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Factors Influencing Decannulation of Tracheostomy in Public Sector Tertiary Care Hospitals

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Abstract

Background: Tracheostomy is a surgical procedure that involves making an incision in the neck to create an opening through the trachea. This opening is used independently as an airway or as a site for tracheostomy tube insertion. The tube allows a person to breathe without relying on their nose or mouth. This procedure is performed on patients who require prolonged mechanical ventilation or those with upper airway obstructions. Decannulation is the gradual withdrawal process from a tracheostomy tube. It aims to restore the patient's ability to breathe spontaneously without assistance from the tube. **Objective:** To determine the factors associated with the decannulation of tracheostomy tube, and to find the effect of tracheostomy tube related complications on the decannulation outcome. **METHODOLOGY:** An observational cross-sectional study was conducted among patients who had undergone tracheostomy through a modified

questionnaire at tertiary care hospitals in Peshawar. A total of 56 patients were sampled from the ICU and HDU, and the data were analyzed by using IBM SPSS Statistics 26.0. **RESULTS:** 56 patients were assessed for tracheostomy tube decannulation. Among them, 76.8% were male and 23.2% were female. They were admitted to the ICU with various types of diseases. The most common disease among them was pulmonary disease, which affected 19.6% patients, 17.9% patients had a neurological disease, and 62.5% patients had other diseases. Out of these, 11 patients (19.6%) had tetanus. During decannulation, 15 patients (26.8%) developed complications. Out of these patients, 7 (12.5%) developed edema, 2 (3.6%) developed septicemia, 4 patients (7.1%) developed tracheoesophageal fistula, 1 patient (1.8%) had stenosis, and 1 patient (1.8%) had stoma enlargement. Significant majorities of 41 patients (73.2%) were able to successfully decannulate from the procedure, while 15 patients (26.8%) were unable to decannulate and required reintubation. **CONCLUSION:** Several factors can affect successful tracheostomy decannulation, including duration of capping trial, coughing effectively, level of consciousness, ability to swallow, and duration of tracheostomy. According to our results, pulmonary disease is the leading cause of unsuccessful tracheostomy decannulation, followed by tetanus and RTA. One of the most common complications of a tracheostomy tube is laryngeal edema, the second complication is the formation of a tracheoesophageal fistula, the third is septicemia, and the fourth is stenosis or narrowing of the trachea, resulting in unsuccessful decannulation of the tracheostomy tube, making it difficult for the patient to breathe without assistance.

Keywords: Tracheostomy, outcomes, ICU, decannulation, complication

Introduction

Tracheostomy is a surgical procedure where an incision is made in the neck to create a direct airway through the trachea and form an opening called a stoma. This opening can be utilized independently as an airway or as a site where a tracheostomy tube can be inserted. The tube enables an individual to breathe without relying on the nose or mouth. This procedure is typically performed by a qualified medical professional and recommended for individuals who require long-term respiratory assistance (1, 2). Technological advancements in critical care have increased the number of patients requiring prolonged mechanical ventilation. The patients requiring prolonged

mechanical ventilation include those with neuromuscular or pulmonary diseases, viral infections such as poliomyelitis, comatose patients, and those with upper airway obstructions resulting from facial burns or head trauma in the ICU. In these cases, mechanical ventilation helps to ensure that the patient receives adequate oxygen and can maintain proper ventilation. However, prolonged use of trans-laryngeal endotracheal intubation increases the risk of ventilator-associated pneumonia (VAP), sinusitis, and severe laryngeal and tracheal damage. It has been observed that nearly 10% of patients in the ICU who are on mechanical ventilation may require a tracheostomy procedure (3-6). Tracheostomy is now the preferred option over prolonged endotracheal intubation due to its numerous benefits; it improves a patient's comfort level and makes oral care and suctioning much easier. It can also reduce the need for sedatives or painkillers and lower the likelihood of accidental extubation. Tracheostomy can improve the weaning process from mechanical ventilation and help with rehabilitation. Moreover, it can lower airway resistance and make airway care easier. Additionally, transfer to a lower level of care is continuous with tracheostomy.

