European Journal of Molecular & Clinical Medicine

ISSN 2515-8260 Volume 9, Issue 4, Summer 2022

ORIGINAL RESEARCH

RESULTS OF EARLY TRACHEOSTOMY AND LATE TRACHEOSTOMY IN CRITICAL ILL PATIENTS IN ICU: AN ORIGINAL RESEARCH

[1]Dr. Rajunaik Ajmeera, [2]Dr. Parashuram, [3]Dr. Madhusudan Reddy, [4]Dr. G Lakpathi, [5]Dr. Talluri Sree Suguna

[1]Assistant Professor, [2]Professor, & HOD, [3]Professor, [4]Associate Professor, [5]Post Graduate, Department of ENT, Kakatiya Medical College, Warangal, Telangana, India

Correspondence:
Dr. Rajunaik Ajmeera
Assistant Professor, Department of ENT, Kakatiya Medical College, Warangal, Telangana, India
Email: mail2raju2k2a@gmail.com

ABSTRACT

Introduction- Ideal timing for tracheostomy in intensive care units (ICUs) is stil a controversial issue forcritically ill patients undergoing prolonged mechanical ventilation (MV).

Objectives- The objective of the present study is to determine proper timing of the tracheostomy and its impact onmultiple clinical outcomes of the adult patients in ICUs undergoing prolonged MV.

Methods and Materials- The present study consisted of a sample of 65 ICU adult patients who weresubmitted to open surgical tracheostomy and divided into two groups: 30 patients inthe early tracheostomy (ET) group (within 1–10 days post intubation), and 35 patients
in the late tracheostomy (LT) group (within 11–21 days post intubation). The data was compiled; the timing of tracheostomy of each group and various associated ICUclinical parameters were analysed and corelated.

Results- The sample consisted of 40 males and 25 female patients, with a meanage of 47.2 years. The mean MV duration in days was 6.91 in the ET group, and 16.32 in the LT group, with amean sedation time of 7.13 in the ET group, and of 12.88 in the LTgroup. The weaning failure rate of 29% in the ET group and 70.42% in the LTgroup. The Mean ICU stay was 26.2 in the ET group, and26.4 in the LT group, and the incidence of ventilator-associated pneumonia (VAP) of 24.2% in the ET group and of 26.8% in the LT group.

Conclusion- It was observed that the early tracheostomy had a significant benefit in shortening the duration ofthe MV, lessening the sedation time and also minimizing the risks of weaning failure, but ithad no notable impact on both the overall duration of ICU stay as well as the VAP incidence.

Keywords: Early Tracheostomy, Late Tracheostomy, Mechanical Ventilator

INTRODUCTION

Mechanical ventilation (MV) is a useful tool for those who are unable to maintain the level of ventilation necessary to sustain gas exchange. It is indicated in various conditions, such as those related to physiologic changes that lead to deterioration of the lung parenchyma, respiratory distress syndrome, and medical and/or surgical procedures, such as postanesthesia recovery, as well as in many other circumstances, such as in cases of head trauma or drug overdose that lead to ventilatory failure.[1] As the ideal concept is to transfer the MV support and the breathing function from the ventilator to spontaneous breathing, this is done through a weaning process, which means a gradual reduction in the level of ventilatory support until a complete discontinuation of the ventilator support is reached, that is, the overall process of removing the patient from the ventilator.[2] To achieve this timely discontinuation of the mechanical ventilatory support, and also to reduce the rate of complications related to the status of the artificial airway and prolonged MV, such as ventilatory-induced lung injury (VALI) and nosocomial infections, a constant and close evaluation of the medical conditions of those patients was required, as well as an assessment of their spontaneous breathing capacity. In contrast, premature discontinuation can result in severe respiratory and/or cardiovascular decompensation, and thus expose the patient to reintubation-associated risks, such as prolonged intensive care unit (ICU) stay and long-term rehabilitation facility care. – However, this is due to undefined reasons, since 3 to 7% of the patients remain in need of prolonged MV support.[3] Tracheostomy is usually indicated for ICU critically ill patients who require prolonged mechanical ventilation, in order to facilitate the removal from the ventilator machine through a weaning process. It has many beneficial effects, such as improved pulmonary mechanics, lessened laryngeal or tracheal nociceptive stimuli, shorter requirement of sedatives and analgesic medications, easier oral hygiene and nutrition, and improved communication. However, it may be associated with some complications related to its surgical technique.[4–6] In 1989, the American College of Chest Physicians (ACCP) guidelines on artificial airways consensus conference recommended considering performing a tracheostomy in patients receiving MV for more than 21 days,7 but the proper timing to perform the tracheostomy remained a matter of debate over the last two decades. Some international surveys record the preferable timing of tracheostomy between 7 to 15 days postintubation.[8,9]. In some reviews, it is defined as either before or after 7 days,[10] but in a Cochrane Review of randomized controlled trials (RCTs) published in 2015 defined tracheostomies performed before 10 days postintubation as early, and those performed after 10 days as late.[11–13] Along with this concept, some studies suggested that early tracheostomy was more associated with better outcomes than late tracheostomy,[14] while other studies disagreed with this finding.[15] However, the tracheostomy must be customized to the patient's medical condition, recovery course expectation, risk of continuous endotracheal intubation, and ventilatory machine support, as well as to the complications of the surgical procedure, and it must also be adapted to the balance of wishes between the pathology-patient.[16]

