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EARLY VERSUS LATE TRACHEOTOMY IN THE INTENSIVE CARE UNIT

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Abstract

Introduction: Prolonged intubation and mechanical ventilation in critically ill patients can lead to several complications such as: Tracheomalacia, tracheoesophageal fistula, pulmonary atelectasis, respiratory infections, which is why tracheotomy is recommended. Also, the purpose of tracheotomy is shortening of the dead space in the airways and easier release (weaning) from mechanical ventilation.

Objectives: To determine the association of early and late tracheotomy with: Total days from tracheotomy to first ventilator weaning, total days of spontaneous breathing-T cannula, Non-invasive ventilation and mechanical ventilation before and after tracheotomy, number of bronchoaspirations, atelectasis and number of respiratory infections (with causative bacteria) before and after tracheotomy, length of hospitalization, death in intensive care and comorbidities. To determine the association of total days from tracheotomy to first ventilator weaning with gender and age of patients and to to determine the percentage of complications in early VS late tracheotomy.

Materials and methods: This comparative study includes 56 patients aged from 18 to 91 years with elective surgical tracheotomy.
Patients are divided into 2 groups:

- 28 patients with early tracheotomy (time from intubation to tracheotomy ≤7 days)
- 28 patients with late tracheotomy (time from intubation to tracheotomy >7 days).

Results: The length of hospitalization was significantly longer in the late tracheotomy group (p=0.0013). The number of days of mechanical ventilation before tracheotomy was significantly higher in patients with late tracheotomy (p=0.000001). The mortality rate was significantly higher in the late tracheotomy group (p=0.009). No statistical significance was found between the time from tracheotomy to the first weaning, the number of bronchoaspirations and atelectasis before and after tracheotomy in both groups of patients.

Conclusion: In our study, we determined that patients with late tracheotomy statistically have higher mortality, longer hospitalization and more frequent respiratory infections before tracheotomy compared to patients with early tracheotomy.

Key words: early tracheotomy, late tracheotomy.

Introduction

Tracheotomy is a minimally invasive surgical method by which it is performed opening (tracheostomy) on the front wall of the cervical part of the trachea. Through this opening, a tracheostomy cannula with a certain diameter is inserted depending on the age and gender of the patient. According to the method of performance, tracheotomy is divided into:

• Percutaneous dilatation tracheotomy, which is performed in intensive care units directly at the patient's hospital bed. It begins with dissection of the pretracheal tissue, followed by dilatation of the trachea with a guide wire and placement of a tracheostomy cannula according to the Seldinger method.

• Surgical tracheotomy is performed in the operating room. It begins with dissection of the pretracheal tissue, incision of the tracheal wall, after which a tracheostomy cannula is placed in the airway.

In intensive care units, prolonged intubation and mechanical ventilation in critically ill patients can lead to several complications such as: Tracheomalacia, tracheoesophageal fistula, pulmonary atelectasis, respiratory infections, vocal cord paralysis, laryngotracheal stenosis, which is why tracheotomy is recommended.

Also, the purpose of tracheotomy is easier cleaning of the trachea, shortening of the dead space in the airways and easier release (weaning) from mechanical ventilation. The timing , i.e. the time when

to perform tracheotomy after intubation, early tracheotomy <7-10 days or late tracheotomy >7-10 days is still a topic of debate in a large number of studies and meta-analyses. [1-4].

Objectives of the study

- To determine the association of early and late tracheotomy with total days from tracheotomy to first ventilator weaning
- To determine the association of total days from tracheotomy to first weaning from a respirator with gender and age of patients.
- To determine the association of early and late tracheotomy with total days of spontaneous breathing-T cannula, non-invasive ventilation and mechanical ventilation before and after tracheotomy.
- To determine the association of early and late tracheotomy with the number of bronchoaspirations, atelectasis and the number of respiratory infections (with causative bacteria) before and after tracheotomy.
- To determine the association of early and late tracheotomy with length of hospitalization, death in intensive care and comorbidities in patients.
- To determine the percentage of complications in early versus late tracheotomy.