All of these benefits combined make tracheostomy a highly effective and safe option for patients requiring mechanical ventilation (3, 7). The first known representation of tracheostomy is from 3600 BC, on Egyptian tables. According to legend, Alexander the Great used his sword to open the airway of a soldier choking from a bone lodged in his throat. The writings of Aretaeus (2nd century AD) and Galen (2nd to 3rd century AD) document tracheostomy performed by the Greek physician Askleiades about 100 BC. During the medieval era, physicians who practiced Islamic medicine played a crucial role in advancing the techniques and understanding of tracheostomy. Through their dedicated efforts, they made significant contributions to the history of this medical procedure, as recently documented. Surgeon Antonio Musa Brasavola described the first successful tracheostomy in 1546. For relief of airway obstruction from enlarged tonsils. From 1546 to 1833, only 28 successful tracheostomies were recorded, and almost all were for relief of upper airway obstruction. In the early 20th century, tracheostomy was made much safer. The famous surgeon Chevalier Jackson refined and detailed the technical aspects of the procedure. During the polio epidemic, the use of tracheostomy became widespread. Currently, tracheostomy is often

used for prolonged mechanical ventilation rather than for upper airway obstruction (3). However, tracheostomy is associated with several complications, including bleeding, which can occur due to damage to blood vessels in the neck during the procedure. Pneumothorax, Subglottic stenosis, a narrowing of the airway below the vocal cords, may develop because of scarring or inflammation. The tracheoesophageal fistula, a connection between the trachea and esophagus, can cause food or liquid to enter the lungs, leading to pneumonia. Other potential problems include stomal granulation, vocal cord dysfunction, scarring, and persistent tracheal fistula. Patients and healthcare providers need to be aware of these potential complications when considering tracheostomy as a treatment option (3, 8). It is crucial to understand that decannulation can come with certain risks. Research suggests that there are benefits to decannulation, such as improved breathing and increased mobility. However, keeping a tracheostomy tube in place for too long may result in inflammation, stenosis, and excessive coughing. Additionally, it may interfere with the natural mechanism of tracheal elevation, which plays a crucial role in preventing food or secretions from entering the lungs during swallowing (9,10). Therefore, it is essential to carefully consider the risks and benefits before proceeding with decannulation.

Methodology

This observational cross-sectional study was conducted from July 01, 2023, to December 31, 2023, in the tertiary care hospital of Peshawar, Pakistan. The study included 56 participants with a tracheostomy tube in the ICU and HDU, with inclusion criteria of all ages and gender and excluded those patients who declared DNR, brain death, and were shifted from general wards with tracheostomy. Data were collected through a modified questionnaire using a non-probability convenience sampling technique. Data were analyzed using SPSS (version 26.0), with descriptive statistics for frequencies and percentages. Associations between factors and decannulation outcomes were examined. Percentages and frequencies have been used to establish different relationships.

Results

Of the 56 patients, 76.8% male patients and 23.2% female patients. They underwent tracheostomy due to prolonged mechanical ventilation.

Table 1: *Demographics*

	Frequency	Percent
Male	43	76.8
Female	13	23.2
Total	56	100.0

Among the patients, 19.6% had pulmonary diseases, 17.9% had neurological disorders, and 62.5% presented with other abnormalities. The 'other abnormalities' category included tetanus (19.6%), road traffic accidents (7.1%), traumatic brain injury (3.6%), Guillain–Barré syndrome (7.1%), and sepsis (3.6%). Additionally, 1.8%, 1.8% of patients each had abdominal aortic aneurysm, intestinal perforation, cardiogenic shock, post-operative craniotomy status, diphtheria, eclampsia, heat stroke, history of fall, penetrating chest injury, and pheochromocytoma. Acute kidney injury was observed in 3.6% of patients.

