

Tracheostomy Complications Over 5 Years: Decannulation Analysis

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Abstract

Introduction:

Tracheostomy is a life-saving surgical intervention commonly performed in patients requiring prolonged mechanical ventilation. However, the decannulation process is associated with various complications that can affect patient outcomes. This study aimed to assess complications and their management during decannulation in a cohort of tracheostomy patients at a tertiary care hospital, considering the complexities introduced by prior intubation.

Materials and Methods:

A retrospective cohort study was conducted involving 450 patients who underwent tracheostomy during a stipulated timeframe. Data regarding demographic characteristics, complications, and management strategies during decannulation were analysed. Special attention was given to distinguishing between complications directly related to the tracheostomy procedure and those potentially influenced by previous intubation.

Results:

Out of the 450 patients, 250 experienced minor complications such as localized bleeding, oxygen desaturation, and minor infections. Another 40 faced major complications including severe haemorrhage, tracheal damage, and stenosis. Increasing age and tracheostomy duration were identified as significant predictors of complications. Pharmacological treatments, surgical interventions, and respiratory therapy were among the management strategies employed. The differentiation between complications arising from tracheostomy and prior intubation highlighted the need for comprehensive patient evaluation.

Conclusion:

Complications associated with decannulation occur frequently with varying severity. Efficient recognition and management of these complications are vital for improving patient outcomes. The study provides important insights into the challenges experienced during the decannulation process and highlights the necessity of considering prior intubation history in the management of tracheostomy decannulation to refine patient care protocols.

Keywords: Decannulation, Tracheostomy, Complications, Mechanical Ventilation, Retrospective Study.

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Introduction

Tracheostomy has been performed for decades to establish a direct incision in the neck to provide access to the trachea, especially for patients suffering from airway obstructions or requiring prolonged mechanical ventilation (1).

Despite its life-saving potential, the procedure is accompanied by various complications and challenges, particularly during the decannulation phase, which involves the removal of the tracheostomy tube (2). Several studies have explored the complications related to tracheostomy, yet there is a gap in the literature regarding the challenges encountered throughout the decannulation process (3).

Recognizing the intricacies of differentiating between complications arising directly from the tracheostomy procedure and those potentially induced by prior intubation is crucial, as each has distinct implications for patient management and outcomes. This study aims to provide a comprehensive assessment of complications and their management during decannulation in a cohort from a tertiary care hospital. Our objective is to understand the prevalence, characteristics, and contributing factors to these complications, with awareness of the potential influence of preceding intubation events. Our goal is to provide valuable insights that can improve clinical practices and enhance patient outcomes.

Materials and Methods

Design and Setting: A retrospective cohort study was carried out in a tertiary care hospital to explore complications identified during decannulation and the subsequent management strategies employed. **Participants Selection:** Adult patients aged 18 years and older who underwent tracheostomy and later decannulation within a specified five-year period (January 2017 to December 2021) were identified using the hospital's database. Individuals with incomplete medical records or who were lost to follow-up were excluded from the study.

Variables Definition: The primary outcome variable was complications observed during the decannulation process. These complications were categorized into:

- **Minor Complications:** Localized bleeding, transient oxygen desaturation, or local site infections.

- **Major Complications:** Severe haemorrhage, tracheal damage, tracheal stenosis, tracheomalacia, granuloma formation, tracheoesophageal fistula, pneumothorax, and severe systemic infections necessitating surgical intervention or extended hospitalization.

Complication Attribution Process: To differentiate between complications potentially induced by prior intubation and those directly resulting from the tracheostomy procedure, patient histories were reviewed for documented intubation events and associated complications prior to tracheostomy. This review aimed to identify any pre-existing conditions or complications that could influence post-decannulation outcomes.

Management of Complications: For each identified complication, the subsequent management strategies and their outcomes were recorded, including surgical procedures, pharmacological treatments, and additional support like respiratory therapy.

Data Sources and Measurement: Data were retrieved from the hospital's medical record department using a standardized collection form. Variables recorded included patient demographics, clinical manifestations, details of the decannulation process, complications, and management strategies employed.

