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Official Publication of the Brazilian Society of Anesthesiology  
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## SCIENTIFIC ARTICLE

# Comparison of early and late percutaneous tracheotomies in adult intensive care unit

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Received 30 June 2013; accepted 19 August 2013

Available online 26 October 2013

### KEYWORDS

Percutaneous tracheotomy;  
Early tracheotomy;  
Late tracheotomy

### Abstract

**Background and objectives:** Percutaneous tracheotomy has become a good alternative for patients thought to have prolonged intubation in intensive care units. The most important benefits of tracheotomy are early discharge of the patient from the intensive care unit and shortening of the time spent in the hospital. Prolonged endotracheal intubation has complications such as laryngeal damage, vocal cord paralysis, glottic and subglottic stenosis, infection and tracheal damage. The objective of our study was to evaluate potential advantages of early percutaneous tracheotomy over late percutaneous tracheotomy in intensive care unit.

**Methods:** Percutaneous tracheotomies applied to 158 patients in adult intensive care unit have been analyzed retrospectively. Patients were divided into two groups as early and late tracheotomy according to their endotracheal intubation time before percutaneous tracheotomy. Tracheotomies at the 0–7th days of endotracheal intubation were grouped as early and after the 7th day of endotracheal intubation as late tracheotomies. Patients having infection at the site of tracheotomy, patients with difficult or potential difficult intubation, those under 18 years old, patients with positive end-expiratory pressure above 10 cmH<sub>2</sub>O and those with bleeding diathesis or platelet count under 50,000 dL<sup>-1</sup> were not included in the study. Durations of mechanical ventilation and intensive care stay were noted.

**Results:** There was no statistical difference among the demographic data of the patients. Mechanical ventilation time and time spent in intensive care unit in the group with early tracheotomy was shorter and the difference was statistically significant ( $p < 0.05$ ).

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**PALAVRAS-CHAVE**

Traqueotomia percutânea;  
Traqueotomia precoce;  
Traqueotomia tardia

**Conclusion:** Early tracheotomy shortens mechanical ventilation duration and intensive care unit stay. For that reason we suggest early tracheotomy in patients thought to have prolonged intubation.

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### Comparação de traqueotomia percutânea precoce e tardia em unidade de terapia intensiva para adultos

#### Resumo

**Justificativa e objetivos:** A traqueotomia percutânea tornou-se uma boa alternativa para os pacientes com previsão de intubação prolongada em unidades de terapia intensiva. Os benefícios mais importantes da traqueotomia são alta precoce da unidade de terapia intensiva e menos tempo de permanência no hospital. As complicações da intubação intratraqueal prolongada são: lesão da laringe, paralisia das pregas vocais, estenose glótica e subglótica, infecção e lesão traqueal. O objetivo deste estudo foi avaliar as potenciais vantagens da traqueotomia percutânea precoce *versus* traqueotomia percutânea tardia em unidade de terapia intensiva.

**Métodos:** Traqueotomias percutâneas foram realizadas em 158 pacientes em unidade de terapia intensiva para adultos e analisadas retrospectivamente. Os pacientes foram alocados em dois grupos para traqueotomia precoce e tardia, de acordo com o tempo de intubação intratraqueal antes da traqueotomia percutânea. As traqueotomias consideradas precoces foram realizadas nos dias 0-7 de intubação intratraqueal e as tardias realizadas após o sétimo dia de intubação intratraqueal. Os pacientes com infecção no local da traqueotomia, intubação difícil ou potencialmente difícil, idade inferior a 18 anos, pressão positiva ao final da expiração acima de 10 cmH<sub>2</sub>O e aqueles com diátese hemorrágica ou contagem de plaquetas em 50.000 dL<sup>-1</sup> foram excluídos do estudo. Os tempos de ventilação mecânica e internação em UTI foram registrados.

**Resultados:** Não houve diferença estatística entre os dados demográficos dos pacientes. Os tempos de ventilação mecânica e de internação em unidade de terapia intensiva do grupo traqueotomia precoce foram menores e a diferença foi estatisticamente significativa ( $p < 0,05$ ).

**Conclusão:** Traqueotomia precoce reduz o tempo de ventilação mecânica e de internação em unidade de terapia intensiva. Portanto, sugerimos a traqueotomia precoce em pacientes com suspeita de intubação prolongada.

