Bedside open tracheostomy at intensive care unit—our experiences of 1000 cases at a tertiary care teaching hospital of eastern India

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ABSTRACT

Introduction: Tracheostomy is usually done on critically ill patients those requiring prolonged mechanical ventilation at the intensive care unit (ICU). Bedside tracheostomy is often helpful for avoiding transferring the unstable patients to operation theater and also minimizing the cost.

Aim: Assessing the safety, cost and procedure time, complications of bedside open tracheostomy at intensive care unit considering comparison to open tracheostomy at operation theater and bedside percutaneous dilatational tracheostomy (PDT) with its complications, cost and its simplicity.

Materials and methods: This descriptive retrospective study was carried out at a tertiary care teaching hospital during December 2006 to January 2016. It included 1000 patients, undergone open bedside tracheostomy along with 152 undergone open tracheostomy at operation room (OR) and 112 bedside PDT. All these patients were undergone bedside tracheostomy, followed up for next 3 months. Complications occurring during and after tracheostomy were documented.

Results and discussion: This study group comprised patients with age group of 8 years to 82 years. The complications among open bed side tracheostomy within 30 days were 10 minor bleeding, 1 major bleeding, 2 cardiac arrest, 1 pneumothorax, 6 stomal sepsis, 5 cervical emphysema. Late complications like 2 laryngotracheal stenosis (LTS) were seen where as other complication like tracheocutaneous fistula and tracheoinominate fistula were not observed. The complications rate is less in bedside open tracheostomy than open tracheostomy at OR and bedside PDT in our study.

Conclusion: Bedside elective open tracheostomy is safe, effective, cost effective and allowing timely tracheostomy with low morbidity.

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1. Introduction

Tracheostomy is one of the frequently done procedure on critically ill patients those requiring prolonged mechanical ventilation at the intensive care unit (ICU). Tracheostomy is done in about 24% of all patients at ICU.1 The advancement of medical treatment among critically ill patients, resulted in more patients at intensive care unit and requiring airway and ventilator support.2 Tracheostomy is needed in critically ill patients those require prolonged respiratory support or bronchopulmonary toileting or helping the patient during weaning from mechanical ventilation. Tracheostomy is better tolerated by the patients in comparing to oral or nasal intubation and it decrease the sedation requirement and period of stay at the ICU.3 Tracheostomy helps to decrease the need of sedation, allow mobilization, feeding and physical and occupational therapy (Table 1). The important complications of prolonged translaryngeal intubation are ventilator associated pneumonia and the adverse effects with long standing sedation. The more dreaded complications of prolonged ventilation with translaryngeal intubation are subglottic stenosis. The risk of transporting sick patients are associated with increased cost of the procedure and operation room schedule are some of the obstacles for wide acceptance of open tracheostomy at Operation room (OR). Elective open tracheostomy needed for ICU patients has been performed in the OR by using classical surgical technique as described...
by Ciglia et al. 5 which was based on concept by Seldinger. Percutaneous dilatational tracheostomy (PDT) was described by Ciglia et al. 5 which was based on concept by Seldinger. 4 Percutaneous dilatational tracheostomy (PDT) was a bedside procedure, has been found widespread acceptance in comparison to open method at OR since it eliminates risk associated to avoid transporting critically ill patients and minimize the cost related to operating room. 6 Both techniques considering their clinical/mortality and morbidity, surgical technique and financial aspect, results are controversial. Their insufficient data to establish a clear superiority of the PDT over open one. Bedside open tracheostomy has several advantages over doing it at operating room. Doing tracheostomy at bedside avoids transfer of the patients to OR where transferring these unstable patients cause deterioration of vital signs.

2. Aim

The aim of this study is to find out the safety of open bedside tracheostomy as a routine Intensive care unit (ICU) procedure without taking any selection criteria and considering its peri-operative complications.

