CLINICAL RESEARCH / KLİNİK ÇALIŞMA

MODIFIED CIAGLIA AND GRIGGS PERCUTANEOUS TRACHEOSTOMY TECHNIQUES: A RETROSPECTIVE ANALYSIS

MODİFİYE CIAGLIA VE GRIGGS PERKÜTANÖZ TRAKEOSTOMİ TEKNİKLERİ: RETROSPEKTİF ANALİZ

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SUMMARY

Objective: *Many techniques of percutaneous tracheostomy have been described in the literature. The two most popular techniques are Griggs and Modified-Ciaglia percutaneous tracheostomies. In this study we report our experience with percutaneous tracheostomy based on Griggs and Modified-Ciaglia techniques, as well as comparison of these techniques regarding their complication rates.*

Method: *Retrospective evaluation of 158 patients' data undergone elective percutaneous tracheotomy in intensive care unit of our institution between 2007 and 2010 was made.*

Results: *Totally 158 percutaneous tracheostomies were performed, where Modified-Ciaglia technique was used in 114 (72.2%) of them and Griggs technique in the rest. The procedure duration was significantly shorter with Griggs than with Modified-Ciaglia technique, (p=0.04). No significant difference was detected between the groups regarding complication development, (p=0.42).*

Conclusion: *Both Modified-Ciaglia and Griggs percutaneous tracheostomy techniques are good alternatives for surgical tracheotomy, with comparable and acceptable complication rates. Duration of percutaneous tracheostomy procedure is shorter with Griggs technique.*

KEY WORDS: *Percutaneous tracheostomy, Griggs, Modified Ciaglia*

ÖZET

Giriş: *Literatürde birçok perkütan trakeostomi yöntemi tanımlanmıştır. Griggs ve Modifiye Ciaglia perkütan trakeostomi en popüler iki yöntemdir. Bu çalışmada biz Griggs ve Modifiye Ciaglia yöntemlerine dayanan perkütan trakeostomi deneyimlerimizi paylaşıp, bu iki yöntemi komplikasyonları açısından karşılaştırdık.*

Gereç ve Yöntem: *Hastanemizin yoğun bakımında 2007-2010 yılları arasında elektif şartlarda perkütan trakeotomi uygulanan 158 hastanın verileri retrospektif olarak incelendi.*

Bulgular: *Toplamda 158 perkütan trakeostomi uygulandı, bunlardan 114'ünde (%72.2) Modifiye Ciaglia yöntemi kullanılmışken, geri kalanında Griggs yöntemi uygulandı. İşlem zamanı Griggs yönteminde, Modifiye Ciaglia ile karşılaştırıldığında, anlamlı bir şekilde daha uzundu, (p=0.04). Komplikasyon gelişmesi açısından iki grup arasında anlamlı bir fark bulunmadı, (p=0.42).*

Tartışma: *Hem Modifiye Ciaglia, hem de Griggs perkütan trakeostomi yöntemleri, birbirine yakın ve kabul edilebilir komplikasyon oranları ile, cerrahi trakeotomiye iyi birer alternatiftir. Perkütan trakeotomi işleminin süresi Griggs yöntemi ile daha kısadır.*

ANAHTAR KELİMELER: *Perkütan trakeostomi, Griggs, Modifiye Ciaglia*

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INTRODUCTION

Percutaneous tracheostomy (PT) is a commonly performed procedure in intensive care units (ICU) to prevent long-term complications of prolonged intubation. Although its technical and surgical complications are generally minor, it can sometimes be associated with severe complications (1-4). Many techniques of PT such as unnoted Shelden's technique have been described in the literature since 1955 (1,5). Newer techniques are still evolving (6,7). Two most popular techniques are Griggs and Modified-Ciaglia tracheostomies.

The Griggs technique, a.k.a. Guidewire Dilating Forceps technique, was first described in 1990 by Griggs (8). It is based on enlarging a small tracheal aperture with a forceps with blunt tip.

The Modified-Ciaglia (M-Ciaglia) technique was described in 1998 by Ciaglia. This was the modification of the original Ciaglia technique which was again described by Ciaglia in 1985 (9). The modification was made on the serial dilatators replacing them with a single tapered dilatator with a hydrophilic coating. This modification enabled complete dilatation in one step, shortening the procedure.

In this study we report our experience of PT with Griggs and Modified-Ciaglia techniques, as well as comparison of these techniques regarding their complication rates.

MATERIAL AND METHODS

Retrospective evaluation of 158 patients' files in Vakif Gureba Research and Educational Hospital was performed, after Investigational Board approval (Bezmi Alem Valide Sultan Vakıf Gureba Educational and Research Hospital Ethics Committee, 29.04.2009; project no: 4/14). The patients had elective PT in ICU because of prolonged endotracheal intubationbetween May 2007 and August 2010. The first-degree relative of each patient was informed about the procedure and informed consent was taken from them. Patients with infection on the site of tracheotomy, bleeding diathesis or platelet count less than 50.000 dL^{-1}, those with known or suspected difficult airway, patients under 18 years old and those requiring PEEP more than 10 cm H_2O were excluded from the study.