Materials and methods

It is a comparative study that was performed in Clinical hospital Acibadem Sistina.The study includes 56 patients from 18 to 91, who underwent elective surgical tracheotomy.

Patients are divided into 2 groups:

- 28 patients with early tracheotomy (time from intubation to tracheotomy ≤7 days)
- 28 patients with late tracheotomy (time from intubation to tracheotomy >7 days).

Patient data is taken from the CEREBRAL+ electronic system of Acibadem Sistina Hospital, which contains all medical data for treated patients.

Inclusion criteria:

- Patients with surgical tracheotomy aged ≥18 years

Exclusion criteria:

- Patients with surgical tracheotomy aged < 18 years.
- Patients with percutaneous tracheotomy.
- Patients with surgical tracheotomy performed in another hospital.

Statistical Analysis

The statistical analysis of the data obtained from the research was done in the statistical program SPSS 23.0. Kolmogorov-Smirnov test and Shapiro Wilk's test were used to test the normality of the data distribution. Categorical (attributive) variables are shown with absolute and relative numbers.

Numerical (quantitative) variables are shown with average, standard deviation, minimum and maximum values, median value and interquartile rank. Chi-square and Fisher's exact test were used to compare groups with early and late tracheotomy in relation to qualitative variables, Stdent t-test and Mann-Whitney U test were used to compare in relation to quantitative variables. Statistical significance was defined at the $p<0.05$ level.

Results

56 respondents participated in the research, patients from Clinical Hospital Acibadem Sistina, aged from 18 to 91 years and average age of 58.3 ± 17.1 years. The majority of patients were male (73.21% vs 26.79%). (Table 1).

Table 1. Patient characteristics.

variable	
Gender n (%)	
male	41 (73.21)
female	15 (26.79)
Age/years (mean±SD) (min – max)	(58.30 ± 17.1) (18 – 91)
median (IQR)	62 (46 – 72)
Diagnosis n (%)	
CVI	15 (26.79)
Cancer	7 (12.5)
Polytrauma	5 (8.93)
Quadriplegia	7 (12.5)
COPD	19 (33.93)
St.post CPR	3 (5.36)

According to the time from intubation to tracheotomy, the patients were divided into two identical groups: 28 patients with early tracheotomy (time from intubation to tracheotomy ≤7 days) and 28 patients with late tracheotomy (time from intubation to tracheotomy >7 days).

Patients with early and late tracheotomy were similar in terms of gender (p=0.76), diagnosis (p=0.2) and age (p=0.9). Male patients were the majority in both groups (75% and 71.43%, respectively patients with early and late tracheotomy). After diagnosis, in the group with early and late tracheotomy patients with COPD were mostly represented (32.14% and 35.71%, respectively). The patients from the early tracheotomy group had a mean age of 58.1 ± 16.7 years, the mean age of the late tracheotomy patients was 58.5 ± 17.6 years. (Table 2).

Table 2. Patients with early and late tracheotomy according to gender and diagnosis.

	Tracheotomy			**p-level**
	n	early	late	
Gender				
male	41	21 (75%)	20 (71.43%)	X^2=0.09
female	15	7 (25%)	8 (28.57%)	p=0.76
Diagnosis				
CVI	15	6 (21.43%)	9 (32.14%)	Fisher's exact
Cancer	7	4 (14.29%)	3 (10.71%)	p=0.2
Polytrauma	5	3 (10.71%)	2 (7.14%)	
Quadriplegia	7	6 (21.43%)	1 (3.57%)	
COPD	19	9 (32.14%)	10 (35.71%)	
St.post CPR	3	0	3 (10.71%)	
Age				
mean ±SD	58.1 ± 16.7		58.5 ± 17.6	t=0.1
min- max	18 – 91		27 – 83	p=0.9

X^2(Pearson Chi-square test); t(Student t-test)

10.71% of patients with early and 21.43% of patients with late tracheotomy were not weaned from the respirator. No statistically significant difference was found in the distribution of patients weaned/not weaned (X2=1.2 p=0.275). (Table 3)

Table 3. Distribution of patients weaned/not weaned from respirator.

