THE IMPORTANCE OF PERCUTANEOUS TRACHEOSTOMY IN CRITICAL CARE FOR IMPROVING PATIENT PROGNOSIS

Abstract:

This review will also provide an outline of how tracheostomy rates have grown since it was demonstrated to enhance the patient's prognosis. Critical care is one of the most crucial components in saving a patient's life. The overconfidence or overwhelming load of determining diagnoses rather than prognoses of a specific sickness at any moment is always a contributing cause to these errors. A research was conducted on 412 patients in medical-surgical intensive care units. Percutaneous tracheostomy was frequently done 11 days following intubation in these individuals. The patient's general health, prognosis, and capacity to be weaned all played a role in the choice. According to research, individuals with SARS-CoV-2 who had tracheostomy had a reasonable chance of survival, with mortality rates ranging from 7% to 23%. The differences in death rates between studies can be ascribed to factors such as follow-up period and accessible outcome data. Another notable exception is a big research done in Spain, which revealed a surprisingly high fatality rate of 23%. Percutaneous tracheostomy is quickly becoming a prominent interventional therapeutic option for patients suffering from respiratory failure or who require mechanical ventilation. It is the least intrusive technique that has been shown to be beneficial in patients admitted to critical care units in hospitals.

Keywords: Critical Care, Tracheostomy, Glasgow Coma Scale, Seldinger Technique, Angioedema.

INTRODUCTION

Critical care is one of the most important factors involved in saving the life of a patient. The prognosis of a patient, the outcomes of the treatment that was given to them and everything that revolves around it are integral parts of critical care. In medical language, the terms 'critical care' and 'critical illness' have frequently been used in the incorrect context. (1)

There is always a leading factor behind these mistakes, and that is the overconfidence or overwhelming burden of judging the diagnoses rather than the prognoses of a given illness at any time. There are wide chances that if a patient and their serious illness are managed and treated as per their prognosis, then the protocols could very easily be changed into life-saving ones instead of the trial and error ones that involve introducing such a therapy that could help save the life of a patient. (2)

Throughout the world, there are strict protocols of management and treatment that need ot be practiced strictly. There is almost no compromise done on this aspect of the critical care of patients, and this is indeed a remarkable practice wherever it is done on strict grounds. Out of all the hospitals in the world, there might be some that do not comply with the rules and regulations of critical care, however, it is needless to say that those hospitals or departments are very few in number, and their negligence has to pay a heavy price one day or the other. (3)

Out of all the protocols that are followed in a critical care setting for improving the prognosis of a given patient, percutaneous tracheostomy is a widely practiced one in nearly all parts of the world. (4) Tracheostomy is one of the most ancient techniques that have been known ad well-recognized in medical science. They are done both surgically and percutaneously, as per the patient's condition and consciousness factors. It is known to be a life-saving procedure that has had several instances of improving the patient's Glasgow Coma Scale (GCS) or consciousness

levels. Nowadays, percutaneous tracheostomy has easily become the choice of intervention that many doctors prefer when it comes to looking forward to improving the prognosis of a patient who is admitted to the critical care wards. Now, tracheostomy is recognized as a distinct procedure that has indications, contraindications, and techniques of its own. (5)

This review aims to reflect on the role of percutaneous tracheostomy in saving the life of a patient. The focus is on the need for percutaneous tracheostomy in critical care settings specifically since it is the place where many life-changing decisions have to be taken by both the doctors and the patient's families and attendants. This review will also do an overview of how the rates of tracheostomy have increased ever since it has been proven to improve the patient's prognosis.

AN OVERVIEW OF PERCUTANEOUS TRACHEOSTOMY

Tracheostomy has been aorund in the field of critical or emergency medicine since the time of Alexander the Great in 1000 B.C. It was reported that it was Alexander himself who made an incision with his sword on a soldier's neck to make breathing a bit easier for him. (6)

Ever since then and maybe even before that, tracheostomy has been around as a life-saving procedure that has helped doctors and patients around the globe in improving the prognosis of several patients admitted to the critical care ward. (7)

Today, there are several techniques for performing tracheostomy in patients. It is commonly done through two major methods; the open surgical and the percutaneous method. Both methods have their sets of advantages, disadvantages, indications, and contraindications that are recommended for the particular patients needing them.

