Kathmandu University Medical Journal (2006), Vol. 4, No. 3, Issue 15, 275-280

Original Article

Percutaneous dilational tracheostomy: An initial experience in community based teaching hospital

Joshi S[1], Agrawal B[1], Deo GP[2], Bhattarai BK[3], Rahman TR[3], Biswas BK[3]
[1]Assistant Professor, [2]Resident, [3]Associate Professor, Department of Anaesthesiology and Critical Care, B. P. Koirala Institute of Health Sciences, Dharan, Nepal.

Abstract
Percutaneous dilational tracheostomy (PDT) is frequently performed in the intensive care unit to prevent the long term complications associated with prolonged endotracheal intubation.
Objective: To report the analysis of our experience with percutaneous dilation tracheostomy.
Study Design: A prospective documentation of 40 patients who received percutaneous dilational tracheostomy in a multidisciplinary intensive care unit during a 12-month period.
Method: The patients demographic, indications of intubation and PDT, time required to perform the procedure, complications and the outcome of these patients in the intensive care unit were noted.
Result: Among 425 patients, 40 underwent percutaneous dilational tracheostomy that included 22 females and 18 males with the median age of 35 years. Prolonged ventilatory support was the most common indication for tracheostomy. The average duration of intubation before PDT was 5 days. Median procedure time was 20 minutes. Complications included minor bleeding in two (5%), subcutaneous emphysema with pneumothorax in two patients (5%), tracheal stenosis in three (7.5%), tracheo-esophageal fistula and glottic granuloma in one patient each (2.5%). Among forty patients, 28 (70%) were discharged to the ward, 8 died in intensive care unit and 4 left hospital against medical advice.
Conclusion: Percutaneous dilational tracheostomy is a safe, quick and effective way for long term airway management in critically ill patients.

Tracheostomy is a well established and frequently performed technique in many intensive care units (ICU) [(1)]. In addition to facilitate weaning, the other important reasons to perform tracheostomy are long term airway protection and pulmonary toileting.

Percutaneous dilational tracheostomy (PDT) is less invasive and safe beside procedure. Several modifications of percutaneous technique have been described [(2)]. We used Ciaglia percutaneous dilational tracheostomy set to perform tracheostomy. This technique involves the sequential use of serial dilators of increasing diameter to create a tracheostome.

To our knowledge, no institute or hospital of Nepal has reported the use of percutaneous dilational tracheostomy to tracheostomise patients either in the intensive care units or in the operating rooms. The purpose of our report is to describe the initial experience with percutaneous dilational tracheostomy in the intensive care unit.

Material and methods

As per requirements and indications, PDT had been performed in patients admitted in the 6- bed general intensive care unit at B.P. Koirala Institute of Health Sciences, Dharan between July 2003 and June 2004. Written informed consent was obtained from the relatives of the patients.

All patients were anaesthetized with Midazolam, Pethidine and Vecuronium. Patients with short, thick neck, coagulopathy and enlarged thyroid gland were not eligible for the procedure. Progressive dilatation percutaneous tracheostomy using Ciaglia percutaneous dilational tracheostomy kits (Cook Critical Care Inc.) was performed at the bedside in the ICU. A PDT kit (Fig 1) included a disposable scalpel blade, an introducer needle, a J-tip flexible guide wire, a short rigid introducing dilator, an 8 FG-guiding catheter, and several curved dilators of graduated size (12FG, 18FG, 21FG, 24FG, 28FG, 32FG, and 36FG) with an optional 38FG dilator.

Correspondence
Dr. Sumati Joshi
Assistant Professor,
Department of Anaesthesiology and Critical Care,
B. P. Koirala Institute of Health Sciences, Dharan, Nepal
E-mail: gs_malla@yahoo.com

PDT was performed by two consultant anaesthesiologists or the anaesthesia trainees under direct supervision. The tracheostomy tubes used for PDT were 7- 8.5mm in internal diameter.

