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Comparative Study between Surgical Tracheostomy and Flexible Fiberoptic Endoscopic Guided Percutaneous Dilatation Tracheostomy in Intensive Care Unit Patients

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ABSTRACT

Background: In the intensive care unit (ICU), surgical tracheostomy (ST) is a popular procedure and elective technique. Percutaneous dilatation tracheostomy (PDT) offers numerous advantages compared to operative tracheostomy.

Objective: This study aimed to select the most safe, inexpensive, rapid technique of tracheostomy in intensive care unit patients through comparing between surgical tracheostomy and flexible fiberoptic endoscopic guided percutaneous dilatation tracheostomy.

Patients and methods: This comparative prospective randomized observational study was carried out on 34 cases admitted to the Intensive Care Unit of Zagazig University Hospital. All of them had either medical causes or surgical causes for prolonged intubation and ventilation. The patients were randomly divided into two groups: Group A was assigned for PDT and group B for ST. Each group included 17 patients.

Results: The incision length and duration were significantly longer among surgical group. Surgical group significantly associated with more ventilator needing. Concerning postoperative complications, such as air leak from a tracheostomy or infection, there was a statistically significant difference between the two groups in favor of PDT. The cost in surgical group was significantly cheaper than the percutaneous group.

Conclusion: In intensive care unit patients, PDT can be chosen as the main tracheostomy procedure. It can be performed faster along with fewer complications compared to ST. ST is more liable to early infections, air leak from tracheostomy fistula with larger incision length however of low cost than PDT. Because PDT is done at the patient's bedside, there is no risk of transportation to the operating room, which is one of the advantages.

Keywords: Surgical tracheostomy, Percutaneous dilatation tracheostomy, Intensive care unit.

INTRODUCTION

Tracheostomy is one of the most common procedures and elective techniques performed in the intensive care unit (ICU) **(1).** Traditionally, it has been used to help patients who are having trouble weaning, to protect airways in patients who are at risk of aspiration, to limit the need for sedation, and to assist in tracheobronchial toileting. Chronic endotracheal (ET) intubation is the leading cause **(2).** The use of a tracheostomy tube to mechanically ventilated patients carries many advantages when compared with the use of an endotracheal tube. The easy replacement of the tracheostomy tube once the tract has been created, along with better nursing hand suction and better patient comfort, makes the tracheostomy tube more favorable solution with avoidance of the risks of prolonged intubation **(3).**

After preparing the area by removing pretracheal tissues and cutting into the tracheal wall, a tracheostomy cannula is inserted under direct visual inspection during a surgical tracheostomy (ST) **(4).** In Percutaneous dilatation tracheostomy (PDT), the pretracheal tissues are bluntly dissected, the trachea is dilated over a guide wire, and a tracheal cannula is inserted **(2).** PDT offers numerous advantages compared with operative tracheostomy. It requires shorter time to perform, less expensive, and can be performed faster (because the operative room does not have to be scheduled). In addition, PDT involves fewer postoperative complications compared to ST **(4).** When patients require ventilator support for an extended period of time, PDT is being used more and more. By using a bronchoscope, the surgeon can see exactly where the needle is going, make sure the tube is in the right spot, and prevent damage to the back of the throat during the procedure. When dealing with an inexperienced operator or challenging neck anatomy, it is typically deemed important. Because of its low mortality and complication rates, fiberoptic bronchoscopic guiding for PDT is the preferred technique for elective tracheostomy in most intensive care patients **(5).**

Pneumothorax, subcutaneous emphysema, and paratracheal false passage were previously documented using blinded percutaneous procedures. However, elective endoscopic guidance seems to improve operation safety and may prevent these problems **(1).** We aimed at this work to select the most safe, inexpensive, rapid technique of tracheostomy in intensive care unit patients through comparing between surgical tracheostomy and flexible fiberoptic endoscopic guided percutaneous dilatation tracheostomy.

PATIENTS AND METHODS

This comparative prospective randomized observational study was carried out on 34 cases admitted to the intensive care unit of Zagazig University Hospital during the period from March 2020 to March

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2022. All of them had either medical causes or surgical causes for prolonged intubation and ventilation.