Table 2: *Primary Causes*

Abdominal Aortic Aneurysm	1	1.8
Acute Kidney Injury	2	3.6
Cardiogenic Shock	1	1.8
Craniotomy Post OP	1	1.8
Diphtheria	1	1.8
Eclampsia	1	1.8
GBS	4	7.1
Heat stroke	1	1.8
HOF	1	1.8
Intestinal Perforation	1	1.8
Penetrating Chest Injury	1	1.8
Pheochromocytoma	1	1.8
RTA	4	7.1
Sepsis	2	3.6

Tetanus	11	19.6
Traumatic Brain Injury	2	3.6

The duration of tracheostomy of patients were; 8.9% had less than 7 days, 69.6% between 8-15 days, 17.9% between 16-30 days, and 3.6% longer than 30 days. After the tracheostomy procedure, 69.6% patients were decannulated during 8 to 15 days. The Glasgow Coma Scale (GCS) score of 67.9% of patients during tracheostomy was 8-14; 30.4% had a score of 15, and one patient had a score of eight. 40 patients had a strong cough spontaneously after decannulation, six patients had a weak spontaneous cough, four patients had a strong provoked cough, and six patients had a weak provoked cough. 89.3% patients had secretions after decannulation. Of these, 48.2% of patients had thick secretions, while the remaining 51.8% had thin secretions. Among the patients with thick secretions, 62.5% patients required oral suction while 37.5% patients did not require suction. 80.4% patients were able to breathe spontaneously, and 19.6% patients required oxygen support. 23.2% patients had a respiratory rate of 12-18 breaths/min, 67.9% patients had 18-24, and 8.9% patients had >24. 76.8% patients had oxygen saturation of 94-100% following decannulation of tracheostomy, and 23.2% patients had O2 saturation of 88-93%. 85.7% patients do not encounter any issues with swallowing. However, 14.3% patients report difficulties with swallowing. 26.8% patients experienced complications, including 12.5% developed edema, 3.6% patients developed septicemia, 7.1% patients developed tracheoesophageal fistula, 1.8% patients developed stenosis, 1.8% patient developed stoma enlargement, and 73.2% patients did not experience any complications during the tracheostomy decannulation.

Table 3: *Complications develop due to tracheostomy*

		Frequency	Percent
Complications develop with tracheostomy	Stenosis	1	1.8
	Septicaemia	2	3.6
	Edema	7	12.5
	Tracheoesophageal Fistula	4	7.1
	Stoma	1	1.8
Patients with no complications		41	73.2
Total		56	100.0

73.2% patients were able to successfully decannulate, and 26.8% patients were unable to decannulate and required reintubation.

Table 4: *Tracheostomy decannulation outcomes*

		Frequency	Percent
Tracheostomy decannulation outcome	Successful	41	73.2
	Unsuccessful	15	26.8
	Total	56	100.0

Discussion

This study highlights critical factors influencing tracheostomy decannulation. Demographics showed 76.8% male patients and 23.2% female patients. Shafique et al., study found that 57% of the patients were male and 43% were female. The study revealed that 19.6% of patients had pulmonary diseases, 17.9% had neurological disorders, and 62.5% presented with other abnormalities. These other abnormalities included tetanus (19.6%), road traffic accidents (7.1%), traumatic brain injury (3.6%), Guillain–Barré syndrome (7.1%), sepsis (3.6%), and acute kidney injury (3.6%). Additionally, 1.8% of patients each had abdominal aortic aneurysm, intestinal perforation, cardiogenic shock, post-operative craniotomy status, diphtheria, eclampsia, heat stroke, history of fall, penetrating chest injury, and pheochromocytoma. Shafique et al. revealed that 47.6% of the cases were attributed to GBS, while only 4.7% were due to head trauma/Traumatic Brain Injury (TBI) (5). Datta et al. also reported similar findings in their studies, with GBS and TBI as common causes of tracheostomy (11). Maheshwari et al. studied that the primary indication for tracheostomy in children is prolonged mechanical ventilation (60%) due to neurological or neuromuscular disorders, as opposed to upper airway obstruction (40%) (12). Santus et al. 2014 studied objective quantitative parameters (capping trial and cough evaluation) and subjective parameters to assess the practicality of removing the tracheostomy tube (4). Enrichi et al. also use the factors that contain cough reflex, voluntary cough, swallowing evaluation, blue dye test, tracheostomy tube capping, endoscopic assessment, trachea suctions, level of consciousness, and saturation levels (6). The other parameter is to evaluate the strength and effectiveness of the patient's cough, which is essential for clearing secretions and protecting the airway. The study showed that 40 patients had a strong cough

