

## ORIGINAL ARTICLE

**PERCUTANEOUS DILATATION TRACHEOSTOMY: THE TECHNIQUE FROM THE ENT SURGEON'S PERSPECTIVE****Mohamed Zahran<sup>1</sup>, Omar Ahmed<sup>1,2</sup>**<sup>1</sup>Department of Otolaryngology, Alexandria University School of Medicine, Egypt<sup>2</sup>Department of Otolaryngology, East Kent University Hospital, National Health Trust, United Kingdom

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**Abstract**

*The percutaneous dilatation tracheostomy (PDT) using the Seldinger technique was developed a few decades ago and gained popularity. PDT has become a more convenient technique for intensive care units (ICU) patients across the world. The present work aims to share our experience as ENT surgeons in performing a percutaneous tracheostomy. A series of eight patients were included in the study. ICU patients on mechanical ventilation more than 14 days were ideal candidates for PDT. The invention of PDT had overcome many obstacles found in the surgical tracheostomy (ST) procedure. PDT can be performed as a bedside procedure which saves both time and cost of operating theatres.*

**Keywords:** *percutaneous tracheostomy, surgical tracheostomy, technique***Introduction**

Tracheostomy is one of the historical procedures on earth. Alexander the great was reported in 1000 BC to have saved the life of a soldier by cutting his neck by his sworn [1]. The Italian Antonio Brassavola was the first surgeon to document a successful tracheostomy in 1546; however, the first detailed description of surgical tracheostomy was in 1909 [2]. 60 years later, the percutaneous dilatation tracheostomy (PDT) using the Seldinger technique was developed [3]. PDT has become a more convenient technique for intensive care units (ICU) patients across the world [4].

The present work aims to share our experience as ENT surgeons in performing percutaneous tracheostomy in collaboration with the intensivist.

**Materials and Methods**

A series of eight patients were enrolled in the study. Patients were considered candidates for PDT according to the following inclusion and exclusion criteria.

*Inclusion criteria*

1. ICU patients that are intubated and on mechanical ventilation for more than 14 days.
2. ICU patients with anticipated prolonged intubation can be done earlier than 14 days e.g. Guillain Barré, subarachnoid hemorrhage, and patients in a deep coma.

*Exclusion criteria*

These patients were considered unsuitable for bedside percutaneous tracheostomy:

1. Patients in need of emergency tracheostomy.
2. All pediatric patients < 16 years.

3. Anatomical obstacles either a) external: neck mass, huge goiter, or b) internal: cancer larynx, tracheal stenosis.
4. Morbid obesity with a short neck.
5. Limited neck extension or cervical spine fixation

In order to perform a safe procedure, the following clinical parameters would be stuck before the procedure:

1. Hemoglobin should be  $\geq 10$  g/dl.
2. INR should be around 1.2 or less.
3. Platelets count  $\geq 100,000$  per mL.
4. Patients should be hemodynamically stable and not on inotropic support.
5. O<sub>2</sub> saturation should be  $\geq 95$  % with FiO<sub>2</sub>  $< 60$  %.

#### *Pre-procedure preparation*

Close collaboration between the intensivist and the ENT surgeon is necessary for a successful outcome. The overall prognosis for these critically ill patients should be clear and the potential benefits have to outweigh the anticipated risks. Informed detailed consent should be taken from the responsible patient's relative with an explanation of the included complications for the procedure. Anesthesia clearance is mandatory before embarking the procedure and necessary consultations should be done if deemed necessary e.g. cardiologist. Anticoagulant therapy should be discontinued; antiplatelet (e.g. aspirin) should be stopped 1 week and Clexane (Enoxaparin Sodium) 12 hours before the procedure. In certain patients with a high risk of thromboembolism, discussion with a cardiologist and ICU physician is helpful.

#### *Technique*

##### A) Instruments

1. Percutaneous Tracheostomy Kit (PORTEX from Smith medical ®) (figure 1). It is mandatory to ascertain the presence of a second set in case there is a problem with the first set.
2. Cuffed tracheostomy tube size 7.5 and 8.
3. Chlorhexidine or Betadine for skin preparation.
4. Silk suture 2/0.
5. Local anesthetic with a vasoconstrictor (1% lidocaine and adrenaline 1: 100,000) prepared in 10 ml sterile syringe with a small needle.

6. Silver nitrate sticks and Surgicel for hemostasis.
7. Lubricant gel.



**Figure 1 – Percutaneous tracheostomy kit**

The surgical tracheostomy set should be available as standby.

##### B) Anesthesia

Adequate sedation and muscle relaxant are given to avoid the patient's movement during the procedure.

##### C) Position

The procedure is done in ICU at the patient's bedside. The patient is put in the supine position with shoulder roll so that the neck is adequately extended. It is crucial to ensure that the patient's head is not hanging and immobile from side to side. If deemed necessary, a head ring can be used.