Inclusion criteria: Age more than 8 years. ICU patients indicated for tracheostomy (Prolonged or suspected prolonged intubation and ventilation or any other indications as risk of aspiration).

Exclusion Criteria: 1. Unsatisfactory surface anatomy. 2. Blood coagulopathy. 3. Unstable cervical spine. 4. Short neck or obesity. 5. Enlarged thyroid isthmus. 6. Radiation therapy. 7. Soft tissues infection of the neck.

34 patients were randomly divided into two groups: group A was assigned for PDT and group B for ST. Each group was composed of 17 patients. All patients of group A were managed by Ciaglia Technique, single dilator Blue Rhinho System Cook Critical Care (Cook Medical Inc., Bloomington, USA) size 7 mm internal diameter for female and 8 mm for male using seldinger technique guided by flexible bronchoscopy. Endoscopic guided tracheostomy was carried out at the bedside in intensive care unit (ICU) patient under general anesthesia. All patients of group B were managed in operation room by standard surgical tracheostomy (ST).

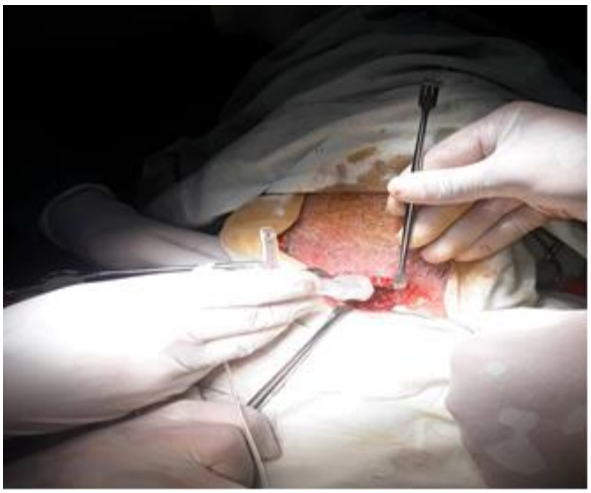
All events and complications were recorded during the tracheostomy either by PDT or ST technique. Follow up was done for complications during procedure and up to 1 week after the procedure with respect to bleeding, infection (Stomal infection), subcutaneous emphysema and wound size extension.

Postoperative chest X-ray was done to assess pneumothorax/pneumomediastinum, and/or misplacement or false passage into paratracheal tissues.

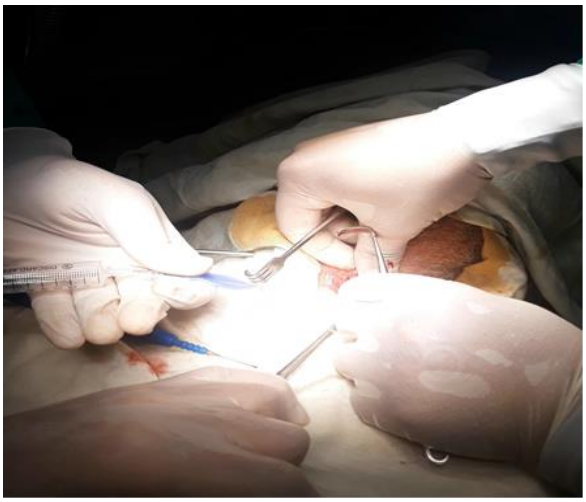
Operative technique of surgical tracheostomy:

By positioning a shoulder roll beneath the patient's upper back, the patient was brought into a supine position with an extended neck. Halfway between the suprasternal notch and the bottom border of the cricoid was where the incision site was indicated. Five to ten milliliters of adrenaline solution (1:200,000) was injected into this region.

