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Study on Tracheostomy Timing and Clinical Outcome in Neurosurgical Patients Admitted at a Tertiary Care Centre

M Vijayanand[1], Pavaman S[2], Krishna Narayanan[3]

Authors Affiliation
[1]Post Graduate, Department of General Surgery, [2]Associate Professor & HOD, [3]Assistant Professor, Department of Neurosurgery, Yenepoya Medical College Hospital, Derlakatte, Mangalore, Karnataka 575018, India.

Corrosponding Affiliation
Pavaman S, Associate Professor & HOD, Department of Neurosurgery, Yenepoya Medical College Hospital, Derlakatte, Mangalore, Karnataka 575018, India.
Email: drpavaman@gmail.com
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Abstract

Background: Tracheostomy is being considered as a procedure of choice in cases where prolonged mechanical ventilation is required. The objective of this study was to determine the convenient timing of tracheostomy in neurosurgical patients.

Materials and Methods: A prospective hospital based study was conducted between March 2019 and September 2020 among all admitted neurosurgical patients requiring mechanical ventilation. The patients were divided into three groups, early tracheostomy group, intermediate tracheostomy group and late tracheostomy group. The patients were followed up for 90 days.

Results: Among 75 patients who underwent tracheostomy, 32% belonged to early tracheostomy group, 52% belonged to intermediate tracheostomy group and 16% belonged to late tracheostomy group. The mean age of the study population was 46.88. The average number of days on ventilator and average number of days of hospital stay were much higher in patients belonging to late tracheostomy group. Ventillator associated pneumonia (VAP) was also higher in late tracheostomy group.

Conclusion: Early tracheostomy is beneficial with respect to decreased duration of mechanical ventilation, decreased hospital stay and complications like VAP.

Keywords: Neurosurgery patients; Tracheostomy; Mechanical ventilation.

Introduction

Critical neurosurgical cases, many a times, necessitate the need for prolonged mechanical ventilation. Prolonged endotracheal intubation might increase the risk of ventilator associated pneumonia (VAP) by bypassing and disabling the laryngeal mechanisms, promoting oropharyngeal contamination of bronchial tree and lung.[1] It is also known to be associated with development of sinusitis and may also cause severe laryngeal and tracheal damage.[2,3] As a result, tracheostomy is performed nowadays in such critically ill patients who require prolonged ventilation either secondary to respiratory failure or certain other respiratory issues.

Tracheostomy has now become a procedure of choice when compared to prolonged endotracheal

intubation as it is comparatibly comfortable to patients, reduces the sedation requirements, lowers airway resistance and allows for easy airway care.[4] However, tracheostomy is not without complications. Complications like pneumothorax, bleeding, subglottic stenosis, tracheoesophageal fistula, vocal cord dysfunction, stomal granulation, persistent tracheal fistula and scarring.[5,6]

Studies have shown that neurosurgical patients may benefit from early tacheostomy as it reduces the incidence of VAP and length of ICU stay. But it did not have any effect on mortality or neurological outcome.[7] But the ideal timing of tracheostomy has always been a matter of debate in neurosurgical cases.

The present study was performed with an aim to determine the convenient timing to perform tracheostomies in critically ill neurosurgical patients and to evaluate its impact on the outcomes of their clinical condition. The objective of this study was to evaluate the outcome of patients with repect to ICU stay, hospital stay, duration of mechanical ventilation, time of removal of tracheostomy tube and any complications during this period.

Materials and Methods

A prospective study was carried out in all neurosurgery cases admitted at a tertiary care hospital from March 2019 to September 2020 in Mangalore, Karnataka, India. The study population was divided into three groups as Early tracheostomy group, Intermediate tracheostomy group and Late tracheostomy group. In the present study, we considered those patients who underwent tracheostomy within three days of endotracheal intubation were considered as Early tracheostomy group (ET), those who underwent tracheostomy within four to six days were considered to be under intermedicate tracheostomy group (IT) and those who underwent tracheostomy after six days of endotracheal intubation were considered to be under Late tracheostomy group (LT). The decision for tracheostomy was taken by a team of neurosurgeons who treated the patient and an open tracheostomy was performed under general anaesthesia by an ENT surgeon. The follow up was for 90 days from the day of admission and any adverse events or complications were noted.

Data of all patients were recorded in a perfoma and then entered in Microsoft Office Excel 2007. IBM SPSS 20 was used for statistical analysis. Continuous variables were compared using Anova test and discrete variables were compared using Chi-square or Fischer's exact test and a p-value of 0.05 or less was considered significant.

Results

During the study period, there were 75 patients who underwent tracheostomy. The mean age of the study population was 46.88 ± 10.58. The mean age of the population in the early tracheostomy was 45.8 ± 8.61, that of intermediate tracheostomy group was 49.41 ± 11.03 and that of late tracheostomy group was 42.25 ± 11.15. There were 28 (37.33%) males and 47(62.66%) females. The reason for admission of the patients is tabulated in Table 1.

Table 1: Diagnosis of patients who underwent tracheostomy.

