Comparative Clinical Trial between Ciaglia and Griggs Techniques during Tracheostomy Performed in Patients Admitted to Intensive Care Unit

Kasra Karvandian, Mahzad Yousefian, Zahid Hussain Khan, Tagi Baigmohammadi, and Sanaz Shabani

Department of Anesthesiology, Tehran University of Medical Sciences, Tehran, Iran

Received: 6 Oct. 2011; Received in revised form: 18 Apr. 2012; Accepted: 11 Aug. 2012

Abstract- Percutaneous dilatation tracheostomy (PDT) is one of the most frequent interventions in ventilator dependant ICU patients. Ciaglia and Griggs are two common PDT techniques. Few studies are available comparing these two methods, but there is no data available to compare these two techniques in Iranian population. The aim of this study was to compare Ciaglia and Griggs technique in our population in order to recognize advantages and disadvantages of each technique in order to identify the most beneficial one. This study is a comparative clinical trial conducted on 100 consecutive ICU admitted patients who needed prolonged intubation; half of them underwent PDT with Ciaglia method and other half with Griggs method. Procedural time and short term complications including bleeding, vital signs instability and technical errors were compared in both two methods. Both groups were comparable in demographic characteristics. Griggs method performed significantly faster than Ciaglia method (P=0.001). Complications such as high grade bleeding (P=0.01) and cardiac dysrhythmias (P=0.07) were less in Ciaglia technique than Griggs. Skin incision smaller than required was reported more with Griggs method than Ciaglia (P=0.03). We conclude that PDT with Ciaglia method is safer with less complications than the Griggs method. We suggest use of Ciaglia for less experienced operators.

Acta Medica Iranica, 2012; 50(8): 525-529.

Keywords: Percutaneus dilatation tracheostomy; Ciaglia; Griggs

Introduction

Percutaneus tracheostomy (PCT) was first introduced by Sheldon *et al.* in 1955. In this primary technique dilatation methods were not employed and blind sharp incisions were performed on trachea with many complications (1). In 1985 Ciaglia and colleagues introduced percutaneus dilatation tracheostomy technique (PDT), in which tracheostomy was performed by step by step gradual dilatation of trachea with minimal damage (2). In 1990 Griggs and colleagues described another method by using forceps for tracheal dilatation and in 1999 Ciaglia suggested modified method by using Blue Rhino Dilator instead of Griggs forceps (3). Nowadays tracheostomy is performed at bedside employing Ciaglia and Griggs methods in ICUs. In comparison with surgical tracheostomy, PDT is more useful with less morbidity and mortality. Most of ICU patients need prolonged ventilator support that lead to increase in the incidence of complications such as tracheal stenosis, ventilator associated pneumonia and other tracheal injuries. This clinical trial is designed for the first time in Iran and we hope to disseminate use of PDT in intensive care units of hospitals in Iran. We compared these two methods to recognize advantages and disadvantages of these two techniques in order to identify the most effective technique.

Materials and Methods

This study was a comparative randomized clinical trial. We performed PDT on 100 patients admitted in ICU of Imam Khomeini Hospital between March 2009 and February 2011. Those were patients dependent on ventilator due to lung disease or neurological disorders. The patients were randomly assigned according to that the first two numbers of their chart either odd or even. We employed Ciaglia for even and Griggs for odd numbers.

Corresponding Author: Zahid Hussain Khan
Department of Anesthesiology, Tehran University of Medical Sciences, Tehran, Iran
Tel: +98 21 61192828, Fax: +98 21 665851, E-mail: khanzh51@yahoo.com

Inclusion and exclusion criteria were the same in both groups. We enrolled the patients being intubated for 7-10 days with no possibility of extubation. Exclusion criteria included coagulopathies: PTT>45; INR>1.4; PLT<75000, Anatomical malformations on the site of procedure, thyroid gland hypertrophy, obesity, short neck, and infection of the neck.

All patients or their first relative filled ethical concent at the beginning. Their gavages were stopped for at least six hours prior to procedure. And prophylactic heparin therapy was with held for 12 hours before performing PDT. All PDTs were done at the bedside in ICU.

Midazolam 2 mg, fentanyl 100 µg, sodium thiopental 5 mg/kg and atracurium 0.5 mg/kg composed the appropriate anesthesia. Ventilator was set up with controlled ventilation by 100% O_2. During the procedure NIBP; SaO_2; Heart rate and ECG were monitored continually. The researcher group included an expert anesthesiologist on PDT; his assistant to perform bronchoscopy and an experienced ICU nurse.

