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Editorial

Percutaneous Tracheostomy: Who is not a Candidate?

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The first documented successful tracheostomy was performed in 1546 by Italian physician Antonio Brasavola on a patient with tonsillar abscess [1]. The present day Surgical Tracheostomy (ST) technique was refined from the works of Chevalier Jackson who identified the indications [2]. The percutaneous technique was first described by Sheldon in 1955 [3].

Pasquale Ciaglia, a thoracic surgeon from Utica, NY introduced the modified technique of Percutaneous Tracheostomy (PT) to the world in 1985 when he used progressive renal dilators to create a stoma through a small skin incision below the cricoid cartilage [4]. He stated...

"Percutaneous subcricoid tracheostomy, properly performed and timed, is recommended as the operation of choice, except in emergencies, in the presence of overlying enlarged thyroid glands, in marked obesity, and in children."

Over the past three decades there has been further modifications and improvement to the technique. A guide-wire dilator forceps to create a stoma was described in 1990 [5]. Fantoni described a translaryngeal technique where stomal dilation was obtained from inside [6]. A screw like dilator is used to slowly twist and dilate the stoma in Percu-Twist technique. The Griggs, Fantoni and Percu-Twist technique were all designed to minimize anterior tracheal wall compression during the dilation of stoma to minimize tissue trauma and avoid injury to the posterior wall.

Today, the most popular technique uses a tapering single dilator that was introduced in 1999 to obtain a one-step dilation instead of the serial dilators (Ciaglia Blue Rhino, COOK Medical Inc. Bloomington, IN). Introduction of a single dilator was much less traumatic than the multiple dilators used initially to dilate the stoma. Bronchoscopic visualization during the PT provides additional safety to prevent posterior wall trauma and to confirm location of the needle placement. Use of suspension laryngoscope instead of a bronchoscope in high risk patients with a single tapering dilator has also been described [7].

While the indications of PT are the same as the ST; marked obesity, coagulopathy, emergency procedures, extreme ventilatory demands (high PEEP or high oxygen requirement) were considered contraindications for PT by the US and European guidelines [8,9]. With wide acceptance of PT, especially in the Intensive Care Units (ICU) and growing experience in recent years, there is overwhelming evidence to suggest that in some of these conditions, PT may even be a safer and easier alternative than ST in the hands of non-surgeons such as intensivists, interventional pulmonologists or anesthesiologists.

The benefit of PT is several folds. First, it can be performed very swiftly minimizing the exposure time to any risks especially for patients who are on high PEEP and high FiO2. Second, the risk of bleeding is very low, and because the stoma is created by dilation, the tracheostomy tube fits firmly in the stoma providing tamponade. Third, the risk of infection is minimal compared to ST. And lastly, since the PT is performed in the ICU, mostly by intensivists, once the decision for tracheostomy is made it can be performed promptly at bedside without any significant delay.

Recent experience suggests that obesity is no longer a contraindication for PT. Ciaglia described in his original publication that the key factor is "neck anatomy" [4] which holds true today. If the cricoid cartilage, sternal notch and the tracheal rings are identifiable by palpation and the cricoid cartilage is at least about 1.5cm above the sternal notch; PT can be performed safely in most cases. Once the soft tissue of the neck is pulled in the cephalad direction, tracheal anatomy and location can be identified in nearly all obese patients. In our experience, truncal obesity does not correlate with the palpability of the tracheal rings. Nevertheless, the skin to tracheal distance in these patients could be as high as 4-5cm and a standard tracheostomy tube may lead to possible cuff leak from malposition of the tracheostomy tube. An extended length tracheostomy tube is better suited to accommodate this additional distance. We routinely use extra-long tracheostomy tubes (Shiley proximal XLT; Covidien, Boulder, CO) in obese patients during the initial placement to avoid possible air leak or tube dislodgement in the future. The ST is a preferred option in obesity; when the tracheal rings or cricoid cartilages cannot be identified, when the cricoid cartilage is at or below the level of the sternal notch or when there is additional comorbidities.

High ventilatory demand has been a contraindication to

PT. Nevertheless, in absence of any other risk factors such as coagulopathy or obesity, PT is possibly a safer option than ST. The shorter duration of the procedure has minimal effect on gas exchange [10]. By applying pressure over the stoma and using a bronchoscope, the loss of PEEP can be minimized. PT has been done safely in patients on more than 20cm $H_2O$of PEEP [11]. Hypoxia from the loss of PEEP can be further prevented by performing the neck dissection and identifying the needle insertion site first. The endotracheal tube is then retracted (to the cricoid cartilage level)and the needle inserted. From needle insertion to the placement of the tracheostomy tube usually takes less than a minute in expert hands.

Emergency PT was contraindicated both by Ciaglia and the guidelines. This was primarily because of the limited initial experience with the PT and potential difficulty in identifying the anatomy to perform it quickly. In recent years there has been several studies [12,13]. documenting the safety of PT in emergency situations.

During PT, the neck is usually extended to better identify the tracheal rings and to move the cricoid cartilage superiorly. PT has been performed safely on patients with neck trauma or cervical spine fractures without neck extension on neck collar or halo [14]. As it is usually done without bronchoscopic guidance, one need to be careful to avoid posterior wall injury.

PT on a patient with previous ST or PT was contraindicated, largely because of the concern about impaired healing since there is already a pre-existing scar with poor vascular supply. However, the same is true for repeat ST. Repeat PT has been reported to have minimal difficulties or complications [15]. We find the repeat PT easier to perform, especially if the previous tracheostomy was a ST. In these patients, the needle can be easily inserted through the defect without a significant difficulty once the previous location has been identified both from outside and inside with a bronchoscope.

The risk of continuous bleeding is 3.9 times higher when the PTT is greater than 50 sec and 5 times higher when the platelet count is below $50x10^9$/L [16]. Coagulopathy is usually corrected by transfusing platelets when platelet count is less than $50x10^9$/L or by transfusing fresh frozen plasma (FFP) when the INR >1.5 [17]. Although clopidogrel and aspirin cause bleeding complication during transbronchial biopsy, the safety of PT on clopidogrel or any antiplatelet agent is yet to be documented. In patients with drug eluting cardiac stents or when the clopidogrel cannot be stopped, we have done PT with favorable neck anatomy without any increased incidence of bleeding.

The patients on vasopressor pose a challenge because vasoconstriction may potentially compromise the healing process. Additionally, the use of sedation may further worsen hypotension. When otherwise indicated, we generally perform PT on low dose norepinephrine (<2.5mcg/kg/min) and has not experienced any significant untoward complication. We avoid dopamine as it tends to cause cardiac arrhythmia.

The technique of PT can be learnt by practicing on a model with further completion of 5-10 procedures under supervision. However, experience with more than 20 is needed to acquire the necessary skills to address common difficulties; such as needle placement in the appropriate location, airway loss, posterior wall injury, bleeding or false track formation and the choice of appropriate tracheostomy tube. The high risk cases as discussed should be attempted once the learning curve is acquired. The skills vary with each individual and an assigned number may not be an accurate estimate of procedural competency, nonetheless, successful completion of at least 50-75 PT is needed to achieve the proficiency to perform PT on patients with obesity, coagulopathy, un-extended neck or hypotension requiring vasopressors.

Familiarity, experience and improvement in technique now allow us to perform PT on complicated cases with ease. Today, PT is the first option in most ICUs and is performed by both surgeons and non-surgeons with minimal complications even in patients where it was previously contraindicated. It is time we revisit the indications and contraindications and update the PT guidelines based on the current evidence.

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