Original Article

Tracheostomy

Frequency of Complication During Percutaneous Dilatational Tracheostomy (PDT) Blind vs Bronchoscopic Guidance

Syed Mazhar Ali Naqvi, Muhammad Javed Bashir and Muhammad Hussain

ABSTRACT

Objective: To evaluate the percutaneous dilatational tracheotomy procedure safety guided by bronchoscopy and without bronchoscopy in the ventilated critical patients.

Study Design: Descriptive study.

Place and Duration of Study: This study was conducted at the Medical ICU, Department of Pulmonary and Critical Care Medicine, Services Institute of Medical Sciences, Lahore from February, 2015 to December, 2016.

Materials and Methods: Fifty three Medical ICU patients underwent tracheostomy procedure through percutaneous dilatational using Bronchoscopic guidance and 50 tracheotomies were preformed blindly. Both type of procedures were performed at bed side using local anesthesia, sedation and systemic analgesia. Patients were monitored for intra-procedural and post-procedural complications like: hemorrhage, stomal infection, injury to adjacent structures, Paratracheal insertion, pneumothorax, sub-cutaneous emphysema, stomal infection, tracheal ring fracture and new lung infiltrate or atelectasis.

Results: A total of 53 Bronchoscopic guided and 50 blind procedures were performed**.** Intra-procedural complications were slightly higher in the blind group: Hemorrhage 3/53 (5.6%) VS 4/50 (8%). No procedure related mortality was noted in either group. Mortality due to primary causes was same (10/53 vs 9/50). Average Length of stay was higher in blind group 7 vs 8 days.

Key Words: Percutaneous dilatation tracheotomy, bronchoscopy, hemorrhage, tracheotomy

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INTRODUCTION

Tracheostomy is a well-known surgical procedure which was described earlier back in ancient Egypt.[1] In 19thcentury, it was considered among dangerous procedure and seldom performed.Jackson[2] in 1909, defined the surgical principles toperform this operation andcould able to avoid most of its(short and long term) complications[5]. Ciaglia in 1985[3], described the first percutaneous dilatational tracheostomy technique with a small skin incision and multiple dilators used over the Seldinger wire.

Percutaneous dilatational tracheostomy (PDT) is an invasive procedure in which a tracheostomy tube is placed after establishing a tracheal stoma through dilatation method, rather than the surgical dissection, cutting of trachea and placing tracheostomy tube under vision.

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Tracheostomy is commonlyperformed in the ICU settings especially in patients requiring prolong ventilation and to those who are unable to secure airways.[4]

Currently two percutaneous dilatational tracheostomy tube placement commercial kits are available:Griggs technique (Portex Ltd; Hythe Kent, United Kingdom) that used an "over the guide-wire" dilating forceps having a central opening, and the other kit which used Ciaglias method (Blue Rhino; Cook Critical Care; Bloomington. IN) that used a single curved conical dilator over the seldinger wire.[5] Both of these methods are safe, quick and simple. Most of percutaneous tracheostomies have been performed under Bronchoscopic guidance for site and successfully cannulation. But it require bronchoscopist, bronchoscopy technician along with intensivist and scrub nurse. This not only increase the cost but engage many persons and availability of team delays the procedure. Percutaneous dilatation tracheostomy have been performed blindly by many doctors including intensivist, thoracic surgeons and general surgeons showing good results in comparison with Bronchoscopic guidance.[6] We prospectively performed the percutaneous dilatational tracheostomies with and without bronchoscopic guidance in a tertiary care

hospital, among icu patients to evaluate the safety of both technique randomly.

MATERIALS AND METHODS

This prospective, randomized, comparative study that was conducted in the Medical ICU, Department of Pulmonary and Critical Care Medicine, Services Institute of Medical Sciences, Lahore, from February, 2015 to December, 2016. The study comprised of 103 icu patients who were intubated and ventilated for various indications including sepsis, tetanus, stroke, ARDS, COPD exacerbation, MOF, ACS and Post CPR vegetative states etc. All of these patients were either ventilator dependent or expected to require long term ventilatory support. Procedure was performed between 04 to 16 days of endo-tracheal intubation/ventilation. Patient with tracheal, neck and spinal abnormalities, previous tracheostomy or neck surgery, thyromegaly, soft tissue infection in the neck, severe hypoxemia, uncorrectable coagulopathy, thrombocyte count<50,000 severe hemodynamic instability or autonomic dysfunction, severe sepsis and status epilepticus were excluded.

