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Comparison of Ciaglia and Griggs Percutaneous Dilatation Tracheostomy Methods: Which One is More Effective and Safe?

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Ciaglia ve Griggs Perkutanöz Dilatasyonel Trakeostomi Yöntemlerinin Karşılaştırması: Hangisi Daha Etkili ve Güvenli?

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ABSTRACT

Objective: *To evaluate Griggs (GWDR) and Ciaglia Blue Rhino (CBR) percutaneous dilatation tracheostomy methods with their advantages and disadvantages and to determine their superiority to each other.*
Method: *A total of 84 patients who underwent percutaneous dilatation tracheostomy between 2015 and 2016 were included in the study. Bronchoscopy-guided tracheostomy was performed in 42 patients with Ciaglia method and 42 patients with Griggs method. All data of the patients were recorded.*
Results: *The median age of the study population was 65.5 (16-88) years in the CBR group and 66.5 (17-83) years in the GWDR group (p>0.05). The median duration of the procedure was 4 minutes (range, 3.5 to 10 minutes) in the CBR group and 4.5 minutes (range, 3.5 to 11 minutes) in the GBWR group (p>0.05). Minor complications were seen in 20 patients in the CBR group and 26 patients in the GDWR group. Major complications were seen in 13 patients in the CBR group and 10 patients in the GDWR group. The comparison of major and minor complications per se in both groups showed no significant difference. The duration of ICU stays after the procedure was significantly lower in the GDWR group compared to the CBR group (p=0.03). It was observed that obesity increased the risk of complications by 22.89% (95% GA, 5.85-89.55, p=0.01).*
Conclusion: *There were no significant differences between GDWR and CBR methods except for small differences. Both methods were found to be effective and safe.*

Keywords: *Griggs, Ciaglia Blue Rhino®, percutaneous dilatation tracheostomy, complications, effectiveness*

ÖZ

Amaç: *Perkutan dilatasyon trakeostomi yöntemlerinden Griggs (GWDR) ve Ciaglia Blue Rhino'yu (CBR) avantajları ve dezavantajları ile değerlendirip birbirlerine üstünlüklerini saptamak.*
Yöntem: *2015-2016 yılları arasında ICU'da percutan dilatasyon trakeostomi yapılan toplam 84 hasta çalışmaya dâhil edildi. Hastaların 42'sine Ciaglia metodu, 42'sine Griggs metodu ile bronkoskopi klavuzluğunda trakeostomi açıldı. Hastaların bütün verileri kayıt edildi.*
Bulgular: *Çalışma populasyonun yaş medianları 65.5 (16-88) CBR, 66,5 (17-83) GWDR yıldı (p>0.05). CBR grubunda işlem süresi medyan 4 dk. (range: 3,5-10), GBWR grubunda 4,5 dk. (3,5-11) idi (p>0.05). CBR grubunda toplam 20 hastada minör komplikasyon görülürken, GDWR grubunda 26 hastada minör komplikasyon görüldü. CBR grubunda toplam 13 hastada major komplikasyon görülürken, GDWR grubunda toplam 10 hastada major komplikasyon görüldü. Major ve minör komplikasyonlar her 2 grupta tek tek karşılaştırıldığında anlamlı bir fark yoktu. Her iki grubun işlem sonrası ICU'da kalış süreleri karşılaştırıldığında GDWR grubunda anlamlı olarak düşüktü (p=0.03). Obezitenin komplikasyon gelişme riskini 22.89 (%95CI: 5.85-89.55, p=0.01) arttırdığı gözlendi.*
Sonuç: *Çalışmada, hem GDWR yöntemi hem de CBR yöntemi arasında küçük farklar dışında önemli bir farka rastlanmadı. Her iki yöntemin etkili ve güvenli olduğu gözlendi.*

Anahtar kelimeler: *Griggs, Ciaglia Blue Rhino®, perkutanöz dilatasyonel trakeostomi, komplikasyonlar, etkinlik*

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INTRODUCTION

Percutaneous tracheostomy was first performed in 1955 by Sheldon et al [1]. As the primary dilatation technique was not used, many complications were observed. Ciaglia in 1985 and Griggs in 1990 performed the first tracheostomy using percutaneous dilatation techniques (PDT) [2,3]. In 1999, Ciaglia developed his technique using a blue rhino dilator [4]. These two methods are the most widely used techniques today. There are publications comparing these two methods [5-9]. However, differences were observed in the results. Türkiye Higher Specialization Training and Research Hospital is one of the reference centers for cardiovascular surgery centers in our country. Numerous PDT procedures are being performed per year. In this study, we aimed to compare the advantages, disadvantages and possible complications of both methods and to determine whether the methods were superior to each other.