	Tracheotomy			p-level
	n	early	late	
first weaning from respirator				
yes	47	25 (89.29%)	22 (78.57%)	X^2=1.2
no	9	3 (10.71%)	6 (21.43%)	p=0.275

Patients from the two groups did not differ significantly in terms of the time elapsed from tracheotomy to first ventilator weaning (p=0.5). The average number of days from tracheotomy to first ventilator weaning was 6.8 ± 13.2 and 3.4 ± 3.6 respectively in the early and late tracheotomy; the median days from tracheotomy to first weaning were 3 and 2 in the early and late tracheotomy groups, respectively. (Table 4).

Table 4. Total days from tracheotomy to first weaning from respirator.

	Tracheotomy			p-level
	n	early	late	
n	25		22	Z=0.67
mean ±SD	6.8 ± 13.2		3.4 ± 3.6	p=0.5
min- max	0 – 66		0 – 13	
median (IQR)	3 (1 – 8)		2 (1 – 5)	

Complications were registered insignificantly more often in patients with late tracheotomy (33.34% vs 15.38%, p=0.14); bleeding was the most common complication, in 25% of patients with late and 15.38% with early tracheotomy. (Table 5).

Table 5. Complications from tracheotomy.

	Tracheotomy			p-level
	n	early	late	
no	38	22 (84.62%)	16 (66.67%)	no/yes
bleeding	10	4 (15.38%)	6 (25%)	X^2=2.2 p=0.14
wetting	1	0	1 (4.17%)	
decubitus	1	0	1 (4.17%)	

Patients with early tracheotomy were in the hospital on average 28.2 ± 20.7 days, patients with late tracheotomy on average 52.5 ± 48.4 days; the median days in the hospital were 18 and 34.5, respectively, in the early and late tracheotomy groups. The length of hospitalization was significantly longer in the late tracheotomy group (p=0.0013). (Table 6).

Table 6. Total days of hospital stay.

	Tracheotomy			p-level
	n	early	late	
mean ±SD	28.2 ± 20.7		52.5 ± 48.4	Z=3.21
min- max	7 – 87		16 – 214	**p=0.0013
median (IQR)	18 (13 – 41.5)		34.5 (25 – 65)	

X^2(Pearson Chi-square test); Z(Mann-Whiitney test)
**sig p<0.01

Patients with late tracheotomy were significantly more likely to breathe spontaneously on a T-cannula before tracheotomy in the ICU (60.71% vs 25%, X2=7.3 p=0.007). The number of days of spontaneous breathing on a T-cannula before tracheotomy in the ICU was significantly higher in the late tracheotomy group (median=1 vs 0 days, p=0.00155); the mean number of days was 0.3 ± 0.6 and 3.0 ± 4.1, respectively, in the early and late tracheotomy groups. (Table 7, figure 1 and 2).

Table 7. Total days of spontaneous breathing on T-cannula before tracheotomy in ICU.

	Tracheotomy			p-level
	n	early	late	
				Z=3.2
mean ±SD		0.3 ± 0.6	3.0 ± 4.1	**p=0.00155
min- max		0 – 2	0 – 14	
median (IQR)		0 (0 – 0.5)	1 (0 – 6)	

