Original article

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Comparison of outcome between percutaneous dilatation tracheostomy and surgical tracheostomy in Intensive Care Unit of Dr. Wahidin Sudirohusodo Hospital Makassar

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Abstract

Percutaneous dilatation tracheostomy (PDT) has been widely used in Indonesia, yet no study to evaluate the outcome of PDT compared to surgical tracheostomy (ST) is available.

***Objective*: This study was aimed to evaluate the use of PDT in Indonesia.**

***Design*: Non-randomized comparative retrospective study.**

***Setting*: Intensive Care Unit of Wahidin Sudirohusodo Hospital Makassar.**

***Patients*: Eighty-four patients aged 15 to 90 years, undergone tracheostomy during 2016 to 2017 were evaluated.**

***Measurements and results*: Samples were evaluated in terms of surgical duration, blood loss volume, mortality, and complication rates such as post-operative bleeding, pneumothorax, subcutaneous emphysema, stomal infection, tracheal stenosis/malacia, and unintended fistula formation. Collected data were analyzed with SPSS version 22. Mean operative duration of PDT (18.3 minutes) were significantly faster than ST (40.2 minutes) ($p<0.05$), accompanied by significant reduction of mean blood loss 13.6 ml compared to 21.1 ml in ST group ($p<0.05$). A total of 9 complications (18.8%) found in ST group and 5 (13.9%) in PDT group, with stomal infection was the most common complications. Mortality rate were 52.8% in PDT group and 45.8% in ST group ($p>0.05$), none associated with the procedure itself.**

***Conclusion*: It is suggested that PDT is a superior technique in placement of tracheostomy canula.**

Key words: Percutaneous dilatation tracheostomy, surgical tracheostomy, complication, duration, blood loss.

Introduction

Tracheostomy is one of the oldest surgical procedures known to mankind, earliest record found even before 100 years BC. Currently there are 2 techniques available, percutaneous dilatation tracheostomy (PDT) and surgical tracheostomy (ST). Both are available in Indonesia, despite late introduction of percutaneous procedure. Tracheostomy is not a risk free procedure. (1,2) Known complications include inflammation, stomal infection, bleeding, pneumothorax, tracheal wall laceration, formation of tracheo-esophageal fistula, tracheal stenosis and malacia, and even death. (3,4) Previous studies comparing both procedures showed contradicting result. Morbidity and mortality varies by institution. In general, PDT is associated with higher procedure related complications, while ST is associated with higher stomal infection rate. (2-9) PDT is logistically superior, as it does not require patient transfer to operating theater, reducing patient transport risk to zero. (6)

Indonesian guideline of PDT is available since 2012 by PERDICI. (10) Although both techniques have been widely used, only ST had received proper evaluation of its use in Indonesia. Accord-

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ing to records, PDT has been performed in Dr. Wahidin Sudirohusodo Hospital as early as 2012. Several previous studies in other hospitals showed contradictory results, so it is necessary to evaluate the implementation of PDT in Wahidin Sudirohusodo General Hospital in particular, and in Indonesia in general.

Materials and methods

A non-randomized comparative retrospective study conducted during January-March 2018. Medical record database searched with key words of percutaneous dilatation tracheostomy and tracheostomy were performed. Only subjects with tracheostomy performed during ICU admission in 2016-2017 were included in the study. Subjects were classified into two groups, based on type of tracheostomy procedure performed. Medical records of subjects were retrieved and the following data were recorded: age, birthday, body height, body weight, working diagnosis, coagulation function test (prothrombin time [PT], international normalized ratio [INR], and activated partial thromboplastin time [aPTT]), ventilatory setting, starting time of tracheostomy procedure, end time of tracheostomy procedure, blood loss volume during procedure, complications seen during course of treatment in the hospital (post-operative bleeding, subcutaneous emphysema, pneumothorax, stomal infection, tracheal stenosis, tracheomalacia, persistent tracheocutan fistula, tracheo-esophageal fistula), and mortality.

Collected data were analyzed using SPSS version 22 software (SPSS Inc., Chicago, IL, USA). Statistical test used to compare PDT and ST was chi-square test and independent T-test. A p value <0.05 was considered statistically significant.

Results

A total of 158 tracheostomies were performed during 2016-2017. Eighty-four samples were included in this study, 48 samples in ST group and 36 samples in PDT group. Subjets' age ranged between 15-87 years old, with mean age of 43 years old. Body mass index of subjects in this study ranged between 17.8-31.2 kg/m^2. There were no significant differences in patients demography and pre-tracheostomy conditions between the two groups, hence both groups were considered homogenous and comparable.

Mean procedure duration of PDT was shorter than ST, which was 18.3 minutes and 40.2 minutes ($p<0.05$) (**Table 1**). Mean blood loss was also statistically significant in PDT (13.6 ml) compared to ST (21.1 ml) (**Table 1**).

A total of 14 complications were observed in this study, 9 (18.8%) from ST group and 5 (13.9%) from PDT group. Amongst all possible complications, 6 types of complications were found. Those were pneumothorax, post-operative bleeding, stomal infection, tracheal stenosis, tracheomalacia, and tracheo-esophageal fistula. Most common complication found was stomal infection, 50% of total complication (7 patients). Second highest complication was post-operative bleeding, found in 2 patients (5.6%) in PDT group. Although there were differences in incidence of each complication, none were statistically significant (**Table 2**).

Based on patient outcome, both groups presented a comparable mortality. Twenty two subjects (45.8%) in the ST group and 19 subjects (52.8%) in the PDT group died, and no type of trachestomy procedure contributed to the patient's death.