Incisions were made in a transverse fashion through the skin halfway between the sternal notch and the inferior border of the cricoid cartilage. Typically, a three centimeters incision was made. Dissection proceeds via subcutaneous fat once skin has been incised. Prior to this, the thyroid isthmus had been drawn back. The third and fourth tracheal rings were often used for the tracheotomy opening. In order to avoid rupturing the endotracheal tube cuff, the cartilage and membrane between the rings were delicately incised. The next step was to inflate the tracheostomy cuff and verify the position by checking both sides (figure 1). To rule out pneumothorax, equal air entry, chest expansion, and other lung problems, a chest X-ray was ordered. If a capnogram was available, it was also used. Measurements involved the procedure's completion time, vital signs of the patient, including pulse rate, blood pressure, and oxygen levels. It served as a starting point before the process and was thereafter recorded every five minutes until it ended. Pneumothorax, subcutaneous emphysema, intraoperative hemorrhage, and a faulty approach are the risks of stoma infection and postoperative complications.



(A)



(B)

Figure (1): Surgical tracheostomy (A): Tracheostomy tube inserted gently, (B): Inflation of the tracheostomy cuff.

Technique of PDT at the bedside in the ICU:

The patient was placed in an extended neck posture with their head resting on a ring. The method is most effective when performed with the trachea in this position. We were able to locate the patient's suprasternal notch, thyroid cartilage, and cricoid cartilage. A 0.5 mg/kg dosage of atracurium was administered in addition to 1 mcg/kg of fentanyl and 2 mcg/kg of propofol for anesthesia. In order to ensure that the patient remained on 100% FiO_2 and that mechanical ventilation provided an acceptable minute volume, a hypnotic, narcotic, and neuromuscular

relaxing drug were administered prior to this. The subglottic area was used for the placement of the endotracheal tube. The trachea seen through the bronchoscope should be impressed by a little pressure applied through the planed incision site. Injecting a local anaesthetic including epinephrine into the midline dermis beneath the cricoid cartilage was the procedure used. At the planned placement site, a transverse incision of 1-1.5 cm (one and a half diameter of the tracheostomy tube) was made. It was optimal to insert the guide needle anteriorly, between the second and third tracheal rings, after palpating them. The gas should have been returned as the needle entered the trachea. After that, the J-shaped guide wire was threaded through the guide needle and led down into the distal airways, which were verified via bronchoscopy. Then, the ridge-equipped guiding catheter was positioned distally over the guide wire. At this moment, the bronchoscope was subsequently removed.

One or more dilators were advanced over the guiding catheter and wire to widen the tracheal aperture. It is important to lubricate the dilators properly. Rather than the trachea itself, the goal was to enlarge the tracheal aperture. To prevent posterior tracheal damage or perforation, the medical assistant should stabilize the guide wire and guiding catheter during the dilatations. This will ensure that the dilator does not progress past the ridge of the guiding catheter. After that, the percutaneous dilatational tracheostomy tube was used to insert the lubricated tracheostomy tube dilator. A stabilised guiding catheter and guide wire were used to advance the dilator and percutaneous tracheostomy tube into the airway. Subsequently, the guiding catheter and wire were extracted. A tracheostomy tube was used to introduce the bronchoscope in order to verify proper placement of the airway. Following the verification of an airway, the tracheostomy tube was inflated using a cuff pressure manometer and the ventilator circuit was connected to it. The percutaneous tracheostomy tube was then secured with tracheal ties after placement of the drain sponge. The towel roll under the patient shoulder was removed. Post-procedure chest radiograph was not usually necessary. Inner lumen insertion was done immediately after securing the outer one according to the patient situation.

Ethical approval: Research Ethics Commission of the Faculty of Medicine, Zagazig University (International Review Board) ZU-IRB #6023/23-3-2020 authorized the study, and patients' first-degree relatives gave written informed consent. All procedures followed the guidelines laid out in the Declaration of Helsinki, which is part of the World Medical Association's Code of Ethics for research involving humans.

Statistical Analysis

The SPSS, v. 20.0, was used to examine the recorded data. For parametric (normal) data, the quantitative data were presented as mean ± standard deviation and ranges. For non-parametric (non-normally distributed) variables, the median with inter-quartile range (IQR) was used. Fisher's exact test, paired sample t-test, Chi-square test, and independent samples t-test were all conducted. P-values were classified as extremely significant (<0.001), inconsequential (> 0.05), and significant (≤ 0.05) depending on their significance.

