Case Series

CLINICAL EXPERIENCE WITH 100 CASES OF PERCUTANEOUS DILATATIONAL TRACHEOSTOMY WITH AND WITHOUT BRONCHOSCOPIC GUIDANCE

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We performed 100 cases of percutaneous tracheostomy with forceps dilatational method in a period of 20 months. 50 cases were performed under bronchoscopic guidance (group A) and other 50 cases without bronchoscopic guidance (group B). 54 patients underwent procedure in Surgical Intensive Care Unit (SICU), 36 patients in operating room and 10 in the other areas of the hospital. Maximum number of patients (37) were neurosurgical. Only 2 patients underwent tracheostomy in first 5 days, whereas 76 of them had tracheostomy done between 11-20 days of endotracheal ventilation. Technical difficulties were encountered during the procedure in both groups. We found that tracheal puncture (25 cases) and forceps dilatation (13 cases) are difficult steps of the procedure requiring multiple attempts and supervision. We did not encounter any life threatening and major complications. However commonest complication during the procedure was minor bleeding (9%). Other complications in both groups were in the similar range and negligible. Absence of bronchoscopic guidance has not increased the morbidity directly but the procedural time was increased significantly in group A (8.76 min) compared to group B (6.04 min).

We concluded that PDT without bronchoscopic guidance is safe and easy procedure and resulted in shorter duration of the procedure. However we believe that use of bronchoscopic guidance will enable operator to avoid technical difficulties and decrease complications.

TRACHEOSTOMY IS A VALUABLE tool in airway protection and prolonged assistance of mechanical ventilation of critically ill patients. About 12.5% of all critically ill patients require tracheostomy during their stay in intensive care unit. [1] In fact this is the most commonly performed procedure on critically ill patients. [2]

Traditionally these cases are scheduled for elective operating lists but considered as low priority as patients are already on mechanical ventilation. As a result several times they are cancelled from the scheduled list due to time shortage. This situation increases the period of endotracheal ventilation and associated morbidity. Practice of percutaneous tracheostomy being performed bedside by the ICU

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Patients and Methods

Starting from December 2003 to August 2005, we performed 100 cases of PDT. These patients were admitted in various ICUs of the hospital. Decision of doing tracheostomy was taken by ICU anaesthetist and treating physician. Patients below 14 years of age with untreated coagulopathies and with anatomical abnormalities of the neck were excluded. Patients on high FIO_2 and high peep (positive end expiratory pressure) of10 – 12 cm. were included. Patients in MICU (Medical ICU) were transported to operating room for doing tracheostomy. All other patients underwent the procedure bed side.

All patients received 100% oxygen, fentanyl, midazolam, muscle relaxants (atracurium or rocuronium) and propofol as required during the procedure. Blood pressure, pulse oximeter, and ventilatory parameters were monitored during the procedure. All the procedures performed in operating room were done under bronchoscopic guidance.

Under laryngoscopy endotracheal tube was pulled out and repositioned at a level where cuff of the tube could be seen just at the vocal cords. Patient was placed in supine position and a rolled towel was placed under the shoulder to assist hyper extension of the neck. A commercial kit for percutaneous tracheostomy (Portex USA) was used in all the cases. After positioning and cleaning the surgical area with

iodine and alcohol, needle with canula was inserted in the trachea at the level of cartilage between 2nd and 3rd ring. Needle was removed and guide wire was introduced through the cannula. Correct position of the needle and guide wire was confirmed by free aspiration of air and bronchoscopic view when it was available. At this stage 2–3 ml of local anesthetic (2% xylocaine) was injected at the entry point of guide wire. At the same point a small skin incision was made horizontally before passing the dilator. Dilator was removed and Kelly's forceps passed over the guide wire t enter the trachea. At first anterior tracheal wall was dilated by gentle passage and opening the forceps. In the next attempt handle of the forceps was raised about 100 to 120 degrees and forceps was further advanced to dilate the tracheal wall. Forceps was removed with its handle open position. At this point a major air leak was noticed. Over the guide wire obturated tracheostomy tube was placed after its placement the obturator was removed and cuff was inflated. First few breaths were delivered with Ambu bag which gave us a feeling regarding the ease of ventilation. Later it was connected to the ventilator.

Results

Hundred cases of PDT were performed in a period of 20 months. These cases were performed in various units of the hospital. Maximum number of the patients (64) was performed in the SICU. A considerable number of patients were performed in operating theatre. Demographic data of these patients is shown in Tables 1 and 2. Maximum number of patients were neurosurgical, who presented with head injury, brain edema or space occupying lesion. The period of endotracheal ventilation prior to undergoing tracheostomy is given in table 4.

