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Comparison of Tracheal Flora Immediately Post Tracheostomy and a Week Later

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ABSTRACT

Tracheostomy is a surgical procedure in which a stoma/opening is made at the skin surface which leads into the trachea creating a direct opening of the trachea to external environment making it susceptible to exogenous organism colonization resulting in infections. The present study is done in patients who underwent tracheostomy and the study tracheal flora immediately post tracheostomy and a week later helps in determining the need for prophylactic antibiotics or change of antibiotic policy in critical care of tracheostomized patients.

INTRODUCTION

A tracheostomy is a procedure that exteriorizes the trachea to the skin of the neck, producing a more permanent fistula/opening and is a common procedure which is done in most intensive care units[1]. It can be an elective oremergency procedure, can be temporary or permanent.

Tracheostomy may result in the following effects [2]

- Laryngeal bypass. All of the normal laryngeal functions are lost, the patient is unable to cough or phonate.
- A reduction in respiratory dead space.
- A redundant area is created between the tracheal opening and the larynx in which mucus tends to accumulate and then fall back into the lungs.
- The filtration of particulate matter and humidification of inspired air by the nasal mucosa is lost.
- An increased risk of infection.
- The tracheostomy tube will act as a foreign body causing local inflammation, and as it tends tomove during swallowing and with normal neck movements, may cause abrasions along the length of the track [2].
- Colonization of lower respiratory tract takes place via various route i.e tracheostomy allows colonization by exogenous bacteria. The risk of nosocomial colonization occurs during suctioning or manipulation of the ventilator circuits and bronchoscopy or from colonization of hands of the health workers [3.]
- Bacterial colonization of the oropharynx followed by aspiration of contaminated oropharyngeal secretions and leakage around the endotracheal tube in to the lower airways alongwith the presence of an invasive medical device (Endotracheal tube & Tracheostomy tube) is animportant contributor to the colonization of the oropharynx and the tracheobronchial tree. 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 over a period of 7 days which plays a crucialrole in the management of patient in terms of requirement of prophylactic antibiotics and preventive measures.
- This study may indicate whether the indigenous bacteria flora from 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 thechoice of empirical antibiotics, if pneumonia develops in these patients.

OBJECTIVE OF THE STUDY

1. To determine the bacterial colonization of trachea during tracheostomy and on 7th day duringtube change.
2. If previously intubated patients have higher likelihood of colonization by micro- organisms.

MATERIALS AND METHODS

STUDY DESIGN

It is a clinical prospective cohort study.

RESEARCH SETTING

The study was conducted in a tertiary care hospital, after approval from Institutional Ethical committee.

POPULATION

The Study population included all patients who underwent tracheostomy at Ramaiah hospital.

SAMPLE PERIOD

The study was conducted over a period from October 2017 to March 2019.

SAMPLE SIZE ESTIMATION

Calculated based on a previous study conducted by M Hemanth Rao, Yelma Bhooma Reddy [4] inwhich the proportion of Acinetobacter species was found to be 27.5 % , In the present study, considering absolute precision of 8% and desired confidence level of 95% required, sample size is calculated to be 120.

CRITERIA FOR SAMPLE SELECTION

Inclusion criteria

Patients undergoing tracheostomy who are Pre-intubated in ICU and patients undergoing tracheostomy directly without any intubation in the recent past.
Exclusion criteria:

- Patients admitted for known infective conditions of the chest and underwent tracheostomy.
- Patients who developed lung infection during stay at hospital and subsequently underwenttracheostomy.
- Those patients who must undergo emergency tube change will be excluded from the study.

SAMPLING TECHNIQUE:

The sampling technique used was non randomized sampling.

Fig.1 cleaning of surgical site

Fig.2 Incision, Retraction of Strap muscles identification of trachea

Fig.3 swab from tracheal stoma.

The following details of the patients were recorded :

Name:

Age:

Sex:

Diagnosis System involved:

Intubated or not:

Flora at the time of tracheostomy:

Flora 1 week after tracheostomy:

Statistical Methods: Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean SD (Min-Max) andresults on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance.The following assumptions on data is made,

Assumptions: 1**.** Dependent variables should be normally distributed, 2. Samples drawn from the population should be random, cases of the samples should be independent.

Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups, Non-parametric setting for Qualitative data analysis. Fisher Exact test used when cell samples are very small.

OBSERVATIONS AND RESULTS

Total of 123 patients were initially studied but patient who had left the hospital prior to completionof 7 days period or has passed away due to their pathology were excluded from the study.

After applying exclusion criteria, a total of 120 patients were included in the study. The patientswere in age group 17 – 88 years.