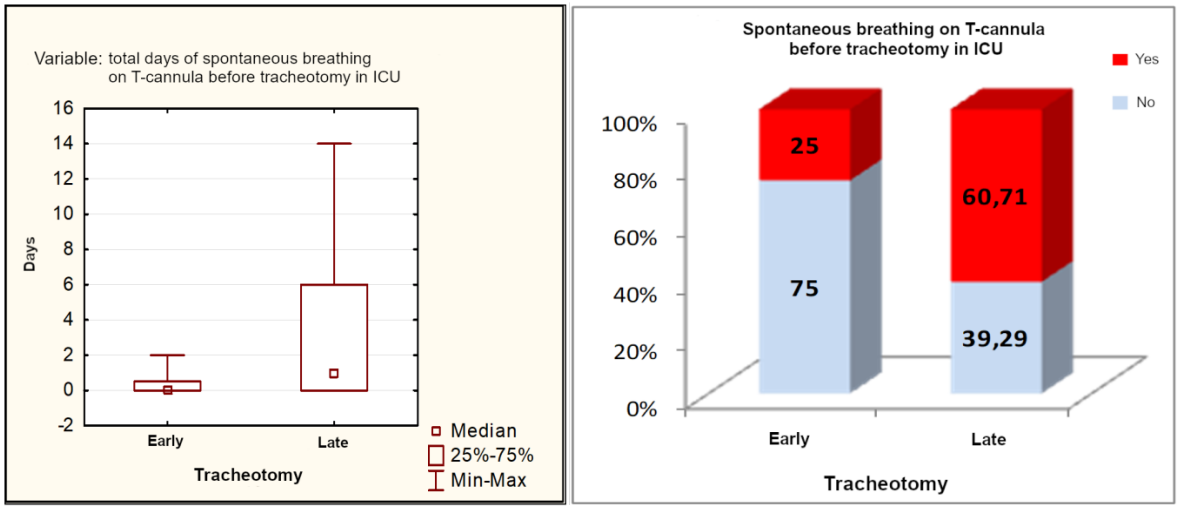

Figure 1 and 2. Graphic display of total days of spontaneous breathing on T-cannula before tracheotomy in ICU.

After tracheotomy in ICU spontaneous breathing on T-cannula was 89.29% patients with early, 78.57% patients with late tracheotomy, without statistically significant difference between the two groups (X2=1.2 p=0.275). The mean number of days of spontaneous breathing on the T-cannula was 6.2 ± 6.5 and 9.1 ± 18.2 days, respectively, in the early and late tracheotomy groups; the median number of days was 4 in both groups. (Table 8).

Table 8. Total days of spontaneous breathing on T-cannula after tracheotomy in ICU.

	Tracheotomy			p-level
	n	early	late	
				Z=0.115
mean ±SD		6.2 ± 6.5	9.1 ± 18.2	p=0.91
min- max		0 – 26	0 – 96	
median (IQR)		4 (1.5 – 9)	4 (2 – 8)	

On mechanical ventilation before tracheotomy in ICU were 96.43% patients with early and all patients with late tracheotomy, without statistically significant difference in their representation in both groups (X2=1.0 p=0.31).

But the number of days of mechanical ventilation before tracheotomy was significantly higher in patients with late tracheotomy (p=0.000001); the average number of days is 3.9 ± 2.2 and 10.0 ± 4.7, respectively in the early and late tracheotomy group; the median number of days was 4 and 9.5, respectively, in the early and late tracheotomy groups. (Table 9, figure 3).

Table 9. Total days of mechanical ventilation before tracheotomy in ICU.

	Tracheotomy			p-level
	n	early	late	
mean ±SD		3.9 ± 2.2	10.0 ± 4.7	Z=4.9
min- max		0 – 7	1 – 19	***p=0.000001
median (IQR)		4 (2 – 6)	9.5 (7.5 – 13.5)	

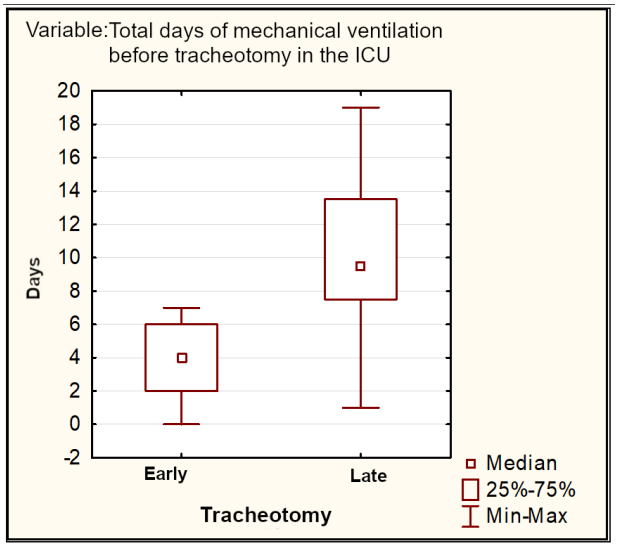

Figure 3. Total days of mechanical ventilation before tracheotomy in the ICU.