We adhered to strict protocols when applying PT in ICU. Routine monitorization included electrocardiography (ECG), non-invasive blood pressure (NIBP) and pulse oxymetry. Anesthesia was induced by propofol 3 mg kg^{-1}, fentanyl 2 µg kg^{-1}, midazolam 0.03 mg kg^{-1} and vecuronium 0.1 µg kg^{-1} intravenously. The patients were pre-oxygenized for 15 minutes and throughout the procedure with 100% oxygen.

The start of both PT techniques is similar. After the proper positioning of patient's head, detection of the anatomical landmarks and application of local anesthesia (2 mL of 2% lidocaine with 1/80000 epinephrine) was followed by a short horizontal incision (1-1.5 cm) to the skin at the level of 2nd and 3rd tracheal rings. The trachea was punctured with the needle of the PT kit that was surrounded by a catheter. A syringe with normal saline was attached to the needle, and appearance of bubbles in the syringe indicates correct (i.e. intratracheal) placement of the needle. A guide-wire was inserted into the trachea through the catheter and then the catheter was removed. From this point, the procedure changed according to the technique. In M-Ciaglia technique (CiagliaBlue Rhino Percutaneous Tracheostomy Introducer Kit; Cook Critical Care Inc., Bloomington, IN), the dilatator with a hydrophilic coating was advanced through the guide-wire into the trachea, making appropriate aperture to accommodate the tracheal tube. In Griggs technique (Guidewire Dilating Forceps kit, SIMS, Portex, Hythe, Kent, UK), the forceps was threaded over the guide-wire into the soft tissue. After the dilatation of the soft tissue the forceps was advanced further reaching the trachea and dilatation was made in the tracheal aperture formed by the needle. The last step for both methods was placement of an appropriate tracheal tube. Portex®tracheostomy canula with internal diameter of 8 mm was used for the patients of both groups in our study.

Demographic data of the patients, mechanical ventilation duration, PT opening time, PT procedure duration, ICU length of stay and decannulation time as well as ICU acceptance reason, complications related to PT and discharge states of the patients from ICU were noted. Statistical analysis performed with SPSS 15.0 program (Chicago, Illinois). Continuous variables were given as mean ±standard deviation. Kolmogorov-Smirnov test was used for assessment of normal distribution. Regarding the comparison of quantitative data between the groups Independent Samples t-test was used for evaluation of data with normal distribution and Mann Whitney U test for the data without normal distribution. Pearson's Chi-Square test was used for comparison of categorical variables. The results in confidence interval of 95% and with $p<0.05$ were considered statistically significant.

RESULTS

Total 158 PTs were performed, where M-Ciaglia technique was used in 114 (72.2%) of them and Griggs technique in the rest. Demographic properties of the patients and other continuous variables are shown in the

Table I. Demographic properties and other continuous variables of the groups

	M-Ciaglia (n = 114)	Griggs (n = 44)	p
Age	58.97±19.41	64.16±17.90	0.126
Height (cm)	169.58±9.67	169.11±9.47	0.786
Weight (kg)	81.53±12.99	84.20±19.69	0.977
BMI (kg m^{-2})	28.69±5.3	29.55±7.13	0.415
BT - MV time (days)	6.28±4.70	6.00±4.40	0.733
PT opening time (days)	6.66±4.80	6.48±4.49	0.830
Procedure duration (min)	7.86±4.98	6.48±4.20	0.041*
AT - MV time (days)	11.39±13.44	15.95±15.73	0.054
Total MV time (days)	17.88±15.75	22.11±17.69	0.145
ICU length of stay (days)	19.58±16.20	24.95±18.54	0.061
Decannulation time (days)	30.19±23.64	36.91±19.42	0.203

Data are represented as mean ± standard deviation. BMI: Body Mass Index, BT: Before tracheostomy, MV: Mechanical ventilation, PT: Percutaneous tracheostomy, AT: After tracheostomy, ICU: Intensive Care Unit.
*p< 0.05

Table I. The procedure duration was significantly shorter with Griggs technique than with M-Ciaglia technique (p = 0.04). Although the difference was not statistically significant, mechanical ventilation time after tracheostomy (AT-MV) and ICU stay were longer with Griggs technique.

Distribution of tracheostomies according to ICU acceptance indication is presented in the Table II. There was significant difference between the groups (p = 0.03).

No significant difference was detected between the groups regarding complication development (Table III) (p = 0.43). One patient in the M-Ciaglia group experienced minor bleeding with subcutaneous emphysema, pneumothorax, subsequent hypoxia and she eventually died. One patient in the Griggs group developed subcutaneous emphysema. Other complications are generally consisted of minor bleeding, without the necessity for surgical intervention.