AGE DISTRIBUTION:

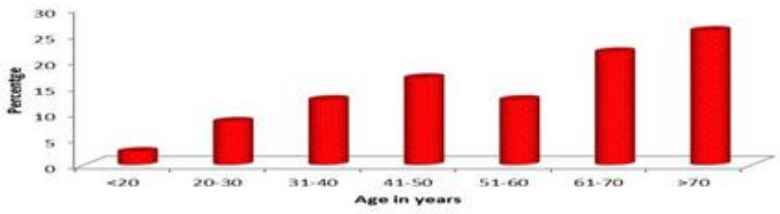

Figure 4: Age in Distribution in Years

Table.1 Primary system involved

CAUSE	PERCENTAGE	TOTAL
CENTRAL NERVOUS SYSTEM	52.7	63
ROAD TRAFFICACCIDENTS	22.5	27
OBSTRUCTIVE	13.3	16
RESPIRATORY	5	6
RENAL	0.8	1
CARDIAC	0.8	1
OTHERS	4.9	6

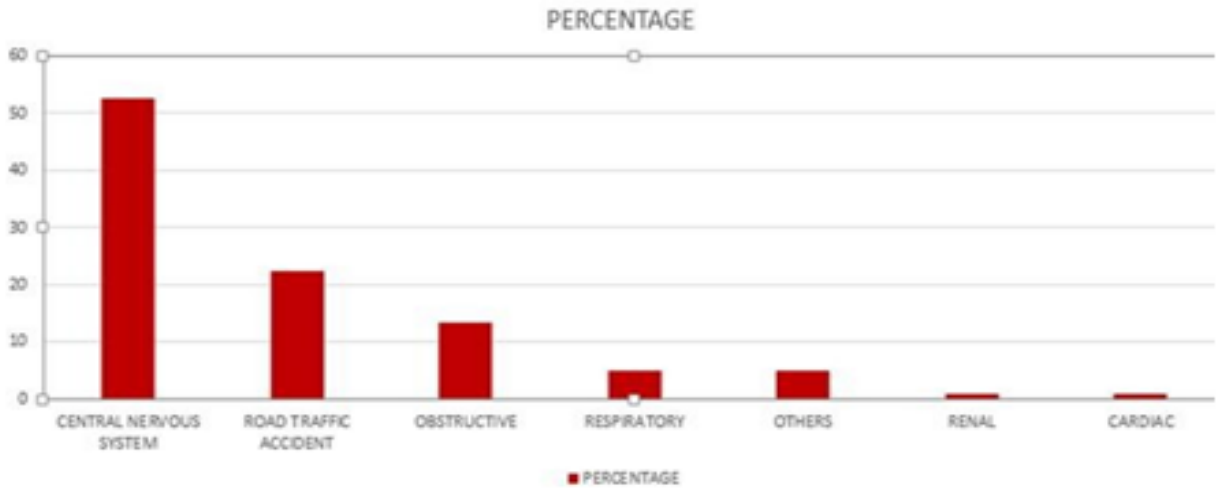

Figure 5 – Bar presentation of causation

Table.2 Intubation status

PREVIOUSLY IN TUBATED	107	89.2%
NOT IN TUBATED	13	10.8%
TOTAL	120	100%

107 patients (89.2%) were intubated prior to tracheostomy while 13 patients (10.8%) underwent tracheostomy without intubations The patients who underwent tracheostomy without intubations are ones who have presented to OPD with signs with acute signs of respiratory obstruction such as stridor and was taken for emergency OT.

Table.3 Growth on day 0 of tracheostomy

Organism 1st Grown on day 0	**Gender**		**Total (n=120)**
	Female(n=29)	**Male (n=91)**	
NO GROWTH	16(55.1%)	48(52.7%)	64(53.3%)
GROWTH	13(44.8%)	43(47%)	56(46.7%)
ACINETOBACTER	0(0%)	14(15.4%)	14(11.8%)
MIXED FLORA	5(17.2%)	6(6.5%)	11(9.2%)
KLEBSIELLA PNEUMONIA	2(6.9%)	6(6.6%)	8(6.7%)
CITROBACTER	2(6.9%)	5(5.5%)	7(5.8%)
PSEUDOMONAS	3(10.3%)	2(2.2%)	5(4.2%)
ENTEROBACTER SPECIES	1(3.4%)	2(2.2%)	3(2.5%)

STREPTOCOCCUS SPECIES	1(3.4%)	2(2.2%)	3(2.5%)
STAPHYLOCOCCUS AUREUS	1(3.4%)	0(0%)	1(0.8%)
COAGULASE NEGATIVE STAPHYLOCOCCUS AUREUS	0(0%)	1(2.2%)	1(0.8%)
ESCHERICHIA COLI	0(0%)	1(1.1%)	1(0.8%)
PROTEUS MIRABALIS	0(0%)	1(1.1%)	1(0.8%)
PROVIDENTIA	0(0%)	1(1.1%)	1(0.8%)

