Morbidity and Mortality rates in early versus late Tracheostomy in Mechanically Ventilated Stroke Patients

ABSTRACT

Background: Some patients who are predicted to need extended endotracheal intubation have conflicting recommendations on when to perform a tracheostomy.

Objective: To assess the effects of early tracheotomy versus late tracheotomy in stroke patients on the occurrence of ventilator-associated pneumonia (VAP), the time required to wean off MV, the length of ICU stay, and the ultimate result.

Concerning the Materials and Techniques: Eighty adult male and female patients with a diagnosis of acute ischemic or hemorrhagic stroke were split into two groups: those who had tracheotomy early and those who underwent it later. Until 40 patients were enrolled in each group, the trial continued.

Results indicated that there was no statistically significant difference in age or gender between the two groups. Most people in both groups reported a family history of hypertension or diabetes (70% in group (1) and 55% in group (2)). Furthermore, APACHE II (p=0.11), SETscore (p=0.09), and intubation cause (p=0.58) showed no statistically significant group differences. Before and after tracheostomy, there were statistically significant variations in VAP (P < 0.001), MV duration (P < 0.001), MV weaning (P < 0.001), and ICU stay (P = 0.045).

The current study concluded that in stroke patients who are expected to need prn ventilation, early tracheotomy (within 7 days from intubation) should be considered. This was because early tracheotomy was associated with decreased incidence of VAP, faster weaning from MV, reduced length of ICU stay, decreased mortality rate, and increased probability of discharge from ICU (more than 7 days).

INTRODUCTION

Patients with stroke who need mechanical ventilation have a dismal prognosis, making it all the more important to properly control their airways. ¹ Patients in need of extended artificial ventilation often undergo tracheostomy, one of several airway management procedures. Weaning off MV is less of a challenge with a tracheostomy, and the patient might potentially benefit from oral nutrition, better communication, and a more relaxed state of mind. Further, it lessens the chances of having to use sedative medication. ²

Some patients who are predicted to need extended endotracheal intubation have conflicting recommendations on when to perform a tracheostomy.
Tracheostomy is often the best option for these individuals. In clinical practise, the window for early tracheostomy is unclear (2-14 days). It provides a safer airway and lessens the likelihood of inadvertent extubation, letting patients get up and moving about more quickly. In the modern era, early patient movement has taken on more significance for those who are dangerously sick. Despite this, 1% of tracheostomized patients have inadvertent decannulation, whereas 8%-21% of patients with trans-laryngeal intubation do.

This study compared the effects of early tracheotomy to those of late tracheotomy in stroke patients admitted to our general ICUs at Benha University hospitals in terms of the occurrence of ventilator-associated pneumonia (VAP), the time required to wean from mechanical ventilation (MV), the length of ICU stay, and the final outcome.

**SUBJECTS AND METHODS**

Eighty adult male and female patients with a diagnosis of acute ischemic or hemorrhagic stroke who needed mechanical ventilation with prognosis of prolonged intubation that may necessitate tracheotomy were included in the Prospective Randomized study (early within seven days after intubation or late from day 14 after intubation). Individuals were randomly allocated to either an early tracheotomy group or a late tracheotomy group from May 1, 2021, and April 30, 2022 at Benha University ICU. Until 40 patients were enrolled in each group, the trial continued.

Patients were not included if they met any of the following criteria: they were unwilling to take part in the study, they had an absolute or relative contraindication for percutaneous
tracheotomy (such as bleeding abnormalities, unstable fracture of the cervical spine, and severe local infection of the anterior neck), or they were taking part in another interventional trial that could have an impact on their risk of death.

In order to ensure that all prospective participants met the study's inclusion and eligibility criteria, clinical scores were recorded, such as the Acute Physiology and Chronic Health Evaluation II (APACHE II) score at the time of hospital admission and the SET score.

Patients in the study were monitored from the time they required artificial breathing until they were either released from the intensive care unit (ICU) or died.

We obtained approval from the Benha medical school’s research ethics committee and all legal representative of participants provided written informed permission.

