

## Percutaneous Dilatational Tracheostomy and Modifications in Intensive Care Unit Patients

Ashraf Ahmed Yakoot EL-Bedeiwy<sup>1\*</sup>, Rasha Mohamed Elsayed<sup>2</sup>, Mohamed Mourad<sup>3</sup> and Mohamed Mohsen Rasheed<sup>4</sup>

<sup>1</sup>Head of Otolaryngology Department, Air Forces Specialized Hospital, Cairo, Egypt

<sup>2,3,4</sup>Lecturers of Anesthesia, Faculty of Medicine, Ain Shams University, Cairo, Egypt

### \*Corresponding author

Ashraf Ahmed Yakoot EL-Bedeiwy, Head of Otolaryngology Department, Air Forces Specialized Hospital, Cairo, Egypt, E-mail: drashraf2007@hotmail.com

Submitted: 02 Nov 2019; Accepted: 15 Nov 2019; Published: 31 Dec 2019

### Abstract

Percutaneous dilatational tracheostomy (PDT) is a commonly performed procedure in critically ill patients [1]. It can be safely performed bedside. This has resulted in decline in the use of surgical tracheostomy except in few selected cases. Over the last 10 years data on newer methods of insertion, timing, safety profile and complication rates has been published, which has greatly improved our understanding of this procedure [2]. The most common indication of tracheostomy in the ICU is the need for prolonged ventilation. Less complication occur with an increase in skills. Many methods of performing PDT have been discovered recently [3]. Bronchoscopy has been found to be beneficial procedural aides the PDT [4]. In our study, a brief overview about the use of PDT in ICU and, different percutaneous techniques will be discussed. The conclusion is that percutaneous tracheostomies offer benefits for some of the outcomes when compared with surgical tracheostomies.

**Keywords:** Critical care, Intensive care unit, Percutaneous dilatational tracheostomy

In the critically ill patients who require a tracheostomy, the Percutaneous dilatational tracheostomy (PDT) rather than the standard surgical technique (ST) is the method of choice as it can be performed at the bedside. It can be performed faster and leaves a smaller scar after decannulation and is associated with fewer complications, but it is associated with increased technical difficulties when compared to ST [3,5].

In our hospital -Air Forces Specialized hospital (Cairo, Egypt), from 2017-2019, we performed more than 70 PDT for ICU patients. The most common primary causes of tracheostomy were prolonged intubation, hypoxic brain damage disorders and other causes e.g. bulbar palsy, pneumonia, severe respiratory distress.

The PDT operation was done for a number of 15 patients in the intensive care unit rooms (bed side), while the remaining 55 patients were transported to the operating room. In most (75%) of our cases we used the well-known 'Cook Medical® Ciaglia Blue Rhino TM, kit, Figure 1. while in rest of patients we modified the technique by using either the Percutaneous nephrostomy package and Basic Central Venous Catheter Insertion Pack, Figure 4: A, B and the results were acceptable.



Figure 1: The 'Cook Medical® Ciaglia Blue Rhino TM, kit

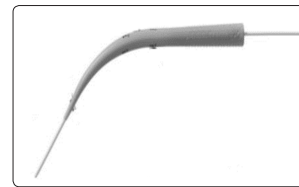
Our purpose is to know if there is other alternatively options cheaper with the same quality and safety than of the tracheostomy package of 'Cook Medical Ciaglia Blue Rhino TM, kit, and to know the Advantages of PDT operation than the open standard surgical technique (ST) in ICU patients. Our team are well harmonized together, either the surgeon, anesthesia who have adequate experience for bronchoscopy.

The operation started by hyperextension of the patient neck, if possible (some difficult cases as after fracture cervical spine fixation) Figure 2.



