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Early versus Late Tracheostomy for Intubated Patients in Intensive Care Units

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Abstract

Background and objectives: Tracheostomy, is an integral component of the management plan for the critically ill patients admitted in the intensive care unit under endotracheal intubation. However, there is controversy regarding the effects of timing of tracheostomy in those patients, which was the purpose of this prospective study **Methods:** A -sample of 48 cases were selected, based on timing of tracheostomy they were assigned into 2 groups: early trache ostomy group; included 24 patients that were intubated for less than 10 days and within this 10 days tracheostomies were performed, and late tracheostomy group in which patients remained on endotracheal intubation for more than 10 days and then tracheostomies were performed. Collected data included; postoperative vital signs, chest X-Rays of the patients, condition of the tracheostomy tubes, any morbidity & mortality and complications that ensued. **Results:** Out of 24 cases in the early tracheostomy group, only 7 of them were associated with lung haziness in the postoperative chest X-Rays, while lung haziness was found in chest X-Rays of 14 out of total 24 cases which was more than half of the sample in the late tracheostomy study group, showing higher rates of ventilator associated pneumonia in late tracheostomy group compared to early tracheostomy group. **Conclusions:** Late tracheostomy associated with a higher risk of ventilator associated pneumonia. It's advised not to leave patients with endotracheal intubation tube for more than 10 days in intensive care units.

Keywords: Tracheostomy, Mechanical ventilation in intensive care unit, Prolonged endotracheal intubation.

Introduction

The term tracheostomy refers to establishing a surgical access into the trachea, through the neck. It's indicated when there is prolonged endotracheal intubation (ETT) such as respiratory and neuromuscular diseases, pulmonary toilet, as a part of other surgeries like head and neck cancer reconstructions and extensive maxillofacial surgeries, for bypassing upper airway obstruction in cases of epiglottitis, neoplasm, bilateral vocal cord paralysis, foreign body inhalation, angioedema, blunt or penetrating neck trauma and in cases of obstructive sleep apnea[1].

Tracheostomy might be associated with some complications, classified according to their onset, into; Immediate intraoperative complications like air embolism, bleeding, and damage to the surrounding vessels, structures and nerves. Postoperative complications in the first few days are called intermediate complications like tube blockage and extrusion, infections of the wound site, subcutaneous emphysema. When the tracheostomy tube is left in place for longer periods or in permanent tracheostomy cases, late complications may occur, including; stenosis of the trachea, fistula between the trachea and skin[2].

There is controversy regarding the appropriate timing of tracheostomy and its effect on the general condition, morbidity and mortality rates in those patients[3]. A study suggested that early tracheostomy resulted in shorter intensive care unit (ICU) stay and hence lower chances of ventilator associated pneumonia (VAP)[4]. While another study by Shrestha et al suggested that the duration of patients' admission in the ICU and hospital was not decreased by performing early tracheostomy[5]. Siempos et al reported lower mortality rates following early tracheostomy[6], also other studies discovered decannulation related obstacles and pitfalls with late tracheostomy[7,8].

Advantages of tracheostomy that make it more preferable to prolonged ETT are; lesser tube related pressure effects or trauma to the larynx and oropharynx, reduced sedation time and dosage, better chest clearance or pulmonary toilet, breathing with lesser effort, shortening ICU and hospital stays by decreasing the time under which patients re-

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main under ETT. While prolonged ETT might be associated with adverse effects including; more chances of ventilator associated pneumonia and more trauma to the larynx[9].

The purpose of this prospective study was observing the effect of tracheostomy timing on intubated patients in ICUs.

Patients and methods

A prospective randomized study in which 48 patients who have been admitted to ICUs of Sulaymaniyah teaching hospital and Shar general hospital from October 2017 to October 2018 were included. All patients were intubated and under mechanical ventilation. After a period, tracheostomy was performed electively for all of them. Critically ill patients that required emergency tracheostomy for urgent airway securing, were excluded.

Patients were divided into two groups. First group in which tracheostomy performed within 10 days of intubation including 24 patients. Second group also composed of 24 patients in which patients remained intubated for more than 10 days and tracheostomy performed afterwards. Patients' vital signs, the state of tracheostomy tube, CXR findings and complications were recorded. The data collection was made by randomly visiting the patients postoperatively in the ICU after the tracheostomy was performed for them.