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## Introduction

Tracheotomy is one of the procedures frequently applied in intensive care units (ICUs). The most important advantages of tracheotomy are early discharge from ICU and shortening of the hospital stay of the patient. Tracheotomy is advisable for the patients who are intubated and predicted to have been on mechanical ventilation for a long period of time.<sup>1,2</sup> Prolonged endotracheal intubation has complications including laryngeal damage, vocal cord paralysis, glottic and subglottic stenosis, infection, tracheal damage (tracheomalacia, tracheal dilatation and tracheal stenosis), etc.<sup>3,4</sup>

While surgical tracheotomy was the single alternative until 1969, percutaneous tracheotomy (PT) has been a new alternative after the first half of 80th. Tracheotomy having a lot of advantages is a good alternative for endotracheal intubation in ICUs.<sup>5</sup>

The main concern is when and to which patients apply the tracheotomy. In 1998 a review notified weak proof about the effect of timing of tracheotomy on mechanical ventilation time and preventing the airway damage in critical patients.<sup>6</sup> Some studies show that early tracheotomy shortens

mechanical ventilation time, ICU and hospital stay times and results in less damage to the airways.<sup>7,8</sup>

Old references propose tracheotomy to patients thought to be intubated for more than 21 days. But today it is advisable to evaluate the patient between the second and tenth days of intubation and consider tracheotomy for them who will require intubation for more than 14 days. Early tracheotomy is beneficial for some special circumstances such as patients with polytrauma, head trauma and low Glaskow Coma Scale (GCS). Ear Nose Throat specialists also advise early tracheotomy for prevention of laryngeal damage.<sup>9</sup>

We aimed to evaluate the effect of early application of PT in our study and see the advantages, if any, over late PT regarding mechanical ventilator and hospital length of stay of the patient.

## Methods

Patients hospitalized in Vakif Gureba Research Hospital Intensive Care Unit between May 2007 and August 2010 who were undergone elective tracheotomy because of prolonged endotracheal intubation were included in the study and were

**Table 1** Sex distribution of patients with early and late tracheotomy.

Groups	Early tracheotomy	Late tracheotomy	<i>p</i>
	<i>n</i> (%)	<i>n</i> (%)	
Male	74 (64.3)	27 (62.8)	0.375
Female	41 (35.7)	16 (37.2)	
Total	115 (100)	43 (100)	

examined retrospectively. Total number of the patients was 158, with the age range of 18–98 years. The First-degree relative of each patient was informed about the procedure and informed consent had been taken from them. Patients were divided into two groups. The patients undergone early tracheotomy (tracheotomy between the 0 and 7th days of endotracheal intubation) named as Group I and those undergone late tracheotomy (tracheotomy after the 7th day of endotracheal intubation) as Group II. Patients with infection on the site of tracheotomy, bleeding diathesis or platelet count less than 50,000 dL<sup>-1</sup>, those with known or suspected difficult airway, patients under 18 years old and those with PEEP more than 10 cm H<sub>2</sub>O were excluded from the study.

Demographic data such as age, sex, body mass and height were noted, as well as ICU hospitalization reason, the day of tracheotomy, average mechanical ventilation time after tracheotomy and total mechanical ventilation duration.

All the patients had been routinely monitored with ECG, NIBP and pulse oxymetry. All patients had received propofol 3 mg kg<sup>-1</sup>, fentanyl 2 µg kg<sup>-1</sup>, midazolam 0.03 mg kg<sup>-1</sup> and vecuronium 0.1 mg kg<sup>-1</sup> iv for sedation. The patients were pre-oxygenized for 15 min and during the procedure with 100% oxygen.

Percutaneous tracheotomy kit (Portex®) tracheotomy cannula with internal diameter of 8 mm had been used for the patients of both groups. The site of tracheotomy had been controlled for any haemorrhage, infection, decannulation during the hospital stay.

Statistical analysis was made via SPSS 15.0 program. Kolmogorov–Smirnov test was used for assessment of normal distribution. Regarding the comparison of quantitative data between the groups Independent Samples *t*-test was used for evaluation of data with normal distribution and Mann Whitney *U* test for data without normal distribution. Paired Samples *t*-test was used for evaluation of the data with normal distribution and Wilcoxon test for the data without normal distribution.  $\chi^2$  test was used for comparison of qualitative data. The results in confidence interval of 95% and with *p* < 0.05 were considered statistically significant.