Figure 2: Hyperextension of the patient is mandatory

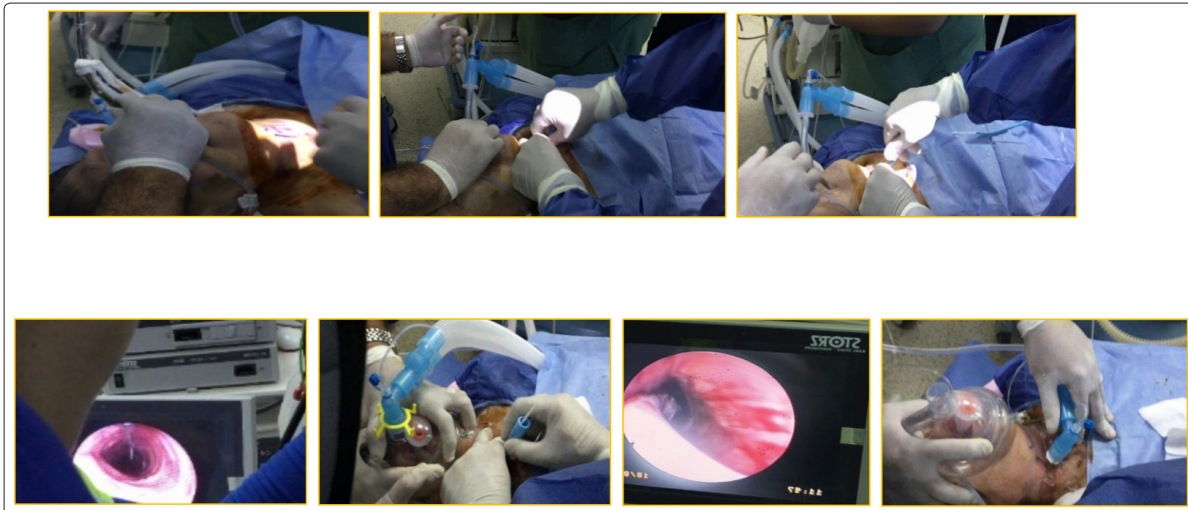
Then the anesthesiologist withdrawn the endotracheal tube until the cuff is just visible at the level of vocal cords, a small scalpel incision 2 cm at the level of second tracheal ring done, minimal separation of the neck fat and subcutaneous tissues with fine mosquito forceps, then identification of the trachea by firstly by seeing air bubbles in the aspirating needle (wide trocar and cannula), at that point applying in the Salinger wire, from here on, all steps of the procedure should proceed under direct bronchoscopic visualization, forming the tracheal stoma by progressive dilators, a series of dilatations are performed over the guide wire, once dilatation is deemed satisfactory, use the last rhino-dilator, Figure 3 and inserting the tracheostomy tube guided by introducer and the Seldinger wire.



**Figure 3:** The Rhino Dilator

It is then secured in place with sutures, visualization of bronchial tree and carina done for revising and documentation.

The following photos showing the serial of whole technique in the operating room.



Changing the tracheostomy package of 'Cook Medical® Ciaglia Blue Rhino TM, kit. By our team, Through using the Percutaneous nephrostomy package and Basic Central Venous Catheter Insertion Pack, Figure 4 A, B.



Figure 4 A

Figure 4 B

It should take in consideration the cost and benefit, meanwhile comparing disadvantages and complications associated with surgical tracheostomies and PDT, lower incidence of wound infection and wound breakdown associated with the smaller tracheal stoma.

Advantages of our modification is that it is of very low price (10 times less) and easy to get, available in the operating room and ICU, and easy to use. But the disadvantages, are that dilators are longer, strength of the guide wire is softer and needs more experience for the surgeon holding power and safety to be directed well into the trachea, the rhino dilator is not existing, which is the key of successful safe procedure.

Bronchoscopy guidance, in spite it prolongs the procedure time, and requires a separate operator, it is mandatory in our PDT protocol, has been used to reduce the number of complications.

Two cases with insertion failure, in our study, and open tech was the solution, factors favorite the complication they were obese patients, road traffic accident with difficulty to do full extension, during the operation cannot identify the tracheal rings easily.

Kost, 2005 mentioned that, the time from the beginning of preparations for tracheostomy until the end of the whole procedure was median 32 min for bedside tracheostomies and 64 min for operations in the operating theatre [7]. While in our cases, the time taken ranges from 7 to 20 minutes even with our modification it takes the same time whereas the time taken to perform the surgical tracheostomy ranges from 15 - 60 minutes.

Jarosz K, et al. 2017 conclude that, in the critically ill patient requiring a tracheostomy the percutaneous technique is more easily and quickly performed at the bedside and may even be safer when compared with the standard surgical technique [8]. With PDT with the aid of bronchoscopy guidance can be done in the ICU (bed side) easily and no need for moving the patient from the critical care unit to the operating theatre. In our series we start the work in the operating rooms initially, and by time, the team gained more experience, so the last 15 cases we managed in the ICU without transportation. Early complications occurred in 16.7% of procedures, of which 9.3% were bleedings (minor, significant and major). Furthermore, the

incidence of late complications was 8.6%, including: stomal infection, difficult replaces tracheostomy tube, tracheoesophageal fistula, tracheal stenosis, and tracheomalacia [7]. An unusual complication of percutaneous dilatational tracheostomy, was reported by Phukan DK 2004, in which the guide wire became lodged in the bronchial tree [9]. We didn't encounter this complication and we hope never.

A high incidence of tracheostomy tube cuff rupture during insertion has been reported with the percutaneous technique [10]. Unlike surgical tracheostomy, we have three cases, we discover the rupture cuff very early by the leaked and hypoventilation, changing the tube at once is mandatory.

