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Trakeostomi Öncesi Boyun Yapılarının Değerlendirilmesi ve Trakeostomi Yönteminin Belirlenmesinde Ultrasonun Etkinliği: Perkütan veya Cerrahi?

The Efficacy of Ultrasound to Evaluate The Neck Structures Before Tracheostomy and To Determine The Methods of Tracheostomy: Percutaneous or Surgical?

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ÖZ

GİRİŞ ve AMAÇ: *Bu çalışmanın amacı, cerrahi trakeostomi veya PDT kararını vermede ultrasonla boyun muayenesinin etkisini ve PDT'ye bağlı komplikasyon oranlarını değerlendirmektir.*

YÖNTEM ve GEREÇLER: *Bu retrospektif çalışmaya 2015-2017 yılları arasında 72 hasta dahil edildi. Tüm veriler, Tepecik Eğitim ve Araştırma Hastanesi'ndeki elektronik veri tabanından tarama yapılarak elde edilmiştir. US, krikoid kıkırdakların, trakea halkalarının, tiroidin ve vasküler yapıların konumunu belirlemek için kullanılmıştır. US ile yapılan boyun muayenesinden sonra uygun olmayan olgulara cerrahi trakeostomi kararlaştırıldı.*

BULGULAR: *İki yıl içinde 72 hastaya trakeostomi kararı alındı. Ultrason ile boyun muayenesinden sonra 13 hastaya (% 18) cerrahi trakeostomi uygulandı. Dört hastaya vasküler yapılar, 7 hastaya trakeal halka tespitinde zorluk ve 2 hastaya geniş tiroid dokusu nedeniyle cerrahi trakeostomi kararı alındı.*

TARTIŞMA ve SONUÇ: *Ultrason vasküler yapılar da dahil olmak üzere boyun bölgesinin anatomisi hakkında bilgi sağlar. Boynun ultrason ile muayenesi komplikasyonları azaltmada ve gerçekleştirilmesi zor olabilecek perkütan dilatasyonal trakeostomiyi belirlemede etkilidir.*

Anahtar Kelimeler: *Ultrason, Trakeostomi, Yoğun Bakım Ünitesi, Perkütan Dilatasyonal Trakeostomi, Cerrahi Trakeostomi*

ABSTRACT

INTRODUCTION: *The aim of this study was to evaluate the influence of neck examination with ultrasound on making the decision of surgical tracheostomy or PDT and complication rates due to PDT.*

METHODS: *This restrospective study was included 72 patients between 2015-2017 years. All the data was obtained by scanning from the electronic data base in Tepecik Training and Research Hospital. US was used to identify the position of the cricoid cartilages, trachea rings, thyroid and vascular structures. After the neck examination with US, surgical tracheostomy was decided on unsuitable cases.*

RESULTS: *Tracheostomy decision was made to 72 patients with in 2 years. After the US neck examination, 13 patients (%18) underwent surgical tracheostomy. Surgical tracheostomy decision was made in 4 patients due to vascular structures, in 7 patients due to the difficulty of identifying tracheal rings and in 2 patients due to the thyroid gland.*

DISCUSSION AND CONCLUSION: *US provides information regarding the anatomy of the neck region, including vascular structures. US examination of the neck is effective in reducing complications and determining percutaneous dilatational tracheostomy which may be difficult to perform.*

Keywords: *Ultrasound, Tracheostomy, Intensive Care Unit, Percutaneous Dilatational Tracheostomy, Surgical Tracheostomy*

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INTRODUCTION

Percutaneous dilatational tracheostomy (PDT) is a method commonly performed on critically ill patients in intensive care unit (1, 2). In spite of numerous advantages, this technique may involve serious complications due to its invasive nature (3).

The use of ultrasound (US) before or during the procedure is becoming increasingly widespread for reduction of procedural related complications. The use of US for PDT procedure has various advantages of US including identification of thyroid gland and vascular structures in the neck, determination of correct tracheal hole position, tracheal midline, located a safe level for needle insertion and revealing skin to anterior tracheal wall distance (4, 5, 6).

In our clinic, we have been performing neck examinations of patients and evaluating of vascular structures under the US guidance since 2 years. After neck examination by US, it was decided to open the tracheostomy surgically, which was thought to be difficult by percutaneous route and could cause serious complications.

The aim of this study was to evaluate the influence of neck examination on making the decision of surgical tracheostomy or PDT and complication rates due to PDT.

MATERIAL AND METHODS

This study was approved by the institutional review board and ethics committee of İzmir Tepecik Training and Research Hospital (Nr: 3/04.04.2018), and written informed consent was obtained from patient's next of kin.