Patients were already intubated prior to tracheostomy. They were ventilated with 100% oxygen throughout the procedure. Electrocardiogram, non-invasive blood pressure, SpO_2 and end-tidal CO_2, tidal volume and airway pressure were monitored during the procedure. Patients were positioned with a transverse roll under the shoulder blades to extend the head and neck to facilitate the identification of landmark and ease tracheostomy. Endotracheal tube was withdrawn under vision with direct laryngoscopy to the level of glottic opening to keep the tracheal lumen free for PDT. The neck was cleansed with antiseptic solution and properly draped. The cricoid cartilage was identified, and the skin was anesthetized with 2% lidocaine with 1:200,000 adrenaline below the cricoid cartilage. A 1.5- to 2-cm transverse skin incision is made at the level of the second and third tracheal rings. Then blunt dissection in the midline was performed until tracheal rings were identified. Introducer needle, attached to a saline filled 5cc syringe was introduced into the trachea and the position was confirmed by free flow of air on aspiration. Guide wire was passed through the needle and the needle was removed leaving the guide wire in situ.

The serial dilators ranging from 21 and 36 FG were advanced over the guide wire and guiding catheter through the soft tissues and into the trachea up to it's marking of 36 FG external diameter to make a tracheostome (Fig 2). Tracheostomy tube was fitted over 24 FG loading dilator and advanced through the stoma once maximum dilation of 36 FG was achieved (fig 3). The position of tracheostomy tube was confirmed by capnography, adequate tidal volume, SpO_2 and easy passage of suction catheter and then the oral endotracheal tube was removed. Tracheostomy tube was secured with the ribbon gauge.

Prospective documentation of data was done to analyze age, sex, diagnosis, indication and duration of intubation, indication of PDT, time required to perform PDT, complications, length of stay in the ICU and the outcome of these patients. Time to perform the procedure was defined as interval from skin incision until connection of tracheostomy tube to the ventilator.

Fig 1: Ciaglia Percutaneous dilational Tracheostomy Kit

Fig 2: Dilation with 36 FG dilator during PDT

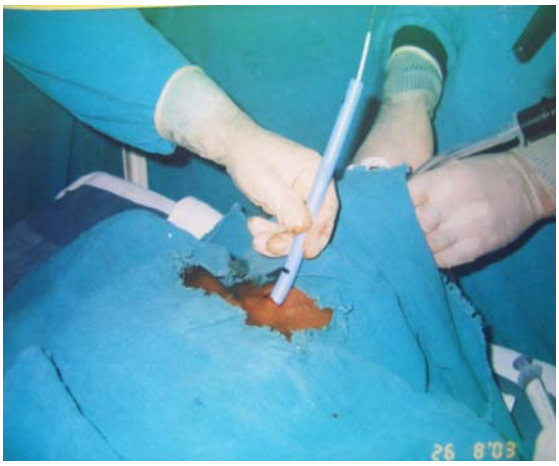

Fig 3: Tracheostomy tube fitted over the 24 FG loading dilator

Results

During the 12-month period of prospective data collection, forty (9.4%) among 425 patients admitted in ICU required tracheostomy (table 1). The mean patient age was 35 years (range 18-65 years). Most of them were females. Head injury was the most common diagnosis (20%) for tracheal intubation followed by post operative patients, drug overdoses (17.5%) and infections (15%) (Table 2) In all patients, trachea was intubated orally for median duration of 5 days (range 1-15 days) before the procedure. Oral intubated were done at various locations of the hospital but all PDT were performed bedside in the intensive care unit. Anticipated prolonged ventilatory support (22/40, 55%) was the most common indication for PDT. Others were for airway protection (14/40, 35%) and pulmonary toileting (4/40, 10%). The median duration of the procedure was 20 minutes (range 13-32 min).

