International Journal of Research in Medical Sciences
Quirino AM et al. Int J Res Med Sci. 2024 Oct;12(10):3562-3566
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20242909

Original Research Article

Impact of early versus late tracheostomy on success or failure of ventilator weaning

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Received: 31 July 2024
Accepted: 17 September 2024

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ABSTRACT

Background: Determine impact of early versus late tracheostomy on success or failure of ventilator weaning. This study is a cross-sectional, observational, descriptive, and analytical study.
Method: Patients, clinical records of patients admitted to intensive care unit (ICU) in our hospital, weaned from invasive mechanical ventilation (IMV) after early versus late tracheostomy. Descriptive and inferential statistical analysis with Chi square ($p<0.05$), using SPSSv25.0 software. Time required after tracheostomy for ventilator weaning.
Results: Positive significant association between ventilator weaning failure and prolonged difficult weaning process, indicate the importance of these factors in tracheostomy patients.
Conclusions: According to this study, early tracheostomy reduces weaning failure and risk of ventilator-associated pneumonia.

Keywords: Tracheostomy, weaning, failure

INTRODUCTION

There's historical evidence of tracheostomies in various cultures dating back thousands of years. In ancient Egypt (1550 BC), hieroglyphics depict tracheostomy procedures, the Ebers papyrus describe techniques for opening of the trachea through incisions in the neck, in the sacred books of medicine, management of the airway through tracheostomy. In Greece Homer et al, mentions it as a relief technique for a suffocating person. The first tracheostomy is attributed to the Greek doctor Asclepiades of Bithynia, in the 1st century AD.2 Advancements in the procedure led Antonio Mussa in 1546 to perform the first successful laryngectomy, becoming a hallmark to manage foreign bodies in the airway through the use of a cannula, and shortly afterward introducing a curved cannula secured to the neck with tape. However, it was not until 1718 that it was referred to as tracheostomy, and 191 years later in 1909 when Chevalier Jackson, refined and described the surgical technique, designing a metal cannula with a curvature to reduce the risk of damage to the trachea, as well as established guidelines for management and care of tracheostomy patients.

Later perfected by Seldinger et al, and resulting in the percutaneous technique known today. Nonetheless, by 1965, knowledge suggesting tracheal intubation as safer and faster decreased tracheostomy procedures.[1,2] Orotracheal intubation (OTI) and invasive mechanical ventilation (IMV) are among the main causes of prolonged intensive care unit (ICU) stays. During the COVID-19 pandemic, tracheostomy was considered to compensate a shortage of mechanical ventilators and

reduce ICU stay and mortality.[1] Currently tracheostomy is the most common surgical procedure in ICU, with four general indications) long-term IMV) weaning failure) upper respiratory tract obstruction) airway permeability and protection.[3] Despite the possible complications that may occur, such as tracheal stenosis, subglottic stenosis, bleeding, wound infection and, occasionally, even death.[5] In recent studies tracheostomy has shown improvements in pulmonary mechanics, facilitates oral hygiene, pain reduction and lower sedative doses, improves communication and reduction in mortality.[4,9] Early tracheostomy (ET) before 10 days and late (LT) after 10 days, with times as late as 14 days still considered early.[1,4] There even those who consider OTI day 1 to 10 as early and later between days 11 and 21, others only as an indication if the duration of IMV is expected to exceed 21 days.[5]

We know that in addition to offering better results, an early tracheostomy facilitates earlier discharge to a non-ICU environment or transfer to a long-term intensive care facility, as has been concluded in other studies.[7] Thus the importance of knowing the benefits, adverse effects, indications, contraindications and weaning of invasive mechanical ventilation in this type of patients.[8]

Furthermore, we could conclude that an ET can lead to a faster weaning process in those patients who require prolonged mechanical ventilation or difficult or prolonged weaning. Although timing of tracheostomy does not have a significant impact on the in-hospital mortality rate, further studies are required to determine which patients will benefit from tracheostomy, and whether it should be an early or late procedure.[11,12]

This research focused on determining the impact of early tracheostomy as less than 7 days versus late tracheostomy on success or failure of ventilator weaning.

METHODS

Study design

This study was approved by the Institutional Ethics and Health Research Committee, obtaining the registration number R-2023-2602-032.

