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Original Research Article

A Clinical Study to Compare the Bacterial Flora of Lower Respiratory Tract immediately after Tracheostomy and during First Tube Change

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Abstract: Tracheostomy directly exposes the lower respiratory tract to the exogenous bacteria increasing the risk of colonization of lower respiratory tract. The present study was done in patients who underwent tracheostomy and the study compares bacterial flora of oropharnyx and lower respiratory tract during tracheostomy with that of the bacterial flora of the lower respiratory tract during the first tube change. Forty patients were included in this study. During tracheotomy, a sterile suction catheter was introduced into the trachea and suction was done. Tip of the suction tube was sent for bacterial culture. Tracheostomy tube was changed after 2 – 11 days. During the tube change, tracheal suctioning was done using sterile suction catheter and the tip of suction catheter was sent for the Bacterial culture. 95% of the study population was intubated before tracheostomy. 40% had positive growth from oropharnyx during tracheostomy, most common bacteria isolated being Enterobacter spp. 20%, (n=8). Only 17.5% had positive growth from trachea during tracheostomy, most common bacteria isolated being Acinetobacter 5%, (n=2). 80% had positive growth from trachea during the first tube change. Colonization of the lower respiratory tract following tracheostomy is mainly by the exogenous bacteria, comprising of Enterobacter (27.5%), Acinetobacter Baumanii (22.5%) and E. coli (20.0%). Colonization of the lower respiratory tract after tracheostomy happens primarily from the exogenous route. Tracheal colonization present at the time of tracheostomy is not significant and does not significantly correlate with the tracheal colonization post tracheostomy. There is no significant influence on the tracheal colonization post tracheostomy by place of performance of tracheostomy.
Keywords: Tracheostomy, Bacterial flora, Lower Respiratory Tract

INTRODUCTION

Tracheostomy is a term used to refer the creation of a surgical opening into the trachea [1]. Indications for tracheostomy can be broadly outlined as respiratory obstruction, respiratory failure, respiratory paralysis, retained secretions and reduction of dead space [2]. Tracheostomy offers several advantages like improved physical and psychological comfort, decreased risk of inadvertent extubation, accelerated weaning from mechanical ventilation, decreased time of ICU stay before transfer to step-down facilities, and reduced risk of developing ventilator-associated pneumonia [3, 4]. Tracheostomy might facilitate weaning by reducing dead space and airway resistance, and by improving secretion clearance. This reduces the likelihood of tube obstruction by insisted mucus, makes the patient more comfortable, requiring less sedation and reducing the likelihood of aspiration through improved glottic function. [5] Endotracheal tubes (ETTs) increase dead space and elevate airway resistance, which could lead to excessive ventilator support. There are various ways of colonization of lower respiratory tract by the bacteria following tracheostomy. By exposing the lower respiratory tract directly to the environment, tracheostomy allows colonization by exogenous bacteria. Colonization by the hands of the healthcare workers increases the risk of nosocomial colonization during suctioning, manipulation of the ventilator circuits and bronchoscopy [6, 7]. Bacterial colonization of the oropharynx followed by aspiration of contaminated oropharyngeal secretions and leakage around the endotracheal tube in to the lower airways also results in colonization of the lower respiratory tract. The presence of an invasive medical device (Endotracheal tube & Tracheostomy tube) is an important contributor to the

colonization of the oropharynx and the tracheobronchial tree. [8]. Pooled secretions are also present in the subglottic area above the inflated endotracheal tube cuff [9] Subglottic secretions accumulated above the endotracheal cuff may progress, descending along the channels within the folds of the cuff wall, in to the lower respiratory tract [10, 11]. Oropharyngeal colonization, present at admission or acquired during intensive care unit stay, has been identified as an independent risk factor for the development of pneumonia [12, 13]. This study is designed to identify the bacterial flora of the lower respiratory tract at the time of tracheostomy and the change in the bacterial flora in due course of time. This study may indicate whether the endogenous bacteria (oropharynx) or the exogenous bacteria (community acquired / nosocomial) are primarily responsible for the colonization of the lower respiratory tract in tracheostomized patients. This knowledge will guide the clinician in the choice of empirical antibiotics, if pneumonia develops in these patients. Also the study may provide baseline data for further research related to prevention and treatment of lower respiratory tract infection following endotracheal intubation and tracheostomy.

MATERIALS AND METHODS

This study was done in Mamata Medical College and Hospital Khammam after approval from Institutional Ethical Committee for this study. It is a clinical prospective cohort study. The Study population included all patients who underwent tracheostomy at Mamata Medical College and General Hospital sample size consisted of 40 patients.

Inclusion criteria

1. Patients undergoing tracheostomy in Pre-intubated in ICU and without Pre –intubation
2. All the patients undergoing tracheostomy Irrespective of Indications

Exclusion criteria

1. Those patients who had undergone emergency tube change at night were excluded from the study because of inadequate time to collect the sterile sample in emergency.
2. Patients admitted for known infective conditions of the chest and underwent tracheostomy.
3. Community acquired pneumonia, TB.
4. Patients who developed lung infection during stay at hospital and subsequently underwent tracheostomy.
5. Ventilator associated pneumonia, Nosocomial Pneumonia.