Table 4 Growth on day 7 post tracheostomy

Growth 7th Day	**Gender**		**Total (n=120)**
	Female(n=29)	**Male (n=91)**	
NO GROWTH	12(38.7%)	34(37.4%)	46(38.3%)
GROWTH	17(62.1%)	57(62.6%)	74(61.7%)
MIXED FLORA	6(20.6%)	16(17.6%)	22(18.3%)
KLEBSIELLA PNEUMONIA	3(10.3%)	9(9.9%)	12(10%)
PSEUDOMONAS	3(10.3%)	8(8.8%)	11(9.2%)
ENTEROBACTER SPECIES	1(3.4%)	8(8.8%)	9(7.5%)
ACINETOBACTER	1(3.4%)	5(5.5%)	6(5%)
STAPHYLOCOCCUS AUREUS	1(3.4%)	4(2.2%)	5(4.2%)
CITROBACTER	1(3.4%)	3(3.3%)	4(3.3%)
COAGUASE NEGATIVE STAPHYLOCOCCUS AUREUS	0(0%)	1(1.1%)	1(0.8%)
PROVIDENTIA	0(0%)	1(1.1%)	1(0.8%)
PROTEUS MIRABALIS	0(0%)	1(1.1%)	1(0.8%)
STREPTOCOCCI SPECIES	1(3.4%)	0(0%)	1(0.8%)
E.COLI	0(0%)	1(1.1%)	1(0.8%)

Table 5 Growth comparison in intubated versus not intubated

	TOTAL	GROWTH	NO GROWTH	P VALUE
INTUBATED	107	51	56	P=0.53
NOT INTUBATED	13	5	8	

P=0.53, Not Significant, Chi-Square

Table 6 Growth on 7th day post tracheostomy with Age

Growth 7thDay	**Age in years**				**Total (n=120)**
	1-30yrs(n=14)	**31-50yrs(n=35)**	**51-70yrs(n=40)**	**71-88yrs (n=31)**	

No Growth	7(50%)	12(34.3%)	10(25%)	16(51.6%)	45(37.5%)
Growth	7(50%)	23(65.7%)	30(75%)	15(48.4%)	75(62.5%)

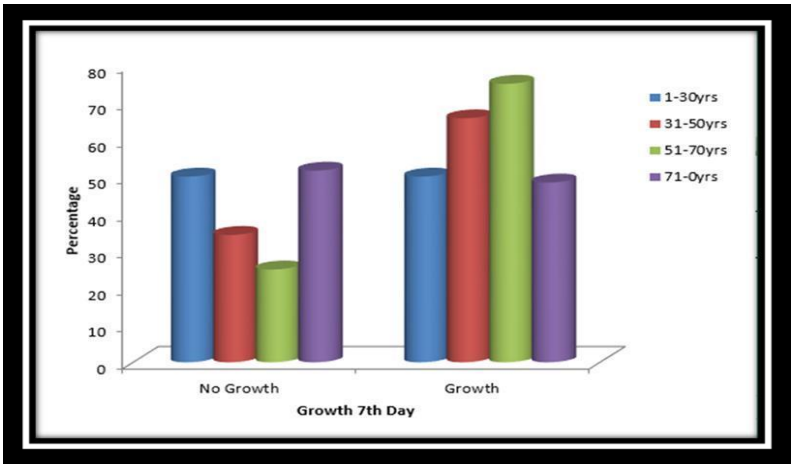

Figure 6 – Growth of organism in comparison with ageP=0.094+, Significant, Chi-Square Test

DISCUSSION

A total of 123 patients underwent tracheostomy by conventional methods during the study period. Those patients who had infective pathology of the lower respiratory tract or patients wholeft (discharged or expired) prior to completion of 7 days post tracheostomy on admission were excluded from the study. After applying exclusion criteria, a total of 120 patients were included in the study.

Patients with cerebrovascular accidents (CNS) constituted highest percentage (50.2%) of the study population who underwent tracheostomy along with 3 cases of meningitis (2.5%). In the study by Amusa Y B[5], the indications for tracheostomy were trauma (n =15), infections (n = 13), laryngeal (benign and malignant) tumors (n = 9), other head and neck malignancies (n = 4),neurological cases with respiratory failure (n = 2), and tracheomalacia (n = 1).