Therefore, many researchers declared that the selection and identification of an ideal timing to perform a tracheostomy in MV patients in the ICU remain a clinical challenging issue, with considerable variations in practice.[17] With this dilemma in mind, the present study was

performed in an attempt to determine the convenient timing to perform tracheostomies in ICU critically ill patients receiving MV, and to evaluate its impact on the outcomes of their clinical condition.

MATERIALS AND METHODS

After obtaining the consent of patients' families, a prospective study was conducted at the ICU of the teaching hospital. The present study included 65 ICU adult patients who had submitted to the bed-side open surgical tracheostomy. The subjects were divided into two groups: early tracheostomy (ET) group, consisting of 30 subjects who were submitted to tracheostomy between 1 and 9 days postintubation, and late tracheostomy (LT) group, consisting of 35 subjects who were submitted to tracheostomy between 10 and 20 days postintubation. Exclusion criteria were: the patients in pediatric age group, comatose patients with severe respiratory distress with refractory hypoxemia and hypercapnia or/and cardiovascular insufficiency, those with chronic coagulation disorders, also those subjects who were tracheostomized prior to the ICU admission. The aim of the current study is to determine and analyse the correlation between the timing of tracheostomy and various associated ICU clinical parameters, such as duration of MV support, duration of sedation and duration of the weaning process trials, as well as overall ICU stay and associated translaryngeal complications. Moreover, multiple post translaryngeal extubation fibre-optic endoscopy was done. The follow up done for 6 months. Based on the multiple factors, decision about the timing of the tracheostomy was taken. Once the medical status of the patient met the following criteria like estimated positive end expiratory pressure, hemodynamic stability, as well as initiation of the inspiratory efforts capacity, which indicated that the underlying pathology has been resolved, thereby enabling consideration of the initiation of weaning process. The patients were subjected to the airway pressure support ventilation which was accompanied by a prudent reduction of positive airway pressure support, or intermittent T-piece for the trail of spontaneous breathing when the medical status improved. Thereby, the successful weaning from MV was considered if it lasted for more than 72 hours. Once the weaning process and tracheostomy were accomplished, the patients were transferred to the long-term care setting. They were under close and regular observation, unless there were any limitations due to other active medical problems. However, the weaning process was considered a failure when it showed evidences of acute respiratory distress, which included an increased positive airway pressure support demand synchronized with increased mandatory ventilation rate. In addition to the clinical signs of the patient, such as sweating, agitation and usage of accessory muscles of respiration. The analysis of the gathered data was performed and tabulated. The quantitative data was tested using the Student t-test, while the qualitative data, using the Pearson chi-squared test. Values of $p < 0.05$ were considered statistically significant.

RESULTS

The sample size of present study comprised of 65 adult patients, which consisted of 40 males and 25 female patients, with a meanage of 47.2 years. The mean MV duration in days was 6.91 in the ET group, and 16.32 in the LT group, with amean sedation time of 7.13 in the ET group, and of 12.88 in the LTgroup. The weaning failure rate of 29% in the ET group and

70.42% in the LTgroup. The weaning process duration had a mean of 3 days in the ET group, and 5 days in the LT group.The Mean ICU stay was 26.2 in the ET group, and26.4 in the LT group, and the incidence of ventilator-associatedpneumonia (VAP) of 24.2% in the ET group and of 26.8% in the LT group. The overall rate of successful weaning was 69%. The impact of the timing of the tracheostomy on the outcomes of the various study parameters revealed statistically significant results for some parameters, such as the duration of the MV, the weaning process, and the sedative exposure ($p < 0.05$), while no statistically significant result was found for the overall duration of the ICU stay (Table 1).