spontaneously after decannulation, six patients had a weak spontaneous cough, four patients had a strong provoked cough, and six patients had a weak provoked cough. In the study conducted by Zanata et al, out of all the patients evaluated, 12 (60%) were able to be decannulated despite experiencing coughing, 2 (10%) were unable to occlude the cannula despite coughing, and 6 (30%) did not experience any coughing, but were still unable to be decannulated (13). The study recognized the Glasgow Coma Scale (GCS) to measure the level of consciousness of the patients under examination. The majority of the patients, specifically 67.9% patients, had a GCS score that ranged from 8 to 14, which is indicative of a moderately reduced level of consciousness. 30.4% patients had a perfect GCS score of 15, signifying full consciousness and responsiveness. Zanata et al evaluated that out of the 20 patients, 6 (30%) had a Glasgow Coma Scale below eight, which is not considered safe for airway protection. However, at the time of evaluation, 14 patients (70%) had scores above eight. Out of these 14 patients, only 2 (14%) were unable to begin the decannulation process. 01 patient could not maintain cuff deflation, while the other could not maintain proper breathing with a closed cannula. They evaluated that 50 patients (89.3%) still had secretions after decannulation. Out of these, 48.2% had thick secretions, and the remaining 51.8% had thin secretions. Among those with thick secretions, 62.5% required oral suction while 37.5% did not require suction (13). Stelfox et al cross-sectional survey gathered responses from 200 physicians and respiratory therapists who specialize in managing tracheostomized patients. The survey showed that out of 325 patients, decannulation was recommended for 196 patients with scant thin secretion, while it was not recommended for 129 patients. For 159 patients with moderate thick secretion, decannulation was recommended, and for 191 patients, it was not recommended (8). The study revealed that a majority of 45 patients (80.4%) were able to breathe without any external assistance after the procedure. However, the remaining 11 patients (19.6%) required some form of oxygen support to facilitate their breathing.

These findings underscore the importance of closely monitoring patients' respiratory function during and after the decannulation process to ensure successful outcomes and minimize potential complications. The study is showing that a vast majority of 48 patients (85.7%) did not encounter any issues with swallowing. However,

eight patients (14.3%) reported difficulties with swallowing. Lanini et al found that out of 495 patients among 194 subjects, 72 (37%) were unable to be decannulated due to severe dysphagia and inability to manage oral secretions in 34 patients (47%) (14). The study showed that out of 11 patients with pulmonary disease, seven were successfully decannulated while four were unsuccessful. Similarly, for neurological impairment, nine patients were successfully decannulated, and only one was unsuccessful. In other diseases, 29 patients were successfully decannulated while six were unsuccessful. Among the unsuccessful decannulation, there was one patient with diphtheria, one with a penetrating chest injury, two with RTA, and two with tetanus. According to Lee et al., reasons for ICU admission in 270 patients were 155 (57%) Respiratory, 36 (13%) Trauma, 34 (12%) Neurologic, 29 (11%) Cardiovascular, 16 (7%) Gastrointestinal (15). The study showed that 15 patients experienced complications that affected the tracheostomy decannulation outcomes, including stenosis, septicemia, edema, tracheoesophageal fistula, and stoma enlargement. According to O'Connor et al. The presence of a tracheostomy tube can lead to complications such as tracheal stenosis, bleeding, infection, aspiration pneumonia, and fistula formation to the esophagus or innominate artery (16).

Conclusions

Several factors can affect the successful decannulation of tracheostomy. These factors include coughing effectively, tracheal or oral secretions, level of consciousness, and the patient's ability to swallow. Additionally, the longer duration of tracheostomy and complications that are associated with tracheostomy delay the process of removing the tracheostomy tube. Primary diseases like pulmonary disease, tetanus, and RTA are leading factors for unsuccessful decannulation of tracheostomy. The most common complications of tracheostomy are laryngeal edema, tracheoesophageal fistula, Septicemia, and stenosis, or narrowing of the trachea, resulting in unsuccessful decannulation of the tracheostomy tube, making it difficult for the patient to breathe without assistance.

Limitation

This study was conducted within a short period. In order to reach a conclusive understanding, it will be necessary to conduct additional research. This is because the

limited duration of the study may have affected the accuracy of the findings. Thus, further investigation is necessary to validate these results and ensure their reliability.

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