MATERIAL and METHODS

This study was performed retrospectively in Türkiye Higher Specialization Training and Research Hospital between January 2015 and July 2016. The exclusion criteria included local infections, malignant cervical tumors, spinal surgery or trauma, goiter and bleeding disorders. This study was approved by the local ethics committee and written informed consent was obtained from the patients. All procedures were performed at the bedside in the intensive care unit.

The whole procedure was carried out by two experienced intensivists other than the study researchers to overcome bias, who have degrees of specialization both in the side branch of intensive care medicine and in the main branch of anesthesia. A total of 84 patients were included in the study. Patients were randomly divided into two groups of 42 consecutive patients. For randomization, only age- and gender-matched patients were considered. In the first group, Ciaglia Blue Rhino (CBR) was used and in the second group, Griggs' Guide Wire Dilating Forceps (GWDF) was used. All procedures were performed under bronchoscopic guidance. The procedure was performed using the technique mentioned in our previous studies [10].

For all patients, the procedure selected, duration of the procedure, pre- and post-operative clotting parameters (INR, PTT, PT and PLT), dates of intubation, laboratory parameters before and after the procedure (Cre, CRP, Hgb, Htc and Wbc), dates of death and discharge, minor, major and late complications were recorded. Chest X-ray was obtained in all patients. Minor complications were recorded as hypotension (not requiring vasopressor), short-term desaturation, stomal overdilatation, stomal infection and minor bleeding. Major complications were recorded as posterior wall injury, endotracheal cuff puncture, tracheal stenosis, tracheal laceration, tracheal ring fracture, arrhythmias, difficult cannulation, subcutaneous emphysema, pneumothorax, decannulation, tracheoesophageal fistula, cardiopulmonary arrest and major hemorrhages.

Statistical Analysis

Statistical analyses were performed using the software (version; 15 SSPSS Inc. Chicago) for windows. All variables were checked for normal distribution. Variables were reported as mean and standard deviation or as median, as appropriate. Continuous variables were compared with Student's t-test or the Mann-Whitney U test as appropriate. The chi-square test was used to test for proportions. The association between the complications (major and minor) and variables (age, tracheostomy method used, gender, day of tracheostomy, duration of the process, BMI) was assessed using binary logistic regression analysis. The odds ratio (OR) with 95% confidence interval (CI) was determined. A p value equal to, or less than 0.05 was considered to indicate statistical significance.

RESULTS

A total of 84 patients were included in the study (GWDF group, n=42:50%) and CBR group, n=42:50%).

The median age of the study population was 65.5 (16-88) years in the CBR group and 66.5 (17-83) years in the GWDR group (p>0.05). There were 27 (64.2%) male and 15 (35.7%) female patients in the CBR group and 26 (61.9%) male and 16 (38.1) female patients in the GWDF group (p>0.05). The mean body mass index (BMI) was 27.5±3.2 in the CBR group and 27.9±2.8 in the GWDF group. The median values of APACHE scores were 27.5 (range: 19-32) in the CBR group and 26.5 in the GWDR group (range: 20-33). Tracheostomy tube remained in situ for a median 8 (range: 1-54) days in the CBR group and 7 (range: 1-60) days in the GWDF group, without a significant intergroup difference (Table 1).

The median duration of the procedure was 4 minutes (range: 3.5-10) in the CBR group and 4.5 minutes (3.5-11) in the GBWR group. There was no statistical difference between the two groups in terms of the duration of the procedure. Median duration of hospitalization in the ICU was 38 (10-185) days in the CBR group and 34 (5-200) days in the GBWR group (p>0.05). Mortality was observed in 17 patients (40.5%) in the CBR group and 19 (45.2%) patients in the GWDF group (p>0.05). The median duration of discharge from ICU was 30 (14-126) days in the CBR group and 23 (11-118) days in the GBWR group. This difference was statistically significant (p=0.03) (Table 2).

In the CBR group, minor complications were stomal overdilatation in 2 (4.8%), hypotension in 4 (9.5%), desaturation in 2 (4.8%) and minor bleeding in 12 (28.6%) patients. In the GBWR group, minor complications were stomal overdilatation in 4 (9.5), voice changes in 1 (2.8), hypotension in 5 (11.9), desaturation in 2 (4.8), and minor bleeding in 14 (33.3) patients. There was no significant difference between the two groups in terms of minor complications (p> 0.05) (Table 3).

