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Microbes in Tracheostomy Aspirates of Head Injury Patients

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Abstract
Background
Tracheostomy is a life saving procedure in head injury patients with GCS less than 8. Tracheostomy exposes lower respiratory tract to exterior so leading to complication of brochopneumonia.
Material and Methods
This study was done to evaluate the microbiology of the tracheal aspirates of tracheostomised head injury patients.
Results
The bacteria isolated by culture of tracheal aspirates with their sensitivity of gram-negative bacilli are shown in table 1.Out of 50 patients 46 (92%) had growth of aerobic gram-negative bacilli particularly Pseudomonas aeruginosa 19(38%) and Klebsiella pneuminae (40%) while Methicillin resistant Staphylococcus aureus (MRSA) was present in 4 patients (8.0%).
Conclusion
This study enlists the microbes and sensitivity in secretions from the tracheostomy of head injury patients staying in general surgery ward in a short period of 7 days.From tracheal aspirate culture in head injury patients, Pseudomonas aeruginosa and Klebsiella pneumoniaewere the commonest isolates.
Keywords: *Tracheostomy, Tracheotomy, Tracheal stoma site infection, Tracheal aspirate, Microbes, Respiratory tract infection,*

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I. Introduction

Tracheostomy is a lifesaving procedure in severe brain trauma. It bypasses the dead space and obstruction due to blood in pharynx. This also avoids the prolonged intubation particularly if assisted ventilation is required.Tracheostomy is required in these patients because of patient's inability to protect the airway and persistence of excessive secretions.

For these excessive secretions in the tracheobronchial tree, tracheostomy provides a route with ease of suction.

The tracheostomised patients with head injury are having a high risk of lower respiratory tract infection because the protective nasal barriers are removed and there is direct entry of microbes into tracheobronchial tree. The irritation by tracheostomy tube causes local inflammatory reaction and oedema leading to bacterial colonization.**[1]** To avoid the lower respiratory tract infection, careful hygiene of tracheostomy is recommended. Use sterile disposable suction catheters, gentle tracheal suction, bacteria free humidifiers, less visitors are recommended. **[2]**However, despite of high level of hygiene, exogenous colonization with or without subsequent infection is common.It is noted that the infection rates are lower after tracheostomy due to improved tracheobronchial toilet. This tracheal suction also inhibits microbial colonization thus avoiding complications.**[3]**Despite the fact that routine care is required for a substantial number of head injury patients with long term tracheostomy, surprisingly little published information is available regarding many aspects of prolong care, including assessment and management of suspected respiratory tract infections. Clinicians utilize tracheal-aspirate specimens to diagnose and treat lower respiratory tract infections**. [4]**

Aim of Study

The aim of this study was to evaluate the bacterial profile and antimicrobial sensitivity of respiratory secretions from tracheostomy in severe head injury trauma patients and to provide guidelines regarding use of antibiotics in treatment of lower respiratory infections.

II. Material and Methods

This descriptive study was done in department of general surgery on 50 patients of either sex. All patients with severe head injury with a GCS of less than 8were having tracheostomy done for various reasons were included in the study. All the patients were in nursed in general surgery ward breathing spontaneously. None of the patient was on the ventilatory support. All the patients were receiving prophylactic antibiotic Amoxyclav 1 gm 8-hourly by intravenous route.Specimens for culture and sensitivity were collected using a catheter which passes through the tracheostomy tube into the trachea. All samples were incubated for 24 hours at 37^0C for obtaining aerobic growths.Microbes were identified by their colonial morphology and characteristic biochemical tests. The susceptibility to antibiotics was tested by employing disc diffusion method using standard antibiotic discs. This study enlists the microbes and sensitivity in secretions from the tracheostomy of head injury patients staying in general surgery ward in a short period of 7 days.

III. Results

The bacteria isolated by culture of tracheal aspirates with their sensitivity of gram-negative bacilli are shown in table 1.Out of 50 patients 46 (92%) had growth of aerobic gram-negative bacilli particularly *Pseudomonas aeruginosa* 19(38%) and *Klebsiella pneuminae* (40%) while Methicillin resistant *Staphylococcus aureus*(MRSA) was present in 4 patients (8.0%). The antibiotic resistant was noted to amoxyclav (100%) and cefaclor (85%). The lowest resistance was noted to piperacillin+tazobactum (5.0%) followed by Inepenum (5.0%), Cefoperazone+Sulbactum (5.0%) and Amikacin (15.0%).Tracheal aspirate isolates of Pseudomonas species showed 5.2%, 10.5%, 21.0%and 21.6% resistance to piperacillin+tazobactam, imipenum, cefoperazone+sulbactum and amikacin respectively. Methicillin resistant *Staphylococcus aureus* (MRSA) showed 100% sensitivity to vancomycin.