All, 103 patients underwent tracheostomy procedure through percutaneous dilatational technique using both commercially available kits(Portex Ltd; Hythe Kent, United Kingdom, that used an "over the guidewire" dilating forceps with central opening -Griggs technique, and Blue Rhino; Bloomington, that uses a single curved, conical dilator with seldinger technique Ciaglias technique). The procedure was done at bedside in the setting of Medical ICU after obtaining an informed consent with and without bronchoscopy depending on availability of bronchoscopist. Sedation and analgesia was achieved using a bolus of both IV Nalbuphine 5-10mg or Tramadol 50-100mg andPropofol, until the adequate sedation was achieved. Atracurium 0.4 to 0.5mg/kg bolus was used as muscle paralyzing agent after adequate sedation and analgesia. Patient was kept on mechanical ventilation during the procedure using controlled mode and 100% Fio2. All patients had continuous ECG, BP, Spo2, Temperatureandend tidal carbon dioxide level (EtCo2) monitoring. Following sedation and muscle relaxation, the head was brought to extension by placing a roll pillow under the shoulders. Gastric emptying was achieved before the procedure by aspirating NG tube. Povidone-iodine was used to cleanse the region and the area was covered with perforated sheet and 2% lidocaine was used as local anesthesia. Patients were followed prospectively for complications like: hemorrhage, stomal infection, injury to adjacent structures, arrhythmias, transient hypoxemia, transient hypotension, Paratracheal insertion, pneumothorax, sub-cutaneous emphysema, loss of airway and new lung infiltrate or atelectasis.

Operative Technique: Patient was kept in supine position with neck mildly hyperextended, the local area was cleaned with alcohol followed by Povidone-iodine solution. The skin and subcutaneous planes were infiltrated with 2% Lidocaine. Simultaneously Olympus Fiberoptic Bronchoscope was inserted through ETT (#8) using "adapter for uninterrupted bronchoscopy" to avoid air leak from the circuit. After a brief endo-bronchial examination, ETT was pulled up in a fashion to keep the cuff immediately under the vocal cords. A 14-G cannula (using the commercially available, either Griggs or Ciaglias kits) was moved between the second and third tracheal rings until air was inspired and/or bronchoscopist confirmed the safe and central position of the tip of cannula inside the trachea.Tracheal space was determined through either through palpation of tracheal rings or endo-bronchially by trans-illumination of the FOB light inside the trachea.Cannula was slided over the needle further into the trachea and needle was withdrawn. After placing the guide wire in the tracheal lumen, cannula was removed. A 10mm transverseskin incision was made (5mm on each side of the tracheal puncture) and the track was dilated with 8-F dilator. Further dilatation was achieved using dilating forceps or blue Rhino dilator, depending upon the size of kit. Tracheostomy cuff was inflated after confirming the position of the tube with bronchoscopist. ETT was removed and ventilator switched to tracheostomy tube. Bronchoscopist, afterwards performed the endo-bronchial examination via tracheostomy tube to reassure the desired position of the tracheostomy tube in the trachea, to estimate the distance of the tracheostomy tube tip from the carina, and to reassure the patency of distal airways. A chest x-ray was ordered for every patient after the procedure, to rule out pneumothorax, surgical emphysema and atelectasis.

In blind technique all pre-operative measure was as above mentioned and patient was place supine with extended neck. 2nd and 3rd tracheal ring was located and needle placed in center applying negative suction. Guide was placed after free flow of air noted on suction via needle. Rest of dilation and placement of tracheostomy tube was same as mentioned above. Tube was confirmed by ambu bagging and auscultating both lungs and chest X-ray.

Data including the age, sex, cause for intubation and tracheostomy, days of intubation/ventilation, APACHE II Score, duration of procedure, lowest intraprocedural spo2, lowest intraprocedural BP, intraprocedural complications such as bleeding, loss of airway for more than 20 seconds, subcutaneous emphysema, tracheal ring fracture and paratracheal placement of the tube; postprocedural complications such as accidental decannulation, pneumothorax, hemorrhage, stomal granulation, infection of stoma or a new lung infiltrate within 48hours of tracheostomy; duration of

tracheostomy; length of ICU stay and mortality were recorded.