RESULTS

Age was distributed as 47.11 ± 23 and 51.64 ± 27 respectively between surgical and percutaneous groups with no significant difference between groups. Also, there was no significant difference regarding sex (majority of both groups were males), occupational, marital, residence distribution, smoking and co-morbidities and the major co-morbidities were HTN & DM.

Table (1): Demographic and comorbidities data distribution between studied groups

			Surgical group	Percutaneous group	t/ X^2	P
Age			47.11±23	51.64±27	U=0.49	0.62
Gender	**Female**	N	2	5		
		%	11.8%	29.4%		
	Male	N	15	12	3.68	0.11
		%	88.2%	70.6%		
Occupation	**Not working**	N	7	9		
		%	41.2%	52.9%		
	Working	N	10	8	0.47	0.49
		%	58.8%	47.1%		
Marital state	**Married**	N	14	12		
		%	82.4%	70.6%		
	Single	N	3	2		
		%	17.6%	11.8%	3.35	0.187
	Widow	N	0	3		
		%	0.0%	17.6%		
Residence	**Urban**	N	7	9		
		%	41.2%	52.9%		
	Rural	N	10	8	0.47	0.49
		%	58.8%	47.1%		
Habits	**No**	N	5	10		
		%	29.4%	58.8%		
	Smoker	N	12	7	2.98	0.084
		%	70.6%	41.2%		
Total		N	17	17		
		%	100.0%	100.0%		
			Group		X^2	P
			Surgical group	Percutaneous group		
Comorbidity	**No**	N	13	8		
		%	76.5%	47.1%		
	Hepatic and DM	N	0	1		
		%	0.0%	5.9%		
	HTN	N	2	5		
		%	11.8%	29.4%		
	HTN and DM	N	2	3	4.47	0.34
		%	11.8%	17.7%		
Total		N	17	17		
		%	100.0%	100.0%		

Table (2) showed that there was statistically insignificant difference of surgical group and percutaneous group regarding diagnosis of cases included in each group (p>0.05).

Table (2): Diagnosis of cases included in the study

		Surgical group	Percutaneous group	T	P
Traumatic brain injury	N	9	11		
	%	53%	64.7%	0.486	0.49
Brain tumor	N	4	3		
	%	23.5%	17.6%	f	0.99
Cerebral Stroke	N	1	2		
	%	5.9%	11.8%	f	0.99
Fecal fistula	N	3	1		
	%	17.6%	5.9%	f	0.6
Total	N	17	17		
	%	100%	100%		

f=Fisher exact test insignificant p>0.05

Table (3) showed that there was statistically insignificant difference of surgical group compared to percutaneous group regard indication of tracheostomy (p>0.05).

Table 3: Indication of tracheostomy distribution between studied groups

		Surgical group	Percutaneous group	Test of significance	P
Prolonged intubation	**N**	**16**	**11**		
	%	**94.1%**	**64.7%**	**F**	**0.085**
Suspected prolonged intubation	**N**	**0**	**2**		
	%	**0**	**11.8%**	**F**	**0.48**
Risk of aspiration	**N**	**1**	**4**		
	%	**5.9%**	**23.5%**	**F**	**0.33**
Total	**N**	**17**	**17**		
	%	**100%**	**100%**		

f=Fisher exact test (S) p>0.05 insignificant

Incision length was significantly larger in surgical group (3.37 ± 0.31 in ST group versus 1.39 ± 0.32 in percutaneous group, (P = 0.00**) and also duration was significantly longer among surgical group (37.94 ± 6.62 in ST group versus 25.0 ± 7.90 in percutaneous group, P = 0.00**) (Table 4).

Table (4): Incision length and procedure duration distribution between studied groups

	Surgical group	Percutaneous group	T	P
Incision length (cm)	**3.37±0.31**	**1.39±0.32**	**18.18**	**0.00****
Duration of procedure (min)	**37.94±6.62**	**25.0±7.90**	**5.172**	**0.00****

There was no significant difference between studied groups regarding days since intubation to tracheostomy procedure (18 ± 2.99 in ST group versus 15 ± 6 in percutaneous group, P = 0.098). Surgical group was significantly associated with more ventilator needed (17 patients 100 % in ST group, versus 12 patients (70.6%) in percutaneous group, P = 0.015*) (Table 5).