Bias Mitigation: The dual-researcher technique was employed to reduce potential biases throughout the data extraction process. Discrepancies were resolved collectively, and a third researcher was consulted when consensus was difficult to achieve.

Statistical Approaches:

- **Descriptive Analysis:** Descriptive statistics were employed to analyze the demographic and clinical data of the group, providing a comprehensive analysis of key variable distribution patterns among the population.

- **Univariate Analysis:** Univariate logistic regression analysis assessed the influence of individual variables on the likelihood of complications arising during the decannulation process. Initial examination identified potential predictors of complications.

- **Multivariate Analysis:** Variables demonstrating a p-value below 0.2 in the univariate analysis were integrated into a multivariate logistic regression model to identify

independent predictors of complications, adjusting for potential confounders.

Outcome Data: The occurrences of complications among the group were carefully documented. A comprehensive comparison analysis was conducted on different subgroups, including age groups, gender, and duration of tracheostomy, to identify any apparent patterns or trends related to complications.

Results Presentation: Results from the regression analyses were expressed as odds ratios (OR) for univariate analyses and adjusted odds ratios (aOR) for multivariate analyses. Each result was accompanied by its corresponding 95% confidence intervals (CI).

Model Validation: The final multivariate model's robustness and validity were assessed using the Hosmer-Lemeshow goodness-of-fit test, providing insights into the alignment between the model's predictions and observed outcomes. **Ethical Considerations:** The study adhered to the principles of the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board (IRB) of the hospital. Due to its retrospective nature, individual informed consent was not required. Rigorous steps were taken to ensure patient confidentiality.

Results

From an initial cohort of 500 patients, 50 participants were excluded due to incomplete medical records (30 individuals) or being lost to follow-up (20 individuals). The final cohort included 450 patients, ensuring the integrity and accuracy of the collected data.

The cohort consisted of 450 participants, the majority being male (60%). The average age of the participants was 58 years. The median duration of tracheostomy among this cohort was approximately 12 days. The demographic and clinical profile provides background data for the findings and analyses (Table 1).

Table 1: Baseline Characteristics of the Study Participants

Characteristic	Total (N=450)
Age (mean ± SD)	58 ± 12
Gender (n, %)	
- Male	270 (60%)
- Female	180 (40%)
Duration of Tracheostomy (median, IQR)	12 (8-16)

Findings and analyses. Within the cohort, 250 individuals (55.6%) experienced minor complications during decannulation, while 40 individuals (8.9%) encountered major complications. This highlights the prevalence of mainly minor complications during the decannulation procedure (Figure 1).

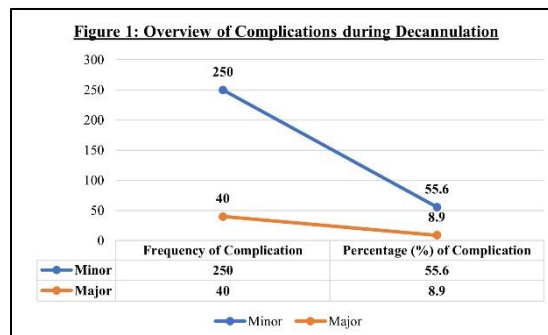


Fig 1: Overview of Complications during Decannulation

Within the cohort, 250 individuals (55.6%) experienced minor complications during decannulation. Minor complications included localized bleeding (140 patients), oxygen desaturation (70 patients), and minor infections (40 patients). Another 40 individuals (8.9%) encountered major complications, highlighting the prevalence of complications mainly minor in nature during the decannulation procedure (Figure 2).

