How to Cite:
Sangavi, A. K. B., Hariprasad, S., Ravikumar, R., & Suhas, Y. C. (2022). Timing of tracheostomy & its outcome in intensive care unit: A retrospective study. *International Journal of Health Sciences*, *6*(S3), 11034–11041.
https://doi.org/10.53730/ijhs.v6nS3.8495

Timing of tracheostomy & its outcome in intensive care unit: A retrospective study

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***Abstract*---**Background: Tracheostomy is a commonly performed procedure to facilitate prolonged ventilator-based respiratory support in patients with respiratory failure. The side effects of tracheostomy includes tracheal stenosis, increased bacterial colonization and haemorrhage. The present study was conducted to assess timing of Tracheostomy & its outcome in Intensive care unit. Material & Methods: A retrospective study was done to assess timing of tracheostomy -early vs late, its outcome, as a determinant of weaning success in intensive care patients. The weaning process was begun with synchronized intermittent mandatory ventilation with pressure support. Medical records were analyzed for age, sex, underlying disease and cause of intubation, Acute Physiology and Chronic Health Evaluation (APACHE) II score17, duration of mechanical ventilation, complications of tracheostomy, pneumonia after tracheostomy, length of ICU stay, and mortality in the ICU and hospital. The analysis of the data was performed using the Statistical Package for the Social Sciences (SPSS, IBM Corp., Armonk, NY, US) software, version 22. $P < 0.05$ will be considered statistically significant. Results: In the present study a total population of 100 patient with tracheostomy were included. Successful weaning occurs in 40% patients and 60% patients fail to wean. Mean age of total patients was 38yrs whereas mean age of patients with successful weaning was 37yrs and mean age of patients with failed weaning was 40yrs. Total male in the study was 67 and females were 33. APACHE II score for total patients was 20 and for successful weaning was 19 and for patients failed to wean

was 21. In successful weaned patients reason for intubation in maximum patients was pulmonary disease. In failed to weaned patients reason for intubation in maximum patients was RTA. In patients with successful weaning ICU mortality was 30%, In hospital mortality was 5%. Intubation period was 16 days. Overall ICU stay was 16 days. Post-tracheostomy ICU stay was 9 days. Post-tracheostomy MV period was 11 days. Post-tracheostomy pneumonia occur in 72.5%. In patients with failed weaning ICU mortality was 46.66%, In hospital mortality was 30%. Intubation period was 19 days. Overall ICU stay was 16 days. Post-tracheostomy ICU stay was 13 days. Post-tracheostomy MV period was 41 days. Post-tracheostomy pneumonia occur in 55%. Conclusion: The present study concluded that early tracheostomy had a notable benefit in shortening the duration of the MV and minimizing the risks of weaning failure, but it had no significant impact on both the overall duration of ICU stay.

***Keywords*---**tracheostomy, weaning, ventilator.

Introduction

Tracheostomy is a commonly performed procedure to facilitate prolonged ventilator-based respiratory support in patients with respiratory failure, and may be carried out in up to 10% of all Intensive Care Unit (ICU) admissions.[1] The first successful tracheostomy was attributed to Antonio Brasavola, who recorded saving the file of a patient close to death from an “abcess of the windpipe in 1546” Tracheostomies are most common procedures performed in ICU.[2,3] Tracheostomy has the following benefits, it is easier, nursing care become easier, improved comfort, more secure tube with increased patient mobility, allowance of speech, oral nutrition and in some studies early weaning from mechanical ventilation.[4,5] Early tracheostomy (ET) is advocated for the prevention of ventilator-associated pneumonia (VAP), earlier weaning and reduction of analgosedation.[6,7]On the other hand, some studies have suggested that tracheostomy is associated with an increased risk of nosocomial pneumonia.[8,9] Main side effects of tracheostomy includes tracheal stenosis, increased bacterial colonization and haemorrhage.[10,11]The present study was conducted with the following objectives:

- To assess early versus late tracheostomy and its outcome.
- To assess timing of tracheostomy as a determinant of weaning success in intensive care patients.
- To assess duration of ventilator support & ICU stay after tracheostomy

Material and Methods

A retrospective study was done to assess timing of tracheostomy -early vs late, its outcome, as a determinant of weaning success in intensive care patients. Patients who underwent tracheostomy in ICU during the period year 2016 to 2019was included in the study. Patients with tracheostomy performed in an emergency

setting because of difficulties with the airway or other causes and Patients with tracheostomy referred from other hospitals were excluded from the study.

