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**T**racheostomy is a very common procedure in neurosurgical ICU patients. In order to improve the respiratory dynamics and for the ease and efficiency of chest physiotherapy, patients with depressed level of consciousness who cannot be extubated early are considered for tracheostomy. In addition to that, complications of prolonged orotracheal intubation also

## Outcome Difference in Neurosurgical Patients Based on Timing of Tracheostomy and Ventilator Associated Pneumonia

**Background and Objective:** Tracheostomy in neurosurgical patients has been shown in various studies to lower the length of ICU stay and the length of hospital stay by decreasing the incidence of ventilator associated pneumonia. In this regard, we wanted to evaluate the outcome of neurosurgical ICU patients based on timing of tracheostomy and ventilator associated pneumonia.

**Methods:** This is a retrospective single centre study performed over a period of two and a half years. Early tracheostomy was defined as those done three days of intubation or earlier and late as those done then after. Statistical analysis was done using SPSS.

**Results:** There were 56 patients over the study period of which 18 patients underwent early tracheostomy and 38 patients underwent late tracheostomy. There was no statistically significant difference between the two groups with regards to the length of ICU stay, the length of hospital stay or the length of tracheostomy tube in situ. But based on tracheal aspirate culture positivity, length of tracheostomy tube in situ was significantly longer in those with positive bacterial cultures.

Early tracheostomy does not improve neurosurgical outcome while documented pneumonia prolongs the length of tracheostomy tube in situ.

**Keywords:** Early, Late, Tracheostomy, Ventilator Associated Pneumonia

need consideration. There is no predefined cut off duration that defines early or late tracheostomy and various authors have used various definitions.<sup>5,8,10,12,13,16,17</sup> In our neurosurgical ICU, based on the experience of senior author, Upendra Prasad Devkota, we have a tendency towards early tracheostomy, defined as that performed at three days of intubation or earlier. In this context, we

wanted to observe if early tracheostomy and tracheal aspirate culture positivity imparts any significant influence to the length of ICU or hospital stay and the length of tracheostomy tube in situ.

### Materials and Methods:

This is a retrospective case series from National Institute of Neurological and Allied Sciences, Bansbari Nepal. Literature review was done and study variables determined. Patients treated between Ashad 2071 to Poush 2073 (two and a half years) were included in the study.

Patients expected to have prolonged ventilatory need based on poor neurological status especially those with pneumonia were considered for tracheostomy, early than late, as this facilitates effective physiotherapy and improved respiratory mechanics. Tracheostomy was done by traditional open method by neurosurgical registrars and ENT surgeon. After tracheostomy, cultures were sent every third day irrespective of any symptoms, signs or radiological suggestion of infection. As per tracheostomy care protocol, first tracheostomy tube change was done after seven days and subsequently every fourth day.

List of patients who underwent tracheostomy in ICU within this period was generated from operative register. Patient charts were then retrieved from medical records for review. Data was compiled in a master sheet in Numbers v 4.2. Data analysis was done using Numbers v 4.2 as well as IBM SPSS (v 20; SPSS Inc., Chicago, IL, USA). P value of 0.05 or less was considered to be significant.

### Results:

A total of 212 patients underwent tracheostomy over a period of two and a half years, of which only 56 patient records could be retrieved and thus were included for the analysis. The mean age was 40.42 years (range 16 to 70). There were 43 males and 13 females with M: F:: 3.3:1.

Early tracheostomy, defined as that performed three days or less of intubation, was done in 18 patients. Late tracheostomy, defined as those performed after three days, was done in 38 patients. Primary diagnosis of patients admitted to ICU ranged from trauma and tumor to cerebrovascular events. Mean GCS at the time of admission was 9.14 (range 3-15). Average length of ICU stay was 17.51 days (range 4 to 44). Average length of tracheostomy tube in situ was 29.84 days (range 6 to 90). Average length of hospital stay was 49.32 days (range 7 to 112).

Thirty-nine patients had bacterial growth on tracheal aspirate culture while 17 patients were culture negative. Bacterial infection was treated according to the sensitivity patterns. 23 patients succumbed due to progression of

their primary disease or resistant bacterial pneumonia.

Effect of early versus late tracheostomy on the length of ICU stay, the length of tracheostomy tube in situ, and the length of hospital stay were studied and has been tabulated in Table 1. Effect of culture positivity of tracheal aspirate on each of these aforementioned three variables was studied and significant association was seen with the length of tracheostomy tube in situ.