Intubation before tracheostomy

107(89.12%) patients were intubated prior to tracheostomy while 13(10.8%) patients (Table 2) underwent tracheostomy without prior intubation. Of these 13 patients who were not intubated prior to tracheostomy, 3 had neck abscess, 3 had glottic tumours, 3 had obstructive sleep apnea, 2 had carcinoma hypopharynx, 2 had supraglottic tumours, 1 had transglottic tumour. These patients had presented to OPD or casualty with symptoms suggestive of impending complete obstruction of laryngeal inlet and hence was taken for emergency tracheostomy.

In case of need for prolonged ventilation or tracheobronchial toileting, tracheostomy is performed.In this study, we compared the occurrence of chance of growth of microorganism in the trachea of patients who underwent intubation prior to tracheostomy versus that of patients who were tracheostomized (p=0.530).

In a study done by J P Dilworth et al [6] showed presence of Haemophilus Influenza in 5 out of 15 post intubated patients trachea of which 3 people developed chest infection. Hence the chance ofintroducing an infection from oropharynx to the trachea can be considered for growth of organismin the trachea and further may give rise to chest infection, but in our study, it was found to be statistically insignificant.

Tracheostomy Tube change:

In our study, the tube was changed exactly at 7 days but conventionally the tube is changed at 7 to 14 days but a tube is changed earlier if there is any features of tube obstruction with crusts or mucus plugs. A mean time interval between the tracheostomy placement and first tube change of 5.3 days (range 3–7 d) was published by a survey of chief residents from otorhinolaryngology programs in the United States [7].

Tracheal swab culture during tracheostomy:
In our study tracheal swab is sent for bacterial culture during tracheostomy.

There was no growth in 64(53.3%) and growth was seen in 56(46.7%). In 46. 7% of patients fromwhom organisms grew in culture, 14 (11.8%) patients had Acinetobacter growth, 11 patients (9.2%) had mixed flora which was reported by microbiologist as comprising of multiple colonies of different species comprising of Klebsiella Pneumonia and Pseudomonas with normal commensals of upper respiratory tract followed by Klebsiella Pneumonia 8(6.7%) (Table 3). In a similar study by Anbuchezian et al [8], there was no growth in 82.5% and among the patients withpositive growth 5% had Acinetobacter and 2.5% had E Coli and Enterobacter spp. In this comparison, we had more growth from tracheal stoma during time of tracheostomy as comparedto that of study by Anbuchezian et al [8]. In another study by Amandeep Kaur et al [9] had reported maximum number of A.baumannii were isolated from respiratory samples-tracheal aspirate. In another study by Aswin Mukundan et al [10] first growth on day of tracheostomy was Acinetobacter(5.4%) which was similar to our study.

Tracheal swab culture on 7th day during tube change:
As per Table 4, there was no growth in 38.3% of patients while growth was seen in 61.5%. In 61.5%, mixed flora was seen in 18.3% followed by Klebsiella Pneumonia 12 (10%) andPseudomonas 11(9.2%).

The reason behind tracheal colonization in endotracheally intubated patients is generally from oropharygeal normal commensal (primary endogenous) or maybe acquired during hospital stay (nosocomial/secondary endogenous). After tracheostomy, the stoma acts as a route for entry of exogenous organism for colonization in the trachea. In a study by Pradeep M et al [11], following tracheostomy 39 out of 45 (86%) children developed colonization of the lower respiratory tract. Of these 39 children, 24 (53%) children had already developed lower respiratory colonization during trans-tracheal ventilation which continued post tracheostomy. S aureus and P aerogenosa were the predominant bacteria isolated during both modes of ventilation. In our study only 46.7% of the patients had lower respiratory tract colonization which is less compared to 86% colonization mentioned in the study by Pradeep M [11]. This can be because of emphasis on health worker handwashing techniques to prevent nosocomial infections that can increase chance of exogenous bacteria entry and also the maintenance of a proper oral hygiene by the respective care takers of the patient but in a similar study by Anbuchezian et al [8], no growth was seen in 80% of cases. Inthe study done by Lipovy B et al [12], 31 children underwent tracheostomy and the most common bacterium isolated from the lower respiratory tract is Acinetobacter Baumanii (31.53%) which is similar to our study in which Acitenobacter Baumanii is the most commonly bacterial isolate seen accounting for 11.8%. So the type of bacteria isolated from the lower respiratory tract after tracheostomy is comparable with the published studies.

CONCLUSION

Colonization of the lower respiratory tract after tracheostomy happens primarily from the exogenous route as there is no significant co relation between an intubated versus non intubated patient in respect to positive growth culture. There is likelihood of colonization of trachea in individuals belonging to older age group. Hence a tracheostomized patient should be started on a broad spectrum antibiotics and a proper tube care has to be done to prevent entry of exogenous bacterial colonization

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