Study type

This study is a cross-sectional, observational, descriptive, and analytical study. Patients admitted to ICU.

Study duration

Study duration was from January to December 2023.

Inclusion criteria

Inclusion criteria consisted of patients who required mechanical ventilation for more than three days during their stay in the ICU in whom tracheostomy was performed, classified as early (≤7 days) or late (8≥ days).

Exclusion criteria

Patients with brain death diagnosis. The study variables were age, gender, days of ventilation, difficult weaning, failure to wean, complications and outcome.

Statistical analysis

Measures of central tendency, averages, mean, median and mode, as well as dispersion, standard deviation, range and variance, relative and absolute frequencies. Inferential analysis through Pearson's Chi square, if assumptions were not met, Fisher's exact test was applied, a p value≤0.05 was considered significant. We used the social science statistical package SPSS version 24 for Windows, with data collected in graphs and tables for ease of interpretation.

RESULTS

A total of 85 records were reviewed, 66 records of patients admitted to the metabolic intensive care unit (MICU) underwent tracheotomy and met the inclusion criteria were selected. The mean age was 45.29 ±SD16 years, minimum 16 years maximum 85 years old, female 28 (42.40%), male 38 (57.67%). The accompanying comorbidities were arterial hypertension 18 (27.27%), diabetes mellitus 7 (10.60%), others 9 (13.63%), no comorbidity 26 (39.39%), (see table 1).

Early tracheostomy in 33 (59%) and 33 late tracheostomies (50%) were performed. The pathologies upon admission to the MICU were mainly neurological 50 (75.75%), metabolic 11 (16.66%) and general surgery 5 (7.50%), difficulties in weaning process from mechanical ventilation occurred in 6 (9.10). %), while 60 (90.90%) had no complications related to weaning process; among the complications in the ICU, there were 11 (16.66%) with ventilator-associated pneumonia, and 55 without complications in 83.33%, the main complication was bleeding with 3 (4.54%) cases. Regarding outcome, there were 15 (22.72%) deaths and 51 (77.27%) were discharged from the ICU table 1.

Inferential analysis use of Pearson’s Chi square, no significant association was found p 0.135 between failure to wean from assisted mechanical ventilation and age ≤49 years or ≥50 years, gender p=0.637, types of comorbidities p=0.183, type of tracheostomy p=0.392, pathology of admission to the ICU p=0.760, complications of tracheostomy p=0.570, nor outcome p=0.780 (p≤0.05). A positive association between failure of weaning and difficult weaning p=0.01 and between weaning failure and prolonged weaning p=0.034 (p≤0.05), was found.

Table 1: Clinical characteristics of 66 patients undergoing tracheostomy surgery in the ICU.

Variables	45.29±SD 16, 15 years			
		N	%	Pearson chi square p≤0.05
Age groups (in years)	≤49	28	34.1	p=0.135
	≥50	38	46.3	
Gender	Female	28	42.4	p=0.637
	Male	38	57.67	
Comorbidities	DM	7	10.6	p=0.183
	HAS	18	27.27	
	Obesity	6	9.09	
	Other	9	13.63	
	None	26	39.39	
Tracheostomy type	Early	33	50	p=0.392
	Late	33	50	
Intubation days	Less than 7 days	19	28.78	
	Greater than 7 days	47	71.21	
Admission pathology	Neurological	50	75.75	p=0.760
	Metabolic	11	16.66	
	General Surgery	5	7.5	
Difficult weaning	Yes	12	18.2	p=0.01
	No	54	81.8	
Prolonged weaning	Yes	54	81.81	p=0.034
	No	12	18.18	
Ventilator disconnection failure	Yes	6 9.1		
	No	60	90.9	
General complications in ICU	Without complications	55	83.33	
	Ventilator-associated pneumonia	11	16.66	
Tracheostomy complications	Tracheal accessory pathway	1	1.51	p=0.570
	Bleeding	3	4.54	
	None	51	77.27	
Outcome	Discharged	51	77.27	p=0.780
	Death	15	22.72	