However, for the sake of convenience, this review will focus on the usage of percutaneous tracheostomy as a whole.

Percutaneous tracheostomy was introduced after the open surgical technique method in 1985.. It is a method that is widely used in intensive care and critical care settings, thus proving that the implementation of percutaneous tracheostomy is usually reserved for people who are critically ill. Percutaneous tracheostomy focuses on using a modified Seldinger technique, which is not employed in open surgical tracheostomy. However, several techniques for inserting the tracheostomy tube have been proposed after the introduction of percutaneous tracheostomy. (8)

Modified Seldinger Technique:

In this modified Seldinger technique, the focus is on accessing the trachea through a needle and then inserting a guidewire through it. Once the guide wire succeeds in achieving the dilation that is needed, the tracheostomy tube is entered. (9)

In the beginning, the focus was on employing the use of serial large-sized dilators to create a stoma for the tracheostomy tube. However, with time, this use of serial dilators went obsolete, and a single, tapered dilator came into use. This way, only a single dilator was used and a single step was required to produce the required stoma instead of a series of steps, which were both time-consuming as well as somewhat invasive for the patient who was already in a compromised state. (10)

In the United States as well as other regions of the world, Portex ULTRAperc Single Stage Dilator Technique Kit, Bloomington, Indiana, etc. are some of the most commonly used kits for percutaneous tracheostomy. These kits have helped improve the overall technique and made the procedure feasible to be performed by the surgeons as well. (11)

To this date, it is the single dilator technique that has received the most acclamations and approvals for being the least invasive method as well as the one with the least rate of complications in the patient.

Griggs Technique:

For the Griggs technique, a special type of forceps was invented in 1997. In this technique, it was seen that the specially designed Griggs forceps were used for dilating the stoma for the insertion of the tracheostomy tube. (12)

This Griggs forceps was introduced with the help of a guidewire and then extended to the preferred length for the dilation of the stoma.

Fantoni's Technique:

Fantoni's technique was another unique technique used for percutaneous tracheostomy. In this technique, a guidewire was inserted through the anterior tracheal wall. (13)

Once this had been done, both the curved dilator and the tracheostomy tube were pulled in a retrograde manner from the larynx.

Balloon Dilation Technique:

In the balloon dilator technique, a balloon was used instead of a curved dilator. This balloon served the same purpose as that of a dilator and that was to dilate the stoma. Once dilation has been achieved, the next step is only to introduce the tracheostomy tube, which in this technique, is introduced proximal to the balloon. (14)

In all the techniques mentioned above, there is no risk associated with injuring the posterior tracheal wall while dilating as well as inserting the tracheostomy tube. However, as has already been mentioned above, it is the use of the single curved dilator that has been found to be the most helpful in performing percutaneous tracheostomy in severely immunocompromised patients.

INDICATIONS OF PERCUTANEOUS TRACHEOSTOMY

Just like the surgical technique, there are certain indications that make the implementation of percutaneous tracheostomy in patients a necessity for improving their outcomes. It has been

declared that about 5-10% of all the patients admitted to the ICU will require a percutaneous tracheostomy at some point during their stay in critical care. (15)

The first and major reason why percutaneous tracheostomy is required in these critical patients is respiratory failure. Since the patients are unable to maintain the flow of carbon dioxide and oxygen as normal patients do, it was evident that they needed continuous mechanical ventilation to help them with this.

Furthermore, percutaneous tracheostomy was also indicated in situations where the patient had some sort of upper airway obstruction. This obstruction could have arisen in a variety of different ways, such as due to angioedema, obstructive sleep apnea, malignancy, and trauma. (16)

When done in an emergency condition, it is mostly due to preserving the airway and making the suctioning of secretions easier. With a potent tracheostomy in place, it is very easy for the nursing staff to carry out the process of suctioning.