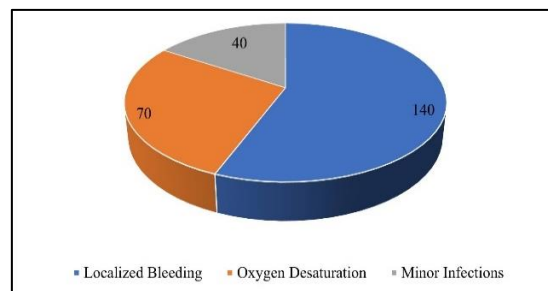


Fig 2: Details of Minor Complications

Among the cohort of 40 patients who suffered major complications following decannulation, the most encountered problem was stenosis (12 patients), implying potential long-term morphological alterations from tracheostomy. Severe haemorrhage was observed in 10 patients, and tracheal injury was found in 8 patients, highlighting complex vascular and anatomical difficulties. Tracheomalacia was present in 5 patients, indicating potential structural vulnerability of the trachea. Additionally, 5 patients experienced various

complications, including granulomas, tracheoesophageal fistula, pneumothorax, and severe systemic infections, requiring surgical intervention or extended hospitalization.

This highlights the wide range of significant adverse outcomes that can occur following decannulation (Figure 3).

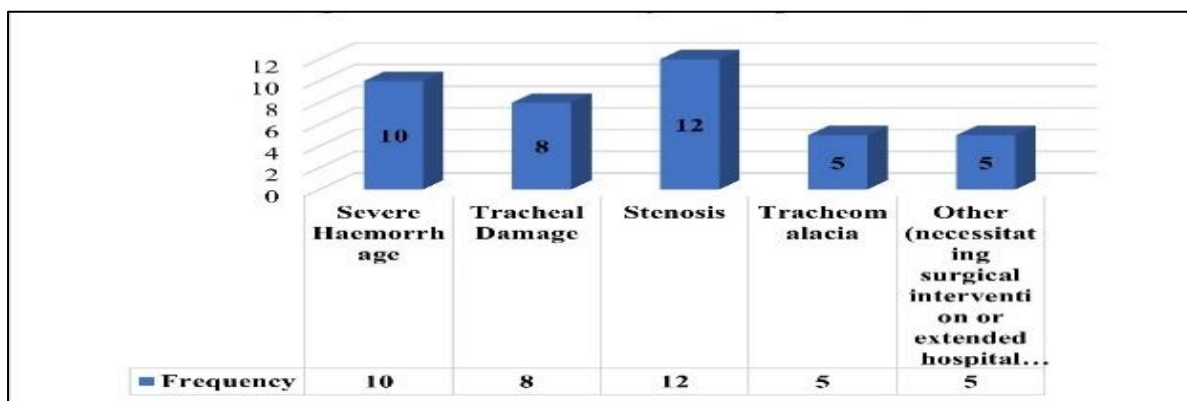


Fig 3: Details of Major Complications

Details of Major Complications:

Various procedures were performed to address complications that occurred after decannulation. Surgical interventions were used in 20 cases, targeting anatomical anomalies such as tracheal stenosis, granulomas, tracheoesophageal fistulas, and tracheocutaneous fistulas.

Pharmacological treatments were required in 15 cases, primarily for treating inflammatory or infectious conditions. Respiratory therapy was applied in 5 cases, highlighting its important role in addressing respiratory imbalances following intervention (Figure 4).