Complications associated with the procedure are shown in table 3. The most common complication was minor bleeding (<10ml) which occurred in three patients; however the bleeding was easily controlled with sustained pressure over the site. A false passage was created in a patient during the procedure which was detected immediately and the procedure was restarted. Subcutaneous emphysema associated with pneumothorax was documented in two patients within 24 hours; that was treated appropriately with intercostal chest drains. Other complications were tracheal stenosis, tracheo-esophageal fistula and glottic granuloma. Three patients had tracheal stenosis, two of them underwent tracheal dilatation successfully and one patient was sent abroad for laser surgery. A patient developed tracheo-esophageal fistula that was detected within a month. Glottic granuloma in another patient was excised. None of the patients were hypoxic or had bradycardia during and following the procedure. Stomal infection was not noted in any patients. The overall complication rate was 27.5% (11/40) but there were no intraoperative or immediate post procedural mortality.

The median ICU stay was 14 days (range 3-58 days). Among 40 patients with PDT, 28 were discharged from ICU to the ward, 8 died in the ICU and 4 left against medical advice.

Table 1: Patient Demographics

Total no. of patients	425
Total no. of PDT	40
Age (years)	35(18-65)
Sex	
Male	18
Female	22
Location of intubation	
Emergency	13
ICU	11
Ward	9
Operating room	7
Intubation prior to PDT (days)	5 (1-15)
Operating time (minutes)	20 (13-32)
Total days in ICU	14 (3-58)

Table 2: Diagnosis of patients admitted in ICU requiring PDT

Diagnosis	No. of patients	%
Road traffic accident: head injury	8	20.0 %
Drug Overdose	7	17.5 %
Post operative: Viscus perforation, Eclampsia, intestinal obstruction,	7	17.5 %
Infections: cerebral malaria, meningitis, Encephalitis,	6	15.0 %
COAD, Pneumonia	5	12.5 %
Hypoxic encephalopathy, CVA,	4	12.0 %
Guillian Barré syndrome	2	5.0 %
Burn	1	2.5 %

Table 3: Procedural complications

	Number	%
No complications	29	72.5%
Minor bleeding	03	7.5%
False passage	01	2.5%
Subcutaneous emphysema & & pneumothorax	02	5%
Glottic granuloma	01	2.5%
Tracheal stenosis	03	7.5%
Tracheo-esophageal fistula	01	2.5%

Discussion

Tracheostomy is a better alternative to oral or nasal intubation because it is well tolerated and eases pulmonary toileting as well. The requirement for less sedation and analgesia facilitates early weaning from the ventilator. Surgical tracheostomy is routinely performed by the ear, nose and throat (ENT) surgeons. Modification of tracheostomy technique has lead to introduction of percutaneous tracheostomy in 1955 that did not gain much popularity because of associated fatalities [3]. Ciaglia and colleagues in 1985 reintroduced the technique as percutaneous dilational tracheostomy [4]. Since then it has almost replaced the conventional (surgical) tracheostomy in critical care setup. Meta-analysis concluded that percutaneous tracheostomy is simpler, quicker and safer bedside procedure with lower complication rate that the surgical approach [5]. Evidence also suggests that the incidence of

ventilatory associated pneumonia may be lower following tracheostomy [6].

We report our early experience of percutaneous dilational tracheostomy in which a total of 40 patients admitted in ICU underwent tracheostomy. We used Ciaglia percutaneous dilational tracheostomy kit because of its availability in the hospital. The appropriate timing of the tracheostomy in intubated patients is yet to be defined. In our report, the mean duration of intubation prior to tracheostomy was 5 days. The earliest tracheostomy (within 24) performed in our report was in a patient with massive facial burn in anticipation of requiring prolonged ventilatory support and delayed PDT was on the 15th day of intubation in another patient as the relatives of the patient failed to consent for the procedure. A recent study compared early (within 48 h) with late (at day 14–16) tracheostomy using a prospective randomized controlled trial in ICU patients[6]. They found a decreased mortality [19/60 (early) vs. 37/60 (late)] and a significantly decreased use of resources in the ICU, including length of stay and days ventilated in early group.