CONTRAINDICATIONS OF PERCUTANEOUS TRACHEOSTOMY

There used to be many speculations related to carrying out percutaneous tracheostomy in patients who were highly unstable or in a condition where nothing could be done to improve their prognosis. However, since a lot of research has been done on the subject, it is now easier to say that tracheostomy could be carried out on those highly critical patients as well, only after looking at their profile and current status. (17)

Any kind of infection that involves the wall of the neck in an unstable patient is a contraindication in an unstable patient. Moreover, conditions such as obesity, limited mobility of the neck secondary to trauma, or patient's underlying disease or condition, a history of prior neck surgery or even a prior tracheostomy history, high ventilator support, and bleeding diathesis are still seen as risks before percutaneous tracheostomy.

COMPLICATIONS OF PERCUTANEOUS TRACHEOSTOMY

There have been several common instances of mild oozing of blood from the incision site. This has been effectively managed using light pressure packing or using a dressing that has been soaked in adrenaline or tranexamic acid. (18)

However, in the cases where bleeding continues or is unable to be stopped, the stoma needs to be re-explored to see where the bleeding is coming from. So far, there have only been a few deaths reported due to the incidence of bleeding after percutaneous tracheostomy.

Trachea-innominate fistula is another rare complication that might arise due to percutaneous tracheostomy. Placing the tracheostomy tube between specific tracheal rings can prevent this, while surgical re-exploration is again necessary for this treatment. (19)

Other than that, respiratory secretions, mucus plugs, and other factors can obstruct the tracheostomy tube. Subcutaneous emphysema and pneumothorax are possible post-tracheostomy complications, with higher risks in obese patients. Tube displacement, particularly in obese patients, can be life-threatening if not managed carefully. Tracheal stenosis, narrowing of the tracheal lumen, is a common issue caused by intubation or tracheostomy, but only a small portion requires intervention. Stomal stenosis and A-form deformities can also develop due to various factors.

OUTCOMES OF PERCUTANEOUS TRACHEOSTOMY IN CRITICAL PATIENTS

Regarding the outcomes of percutaneous tracheostomy in critical patients, there have been mixed studies in this regard. Few of them have viewed this as a good sign for the patient, whereas few studies found no impact whatsoever on the health of the patient even after percutaneous tracheostomy was done.

However, an interesting trend that was found in relation to tracheostomy and its outcomes on the patient was related to the timing of the tracheostomy procedure.

A study was carried out on 412 patients in medical-surgical ICUs. In these patients, the percutaneous tracheostomy was generally performed around 11 days after intubation. The decision was heavily influenced by the patient's overall health status, prognosis, and ability to be weaned. (20)

Research has shown that patients with SARS-CoV-2 who underwent tracheostomy experienced reasonably favorable survival outcomes, with mortality rates spanning from 7% to 23%. The variation in mortality rates across studies can be attributed to factors like follow-up duration and available outcome information. Notably, a significant study conducted in Spain reported a relatively high mortality rate of 23%, which is another exception. (22)

However, the majority of the studies have shown beneficial impacts on the patient's health, when viewed irrespective of the timing of the tracheostomy.

CONCLUSION

Percutaneous tracheostomy is becoming a popular interventional treatment of choice for patients with respiratory failure or those needing mechanical ventilation. It is the least invasive procedure that has especially been seen to be helpful in patients admitted to critical care departments in hospitals.

So far, there have been no serious adverse events associated with the application of percutaneous tracheostomy and therefore, it is said that it is a safe means of intervention that could be used on the patients.

REFERENCES

1. Kayambankadzanja, RK, Schell CO, Gerdin Wärnberg M, Tamras T, Mollazadegan H, Holmberg M, et al. Towards definitions of critical illness and critical care using concept analysis. BMJ Open. 2022 Sep 5;12(9):e060972.