Table1- Effect of Tracheostomy timing distribution on various studied parameters

Indications	ET group	LT group
MV duration (days)	6.91	16.32
Sedation duration (days)	7.13	12.88
Weaning process duration (days)	3	5
Overall ICU stay (days)	26.2	26.4

There was finding of some secondary clinical outcomes such as 2 cases of minor bleeding in the ET group and 3 cases in the LT group, as well as 1 case of mild localized surgical emphysema in the ET group and 4 cases in the LT group. All of these morbidities were very mild, and were resolved spontaneously within duration of hours or a few days' time span without showing any adverse effects. Multiple post extubation endoscopic sessions were performed within 6 months to reveal laryngeal ulcer at the arytenoid area in 8 cases, which was the most common laryngotracheal injury detected (Table 2).

Table 2- Endoscopic findings

Findings	Total	ET group	LT group
Subglottic stenosis	4	1	3
Laryngeal granuloma	7	3	4 (8.1%)
Laryngeal ulceration	7	3	4

DISCUSSION

The critically ill patients in ICU who are on prolonged MV frequently require tracheostomy in order to simplify long-term airway management. The concept of its prevailing timing is still a matter of debate. Thereby further investigations are needed as it depends mainly on the prediction of physician regarding the need for the prolonged MV[18] rather than on the evidence-based practice. Due to lack of availability of obvious evidence-based guidelines, the convenient timing to perform the tracheostomies in ICU critically ill patients on MV will vary according to their respective medical conditions, the judgment of the physician, as well as the communication with families of the patients. The main observation in the clinical outcomes of the patients in the present study was a significant shorter duration of MV in the ET group when compared to the LT group, which is similar in many studies.[20–23]. The present study also showed that by both a statistically lower duration of the weaning process is required to accomplished the MV discontinuation; also, higher successful weaning rate in the ET group than in the LT group was seen. These results were supported by Hsu et al[24] in a study that reported that the patients of the ET group had a higher rate of successful weaning. Although few other studies[10,11] did not show any significant difference in reduction of MV

duration between ET and LT groups. The present study also revealed a statistically significantly reduced sedation time in the ET group compared
to the LT group, which is in accordance with other studies,[12,19] It was observed in the current study that the incidence of VAP was slightly higher in LT group than in ET group. However, this numerical difference was considerably small, and thus did not reach a statistically significant level, and also it was related to the pre-tracheostomy clinical status of the patients. This observation is similar with data from meta-analytic studies.[10–12], however; Moller et al[22] showed that early tracheostomy minimized the incidence of VAP. It was also observed in the present study that there was no significant statistical difference regarding the overall duration of ICU stay in ET group compared to LT group. This result was similar with some studies that concluded that the timing of tracheostomy has no impact on duration of
the ICU stay.[19,25] However, the authors of other studies have different opinions, and reported that early tracheostomy shortens the duration of the ICU stay.[13,22,23] In present study, other secondary outcomes were post-intubation laryngotracheal injuries, such as laryngeal ulcer, laryngeal granuloma and subglottic stenosis, which were detected at a higher rate in the LT group than in the ET group, but with no statistically significant value; however, all these pathologies were resolved with conservative management.

CONCLUSION

The ET had a remarkable effect in shortening the duration of MV, also lessening the sedation time, as well as minimizing the risks of weaning failure, but had no significant impact on overall duration of the stay in ICU and on the incidence of VAP. However, no objective evidence-based guidelines for a proper definition of tracheostomy timing for ICU critically ill patients receiving prolonged MV were meticulously clarified.

REFERENCES

1. David W, James HHC. Initiation of mechanical ventilation In:David W. Principles and practice of mechanical ventilation. 4th ed. Stephen Helba. USA: Health Care; 2014:214–218
2. Maclntyre NR. Evidence-based guidelines for weaning and discontinuing ventilator support. Chest 2001;120:375S–396S
3. Robert M, Kacmarek R. Discontinuing ventilatory support. In: Robert M, James K. Stoller, Albert J Heuer. Fundamentals of respiratory care, 10th ed. Mosby,China2013:1200–1221
4. Cheung NH, Napolitano LM. Tracheostomy: epidemiology, indications, timing, technique, and outcomes. Respir Care 2014;59(06): 895–915, discussion 916–919
5. Rana S, Pendem S, Pogodzinski MS, Hubmayr RD, Gajic O. Tracheostomy in critically ill patients. Mayo Clin Proc 2005;80(12):1632–1638
6. Groves DS, Durbin CG Jr. Tracheostomy in the critically ill: indications, timing and techniques. Curr Opin Crit Care 2007;13(01):90–97
7. Plummer AL, Gracey DR. Consensus conference on artificial airways in patients receiving mechanical ventilation. Chest 1989;96 (01):178–180

