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Is Percutaneous Tracheostomy Safe in Critically Ill Patients: A Retrospective Analysis

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Abstract

Objective: Percutaneous tracheostomy (PCT) is a commonly performed procedure in critically ill patients. It is used mainly to assist weaning from mechanical ventilation that arises from pneumonia refractory to treatment, severe chronic obstructive pulmonary disease, acute respiratory distress syndrome, severe brain injury, or multiple organ system dysfunctions. The aim of this study was to evaluate the reliability and outcomes of the PCT performed *via* Griggs' technique in our intensive care unit.

Methods and Materials: The records of 182 patients who underwent PCT in the intensive care unit (ICU) by Griggs' technique between April 2011-February 2018 were analyzed retrospectively. Demographic data, diagnoses of patients, duration of the procedures and percutaneous tracheostomy complications were evaluated.

Results: The mean age was 62.12 ± 12.62. Obesity was present in 12 (6.59%), short neck in 30 (16.48%), high FiO_2 requirement in 48 (26.37%), PEEP requirement in 40 (21.97%) of the patients. The average time taken for PCT was 6.98 ± 1.8. Totally 54.94% of the patients were found at high risk. Minor complications were seen in 27 patients. Three patients required conversion into open tracheostomy.

Conclusions: PCT offers many advantages in terms of improving patient life quality, facilitating weaning of patients from the mechanical ventilator, and providing clearance of pulmonary secretions by reducing pulmonary dead-spaces. PCT *via* Griggs tecnique is a reliable procedure with lower complication rates and safely can be performed in high risk patients with minimal complication rates.

Keywords:

Percutaneous tracheostomy; Complications; Intensive care unit

Introduction

Percutaneous tracheostomy technique which has gained acceptance until the mid 1980 primarily used for weaning from mechanical ventilation has many advantages like improving airway suctioning with less laryngeal complications.

Although the ideal timing of PCT is controversial, patients who admitted to the intensive care unit may require tracheostomy. Recent studies have shown the benefits of early tracheostomy in order to prevent laryngeal injury and lower the respiratory tract infections. Patients requiring mechanical ventilation are at high risk for respiratory infections and the studies on the

relationship between tracheostomy and respiratory infections have yielded inconclusive results [1,2].

In this study we aimed to evaluate the reliability and outcomes of the PCT technique performed *via* Griggs' method in the intensive care unit.

Materials and Methods

After obtaining approval from the institutional ethical committee this retrospective study was carried out in our Intensive Care Unit (ICU) at a tertiary center. Totally 182 critical ill patients' records were evaluated. Patients who required endotracheal intubation for more than 10 days, prolonged mechanical ventilation, ARDS, weaning failure were included in the study. All tracheostomies were performed by the experienced intensivists of the ICU. The exclusion criteria were; the infection of the neck, haemostatic defect presence, patients requiring FiO_2>0.8 and PEEP>12 cm H_2O. All patients who were excluded from the study underwent open tracheostomy. Data was collected from the case notes. Demographic variables, ventilatory parameters, FiO_2 and PEEP values were noted.

Bedside tracheostomy was performed. Arterial blood pressure, heart rate, peripheral oxygen saturation was monitored continuously during the procedure. Analgesia, sedation and relaxation regimen were administered before the procedure. Anaesthesia was provided with intravenous propofol and vecuronium infusion. Neck was extended with placing the roll between the shoulders. Following aseptic preparations skin was infiltrated with 2% lignocaine between the cricoid and suprasternal notch. A horizontal incision was made. Griggs' tecnique was used for PCT. By aspirating air with 14 G cannula, trachea was located. Guide wire was introduced in trachea caudally. The tracheal tube's position was confirmed by X-ray chest. The duration of the procedure, major and minor complications within 24 hours were recorded.

Statistical analysis

A statistical analysis has been carried out in the present study. Data analysis has been performed using SPSS version 21. Continuous measurements (age, sex, weight, height, BMI, crico sternal distance, duration of procedure) are presented as mean ± SD and categorical measurements (minor complications and major complications) are presented in number (%).

Results

PCT was performed in 182 patients between April 2011-February 2018 out of which 102 were male and 80 were female. The mean age was 62.12 ± 12.62. The average time for the procedure was 6.98 ± 1.8 (Table 1).

Table 1: Demographic data.

Parameter	Mean
Age (years)	62.12 ± 2.62
Sex (M/F)	102: 80
Weight (kg)	78.82 ± 8.92
Height (cm)	166.48 ± 7.57
BMI (kg/m^2)	78 ± 11
Duration of procedure (min)	6.98 ± 1.8

The number of patients with high risk factors were 100 (54.94%) of the study population. Obesity was present in twelve (6.59%) short neck in thirty (16.48%) high FiO_2 requirements in 48 (26.37%), high PEEP requirements in 40 (21.97%) patients (Table 2).

Table 2: Incidence of high risk factors.

Risk factor	Number	%
Obesity	12	6.59
Short neck	30	16.48
FiO_2 0.6-0.8	48	26.37
PEEP 8-12 cm H_20	40	21.97
Total high risk patients	100	54.94

Minor bleedings were present in 22 patients. Transient hypotension was seen in 12 patients. Accidental extubation was seen in 4 patients. Subcutaneous emphysema was detected in 5 patients (Table 3).

Table 3: Incidence of minor complications.

