Original Article

Pondering for the Frequency of Routine Single-Lumen Tracheostomy Tube Change for Ongoing Airway Management in Adult Intensive Care Unit

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Abstract

Background: Tube blockage in the Intensive Care Unit (ICU) leads to preventable deaths. Routine change of tube for ongoing airway management is one of the indications for tracheostomy tube (TT) changes. However, there are limited data or evidence to recommend the frequency of such change. **Aim:** The study aims to determine the frequency of routine TT change in adult ICU patients. **Subjects and Methods:** A retrospective evaluation of ICU records of the patients who had been on TT for >5 days from July 2013 to April 2015 was performed. Data with regard to age, sex, diagnosis, and on tube days (TDs) before the TT was changed with either confirmed/suspicion of blockage and nonblockage were collected. Patients who had blockage and nonblockage were analyzed as individual groups as well as compared using INSTAT software to find the statistical estimates. **Results:** A total of 62 patients (72.58% males; mean ± standard deviation age: 50.62 ± 18.47 years; mean intubated days of 11.42) with a total of 1022 TT days were evaluated. Fifty-six episodes of tube blockage and 57 episodes (each >5 TT days) of nonblockage were analyzed and compared. The 95% confidence interval (CI) for mean of on TDs for nonblockage and blockage was 7.16–8.27 and 8.08–9.84 days, respectively, in the study population ($P = 0.0171$). **Conclusion:** The frequency for routine change of single-lumen TT for ongoing airway management in ICU patient should be 7–10 days taking the lowest 95% CI for nonblockage as the earliest point and the highest 95% CI for blockage as the late point.

Keywords: Airway management, critical care, time, tracheostomy

Introduction

Intensive Care Unit (ICU) patients need intubation and ventilation for a number of reasons, and many patients remain on tracheostomy tube (TT) for prolonged durations for ongoing airway management. Tube blockage is a common airway accident in the ICU.[1] There are instances of even losing patients' life due to tube blockage.[2,3] Routine change of tubes for ongoing airway management and prevention of infection is one of the indications for TT change.[4] It is suggested that a TT should be changed every 7–14 days after initial insertion.[4,5] However, these recommendations are not supported by good evidence, and yet, there is relative lack of data in this aspect to make an evidence-based decision. The present study aimed to assess the duration of on tube days (TDs) before the TT gets blocked or changed with either suspicion of or confirmed blockage in patients who are on TT for ongoing airway management in adult ICU. This will help in evidence-based decision-making on frequency of routine TT change for ongoing airway management as well as building data bank for future-pooled analysis.

Subjects and Methods

The present retrospective analysis was conducted at a tertiary care teaching hospital in Northeast India. The previously collected data on the broad objective of tube blockage and its impact were collected after approval

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from the institute research review board and ethical committee (project number: P-5/16/018). The ICU progress record files of the patients of an adult ICU of mixed category (medical, surgical, and trauma patients) who were treated from July 2013 to April 2015 were reviewed. Adult patients of either sex on TT for >5 days for ongoing airway management were included. Patients who remained intubated for <5 days on TT were excluded. Patients who were on tube for >5 days (initially on endotracheal followed by tracheostomy) but on TT for <5 days were also excluded [Figure 1]. Data with regard to the patients' age, sex, and diagnosis as well as on TDs before the TT was changed with either suspicion or confirmed blockages, and nonblockages till extubation/death or discharge were noted. Patients who were decannulated/discharged or who expired on TT or whose TT was changed in <5 days ago from discharge or death or decannulation were excluded the in nonblocked category for analysis to reduce the discrepancy between blocked and nonblocked category. INSTAT software (GraphPad Prism Software, Inc., La Jolla, CA, USA) was used to find the measures of dispersion and central tendencies for on TDs before TT got blocked or remained unblocked. These statistical estimates were then used to determine the frequency for routine tube change.

Results

A total of 527 files of intubated patients with 2514 intubated days were reviewed. Sixty-two (11.76%) patients with 1022 tracheostomy TDs met the inclusion criteria and were evaluated for this study. There were 45 (72.58%) males and 17 (27.42%) females in the study cohort. The mean ± standard deviation (SD) and 95% confidence interval (CI) age of the cohort were 50.62 ± 18.47 and 45.93–55.32 years, respectively. The mean (95% CI) intubated and ventilated days of the cohort were 11.42 (10.40–12.81) and 8.59 (7.79–9.38) days, respectively. The predominant diagnosis of the patients was cerebrovascular accidents (48.38%), and the predominant organ system involved was central nervous system (70.97%). The diagnosis-wise distributions are shown in Table 1. Forty-three (69.35%) of the 62 patients who were on TT for >5 days suffered from a total of 56 episodes of tube blockage. There were also 57 episodes (each >5 TT days) of nonblockage till decannulation or discharge or TT was changed without blockage with suspicion. The mean ± SD of the durations (on TDs) before the TT was changed for blockage was significantly higher than the nonblockage (8.96 ± 3.26 vs. 7.71 ± 2.07; $P = 0.01$). The measures of dispersion and central tendencies of these two categories of TDs are shown in Table 2.