Table (5): Days since intubation to tracheostomy procedure between studied groups and one week Ventilator needing after tracheostomy distribution between studied groups

			Surgical group	Percutaneous group	U	P
Duration of intubation (days)			**18±2.99**	**15±6**	**1.8**	**0.098**
			Group		**t/X^2**	**P**
			Surgical group	**Percutaneous group**		
Need for Ventilator until one week after insertion	**Needed**	**N**	**17**	**12**		
		%	**100.0%**	**70.6%**		
	Not	**N**	**0**	**5**	**5.86**	**0.015***
		%	**0.0%**	**29.4%**		
Total		**N**	**17**	**17**		
		%	**100.0%**	**100.0%**		

U=Mann Whitney U test of significance

There was no significant difference between studied groups regarding postoperative complications except wound infection was 58.8% in surgical group versus 17.6% in percutaneous group, (p=**0.013**) and air leak from tracheostomy was 29.4% in surgical group versus none in percutaneous group, (p=**0.044**), with a significant difference between studied groups (Table 6).

Table (6): Postoperative complication and outcome distribution between studied groups

			Group		X^2	P
			Surgical group	Percutaneous group		
Mediastinitis	No	**N**	**17**	**17**		
		%	**100.0%**	**100.0%**		
	Yes	**N**	**0**	**0**	------	-------
		%	**0.0%**	**0.0%**		
Wound infection	No	**N**	**7**	**14**		
		%	**41.2%**	**82.4%**		
	Yes	**N**	**10**	**3**	**6.1**	**0.013 (S)**
		%	**58.8%**	**17.6%**		
Intra-tracheal hemorrhage	No	**N**	**12**	**16**		
		%	**70.6%**	**94.1%**		
	Yes	**N**	**5**	**1**	**3.23**	**0.072**
		%	**29.4%**	**5.9%**		
Pneumothorax	No	**N**	**17**	**17**		
		%	**100.0%**	**100.0%**		
	Yes	**N**	**0**	**0**	------	-------
		%	**0.0%**	**0.0%**		
Cannula obstruction	No	**N**	**13**	**15**		
		%	**76.5%**	**88.2%**		
	Yes	**N**	**4**	**2**	**0.81**	**0.36**
		%	**23.5%**	**11.8%**		
Pneumonia	No	**N**	**10**	**12**		
		%	**58.8%**	**70.6%**		
	Yes	**N**	**7**	**5**	**0.51**	**0.47**
		%	**41.2%**	**29.4%**		
Difficult cannula change	No	**N**	**17**	**17**		
		%	**100.0%**	**100.0%**		
	Yes	**N**	**0**	**0**	------	-------
		%	**0.0%**	**0.0%**		
External hemorrhage	No	**N**	**16**	**17**		
		%	**94.1%**	**100.0%**		
	Yes	**N**	**1**	**0**	**1.03**	**0.31**
		%	**5.9%**	**0.0%**		
Tracheal cartilage lesion	No	**N**	**17**	**17**		
		%	**100.0%**	**100.0%**	------	-------
	Yes	**N**	**0**	**0**		
		%	**0.0%**	**0.0%**		
Air leak from tracheostomy	No	**N**	**12**	**17**		
		%	**70.6%**	**100.0 %**	**f**	**0.044 (S)**
	Yes	**N**	**5**	**0**		
		%	**29.4%**	**0.00**		
Total		**N**	**17**	**17**		
		%	**100.0%**	**100.0%**		

The cost of surgical group was significantly cheaper than the percutaneous group (Table 7).

