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ORIGINAL ARTICLE

Changes in Early Infection Parameters After Percutaneous Tracheotomy

Alev Öztaş[1], Arzu Yıldırım Ar[2], Güldem Turan[1]

[1]Department of Intensive Care, Universty of Health Sciences, Başakşehir Cam and Sakura City, Teaching and Research Hospital, İstanbul, Türkiye
[2]Department of Anesthesiology and Reanimation, Fatih Sultan Mehmet, Teaching and Research Hospital, İstanbul, Türkiye

Abstract

Introduction: Although tracheotomy (TO) is preferred in patients who require long hospital stays and mechanical ventilation (MV) support in the intensive care unit (ICU), it is a procedure that carries serious complications such as bleeding, tracheal damage, pneumothorax, emphysema, and infection. In our retrospective study, we evaluated early infection parameters after percutaneous TO. We also aimed to evaluate changes made in the first 48 h after TO without any other reason.

Methods: We retrospectively evaluated the data of 125 patients who underwent TO between January 2018 and June 2019 by obtaining the permission of the scientific study committee of our hospital with the decision numbered 170173117–05006. In our clinic, percutaneous TO is performed at the bedside in accordance with sterile asepsis conditions. If the patient who underwent the procedure does not use antibiotics, prophylactic antibiotics are not administered. In our study, demographic data of the patients, APACHE-II, SAPS-2, primary diagnosis, TO opening time, C-reactive protein before and after tracheotomy, leukocytes, neutrophil–lymphocyte ratio, MV day time, ICU discharge, and presence of mortality were examined.

Results: The mean age was 70±17.3, APACHE–II mean was 17.1±6.3, and mortality was 36.4%. No antibiotic changes were detected after TO. No differences were observed in the infection parameter changes after TO and the percentage change rates of infection parameters according to the presence of antibiotic use.

Discussion and Conclusion: Since the TO opening period is usually after the 10th day of intensive care hospitalization, patients may show signs of infection due to other causes. We are of the opinion that percutaneous TO applications in intensive care may also be a primary source of infection, and therefore, it is necessary to pay attention to the follow-up of infection parameters in this period.

Keywords: Infection parameters; intensive care unit; percutaneous tracheotomy.

Intensive care patients are at risk of prolonged mechanical ventilation (MV) and length of stay. Longer times on MV increase the rate of complications related to prolonged orotracheal intubation. The most important of these complications is tracheal stenosis which negatively affects the quality of life after intensive care. In addition, infection due to frequent tracheal aspirations and mortality due to potential obstruction of the airway are associated risks. In patients with prolonged intubation, tracheotomy (TO) is indicated and applied extensively in intensive care units

Correspondence: Güldem Turan, M.D. Department of Intensive Care, Universty of Health Sciences, Başakşehir Cam and Sakura City, Teaching and Research Hospital, İstanbul, Türkiye
Phone: +90 533 216 15 76 **E-mail:** gturanmd@yahoo.com
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(ICUs)[1-3]. Percutaneous TO is a less invasive technique compared to the surgical technique and can be performed by the intensive care team at the bedside. There are early and late complications that may result from this procedure. Early complications include bleeding, infection, posterior membrane damage, and complications due to incorrect placement, while late complications include tracheal stenosis, granulation tissue formation, tracheoesophageal fistula, trachea innominate fistula, and tracheomalacia[4-6]. Besides these complications, infections are also observed, although to a lesser extent.

In our study, we aimed to investigate procedure-related infection in patients requiring percutaneous TO in our intensive care clinic within an 18-month period using periprocedural infectious markers.

Materials and Methods

With approval from the hospital scientific board (No: 17073117–050.06), the data of 126 patients who underwent percutaneous TO between January 2018 and June 2019 were retrospectively evaluated. In our clinic, percutaneous TO is performed at the bedside with the sterile aseptic technique. Prophylactic antibiotics were not started even if the patient undergoing the procedure was not on antibiotic treatment.

Demographic data, APACHE-2, SAPS-2, primary diagnosis, TO time, C-reactive protein (CRP), leukocytes, and neutrophil–lymphocyte ratio (NLR) 24 h before and after TO were recorded. Duration of MV, discharge from intensive unit care, and changes in antibiotic treatment within 48 h of TO were also evaluated.