Tracheostomy was performed under local anaesthesia. After thorough surgical cleaning of the area with Isopropyl alcohol, the area was draped with sterile towels. Thorough oropharyngeal suctioning was done with sterile catheter and the tip of the suction catheter was cut and kept in sterile container. Infiltration was given with 2 percent lignocaine and 1 in 1, 00,000 adrenaline. Horizontal incision was given two finger breadths above the suprasternal notch. Subcutaneous tissue and platysma were incised horizontally and the strap muscles were retracted laterally. Isthmus of the thyroid gland if encountered retracted superiorly and tracheal rings were identified. Pre tracheal fascia was cleared off the anterior surface of the trachea. Position was confirmed by aspirating air from the trachea with saline filled syringe and 4% lignocaine was injected into the lumen to anaesthetize the tracheobronchial tree mucous membrane. Inferior based flap was created in the second or third tracheal ring on the anterior wall of the trachea and secured by suturing with the skin**.** Cuffed tracheostomy tube was introduced and position was confirmed. Tracheal suctioning was done to clear the secretions form the tracheobronchial tree**.** Tip of the suction catheter was cut and kept in a sterile container**.** Tube was secured with tapes and wound closed with sutures. Stomal was dressing given. The tips of both the suction tips were sent for bacterial culture.

Standard post tracheostomy care included

1. Regular oropharyngeal and tracheobronchial suctioning using separate sterile suction catheters.
2. 2 hourly deflation of the cuff for 10 min to reduce the risk of tracheal necrosis and granuloma.
3. Stomal dressing.
4. Provision of humidified air.

Tube change was done 2 to 11 days after tracheostomy. Tracheostomy tube was removed and new tracheostomy tube was inserted and the endotracheal suctioning was done with sterile suction catheter. The tip of the suction catheter was cut and kept in sterile container**.** The tip was sent for bacterial culture and sensitivity.

RESULTS

40 patients were included in this study. The patients were in the age group of 19 – 86 yrs. Of this group male patients were 34 and female patients were 6. Mean age of the patients is 59 yrs. (Mean ± SD: 59.05±15.92)

Table 1: Primary system involvement of patients studied

Primary system involvement of patients	Number of patients	Percentage
CNS	18	45.0
Trauma	9	22.5
Respiratory	6	15.0
Infection	3	7.5
Renal	3	7.5
Cardiac	1	2.5
Total	40	100.0

Patients with cerebrovascular accidents (CNS) constituted highest percentage (45%) followed by patients with Polytrauma and head injury (22.5%). Respiratory group included 6 patients (15%), of which 3 patients had COPD, 2 patients had cor pulmonale and 1 patient had edema of the upper aero digestive tract. 38 patients (95%) were intubated before tracheostomy and 2 patients were not intubated before tracheostomy. The most common indication for the tracheostomy is Low GCS (47.5%) followed by prolonged ventilation (27.5%). The third most common indication for the tracheostomy is Respiratory failure (15%) Table 1.

Table 2: No. of days taken for 1st tracheostomy tube change after the procedure

No. of days taken for 1st tracheostomy tube change after the procedure	Number of patients (n=40)	Percentage
1-2	6	15.0
3-4	21	52.5
5-6	8	20.0
7-8	3	7.5
9-11	2	5.0

First tracheostomy tube change was done between 2 to 9 days (4.10 ±1.87). Most of the patients underwent first tracheostomy tube change between 3 to 8 days (80%) Table 2.

Table 3: Tracheal suction catheter tip culture report during tracheostomy

Tracheal suction catheter tip culture during tracheotomy	Number of patients (n=40)	Percentage
No growth	33	82.5
Growth	7	17.5
Acinetobacter baumanii	2	5.0
Gram Positive Cocci	1	2.5
Commensals of Respiratory tract grown	1	2.5
Coagulase negative Staphylococcus	1	2.5
E Coli	1	2.5
Enterobacter spp	1	2.5

82.5% (n=33) of the patients had no growth from the tracheal suction catheter tip culture during tracheostomy and 17.5% (n=7) had growth from the tracheal suction catheter tip during tracheostomy**.** Acinetobacter had grown in 5% (n=2) of these patients. Gram positive cocci, Commensals of lower respiratory tract, Coagulase negative Staphylococcus aureus, E Coli, Enterobacter spp. had grown in one culture each (2.5%) Table 3.

Table 4: Tracheal suction catheter tip culture report during 1st tube change

Tracheal suction catheter tip culture report during 1st tube change	Number of patients (n=40)	Percentage %
No growth	8	20.0
Growth	32	80.0
Acinetobacter baumanii	11	27.5
Gram Positive Cocci	9	22.5
Commensals of Respiratory tract grown	8	20.0
Coagulase negative Staphylococcus	1	2.5
E Coli	1	2.5
Enterobacter spp	1	2.5

First tube change was done approximately 4 (4.10 ± 1.87) days after the procedure. During first tube change, 80% (n=32) had growth in tracheal suction catheter tip culture and 20% had no growth. Enterobacter spp was found in 11 (27.5%) patients, Acinetobacter was found in 9 patients (22.5%) and E Coli was found in 8 patients (20%). 80% (n=32) of the patients had positive growth during first tube change table 4. Most common antibiotic to which the organisms sensitive were Imipenum (57.5%, n=23) and 20% of the bacteria were sensitive to Piperacillin with Tazobactum and 20% of these bacteria were also sensitive to Netilmycin. 17.5% (n=7) bacteria were sensitive to Polymyxin B.