Table 1. Showing Gram Negative Bacteria isolated and their Resistance and Sensitivity

Antibiotic	*Kieibsiella pneumonia N = 20*	*Pseudomonas aueroginosa N = 19*	*Eischerchia coli N = 3*	*Proteus mirabilis N = 2*	Others N = 2
Amoxyclav	R- 20 (100%) S- 00	R- * S-	R- 3 (100%) S- 00	R- 2 (100%) S- 00	R- 2 (100%) S- 00
Cefaclor	R- 17 (85.0%) S- 3 (15.0%)	R- * S-	R- 3 (100%) S- 00	R- 2 (100%) S- 00	R- 2 (100%) S- 00
Cefoperazone +Sulbactum	R- 2 (10.0%) S- 18 (90.0%)	R- 4 (21.0%) S- 15 (79.0%)	R- 1 (33.3%) S- 3 (66.7%)	R- 0 S- 2 (100%)	R- 1 (50.0%) S- 1 (50.0%)
Ceftazidine	R- 4 (20.0%) S- 16 (80.0%)	R- 5 (26.3%) S- 14 (73.7%)	R- 1 (33.3%) S- 2 (66.7%)	R- 00 S- 2 (100%)	R- 1 (50.0%) S- 1 (50.0%)
Amikacin	R- 3 (15.0%) S- 17 (85.0%)	R- 4 (21.0%) S- 15 (79.0%)	R- 2 (66.7%) S- 1 (33.3%)	R- 0 S- 2 (100%)	R- 0 S- 2 (100%)
Ciprofloxacillin	R- 6 (30.0%) S- 14 (70.0%)	R- 8 (42.0%) S- 11 (58.0%)	R- 1 (0) S- 2 (100%)	R- 0 S- 2 (100%)	R- 2 (100%) S- 00
Piperacillin+Taz obactum	R- 1 (5.0%) S- 19 (95.0%)	R- 1 (5.2%) S- 18 (94.8%)	R- 0 S- 3 (100%)	R- 0 S- 2 (100%)	R- 0 S- 2 (100%)
Inepenum	R- 1 (5.0%) S- 19 (95.0%)	R- 2 (10.5%) S- 17 (89.5%)	R- 0 S- 3 (100%)	R- 0 S- 2 (100%)	R- 1 (50.0%) S- 1 (50.0%)

IV. Discussion

The brochopneumonia and static pneumonia are the common affections of the lower respiratory tract infection in these patients. The tracheal aspirates cultures were used to study the microbes and their antibiotic sensitivity. Single tracheal aspirate sampling was used for culture and sensitivity in this study. The time interval between the tracheostomy and tracheal aspirate collection was 7th day. So, the results of culture sensitivity represent the first bacterial infection of the tracheobronchial tree in tracheostomised head injury patients. Tracheostomy in head injury patients is necessary for aspiration of foreign bodies like blood clots and broken tooth. This helps in reducing the dead space in trachea and also improved ventilation. The head injury patients with axonal injury but with Glasgow Coma Scale less than 12 are treated in the general surgery ward. The patients on bed-side ventilator were excluded from the purview of this study. **[5]**Although tracheostomy helps in better tracheobronchial suction but is entry point for microbes in lower respiratory tract. This leads to colonization of the major airway and infection. **[6]**There are studies showing that after tracheostomy bacterial colonization occurs in 100% of patients within two weeks after surgery.**[7]**

Tracheal aspirate cultures have been used to identify bacteria causing lower respiratory infection and guide therapy with antibiotics.**[8]**

Only a few studies are available in medical literature regarding lower respiratory infections in severe head injury patients with tracheostomy. There is a similar national study conducted in India which reports that aerobic gram negative bacilli(GNB) cause more than 60% of nosocomial chest infections.**[9]**Similar study in Pakistan concluded gram negative bacilli are particularly *Klebsiella pneumonia an Pseudomonas* are the predominant isolates from tracheostomy secretion of head injury patients.Internationally, also, GNB are the most common pathogens causing nosocomial pneumonia in several studies.*Pseudomonas aeruginosa* being the most common gram-negative species isolated.**[10]**

