

The pattern of Microbiological Colonization of Endotracheal Tube Aspirate on Mechanically Ventilated Patients: A Clinical Study from central India

JL Wadhvani¹, Anil Sejwar^{2*}, Dharmendra Kumar Mekle³

¹Associate Professor, Department of Medicine, Gandhi Medical College, Bhopal, Madhya Pradesh, India

²Designate Associate Professor, Department of Medicine, Gandhi Medical College, Bhopal, Madhya Pradesh, India

³Assistant Professor, Department of Medicine, Gandhi Medical College, Bhopal, Madhya Pradesh, India

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Abstract

Background: Among intubated patients, nosocomial infection is a serious problem that contributes significantly to their morbidity and mortality. Pneumonia, a common complication of the endotracheal tube and mechanical ventilation, is one of the most important types of this infection. **Aims and objectives:** To study the antibiotic sensitivity patterns for the most common microorganisms isolated from the endotracheal tubes of hospitalized patients. **Materials and Methods:** Patients admitted to Hamidia Hospital's emergency medical ward and then intubated and assisted by mechanical ventilation due to insufficient self-ventilation were studied. For microbiological cultures and sensitivity tests, specimens were collected 48 hours after intubation using a mucous extractor and sent to the Microbiology Laboratory for processing. **Results:** During our study, we found that 25 percent of our patients had Ventilator-associated pneumonia. *Pseudomonas aeruginosa* accounts for 17 percent of positive sputum cultures, followed by *klebsiella* (6%) and *staphylococcus aureus* (2%). **Conclusion:** *Pseudomonas* was the most common organism found, followed by *klebsiella* and *staphylococcus aureus*, and the majority of the organisms were susceptible to piperacillin-tazobactam and meropenem.

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

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Introduction

There is a high mortality and morbidity rate associated with infections in intensive care unit (ICU) patients. Intubated patients are particularly vulnerable to nosocomial infections, resulting in significant morbidity and mortality[1].

One of the most common forms of this infection is ventilator-associated pneumonia, which is associated with using an endotracheal tube and mechanical ventilation. Respiratory tract infections are more common in patients receiving mechanical ventilation due to the tube's inability to clear bacteria and increase leakage around its cuff, which damages the ciliary tract[2].

Nosocomial infection is a costly and time-consuming problem, and the longer patients are in the hospital, the greater the strain on the health care system[3].

Hence, in the present study, we evaluated microorganisms and antibiotic sensitivity in intubated patients (>48 hours) in the emergency medical ward of Hamidia Hospital Bhopal.

Materials and methods

It was an observational cross-sectional study of 1 year period. Two hundred patients admitted to the 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 hours of intubation by mucous extractor under all aseptic techniques and then sent to Microbiology laboratory for culture and antibiotic sensitivity test.

Patients intubated for >48 hours in the emergency medical ward due to insufficient self ventilation were included in the present study.

Patients who already had any respiratory tract infection or any other disease related to the respiratory system and were intubated for <48 hours were excluded from the present study.

A total of two hundred patients on mechanical ventilation were chosen at random. Hospital-acquired infections were prevented at all costs.

Based on the modified Clinical Pulmonary Infection Score (CPIS) system, developed by Pugin and others, 0–2 points were given for fever, leukocyte count and oxygenation status, quantity and purulence of tracheal secretions, type of radiographic abnormality, and the results of sputum culture and Gram stain for the diagnosis of ventilator-associated pneumonia. Pneumonia caused by a ventilator was divided into two types: early-onset (within 48–96 hours) and late-onset (>96 hours). Based on American Thoracic Society guidelines, empirical antibiotic therapy was started once the clinical suspicion was established. ABG analysis was performed on all patients at least once every 12 hours, and any deviations were promptly addressed. Corrective action was taken on an hourly basis.

*Correspondence

Dr. Anil Sejwar

Designate Associate Professor, Department of Medicine, Gandhi Medical College, Bhopal, Madhya Pradesh, India.

E-mail: sejwardrani@yahoo.com

Table 1: 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	>4000 and <11000	0
	<4000 or >11000	1
	<4000 or >11000 & band forms >50%	2
Tracheal Secretions	Scanty	
	Purulent	
PaO2/FiO2	>240, ARDS or pulmonary contusion	1
	<240 and no ARDS	2
Chest radiograph	No, infiltrate	0
	Diffuse or patchy infiltrate (localized infiltrate)	1

Results

Pseudomonas aeruginosa, klebsiella, and Staphylococcus aureus were the most frequently found microorganisms in our endotracheal tube isolation setup. Furthermore, piperacillin-tazobactam and meropenem were effective against most of the microorganisms tested.

Table 2: Distribution of Cases According to Duration of Stay

Duration of stay	Culture Positive	Negative	Total	P-value
< 4 days	18 (14.8)	104 (85.2)	122 (100)	0.001
> 4 days	32 (41)	46 (59)	78 (100)	
Total	50 (25)	150 (75)	200 (100)	

Table 2 shows that longer stay leads to more ventilator-associated pneumonia (p=0.001).