DISCUSSION

The Mean age of patients studied was in the age group of 50 to 70 yrs, increased incidence of systemic illnesses like Primary Hypertension, Diabetic Mellitus, Cerebrovascular accidents, COPD with increasing age may be the causative factor for the increasing number of tracheostomy in this age group. Patients with cerebrovascular accidents (CNS) constituted highest percentage (45%) of the study population who underwent tracheostomy, followed by patients with polytrauma and head injury (22.5%). In contradiction to our study, in which cerebrovascular accidents (CNS) constituted 45% of the cases, in a study by Amusa et al [14] indicated neurological cases and respiratory failure as one of the least common cause for tracheostomy (n=2). In our study indication for tracheostomy is noted from the treating physician's requisition notes. Most common indication for tracheostomy is Low GCS (47.5%). Indication for tracheostomy is prolonged ventilation in 27.5% and Respiratory failure (Type I & Type II) in 15% of the patients. In the study by João Aléssio Juliano Perfeito [15] 35 of 73 patients that were evaluated post tracheostomy; the most common indication was prolonged or tracheal intubation (76.7%). In our study low GCS was the most common indication and these patients also required prolonged ventilation and can be positively correlated with above mentioned study. In this study, 75% of the patients were with endotracheal tube for less than 7 days before the tracheostomy and 20% patients were intubated for more than 7 days. Patients suspected to be on prolonged ventilation were tracheostomized early i.e., less than 7 days (75%) positively correlating with published literature.

As per Bergman's DC, modulation of oropharyngeal colonization, by combinations of oral antibiotics, with or without systemic therapy, or by selective decontamination of the digestive tract, is also effective in significantly reducing the frequency of pneumonia. [16] In our study, antibiotics were not prescribed by the operating surgeon pre or post tracheostomy. However antibiotics prescribed by the treating physician before tracheostomy were continued after the procedure. 20% of the patients were not on any antibiotics and 80% (n=32) were on antibiotics. Among the antibiotics, Imipenum was commonly prescribed (17.5%). In study by P Morar *et al.;* [17] the authors mention about presence of two types of potentially pathogenic microorganisms. First type are the community microorganisms which include S pneumoniae, H influenzae, M catarrhalis, E coli, and S aureus that present in previously healthy individuals, Second type are the hospital bacteria that are carried by patients with an underlying condition both chronic and acute (Klebsiella, Proteus, Morganella, Enterobacter, Hafnia, Serratia, Pseudomonas, Acinetobacter spp and methicillin-resistant S aureus (MRSA). In the same [17] study 25 (55%) were abnormal oropharyngeal carriers of the aerobic gram negative bacteria. In that eleven carried P aerogenosa, four had Klebsiella in the oropharynx, while Enterobacter spp, Acinetobacter spp, and E coli were present in the throat of three children each.

On calculating presence of individual bacteria as percentage of the total population studied, 24.4% (n=11) had Pseudomonas aerogenosa and four pts had Klebsiella (8.88%) and Enterobacter spp, Acinetobacter spp and E Coli had grown in 6.66% (n=3, each) of the patients each. In the study done by Lipovy B *et al.;*

[18] children underwent tracheostomy and the most common bacterium isolated from the lower respiratory tract is Acinetobacter baumanii (31.53%). In our study Acinetobacter was isolated in 22.5% of the cultures and second most common bacteria isolated. So the percentage of the positive growth isolated and the type of bacteria isolated from the lower respiratory tract after tracheostomy is comparable with the published studies.

The most types of bacteria isolated from trachea after the tracheostomy in our study are Enterobacter, Acinetobacter which are considered hospital bacteria and E Coli, which is considered as community bacteria in the study by Pradeep M *et al.;* [19] This finding depicts that the colonization of the lower respiratory tract is primarily by the exogenous route through the tracheostomy than the endogenous route from the oropharynx. Correlation between the positive growths in oropharynx with that of trachea during first tube change was done. There is no statistically significant correlation. This finding again reinforces that the tracheal colonization following tracheostomy is by exogenous route. The data collection and analysis was done to find out whether there is any change percentage of positive growth or the type of bacteria isolated with the place where the tracheostomy was performed. There is no positive correlation between the colonization of the lower respiratory tract and the place of tracheostomy.

CONCLUSION

Colonization of the lower respiratory tract after tracheostomy happens primarily from the exogenous route. Oropharyngeal colonization does not significantly correlate with the colonization of the trachea after tracheostomy. Tracheal colonization present at the time of tracheostomy is not significant and does not significantly correlate with the tracheal colonization post tracheostomy.

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