The median time required to perform PDT was 20 minutes. The minimum time in our report was 13 minutes. The time was comparable with Donaldson et al who reported a mean time of 13.2 minutes but Bewsher et al completed PDT in 2 min 7 sec[7, 8]. Our early experience may have contributed for longer time to perform the procedure. Percutaneous tracheostomy is not without complications but fatal life threatening complications are rare. The peri-procedural complication rate with percutaneous dilational tracheostomy (PDT) technique is 4 to 15%[9]. Twenty nine patients (72.5%) in our report were without complications. The most common intra-operative complication was bleeding described oozing (<10ml) which was noted in three patients. Freeman et al conducted meta-analysis of trials comparing percutaneous and surgical tracheostomy in critically ill patients reveals that PDT was associated with less perioperative bleeding, less postoperative complications, lower postoperative bleeding and stomal infections[5]. Subcutaneous emphysema associated with right-sided pneumothorax was recorded in two patients requiring intercostals chest drain. Chest X-ray was done in all the patients following PDT.

Blind insertion of introducer needle can cause tracheal injury more frequently leading to the development of potentially life threatening complications as tension pneumothorax, pneumomediastinum and even false passage. There are evidences to suggest that use of bronchoscopes to visualise the correct position of introducer needle into the tracheal lumen during PDT decreases the chances of complications related to the procedure[10]. We could not perform bronchoscopy because of the unavailability of the equipment in the department. The other complications encountered were glottic granuloma, tracheo-esophageal fistula and tracheal stenosis. Three patients who developed tracheal stenosis remained intubated for 13 or more days prior to PDT. The definite cause of stenosis could not be established but CT neck confirmed stenosis. The other patient who developed tracheo-esophageal fistula was discharged from the hospital following successful repair of the fistula. There were no mortalities related to PDT. Among 40 patients with PDT, 28 (70%) were discharged to the ward, 8 (20%) died in ICU and 4(10%) patients left ICU against medical advice with tracheostomy in situ. Among 28 patients, 20 (71.4%) were decannulated and discharged from the hospital and 8 died in the ward within a month.

Conclusion

Our study shows PDT can be done safely in hospitals and with low morbidity and mortality rates. With growing operator and experience, most of the tracheostomy performed in our ICU is PDT. We expect the use of PDT in other hospitals of Nepal because it is safe, minimally invasive technique and easy to perform.

Reference

1. Cooper RM. Use and safety of percutaneous tracheostomy in intensive care. Report of a postal survey of ICU practice. Anaesthesia 1998; 53: 1209–12
2. Sirak Petros. Review Percutaneous tracheostomy. Critical Care 1999, 3:R5-R10
3. Shelden CH, Pudenz RH,Freshwater DB, Crue BI. A new method for tracheostomy. J Neurosurg 1955; 12: 428-31.
4. Ciaglia P, Firsching R, Syniec C. Elective percutaneous dilational tracheostomy. A new simple bedside procedure, preliminary report. Chest 1985; 87: 715–9.
5. Freeman BD, Isabella K, Lin N, et al: A meta-analysis of prospective trials comparing percutaneous and surgical tracheostomy in critically ill patients. Chest 2000;118:1412–1418
6. Rumbak MJ, Newton M, Truncale T, Schwartz SW, Adams JW, Hazard PB. A prospective, randomized, study comparing early percutaneous tracheostomy dilational to prolonged translaryngeal intubation (delayed tracheostomy)

in critically ill medical patients. Crit Care Med 2004; 32: 1689–94.).
7. Donaldson DR, Emami AJ, Wax MK. Endoscopically Monitored Percutaneous Dilational Tracheostomy in a Residency Program. Laryngoscope 2000; 110:1142-6.
8. Bewsher MS, Adams AM, Clarke CW, McConachie I, Kelly DR. Evaluation of a new Percutaneous dilatational tracheostomy set apparatus. Anaesthesia 2001; 56: 859–64.
9. Friedman Y, Mayer AD. Bedside percutaneous tracheostomy in critically ill patients. Chest 1993; 104:532-535.
10. Frosh A, Thomas ML, Weinbren J, Djazaeri B, Richards A. Tracheal ring rupture and herniation during percutaneous dilatational tracheostomy identified by fibreoptic bronchoscopy. Review of Laryngology Otology Rhinology (Bord) 1997; 118: 179 80.