The representation of patients on mechanical ventilation after tracheotomy in the ICU with early and late tracheotomy was insignificant (89.29% vs 85.71%, X2=0.16 p=0.69). The two groups did not differ in terms of the number of days of mechanical ventilation after tracheotomy (p=0.88). Patients with early tracheotomy were on mechanical ventilation after tracheotomy for an average of 7.6 ± 9.6 days, half of them more than 4 days; patients with late tracheotomy were on mechanical ventilation after tracheotomy for an average of 11.3 ± 19.3 days, half of them more than 4.5 days. (Table 10).

Table 10. Total days of mechanical ventilation after tracheotomy in the ICU.

	Tracheotomy			p-level
	n	early	late	
mean ±SD		7.6 ± 9.6	11.3 ± 19.3	Z=0.16
min- max		0 – 46	0 – 84	p=0.88
median (IQR)		4 (2.5 – 9)	4.5 (2 – 8)	

Z(Mann-Whiitney test)
**sig p<0.01, ***sig p<0.0001

Before tracheotomy, bronchoaspirations were registered in 17.86% of patients with early and 35.71% of patients with late tracheotomy. No statistically significant difference was confirmed in the distribution of patients without, with 1, 2, 3 and 4 bronchoaspirations before tracheotomy in the ICU (p=0.45). The average number of bronchoaspirations before tracheotomy was 0.3±0.6 and 0.6±1.0, respectively, in the groups with early and late tracheotomy. The difference in the number of bronchoaspirations before tracheotomy between the two groups was insignificant (Z=1.5 p=0.14). (Table 11).

Table 11. Bronchoaspiration before tracheotomy in ICU**.**

	Tracheotomy	p-level

	n	early n(%)	late n(%)	
0	41	23 (82.14)	18 (64.29)	Fisher's exact test p=0.45
1	7	2 (7.14)	5 (17.86)	
2	6	3 (10.71)	3 (10.71)	
3	1	0	1 (3.57)	
4	1	0	1 (3.57)	

After tracheotomy, we noted bronchoaspirations in 32.14% of patients with early and 28.57% with late tracheotomy. Patients without, with 1, 2, 3 and 4 bronchoaspirations after tracheotomy were similarly distributed in both groups (p=0.95).

The average number of bronchoaspirations was identical. after tracheotomy in both groups (0.6±0.9 and 0.6±1.0, respectively in the groups with early and late tracheotomy). The number of bronchoaspirations after tracheotomy did not differ significantly between the two groups (Z=0.2 p=0.82). (Table 12).

Table 12. Bronchoaspiration after tracheotomy in ICU.

	Tracheotomy				**p-level**
	n	early n(%)	late n(%)		
0	39	19 (67.86)	20 (71.43)		Fisher's exact test p=0.95
1	6	3 (10.71)	3 (10.71)		
2	8	5 (17.86)	3 (10.71)		
3	2	1 (3.57)	1 (3.57)		
4	1	0	1 (3.57)		

Atelectasis before tracheotomy in the ICU had 7.14% patients with early and 25% with late tracheotomy. No statistically significant difference was found between the two groups in the distribution of patients without, with 1,2,3 and 4 atelectasis (p=0.36), as well as in the number of atelectasis before tracheotomy (Z=1.8 p=0.07). On average, 0.1±0.4 atelectasis were registered in the early tracheotomy group, 0.5±0.9 atelectasis in the late tracheotomy group. (Table 13)

Table 13. Atelectasis before tracheotomy in ICU.

