



Tracheal Stenosis After Intubation and Tracheostomy in Patients Admitted to Intensive Care Units: A Case-Control Study

Roya Dokoohaki ¹, Malihe Ebrahimzadeh ², Nasrin Sharifi ^{3,*}

¹ Department of Nursing, School of Nursing and Midwifery, Shiraz University of Medical Sciences, Shiraz, Iran

² Student Research Committee, School of Nursing and Midwifery, Shiraz University of Medical Sciences, Shiraz, Iran

³ School of Nursing and Midwifery, Shiraz University of Medical Sciences, Shiraz, Iran

*Corresponding author: School of Nursing and Midwifery, Shiraz University of Medical Sciences, Shiraz, Iran. Email: sharifin@sums.ac.ir

Received 2024 February 14; Revised 2024 May 29; Accepted 2024 June 1.

Abstract

Background: One of the most dangerous complications after endotracheal intubation or tracheostomy is tracheal stenosis.

Objectives: This study aimed to determine the personal and clinical characteristics of tracheal stenosis following intubation or tracheostomy in intensive care unit patients.

Methods: This is a nested case-control study. Thirty-five patients who suffered from tracheal stenosis from March 2016 to March 2021 and had been intubated and tracheostomized in intensive care units (ICU) were selected for the case group. The control group included 105 patients intubated and tracheostomized in ICU during the same period without tracheal stenosis. A demographic and clinical characteristics questionnaire was used to collect data from the patients' medical records.

Results: The mean length of intubation ($P < 0.001$), endotracheal and tracheostomy tube cuff pressure ($P < 0.001$), chronic obstructive pulmonary disease (COPD) ($P = 0.043$), intubation history ($P = 0.045$), and airway management ($P < 0.001$) showed significant differences between the case and control groups. The logistic regression model revealed that COPD (OR = 8.519, $P = 0.037$), intubation history (OR = 3.939, $P = 0.013$), length of intubation (OR = 1.118, $P = 0.003$), age (OR = 0.960, $P = 0.030$), and endotracheal and tracheostomy tube cuff pressure (OR = 1.988, $P < 0.001$) were associated with tracheal stenosis. The time interval between intubation/tracheostomy ranged from approximately 28 to 938 days.

Conclusions: Given the impact of certain care practices during hospitalization on the occurrence of tracheal stenosis, such as the mean length of intubation, endotracheal and tracheostomy tube cuff pressure, and airway management, it is recommended that standardized training on these interventions be prioritized for staff in intensive care departments. Additionally, attention must be given to specific patient characteristics, such as age, COPD, and history of intubation.

Keywords: Intensive Care Unit, Intubation, Pressure, Tracheal Stenosis, Tracheostomy

1. Background

Patients admitted to intensive care units (ICU) often experience low levels of consciousness, acute respiratory failure, or cardiopulmonary arrest, and endotracheal intubation is a commonly performed procedure in critically ill patients (1). In these situations, it usually takes several days before the patient is extubated; therefore, with prolonged hospitalization, a tracheostomy is performed (2). Tracheostomy is a common procedure, performed in 2 - 11% of patients requiring mechanical ventilation in the ICU, and it is one of the most commonly performed procedures in

critically ill patients. Several advantages have been reported for performing tracheostomy following endotracheal intubation, including improving patient comfort, reducing airway resistance, ensuring safer and easier tracheal suction, improving patient communication, and enhancing oral feeding (3, 4). The tracheostomy tube is the preferred method of maintaining the airway in patients who require long-term intubation. The rate of intubation in the United States is 13 - 20 million per year (5). Although endotracheal intubation and mechanical ventilation are therapeutic approaches for managing critically ill patients, they are associated with serious complications.

introduce selection bias or information bias due to incomplete or inaccurate documentation. Third, in this study, all patients had only undergone open tracheostomy. Therefore, we could not determine the relationship between tracheal stenosis and the tracheostomy method.

5.2. Conclusions

This study showed that tracheal stenosis after intubation or tracheostomy is a serious complication. The main risk factors for tracheal stenosis are prolonged intubation, high endotracheal tube (ETT) and tracheostomy tube cuff pressure, COPD, intubation history, and age. The main protective factors include optimal cuff pressure and appropriate endotracheal intubation. Prevention of tracheal stenosis involves minimizing the length of intubation, monitoring and adjusting cuff pressure, selecting the appropriate method of airway management, and avoiding unnecessary trauma to the airway. Additionally, by knowing the time interval between intubation/tracheostomy and the onset of tracheal stenosis, patients can be followed up more effectively for this complication.