## Results

158 patients were included in the study. 101 of them were males and 57 females. Males and female ratios with

**Table 2** Age and BMI distribution of tracheotomies.

Groups	Early tracheotomy		Late tracheotomy		<i>p</i>
	Mean	SD	Mean	SD	
Age (years)	59.591	18.987	62.628	19.428	0.375
BMI (kg m <sup>-2</sup> )	29.174	6.031	28.279	5.409	0.395

**Table 3** Distribution of tracheotomy according to ICU acceptance indication.

	Early tracheotomy		Late tracheotomy		<i>p</i>
	<i>n</i>	%	<i>n</i>	%	
<i>ICU acceptance indication</i>					0.827
Cerebrovascular accident	41	35.7	16	37.2	
Cardiac pathology	21	18.3	8	18.6	
Pulmonary pathology	28	24.3	9	20.9	
Sepsis	15	13.0	4	9.3	
Trauma	7	6.1	3	7.0	
Other	3	2.6	3	7.0	

**Table 4** Mechanical ventilation time and ICU stay duration after early and late tracheotomy.

Groups	Early tracheotomy		Late tracheotomy		<i>p</i>
	Mean	SD	Mean	SD	
Total mechanical ventilation duration (days)	11.27	13.122	16.40	16.377	0.043 <sup>a</sup>
ICU stay duration (days)	17.38	14.561	30.95	19.166	<0.001 <sup>a</sup>

<sup>a</sup> *p* < 0.05.

early tracheotomy were respectively 64.3% and 35.7%, while with late tracheotomy were respectively 62.8% and 37.2%. There was no statistically significant difference between two groups according to the sexes of the patients ( $p > 0.05$ ). Early PT was applied to 115 patients, while late PT to 43 patients. There was no statistically significant difference between two groups according to the demographic data ( $p > 0.05$ ) (Tables 1 and 2).

There was no statistically significant difference between two groups regarding hospitalization indication into the ICU ( $p > 0.05$ ) (Table 3).

Mechanical ventilation time after tracheotomy was long in Group II compared with Group I. This difference was statistically significant ( $p < 0.05$ ) (Table 4).

ICU stay duration after tracheotomy was long in Group II compared with Group I. This difference was statistically significant ( $p < 0.05$ ) (Table 4).

## Discussion

While it was advisable to apply tracheotomy before 21st day of endotracheal intubation in the past, Durbin et al.<sup>9</sup> have proposed to evaluate the patient for tracheotomy between days 2–10 of mechanical ventilation and perform tracheotomy for patients thought to be left intubated for more than 14 days, especially for some selected patient groups such as major polytrauma, low GCS and head trauma.

Zagli et al.<sup>10</sup> have compared effects of early and late tracheotomies in 506 patients. Early tracheotomy was defined as tracheotomy in the first three days of endotracheal intubation in this study and mechanical ventilation duration and hospital length of stay were shorter in the early tracheotomy group.

However, there are some studies that show no difference between early and late tracheotomy. Sugerman et al.<sup>11</sup> have shown no difference between early and late tracheotomy regarding ICU length of stay. They performed early tracheotomy between days 3–5 and late tracheotomy between days 10 and 14 of endotracheal intubation. Blot et al.<sup>12</sup> compared two groups of patients with early tracheotomy versus prolonged intubation and found no data favoring early tracheotomy, so proposed not to apply early tracheotomy besides selected patient groups.

We have found shorter hospital length of stay in the patients with early tracheotomy in our study. Mean hospital length of stay for early and late tracheotomy groups were 17.4 and 31.0 days respectively. The difference was statistically significant.

Yavas et al.<sup>13</sup> have compared surgical and PT and concluded that both methods can be used in ICU but with lower infection rate with early tracheotomy. Lesnik et al.<sup>14</sup> showed that patients with early tracheotomy have significantly lower mechanical ventilator stay compared with late tracheotomy in the study where they applied tracheotomy on the fourth day of endotracheal intubation to the early tracheotomy group. These findings are coherent with the results of our study.

Both percutaneous and surgical tracheotomies have complications such as haemorrhage, subcutaneous emphysema, tracheal damage, wound infection, pneumothorax and pneumomediastinum.<sup>15</sup> Holdgaard et al.<sup>16</sup> have

compared surgical and percutaneous tracheotomies and illustrated superiority of percutaneous technique. Freidman et al.<sup>17</sup> displayed complication rates for percutaneous and surgical tracheotomies as 12% and 42% respectively. As a result of these data PT has gradually become more preferable method. Compared with surgical tracheotomy, PT reduces expenditure because of shortening of time spent in operation room and sparing operation room crew need.<sup>18,19</sup>

## Conclusions

Early PT shortens mechanical ventilation duration time and ICU length of stay.

## Conflicts of interest

The authors declare no conflicts of interest.

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