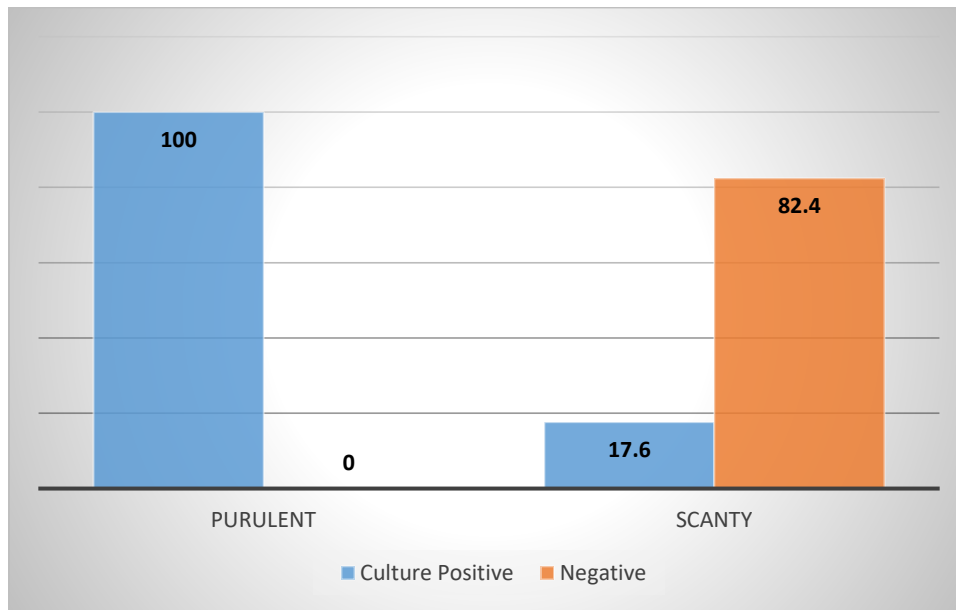


Fig. 1: Distribution of cases according to type of tracheal secretions

Table 3: Distribution of Cases According to Tracheal Aspirate Culture

Tracheal aspirate culture	Number of cases	Percentage
Klebsiella	8	4
Pseudomonas	34	17
S. aureus	4	2
Negative	150	75
Total	200	100

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

Antibiotics	Klebsiella ; n=8	Klebsiella sensitivity	Pseudomonas; n=34	Pseudomonas sensitivity	S Aureus; n=4	S Aureus sensitivity
Ceftriaxone	2	25	0	0	0	0
Piperacilin-Tazobactam	8	100	30	88.2	0	0
Meropenem	6	75	22	64.7	0	0

Discussion

Our setup has a 25 percent rate of ventilator-associated pneumonia. Sputum culture positive for pseudomonas aeruginosa was found in 17% of cases, followed by klebsiella (6%) and S. aureus (2%).

Our study found that those who needed long-term ventilator support had a significantly higher incidence of ventilator-associated pneumonia (P-value, 0.003). Of the 50 patients who developed ventilator-associated pneumonia, 18 developed early-onset (14.8%), and 32 developed the late-onset type (41%).

Our research showed a significant ($p = 0.001$) correlation between purulent secretions and positive sputum culture. In agreement with Vincent et al[4]. and Kalanuri et al.[5], the present study also found a 25% incidence of ventilator-associated pneumonia.

According to Kalanuri et al.[5], ventilator-associated pneumonia (VAP) affects 9 to 27% of all mechanically ventilated patients, with the highest incidence occurring early in the hospital stay.

Patients hospitalized for a longer period were more likely to develop ventilator-associated pneumonia (p -value, 0.03). Even though Simoni et al[6]. and Pugin et al[7]. found that 100 percent of samples obtained from airway prostheses were positive in culture, other studies have found that samples obtained from airway tubes had a positive culture rate ranging from 0% to 33%[8]. Samples from Cardinosa and colleagues showed positive results in 89 percent of cases. Intubation technique, clinical and individual characteristics of the study population, colonization during intubation, or a lack of adequate intubation precautions due to the high workload in an emergency setting could explain some variations.

Gram-negative bacteria, such as Pseudomonas aeruginosa and klebsiella, were the most frequently isolated organisms in our study, which is consistent with the findings of Nardi et al[9].

S.aureus (23.6%), Klebsiella species (23.3%), Acinetobacter species (20.7%), P.aeruginosa (18.2%), E.coli (7.7%), and Enterobacter species were the most common isolates, according to Amini et al[10]. The latter also performed a descriptive study on the distribution of isolated microorganisms from tracheal tubes of ICU patients[9].

In our study and similar studies, P. aeruginosa, klebsiella, and S. aureus were the three most commonly isolated organisms from endotracheal tube aspirate. Pseudomonas aeruginosa is the most common cause of Endotracheal tube infection, according to Kabak et al[11]. This could be due to many patients with COPD and long-term intubation and a previous history of antibiotic therapy[12].

Different studies have reported varying sources of isolations, such as our study reporting the colonization of organisms into the Endotracheal tube. In contrast, other studies may have considered Endotracheal tube-related infections in their study analysis.

Conclusion

Our study shows pseudomonas is the most common microorganism isolated from the endotracheal tube in our setup. Moreover, most of the microorganisms were sensitive to piperacillin-Tazobactam and meropenem. Though our study comprises 100 patients, for the study to apply to the general population and in our setup, we require further studies with more study subjects.

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