3. Materials and methods

This study was conducted in our tertiary care teaching hospital for the period of ten years, between December 2006 to January 2016. This study was approved by Institutional ethical committee (IEC) and written consent was taken from patients relatives in each cases. Indications and timing of tracheostomy were decided by intensivist. There was no selection criteria like age, history of difficult intubation, anatomical landmark were adopted. Other than 152 open tracheostomy at OR and bedside PDT, open bedside elective tracheostomy was done by conventional open surgical method under local anesthesia in 1000 cases. Patient’s vitals were monitored by intensivist during the procedure. Before doing the tracheostomy, the patient’s ventilator was changed to a set rate of 16 breaths per minute. Pulse oximetry and hemodynamic were monitored during the procedure. In open tracheostomy (Fig. 1), vertical incision was made at the midline of the neck two fingers above the suprasternal notch. Cuffed portex tracheostomy tube was used and the size of the tubes decided according to the age of the patients. Chest X-ray was routinely done just after tracheostomy for confirming the placement of tube and to assess the pneumothorax. Complications of open bedside tracheostomy were assessed up to three months and compared with open tracheostomy at OR and bedside PDT. Bleeding from the stoma around tracheostomy tube was considered major if blood transfusion is needed and exploration of the wound is needed. Bleeding was considered minor, if it is controlled by digital compression or cautery or gauze packing. Infection of the stoma is considered when cellulitis occurs around the stoma. Costs of the open bedside tracheostomy, OR open procedure and bed side PDT was calculated by financial department of the hospital. The cost of the procedure includes surgeon’s fees, materials, drugs, bronchoscopy charges during PDT, kits for PDT and OR charges as applicable are considered in our study.

4. Results

There are total 1000 patients underwent elective bedside open tracheostomy and 152 open tracheostomy at OR and bedside PDT. The reasons for tracheostomy among all cases were prolonged ventilation and pulmonary toileting. The causes for mechanical ventilation in above patients were head injury, organophosphorous poisoning, polytrauma, septicemia, post operative brain surgery etc those admitted in neurosciences, medical, gastroenterology, cardiac, surgical and pediatric intensive care units of our tertiary care teaching hospital. Among 1000 bed side open tracheostomy patients, 682 were male and 318 were female with male to female ratio of 2.14:1, whereas in open tracheostomy at OR is 1.53 (92 male/60 female) and in bedside PDT is 1.66 (70 male/42 female). The average age of the patient’s undergone tracheostomy among all three techniques is 32 years, youngest being 8 years and oldest being 82 years. The complications are summarized in Tables 2 and 3 and its comparison to other study are given in Table 4. Bleeding was the most common complication. Among bedside open tracheostomy, eleven patients developed hemorrhage from operative site during first post operative day. The tracheostomy site was checked with identification of bleeding point and ligations done at bed side. In one patient, exploration of neck was done at Operation Theater. In such patient, blood transfusion was needed. Two patients developed cardiac arrest during the tracheostomy but the patient was revived successfully. Five patients developed surgical emphysema in the neck and facial area during first six hours of the tracheostomy. The surgical emphysema was managed conservatively and it was subsided after 5th day. One patient developed right sided pneumothorax during first post operative day and the patient was managed by insertion of intercostals drain. Infections at the stoma are seen in 6 cases treated with broad spectrum antibiotics and daily dressing. The infections subsided after treatment of 2 weeks. Among open bedside tracheostomy, in two cases after one month, decannulation was difficult, diagnosed as laryngotracheal stenosis (LTS) confirmed by computed tomography (CT scan) of the neck. In open tracheostomy at OR and bedside PDT developed LTS in 1 and 2 cases respectively. Even some complications like trachea-esophageal fistula, trachea-cutaneous fistula, posterior tracheal wall lesion and accidental extubation are described in literature; no such complications were seen in open tracheostomy in OR whereas 1 case of trachea-esophageal fistula is seen in open bedside tracheostomy and 2 such cases of complications were seen in bedside PDT. The cost of the procedure includes surgeon’s fees, materials, drugs, bronchoscopy charges during PDT, kits for PDT and operating room (OR) charges as applicable are compared in Table 5. The median procedure duration was 12 min in our series. There was no death related to bed side open tracheostomy seen in our study.