Study procedure

- Early tracheostomy (ET) was defined as ≤4 days,
- Intermediate tracheostomy (IT) as tracheostomy within 5-9 days,
- Late tracheostomy (LT) was defined as 10-14 days,
- Very late tracheostomy (VLT) was defined as ≥15 days after endotracheal intubation.

Tracheostomy which was performed using standard open surgical techniques at bedside in the ICU/OT, and no patients underwent percutaneous tracheostomy. The timing of tracheostomy depended on the attending physician's decision. Indications to initiate an attempt to wean a patient from mechanical ventilation included stable haemodynamic status, improved oxygenation (arterial oxygen tension [PaO2]/fractional inspired oxygen [FiO2] ratio >150), controlled infection and lack of need for further intervention. The weaning process was begun with synchronized intermittent mandatory ventilation with pressure support. Then, patients underwent continuous positive airway pressure with pressure support, or intermittent T-piece for a spontaneous breathing trial when clinical conditions improved. Successful weaning was defined as weaning from mechanical ventilation for more than 72 hours. Medical records were analyzed for age, sex, underlying disease and cause of intubation, Acute Physiology and Chronic Health Evaluation (APACHE) II score[12], duration of mechanical ventilation, complications of tracheostomy, pneumonia after tracheostomy, length of ICU stay, and mortality in the ICU and hospital. APACHE II scores were calculated using clinical data, which were available from the first 24 hours of intensive care. Clinical data within 72 hours before tracheostomy, including PaO2/FiO2 ratio, peripheral white blood cell (WBC) counts, haemoglobin, creatinine and albumin, were also recorded and analyzed. Old age was defined as age above 65 years. Anaemia is defined as haemoglobin below 10 g/dl, and leucocytosis is defined as a WBC count above 11,000/ µl before tracheostomy. Renal insufficiency is defined as creatinine above 1.5 mg/dl, and poor oxygenation as PaO2/FiO2 ratio below 250.

Complications of tracheostomy, including bleeding, air leakage, pneumothorax, subcutaneous emphysema, cardiopulmonary arrest, dislodgement of the tube, obstruction, tracheal stenosis, granuloma, tracheo-oesophageal fistula and tracheomalacia, will be recorded. Complications that occurred within 7 days after tracheostomy will be defined as early complications; those occurring later will be considered late complications. Severity of bleeding after tracheostomy was classified as follows: minor if there will be only minimal blood clot over the wound or if new onset bloody sputum was noted on the next day of the tracheostomy; moderate if bleeding needed external compression and component therapy or surgical management; and massive if the bleeding resulted in obvious haemodynamic change. The clinical definition of post-tracheostomy pneumonia used was follows[13]: new and persistent radiographic opacity found after the tracheostomy had been removed and within 48 hours into the weaning period; positive sputum culture; and three of body temperature above 38°C, WBC count above 15,000/µl, increased airway secretions, or worsening gas exchange.

Patients were transferred to long-term care settings once tracheostomy and the weaning process were completed if there was no other active clinical disease.

Statistical Analysis

The analysis of the data was performed using the Statistical Package for the Social Sciences (SPSS, IBM Corp., Armonk, NY, US) software, version 22. Values was expressed as mean ± standard deviation. Analysis was done by using x2 test, an independent t-test, Pearson bivariate correlation test, Kaplan–Meier method with a log rank test, Cox regression model. $P < 0.05$ was considered statistically significant.