Consent of data collection was obtained from the patient companions and the anesthetist on call in the ICU, as the patients themselves were unconscious and unable to give verbal consent. Discussion of the patients' findings was done with the anesthetists in charge of the ICU who also were responsible to decide at which time the tracheostomies were ordered for the patients admitted in ICU. CXRs when available, were collected from the patient companions or the ICU staff after getting the approval of the anesthetist on call in the ICU, those data were collected on daily basis from those patients in ICU until patients were discharged from the ICU.

The "IBM SPSS Statistics version 25" was used for data analysis and p-values of ≤ 0.05, were considered statistically significant. The study is approved by Ethical and Scientific committee in Kurdistan Board for
Medical Specialties.

Results

In the early tracheostomy group; regarding the gender of the patients, there were 14 male and 10 female cases. The mean duration of ETT was 5.9 days, ranging from 4 to 9 days. The mean age was 35.2 years, ranging from 5 to 66 years of age. Average SPO2% in the first postoperative week was 96.5%, with a range of 94 to 98%. Average postoperative pulse rate was 81.3 beats per minute BPM, ranging between 65 and 102BPM. The average temperature of the patients in the first postoperative week was 37.4oC, ranging between 36.3 to 38.1oC.

Regarding the late tracheostomy group; there were 15 male and 9 female patients. The mean duration of ETT was 15 days, the range was 10 to 23 days. The average age was 43.5 years ranging from 5 to 71 years old. In the first postoperative week, SPO2 averaged at 96.2%, in a range between 94 and 98%. Postoperative pulse rate of the patients averaged at 81.7BPM with a range between 69 to 105BPM. In the first postoperative week, temperature of the patients averaged at 37.2oC with a range of 36.5 to 38.1oC.

In this study; there were insignificant associations between both early and late postoperative complications following both early and late tracheostomy groups. For instance; in the early postoperative observations, bleeding, tube extrusion or infection and tube blockage occurred in both early and late tracheostomy cases with no significant difference. Regarding late postoperative complications they also occurred in a similar pattern in both study groups, including wound infection, granulation tissue formation and extrusion of the tube along with blockage that needed frequent suction. Other parameters including postoperative pulse rate, SPO2%, temperature, were all inconclusive of any significant differences between the early and late tracheostomy study groups.

A total of 14 out of 24 cases in the early tracheostomy group showed clear pre-tracheostomy CXR while only 7 out of 24 cases in the late tracheostomy group showed clear pre-tracheostomy CXR results, as shown in Table 1.

Table (1): The pre-operative chest X-ray findings in both the studied groups

Pre-operative chest X-ray	Early tracheostomy (n = 24)	Late tracheostomy (n = 24)
Clear	14 (58.3)	7 (29.2)
Haziness in both lungs	8 (33.3)	14 (58.3)
Haziness in left lung	1 (4.2)	1 (4.2)
Haziness in right lung	1 (4.2)	2 (8.3)
Total	**24 (100)**	**24 (100)**

Post-tracheostomy CXR collected in the early tracheostomy group and the absolute majority in 20 out of 24 total cases showed clear results. While in the late tracheostomy group, 15 cases out of total 24 cases showed clear results, 9 cases of them showed haziness in both lungs, as demonstrated in Table 2.

Table (2): The post-operative chest X-ray findings in both the studied groups

Post-operative chest X-Ray	Early tracheostomy (n = 24)	Late tracheostomy (n = 24)
Clear	20 (83.3)	15 (62.5)
Haziness in both lungs	3 (12.5)	9 (37.5)
Haziness in left lung	1 (4.2)	0 (0)
Total	**24 (100)**	**24 (100)**

There was a significant finding that showed higher incidences of post-tracheostomy haziness in one or both lungs, found in the CXR of the late tracheostomy study group, compared to the early tracheostomy group. As shown in the table number (3), with a p-value of <0.001 (0.299), 14 cases, which is almost half of the patients in the late tracheostomy group had haziness in both lungs, while in the early tracheostomy group, only 7 cases out of total 24, which is only one third of the cases, showed lung haziness in their CXR. Hence, the most striking difference between the early and late tracheostomy groups was the post-tracheotomy CXR of the patients.

Table (3): Association between pre- and post-tracheostomy chest X-ray findings for both the studied groups.

