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Effects of early verses late percutaneous dilatational tracheostomy on mechanically ventilated ICU patients.

Sandeep Yadav[1], Ghanshyam Yadav[2]*, Alok Kumar Bharti[3], Amit Shrivastav[1], and R.K. Verma[4].

[1]Junior Resident, Department of Anesthesiology, Institute of Medical Sciences, Banaras Hindu University, Varanasi.
[2]MD, Associate Professor, Department of Anesthesiology, Institute of Medical Sciences, Banaras Hindu University, Varanasi.
[3]Senior Resident, PDCC, , Department of Anesthesiology, Institute of Medical Sciences, Banaras Hindu University, Varanasi, UP, India, 221005.
[4]MD, Professor, Department of Anesthesiology, Institute of Medical Sciences, Banaras Hindu University, Varanasi, UP, India, 221005.

ABSTRACT

Critically ill patients frequently require tracheostomy to simplify long term airway management. This study was performed to compare differences between early and late percutaneous dilatational tracheostomy regarding duration of mechanical ventilation, length of ICU stay, incidence of ventilator associated pneumonia and finally outcome in term of mortality. 120 patients were randomly divided into early percutaneous dilatational tracheostomy (tracheostomy done within 7 days of mechanical ventilation) and late percutaneous dilatational tracheostomy (tracheostomy done after 7 days of mechanical ventilation). On admission acute physiological and chronic ill Health II and Glasgow coma scale were collected. The duration of mechanical ventilation, ICU length stay and ventilator associated pneumonia were noted. Statistical analysis was done by chi-square test, student t test and Fischer's exact test. There were no significant differences between both group regarding demographic data or APACHE II score. Early percutaneous dilatational tracheostomy was not associated with improvement in hospital mortality but other secondary outcome like duration of mechanical ventilation and length of ICU stay were significantly shorter in early percutaneous dilatational tracheostomy.

Keywords: Early percutaneous dilatational tracheostomy, Intensive care unit, Late percutaneous dilatational tracheostomy, Mechanical ventilation.

Corresponding author

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INTRODUCTION

Critically ill patients frequently require tracheostomy to simplify long term airway management[1]. While tracheostomy indications have remained unchanged, the timing of elective tracheostomy for the ventilated patients has been questioned [2,3]. A tracheostomy is commonly performed when clinicians predict a patient will need prolonged mechanical ventilation [4]. The perceived advantages of a tracheostomy over prolonged trans laryngeal endotracheal intubation include improved patient comfort and reduced sedative drug use, faster weaning from mechanical ventilation, a reduced incidence of nosocomial pneumonia, and shorter hospitalization [5,6]. Placement of tracheostomy in Intensive Care Unit (ICU) is usually an elective procedure increase patient comfort and decrease length of ICU stay, incidence of VAP and mortality. The incidence of ventilator-associated pneumonia is related directly to the duration of mechanical ventilation which is a complication that carries significant morbidity and mortality [7]. So the beneficial effects might be maximized if tracheostomies were performed early in a patient's illness. National Association of Medical Directors of Respiratory Care recommended that translaryngeal (endotracheal) intubation be used only for patients requiring less than 10 days of artificial ventilation and that a tracheostomy should be placed in patients who still require artificial ventilation 21 days after admission [8].

MATERIAL AND METHODS

After taking ethical committee clearance and written informed consent this is prospective randomized study was conducted in department of anesthesia between april 2014 to july 2015 in patients who underwent bedside percutaneous dilatational tracheostomy (PDT) using the Ciaglia's method in ICU. Patients needed mechanical ventilation >24 hour, age of >18 years, without previous pulmonary infection were included in this study. Exclusion criteria are history of anatomical deformity of the neck (including thyroid gland enlargement), cervical and lung carcinoma, preexisting tracheostomy, preexisting pneumonia, coagulopathy, estimated to die within the next 24 hours and more than 3 days of ventilation before entry into ICU, history of esophageal and neck soft tissue infection, terminal malignancy etc.