8. Veenith T, Ganeshamoorthy S, Standley T, Carter J, Young P. Intensive care unit tracheostomy: a snapshot of UK practice. Int Arch Med 2008;1(01):21
9. Vargas M, Sutherasan Y, Antonelli M, et al. Tracheostomy procedures in the intensive care unit: an international survey. Crit Care 2015;19(01):291
10. Siempos II,Ntaidou TK, Filippidis FT,Choi AMK. Effectofearly versus late or no tracheostomy on mortality and pneumonia of critically ill patients receiving mechanical ventilation: a systematic review and meta-analysis. Lancet Respir Med 2015;3(02):150–158
11. Huang H, Li Y, Ariani F, Chen X, Lin J. Timing of tracheostomy in critically ill patients: a meta-analysis. PLoS One 2014;9(03): e92981
12. Meng L, Wang CM, Li JX, Zhang J. Early versus late tracheostomy in critically ill patients: a systematic review and meta-analysis. Clin Respir 2015. Doi: 10.1111/crj.12286
13. Andriolo BN, Andriolo RB, Saconato H, Atallah AN, Valente O. Early versus late tracheostomy for critically ill patients. Cochrane Database Syst Rev 2015;1:CD007271
14. Griffiths J, Barber VS, Morgan L, Young JD. Systematic review and meta-analysis of studies of the timing of tracheostomy in adult patients undergoing artificial ventilation. BMJ 2005;330(7502):1243
15. Young D, Harrison DA, Cuthbertson BH, Rowan K; TracMan Collaborators. Effect of early vs late tracheostomy placement on survival in patients receiving mechanical ventilation: the TracMan randomized trial. JAMA 2013;309(20):2121–2129
16. Durbin CG Jr. Indications for and timing of tracheostomy. Respir Care 2005;50(04):483–487
17. John E. Heffner, David L. Hotchkin. Care of the mechanically ventilated patient with a tracheostomy In: Martin J. Tobin, Principles and practice of mechanical ventilation. 3th ed. USA: Mcgraw-Hill education; 2013:941
18. De Leyn P, Bedert L, Delcroix M, et al; Belgian Association of Pneumology and Belgian Association of Cardiothoracic Surgery. Tracheotomy: clinical review and guidelines. Eur J Cardiothorac Surg 2007;32(03):412–421
19. Diaz-Prieto A,Mateu A, GorrizM, et al. A randomized clinical trial for the timing of tracheotomy in critically ill patients: factors precluding inclusion in a single center study. Crit Care 2014;18(05):585
20. Rumbak MJ, Newton M, Truncale T, Schwartz SW, Adams JW, Hazard PB. A prospective, randomized, study comparing early percutaneous dilational tracheotomy to prolonged translaryngeal intubation (delayed tracheotomy) in critically ill medical patients. Crit Care Med 2004;32(08):1689–1694
21. Flaatten H, Gjerde S, Heimdal JH, Aardal S. The effect of tracheostomy on outcome in intensive care unit patients. Acta Anaesthesiol Scand 2006;50(01):92–98
22. Möller MG, Slaikeu JD, Bonelli P, Davis AT, Hoogeboom JE, Bonnell BW. Early tracheostomy versus late tracheostomy in the surgical intensive care unit. Am J Surg 2005;189(03):293–296
23. Terragni PP, Antonelli M, Fumagalli R, et al. Early vs late tracheotomy for prevention of pneumonia in mechanically ventilated adult ICU patients: a randomized controlled trial. JAMA 2010; 303(15):1483–1489

24. Hsu CL, Chen KY, Chang CH, Jerng JS, Yu CJ, Yang PC. Timing of tracheostomy as a determinant of weaning success in critically ill patients: a retrospective study. Crit Care 2005;9(01):R46–R52
25. Boynton JH, Hawkins K, Eastridge BJ, O'Keefe GE, O'Keefe G. Tracheostomy timing and the duration of weaning in patients with acute respiratory failure. Crit Care 2004;8(04):R261–R267