This retrospective study was included 72 patients between 2015-2017 years, who were aged 18 years or above, were dependent on mechanical ventilation in an intensive care unit, and were decided for tracheostomy. All the data was obtained retrospectively by scanning from the electronic data base in Tepecik Training and Research Hospital.

A single US device (SonoSite M-Turbo; SonoSite Inc., Bothell, WA, USA) and 6–12 MHz probe were used in all patients. US was used to identify the position of the cricoid cartilages, trachea rings, and the neck region was examined by a physician using US with a midline longitudinal probe position. Subsequently, US with a transverse probe position was used to locate the thyroid, vascular structures, trachea, and endotracheal tube. After the neck examination with US, surgical tracheostomy was decided on unsuitable cases.

Percutaneous tracheostomy procedure was applied as follows: A 14 G intravenous cannula was inserted in the tracheal lumen 1.5-2.0 cm below the cricoid with air aspiration using US or FOB guidance to move it between the second and third tracheal cartilage. Following placement of the guide wire in the tracheal lumen, the cannula was withdrawn and expanded with an 8 F dilatator. Using forceps to enlarge the skin and trachea, no. 7 and no. 8 tracheostomy cannula were placed for female and male patients, respectively. The tracheostomy cuff was inflated and endotracheal tube removed after confirming location of cannula through assessing for respiratory sounds. Bedside chest X ray was taken for all patients 6 hours following the procedure.

PDT procedure was performed with "Percutaneous tracheostomy kit" (Portex, Hythe, Kent, England) using Griggs method for all patients. PDT procedure were performed under elective conditions with 2 intensive care clinicians accompanied by assistant medical staff in critical care unit. Clinicians had minimum 4 years of experience in intensive care unit, completed US training programs and performed at least 50 PDT procedures.

Surgical tracheostomy was performed by otorhinolaryngologist who has minimum 2 years of experience and performed at least 30 surgical tracheostomy. Following the procedure, thoracic US was performed and a bedside chest X ray was taken in all patients to detect any complications. In our clinic, complications arising during and after tracheostomy are routinely recorded in hospital data for all patients. The complications recorded for tracheostomy are as follows: hemorrhage during and after the procedure (minor and major), subcutaneous emphysema, pneumothorax, esophageal perforation, and rear wall damage.

The minor or major definition of hemorrhage is made as follows in our ICU: Cases where bleeding did not stop shortly after surrounding stoma with sponges and/or there was blood in tracheostomy

tube with aspiration were evaluated as minor hemorrhages. Cases where there was continuous haemorrhage from the stoma and/or from the trachea with aspiration despite compresses were defined as a surgical haemorrhages (major). All data were obtained retrospectively from hospital and ICU database for all patients who had undergone tracheostomy decision.

Statistical Analysis

SPSS 21.0 statistical software package was used for statistical analysis. Descriptive statistics were generated for all continuous (mean, median, interquartile range, min, max) and categorical (percentage of each response) variables.

RESULTS

Tracheostomy decision was made to 72 patients with in 2 years. Demographic data of patients 55.6% were male and 44.4% were female (Table 1).

Table 1. Demographic data of the enrolled patients

	Surgical Tracheostomy		Percutaneous Dilatational Tracheostomy		Total	
	Mean ± Sd	Median (max min)	Mean ± Sd	Median (max min)	Mean ± Sd	Median (max min)
Age	64.4±22.5	70 (19 -90)	67.4±19.02	72 (22-91)	66.9±19.5	71.5 (19 91)
Sex	Male	Female	Male	Female	Male	Female
	5 (38.5%)	8 (61.5%)	35 (59.3%)	24 (40.7%)	40 (55.6%)	32 (44.4%)

After the US neck examination, 13 patients (%18) underwent surgical tracheostomy (Figure 1).

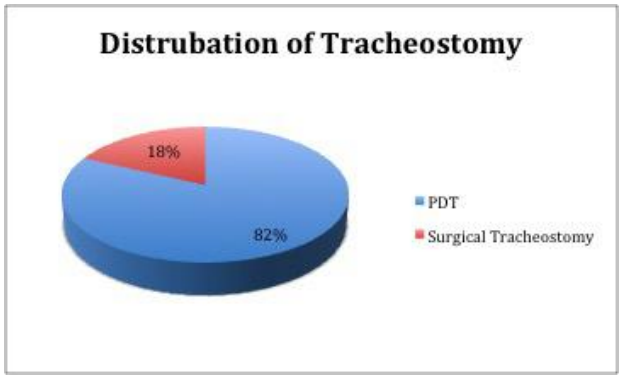

Figure 1. *Distrubation of Tracheostomy*

Surgical tracheostomy decision was made in 4 patients due to vascular structures, in 7 patients due to the difficulty of identifying tracheal rings and in 2 patients due to the thyroid gland. (Table 2).