120 patients were randomly divided into early PDT who had tracheostomy within 7 days of mechanical ventilation (MV) and late PDT who had tracheostomy after 7 days of MV. Patients were randomly assigned in early or late PDT groups depending on the timing of tracheostomy, according to needs of ventilation for patients, decided by clinicians who treat the patients either to early PDT or late PDT. From randomization, daily information on respiratory support was recorded. Data were collected on demographics and admission severity of illness, estimated using the Acute Physiology and Chronic Health Evaluation (APACHE) II (88) and Glasgow Coma Score (GCS). Data included routine blood investigation, Coagulation profile and Cultures of samples from sputum, blood, and urine before tracheostomy. The clinical assessment of the severity of their illness was done by APACHE II score and GCS. All other cares was at the discretion of the treating clinicians. During the first 24 h in the Critical Care Unit, clinicians recorded patients' data. Details of the tracheostomy procedure were collected including timing, immediate and late complications. Treatment assignment could not be blinded to the caring team or to the analysis team because it was apparent from the data to which group a patient had been assigned. The procedure was performed, using the multiple dilator, with the head extended on the chest, using a standard preparation and drape. The patient was ventilated on 100% oxygen and vital signs were continuously monitored. Local anesthesia augmented by intravenous sedation was required. A 1.5 cm horizontal incision was placed two to three finger breadths above the sternal notch, corresponding to second and third tracheal ring. Then the subcutaneous fat was separated using a curved hemostat. At this point, a flexible bronchoscope was inserted and aligned with the tip of the endotracheal tube (ETT). The bronchoscope and ETT were slowly withdrawn until the incision is maximally trans-illuminated, allowing continuous visualization of the entire procedure. A 14-gauge catheter introducer needle was inserted between the first and second, or second and third tracheal rings. Then passed a guide wire through the needle. Over this guide wire multiple graded dilators were inserted in an arc like manner. By using the multiple dilator kit, the tracheal aperture was sequentially enlarged using a series of graduated dilators. The final step involved inserting a preloaded tracheostomy tube over the guide wire unit. Placement of the tube was confirmed again by visualizing the tracheobronchial tree through the tube. Tube was secured to the skin with sutures and the tracheostomy tap.

Primary outcome was 33 days mortality. Duration of mechanical ventilation and length of ICU stay were taken as secondary outcome.

On admission, demographic data and acute physiological and chronic ill Health II and GCS were collected. The duration of mechanical ventilation, ICU length stay (LOS) were all calculated. All these durations were calculated as the number of calendar days. ICU mortality rates were documented. VAP were estimated by using clinical pulmonary infection score (CPIS). The observation in two group were compared statistically using chi-square test, student's t test and Fischer's exact test and analyzed by SPSS 16 version software.

RESULTS

A total of 120 patients were evaluated. There was no substantial difference among the groups with regards to age, sex, APACHE II score. (Table 1) Although there was more 33 days mortality in early PDT than late PDT but it was statistically insignificant (p= 0.194). (Table 2) There were significant differences between two group regarding mean mechanical ventilation duration, which was shorter in early PDT than late PDT (16.71± 7.268) vs (27.76 ± 9.94 days; p=<0.01) and mean ICU stay was shorter in early PDT than late PDT (19.7 ± 8.683) vs (31.61 ± 10.63 days; p=<0.01). (Table 3). Incidence of VAP was lower in early PDT than late PDT between 12th day to 24th days. (Table 4)

Tables 1: Demography

	Early PDT	Late PDT	t-value	p-value
Age (Years)	38.33±17.74	44.51±19.95	1.734	0.086
Male/Female (Number)	47/32	31/10	3.082	.079
APACHE II SCORE (Mean ± SD)	19.177 ± 5.705	21.365 ± 6.191	1.938	0.0550

(PDT= Percutaneous Dilatational Tracheostomy)

Table 2: Outcome in terms of 33 days mortality

Outcome	Early PDT		Late PDT		P value
	No.	%	No.	%	
Expired	27	34.2	19	46.3	0.194
Survived	52	65.8	22	53.7	
Total	79	100	41	100	

Table 3: Duration of MV and length of stay in ICU.