Major complications in the CBR group were posterior wall injury in 1 (2.8), endotracheal cuff puncture in 4 (9.6), tracheal laceration in 1 (2.8) patient, major bleeding in 1 (2.8), arrhythmias in 2 (4.8), difficult cannulation in 1 (2.8), subcutaneous emphysema in 1 (2.8), decannulation in 1 (2.8) and late complications in 1 (2.8) patient. In the GBWR group, major complications were endotracheal cuff puncture in 4 (9.6), major bleeding in 3 (7.1), arrhythmias in 2 (4.8) and decannulation in 1 (2.8) patient. No significant difference was found between the two groups in terms of major complications (p>0.05) (Table 3).

Table 1. The demographic and clinical characteristics of the study population.

	CBR (n=42)	GWDF (n=42)	p value
Age in years, median (range)	65.5 (16-88)	66.5 (17-83)	NS
Sex (male/female)	27/15	26/16	NS
Body mass index, mean±SD	27.5±3.2	27.9±2.8	NS
APACHE (range)	27.5 (19-32)	26.5 (20-33)	NS
Tracheostomy days, median (range)	8.5 (1-54)	7 (1-60)	NS

NS, Not Statistically Significant; APACHE, Acute Physiology and Chronic Health Evaluation CBR, Ciaglia Blue Rhino; GWDF, Griggs percutaneous dilatation tracheostomy.

Table 2. The procedural times and outcomes of the study population.

	CBR (n=42)	GWDF (n=42)	p value
Duration of the procedure, median (range) minutes	4 (3.5-10)	4.5 (3.5-11)	NS
Duration of hospitalization in the ICU, median (range), day	38.5 (10-185)	34.5 (5-200)	NS
Duration of Discharge from ICU (range), days*	30 (14-126)	23 (11-118)	0.03
Mortality n (%)	17 (40.5)	19 (45.2)	NS

*NS=Not Statistically Significant, *= In patients without mortality, CBR, Ciaglia Blue Rhino; GWDF, Griggs percutaneous dilatation tracheostomy; ICU, Intensive care unit.*

Table 3. Minor complications.

Minor Complications	CBR (%)	GWDF (%)	p value
Stomal over dilatation	2 (4.8)	4 (9.5)	NS
Voice changes	-	1 (2.8)	NS
Hypotension	4 (9.5)	5 (11.9)	NS
Desaturation	2 (4.8)	2 (4.8)	NS
Minor bleeding	12 (28.6)	14 (33.3)	NS

NS, Not Statistically Significant; CBR, Ciaglia Blue Rhino; GWDF, Griggs percutaneous dilatation tracheostomy

Table 4. Major complications.

Minor Complications	CBR (%)	GWDF (%)	p value
Posterior wall injury	1 (2.8)	-	NS
Endotracheal cuff puncture	4 (9.6)	4 (9.6)	NS
Tracheal stenosis	-	-	NS
Tracheal laceration	1 (2.4)		NS
Trakeal ring rupture	-	-	NS
Major bleeding	1 (2.4)	3 (7.1)	NS
Arrhythmias	2 (4.8)	2 (4.8)	NS
Difficult cannulation	1 (2.8)	-	NS
Subcutaneous emphysema	1 (2.4)	2 (4.8)	NS
Pneumothorax	-	-	NS
Decannulation	1 (2.4)	1 (2.4)	NS
Late complication	1 (2.4)	-	NS

NS, Not Statistically Significant; CBR, Ciaglia Blue Rhino; GWDF, Griggs percutaneous dilatation tracheostomy.

There was a positive correlation between the duration of hospitalization in ICU and the number of days of tracheostomy application (Pearson correlation test, p=0.001). The higher the number of the days of tracheostomy application, the higher the mortality rate (Pearson's correlation test, p=0.001).

The risk analysis between the complications and age, tracheostomy method, gender, day of tracheostomy, between BMI and duration of treatment (binary logistic regression) showed that only an increase in BMI caused an increased risk (OR: 1.67; %95CI, 1.26-2.21; p>0.05). In addition, the risk of complications in obese patients (BMI>25 kg/m^2) was found RR: 22.89 (%95CI: 5.85-89.55, p<0.05).