Tracheostomy			Post-operative chest X-Ray (%)			Total (%)	p-value (Pearson R Correlation)
			Clear	Haziness in both lungs	Haziness in left lung		
Early tracheostomy (n = 24) (%)	Pre-operative chest X-Ray	Clear	14 (29.2)	0 (0)	0 (0)	14 (29.2)	<0.001 (0.299)
		Haziness in both lungs	5 (10.4)	3 (6.3)	0 (0)	8 (16.7)	
		Haziness in left lung	0 (0)	0 (0)	1 (2.1)	1 (2.1)	
		Haziness in right lung	1 (2.1)	0 (0)	0 (0)	1 (2.1)	
	Total		**20 (41.7)**	**3 (6.3)**	**1 (2.1)**	**24 (50)**	
Late tracheostomy (n = 24) (%)	Pre-operative chest X-Ray	Clear	7 (14.6)	0 (0)	0 (0)	7 (14.6)	
		Haziness in both lungs	5 (10.4)	9 (18.8)	0 (0)	14 (29.2)	
		Haziness in left lung	1 (2.1)	0 (0)	0 (0)	1 (2.1)	
		Haziness in right lung	2 (4.2)	0 (0)	0 (0)	2 (4.2)	
	Total		**15 (31.3)**	**9 (18.8)**	**0 (0)**	**0 (0)**	
Total (%)	Pre-operative chest X-Ray	Clear	21 (43.8)	0 (0)	0 (0)	21 (43.8)	
		Haziness in both lungs	10 (20.8)	12 (25)	0 (0)	22 (45.8)	
		Haziness in left lung	1 (2.1)	0 (0)	1 (2.1)	2 (4.2)	
		Haziness in right lung	3 (6.3)	0 (0)	0 (0)	3 (6.3)	
	Total		**35 (72.9)**	**12 (25)**	**1 (2.1)**	**48 (100)**	

Discussion

Despite its being a commonly performed procedure, appropriate timing of tracheostomy in patients admitted in ICU under prolonged ETT is a matter of debate. Some studies showed that early tracheostomy in critically ill patients who are expected to be under prolonged ETT in the ICU, lead to lesser ICU and hospital stays with less postoperative morbidity and mortality[10-13].

While other study findings gave rise to skepticism regarding the effectiveness of performing early tracheostomy. For example; Meng et al and Ganuza et al, stated that early tracheostomy was not better than late tracheostomy regarding risks of VAP[14.15]. Moreover, Young et al, suggested early tracheostomy to be avoided until necessary tools to predict the expected duration of mechanical ventilation is obtained as his study revealed that early tracheostomy <4 days of ETT did not show evident benefits in patients' general condition improvement and postoperative morbidity or mortality[16].

While other studies proved that although early tracheostomy lead to shorter ETT time and ICU stay, it didn't decrease postoperative morbidity and mortality rates[17-20].

Our study demonstrated significant differences in the post-tracheostomy CXR findings between the early and late tracheostomy study groups, showing higher incidences of post-tracheostomy VAP in late tracheostomy group.

The explanation was; prolonged ETT increases the risk of tube related infection and acquired pneumonia as tracheostomy provides better patient and tube care with cleaning compared to ETT, also prolonged ETT lead to more contact with other critically ill patients thereby increasing chances of hospital acquired pneumonia. This was in accordance with the results of Moller et al, Lu et al, Cai et al, Hyde et al, who all found lower risks of VAP associated with early tracheostomy[21-24].

Hosokawa et al, also mentioned that early tracheostomy lead to lesser incidences of chest infection, but with no effect on death rates amongst those patients who have undergone tracheostomy[25].

Szakmany et al discovered that although tracheostomy performed <10 days of ETT might reduce the sedation dosages, but there was no reduction in duration of ICU stay, incidence of VAP and mortality rate, with unnecessary higher rates of performing the tracheostomy[26]. Unlike Villwock et al study that revealed shorter ICU admissions and lower VAP rates in cases of early tracheostomy as compared to late tracheostomy[27]. Keenan et al had a different result, suggesting higher mortality rates associated with early tracheostomy[28].

Occasionally, lack of accurate vital signs records of the patients due to ICU staff or equipment shortcomings. Sometimes, CXR was not available, hence, some patients were omitted from the study sample due to the lack of CXR, which was an important parameter of the study. Six patients died due to succumbing to their comorbidities or underlying illnesses, 2 cases in the early tracheostomy and 4 cases in the late tracheostomy groups, hindering long term assessment impossible. Therefore, the total number of cases in the study sample was less than planned.

Conclusions

Late tracheostomy group or those patients on ETT for more than 10 days were associated with higher risks of VAP as compared to that performed at an earlier time before 10 days of ETT, which leads to additional burdens on the hospital and patients as well. Therefore, it is advised not to delay tracheostomy beyond 10 days of ETT in critically ill patient patients in the ICU to minimize the risks of VAP.

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