	Early PDT	Late PDT	t-value	p-value
Duration of MV (Mean ± SD)	16.71 ± 7.268	27.76 ± 9.947	6.937	**<0.001**
Length of stay in ICU (Mean ± SD)	19.70 ± 8.683	31.61 ± 10.635	6.592	**<0.001**

(MV= mechanical ventilation)

Table 4: Incidence of VAP on basis of CPIS Score calculated at the interval of every 3 days, upto Max 33 days of mechanical ventilation for a patient.

Time interval	Early PDT		Late PDT		P-value
	No.	%	No.	%	
Day 0 (n=120)	0	0	0	0	--
Day 3 (n=120)	4/79	5.1	4/41	9.8	0.328
Day 6 (n=120)	15/79	19.0	9/41	22.0	0.700
Day 9 (n=114)	15/73	20.5	14/41	34.1	0.110
Day 12 (n=108)	11/67	16.4	19/41	46.3	**0.001**
Day 15 (n=86)	5/47	10.6	13/39	33.3	**0.010**
Day 18 (n=75)	2/40	5.0	11/35	31.4	**0.003**
Day 21 (n=57)	1/41	4.2	8/33	24.2	**0.040**
Day 24 (n=39)	0/14	0	7/25	28.0	**0.036**
Day 27 (n=29)	0/9	0	2/20	10.0	1.000
Day 30 (n=23)	0/7	0	4/16	25.0	0.273
Day 33 (n=14)	0/3	0	1/11	9.1	1.000

(VAP= Ventilator Associated Pneumonia)
(CPIS= Clinical Pulmonary Infection Score)

DISCUSSION

In both groups, vitals at the time of admission, general condition of the patient, cause of admission, indication for conducting tracheostomy were taken into consideration. The patients were also evaluated according to APACHE II, GCS as per the clinician in the ICU set up and accordingly distributed in early and late PDT. In the current study, the baseline demographic characteristic (Age, Gender), clinical variables on admission (APACHE II score, GCS), indications of percutaneous tracheostomy, comorbidities were homogenous between both groups without significant statistical differences. Trauma and neurological (including cerebro vascular accident) cases were the most frequent causes of ICU admissions in our setup. This agreed with results of Engoren et al [5], Ahmed et al [6] and Aissaoui et al [7]. There was no statistical significant difference between the groups in our study, which is supported by Griffiths et al [9], Dunham et al [10] ,Rumbak et al [8], Flaatten et al [11] Louis et al [12] and Young et al [13]. In our ICU set up we have concluded after observing that the total duration of mechanical ventilation in early PDT group was relatively lesser as compared to that of late PDT group. The total duration of mechanical ventilation has been shown to be influenced by timing of tracheostomy viz.early or late.

Several studies have shown that early PDT decreases the duration of mechanical ventilation [14-19]. Our results were comparable to that reported by Gatti et al [20] and Zagli et al [21] but different from that mentioned by Terragni et al. [22]

In our study we have taken into consideration the outcome on length of stay in ICU according to the determination by duration of tracheostomy i.e. early or late. One of advantages of tracheostomy is to hasten the transfer of patients out of ICU [14-18]. As the study was conducted on our behalf, eventually we realize that the patients in group 1 had a relatively shorter length of stay in ICU. We have further carried out this study taking into account the ventilator associated pneumonia (VAP). VAP is a frequently occurring nosocomial infection in ICU [23] patients and has been associated with increased morbidity, prolonged duration of mechanical ventilation and ICU stay. Diagnosis of ventilator-associated pneumonia is difficult and is not standardized. In our study we found that there was decreased incidence of VAP in early tracheostomy group as compared to that in late tracheostomy. Our study was supported by Durbin et al [24], Wise et al [25], Fikkers et al [26], Li et al [27] and Rumbark et al [8].

As our study was not blinded a potential performance bias could have influence our outcome because decision to wean the patient was left in the end discretion of ICU attending physician. We can control such factor by strictly following the ICU policy.

It is concluded that in mechanically ventilated critically ill patients, early percutaneous dilatational tracheostomy (within first 7 days after admission) was not associated with improvement in hospital mortality but other secondary outcome like duration of mechanical ventilation and length of ICU stay were significantly shorter in early percutaneous dilatational tracheostomy.

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