The patient was positioned supine with a bolster placed transversely behind the shoulders to extend the neck and provide optimal exposure. The neck was scrubbed from inferior border of mandible to upper parts of the chest with povidone iodine solution and alcohol and draped. Thyroid cartilage, cricoid cartilage, the intercatillage space, and the first third rings of trachea were palpated and marked. 2-3 ml of lidocaine 2% plus 1/200000 epinephrine in order to lessen bleeding was infiltrated. The fiber optic bronchoscope was positioned from self-sealing connection in to endotracheal tube (ETT) and was pushed caudally up to glottis by withdrawing the deflated cuffed ETT since complete exposure was achieved. A 10-15 cm horizontal skin incision was made in 10-15 cm length at the level of the first and second tracheal rings, the soft tissues were dissected by mosquito; by improving exposure of trachea the seeker needle connected to a saline-filled syringe was inserted midline between the first or second tracheal rings, or between the second and third tracheal rings, considering minimal tissue damage and injury to posterior tracheal wall by using bronchoscope coincidently; aspiration of air bubbles suggested appropriate tracheal puncture. By needle removal the guide wire was introduced into the trachea, and then tissue dilator passed through on the guide wire. Since this step both Ciaglia and Griggs were identical. In Griggs method the Griggs forceps passed from dilated stoma step by step by bronchoscopist observation since the tracheostomy tube was introduced in appropriate position. In Ciaglia method the main blue horn dilator was inserted through the wire since the stoma became as large enough to pass a tracheostomy tube. Finally in both techniques the proper tube size according to sex and tracheal size-ID: 7-7.5 mm for woman and ID: 8-8.5 mm for men- was introduced in to the stoma. The tube appropriate positioning was checked by auscultation and oximetry. Direct bronchoscopy was done from tube inlet to visualize carina and tracheal rings and also to suction the secretions and probable minimal blood from the main bronchus. The ventilator machine also confirmed correct tube site by comparing pulmonary ventilating volumes and internal pulmonary pressure with those in the initial of the procedure.

The recorded complications included subcutaneous emphysema, pneumothorax, desaturation > 5%, cardiac dysrhythmias or heart rate abnormalities and hemodynamic instabilities. Chest x-ray was performed for all patients.

Also the bleeding was estimated by bloody 4x4 counts, by the expert anesthesiologist. And was defined in 4 grades: grade1: 1-5 ml, grade 2: 6-10 ml, grade 3: 11-50 ml and grade 4 > 50 ml. For next 10 days after procedure the site of tracheostomy was checked for any probable delayed bleeding, infection or inflammation.

At the end of the study SPSS16 was used for statistical analysis. Ciaglia and Griggs methods were compared using the Chi-square test for qualitative variables and t-test was employed for quantitative data. *P*-value less than 0.05 was considered statistically significant.

Results

A total of 100 patients were enrolled in this study, 50 of whom undergone PDT with Ciaglia method (A) and other 50 with Griggs method (B). The mean age of patients in group A was 58 y/o and in group B was 53 y/o. And the sex distribution male/female ratio in group A was 37/13 and in group B was 31/19. The demographic data are present in table 1.

In 88% of group A and 82% of group B the period of intubation before PDT was more than 10 days (Table 1).

Table 1. Demographic data of enrolled patients.

	Ciaglia	Griggs	*P*-Value
Age (mean)	58	53	NS*
Gender (Male/female)	37/13	31/19	NS
Intubation period before PDT >10 days	44(88%)	41(82%)	NS

* NS: Non-significant

37 patients of group A and 28 patients of B group were enrolled the study due to respiratory insufficiency and pulmonary disorders which needed prolonged mechanical ventilation. 13 patients among A and 22 patients among B had prolonged loss of consciousness with neurologic causes and laryngeal reflex`s insufficiency who needed prophylactic intubation to avoid aspiration.

Comparative items of two study groups and their results are available in table 2. In 82% of group B the time taking to complete tracheostomy was less than 5 minutes but in group A only 24% had procedure time less than 5 minutes; this means that PDT in Griggs method is significantly time saving than Ciaglia method (P= 0.001).

In group A, 92% and in group B, 70% had minimal bleeding (grade 1: 1-5 ml_. The incidence of grade 2 and 3 of bleeding were documented in group B.