**STATISTICAL ANALYSIS**

The Social Science Statistical Software (SPSS) was used for data input and analysis (SPSS, Version 20). Prior to analysis, data was coded, inputted, and validated. Statistics were summarised using measures of central tendency (mean, median, range, and standard deviation) for quantitative variables. Quantitative and qualitative variables were both presented using frequency and percentages of the whole.

The Chi-square test was used to compare qualitative characteristics between the two intervention groups. Normally distributed quantitative variables were compared using the student t test, whereas non-normally distributed variables were compared using the Mann-Whitney U test. In this case, a 5% threshold of significance was used to evaluate the data.

**RESULTS**
The age of studied patients ranged from 50 to 70 years. There were non-significant differences between the early and late tracheotomy groups as regards the age ($P = 0.359, 0.49$ respectively) (Table 1).

**Table (1): Distribution of studied patients according to their age and sex.**

<table>
<thead>
<tr>
<th>Age (yrs.)</th>
<th>Group (1) Early tracheotomy n=40</th>
<th>Group (2) Late tracheotomy n=40</th>
<th>Test</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>56.6 ± 6.20</td>
<td>57.9± 5.66</td>
<td>0.923</td>
<td>0.359</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sex</th>
<th>Group (1) Early tracheotomy n=40</th>
<th>Group (2) Late tracheotomy n=40</th>
<th>Test</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>♂</td>
<td>25 (62.5%)</td>
<td>22 (55%)</td>
<td>0.046</td>
<td>0.49</td>
</tr>
<tr>
<td>♀</td>
<td>15 (37.5%)</td>
<td>18 (45%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Statistically significant at $p \leq 0.05$

As regard presence of risk factors for either ischemic or hemorrhagic stroke, history of hypertension and Diabetes were the most reported risk factors in both groups (70% and 55% in group (1) and (2) respectively) but with non-significant difference between the groups ($P \geq 0.05$).

The majority (72.5%) of patients in group (1) suffered from ischemic stroke compared to (70%) of the patients in group (2). This difference was statistically non-significant ($P = 0.8$). There were non-significant differences between both groups as regards APACHE II score ($P = 0.11$) and the SET score ($P = 0.09$).

There was a non-significant difference between the groups regarding the cause of intubation and mechanical ventilation ($P = 0.58$) (Table 2)

**Table (2): Distribution of studied patients according to cause of intubation.**

<table>
<thead>
<tr>
<th>Cause of intubation</th>
<th>Group (1) Early tracheotomy n=40</th>
<th>Group (2) Late tracheotomy n=40</th>
<th>Chi-square test</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulbar* (42.5%)</td>
<td>Bulbar* (32.5%)</td>
<td></td>
<td>1.06</td>
<td>0.58</td>
</tr>
<tr>
<td>GCS** (32.5%)</td>
<td>GCS** (42.5%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>both (25%)</td>
<td>both (25%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Bulbar dysfunction
** Glasgow Coma Scale (GCS)

There was a statistically significant difference among studied patients regarding the incidence of VAP after tracheotomy ($P <0.001$). There was a
statistically significant difference between the studied groups regarding the duration of MV being longer in the late tracheotomy group ($P < 0.001$).

As regard weaning from MV, (75%) of studied patients in group (1) were successfully weaned from MV compared to only about (25%) of studied patients in group (2). The difference observed in both groups is statistically significant ($P<0.001$).

There was a statistically significant difference regarding the length of ICU stay among group (1) and group (2) being longer in group (2) ($P = 0.045$) as shown in table (3).

**Table (3): Distribution of studied patients according to length of ICU stay**

<table>
<thead>
<tr>
<th>Length of ICU** stay</th>
<th>Group (1) Early tracheotomy n=40</th>
<th>Group (2) Late tracheotomy n=40</th>
<th>Test</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration (days) Min- max</td>
<td>12-20 15.32± 2.58</td>
<td>20-40 29.6± 6.20</td>
<td>13.430</td>
<td>.045*</td>
</tr>
</tbody>
</table>

As regard the final outcome of studied patients, (62.5%) of studied patients in group (1) died compared to (72.5%) of studied patients in group (2). Whereas, in group (1), (37.5%) of patients in group (1) were discharged from ICU compared to (27.5%) of patients in group (2) and this difference was statistically insignificant ($P=0.34$).

