up the incidence of ventilator associated pneumonia is 25% supported by Kalanuri et al^[1,2]. Kalanuri et al^[2] found ventilator associated pneumonia (VAP) estimated to occur in 9-27% of all mechanically ventilated patients, with the highest risk being early in the course of hospitalization.

The study also shows that patients with longer duration of hospital stay, had more chances of development of ventilator associated pneumonia (p value, 0.03]

The study by Simoni et al^[3,4] showed that 100% of samples from airway prosthesis are positive in culture; however, other studies have reported a positive culture rate between 0% and 33% in obtained samples from airway tubes. Cardinosa et al. have reported a positive culture result in 89% of their samples. The variation could be explained by the technique of intubation, clinical and individual characteristics of study population, colonization during intubation or lack of sufficient precautions for intubation due to the high work load in an emergency setting.

In our study, Gram negative bacteria were the most common isolated organisms including *Pseudomonas aeruginosa* and *Klebsiella* which is in the same line with the study by Nardi et al^[6]. Amini et al^[7] also conducted a descriptive study on distribution of isolated microorganisms from tracheal tube of ICU patients declaring that *S.aureus* (23.6%), *Klebsiella* species (23.3%), *Acintobacter* species. (20.7%), *P.aeruginosa* (18.2%), *E.coli* (7.7%), and *Enterobacter* species, were the most common isolates^[8]. Our study as well as the other ones in similar settings confirm that *P. aeruginosa*, *klebsiella* and *S. aureus* are among the most 3 prevalent isolated organism from endotracheal tube aspirate.

In contrast, Rello et al^[5,6] in their study have demonstrated that *Pseudomonas aeruginosa* is the most common causative organism for infection of Endotracheal tube and this could be the result of large number of patients with chronic obstructive pulmonary disease (COPD) and long time of intubation and even a previous history of antibiotic therapy. It should be noted that although there are minor variations in relative frequency of obtained organisms, different studies have reported varying sources of isolations as in our study we did report colonization of organisms into the Endotracheal tube while other studies may have considered Endotracheal tube related infections in their study analysis.

7. Conclusion

Our study shows *pseudomonas* is the most common microorganism isolated from endotracheal tube in our set up. Moreover, most of the microorganisms were sensitive to and piperacillin-Tazobactam and meropenem. Though our study comprise 100 number of patients, for the result of the study to be applicable to general population and in our setup we require further studies with larger number of study subjects.

8. Acknowledgment

We sincerely thanks to all members of Emergency Medical ward of department of medicine of Gandhi Medical college and Hamidia Hospital Bhopal.

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Table 1: Distribution of Cases According to Duration of Stay

Duration of stay	Culture Positive	Negative	Total
< 4 days	9	52	61
	14.8%	85.2%	100.0%
> 4 days	16	23	39
	41.0%	59.0%	100.0%
Total	25	75	100
	25.0%	75.0%	100.0%

P=0.003 [significant, Longer stay more VAP

Table 2: Distribution of Cases According to Type of Tracheal Secretions

Tracheal Secretions Type	Culture Positive	Negative	Total
purulent	9	0	9
	100.0%	0.0%	100.0%
scanty	16	75	91
	17.6%	82.4%	100.0%
Total	25	75	100
	25.0%	75.0%	100.0%

P< 0.001[significant, all purulent tracheal secretions had vap

Table 3: Distribution of Cases According to Tracheal Aspirate Culture

Tracheal aspirate culture	Number of cases	% of cases
Klebsiella	4	4.0
Pseudomonas	17	17.0
S. aureus	2	2.0
Negative	75	75.0
Total	100	100.0

Table 4: Distribution of Case According to Tracheal Aspirate Culture and Their Antibiotic Sensitivity Pattern

Antibiotics	Klebsiella [4]	% Klebsiella sensitivity	Pseudomonas [17]	% Pseudomonas sensitivity	S Aureus [4]	% S Aureus sensitivity
Ceftriaxone	1	16.6	0	0.0	0	0.0
Piperacilin-Tazobactam	6	100.0	15	88.2	0	0.0
Meropenem	3	50.0	11	64.7	0	0.0