DISCUSSION

Currently early and late tracheostomy continue to be topic of debate, the scarce existing literature, does not provide any solid evidence on the cut-off point for early and late tracheostomies, make reaching a consensus time interval between intubation and performance of surgical procedure and thus defining the exact time for a tracheostomy after intubation is difficult.[8] Our results regarding age were similar to that described by Arvind Kumar with 38 years, but younger than what was reported by Marinaki et al, in the United Kingdom with 58 years.[8,10] Other studies by Chopra with 61 and Hadjilouca et al, with 58, this difference is probably because our population has a large number of neurological cases due to trauma, the younger age of our series was influenced by the fact that the accidents occur in a young, work-active population.[10,11] In relation to gender, predominance in males, as reported by Marinaki et al, Chopra et al, and Yun Tang et al.[8,10,12]

Neurological problems were one of the main causes of admission to the ICU, as described by Marinaki et al, Chopra et al, and Mota et al, comorbidities hypertension and diabetes were similar to results by Yu Shen et al and Yun Tang et al in China, as opposed to findings by Marinaki et al, where cardiovascular, respiratory and diabetes conditions were third in prevalence, followed by neurological, urological and other conditions, like Yun Tang et al.[8-12] Early tracheostomy ≤7 days and late tracheostomy ≥8 days of were similar, with 33 procedures, different from what was presented by Chopra et al, in 83 patients where 51 (61.45%) underwent an early tracheostomy and 32 (38.55%) late, our groups were closer to what Duncan et al reports 44.9% in late tracheostomy and 55.1% in early tracheostomy was made.[8,10]

Among the complications related to the procedure, bleeding was the most common, similar to that reported by Duncan, weaning failure after tracheostomy was

generally lower than that reported by Shin et al with 32.3%, Yun Tang et al, 2%, Kumar 28.57% while our series was 9.10%, the closest to our results was that of Chen 16.4%, this establishes a variability of patients weaned from the ventilator after tracheostomy, on the other hand , mortality was lower than that reported by Shin with 55.1%, similar to that described by Chen (23.1%).[9,10,17]

An investigation in China, carried out by Tang et al. compared outcomes between early and late tracheostomy in a sample of ICU patients with COVID-19. The results showed that tracheostomies performed late (after 14 days) were associated with a higher mortality rate compared to those performed early (before 14 days).[18] In our sample, no differences were found between both procedures and mortality, according to mentions Mehta et al, the long-term results after tracheostomy are extremely poor with high mortality, morbidity and utilization of health resources, especially among older patients, however, our results found no differences in mortality and complications in patients ≤49 years and ≥50 years.[19]

Regarding the complications observed, we found that ventilator-associated pneumonia occurred as the only event in our series. Nseir et al, found that tracheostomy reduces the risk of ventilator-associated pneumonia. We found no association, however, Ibrahim et al found that tracheostomy was independently associated with a six-fold increase in the risk of nosocomial pneumonia compared with endotracheal intubation.[20]

We did not find an association between difficult weaning and variables such as age, gender, comorbidities, like Sandoval in Colombia et al and Heiderick et al, nor type of tracheostomy et al, however, Marinaki et al, in Greece did find an association between early tracheostomy and successful weaning from ventilation.[8,13,16,21] A study by Tang et al found that patients who underwent late tracheostomy were associated with higher mortality, like Tanaka et al.[12,22] Our research didn´t find such association. The factors that were associated with ventilator failure were difficult weaning and prolonged weaning, as stated by Selllares et al.[23]

CONCLUSION

Orotracheal intubation and IMV are one of the leading causes of increased stay in the intensive care unit, playing a significant role in the critically ill. In the analysis of this study, we obtained demographic and pathological similarities to other investigations, such as the age, gender of the patients, as well as the main complications, where neurological pathology was the main cause of admission to the ICU.

However, we do not find significant association between early or late tracheostomy and failure to wean from mechanical ventilation, adding important perspective to existing knowledge. On the other hand, the limitation of the sample size suggests the need for larger studies on the risks associated with weaning from mechanical ventilation in patients with tracheostomy.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Quirino AM, Arrambí-Díaz C, Ramírez JC, Lugo JA, Morales JA, López RM. Impact of early versus late tracheostomy on success or failure of ventilator weaning. Int J Res Med Sci 2024:12:3562-6.