Results

In the present study a total population of 100 patient with tracheostomy were included. Successful weaning occurs in 40% patients and 60% patients fail to wean. Mean age of total patients was 38yrs whereas mean age of patients with successful weaning was 37yrs and mean age of patients with failed weaning was 40yrs. Total male in the study was 67 and females were 33. APACHE II score for total patients was 20 and for successful weaning was 19 and for patients failed to wean was 21. In successful weaned patients reason for intubation in maximum patients was pulmonary disease. In failed to weaned patients reason for intubation in maximum patients was RTA. In patients with successful weaning ICU mortality was 30%, In hospital mortality was 5%. Intubation period was 16 days. Overall ICU stay was 16 days. Post-tracheostomy ICU stay was 9 days. Post-tracheostomy MV period was 11 days. Post-tracheostomy pneumonia occur in 72.5%. In patients with failed weaning ICU mortality was 46.66%, In hospital mortality was 30%. Intubation period was 19 days. Overall ICU stay was 16 days. Post-tracheostomy ICU stay was 13 days. Post-tracheostomy MV period was 41 days. Post-tracheostomy pneumonia occur in 55%.

Table 1
Demographic details

Variable	Total(n=100)	Successful weaning(n=40)	Failure to wean(n=60)	P value
Age	38.6 ±12.4	37.8±18.5	40.4±12.3	< 0.05
Gender(M/F)	67/33	27/13	40/20	
APACHE II score	20.4±5.8	19.9±5.6	21.9±5.9	

Table 2
Reasons for intubation

Reasons for intubation	Total(n=100)	Successful weaning(n=40)	Failure to wean(n=60)	P value
Infectious disease	13	10(25%)	1(2.5%)	< 0.05
Stroke	16	2(5%)	15 (22.5%)	
Cardiac	12	6(15%)	6(10.83%)	

Organophosphate poisoning	31	18(45%)	13(20%)	
RTA	17	2(5%)	16(24.16%)	
Others	11	2(5%)	9(15%)	

Table 3
Outcomes after tracheostomy

Outcomes	Total(n=100)	Successful weaning(n=40)	Failure to wean(n=60)	P value
ICU Mortality	40	12(30%)	28(46.66%)	< 0.05
In-hospital mortality	20	2(5%)	18(30%)	
Intubation period(days)	17.8±9.8	16.9±10.5	19.6±9.8	
Overall ICU stay (days)	15.4±13.7	16.1±12.6	16.6±13.8	
Post-tracheostomy ICU stay (days)	10.6±8.7	9.5±6.8	13.8±12.9	
Post-tracheostomy MV period(days)	26.5±39.8	11.9±11.9	41.8±41.7	
Post-tracheostomy pneumonia	62	29(72.5%)	33(55%)	

Discussion

In the present study a total population of 100 patient with tracheostomy were included. Successful weaning occur in 40% patients and 60% patients fail to wean. Mean age of total patients was 38yrs whereas mean age of patients with successful weaning was 37yrs and mean age of patients with failed weaning was 40yrs. Total male in the study was 67 and females were 33. APACHE II score for total patients was 20 and for successful weaning was 19 and for patients failed to wean was 21. In successful weaned patients reason for intubation in maximum patients was pulmonary disease. In failed to weaned patients reason for intubation in maximum patients was RTA. In patients with successful weaning ICU mortality was 30%, In hospital mortality was 5%. Intubation period was 16 days. Overall ICU stay was 16 days. Post-tracheostomy ICU stay was 9 days. Post-tracheostomy MV period was 11 days. Post-tracheostomy pneumonia occur in 72.5%. In patients with failed weaning ICU mortality was 46.66%, In hospital mortality was 30%. Intubation period was 19 days. Overall ICU stay was 16 days. Post-tracheostomy ICU stay was 13 days. Post-tracheostomy MV period was 41 days. Post-tracheostomy pneumonia occur in 55%.

Hu CL et al[14]cond5ucted a study by reviewing the medical records of apatients who underwent tracheostomy in the medical intensive care unit (ICU) of a tertiary medical centre from July 1998 to June 2001. Clinical characteristics, length of stay in the ICU, rates of post-tracheostomy pneumon9ia, weaning from mechanical ventilation and mortality rates were analyzed. Results showed that a total of 163 patients (93 men and R70 women) were included; their mean age was 70 years. Patients were classified into two groups: successful weaning (n = 78) and failure to wean (n = 85). Shorter intubation periods (P = 0.02), length of2 ICU stay (P = 0.001) and post-tracheostomy ICU stay (P = 0.005) were noted in patients in the su8ccessful weaning group. Patients who underwent racheostomy more than 3 weeks after intubation had higher ICU mortality rates and rates of weaning failure. The length of intubation correlated with the length of ICU stay in the successful weaning group (r = 0.70; P < 0.001). Multivariate analysis revealed that tracheostomy after 3 weeks of intubation, npoor oxygenation before tracheostomy (arterial oxygen tension/fractional inspired oxygen ratio <250) and occurrence of nosocomial pneumonia after tracheostomy were independent predictors of weaning failure.