Table 1. *Demographic Data*

Parameter	Group A (with bronchoscope)		Group B (without bronchoscope)	
	Male	Female	Male	Female
Number	34	16	33	17
Mean age	63.0 ± 12.8	56.3 ± 11.3	46.9 ± 13.8	53.8 ± 12.8
Weight	71.6 ± 11.7	66.1 ± 12.9	74.8 ± 15.1	76.3 ± 17.6

Table 3. *Specialty wise distribution of 100 petients*

Specialty	Number of patients
Neurosurgery	37
Medical, pulmonlogy, cardiology, etc	36
General surgery	10
Cardiac surgery	07
Thoracic surgery	05
Orthopedic surgery	02
Vascular surgery	01
Plastic surgery	01
Obstetrics & gynecology	01

Table 4. *Timings of tracheotomy*

Period of ET ventilation before tracheostomy	Number of patients
First 5 days	02
6 – 10 days	07
11- 20 days	76
21 – 30 days	15

Time taken for the procedure is shown in table 5. Time taken for the procedure with bronchoscopic guidance took a mean time of 8.76±2.4 min where as procedure without bronchoscopic guidance was completed in 6.04±1.7 minutes. The difference in the median values between the two groups is greater than would be expected by chance (Mann-Whitney Rank sum test); there is a statistically significant difference between the times taken for the procedure between the two groups. (P = <0.001)

Table 5. *Time taken for the procedure*
(From the attempt of tracheal puncture to the insertion of tracheostomy tube)

Parameter	Group A (with bronchoscopic guidance)	Group B (with out bronchoscopic guidance)
Number	50	50
Mean time (min)	8.76 ± 2.4	6.04 ± 1.7

Technical difficulties encountered during the procedure are shown in table 6. We found that tracheal puncture and forceps dilatation were technically difficult. In 10 cases tracheal puncture (insertion of needle) was successful after two attempts, and in 15 cases it took more than 3 attempts for a successful entry of needle into the trachea. Various complications encountered during and after the procedure are illustrated in table 7 & 8. We found that minor bleeding was the commonest complication both during and after the procedure in this series.

Table 6. *Technical difficulties encountered during the procedure*

Difficulty encountered	Group A (with bronchoscope)	Group B (without bronchoscopic aid)	Total number of cases

Difficulty in positioning	0		0		0
Difficulty in tracheal puncture	2-3 Attempts	> 3 Attempts	2-3 Attempts	> 3 Attempts	25
	5 Cases	4 Cases	5 Cases	11 Cases	
Difficulty in passing guide wire	0		0		0
Difficulty in forceps dilatation	5		8		13
Difficulty in passing tracheostomy tube	3		0		3

Table 7. *Complications during the procedure*

Complications	Group A	Group B	Total
False passage	0	1	1
Failed procedure	0	1	1
ET tube puncture	0	1	1
Damage to bronchoscope	1	NA	1
Guide wire knotted in ET tube	0	1	1
Minor bleeding*	4	5	9
Major bleeding ¤	0	0	0
Surgical intervention required	0	0	0
Desaturation during the procedure	2	2	4

*Minor bleeding: less than 50 ml. blood loss during the procedure & first 24 hrs

¤major bleeding: more than 50 ml. blood loss during the procedure and/or continued oozing for more than 24 hours

Table 8. *Complications after the procefure*

Complications	Group A	Group B	Total
Surgical emphysema	0	0	0
Pneumothorax	0	0	0
Minor bleeding	2	4	6
Major bleeding	0	0	0
Inadvertent extubation	0	0	0

Discussion

In this clinical report we are elaborating our experience with early cases of PDT which were performed by both experienced and inexperienced operators. Patient population included both surgical and medical patients. However maximum numbers of the patients were neurosurgical and victims of head injury.

Ideally tracheostomy should be performed during first seven days. Long term trans-laryngeal intubation favors occurrence of laryngeal and sub-glottic stenosis, mainly during first 7-10 days. 5% of the patients are likely to develop this serious complication during the first 10 days of endotracheal ventilation.[6] Moreover early tracheostomy makes it possible to stop sedation and mechanical ventilation at an early stage. However this principle could not be applied on our patients. Majority of our patients were tracheostomized during 11-20 days. The delay

Table 2. *Patient location of 100 petients*

Hospital area where procedure performed	Number of patients
Surgical Intensive care unit (SICU)	54
Operating room (OR)	36
Cardiac Intensive care unit (CICU)	07
Coronary care Unit (CCU)	02
Emergency Room (ER)	01

is evident. Many factors are responsible for this practice. The most important of these is the protocol by which in-charge surgical consultant has to be convinced before the decision of the tracheostomy is made. Most of our surgical consultant still believe in "wait and watch for some more time" policy. This trend needs to be updated based on evidence.