In this study gram negative bacteria have predominantly isolated in 46 samples out of 50 samples (92%). *Pseudomonas aeroginosa and Klebsiella pneumonia* being the most common isolates. The gram positive cocci isolation is low (8%). **[11]**Defining the exact aetiology of most hospital acquired infection of lower respiratory tract in severe head injury patients is difficult. In one series, 44% of all nosocomial chest infections were found to be of uncertain aetiology. **[12]**Although overall least mean resistance was noted to piperacillin+tazobactam(7.7%)followed by imipenum (20.6%),considerable resistance was noted among gram negative bacilli of tracheal aspirate in the present study. In some other studies also, resistant strains have occurred frequently in tracheal secretions, suggesting emergence of resistance.**[13]**In this study, tracheal secretions and bronchial secretions from long term tracheostomised patients were cultured. The alpha-streptococci and Neisseria were bacteria isolated from tracheal secretions in 96.2% and 69.6% and *Pseudomonas aeruginosa* was predominantly cultured (75.7%) from bronchial secretions suggesting that colonization of lower respiratory tract by *Pseudomonas aeruginosa* is responsible for bronchopneumonia in long term tracheostomised patients.**[14]**

In a recent study, the tracheal aspirates were cultured and antibiograms were obtained in children and adolescent patients with tracheostomy in 20 patients. The culture was positive in 90% of samples. The *Pseudomonas aeruginosa* (55.5%) and *Staphylococcus aureus* (27.7%) were the most common microbes present in these patients. **[15]**A study on children with long term tracheostomy concluded that colonization of trachea most commonly occurs with *Pseudomonas aeruginosa* and other gram-negative bacteria; secondly by methicillin sensitive *Staph aureus*and methicillin resistant *Staph aureus* gram positive bacteria. The empirical use of antibiotics in these patients for treatment of lower respiratory tract infection must cover with *Pseudomonas aeruginosa* methicillin sensitive *Staph aureus* and methicillin resistant *Staph aureus* gram positive bacteria.**[16]**

In a similar study, antimicrobial sensitivity was done in tracheal aspirates of 50 tracheostomised head injury patients. The culture growth was noticed in 41 (82%) of samples. The Pseudomonas aeruginosa was the most prominent microbes grown in 32% and Klebsiella pneumonia (28%) while methicillin resistant Staphylococcus aureus was present in 6% of patients. The gram-negative bacteria cultured from these tracheal aspirates were 100% resistant to amoxiclav and cefaclor. The least resistance in increasing order was noted to piperacillin+tazobactum (7.7%), imipenum (20.6%), cefoperazone+sulbactum (23.7%) and amikacin (26.3%). Methicillin resistant Staph aureus was 100% sensitive to vancomycin.**[17]**

In chronic tracheostomy patients treated at home, swab culture from tracheostomy stoma and trachea were done. The microbes were grown in 95% and 83% respectively from these two sites. *Staphylococcus aureus*, gram-negative enteric bacteria, and *Pseudomonas aeruginosa* were the most common bacteria isolated at from these sites.**[18]**Kamath et al (2015) studied 70 tracheal aspirates culture after one week; 56 patients (86%) developed growth on culture plates. Gram negative bacteria were isolated mainly *Pseudomonas aeruginosa*in 48.6% and *Klebsiella pneumoniae* in 15.7% patients. The methicillin resistant Staphylococcus aureus was seen in 1 patient only. Pseudomonas was foundto be resistant to cephalosporinsandmajority

butsensitive to carbapenemsand gentamicin. Other gram-negative bacteria were sensitive to piperacilin-tazobactam and carbapenems only.**[19]**

Most of clinicians consider aminoglycosides a critical component of therapy for life threatening gram-negative infection of the lung. Unfortunately, the therapeutic to toxic ratio for aminoglycosides in serum is narrow and the penetration of aminoglycosides from blood into the infected respiratory tissues may be insufficient to achieve local drug concentration above the minimum inhibitory concentration necessary for the infecting organisms.

In our study combination of cefoperazone and sulbactum was found to be very effective in most (90%) of the cases.In patients with clinically suspected pneumonia, specimens should be obtained from the respiratory tract for microbiologic processing, followed by the timely administration of an empirical antimicrobial regimen selected according to the presence or absence of risk factors for infection with antimicrobial-resistant bacteria.

V. Conclusion

Gram negative bacteria were primarily isolated from tracheostomy secretions of severe head injury patients. *Klebsiella pneumoniae and Pseudomonas aeruginosa* as the commonest aerobic gram-negative bacteria isolated. As these patients are having altered consciousness and are receiving empirical prophylactic antimicrobial therapy; they are at very high risk of acquiring bronchopneumonia due to resistant aerobic gram-negative bacilli. So, theantimicrobial sensitivity of tracheostomy secretions guides for judicious use of antibiotics in prevention of bronchopneumonia in severe head injury patients. It is concluded that tracheal aspirates sampling is good for culture and sensitivity in tracheostomised head injury patients.

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