	Tracheotomy				**p-level**
	n	early n(%)	late n(%)		
0	47	26 (92.86)	21 (75)		Fisher's exact test p=0.36
1	4	1 (3.57)	3 (10.71)		
2	3	1 (3.57)	2 (7.14)		
3	1	0	1 (3.57)		
4	1	0	1 (3.57)		

Atelectasis after tracheotomy was registered in 17.85% of patients with early and 3.57% with late tracheotomy. One atelectasis after tracheotomy was registered in 10.71% of patients with early tracheotomy, 2 atelectasis in 7.14% of patients with early and 3.57% of patients with late tracheotomy, but these differences were not confirmed as statistically significant (p=0.226). (Table 14)

Table 14. Atelectasis after tracheotomy in ICU.

	Tracheotomy			**p-level**
	n	early	late	

		n(%)	n(%)	
0	50	23 (82.14)	27 (96.43)	Fisher's exact test p=0.226
1	3	3 (10.71)	0	
2	3	2 (7.14)	1 (3.57)	

Respiratory infection before tracheotomy in the ICU, one, was significantly more frequent in patients with late tracheotomy (53.57% vs 14.29%, p=0.0019). As the causative agent of the infection in the tracheal aspirate, Acinetobacter baumannii (7.14%) was consistently isolated in the groups with early and late tracheotomy. and 28.57%), Staphylococcus aureus MRSA (7.14% and 10.71%), Enterococcus faecium (3.57% and 3.57%), and only in the late tracheotomy group Candida albicans (3.57%), Pseudomonas aeruginosa (14.29%), Streptococcus beta- haemolyticus gr (3.57%) and Klebsiella pneumoniae (10.71%). (Table 15)

Table 15. Respiratory infection before tracheotomy in ICU.

	Tracheotomy			**p-level**
	n	early n(%)	late n(%)	
0	37	24 (85.71)	13 (46.43)	X^2=9.64 **p=0.0019
1	19	4 (14.29)	15 (53.57)	

After tracheotomy, respiratory infection was present in 35.71% of patients with early and 39.29% of patients with late tracheotomy. No statistically significant difference was confirmed in the distribution of patients without, with 1, 2, 3 and 4 respiratory infections after tracheotomy (p=0.66). Patients with early and late tracheotomy had on average 0.3±0.4 and 0.4±0.5 respiratory infections after tracheotomy.

The difference in the number of bronchoaspirations before tracheotomy between the two groups was insignificant (Z=0.3 p=0.79). Acinetobacter baumannii (17.86% and 21.43%), Staphylococcus aureus MRSA (17.86% and 7.14%), Enterococcus faecium (7.14% and 7.14%), Pseudomonas aeruginosa were consistently isolated in the groups with early and late tracheotomy as the causative agents of the infection in the tracheal aspirate. (7.14% and 21.43%), Klebsiella pneumoniae (7.14% and 17.86%), Enterobacter aerogenes (3.57% and 3.57%), only in the early tracheotomy group Candida (7.14%), only in the late tracheotomy group (7.14%) . (Table 16)

Table 16. Respiratory infection after tracheotomy in ICU.

	Tracheotomy			**p-level**
	n	early n(%)	late n(%)	
0	35	18(64.29)	17(60.71)	Fisher's exact test p=0.66
1	12	7(25)	5(17.86)	
2	6	3(10.71)	3(10.71)	
3	2	0	2(7.14)	
4	1	0	1(3.57)	

2 patients with early and 10 with late tracheotomy died. The mortality rate was significantly higher in the group with late tracheotomy (35.71% vs 7.14%, X2=6.8 p=0.009). (Figure 4)

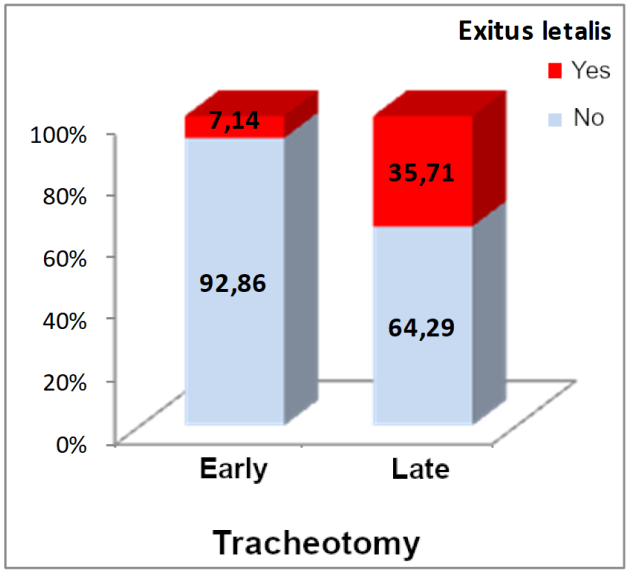

Figure 4. Graphic display of deceased patients after early/late tracheotomy.