Minor bleeding	22	12%
Transient hypotension	12	6.59%
Desaturation SpO_2	8	4.39%

Accidental extubation	4	2.19%
Subcutaneous emphysema	5	2.74%

Major haemorrhage was seen in 1 patient, false passage in 3 patients. Oesophageal perforation was nor recorded in any of the patients. Pneumothorax was seen in 1 patient. Haemothorax, cardiac arrest was not recorded. Three PCT's were converted to open surgery (Table 4).

Table 4: Incidence of major complications.

Major haemorrhage	1	0.54%
False passage	3	1.64%
Oesophageal perforation	0	0%
Pneumothorax	1	0.54%
Haemothorax	0	0%
Cardiac arrest	0	0%
Conversion to open surgery	3	1.64%

Discussion

PCT has become the accepted way of tracheostomy prefered to establish a definitive airway in the ICU by intensivists. Tracheostomy provides reduction of pulmonary dead spaces, helps to clean the pulmonary secretions, facilitates weaning from the mechanical ventilator, and prevents from nasocomial infections. This less expensive bedside technique alleviates the risk of transferring critically unstable patients from the ICU to the operating room with its carrying high risks [2,3].

In the most of the ICUs, it is the preferred rapid technique due to the low cost, but its safety still continues to be a major point of research. Furthermore, several techniques recently have been developed to minimize the complications associated with the technique.

Sheldon first described PCT technique in 1955 and this technique evolved over years. Ciaglia described in 1985 another technique using serial dilators over a guide wire and followed by Griggs one stage dilatation technique using a tracheal dilator in 1990 [4,5].

In the initial period due to the inadequate training, resulted with the high complication rates. Up to date in many reports PCT has been proven to be a safe method even in the situations described as contraindications. Short neck, obesity, prior tracheostomy, cervical injury, pediatric age, high ventilator support, uncontrolled coagulopathy are defined as relative contraindications.

Obesity, short neck, limited neck movement and history of prior tracheostomy were considered as difficulty in identification of anatomical landmarks. Aids like USG and bronchoscopy help to overcome the technical difficulties. In this retrospective review, without the use of aids such as USG and bronchoscopy we safely performed PCT in critically ill patients with anatomical deformity. We choose Griggs' technique during PCT procedure in this study based on our experience using this method.

Different complications have been introduced as a result of PCT. They are usually defined as minor (minor bleeding, hypotension, desaturation, accidental extubation, subcutaneous emphysema) and life threatening major ones (major hemorrhage, false passage, tear of post tracheal wall, esophageal perforation, pneumothorax). Various studies have found the complication rate to be lower to surgical tracheostomy.

We choose Griggs' technique during percutaneous tracheostomy procedure in this study based on our experience using this method. Tracheal rings are easily paipabl when the neck is positioned correctly.

The most common complication that we observed with Griggs' technique during percutaneous tracheostomy was minor bleeding (12%), which could be easily controlled with compression and requires no additional intervention.

In our study, all minor bleeding complications were prevented simply by compressing a sterile gas. In addition, bleeding complications can be reduced by performing the procedure platelet and INR count follow-up and by administering local anesthetics with adrenaline to the subcutaneous tissue on the puncture site. Since PCT is an elective procedure, there is usually sufficient time to complete required preparations.

Higgins et al. performed 15 studies and in their analysis they reported lower complication rate but higher accidental decannulation rate [6].

The most common complication that we observed during percutaneous tracheostomy was minor bleeding which could be controlled with compression by a sterile gas without requiring any additional intervention. In our study, all minor bleedings were controlled easily by compressing a sterile gas. Hypotension was transient, and we considered it was related to the administration of the anesthetic agents. Hemorrhage did not require surgical ligation, or delay of the procedure.

Reduced procedure time is often considered as an additional advantage of bedside PCT. Agarwal et al. reported significantly lower procedure time in the Griggs guide wire dilating forceps technique compared with Ciaglia technique [7].

Dennis et al in a retrospective analysis of 3162 PCTs majority without bronchoscopic guidance from the year 2001 to 2011 showed successful completion of the procedure in 99.62% patients including morbidly obese patients with difficult anatomy. They had encountered major airway complications in 12 (0.38%) patients accounting for death in 5 (0.16%) patients [8].

Cabrini et al. in a study on different techniques in PCTs from 1998 to 2010 involving 13 trials with a total of 1030 patients found that Griggs technique was equivalent with other techniques as far as safety and success rate was concerned [9].

Jackson et al and Abdulla et al. in their retrospective review of PCTs with and without bronchoscopic guidance. They observed mostly minor complications and of insignificant difference compared between them. Without bronchoscopy operation time was shorter. Bronchoscopic guidance can be useful adjunct in patients with difficult anatomy. In our study we didn't use bronchoscopy guidance in cases with difficult anatomy [10].

Kearney and friends examined the complications of 827 PCT procedures, mostly done without bronchoscopic guidance and found that procedure-related mortality rate was 0.6% [11].

We limited our study to perioperative complications. Late complications like infection, trachea-esophageal fistula have been reported. Further studies are required to define these complications for long term survivors after tracheostomy. We should be more cautious to reduce the possibility of dislodgement of tracheostomy tube during these bedside short duration procedures.

Future valuable researches may include late complications PCT performance in cervical spine injuries and airway emergencies.

In conclusion, PCT can be safely performed in critically ill patients who have difficult anatomy, bleeding diathesis, high ventilator support. Expertise and experience are very important. Ultrasound and fiber optic bronchoscopy guidance strengthen the safety of the procedure, reduce the complications.

Ethical Approval

The as approved by the institutional ethics committee.

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Conflict of Interest

None declared.

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