Presently two techniques of tracheostomy are commonly practiced. One is in which dilating forceps is used for tracheal dilatation (Grigg's method), in the other, a hydrophilic gel coated plastic boogie, tapering in shape is used for dilatation (Ciaglia's method) which is supposed to be associated with less traumatic and hemorrhagic complications.[7] Ciaglia's method is gaining popularity rapidly. In spite of this we found the authors who prefer forceps (Grigg's method) as their personal choice.[8] All the patients included in this study underwent tracheostomy with dilating forceps. We did not encounter any life threatening complications, and the rate of minor and major complications are fairly acceptable. Overall rate of complications in our patients is 18%, half of which is minor bleeding (less than 50 ml in 24 hours). That means minor bleeding is the most frequently encountered complication. Other workers also agree that bleeding is the commonest complication of this procedure. A survey of 14 different publications [9] show that out of 1043 cases overall complication rate is 11.4%, the most frequent of them is bleeding with a rate of 3.2%. Escarment has reported that 25% of his 162 patients developed hypoxia during the procedure.[10] This incidence is too high when compared to our series where only 4% of our patients desaturated during the procedure. The reasons could be, we delayed the procedure for 1-2 days and optimized the condition. All the patients were on 100% oxygen and under full muscle relaxation. Air leak was minimized by manually covering the stoma and was compensated by adjusting the tidal volume. All these measures helped us to minimize patients desaturation (less than 90%) during the procedure.

One of our patients who desaturated during the procedure was an obese lady who had undergone a major vascular operation. During the first attempt at

bed side a false track formed along the paratracheal tissues. The procedure was abandoned. Two days later tracheostomy was accomplished under bronchoscopic guidance, though passing the tracheostomy tube was difficult due to existing false track. In another patient J tipped guide wire entered the endotracheal tube through the Murphy's eye and caused extreme difficulty in passing tracheostomy tube. We removed the whole assembly of tracheostomy tube with obturator and guide wire. Tracheostomy tube with obturator was reinserted through the existing partially opened stoma. Though the tracheostomy was accomplished but at the risk of loosing the track and airway. In other patient who was short neck, ET tube was repositioned maximum out and cuff was placed just below the level of vocal cords. Tracheal puncture was attempted under bronchoscopic guidance and tracheal location was difficult. Later we found that needle had injured the fiber bundle of the flexible fiberoptic bronchoscope, requiring repair. Fiberoptic bronchoscope is an expensive and delicate instrument which requires careful handling. Occasionally such an injury can happen due to biopsy forceps also [12]. Such a loss can be prevented by extra care and experience. It is emphasized that all these problems are encountered in our early patients. With gaining experience we took lesser time for the procedure and technical difficulties were minimized. We maintained a record of technical difficulties during the procedure and found them to be inversely related to experience of the main operator. We found that successful location of the needle in the trachea (tracheal puncture) and adequate dilatation of the trachea by Kelly's forceps are the two steps of the procedure which needs experience and supervision.

Use of the bronchoscope as a mandatory part of the procedure is debatable. Presently we find all kinds of opinions in the literature. Some authors believe that PDT without bronchoscopy is safe. [13] Others feel bronchoscopy is the mandatory part of the PDT to prevent life threatening complications [14]. Others have reported complications like perforation of the posterior wall of the trachea even under bronchoscopic guidance. [15]

In our own experience bronchoscopy is helpful but can not be a replacement of clinical experience and attention. In these 100 cases though absence of bronchoscope has not increased the morbidity, but it was definitely advantageous in helping out in technical difficulties. It is note worthy that in above mentioned two cases (false track formation and entangling of the guide wire with ET tube) bronchoscope was not used. These problems could have been prevented under bronchoscopic guidance. However use of bronchoscope significantly increased the time taken for the procedure (8.760 min versus 6.040 min). This delay did not have any adverse effects on the outcome of the procedure.

We conclude that percutaneous dilatational tracheostomy by forceps method, with or without bronchoscopy, is safe and easy procedure.

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