2. Croft P, Altman DG, Deeks JJ, Dunn KM, Hay AD, Hemingway H, et al. The science of clinical practice: disease diagnosis or patient prognosis? Evidence about "what is likely to happen" should shape clinical practice. BMC Med. 2015 Jan 30;13:20.

3. Vincent JL. The continuum of critical care. Crit Care. 2019 Jun 14;23(Suppl 1):122.

4. Mehta C, Mehta Y. Percutaneous Tracheostomy. Ann Card Anaesth. 2017 Jan;20(Suppl 1):S19–25.

5. Raimonde AJ, Westhoven N, Winters R. Tracheostomy. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 [cited 2023 Aug 14]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK559124/

6. Engels PT, Bagshaw SM, Meier M, Brindley PG. Tracheostomy: from insertion to decannulation. Can J Surg. 2009 Oct;52(5):427–33.

7. Frost EA. Tracing the tracheostomy. Ann Otol Rhinol Laryngol. 1976;85(5 Pt.1):618–24.

8. Rashid AO, Islam S. Percutaneous tracheostomy: a comprehensive review. J Thorac Dis. 2017 Sep;9(Suppl 10):S1128.

9. Pelausa EO. Percutaneous tracheostomy: ready or not? J Otolaryngol. 1991 Apr;20(2):88–92.

10. Seldinger SI. Catheter replacement of the needle in percutaneous arteriography; a new technique. Acta Radiol. 1953 May;39(5):368–76.

11. Sanuki T, Son H, Kishimoto N, Kotani J. Utility of the Portex introducer, ivory type, as a tube exchanger. J Oral Maxillofac Surg Off J Am Assoc Oral Maxillofac Surg. 2009 Aug;67(8):1615–8.

12. Şahiner İT, Şahiner Y. Bedside Percutaneous Dilatational Tracheostomy by Griggs Technique: A Single-Center Experience. Med Sci Monit Int Med J Exp Clin Res. 2017 Sep 30;23:4684–8.

13. Divisi D, Altamura G, Battaglia C, Di Francescantonio W, Rosa E, Torresini G, et al. [Translaryngeal tracheostomy using the Fantoni technique: report of 104 cases]. Ann Chir. 2002 Feb;127(2):130–7.

14. De Nicola A, Sucre M. Safety of balloon dilatational tracheostomy with the Ciaglia Blue Dolphin device. Crit Care. 2010;14(Suppl 1):P226.

15. Cohen IL, Booth FV. Cost containment and mechanical ventilation in the United States. New Horiz Baltim Md. 1994 Aug;2(3):283–90.

16. Esteban A, Anzueto A, Alía I, Gordo F, Apezteguía C, Pálizas F, et al. How is mechanical ventilation employed in the intensive care unit? An international utilization review. Am J Respir Crit Care Med. 2000 May;161(5):1450–8.

17. Lewith H, Athanassoglou V. Update on management of tracheostomy. BJA Educ. 2019 Nov;19(11):370.

18. Simon M, Metschke M, Braune SA, Püschel K, Kluge S. Death after percutaneous dilatational tracheostomy: a systematic review and analysis of risk factors. Crit Care Lond Engl. 2013 Oct 29;17(5):R258.

19. Pilarczyk A, Dusse N, Marggraf A, Schönfelder M, Jakob B. Repeat bedside percutaneous tracheostomy: still a contraindication? Crit Care. 2014;18(Suppl 1):P327.

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 Aug;32(8):1689–94.

21. Andriolo BNG, Andriolo RB, Saconato H, Atallah ÁN, Valente O. Early versus late tracheostomy for critically ill patients. Cochrane Database Syst Rev. 2015 Jan 12;1(1):CD007271.

22. Arnold J, Gao CA, Malsin E, Todd K, Argento AC, Cuttica M, et al. Outcomes of Percutaneous Tracheostomy for Patients With SARS-CoV-2 Respiratory Failure. J Bronchol Interv Pulmonol. 2022 Apr 5;30(1):60–5.