Comparison of the two groups regarding the patients' discharge states revealed significantly more mortality rate in the M-Ciaglia group, (p = 0.03), (Table IV).

Table II. Distribution of PT according to ICU acceptance indication

ICU acceptance indication	M-Ciaglia (n = 114)	Griggs (n = 44)	p
Cerebrovascular event	36 (31.6%)	21 (47.7%)	0.03*
Cardiac pathology	23 (20.2%)	6 (13.6/)	
Pulmonary pathology	23 (20.2%)	14 (31.8%)	
Sepsis	16 (14%)	3 (6.8%)	
Trauma	10 (8.8%)	-	
Other	6 (5.3%)	-	

Data in the parentheses represent percent values.
*p< 0.05

Table III. Complications associated with percutaneous tracheostomy

Complications		M-Ciaglia (n = 114)	Griggs (n = 44)	p
No		92 (80.7%)	33 (75.0%)	0.43
Yes		22 (19.3%)	11 (25.0%)	
	Minor bleeding	13 (11.4%)	10 (22.7%)	
	Surgical bleeding	1 (0.9%)	-	
	Subcutaneous emphysema	1 (0.9%)	1 (2.3)	
	Pneumothorax	1 (0.9%)	-	
	Hypoxia	5 (4.4%)	-	
	Mortality	1 (0.9%)	-	

Data in the parentheses represent percent values.
*p< 0.05

Table IV. Discharge status of the patients from ICU

Discharge status	M-Ciaglia (n = 114)	Griggs (n = 44)	p
Healthy	21 (18.4%)	12 (27.3%)	0.03*
Sequelae	18 (15.8%)	13 (29.5%)	
Mortality	75 (65.8%)	19 (43.2%)	

*p< 0.05

DISCUSSION

The main finding of the study was that Griggs PT technique duration was shorter than M-Ciaglia. The mean PT procedure time was 6.48 and 7.86 minutes for Griggs and M-Ciaglia, respectively. Agro et al (10) have demonstrated the time needed for Griggs PT to be 6 minutes and 57 seconds. We haven't encountered a study presenting surgical time for M-Ciaglia technique, but Remacle et al (11) needed 8 ± 3 min for tracheostomy with Ciaglia method, although we know that M-Ciaglia technique lasts shorter (12,13). Our results were comparable with these.

Tracheostomy is a procedure of choice for long term endotracheal intubation in ICUs, owing to its advantages like improvement of respiratory mechanics, reduced laryngeal ulceration, improved nutrition, mobility and speech; improved patient comfort and better clearance of secretions (14). Controversy exists about the timing of PT, but it is recommended for the patients requiring prolonged ventilator support (1,15-18). Percutaneous dilatational tracheostomy (PDT) is commonly preferred to surgical tracheotomy (ST) in ICUs due to its ease of application and fewer cost (11,19). PDT can be performed at the bedside without the necessity for operating room personnel and equipment. Moreover, peri-procedural and late complications of both methods are comparable, sometimes PDT has been favoured regarding complications (20,23). Some studies have shown PDT to be associated with more bleeding compared to ST, but these were minor bleedings without the necessity for surgical intervention (24,25). PDT can also safely be performed in obese patients (26,27). Complications decrease with experienceand PDT could be included into the training curriculum of anesthesiologists (28).

We observed only one death among 158 patients. The patient from M-Ciaglia group developed subcutaneous emphysema, pneumothorax, and subsequent hypoxia and she eventually died. Only one patient in the Griggs group developed subcutaneous emphysema, whereas the number of patients who developed subcutaneous emphysema was 5 in M-Ciaglia group. Although the difference of complications revealed no statistical significance, we can suggest that M-Ciaglia technique resulted in more hypoxia, where Griggs technique resulted in more minor bleeding. This can be explained by the fact that M-Ciaglia needed more time, and so some patients experienced hypoxia. Pietkiewicz et al (29) have reported bleeding to be the most prominent early complication of Griggs technique, yet mostly minor without the necessity for surgical intervention. Several other studies have also reported more complications with Griggs technique, especially minor bleeding, compared with Ciaglia (30-33). Our results were in coherence with these.

Discharge states of the patients revealed significant difference, where the patients in M-Ciaglia group had 1.5 times more mortality compared to Griggs group. This can be explained by the fact that all the trauma patients in the study (10/158) had PT opened via M-Ciaglia technique. As we were more familiar with the M-Ciaglia, this technique was primary choice for these trauma patients. To evaluate the real effect of these techniques on mortality and discharge states from the hospital prospective randomized studies with homogenous groups need to be done.

Retrospective nature of the study was the limitation. Homogenous groups, especially for ICU acceptance indications would be more reasonable.

In conclusion, both M-Ciaglia and Griggs techniques are acceptable alternatives with comparable and acceptable complication rates. Duration of percutaneous tracheostomy procedure is shorter with Griggs technique.

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