ORIGINAL RESEARCH PAPER

Volume-8 | Issue-1 | January-2019 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

COMPARISON OF SUBGLOTTIC SECRETION DRAINAGE ENDOTRACHEAL TUBE WITH CONVENTIONAL ENDOTRACHEAL TUBE IN PREVENTION OF VENTILATOR ASSOCIATED PNEUMONIA IN PATIENTS ADMITTED IN THE MEDICAL INTENSIVE CARE UNIT

Clinical Research

Dr.sheena Mary Boban Postgraduate, Department Of Anaesthesiology, Yenepoya Medical College, Mangalore

Dr.priya B Naik* Professor, Department Of Anaesthesiology, Yenepoya Medical College, Mangalore *Corresponding Author

ABSTRACT

Objective: To compare the effect of subglottic secretions drainage endotracheal tubes with conventional endotracheal tubes on the incidence of ventilator associated pneumonia in patients receiving mechanical ventilation.
Design: A prospective, quasi experimental comparative study
Setting: A 28 bed general ICU
Patients: One hundred patients with an expected duration of mechanical ventilation > 48 hours were enrolled in the study.
Intervention: Patients were randomly assigned to receive either a subglottic secretions drainage (ssd) endotracheal tube or a standard endotracheal tube.
Results: 48 patients were randomized to receive subglottic secretions drainage endotracheal tubes and 52 patients received standard endotracheal tubes (control group). The two groups were similar at the time of randomization with respect to demographic characteristics and severity of illness. Ventilator Associated Pneumonia was seen in 2 patients (4.20%) receiving subglottic secretions drainage and in 12 patients (23.10%) in the control group.
Conclusion: Intermittent subglottic secretion drainage reduces the incidence of VAP in patients receiving mechanical ventilation.

KEYWORDS

mechanical ventilation; aspiration; subglottic secretion drainage; ventilator- associated pneumonia

INTRODUCTION

Ventilator associated pneumonia (VAP) is a major cause of morbidity and mortality in the intensive care unit (ICU) and is estimated to occur in 9-27 % of all mechanically ventilated patients[1]. Research[2-4] has shown that pooling of subglottic secretions above the endotracheal tube balloon are a rich culture medium for bacterial growth and that microaspiration of this infected material around the balloon causes early VAP in intubated patients. The use of subglottic secretion drainage endotracheal tubes (SSD ETTs) in ventilated patients has been shown to significantly reduce VAP[5-8]. There is no survey comparing the SSD ETT with conventional endotracheal tube (ETT) in prevention of VAP done in India. The microbiological profile and epidemiology of pneumonia has been found to be different in Indian patients compared to those in the West/ developed countries. Hence, we performed this study in patients receiving mechanical ventilation for more than 48 hours in our institution to know which ETT is better in prevention of VAP.

MATERIALS AND METHODS

After obtaining ethical committee clearance, the study was conducted in the Medical intensive care unit (MICU) of Yenepoya medical college hospital, Mangalore. Between January and September 2018, we studied 100 patients admitted to our MICU and who received mechanical ventilation for > 48 hours.

On admission to the MICU, patient details including age, gender, associated comorbidities, primary reason for ICU admission and indication for intubation was recorded.

Patients were conveniently assigned to study group (ssd) or control group (ett) and were intubated alternately with ssd tube or conventional endotracheal tube. Patients in the study group received intermittent subglottic secretions drainage every 4 hours. The control group consisted of patients intubated with conventional endotracheal tubes for more than 48 hours. Surrogate consent was obtained from the nearest relative in both the groups.

Patients intubated in our institution, in or outside the MICU were included with day of intubation being taken as Day 1. Exclusion criteria were as follows: patients aged < 18 years, tracheostomy in place before admission, patients intubated outside our institution and patients who die within 48 hours of intubation.
Our standard protocol for infection prevention in patients receiving mechanical ventilation was followed in both the groups including use of closed suction system, head of bed elevation to 30-45 degrees, daily sedation vacation, chlorhexidine mouthwash, peptic ulcer disease prophylaxis and deep venous thrombosis prophylaxis.

On admission to the ICU, endotracheal aspirate was sent for culture and sensitivity on Days 1, 3 and at an interval of 5 days thereafter till extubation. The diagnostic criteria for VAP was: The Modified Clinical Pulmonary Infection Score (CPIS) for VAP which is followed in our institution which is depicted below (Table 1). A CPIS score of more than 6 at baseline or after incorporating the culture was

Table 1: Modified Clinical Pulmonary Infection Score (CPIS) for VAP

CPIS POINTS	0	1	2
TRACHEAL SECRETIONS	Rare	Abundant	Abundant &Purulent
CHEST X RAY INFILTRATES	No infiltrate	Diffused	Localized
TEMPERATURE,˚C	36.5 – 38.4	38.5-38.9	39 OR ≤ 36
LEUKOCYTES COUNT, PER mm3	4000-11000	≤4000 or ≥11,000	≤4000 or ≥11,000+band forms ≥500
PAO2/FIO2 mm Hg	≥ 240 or ARDS		≤240 and no evidence of ARDS
CULTURE	Negative		Positive
CPIS POINTS			

considered as pneumonia.