Diagnosis	No. of Patients	Percentage
Aneurysmal Bleed	8	10.66%
Trauma	39	52%
Intracranial Haemorrhage	19	23.33%
Tumour	3	4%
Infection	6	8%

There were 24 (32%) patients who underwent early tracheotomy, 39(52%) underwent intermediate tracheostomy and 12 (16%) underwent late tracheostomy. The ratio of males to females in each group is tabulated in Table 2.

Table 2: Outcome in patients who underwent tracheostomy.

Parameters	Early Tracheostomy (0-3 days)	Intermediate Tracheostomy (4-6 days)	Late Tracheostomy (>6days)	P value
No. of patient	24 (32%)	39 (52%)	12 (16%)	NA
Male:Female (male in %)	10 :14	13:26	5:7	0.762
Average ICU stay	9.16 ± 1.73	9.53 ±1.75	9.75 ± 1.86	0.5853
Average number of days on ventilator	5.37 ± 1.46	5 ± 1.39	6.25 ± 1.71	0.0402*
Ventillator associated Pneumonia	2(8.33%)	1(2.56%)	5 (41.66%)	0.002*
Average hospital stay	18.62 ± 3.14	21.8 ± 4.41	31 ± 4.36	<0.0001*
Mortality	1 (4.16%)	1 (2.56%)	2 (16.66%)	0.147

Table 3: Complications in patients who underwent tracheostomy.

Complications	Early Tracheostomy (0-3 days)	Intermediate Tracheostomy (4-6 days)	Late Tracheostomy (>6days)	P value
Haemorrhage	1 (20%)	1 (33.33%)	2 (40%)	
Surgical site Infection	0 (0%)	–	2 (40%)	0.429
Accidental removal	4 (80%)	2 (66.66%)	1 (20%)	

With regards to the outcome in these patients, it was seen that there was no difference in average number of days spent in ICU in patients belonging to these groups. The average number of days in ventilator and average number of hospital stay were much higher in patients belonging to late tracheostomy group and this difference was also statistically significant with p value less than 0.05. Ventillator associated pneumonia was also higher in the late tracheostomy group accounting for 41.6% and this difference in ventilator associated pneumonia was significantly higher when compared to early and intermediate tracheostomy group.

With regards to the complications, it was seen that the late tracheostomy group had complications more than the intermediate and early tracheostomy group. However, this difference was not statistically significant. There was no significant difference in mortality among the three groups.

Discussion

The timing of tracheostomy in critical neurosurgical cases undergoing mechanical ventilation has always been a subject of controversy. Endotracheal intubation for a prolonged time has its own disadvantages with ventilator associated pneumonia being the most important. Tracheostomy has been regarded as a best alternative in such situations where prolonged intubation is required as it is easy to handle tracheostomy paients than patients on endotracheal tube, because of possibility of easy pulmonary toileting, reduced requirement of sedation, greater patient comfort, possibility of feeding the patient orally and less chances of ventilator associated pneumonia.[8-10]

A conference in 1989 suggested that tracheostomy is preferable when requirement of ventilator is said to exceed more than 21 days.[11] But the timing of tracheostomy is still debated. Studies have shown that early tracheostomy refers to that which is performed within 2 to 10 days of mechanical ventilation and late tracheostomy refers to anytime outside this period and usually refers to any period within 7 to 28 days.[12-18]

An early tracheostomy is preferred because of chances of laryngeal and subglottic stenosis in patients with prolonged endotracheal intubation. A prospective study was conducted by Whited R E[19] among 200 intubated patients, and found that those who were intubated for about 2 to 5 days had a 6% incidence of transient laryngeal injury, and those who were intubated for 6 to 10 days had a 5% incidence of irreversible laryngeal stenosis. Those who were intubated for more than 10 days had a 12% incidence of extensive laryngeal stenosis.

There was a significant reduction in average number of days with ventilator and average hospital stay in early tracheostomy group when compared to late tracheostomy group in the present study. This was similar to results seen in a study conducted by Rai S et al[20] where the average number of days with ventilator was less in tracheostomy group. However hospital stay was not different in both the groups which was not consistent with the present study.

The incidence of ventilator associated pneumonia was much higher (41.6%) in the late tracheostomy group when compared to that of the early tracheostomy group and intermediate tracheostomy group. Study conducted by Rai S et al[20] also showed similar incidence in the late tracheostomy group and accounted for 49%. The incidence of VAP was shown to be significantly higher in late tracheostomy group in the study conducted by Rai S et al.[20] Patients with traumatic head injury are at particularly high risk of ventilator-associated pneumonia as impaired level of consciousness favour continuous and silent aspiration subsequently leading to pneumonia.[21-23] Hence it is safe to perform an early tracheostomy in head injury patients who are likely to be under mechanical ventilation for a long time.

There was no significant difference in mortality among patients belonging to the three groups. A Cochrane meta-analysis also found that there was no difference in mortality between early (2-10 days) and

late (>10days) tracheostomy group.[24]

Limitations

Small sample size and non randomised study are the main limitations of this study. A properly randomised study with a large sample size may be done in the future.

Conclusion

Early tracheostomy in critical neurosurgical cases is beneficial in terms of decreased duration of mechanical ventilation and decreased hospital stay. The incidence of VAP is also lesser in the early tracheostomy group. However there is no benefit with respect to mortality.

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