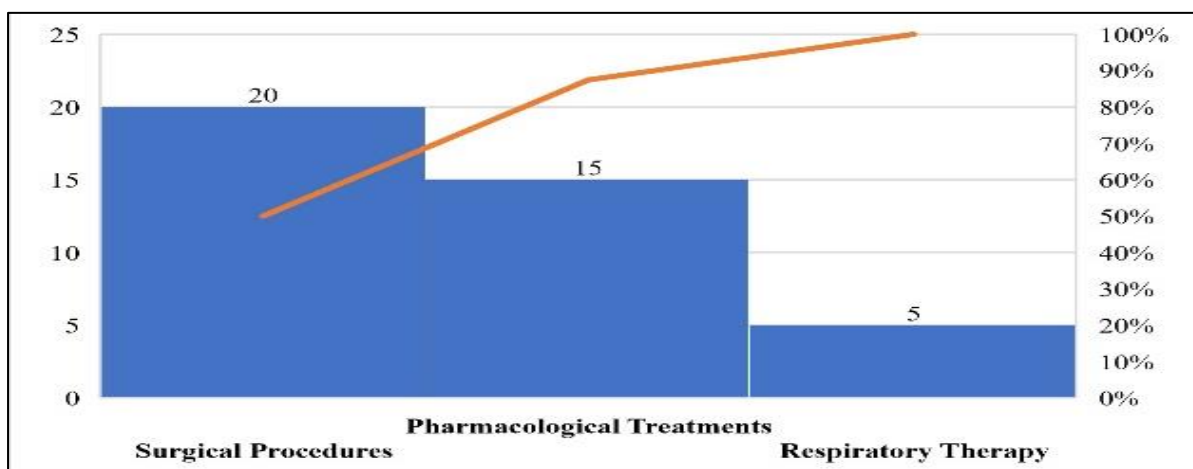


Fig 4: Management Strategies for Complications

After initial analysis, it was found that each incremental year of age increased the odds of post-decannulation complications by a factor of 1.03, indicating a modest yet statistically significant association between age and risk of complications. The results also suggested that males have a slightly higher risk of complications, though this should be interpreted with caution due to the large confidence interval. Additionally, an increase in the duration of tracheostomy was associated

with a higher probability of developing complications, highlighting the risks related to prolonged tracheostomy (Table 2).

Table 2: Univariate Analysis for Predictors of Complications

Variable	OR (95% CI)
Age (per year increase)	1.03 (1.01 - 1.05)
Gender (Male vs. Female)	1.20 (0.80 - 1.79)
Duration of Tracheostomy (per day increase)	1.05 (1.03 - 1.07)

Tracheostomy Complications: 5 Years

In multivariate analysis, age was a significant predictor, with each additional year increasing the probability of post-decannulation complications by 4%. Similarly, each additional day of tracheostomy increased the risk, indicating cumulative complications

related to prolonged tracheostomy. While gender showed some influence, its wider confidence interval suggests that it is a less conclusive predictor compared to age and duration of tracheostomy (Table 3).

Table 3: Multivariate Analysis for Predictors of Complications

Variable	aOR (95% CI)
Age (per year increase)	1.04 (1.02 - 1.06)
Gender (Male vs. Female)	1.15 (0.76 - 1.74)
Duration of Tracheostomy (per day increase)	1.06 (1.04 - 1.08)

Ancillary Analyses

Distinct patterns emerged while analyzing post-decannulation complications by subgroup. Age was significant, with individuals aged 50 to 70 exhibiting the highest incidence of complications. Gender disparities were noticeable, as males reported a higher incidence

of complications compared to females. Additionally, those who underwent tracheostomies for more than 10 days experienced a slightly higher incidence of complications compared to those with shorter durations (Fig 5).

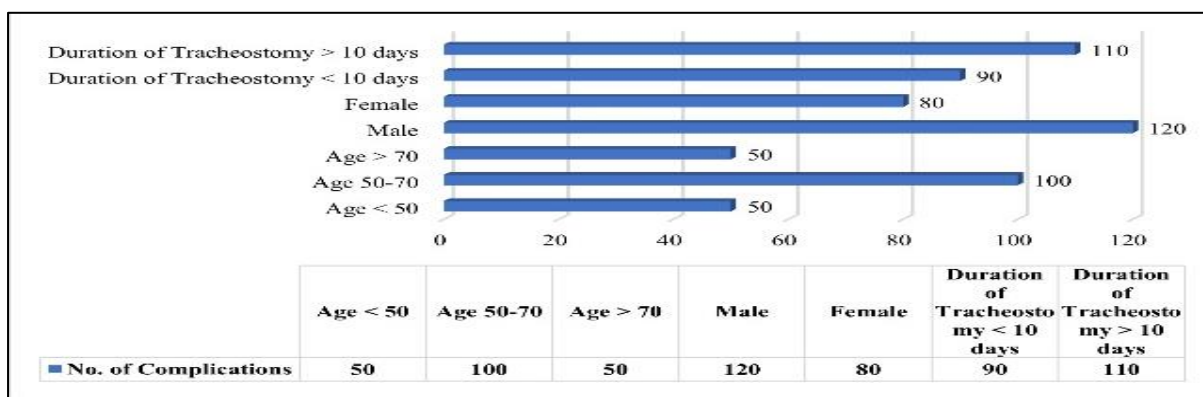


Fig 5: Complications by Age, Gender, and Duration of Tracheostomy

Missing Data

For the selected cohort of 450 patients included in the study, there were no missing data for any of the variables discussed in the results.