Regarding comorbidities, late tracheotomy was significantly more often indicated in patients with CAD (17.86% vs 0%, p=0.019), respiratory diseases were significantly more often associated with early tracheotomy (17.86% vs 0%, p=0.019). No statistically significant difference was found between patients with early and late tracheotomy in relation to other chronic diseases present in the patients (p>0.05). (Table 17)

Table 17. Patients with early and late tracheotomy in relation to other chronic diseases present in the patients (p>0.05)

variable	**Tracheotomy**			**p-level**
	n	early n(%)	late n(%)	
Hypertension	38	20 (71.43)	18 (64.29)	X^2=0.33 p=0.57
DM	17	7 (25)	10 (35.71)	X^2=0.76 p=0.38
CAD	5	0	5 (17.86)	X^2=5.49 *p=0.019
Heart valve diseases	1	0	1 (3.57)	X^2=1.02 p=0.31
Arrhythmias	8	3 (10.71)	5 (17.86)	X^2=0.58 p=0.445
Respiratory disease	5	5 (17.86)	0	X^2=5.49 *p=0.019
Kidney disease	8	2 (7.14)	6 (21.43)	X^2=2.33 p=0.13
Liver failure	3	0	3 (10.71)	X^2=3.17 p=0.075
Malignant disease	7	3 (10.71)	4 (14.29)	X^2=0.16 p=0.69
Neurological disease	8	5 (17.86)	3 (10.71)	X^2=0.58 p=0.445
GIT disease	4	2 (7.14)	2 (7.14)	
Rheumatological disease	1	0	1 (3.57)	
Autoimmune disease	4	3 (10.71)	1 (3.57)	X^2=1.08 p=0.3
Infectious disease	1	0	1 (3.57)	

X^2(Pearson Chi-square test); Z(Mann-Whiitney test)
*sig p<0.05

Discussion

A total of 56 subjects participated in this comparative study, identically distributed in 2 groups: 28 patients with early and 28 patients with late tracheotomy. Regarding the gender structure, male patients dominated (73.21% vs 26.79%) and average age of 58.3 ± 17.1 years in the groups with early and late tracheotomy. We determined that the length of hospitalization in patients with late tracheotomy

was on average 52.5 ± 48.4, while in patients with early tracheotomy they were in the hospital on average 28.2 ± 20.7 days, the length of hospitalization was significantly longer in the group with late tracheotomy (p=0.0013).

These findings coincided with data from a retrospective study by Zhao J et Al. [5], in which patients with late tracheotomy had a longer hospital stay of 39 days on average, $p < 0.001$ and in the cohort study of Fernanda Kazmierski Morakami et al. [6] where patients with early vs. late tracheotomy had a shorter hospital stay (42 ± 32 vs. 52 ± 50 days, $p < 0.001$).

In contrast Chopra P et al. [7] in their retrospective observational study did not associate early tracheotomy with shorter hospitalization in intensive care unit patients. The mortality rate in our study was significantly higher in the late tracheotomy group (35.71% vs 7.14%, X2=6.8 p=0.009), which was also confirmed in the study by Chopra P et al. [7], Patel SA et al. [8] and the multicenter cohort study of Tanaka A. et al. [9] .