Emphysema, respiratory distress and pneumothorax was detected only in one patient in group A, which was due to dilatation and tract formation in false lumen, in this case following respiratory signs and hemodynamic instability the tracheostomy tube was immediately removed, the patient was reintubated with ETT, chest tube was inserted, by administration of appropriate drug and conservative cares the situation became stable and the patient`s condition improved.

Cardiac dysrhythmia was detected in 4% of patients in Ciaglia group and 14% of patients in Griggs group.

Need for larger incision was recorded in 2% of group A and16% of group B (P= 0.03).

There was one case of big incision in group A which resulted in delay bleeding in group A, and was controlled by suturing and compressive dressing.

Incidence of hypotension was recorded in 6 patients of group A and 5 patients of group B.

There was no incidence of tracheal rupture or tracheal rings fracture either in group A or B.

There was no evidence of stoma site infection in 10 days follow up of both groups.

Table 2. Technical comparison and complications of two study groups.

	Ciaglia	Griggs	*P*-value
PDT due to respiratory failure	37(74%)	28(56%)	NS*
PDT due to loss of consciousness	13(26%)	22(44%)	NS
Procedure time less than 5 minutes	12(24%)	41(82%)	0.001
minimal bleeding (grade: 1)	46(92%)	35(70%)	0.03
Significant bleeding(grade: 2 and 3)	4(8%)	15(30%)	0.01
Cardiac dysrhythmias	2(4%)	7(14%)	0.07
Hypotension	6(12%)	5(10%)	NS
Emphysema	1(2%)	0	NS
Respiratory distress	1(2%)	0	NS
Pneumothorax	1(2%)	0	NS
Infection	-	-	-
Rupture of trachea and fracture of tracheal rings	-	-	-
Small skin incision	1(2%)	8(16%)	0.03

* NS: Non-significant

Discussion

Tracheostomy has many benefits in patients admitted in ICU, who need prolonged intubation; among these benefits are better orodental hygiene and facility for feeding, and speaking. Also the patients may have more activity. Ventilator associated pneumonia is less with tracheostomy and weaning the patient from mechanical ventilation is more probable (4). The other advantage of PDT is that it can be performed at the bedside in ICU with no need to transfer the ventilator depended patients to the operative room, so the possible complications in transferring the patients can be avoided. Also there are many economically advantages in PDT comparing with surgical tracheostomy (5). The patients may have shorter ICU stay because this technique is neither dependant on the availability of surgeon nor dependant on the facility of being scheduled in operating room lists. Therefore, time and money will be saved (6).

As described previously Ciaglia technique is performed by dilator and Griggs is done by forceps, few other studies were done to compare these two methods before, Anon *et al*. concluded from their study that Griggs method consumed less time to be performed than Ciaglia (7), this was similar to what we concluded in our study.

In Griggs method there was higher incidence of significant bleeding (11-50 ml) than Ciaglia method. Although in all cases the bleeding was controlled with compressive dressing, in two cases surgical intervention and suturing was needed; in none of them blood transfusion was done, and none had hemorrhage in trachea and lung to induce respiratory complications. Heron *et al.* also illustrated much more bleeding in Griggs method (8).

About the incidence of cardiac dysrhythmias there were 7 cases in group B and two cases in group A. among those in group B, 4 cases developed sinus tachycardia which induced hypertension and was managed by supplemental anesthetic drugs and 2 cases presented with premature ventricular contractions PVC which was subsided by conservative care and intravenous lidocaine. Since all these dysrhythmias happened in patients when their anesthesia was light and it was controlled by increasing depth of anesthesia, we can conclude that Griggs method might be more painful than Ciaglia and might need deeper anesthesia, it is what Kaiser *et al*. reported in 2006 (9). There were two incidences of bradycardia in Ciaglia method and one in Griggs method all happened coincidently by entrance of the wire in to carina.

We should consider that in Griggs method the depth of forceps entrance in to the trachea is directly dependant to the anesthesiologist's experience, although the size of skin incision is an important item in controlling this matter. There are reports of sudden opening of Griggs forceps which resulted in tracheal rupture (1).

In our study there were 8 cases of insufficient dilated stoma for tube passage in Griggs method which needed slightly increasing the incision by knife and repeating dilatation; there was one similar case in Ciaglia method which was due to stiffness of tracheal tissue and by repeating dilatation, the tube entered the stoma. There was also one case of excessive stoma opening which resulted in delayed bleeding in Ciaglia method which needed to be controlled by suturing and compressive dressing.