5. Discussion

Tracheostomy is one of the common surgical procedure done on the critically ill patients at the intensive care unit (ICU). Tracheostomy is the surgical procedure which involve the incision over the trachea whereas the term tracheostomy is the procedure which involve incision on the trachea followed by insertion of tracheostomy tube with maintenance of patency of the opening on
Tracheostomy is a standard surgical procedure for the management of long term ventilator dependent sick patients. Initially this surgical procedure has been done by surgeon at the OR by open technique. Recent introduction of bedside PDT has been reported as a cost effective alternative. Tracheostomy is done more often in these days in critical ill patients due to improvements in treatment standards in intensive care unit. Tracheostomy has several advantages over trans-oral endotracheal intubation. The advantages are smaller dead space, lower airway resistance, less movement of the tube within the trachea, greater patient comfort and more effective suction of the secretions. Tracheostomy is better tolerated than oral intubation and reduce sedation requirement and duration in the ICU. Bed side or OR open tracheostomy or bedside PDT have similar clinical indications such as protection of the larynx and upper airways, as well as weaning from prolonged mechanical ventilation. Bed side tracheostomy takes less time to perform the procedure with low morbidity. The concept behind bedside open tracheostomy is attractive and supported by many people. The intensivist and surgeon like for doing it at intensive care unit. Bed side approach is often a safe procedure in ICU patients. One study by Massick et al. showed excellent result of open bedside tracheostomy as it gives more secure airway at a markedly reduced patient charges. Using rigid selection criteria excludes many patients for benefiting from this bedside open tracheostomy. No evidence gives support these exclusion criteria and it is doubtful whether they are really needed. Cost of the procedure is usually less if it is performed at the bedside. Bedside PDT with bronchoscopic guidance is more costly than simple bed side tracheostomy. Open tracheostomy is preferable to PDT in certain situations like coagulation abnormality, unstable/fragile cervical spine, neck injury, high level ventilator support(FiO2 > 7 and PEEP > 10 cm H2O), unfavorable neck anatomy(previous surgery, tumour etc) and obesity. For successful bedside tracheostomy at ICU, the team must be expert with tracheostomy procedure. Often people think tracheostomy is a simple surgical procedure and can be done by least trained surgeon. But due to inexperience, it may lead to disastrous condition. Surgeon’s experiences are paramount for managing the complications of tracheostomy. Intensivist and nursing staff co-operations towards the procedure are important for successful result. Adequate lightening and positioning of the patients makes procedure simple and rapid. As cost of the open bed side tracheostomy is less and risk of trans-

| Table 2 | Complications seen in open bed side tracheostomy. |
|-----------------|-----------------|-----------------|
| Complications | Number of patients | Time |
| Hemorrhage      | 11 (Minor-10, Major-1) | Within 72 h of surgery |
| Surgical emphysema | 5 | Within 6 h of surgery |
| Infections at the stoma | 6 | During surgery |
| Cardiac arrest | 2 | After one month |
| Pneumothorax | 1 | During surgery |
| Laryngotracheal stenosis | 2 | After one month |
| Tracheo-oesophageal fistula | 0 |
| Tracheo-cutaneous fistula | 0 |

| Table 3 | Complications among open bed side tracheostomy, open tracheostomy at OR and bed side PDT. |
|-----------------|-----------------|-----------------|-----------------|
| Complications | Bed side open Tracheostomy (n = 1000) | Open Tracheostomy at OR (n = 152) | PDT (n = 112) |
| Hemorrhage | 11 (1.1%) | 5 (3.28%) | 3 (2.67%) |
| Surgical emphysema | 5 (0.5%) | 4 (2.63%) | 1 (1.78%) |
| Infections at the stoma | 6 (0.6%) | 5 (3.28%) | 3 (2.67%) |
| Cardiac arrest | 2 (0.2%) | 1 (0.65%) | 0 |
| Pneumothorax | 1 (0.1%) | 1 (0.65%) | 0 |
| Laryngotracheal stenosis | 2 (2%) | 1 (0.65%) | 2 (1.78%) |
| Tracheo-oesophageal fistula | 1 (0.1%) | 0 | 3 (2.67%) |
| Tracheo-cutaneous fistula | 0 | 0 | 0 |

Fig. 1. Picture showing steps of bedside open tracheostomy.
be expert and committed for successful outcome. The procedure must be standardized and must have adequate lightening, materials and everybody involved in the procedure must know the steps. We believe that economical and clinical advantages of open bedside tracheostomy at ICU over other methods are worth consideration in selecting tracheostomy. We always need safest, simplest and least expensive technique in our day to day medical practice. Even open bedside tracheostomy looks old fashioned, is safe and simple procedure and cheaper than other procedure. Open bedside tracheostomy should be an option at ICU patients those requiring tracheostomy.

### 6. Conclusion

Everybody wants the safest, simplest and least expensive technique in medical practice. Bedside elective open tracheostomy is still simple and safe procedure in comparison to other technique. It is low cost and considered to be a better option for ICU patients those need prolonged mechanical ventilation. After accurate clinical and economical analysis of different methods of tracheostomy for ICU patients, open bedside technique is worth considering in patients who need tracheostomy for prolonged mechanical ventilation. The open bedside tracheostomy can be safely done at ICU without transporting patients to the operating room, thereby avoiding the hazards of the transportation and minimize the cost.

### References