##### D) Surgical site preparation

The skin of the neck should be sterilized from the chin till the nipple line then the patient is draped from head to toe in a sterile fashion. The anatomical landmarks of the neck are palpated and marked (thyroid notch, cricoid, and suprasternal notch). The incision site is also

marked. The prepared mixture of lidocaine/adrenaline is infiltrated into the proposed incision site. Too much injection is not advisable as it causes ballooning of subcutaneous tissues and distorted landmarks.

#### E) Operative Procedure

A skin incision is done using a number 15 blade. The assistant (ENT surgeon/anesthetist) is asked to withdraw the endotracheal tube (ETT) under direct vision with the flexible fiberoptic bronchoscope (FFB) to the desired position just at or below the subglottic area. The ETT is then re-fixed in place. Under direct vision on the bronchoscope monitor, needle puncture is done from the skin outside to the inside of the trachea. The ETT and FFB should be positioned just proximal to the intended puncture site to avoid accidental damage of FFB by the sharp needle. It is important to confirm that the needle with the sheath is located near the 12 o'clock position in the trachea via the monitor. The needle is withdrawn with the sheath in place then the guidewire is inserted and directed downwards to the distal trachea. After confirmation of the intraluminal position of the guidewire, the sheath is removed. The trachea is progressively dilated trachea over white plastic guide and wire. Lastly, the lubricated tracheostomy tube (TT) and the internal dilator is inserted into the trachea. The cuff of the TT is inflated and connected to the

ventilator circuit. The anesthetist is asked to confirm the position of TT via ETCO<sub>2</sub> (End-tidal CO<sub>2</sub>) and chest auscultation. Any blood oozing from the puncture site can be controlled by a sliver nitrate stick or a small piece of Surgicel. The FFB is passed through the TT to check the distance from the TT tip and the carina. Any blood or secretions are suctioned using the bronchoscope suction side port. TT is fixed to the neck by 4 silk stitches and necktie.

#### F) Post-operative care

A routine chest X-ray is done to exclude pneumothorax. Regular TT care is to be provided to the patient. Regular gentle suction using soft small catheter is necessary and the nursing staff should be educated. A broad-spectrum antibiotic is given for 1 week if the patient is not on any antibiotic from the ICU side. Daily wound care and dressing are essential to prevent contamination at the TT site. The ICU physician is instructed how to deal with accidental desaturation or dislodgement of the TT and airway cart should be available at all times.

### **Results and Discussions**

The results of our series are summarized in Table 1.

<b>Clinical data</b>	<b>Results</b>
Number of cases	8 patients
Age	Range 52-78 years
Sex	5 males & 3 females
Primary comorbidities	Case 1: cerebrovascular stroke "infarction" Case 2: aspiration pneumonia Case 3: aspiration pneumonia Case 4: bulbar palsy (after excision of brain stem lesion) Case 5: severe subarachnoid hemorrhage Case 6: metastatic breast cancer Case 7: neurodegenerative disease Case 8: severe pneumonia
Operative time	Range 40-60 minutes
Major complications	None
Minor complications	Excessive blood oozing in one case (managed by conservative measures)

**Table 1 – Clinical characteristics of patients included in the study**

The invention of PDT had overcome many obstacles found in the surgical tracheostomy (ST) procedure. PDT can be performed as a

bedside procedure which saves both time and cost of operating theatres. Although PDT can be performed by surgeons and non-surgeons such as

intensivists and anesthesiologists in ICU, it is little performed by ENT surgeons. We believe that the ENT surgeon is the best one to perform the procedure for two reasons. First, he can manage the complications; second, he can convert the procedure to ST at any time if required. All our cases were performed with close collaboration between ENT surgeon and intensivist.

In our study, no major complications were reported. Excessive blood oozing from the wound was seen in one case and was managed by conservative measures. The safety of the technique is maximized when performed by the Otolaryngologist. We used flexible bronchoscopy in all patients which enabled us to perform the procedure under direct vision. Additionally, the surgical tracheostomy set was available to be used if any difficulty or emergency encountered during the procedure.

Voelker et al reported no significant difference in perioperative complications. Conversion to a surgical procedure during PDT or surgical intervention after PDT is rare [5]. There is a quite few studies in the literature regarding short-term complications in PDT compared to ST. Several studies show more short-term complications in ST patients [6, 7]. Though Oliver et al. found less early complications in ST compared to PDT; other studies do not show any differences [8-10]. Higgins et al. showed no obvious difference, but a trend toward fewer short-term complications in PDT [11]. Only two studies in the literature compared both techniques in terms of long-term complications. Both of them showed no significant differences between PDT and ST [12, 13].

## Conclusion

PDT is a safe surgical procedure when performed in carefully selected cases. Close collaboration between the ENT surgeon and the intensivist is crucial for a successful outcome. Cumulative experience is necessary to master the procedure. We recommend that PDT training

should be integrated into Otolaryngology residency programs worldwide.

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