Statistical analysis was carried out using IBM SPSS Statistical 22 (IBM SPSS, Türkiye) software. The normal distribution of parameters was evaluated with the Shapiro–Wilk test. In addition to descriptive statistical methods (mean and SD), the Mann–Whitney U-test was used to compare quantitative data between groups for parameters without normal distribution. The Wilcoxon signed-rank test was used for the change in parameters without normal distribution. A $p<0.05$ was accepted as significant.

Results

The mean age of the patients was 70.03±17.34, falling into the geriatric age category with most patients admitted to the intensive care in recent years being in the geriatric age group. The mean APACHE 2 score was 17.17±0.6.37, showing that the patients had a high expected mortality rate. TO time, MV days, and length of stay in ICU were determined as expected averages for ICUs. Among the primary diagnoses, cerebrovascular disease was the most frequent as expected in the geriatric age group. While 83.3% of the patients were on antibiotics before the procedure, no patient required a change antibiotic treatment after the procedure. No difference was observed in the absolute and percent changes of infectious parameters after TO according to the presence of antibiotic use. No patient had a change in antibiotic treatment for any reason within the first 48 h of the TO procedure. Overall mortality was 36.5%, with 47.6% of the patients discharged to the ward and 15.9% discharged to palliative care (Table 1).

There was no statistically significant change after the TO time in CRP values, leukocyte, neutrophil, or lymphocyte counts, or NLR. ($p>0.05$) (Table 2).

When patients who were on antibiotics were compared against patients who were not, no statistically significant difference was observed in the percent changes of CRP values, leukocyte, neutrophil, or lymphocyte counts, or NLR. ($p>0.05$) (Table 3).

Table 1. Demographic characteristics of patients

	Min-Max	Mean±SD
Age (year) (n=125)	21–95	70.03±17.34
APACHE II (median)	6–38	17.17±6.37 (16)
SAPS-2 (median)	13–85	40.42±13.91 (36)
Tracheotomy time (day) (medyan)	1–73	15.14±8.62 (14)
Mechanical ventilation days (median)	6–122	33.11±19.53 (28.5)
Length of stay in ICU (n=125) (median)	8–124	37.62±20.22 (33)
	n	**%**
Gender		
Male	62	49.2
Female	64	50.8
Primer diagnosis		
Primer respiratory failure	21	16.7
Seconder respiratory failure	37	29.4
Trauma	14	11.1
Cerebrovascular disease	54	42.9
Antibiotics		
Yes	21	16.7
No	105	83.3
Discharge types from ICU		
Ex	46	36.5
Ward	60	47.6
Palliative	20	15.9

Table 2. Evaluation of the changes observed after the tracheotomy time compared to the study parameters

	Before tracheotomy		After tracheotomy		p
	Min-Max	Mean±SD (Median)	Min-Max	Mean±SD (Median)	
CRP	0.29–28.25	10.58±6.08 (8.9)	0.64–32.87	10.49±6.01 (9.9)	0.977
Leukocyte	2.8–29.1	11.75±5.17 (11)	2.2–40.6	11.73±5.72 (11.3)	0.973
Neutrophil	1.8–25.9	9.66±4.7 (8.4)	1.5–37.2	9.74±5.32 (9.1)	0.991
Lymphocyte	0.3–6.8	1.3±0.82 (1.1)	0.2–3.8	1.23±0.63 (1.1)	0.792
NLR	1.4–82.66	9.78±9.56 (7.6)	1.02–44.75	9.66±7.26 (7.5)	0.543

Wilcoxon sign-rank test; CRP: C-reactive protein; NLO: Neutrophil–lymphocyte ratio.