Table 2. Reasons for preferring surgical tracheostomy and difficulties related to the procedures

	Surgical Tracheostomy n / %	Percutaneous Dilatational Tracheostomy n / %
Number of Patients	13 (18%)	59 (82%)
Vascular Structures	4 (30.7%)	(-)
The difficulty of identifying tracheal rings	7 (53.8%)	(-)
Thyroid Gland	2 (15.3%)	(-)

PDT using the Griggs technique were performed to 59 patients (%82). No complications were found in any of the patients who underwent PDT. Major bleeding occurred in 2 of 13 patients who underwent surgical tracheostomy, and minor bleeding occurred in 4. In 3 patients who underwent surgical tracheostomy, it was learned from the note of the surgical team that bleeding vessels were visually ligated and cauterization was applied.

No subcutaneous emphysema, pneumothorax, esophageal perforation or rear-wall damage was observed in any procedure.

DISCUSSION

Our study indicates ultrasonography is an effective method in the decision of the tracheostomy procedure. Many studies have emphasized that US examination of the neck allows the identification of vascular structures and reduces the hemorrhage risk and complication rate (4,6). In numerous studies stated that puncture sites have been changed to prevent puncturing of vascular structures after ultrasonography examination of the neck (7,8). In another study, the puncture sites were modified in the 24% of patients after US neck examination (9). Rajajee et al indicates the place to puncture the trachea was changed in 20% of the patients to avoid vascular structures. (4). In most of these studies, the modification in the puncture site was performed during the real-time US guided procedure. In our clinic, we perform US for the neck examination before the PDT procedure to

evaluate the neck anatomy and procedure difficulty. It has been decided to apply surgical tracheostomy to the patients, which are thought to may cause procedure difficulty or serious complications with the percutaneous method. To the patients who decided to perform PDT, procedure was performed under real-time fiberoptic bronchoscopy and real-time US guidance. In our study, no complications were found in any of the patients who underwent PDT. Among patients with surgical tracheostomy, 2 had major and 4 had minor hemorrhage. The reason for hemorrhage may be that surgical tracheostomy was only applied after neck examination with US, in patients that were considered difficult with large vascular structures and/or isthmus tissue at the level of the trachea anterior wall. Only 1 patient developing hemorrhage had chronic renal disease (thrombocyte dysfunction?), while the others had no coagulopathy or thrombocytopenia.

We believe that pre procedural neck US examination is as important as the fiberoptic bronchoscopy applied during the procedure, predicting the serious complications and difficulties that may develop. For prediction, we believe US should not only be used for guidance during the procedure but also be definitely used to assess the airway and neck before the procedure. The use of US during PDT has increased recently. US has several advantages, such as high portability, safety, and reliability; furthermore, it is a pain free, simple procedure (10,11). Many studies have stated that the use of PDT with real time US is a reliable and effective method that reduces complications (12,13).

Despite the advantages of guidance of real time ultrasound in PDT, this procedure can lead to serious complications in some anatomical difficulties such as vascular structures, large thyroid tissue and short neck. Determination of these patients beforehand and completion of the tracheostomy procedure with surgical methods will reduce the complication rate and ensure easier and more accurate intervention for complications that may develop.

There are many studies comparing PDT with surgical tracheostomy. Düger et al. (14) reported that PDT was more advantageous in terms of hemorrhage and complications, and so is preferred over surgical tracheostomy. In numerous studies (15,16,17) stated that as PDT was more advantageous than surgical tracheostomy, it is used frequently in ICUs. However, some studies indicated both the surgical and the percutaneous dilatational strategies provide advantages and disadvantages. It is stated that some complications that may endanger the respiratory tract like technical difficulties, paratracheal insertion, airway loss and hemorrhage are more probable with the percutaneous procedure (18,19). Klotz et al stated that there is no gold standard for the strategy of tracheostomy (20). They indicated that both techniques can be performed successfully in an ICU setting and PDT is restricted by several contraindications like abnormal anatomy or difficult airway of the patient. (21).

Before the tracheostomy procedure, we believe neck examination should definitely include assessment with US and cases considered difficult or likely to have complications with the percutaneous method due to short neck or presence of vascular structures and large thyroid tissue should have the surgical technique applied.

US provides information regarding the anatomy of the neck region, including vascular structures. Examination of the neck with US is effective and necessary to predict and determine patients that may have difficulty or complications with the percutaneous method, to decide on which tracheostomy technique to use and to reduce complications.

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