Elective open tracheostomy for patients under prolonged mechanical ventilation—a study

U. P. Santosh · B. Sanjay Patil · Vinay Bhat · Sunil Pai

Abstract

Objective To determine the safety of elective open tracheostomy as a routine intensive care unit (ICU) procedure without any selection criteria, considering its peri- and post-operative complications.

Materials and methods This is a descriptive study conducted in two hospitals in Davangere for a period of three years between April 2005 and March 2008. 40 patients, both male and female, of all age groups who were under mechanical ventilation in whom open tracheostomy was performed were included in the study. All patients who recovered were followed-up for two months. Complications arising during this period were recorded in the proforma.

Results Our study consisted of 40 patients comprising 30 males and 10 females with male to female ratio of 3:1 and average age of 35 years, all undergoing open tracheostomy for prolonged mechanical ventilation. Various indications for mechanical ventilation included polytrauma, head injury, septicemia with multiorgan failure and dengue encephalitis. The complications which arised during the procedure and follow-up period included cardiac arrest, surgical emphysema, reactionary hemorrhage, pneumothorax, tracheo-cutaneous fistula, tracheo-oesophageal fistula.

Conclusion Elective open tracheostomy seems to be a safe and simple procedure, when performed by experienced surgeon under controlled circumstances, and should be considered as an option for mechanically ventilated patients.

Keywords Tracheostomy · Mechanical ventilation

Introduction

Tracheostomy is electively performed in critically ill patients requiring prolonged respiratory support or frequent bronchopulmonary toilet, or to help with weaning from mechanical ventilation. It is better tolerated than oral or nasal tracheal intubation and is thought to reduce sedation requirements and time in the intensive care unit (ICU) [1].

Traditionally, elective tracheostomy has been performed in the operating room (OR) by using the standard surgical techniques originally described by Jackson [2]. Ciaglia et al. [3] described a percutaneous dilational tracheostomy (PDT) based on a model proposed by Seldinger for endovascular intervention procedures. This technique, described as a bedside procedure, has found widespread acceptance as an alternative method to the conventional open procedure, since it eliminates risks associated to transporting critically ill patients and decreases costs related to the operating room. Both methods have been compared to assess their clinical (morbidity and mortality), surgical (technique), and/or financial (cost) differences, but results are controversial, and there are insufficient data to establish a clear superiority of the PDT technique.

The approach of elective open tracheostomy has proved to be safe in selected patients. In a prospective randomized study, Massick et al. [4] found excellent results and stated that elective open tracheostomy represents the standard of care in bedside tracheostomy, since it provides a more secure airway at markedly reduced patient charge.

U. P. Santosh · B. S. Patil · V. Bhat · S. Pai
Department of ENT,
JJM Medical College,
Davangere, India

V. Bhat (✉)
e-mail: drvinaybhat@gmail.com

However, the use of very rigid selection criteria excluded many patients who might have benefited from this approach. No evidence supports these exclusion criteria, and it is not clear whether they are really necessary.

The primary objective of this study was to determine the safety of elective open tracheostomy as a routine ICU procedure without any selection criteria, considering its peri- and postoperative complications.

Materials and methods

It is a descriptive study conducted in two hospitals of Davangere for the period of three years, between April 2005 and March 2008

During this study, prior to tracheostomy brief history was noted about all the patients. A general physical and systemic examination was carried out and thorough local examination was done. Investigations were individualized for each patient consisted of chest X-ray PA view, X-ray neck lateral view, Hb%, BT, CT, PT, APTT and renal function tests, ECG for middle aged and older patients and oxygen saturation was monitored throughout the procedure. Informed consent was taken for surgery and follow up also from the patient's relative. Bedside elective tracheostomy was performed by conventional open surgical technique under local anesthesia with patient's vitals being monitored by an intensivist. Vertical incision technique was used in all patients. Cuffed Portex tracheostomy tube of different sizes according to age of the patient was used. All the patients were observed for complications during the procedure and follow up for the period of two months. First follow up was done one week after discharge. Second follow up was conducted two weeks later last follow up was done after two months. During second follow up strapping of the tracheostomy site was done.

Results

In our study a total of 40 patients underwent bedside elective open tracheostomy during the course of mechanical ventilation. Reasons for mechanical ventilation in above patients included polytrauma, head injury, organo-phosphorous poisoning, septicemia with multi organ failure, dengue

encephalitis etc. In this study of 40 patients, 30 were male and 10 were female with a male to female ratio of 3:1 and average age of 35 years, youngest being 18 years and oldest being 60 years.