Table (7): Cost distribution between studied groups

	Surgical group	Percutaneous group	T	P
Set	**150.0±10.0**	**5500.0±20.0**	**28.63**	**0.00****
Anesthesia	**335.29±60.6**	**261.76±55.5**	**3.413**	**0.002***
Resources	**400.0±40.0**	**300.0±30.0**	**8.24**	**0.00***
Bronchoscopy	----------	**1000.0±0.0**	-------	--------
Staff fees	**NA**	**NA**	-------	--------
Total cost (EGP)	**885.29±60.6**	**7061.76±65.02**	**218.3**	**0.00****

(EGP)=Egyptian pound, NA =Not Applicable

DISCUSSION

The first written mention of a tracheostomy dates back at least one hundred years before the Common Era (BC). Percutaneous dilatation tracheostomy (PDT) and surgical tracheostomy are the two methods that are currently accessible (ST). The tracheostomy technique is not without its risks [6]. Complications that have been documented include inflammation, stomal infection, haemorrhage, pneumothorax, rupture of the tracheal wall, creation of a tracheo-esophageal fistula, tracheal stenosis, and death. Conflicting results were found in prior research that compared the two methods. Institutional factors influence mortality and morbidity rates [7]. Because PDT eliminates the need to move patients to the operating room, the logistical risk associated with this procedure is eliminated, making it the preferred choice [8].

The current study showed that age distributed was 47.11±13.05 and 51.64±15.58 respectively between surgical and percutaneous group with no significant difference between groups regarding age, sex (where majority of both groups were males), occupational, marital or residence distribution and smoking. This is in agreement with **Rai *et al.*** [9] study on 60 patients (30 in each group) who reported no significant difference regarding age (p=0.46) or sex (p=0.60).

The most common co-morbidity in the present study was hypertension (shown in 12 patients (35.3%), in 4 patients (23.5%) in ST group and 8 patients (47%) in PDT group. No significant difference was found regarding hypertension in both groups (p=0.34).

Rai *et al.* [9] reported that hypertension was the major co-morbidity in his study in 21 patients (35%), in 13 patients (43.3%) in surgical group vs 8 patients (26.7%) in percutaneous group without significant difference (p=0.17).

In the current study, D M is seen in 6 patients (17.6%), in 2 patients in surgical group vs 4 patients in percutaneous group. There was no statistically significant difference found between both groups regarding D M (p=0.34%). **Rai *et al.*** [9] found D M in 22 patients (36.7%) in his study, 10 patients (33.3%) in surgical group vs 12 patients (40%) in percutaneous group. While, hepatic disease and failure was reported in one patient (3.4%) in the present study, in the percutaneous group, **Rai *et al.*** [9] reported CKD in 5 patients (8.33%) of his cases,3 patients in surgical group (10%) and 2 patients (6.7 %) in percutaneous group.

The present study showed that the commonest admission diagnosis of cases included was traumatic head injury, 20 patients (58.8%), followed by brain tumors 7 patients (20.6 %), fecal fistula in 4 patients (11.7%) and stroke in 3 patients (8.9%). There was no significant difference regarding admission diagnosis between surgical group and percutaneous group (p>0.05). **Boran *et al.*** [10] reported neurological etiology in 16.3% of surgical group versus 17.1% in percutaneous group, respiratory failure in 10.2% in surgical group versus 8.9% in percutaneous group, and infection in 6.8% in surgical group versus 5.4% in percutaneous group, they found no significant difference between both groups regarding admission diagnosis.

No statistically significant difference was found regarding the indication of tracheostomy between both groups. The most prevalent indication was prolonged intubation, as most tracheostomies done, were for patients with disturbed conscious level (coma like state) in need for prolonged intubation. **Gupta *et al.*** [11] reported prolonged intubation as the commonest indication of tracheostomy in their study (51.3%) and airway compromise in (2.6%) of cases. They found statistically significant difference between both groups regarding prolonged intubation as an indication of tracheostomy in their study (p=0.0008%) but no significant difference regarding airway compromise (p=0.394%)

The current study showed that incision length was significantly longer in surgical group (3.37 ± 0.31 in ST group versus 1.39 ± 0.32 in percutaneous group, P = 0.00**) and also duration was significantly longer among surgical group (37.94 ± 6.62 in ST group versus 25.0 ± 7.90 in percutaneous group, P = 0.00**). This is in agreement with the study of **Rai *et al.*** [9] who reported that the incision length in surgical group was 2-3 cm and in percutaneous group was 1cm, and mean operative time in surgical group was 35.00 ± 9.56 min and in percutaneous group was 18.17 ± 8.78 min and the difference was statistically significant (p=0.00).