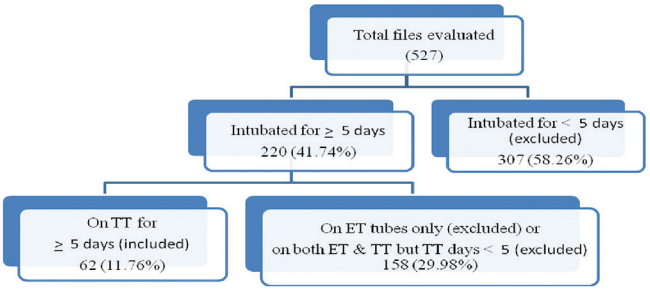

Figure 1: Hierarchy flowchart of the process for selection of sample. (TT: Tracheostomy tube, ET: Endotracheal tube)

Discussion

Tracheostomy is one of the most common procedures performed in the ICU. ICU patients need TT for many indications and advantages.[6,7] The American College of Chest Physicians guidelines suggest that tracheostomy should be considered after an initial period of stabilization on the ventilator (generally, within 3–7 days), when it becomes apparent that the patient will require prolonged ventilator assistance.[8]

TT needs to be changed periodically, and it is a common practice to electively change single-lumen tubes 10–14 days after initial insertion to prevent the development of granulation tissue around the TT and tube blockage from excessive secretions.[9] An observational study had reported fewer complications due to granulation tissue after

Table 1: Diagnosis- and organ system-wise distribution of the cohort

Diagnosis (*N*=62)	*n* (%)
Nervous system	44
Cerebrovascular accidents	30 (48.38)
Tubercular meningitis	3 (4.84)
Neurosurgery	2 (3.23)
Traumatic brain injury	2 (3.23)
Japanese encephalitis	1 (1.61)
Guillain–Barre syndrome/motor neuron disease	2 (3.23)
Others	5 (8.06)
Hollow viscus perforation postoperative	4 (6.45)
Chronic kidney disease	3 (4.84)
Road traffic accidents with polytrauma	2 (3.23)
Head and neck cancer postoperative	2 (3.23)
Pneumonia, pulmonary tuberculosis, COPD	4 (6.45)
Burn	1 (1.61)
Cancer	1 (1.61)

N: Total number, *n*: Number, COPD: Chronic obstructive pulmonary disease

Table 2: Measures of dispersions and central tendencies for blocked and nonblocked tube days

Statistical estimates	Blockage episodes (*N*=56)	Nonblockage episodes (*N*=57)	*P*
Range	5-22	5-14	0.0171
Mean±SD	8.96±3.26	7.71±2.07	
95% CI	8.08-9.84	7.16-8.27	
Median	8.5	7.5	

N: Total number, SD: Standard deviation, CI: Confidence interval

implementation of a policy where TTs were changed every 14 days.[10] ICU patients are at risk of more tube blockage as they are unable to clear their airways by coughing. Ventilator-associated pneumonia is also common in ICU which produces increased purulent sputum/tracheobronchial secretions. It has been shown to be associated with increased tube blockage incidents.[3] However, there are little evidence and data to guide the practice of routine single-lumen TT change in ICU patients for ongoing airway management. Blockage of the tube is one of the indications for tube change. Unfortunately, tube blockage has been reported to be associated with preventable ICU deaths.[2,3] Therefore, it is necessary to have data from ICU patients to build data bank and evidence-based decision. The practice of changing tubes in every 7–14 days for ongoing airway management is still mostly based on the consensus recommendations.[4,5] However, these consensuses are limited with regard to the first TT change and not very much meant for ICU patients.

In the present study, different durations of on TDs before the single-lumen TT got blocked and on TDs without getting blocked were analyzed. Statistical estimates were used to determine the frequency of changing the TT for ongoing airway management. A point estimate (i.e. mean) by itself is of limited usefulness because it does not reveal the uncertainty associated with the estimate.[11] Taking 95% CI into consideration for deciding the frequency will reduce the uncertainty associated with the mean. A 95% CI says that if the same population (patients of mixed ICU) is sampled on numerous occasions, there is a 95% chance that the CI calculated for tube blockage and nonblockage will contain the true population means. Therefore, taking the lowest 95% CI for nonblockage as the earliest point and the highest 95% CI for blockage as the late point to estimate the frequency for routine TT tube change, it is expected to arrive on the acceptable value in range. These values for the present study give the frequency as 7–10 days.

The finding of the present study indicates that the TT of the ICU patients should be removed between 7 and 10 days for routine ongoing airway management. Although this estimate is well within the consensus recommendation range (i.e., 7–14 days),[4,5] the suggested upper limit is lower in the present study. There is no doubt that the suspicion should always be there for early detection of blocked tubes, but routine change within 7–10 days range is expected to reduce blockade incidence as compared to 7–14 days.

TT blockage in ICU is mostly the result of inspissated secretions and blood clot.[12] Blockages can be prevented by suctioning and humidifying the air. Humidification minimizes the risk of developing thick and tenacious secretions, and failure to provide adequate humidification contributes to tube blockage.[13] As the nursing staffs are involved with the suctioning as well as humidification, the nurse–patient ratio and their knowledge on tube blockage and suctioning are also likely to affect the incidence and frequency of tube blockage. Knowledge of nursing staffs on tube blockage has also been shown to be poor, especially in newly rotated and less experienced staff.[14] Humidification was used in the entire cohort studied in the present analysis. However, the nurse–patient ratio in the current ICU was only 1:4–1:5 at the time of data collection. Different nurse–patient ratio and level of knowledge are expected in different setups. Therefore, even if the study is repeated in the same population, the result may be slightly different than the present study. The present study is also limited with the fact that it is a single-center, retrospective study. Hence, similar studies or prospective, multicenter studies from different areas and populations are likely to contribute more in building up the data bank. Such data will help us in making more strong evidenced-based decision in the future.

Conclusion

We conclude that the frequency for routine change of single-lumen TT for ongoing airway management in ICU patient should be 7–10 days. However, further prospective and multicenter studies are required to give more concrete range as well as validation.

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Conflicts of interest

There are no conflicts of interest.

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