Acknowledgements

We are thankful to Shiraz University of Medical Sciences for providing the research platform. This study is extracted from a research project with the code number 22,766 approved by Shiraz University of Medical Sciences, Shiraz, Iran. We would like to express our grateful appreciation and thanks to the respected Vice-Chancellor of the Research and Ethics Committee of Shiraz University of Medical Sciences and all the personnel of the medical records department of Nemazee and Faghihi Hospitals for their sincere cooperation. The authors would also like to thank the Center for Development of Clinical Research of Nemazee Hospital and Dr. Nasrin Shokrpour for editorial assistance.

Footnotes

Authors' Contribution: Study concept and design: R. D., M. E., and N. Sh.; acquisition of data: M. E.; analysis and interpretation of data: M. E., N. Sh., and R. D.;

drafting of the manuscript: M. E.; critical revision of the manuscript for important intellectual content: N. Sh., R. D., and M. E.; statistical analysis: N. Sh., and M. E.; administrative, technical, and material support: R. D., M. E., and N. Sh.; study supervision: N. Sh., and R. D.

Conflict of Interests Statement: Authors declared no conflict of interests.

Data Availability: The datasets of the current study are available from the corresponding author on reasonable request.

Ethical Approval: This study is approved under the ethical approval code of [IR.SUMS.REC.1400.174](#).

Funding/Support: The present study was supported by Shiraz University of Medical Sciences.

Informed Consent: The data of this study was collected using the information recorded in the files archived in two hospitals affiliated to Shiraz University of Medical Sciences, and there was no contact with the patients. Also, the information was anonymous.

References

- Smischney NJ, Demirci O, Diedrich DA, Barbara DW, Sandefur BJ, Trivedi S, et al. Incidence of and Risk Factors For Post-Intubation Hypotension in the Critically Ill. *Med Sci Monit*. 2016;**22**:346-55. [PubMed ID: [26831818](#)]. [PubMed Central ID: [PMC4745660](#)]. <https://doi.org/10.12659/msm.895919>.
- Farzanegan R, Farzanegan B, Zangi M, Golestani Eraghi M, Noorbakhsh S, Doozandeh Tabarestani N, et al. Incidence Rate of Post-Intubation Tracheal Stenosis in Patients Admitted to Five Intensive Care Units in Iran. *Iran Red Crescent Med J*. 2016;**18**(9). e37574. [PubMed ID: [28144465](#)]. [PubMed Central ID: [PMC5253460](#)]. <https://doi.org/10.5812/ircmj.37574>.
- Andriolo BN, Andriolo RB, Saconato H, Atallah AN, Valente O. Early versus late tracheostomy for critically ill patients. *Cochrane Database Syst Rev*. 2015;**1**(1). CD007271. [PubMed ID: [25581416](#)]. [PubMed Central ID: [PMC6517297](#)]. <https://doi.org/10.1002/14651858.CD007271.pub3>.
- Curry SD, Rowan PJ. Laryngotracheal Stenosis in Early vs Late Tracheostomy: A Systematic Review. *Otolaryngol Head Neck Surg*. 2020;**162**(2):160-7. [PubMed ID: [31766966](#)]. <https://doi.org/10.1177/0194599819889690>.
- Totonchi Z, Jalili F, Hashemian SM, Jabardarjani HR. Tracheal Stenosis and Cuff Pressure: Comparison of Minimal Occlusive Volume and Palpation Techniques. *Tanaffos*. 2015;**14**(4):252-6. [PubMed ID: [27114727](#)]. [PubMed Central ID: [PMC4841992](#)].
- Nesek-Adam V, Masic V, Oberhofer D, Grizelj-Stojcic E, Kosuta D, Rasic Z. Post-intubation long-segment tracheal stenosis of the posterior wall: a case report and review of the literature. *J Anesth*. 2010;**24**(4):621-5. [PubMed ID: [20454809](#)]. <https://doi.org/10.1007/s00540-010-0956-8>.
- Eliçora A, Akgül AG, Topçu S, Özbay S, Hoşten T, Sezer HF, et al. Management of post-intubation tracheal membrane ruptures. *Arch Iran Med*. 2016;**19**(7):0.