Bickenbach J et al[15] assessed the effects of early tracheostomy compared with intermediate and late tracheostomy in critically ill patients. Data collected from January 2005 to December 2007 were conducted for retrospective analysis. All patients needing tracheostomy due to extubation failure and/or weaning failure were included (N.=296). Early tracheostomy (ET) was defined as ≤4 days, intermediate tracheostomy (IT) as tracheostomy within 5-9 days, and late tracheostomy (LT) was defined as ≥10 days after endotracheal intubation. Results showed that Intensive care unit (ICU) mortality was significantly higher in the LT group when being compared with the ET but not when being compared with the IT group (40.7% vs. 24.8% vs. 17.1%). Further, a significantly reduced incidence of VAP and sepsis, a smaller amount of ventilator days and a shorter ICU length of stay could be observed for the ET group. Length of weaning was not significantly different between the groups.

Ho YMet al[16]conducted a study among patients who underwent tracheostomy between January 1999 and June 2008 identified on the basis of Diagnostic Related Group coding and the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification procedural code. Results showed that One hundred and sixty-eight patients underwent tracheostomy between January 1999 and 30 June 2008. In-hospital mortality was 22.6%. The probability of death was found to be independent of timing of tracheostomy, technique used (percutaneous vs. surgical), number of failed extubations and obesity. On univariate analysis, the null hypothesis of independence was rejected for age on admission (P = 0.014), diagnosis of sepsis (P = 0.0008) or cardiac arrest (P = 0.0016), Acute Physiology and Chronic Health Evaluation II score (P = 0.0319) and the Australasian Outcomes Research Tool for Intensive Care calculated risk of death (P = 0.0432).

Khammas AH[17]determine the proper timing of tracheostomy and its impact on various clinical outcomes of adult patients in ICUs undergoing prolonged MV. The present study consisted of a sample of 67 ICU adult patients who were submitted to open surgical tracheostomy and divided into two groups: 30 patients in the

early tracheostomy (ET) group (within 1–10 days post intubation), and 37 patients in the late tracheostomy (LT) group (within 11–21 days post intubation). Results showed thatthe sample consisted of 61.19% male and 38.81% female patients, with a mean age of 47.263 ± 7.581 years. The mean MV duration in days was 7.91 ± 4.937 standard deviation (SD) in the ET group, and 15.32 ± 7.472 SD in the LT group (p= 0.001), with a mean sedation time of 6.13 ± 4.647 SD in the ET group, and of 11.98 ± 6.596 SD in the LT group (p= 0.001). The duration of the weaning process duration had a mean of 2.75 ± 2.586 SD days in the ET group, and of 5.39 ± 5.817 SD days in the LT group (p= 0.025), with a weaning failure rate of 28.57% in the ET group and 71.42% in the LT group (p= 0.01). The Mean ICU stay was 26.18 ± 4.732 SD in the ET group, and 11.98 ± 6.596 SD in the LT group (p= 0.879), and the incidence of ventilator-associated pneumonia (VAP) of 23.33% in the ET group and of 27.02% in the LT group (p= 0.15).

Alturaihy SH[18]examined the potential effects of time tracheostomy in ICU. This study was conducted at department of otolaryngology in Al-Hilla Teaching General Hospital over a period of two years from Feb 2014 to Feb 2016, regardless the age, sex and type of tracheostomy. Tracheostomy was considered as early ET if it is performed before or on day ten of mechanical ventilation MV of 263 ICU patients,64 require tracheostomy,23 of whom were early and 42 were late. Results showed that Most common causes of ICU admission who need ET was traumatic patient, Overall mortality rate was less in ET vs LT group, Other outcomes like duration of MV, LOS, VAP, laryngotracheal lesions were also less with ET vs LT.

Conclusion

The present study concluded that early tracheostomy had a notable benefit in shortening the duration of the MV and minimizing the risks of weaning failure, but it had no significant impact on both the overall duration of ICU stay.

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