DISCUSSION

Percutaneous dilatational tracheostomy is an outstanding method for intensive care patients. Compared to surgical tracheostomy, percutaneous tracheostomy has been shown to be a faster, more effective, reliable method, with fewer early and late complications [11-13]. The main question is that, which method will be used? CBR and GBWR are the two most commonly used methods. Although studies have generally shown that these two methods do not have any superiority to each other, there are studies showing minor differences [11-13]. However, these studies were generally performed in small patient groups.

Karvadian et al. showed that there was significantly greater number of patients, in whom the duration of the GDWR method is less than 5 minutes [5]. Studies have shown that the duration of the procedure is lower for the GBWR method. This difference was significant only in the study of Anon et al. [6] However, no statistical difference was observed in any other study. In our study, we did not observe a significant difference between the GBWR and CBR methods in terms of the duration of the procedure. We believe that the duration of the procedure is associated with

the operator's experience.

Ambesh et al. found a higher incidence of stomal overdilatation, difficult cannulation and bleeding in the GBWR group, but found a higher risk of tracheal ring rupture in the CBR group [7]. The study by Annon et al. didi not show any serious complications except moderate bleeding [6]. In addition, they reported a long-term complication for three patients in the GBWR group. Again, they thought the GBWR method was more difficult because of the location of the cannula. Karvandian et al. found that the incidence of minor bleeding was higher in the CBR group [5]. However, they found no significant difference in the incidence of major bleeding. In conclusion, the authors concluded that CBR was a safer method, with lower complication rates. In a study conducted on a relatively small group of patients, Kumar et al. showed a higher number of complications in the CBR group [8]. They found 5 major complications in the CBR group includinmg false passage, hypotension, reintubation, pneumomediastinum, and subcutaneous emphysema. They stated that the anesthesiologists who performed the procedure had 10 years of experience, but did not state their experience with the procedure. In a study on a large group of patients (171 patients in each), Fikkers et al. showed major complications such as major bleeding, false passage, pneumothorax in a small number of cases, without a significant difference between the two groups [9]. In the CBR group, they found a high rate of minor complications, including minor bleeding and difficult dilatation.

In our study, minor complications were stomal overdilatation, hypotension, desaturation and minor bleeding in the CBR group, whereas stomal overdilatation were voice changes, hypotension, desaturation, and minor bleeding in the GBWR group. Furthermore, major complications were posterior wall injury, endotracheal cuff puncture, tracheal laceration, major hemorrhages, arrhythmias, difficult cannulation, subcutaneous emphysema, decannulation and long-term complications in the CBR group, and endothelial cuff puncture, major hemorrhages, arrhythmias and decannulation in GBWR group. However, no significant difference was observed between the two groups in terms of major and minor complications. There were relatively few complications, with no serious life-threatening condition. The literature review showed similar results with the use of both methods except for minor differences [5-9]. We observed that the number of complications reported decreased with the increase in the years in which the studies were published. These results can be interpreted as that CBR and GDWR techniques are better known and there is an increase in knowledge in this field with the progress of the years. This may explain the lower incidence of complications.

Two important reviews have noted that early PDT shortens the duration of ICU stay and reduces short-, and long-term mortality rates [14,15]. It has also been reported that PDT reduces the number of days on the mechanical ventilator [16-18]. However, this difference was not observed between CBR and GDWR procedures in studies [5-9]. We have found significantly shorter length of stay in the ICU in patients undergoing the GDWR procedure. We believe that this result should be taken into consideration in further studies.

Although there are studies claiming the contrary [19,20], it is known that obesity makes the PDT procedure more difficult [21,22]. Indeed, in some studies it has been accepted as the exclusion criteria [5,8]. Our study also supports the literature. We observed that obesity causes a 22-fold increase in the risk of complications. Furthermore, as the BMI of the patients increases, the risk of complications increases.

Limitations

Our study had various limitations. Our study had a limited number of cases and was a retrospective study. This may lead to bias in the collection of data. In retrospective studies, there may be losses or underestimation in the records of complications in particular.

CONCLUSION

In our study, we observed that there was no difference between the GDWR and CBR techniques in terms of the duration of the procedure and the number of major and minor complications. We found that the patients undergoing GDWR technique only had a shorter ICU stay. In our study, the absence of major life-threatening complications can be attributed to our use of bronchoscopy- guided procedures. In conclusion, we believe that the two methods are effective and safe.

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