This mortality rate could be explained by the fact that respiratory infection before tracheotomy in intensive care was significantly more frequent in patients with late tracheotomy (53.57% vs 14.29%, p=0.0019), while after tracheotomy statistically insignificantly 35.71% with early and 39.29% patients with late tracheotomy had respiratory infection. Also in our study the largest number of patients in both groups were with COPD as admission diagnosis (32.14% and 35.71%, respectively). and CAD (17.86% vs 0%, p=0.019) as a comorbidity in patients with late tracheotomy, which also influence the increased mortality in patients with late tracheotomy, [10, 11]. In our study, complications were registered insignificantly more often in patients with late tracheotomy p=0.14; bleeding was the most common complication, in 25% of patients with late and 15.38% with early tracheotomy.

Most often these bleedings are associated with infection around the tracheostomy itself, granulations, tracheo-arterial fistula, bleeding from the lungs, excessive aspiration of the tracheobronchial stem [12,13].

No statistically significant difference was found among patients in terms of the time elapsed from tracheotomy to first weaning from a respirator (p=0.5), the median days from tracheotomy to first weaning from a respirator were 3 and 2, respectively, in the early and late tracheotomy groups. However, patients with late tracheotomy were significantly more likely to breathe spontaneously on a T-cannula before tracheotomy in the ICU (60.71% vs 25%, X2=7.3 p=0.007).

The number of days of spontaneous T-cannula breathing before tracheotomy in the ICU was significantly higher in the late tracheotomy group (p=0.00155). Also, the number of days of mechanical ventilation before tracheotomy was significantly higher in patients with late tracheotomy (p=0.000001), which indicates a greater possibility of developing respiratory infections and increased mortality in this group of patients [14,15].

The days and number of spontaneous breathing on T-cannula and mechanical ventilation after tracheotomy were without statistical significance in both groups of patients with early and late tracheotomy. Pulmonary atelectasis in patients in intensive care units before and after tracheotomy usually occurs as a result of cannula obstruction from coagulum, mucous secretion due to generalized weakness and inability to expectorate it, and respiratory infections [13].

In our study, atelectasis before tracheotomy in the ICU was 7.14% of patients with early and 25% with late tracheotomy with an average of 0.1±0.4 atelectasis in the early tracheotomy group, 0.5±0.9 atelectasis in the late tracheotomy group, without statistical significance in both groups of patients (p=0.36). Also, these differences were not confirmed as statistically significant in both groups of patients after tracheotomy (p=0.226).

Accordingly, the difference in the number of bronchoaspirations in both groups of patients before and after tracheotomy was not statistically significant. In addition to the recurrent atelectasis in our study, it is argued that clinical experience shows that atelectasis often recurs after bronchoscopy because the cause of impaired airway hygiene continues.

Thus, failure to resolve the primary problem should not be an indication for repeated invasive airway intervention [16].

The most common pathogens isolated from tracheal aspirate in our study are Acinetobacter baumannii and Staphylococcus aureus MRSA. Their percentage representation was (7.14% and 28.57%) and (7.14% and 10.71%) before tracheotomy with (17.86% and 21.43%) and (17.86% and 7.14%) after tracheotomy in both groups of patients. As multiresistant bacteria and frequent causes of

respiratory infections in the upper and lower respiratory tracts that lead to increased secretory production in them and frequent atelectasis [17].

Conclusion

In our group comparison study, we found that patients with late tracheotomy had statistically significantly higher mortality, longer hospitalization, and more frequent respiratory infections before tracheotomy compared to patients with early tracheotomy.

Non-significantly more frequent tracheostomy cannula bleeding was found in patients with late tracheotomy. No significant statistical data were obtained for the patients regarding the time elapsed from tracheotomy to the first weaning from the respirator and for the number of atelectasis before and after tracheotomy in both groups of patients.

However, our study has certain limitations because it is a unicentric study with a relatively small number of subjects with different diagnoses on admission to the intensive care unit.

Abbreviations

- DM-Diabetes mellitus
- CAD-Coronary artery disease
- GIT disease-Gastrointestinal disease
- COPD-Chronic obstructive pulmonary disease
- MRSA-Methicillin-resistant Staphylococcus aureus
- CVI-Cerebrovascular stroke
- St.post CPR-Condition after cardiopulmonary resuscitation

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