**DISCUSSION**

Ischemic and hemorrhagic processes both contribute to the rapid loss of neurological function characteristic of a stroke. 5 The use of extended orotracheal intubation (OTT) has a domino effect, increasing the need for mechanical ventilation, which in turn lengthens intensive care unit (ICU) and hospital stays, increases the risk of complications, and drives up healthcare expenditures. When compared to OTT, tracheostomy reduces the risk of laryngeal or upper
airway injury, facilitates the evacuation of secretions from the lower airway, improves weaning, shortens the duration of sedation, and makes better use of hospital resources. For this research, patients of similar ages were randomly assigned to each of the two groups. Concerning gender, 62.5 percent of the patients in group 1 were male whereas 55.0 percent of the patients in group 2 were male, with no discernible difference between the two groups. Stroke patients in Western Ethiopia: Demographics and clinical features, by 7. Consistent with past research from a variety of contexts, they discovered that men were more likely than women to have a stroke 8 and 9 Hypertension and diabetes mellitus were the most often reported risk factors (70% and 55% in group (1) and (2), respectively). In line with findings from the studies by 10 and 11, hypertension was shown to be the most prevalent risk factor for stroke. Patients in both groups, but especially in group 2, were suffering from ischemic stroke (72.5%). This finding is consistent with the findings of earlier studies by 7 and 9, which found that ischemic strokes were the most often diagnosed form of stroke.

Patients were included if they had a score of 10 or above and were expected to need ventilation for at least two weeks. No statistically significant differences were found between the two groups. Previous research using the SETscore for predicting prolonged intubation has been published in 12, 13, 8, and 14.

Patients having late tracheotomy had a higher incidence of VAP compared to those whose tracheotomies were performed earlier. Supporting these findings is a research by 15, which found that the incidence rate of VAP was 39.8 VAP cases per 1000 ventilator days and that just under three quarters (72.9%) of VAP patients experienced VAP after the
fourth day after beginning MV. When comparing the two groups, \(^{16}\) found that the late group had a greater incidence of VAP before tracheostomy.

Mechanical ventilation was required for a shorter time period among patients in the early tracheotomy group compared to the late tracheotomy group in the current research. Researchers \(^{17}\) compared the efficacy of early tracheostomy to that of late tracheostomy and found that the former significantly shortened the length of mechanical ventilation (MV).

Our results revealed that patients whose tracheotomies were performed sooner rather than later spent less time in the intensive care unit. There is substantial consistency between our findings and those of previous investigations \(^{18}\) and \(^{19}\).

As a result, our research shows that tracheotomies performed sooner rather than later are connected with a greater chance of being released from the intensive care unit.

A 2015 study by \(^{20}\) indicated that patients who had tracheostomy sooner rather than later had a decreased risk of death. \(^{21}\) observed that early tracheostomy was related with improved results, decreased length of MV, shorter ICU stay, and reduced death. By contrast, \(^{22}\) found that early tracheostomy did not enhance 30-day mortality or other important secondary outcomes.

Early tracheostomy implantation in patients with hemorrhagic stroke was investigated by \(^{23}\). Early tracheostomy was linked to a shorter length of stay in the hospital.

This research has a number of caveats. To begin, there is no agreed-upon definition of an early tracheotomy. Both the treating doctors and the majority of the researchers in our study were not blinded to the results. Our sample size was also rather low. As a consequence, we
urge more research with a bigger sample size to confirm the positive findings of our study. Patients who were finally released to either home care or long-term care institutions were not included in our analysis, nor were their long-term outcomes reported. Finally, the significant prevalence of VAP among our sample of patients was associated with a failure to strictly follow to established infection control measures.

REFERENCES


7. Fekadu G, Adola B, Mosisa G, Shibiru T and Chelkeba L. Clinical characteristics and treatment outcomes among stroke patients hospitalized to Nekemte referral


20. Andriolo BN, Andriolo RB, Saconato H, Atallah ÁN and
Valente O. Early versus late tracheostomy for critically ill patients. *Cochrane Database of Systematic Reviews*. 2015; (1).