The technique of PDT does not provide controlled haemostasis and one of the common complications associated with this technique is haemorrhage. The bleeding usually stops with lateral pressure applied by the tracheostomy tube or with direct pressure applied to the lateral walls of the tracheal stoma. Controlled by bipolar electrocautery.

The rate of subcutaneous emphysema has been reported to be approximately 1.4% [9]. Common causes of subcutaneous emphysema during percutaneous tracheostomies include multiple punctures of the anterior trachea, excessive dilatation of the trachea, posterior tracheal lacerations, and use of a fenestrated cannula [9]. Only one case of surgical emphysema in ICU, the patient had previous liver transplantation, with in one lung rt side and it resolved in 10 days.

Tracheo- esophageal fistula are very rare, it is a relatively unusual and rare complication occurring in < 1% of patients undergoing and was universally fatal 17. As such serious complications as laceration of the posterior tracheal wall. However, it is very important that they are diagnosed and treated very fast. To avoid such complications, it is recommended to use bronchofiberoptic guidance during the PDT. One of the therapeutic options for this type of complication could be Montgomery tube, which preserves normal respiration while the fistula heals [8].

As Tracheo- esophageal fistula relates to tracheostomy placement, over-inflation of the cuff or direct trauma from insertion of the tracheostomy with the obturator in place may cause injury to an already vulnerable posterior wall 12. In our series we documented two cases of tracheoesophageal fistula, managed conservatively (drainage gastrostomy, feeding jejunostomy) and treat the pulmonary infection and biological deficits, as the guidelines of ICU & Trauma recommendations [10].

We concluded that the PDT I technique is commonly used. It can be performed rapidly and easily at the bedside, is associated with fewer complications, safe and cost-effective procedure in the intensive care unit (ICU).

The use of only the rhino dilator with the renal nephrostomy package, is satisfying and safe alternative, modification done is accepted and more researches needed [13].

## References

1. Delaney A, Bagshaw SM, Nalos M (2006) Percutaneous dilatational tracheostomy versus surgical tracheostomy in

critically ill patients: a systematic review and meta-analysis. Crit Care 10: R55.

- Freeman BD, Isabella K, Lin N, Buchman TG (2000) A meta-analysis of prospective trials comparing percutaneous and surgical tracheostomy in critically ill patients. Chest 118: 1412-1418.
- Wang F, Wu Y, Bo L, Lou J, Zhu J, et al. (2011) The timing of tracheotomy in critically ill patients undergoing mechanical ventilation: a systematic review and meta-analysis of randomized controlled trials. Chest 140: 1456-1465.
- Winkler WB, Karnik R, Seelmann O (1994) Bedside percutaneous dilatational tracheostomy with endoscopic guidance: experience with 71 ICU patients. Intensive Care Med 20: 476.
- Vafaii K, Chalechale M, Mohammadi S, Kaviannezhad R (2017) Percutaneous Dilatational Tracheostomy via Griggs Technique. Arch Iran Med 20: 49-54.
- Laisaar T, Jakobson E, Sarana B, Sarapuu S, Vahtramäe J, et al. (2016) Prospective study of percutaneous tracheostomy: Role of bronchoscopy and surgical technique. SAGE Open Med 4: 2016.
- Kost KM (2005) Endoscopic percutaneous dilatational tracheotomy: a prospective evaluation of 500 consecutive cases. Laryngoscope 115: 1-30.
- Jarosz K, Kubisa B, Andrzejewska A, Mrówczyńska K, Hamerlak Z, et al. (2017) Adverse outcomes after percutaneous dilatational tracheostomy versus surgical tracheostomy in intensive care patients: case series and literature review. Ther Clin Risk Manag 13: 975-981.
- Anthony Cipriano, Melissa L Mao, Heidi H Hon, Daniel Vazquez, Stanislaw P Stawicki, et al. (2015) An overview of complications associated with open and percutaneous tracheostomy procedures. Symposium - icu & trauma procedure complication 5: 179-188.
- M Paraschiv (2014) Tracheoesophageal fistula - a complication of prolonged tracheal intubation. J Med Life 7: 516-521.
- Cabrini L, Landoni G, Greco M, Costagliola R, Monti G, et al. (2014) Single dilator vs. guide wire dilating forceps tracheostomy: a meta-analysis of randomised trials. Acta Anaesthesiol Scand 58: 135-142.
- Phukan DK, Andrzejowski J (2004) Percutaneous tracheostomy: a guide wire complication. Br J Anaesth 92: 891-893.
- Putensen C, Theuerkauf N, Guenther U, Vargas M (2014) Percutaneous and surgical tracheostomy in critically ill adult patients: a meta-analysis. Pelosi P Crit Care 18: 544.

**Copyright:** ©2019 Ashraf Ahmed Yakoot EL-Bedeiwy, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.