The current study showed that there was no significant difference between studied groups regarding days since intubation to tracheostomy procedure (18 ± 2.99 in ST group versus 15±6 in percutaneous group, P = 0.098). **Suzuki *et al.*** [12] reported that the time to tracheostomy from intubation (days) was 7.0 (5–10) in surgical group versus 7.5 (6–11) in percutaneous group with no significant difference between both groups (P = 0.22). In contrast, **Boran *et al.*** [10] reported that the time from intubation to tracheostomy was determined as 22.73 ± 15.23 days in surgical group and 12.65 ± 7.64 days in percutaneous group with a significant difference between both groups.

The most frequent post-tracheostomy complication reported in the present study was stomal infection in 13 patients (38.2%) followed by pneumonia in 12 patients (35.3%), external hemorrhage reported in 6 patients (17.6%), cannula obstruction in 6 patients (17.6%) and air leak from tracheostomy in 5 patients (14.7%). No significant difference between studied groups regarding postoperative complications was reported except for wound infection, which was 58.8% in surgical group versus 17.6% in percutaneous group, (p=**0.013**) and air leak from tracheostomy, which was 29.4% in surgical group versus none in percutaneous group, (p=**0.044**). **Suzuki *et al.*** [12] reported that postoperative complications were lower in patients who underwent the PDT procedure (9.6% vs. 34.6%, p = 0.003). The PDT group had a lower incidence of postoperative problems, such as air leaks from tracheostomies and unintentional

removal of the tubes, compared to the ST group. While, **Arif *et al.*** [8] reported that there were 84 samples used in the analysis; 48 from the ST group and 36 from the PDT group. Out of a total of fourteen problems, nine (18% of the total) occurred in the ST group and five (13% of the total) in the PDT group. Six distinct kinds of issues were identified out of all the potential ones. Some of these complications were pneumothorax, postoperative haemorrhage, stomal infection, tracheal stenosis, tracheomalacia, and tracheo-esophageal fistula. Half of all complications were stomal infections, making them the most common (7 patients). Postoperative haemorrhage was the second most common consequence, affecting 2 patients (5.6 percent) in the PDT group. The incidence of each consequence varied, but there was no statistically significant variation.

The current study showed that surgical group was significantly cheaper than the percutaneous group where the mean total cost in surgical group was 885.29 Egyptian pound versus 7061.76 in PDT group (p=0.00**). This is in agreement with the study of **Kumar *et al.*** [13] who reported that the cost of the percutaneous kit and fiberoptic bronchoscopy is a limiting factor in performance of the procedure.

In contrast **Gupta *et al.*** [11] found that in the ST group, the real procedure cost was significantly higher than in the PDT group (p = 0.002). Also, **Shrestha *et al.*** [14] reported that total cost was lower in percutaneous tracheostomy group than surgical group, where average cost for percutaneous tracheostomy was 8241 Rs and for surgical tracheostomy it was 10547 Rs. This variation might be because the study did not account for other factors that could affect the procedure's cost, such as the cost of man-hours, the cost of blood supplies (if any were used), or the economic implications of complications.

Higher cost of the PDT set is the cause of increased cost of PDT more than ST together with using the fiberoptic endoscope, which sometimes need maintenance charges [2]**.** While, some studies have found a difference in the rate of problems between the PDT and ST groups, the majority of research, including this one, have found that PDT is safer for patients. It is now common practice to conduct percutaneous dilatation tracheostomy (PDT) in intensive care units [15]. The procedure of a percutaneous tracheostomy is less invasive and takes less time. In situations when there is a scarcity of operating rooms, percutaneous tracheostomy can also prevent open tracheostomy from being postponed. It is possible that the little skin incision made during PDT contributes to less postoperative complications [17].

CONCLUSION

In intensive care unit patients, PDT can be chosen as the main tracheostomy procedure. It can be performed faster along with fewer complications compared to ST. ST is more liable to early infections, air leak from tracheostomy fistula with larger incision length however of low cost than PDT. Because PDT is done at the patient's bedside, there is no risk of transportation to the operating room, which is one of the advantages.

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- **Conflict of Interest:** Nil.

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