Discussion

As seen by percentage of type of tracheostomy, ST is a preferred method of tracheostomy in our institution. Patients' demography in both groups was comparable and none of the patients had contraindications of PDT procedure. Higher number of ST was related to limited supply of PDT set in our institution.

PDT procedure is significantly faster, requiring only 45% of time needed to perform ST. These findings come along with higher intraoperative blood loss in ST group, 1.5 times higher in general. Our finding was consistent with study by Kannan, which showed that PDT procedure was faster, accompanied by less bleeding complications. Although PDT procedure duration was longer in our institution compared to duration of procedure in study by Kannan (9.6 minutes vs 18.3 minutes). (2) Minimal blood loss in PDT could be contributed by smaller incision made and significant shorter procedure duration. Longer PDT procedure in our institution might be related to high caution exercised by operators. These can be seen with reduced complications in PDT group in our study compared to study performed in other institutions. (7,11) In our study, there was no incidence of false track insertion, loss of airway control, nor fistula formation in PDT group. Pneumothorax found in ST group (2%) and none in PDT group, this was significantly lower than study by Capriano and Kumar. (7,11) In terms of presence of post-operative subcutaneous emphysema and post-operative bleeding, our study supports finding of previous study. Tracheal stenosis was found in almost all patients who underwent tracheostomy, but less than 10% required intervention. Yet incidence of

tracheomalacia can be as high as 20-60% of patients. (12,13) Incidence of tracheal stenosis and tracheomalacia in this study was significantly lower than previous study, each was only 2%. There was 1 (2%) tracheo-esophageal fistula case found in ST group. This supports previous study by Epstein, which stated that fistula formation rate was minimal. (12)

Stomal infection was the most common complications in our study. A total of 14 patients had this complication, 10.4% in ST group and 5.6% in PDT group. We found a lower infection rate compared to previous study by Lin. (14) Rate of stomal infection was nearly half in our institution compared to study by Lin. This showed superior daily care technique exercised by our ICU nurses. In terms of mortality rate, previous study by Kannan and Delaney found mortality rate as high as 40-50% of patients. (1,2) Mortality was closely associated to the working diagnosis that causes the patient to be admitted to ICU. Mortality rate in our study were 45.8% in ST group and 52.8% in PDT group. From this rate can be inferred that 50% of patients who needs tracheostomy in our institution will not survive.

Conclusion

PDT can be selected as primary tracheostomy procedure in ICU patients. This technique can be performed faster with minimal blood loss, along with fewer complications compared to ST. These advantages were accompanied with minimal risk of transportation to operating theater, as PDT is performed bedside.

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Table 1. Demography and intraoperative by groups

Parameters	Groups	n	Mean	SD	p
Age	ST	48	41.9	20.0	0.488
	PDT	36	44.9	19.5	
BMI	ST	48	22.3	2.8	0.919
	PDT	36	22.2	2.9	
PT	ST	48	11.2	1.2	0.746
	PDT	36	11.1	1.5	
INR	ST	48	1.0	0.1	0.670
	PDT	36	1.0	0.2	
aPTT	ST	48	25.8	3.6	0.178
	PDT	36	32.4	33.6	
Platelet	ST	48	247.5	90.9	0.856
	PDT	36	243.1	130.1	
Procedure duration	ST	48	40.2	17.6	0.000*
	PDT	36	18.3	11.1	
Blood loss	ST	48	21.1	17.2	0.020*
	PDT	36	13.6	9.3	

Legend: p values were calculated with the use of independent t-test. BMI=body mass index; PT=prothrombin time; INR=international normalized ratio; aPTT=activated partial thromboplastin time; ST=surgical tracheostomy; PDT=percutaneous dilatation tracheostomy; *=$p<0.05$ (statistically significant).

Table 2. Complication incidence by groups

			Groups		Total	p value
			ST	PDT		
Subcutaneous emphysema	Present	n	1	0	1	1.000
		%	2.1%	0.0%	1.2%	
	Absent	n	47	36	83	
		%	97.9%	100.0%	98.8%	
Pneumothorax	Present	n	1	0	1	1.000
		%	2.1%	0.0%	1.2%	
	Absent	n	47	36	83	
		%	97.9%	100.0%	98.8%	
Post-operative bleeding	Present	n	0	2	2	0.181
		%	0.0%	5.6%	2.4%	
	Absent	n	48	34	82	
		%	100.0%	94.4%	97.6%	
Stomal infection	Present	n	5	2	7	0.683
		%	10.4%	5.6%	8.3%	
	Absent	n	43	34	77	
		%	89.6%	94.4%	91.7%	
Tracheomalacia	Present	n	1	0	1	1.000
		%	2.1%	0.0%	1.2%	
	Absent	n	47	36	83	
		%	97.9%	100.0%	98.8%	
Tracheal stenosis	Present	n	0	1	1	1.000
		%	0.0%	2.8%	1.2%	
	Absent	n	47	36	83	
		%	97.9%	100.0%	98.8%	
Tracheo-esophageal fistula	Present	n	1	0	1	1.000
		%	2.1%	0.0%	1.2%	
	Absent	n	47	36	83	
		%	97.9%	100.0%	98.8%	
Overall complication	Present	n	9	5	14	0.554
		%	18.8%	13.9%	16.7%	
	Absent	n	39	31	70	
		%	81.3%	86.1%	83.3%	
Diagnosis-related mortality	Died	n	22	19	41	0.529
		%	45.8%	52.8%	48.8%	
	Recover	n	26	17	43	
		%	54.2%	47.2%	51.2%	

Legend: ST=surgical tracheostomy; PDT=percutaneous dilatation tracheostomy.

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