In this clinical trial we had 11 cases of hypotension due to anesthetic drugs and patients' underlying diseases which were controlled by administration of crystalloid and cardiovascular protective agents. Bronchoscopy was done in all patients during the procedure and this helped us for correct needle puncture at midline, avoiding damage to posterior tracheal wall, controlling the depth of entrance and not malpositioning the dilator devices to the lateral tracheal wall. We also had complete exposure to detect and control the possible complications such as excessive damage on tracheal tissue and bleeding. Finally bronchoscopy helped us for appropriate insertion of tracheostomy tube (10-14). A recent report by Kornblith *et al*. concluded that PDT in surgical care unit is a safe procedure and suggested bedside percutaneous tracheostomy as a new gold standard for patients requiring tracheostomy for mechanical ventilation (15). Finally our study suggests that PDT with Ciaglia method is safer with less complication than the Griggs method. We suggest the use of Ciaglia for less experienced operators.

References

1. Margulies DR, Mischael S. Percutaneous dilational tracheostomy. In: Fink MP, Abraham E, Kochanek PM, Vincent JL, editors. Textbook of Critical Care. 5th ed. Philadelphia, PA: Elsevier Saunders; 2005. p. 1871-75.
2. Ambesh SP, Pandey CK, Srivastava S, Agarwal A, Singh DK. Percutaneous tracheostomy with single dilatation technique: a prospective, randomized comparison of Ciaglia blue rhino versus Griggs' guidewire dilating forceps. Anesth Analg 2002;95(6):1739-45.

3. Ciaglia P, Firsching R, Syniec C. Elective percutaneous dilatational tracheostomy. A new simple bedside procedure; preliminary report. Chest 1985;87(6):715-9.
4. Charra B, Hachimi A, Benslama A, Motaouakkil S. Tracheotomy versus prolonged intubation in medical intensive care unit patients. Signa Vitae 2009;4(1):21-3.
5. Hazard P, Jones C, Benitone J. Comparative clinical trial of standard operative tracheostomy with percutaneous tracheostomy. Crit Care Med 1991;19(8):1018-24.
6. Friedman Y, Franklin C. The technique of percutaneous tracheostomy. Using serial dilation to secure an airway with minimal risk. J Crit Illn 1993;8(2):289-97.
7. Anon JM, Gomez V, Escuela MP, Paz VD, Solana LF, De La Casta RM, Perez JC, Zeballos E, Navarro L. Percutaneous tracheostomy: comparison of Ciaglia and Griggs techniques. Crit Care 2000;4(2):124-8.
8. Van Heurn LW, Mastboom WB, Scheeren CI, Brink PR, Ramsay G. Comparative clinical trial of progressive dilatational and forceps dilatational tracheostomy. Intensive Care Med 2001;27(1):292-5.
9. Kaiser E, Cantais E, Goutorbe P, Salinier L, Palmier B. Prospective randomized comparison of progressive dilational vs forceps dilational percutaneous tracheostomy. Anaesth Intensive Care 2006;34(1):51-4.
10. Moe KS, Stoeckli SJ, Schmid S, Weymuller EA Jr. Percutaneous tracheostomy: a comprehensive evaluation. Ann Otol Rhinol Laryngol 1999;108(4):384-91.
11. Marelli D, Paul A, Manolidis S, Walsh G, Odim JN, Burdon TA, Shennib H, Vestweber KH, Fleiszer DM, Mulder DS. Endoscopic guided percutaneous tracheostomy: early results of a consecutive trial. J Trauma 1990;30(4):433-5.
12. Manara AR. Experience with percutaneous tracheostomy in intensive care: the technique of choice? Br J Oral Maxillofac Surg 1994;32(3):155-60.
13. Winkler WB, Karnik R, Seelmann O, Havlicek J, Slany J. Bedside percutaneous dilational tracheostomy with endoscopic guidance: experience with 71 ICU patients. Intensive Care Med 1994;20(7):476-9.
14. Moore FA, Haenel JB, Moore EE, Read RA. Percutaneous tracheostomy/gastrostomy in brain-injured patients: a minimally invasive alternative. J Trauma 1992;33(3):435-9.
15. Kornblith LZ, Burlew CC, Moore EE, Haenel JB, Kashuk JL, Biffl WL, Barnett CC, Johnson JL. One thousand bedside percutaneous tracheostomies in the surgical intensive care unit: time to change the gold standard. J Am Coll Surg 2011;212(2):163-70.