	Early tracheostomy	Late tracheostomy	P value
Length of ICU stay	16.56	18.91	0.584
Length of tracheostomy in situ	29.36	30.45	0.907
Length of hospital stay	46.40	52.69	0.525
Outcome			
Dead	12	8	0.643
Alive	17	16	

Table 1: Effect of timing of tracheostomy on length of ICU stay, hospital stay and tracheostomy tube in situ

	Culture negative	Culture positive	P Value
Length of ICU stay	16.64	21.40	0.377
Length of tracheostomy in situ	24.70	50.40	0.019
Length of hospital stay	23.984	31.285	0.608
Outcome			
Dead	11	9	0.188
Alive	26	7	

Table 2: Effect of tracheal culture positivity on length of ICU stay, hospital stay and tracheostomy tube in situ

### Discussion:

In patients receiving mechanical ventilation, tracheostomy renders nursing care easier and provides more security allowing patient mobility. It has many advantages over translaryngeal intubation and is better tolerated by patients.<sup>4, 7</sup> Tracheostomy reduces laryngeal

irritation, lowers resistance, improves pulmonary toilet, and decreases the requirement for sedation. However the procedure itself is fraught with complications like stomal bleeding, infection, pneumothorax, pneumomediastinum, tracheomalacia, tracheo-esophageal fistula or catastrophic arterial fistula.<sup>2, 5, 15</sup>

In 1989 the American consensus conference on artificial airways issued the statement that tracheostomy is preferred if the need for an artificial airway is anticipated to be greater than 21 days.<sup>2</sup> When a low pressure and high volume endotracheal tube is used, intubation is safe till two weeks;<sup>3</sup> however, the timing of tracheostomy varies widely in various setups. Many clinicians would support a tracheotomy in patients who are receiving mechanical ventilatory support for more than 7 to 10 days, but its use earlier in the course of respiratory failure management remains controversial.<sup>16</sup> There is no predefined cut off duration that defines early or late tracheostomy.<sup>5, 8, 10, 12, 13, 16, 17</sup> Of extremes, Rumbak et al has regarded early tracheostomy as that performed within 2 day, and Mehta et al as that done within 21 days.<sup>11, 14</sup>

Ventilator-associated pneumonia (VAP) is an iatrogenic pulmonary infection that develops in tracheally intubated patients on mechanical ventilation for at least 48 hours.<sup>1</sup> According to Bourdeka et al., early tracheotomy decreases the total days in the ventilator in patients with pneumonia, but does not reduce either ICU stay or the frequency of pneumonia or mortality.<sup>2</sup> In our study however, the days on ventilator in both groups was not different. As per Griffiths et al. and Terangi et al., early tracheostomy compared with late tracheotomy did not result in statistically significant improvement in the incidence of ventilator-associated pneumonia.<sup>5, 16</sup> Kang B H et al did a propensity scoring to match cases adjusting for age and injury severity, to reduce selection bias in the early and late tracheostomy subgroups and concluded that patients who underwent tracheostomy within 7 days of endotracheal intubation had decreased overall ventilator duration, length of stay at the ICU, and reduced duration of post-tracheostomy ventilation.<sup>9</sup> Prior to matching this advantage was not evident.

In our study we could not identify the incidence of ventilator-associated pneumonia and hence the difference in the two groups as the medical records lacked adequate recording and confirmation of the diagnosis; however, we analyzed the culture sensitivity reports of the tracheal aspirates. We did not analyze the type of organism grown in the tracheal aspirate, as it was not an important variable regarding our study objective.

Early tracheostomy significantly reduced duration of artificial ventilation by 8.5 days, and length of stay in intensive care by 15.3 days and even reduced the duration

of antibiotic treatment.<sup>5, 8, 17</sup> Kang B H et al did a propensity scoring to match cases adjusting for age and injury severity, to reduce selection bias in the early and late tracheostomy subgroups and concluded that patients who underwent tracheostomy within 7 days of endotracheal intubation had decreased overall ventilator duration, length of stay at the ICU, and reduced duration of post-tracheostomy ventilation.<sup>9</sup> Prior to matching this advantage was not evident.

Herrit B et al. substantiated this difference financially, stating, that patients undergoing early tracheostomy had an average weighted cost of ICU stay less than those undergoing late tracheostomy by \$4316.<sup>6</sup> Our study however, did not substantiate this advantage. In other studies, the incidence of pneumonia was significantly higher in the late tracheostomy group, relative to the early tracheostomy group with longer ventilator days, hospital stay, and even the overall mortality, though these findings are not consistent over other studies.<sup>12, 13</sup>

Our study had specific objectives and we wanted to answer if early tracheostomy, done within three days of endotracheal intubation, as was the trend in our hospital, had added benefit to those done after that. In our setup, we were able to establish that the outcome regarding the ICU stay, length of tracheostomy tube in situ, hospital stay and the patient outcome did not differ with this early intervention. As expected the patients that did have a positive culture of the tracheal aspirate had a significantly longer duration of tracheostomy tube in situ; so as to clear the infection. Our limitations were, we could not establish the incidence of ventilator associated pneumonia in these subgroups due to inadequate record-keeping.

### Conclusion:

Early tracheostomy does not decrease the length of ICU stay, the length of hospital stay or the length of tracheostomy tube in situ. However the duration of tracheostomy tube in situ is significantly prolonged if the patient had pneumonia documented with positive tracheal aspirate cultures.

### Conflict of interest:

We disclose no conflict of interest.

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