Complications were defined as below: Bleeding was classified to be mild (25 to 100mls), moderate (from 100 to 250mls) and severe (>250mls). A stomal infection was considered when there was afrank purulent discharge from the source with surrounding erythema of ≥1cm.

RESULTS

In our series, total 103 percutaneous dilatational tracheostomies were performed using Grigg's or Ciaglia's technique, from the period of February 2015 to December 2016.Fifty three patient had bronchoscopy guidance and was in bronchoscopy group while 50 were in blind group. Out of 53, 29 were females and 24 male patients with age ranges between 15 to 71 years while in blind group 26 were female and 24 were male. Mean age was 44±27years in bronchoscopy group and 45±20 in blind group.

Among the different indications for tracheostomy, prolonged ventilation due to reasons including tetanus, GBS, COPD, ARDS, and Myasthenia were most common 31/53(58.5%) vs 30/50 (60%)in both groups. Frequency of other indications given in table. Patients were tracheostomized on average at 10±6 days in Bronchoscopic and 11±6 in blind group.

No patient underwent a repeat tracheostomy after an elective decannulation and no patient died during the PDT due to any intraprocedural complications. A total of 10 patients (19%), out of 53 died during the ICU stay due to the original underlying disease with tracheostomy tube, and only one patient (≈2%) died after a successful decannulation, related to primary disease as well. Of the 36 patients (68%) out of 53, who survived successful decannulation, the time duration from the insertion of tracheostomy to decannulation ranged 10 to 96 days. Out of 53, six patients (11%) were directly discharged from ICU with tracheostomy in situ, for home nursing care, with or without domiciliary ventilatory support.

Among the intraprocedural complications transient hypoxemia was noted in 4/53 (7.5%) patients, transient hypotension in 3/53 (5.6%) patients and mild hemorrhage in 3/53 (5.6%) patients. There was no incidence of moderate or severe hemorrhage. Complications like loss of airway, sub-cutaneous emphysema and tracheal ring fracture were not encountered.

Table No.1: Patient's Characteristics

1.	Gender			Bronch group	Blind Group
	Male Female			24 29	24 26
2.	Age, yr, mean ±SD			44±27	45±20
3.	Indications for tracheostomy	a.	Prolonged ventilation: Tetanus ,GBS, COPD, ARDS, Myasthenia etc	31(58.5%)	29
		b.	Airway protection	3(5.6%)	3
		c.	Post CPR status/Persistent vegetative state.	5(9.4%)	5
		d.	Difficult weaning due to various reasons.	8(15%)	7
		e.	CVA/Low GCS state.	4(7.5%)	4
		f.	Sepsis/MOF/Polytrauma.	2(3.7%)	2
4.	Days of intubation prior to tracheostomy.			10 ±6	9±6
5.	Repeat tracheostomy after an elective decannulation.			0	0
6.	Mortality during the PDT procedure.			0	0
7.	Patients died with tracheostomy due to original disease.			10 (19%)	9
8.	Patients died after successful decannulation due to primary disease			1 (≈2%)	1
9.	Procedure duration, mins (time from local anesthesia till tracheostomy insertion)			9.5±4.5	6±5
10.AP	APACHE II score			19±6	18±7

Table No.2: Intraprocedural Complications

No.	Complications		Bronch group	Blind Group
1.	Transient Hypoxemia/Spo2 drop ≤ 90% for more than 2mins		4/53 (7.5%)	5/50
2.	Transient Hypotension/ BP < 90 systolic		3/53 (5.6%)	3/50
3.	Bleeding	Mild (25 to 100mls)	3/53 (5.6%)	6/50
		Moderate (100 to 250mls)	0/53	1/50
		Severe (>250mls).	0/53	0/50
4.	Loss of airway for more than 20 seconds		0/53	0/50
5.	Subcutaneous emphysema		0/53	1/50
6.	Tracheal ring fracture		0/53	0/50
7.	Paratracheal placement of the tube		1/53 (≈2%)	0/50

Table No.3: Postprocedural Complications

No.	Complications	Bronch group	Blind Group
1.	Accidental decannulation	0/53	0/50
2.	Pneumothorax	0/53	0/50
3.	Hemorrhage (Mild - 25 to 100mls)	1/53 (≈2%)	1/50
4.	Stomal granulation	0/53	0/50
5.	Stomal infection	0/53	0/50
6.	A new lung infiltrate within 48hours of tracheostomy	0/53	0/50

One case (≈2%) of paratracheal placement of tracheostomy was observed due to technical difficulty, which was corrected during the same procedure.