The reliability of the multivariate model was assessed using the Hosmer-Lemeshow goodness-of-fit test. A p-value of 0.37, well above conventional significance thresholds, confirms the model's suitability for accurately predicting complications (Table 4).

Table 4: Model Validation using Hosmer-Lemeshow Test

Test Statistic	Value
Chi-square	8.65
p-value	0.37

Note on Complication Attribution:

In this retrospective analysis, while our focus is on identifying and categorizing complications arising during the decannulation process, we acknowledge the challenges in definitively attributing these complications solely to the tracheostomy procedure, considering the potential influence of prior intubation in some patients.

This study's design and data sources, primarily hospital records, provide a comprehensive overview of observed complications. However, detailed differentiation between tracheostomy-related and prior intubation-induced complications may require further prospective studies.

Discussion

Key Findings

Our retrospective cohort study explored complications during decannulation and their management strategies. Minor complications were more common than major ones, with localized bleeding being the most frequent minor complication and stenosis the most frequent major complication.

The risk factors included increasing age and prolonged tracheostomy duration. Surgical interventions were the primary management strategy for major complications. Distinguishing the direct cause of these complications, whether due to the tracheostomy itself or as a result of prior intubation, remains a complex challenge.

Comparison with Prior Work

Our findings confirm previous research on tracheostomy-related complications. The correlation between advancing age and increased complications aligns with results reported by Halum et al. (4). The vulnerability in elderly individuals can be attributed to physiological changes, diminished functional capacity, or comorbid conditions (5). Risks associated with prolonged tracheostomy, identified in our study, are consistent with findings by Young et al. (6), emphasizing the importance of timely decannulation. Gender disparities in complications align with Carron et al. (7), though more research is needed to understand the underlying causes, including the potential impact of prior intubation.

Strengths and Limitations

A primary strength of our study is the thorough assessment of a large cohort from a tertiary care hospital, ensuring a heterogeneous patient group. However, the single-center focus limits the applicability of results to broader settings. The retrospective methodology may introduce biases due to reliance on pre-existing data, limiting the ability to attribute complications precisely to either tracheostomy or prior intubation. Prospective studies are needed to further explore this distinction.

Interpretation

The observed complications highlight the need for meticulous patient monitoring. The correlation between age and complications

underscores the importance of tailored care strategies for elderly individuals. Further research is required to understand the underlying reasons and potential preventive actions for observed gender disparities. Our findings also suggest the need for comprehensive review of patient histories to assess the influence of prior intubation on complications.

Generalizability

While our study provides valuable insights into the decannulation process, caution is needed when generalizing these findings to different settings or groups. Distinguishing between complications directly related to tracheostomy versus those influenced by prior intubation complicates generalizability. Multi-center studies could enhance the validation of our findings.

Recommendations

To address potential complications associated with prolonged tracheostomy and evident gender and age disparities, a customized approach to patient care is essential. Continuous monitoring, timely interventions, and a multidisciplinary approach are critical. Healthcare personnel should prioritize regular training and workshops to stay updated on best practices, including strategies for assessing and managing patients with a history of intubation (8).

Conclusion

Our study provides valuable insights into complications associated with the decannulation procedure in tracheostomy patients. The correlations between age, tracheostomy duration, and complications underscore the need for individualized treatment protocols. Although minor complications were more prevalent, major complications highlight the need for diligent patient care.

Our findings also suggest the importance of considering prior intubation history in clinical evaluations. Further multi-center research is needed to validate and expand these conclusions, explore gender disparities, and understand how pre-existing intubation conditions impact decannulation outcomes, leading to proactive strategies for prevention and management.

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