Table 3. Evaluation of the percentage change in study parameters according to antibiotic use

Percent change	Antibiotic use		Total	p
	Yes	No		
	Mean±SD (Median)	Mean±SD (Median)	Mean±SD (Median)	
CRP	10.56±63.36 (−2.5)	13.46±61.76 (1.6)	12.98±61.78 (1.3)	0.842
Leukocyte	10.22±39.87 (14.9)	2.8±35.59 (2.6)	4.04±36.28 (4.4)	0.301
Neutrophil	8.14±41.25 (10.4)	5.46±42.52 (3)	5.91±42.16 (4.8)	0.571
Lymphocyte	6.12±64.48 (−14.3)	6.36±39.38 (0)	6.32±44.22 (0)	0.463
NLR	68.71±244.49 (−15.7)	17.36±98.31 (−2.2)	25.92±134.07 (−4.6)	0.930

Mann–Whitney U-test; CRP: C-reactive protein; NLR: Neutrophil–lymphocyte ratio.

Discussion

Percutaneous TO is widely used in ICUs. Early and late complications of the procedure are well described. A new-onset infection is among the early complications and is reported at the lowest rates (<0.5%) There is no difference between bedside and surgical TO in terms of reported non-infectious complications[7,8]. However, some studies show a higher infection rate with surgical tracheostomy[9,10]. It is not easy to demonstrate that a new-onset infection is primarily due to the TO procedure. One reason for this difficulty is that the parameters associated with infection are affected by many other factors in intensive care patients. TO is performed under the most favorable conditions for the patient, and most patients are under antibiotic treatment at the time of the procedure. These conditions are other reasons why differentiation of infection due to TO is difficult. We aimed to investigate whether the infectious markers that we determined in our study were useful in determining TO-related infection. Yeşiler et al.[11] reported wound infection in 1 of the 20 patients who underwent percutaneous TO with bronchoscopy. In reviews and clinical studies, the rate of infection for the percutaneous TO procedure ranges between 0.5% and 6%[9,12,13].

The rate of ventilator-associated pneumonia (VAP) in TO patients is reported at 6–26%, however, a relationship between VAP and the timing of TO was not demonstrated[14,15]. Magdić Turkovic et al.[16] investigated the correlation between percutaneous TO and VAP. In their study, two groups with early (<7 days) and late (≥7 days) TO were compared. They observed a specific increase in the VAP rate in both groups of patients who underwent TO before or after 7 days. Diagnosis of VAP was made with bacterial productions at tracheal cultures. Of positive cultures, 70% had growth of Gram-negative bacteria. In our study, we evaluated the presence of an infection with changes in laboratory parameters. In addition, we accepted a need for the change of antibiotic treatment as in the first 48 h after the procedure without any other documented reason in favor of infection. In the same study of Magdić Turkovic et al.,[16] it was shown that diabetes was significantly higher in patients who developed VAP after a TO was performed.

In a study conducted with 7-year patient data on pediatric patients with a mean age of 8, complications of surgical tracheostomy in 69 pediatric patients were studied. They ob-

served an increase in the rate of pneumonia development within 30 days after the procedure and showed that 50% of these infections were caused by *Staphylococcus aureus*[17].

In our study, we primarily investigated infection markers as predictors of infection due to TO and did not observe any significant changes in the studied parameters after the procedure. No patient required any change antibiotic treatment within 48 h for any reason. Demonstrating the presence of infection with positive cultures would have strengthened our results, but the presence of VAP during the invasive MV period until the TO may make it difficult to ascertain whether the primary cause is due to the TO. Therefore, we studied the trend of laboratory parameters associated with infections.

The mean age of our patients is in the geriatric age group which may have resulted in a higher number of days on MV, predisposing patients to VAP. That 80% of our patients were on antibiotics at the time of the TO procedure can also be attributed to these reasons.

A limitation of our study is that it is retrospective. For this reason, the data on infectious parameters were limited to 24 h before and after the TO. A second limitation is that our patients are not homogenous in terms of age and are mainly in the geriatric group. Different results may be observed in patient groups with a lower mean age.

Conclusion

Although the risk of infection due to percutaneous TO is very low, the change in infectious parameters can guide the intensive care clinicians for a new infection after the procedure.

This study complies with Helsinki Declaration.

Ethics Committee Approval: This study was approved by Fatih Sultan Mehmet, Teaching and Research Hospital Ethics Committee (Date: 26.11.2019, Number: 17073117-050.06).

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