Postprocedural complications like accidental decannulation, pneumothorax, stomal granulation, stomal infection or new lung infiltrate with 48hours of tracheostomy were not observed in our case series. Only one case (≈2%) of mild post procedural hemorrhage was noted which was due to stomal skin bleeder. This required exploration of stoma and bleeding vessel was ligated.

DISCUSSION

PDT has several benefits over the routine surgical approach. It is simpler, quicker, less expensive and easy to perform at bedside without moving the patient outside the ICU premesis.[7] This is mostly important in cases where the patient's condition is critical, and displacing the patient from the unit is difficult and sometimes dangerous.[8]

The complications rate of ordinary surgical tracheostomy seems inordinately high in the context of being relatively simple surgical procedure.[9] Surgical tracheostomy complications rate ranges from 5 to 66% and mortality from 0 to 5% and the complications rate of procedure done in ICU are comparable to those performed in operating theater.[10] In contrast to "routine" tracheostomy, the PDT technique uses the tube of smallest possible size (and stoma) required for adequate air flow and suctioning, and moreover, this smaller size aids in minimizing the chance of hemorrhage.[11] When properly performed, the large blood vessels are avoided, and the slight ooze of blood from the small incision is tamponaded by the snug fit of the tracheostomy tube. In addition, the rate of infection is reduced, since less soft tissue is exposed for a possible contamination. One study[12] compared PDT and surgical tracheostomy and reported that PDT was more advantageous in terms of hemorrhage and complication, and so was preferred over surgical tracheostomy.

In our case series of 53 patients, in whom percutaneous dilatational tracheostomy tube was inserted, using both Grigg's and Ciaglia's methods, no procedure technique related mortality was observed. Intraprocedural complications rate was significantly low, which is comparable with internationally published data about the safety of PDT.[14,16] A single case of paratracheal placement, which was corrected during the same procedure uneventfully, was related to obesity and kinking of guide wire & guiding catheter. Transient hypotension and hypoxemia, occurring in 3 & 4 patients respectively, was related to either sedatives/muscle relaxants use or due to the preexistingcompromised respiratory status of a patient. Drug induced hypotension was controlled in successive procedures by injecting the sedatives/muscle relaxants in small & frequent boluses, and by improving the hydration status of patient before the procedure. Early tracheostomies were performed in our study especially for patients like tetanus, GBS and with low GCS state.[17,18]

We have found the PDT bedside procedure very useful and safe especially for patients in whom transportation carried more risk due to different reasons like: morbid obesity, polytrauma/axial skeleton fractures, unstable general status, difficult intubation and moderate to severe dysautonomias. Patients with minor coagulopathies, anemia or mild thrombocytopenia who had relative contraindication to blood products transfusion, e.g a patient with a recent history of transfusion related acute lung injury, were declared unfit for the procedure by surgeons and anesthetists for conventional surgical tracheostomy procedure. These patients underwent PDT without any increased incidence of intra or postprocedural complication rate emphasizing the ease and safety of the procedure. Same findings were noted by Karvandian et al[13] and Akyut S et al[14] that the complication rates of hemorrhage, pneumothorax, surgical emphysema, esophageal perforation and tracheomalacia were significantly less with percutaneous dilatational tracheostomy and was preferred for critically ill patients.

In other studies in which patients who were managed in an ICU of a tertiary care hospital[19-21] reported an overall 8.6% complication rate which included the cases of minor and major bleeding which is comparable with our case series where the overall intraprocedural complication rate was 10.7%.

CONCLUSION

In conclusion, percutaneous dilatational tracheostomy is a safe procedure with low complications rate and blindly performed tracheostomies have comparable complication rate with Bronchoscopic guided tracheostomies.

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Conflict of Interest: The study has no conflict of interest to declare by any author.

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