One patient (2.5%) developed cardiac arrest during the procedure and he was revived successfully and procedure was completed. 1 patient (2.5%) developed surgical emphysema involving face, neck and upper chest during first six hours after the procedure. He was managed conservatively and it subsided after three days. 1 patient (2.5%) developed hemorrhage from operated site during first post operative day. Tracheostomy site was reopened and bleeding vessel was ligated. 1 patient (2.5%) developed left sided pneumothorax during second post operative day. He was managed by insertion of inter costal drainage tube. 1 patient (2.5%) developed tracheo-cutaneous fistula during second post operative week. The patient was managed by excision of fistulous tract and secondary suturing under local anesthesia. 2 patients (5%) developed tracheo-oesophageal fistula during the 3rd post operative week and they were referred to thoracic surgeon for further management (Table 1).

Discussion

Tracheostomy is performed primarily in critically ill patients who require prolonged mechanical ventilation and/or in whom multiple attempts to wean from mechanical ventilation have been unsuccessful for 14–21 days. Tracheostomy facilitates weaning by decreasing the work of breathing in patients with limited reserve. However, the effect on dead space ventilation is marginal. Tracheostomy decreases the requirement for sedation and may allow for earlier patient mobilization, feeding, and physical and occupational therapy. Less common indications include relief of upper airway obstruction, severe sleep apnea, difficult airway, and pulmonary secretion clearance. The main complications of prolonged tracheal intubation are ventilator-associated pneumonia and the adverse effects associated with persistent sedation. Local complications including subglottic stenosis are more likely if tracheal intubation is continued for more than 2 weeks.

Tracheostomy procedures have been associated with high morbidity and mortality. So it has been thought that the procedure should be performed in the operating room

Table 1

Complications	Time	No of patients	Percentage
Cardiac arrest	Intraoperative	1	2.5%
Surgical emphysema	6 hrs	1	2.5%
Hemorrhage	1st day	1	2.5%
Pneumothorax	2nd day	1	2.5%
Tracheo-cutaneous fistula	2nd week	1	2.5%
Tracheo-oesophageal fistula	3rd week	2	5%

because of the need for adequate lighting, instruments, and support facilities [5]. However, some problems must be handled under this circumstance, including the hazard of moving critically ill patients to the operating room the associated cost, and the inconvenience of the operating room schedules. The PDT procedure helped to resolve some of these issues. It convinced surgeons and intensivists that tracheostomy could be done at the bedside. The good outcomes seen in several series led to a change in ICU practices worldwide. Comparative studies of PDT and elective open tracheostomy showed similar results regarding complications. Two recent meta-analyses showed similar rates of major peri-procedural and long-term complications for both procedures.

Unfortunately, exclusion criteria such as anatomic features (obesity and cervical features such as distance between cricoid and supraasternal notch) surgeon's preference, and/or higher FiO₂ requirements, limit a more widespread use of bedside procedures (both PDT and elective open tracheostomy).

Patients who had a neck injury or were morbidly obese were included in our series and probably would have been excluded if literature criteria had been used. Unfortunately, we were unable to identify how many more patients would have been assigned to the operating room tracheostomy based on literature criteria; because anatomical landmarks were not considered exclusion criteria. Despite this absence of selection criteria, our average procedure time and complication rate were similar to those now available for open tracheostomy performed either at bedside or in the operating room. Our median procedure time was 20 minutes, but a large range was observed (8–60 minutes). This can be explained by the fact that even patients with unfavorable anatomical features such as distance between cricoid and supraasternal notch were included. In these cases, dissection and tracheal exposition can be difficult and more time consuming.

We identified three crucial principles for good results with bedside tracheostomy. First, the team must be expert with tracheostomy. Many people think that tracheostomy is a simple procedure, and the least trained surgeon usually performs it. In the ICU, the consequences of inexperience

may be disastrous. Surgeons experience is very important for managing complications. Second, team cooperation is essential. Nurse staff and intensivist must be committed for successful outcomes. Third, there must be adequate lighting and material, and everyone involved must know all the procedural steps.

However, the absence of a control group limits the power of our conclusions. The absence of some information such as APACHE II scores, ventilatory parameters, coagulation disorders, and intraoperative bleeding quantification are a consequence of incomplete recordings. Unfortunately, these gaps in the data also weaken our conclusions and prevent statistical analysis that would be of great interest.

Conclusion

We must seek the safest, simplest and least expensive procedure, even if it looks old-fashioned. Elective open tracheostomy seems to be a safe and simple procedure. It is cheaper than other techniques and should always be considered as an option for ICU patients who are under prolonged mechanical ventilation.

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