Statistical Analysis
The data collected was entered into Microsoft excel spreadsheet and analyzed using IBM SPSS Statistics, Version 20(Armonk, NY: IBM Corp). Comparisons of VAP incidence between the study groups was performed using the chi square test or fishers test. P value < 0.05 was considered as statistically significant.

RESULTS

Over a period of 9 months, 100 patients were enrolled in the study. The demographic data of the study population is depicted in Table 2. The two groups were similar in demographic characteristics.

Table 2: Demographic data of the total patient population

		N	SSD/ETT				Chi square	P value
			ETT		SSD			
			Count	Column N %	Count	Column N %		
AGE	<20	1	1	1.90%	0	0.00%	6.687	0.462
	21-30	7	2	3.80%	5	10.40%		
	31-40	7	3	5.80%	4	8.30%		
	41-50	19	9	17.30%	10	20.80%		
	52-60	27	12	23.10%	15	31.20%		
	61-70	23	15	28.80%	8	16.70%		
	71-80	11	6	11.50%	5	10.40%		
	>80	5	4	7.70%	1	2.10%		
SEX	F	30	12	23.10%	18	37.50%	2.473	0.116
	M	70	40	76.90%	30	62.50%		

	N	SSD/ETT			
		ETT		SSD	
		Count	Column N %	Count	Column N %
CKD	9	5	9.60%	4	8.30%
UREMIC ENCHEPALOPATHY	3	3	5.80%	0	0.00%
PANCREATITIS	1	1	1.90%	0	0.00%
AKI	4	2	3.80%	2	4.20%
ANEMIA	1	1	1.90%	0	0.00%
ARDS	5	1	1.90%	4	8.30%
ASTHMA	1	1	1.90%	0	0.00%
CIRRHOSIS	7	3	5.80%	4	8.30%
IHD	10	8	15.40%	2	4.20%
MENINGITIS	1	0	0.00%	1	2.10%
PNEUMONIA	2	2	3.80%	0	0.00%
DM	17	14	26.90%	3	6.20%
HTN	37	22	42.30%	15	31.20%
CVA	2	2	3.80%	0	0.00%
COPD	19	9	17.30%	10	20.80%

Table 3: VAP occurrence and clinical outcome in patients receiving mechanical ventilation for > 48 hours

		N	SSD/ETT				Chi square	P value
			ETT		SSD			
			Count	Column N %	Count	Column N %		
Vap	No	86	40	76.90%	46	95.80%	7.413	0.006
	Yes	14	12	23.10%	2	4.20%		
End Result After 48 Hours	Dama	15	7	13.50%	8	16.70%	1.228	0.746
	Died	23	11	21.20%	12	25.00%		
	Extubated	58	31	59.60%	27	56.20%		
	Tracheostomy	4	3	5.80%	1	2.10%		

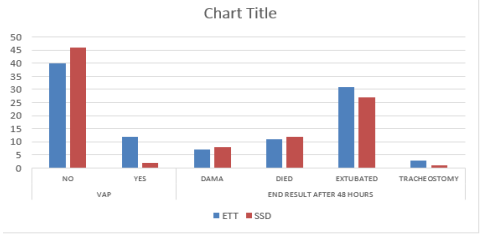

Figure 1: Occurence of VAP and clinical outcome after 48 hours

Table 4: Bacterial isolates from tracheal secretions

	N	SSD/ETT			
		ETT		SSD	
		Count	Column N %	Count	Column N %
Klebsiella Pneumoniae	4	4	7.70%	0	0.00%
Pseudomonas aeruginosa	3	3	5.80%	0	0.00%
Acinetobacter Baumanii	9	7	13.50%	2	4.20%
MRSA	5	5	9.60%	0	0.00%

Table 5: Antibiotic susceptibility of endotracheal aspirate

		N	SSD/ETT			
			ETT		SSD	
			Count	Column N %	Count	Column N %
Antibiotic Susceptibility Of Et Aspirate	No Resistance Noted	88	42	80.80%	46	95.80%
	Ampicillin&meropenem Resistant	1	1	1.90%	0	0.00%
	Cotrimoxazole Sensitive	1	1	1.90%	0	0.00%
	Multidrug Resistant	8	6	11.50%	2	4.20%
	Penicillin Resistant	1	1	1.90%	0	0.00%
	Vancomycin Resistant	1	1	1.90%	0	0.00%



Image 1: Blue Line SACETT – Suction Above The Cuff. Profile Soft- Seal Cuff, Portex tube

Fourteen patients (14%) had VAP develop. 12 patients (23.10%) in the control group (ETT) and 2 patients (4.20%) in the study group (SSD) developed VAP, which was significant (p = 0.006; Table 3). All patients with a diagnosis of VAP were treated with antibiotics.

The final clinical outcome of all the patients is depicted in Table 3(Figure1). Of the hundred patients studied, mortality was 23%. Eleven patients (21.2%) in the control group and twelve patients (25 %) in the study group died. Thirty one patients (59%) in the control group and twenty seven patients (56%) in the study group were extubated. Three patients in the ETT group and one patient in the SSD group were tracheostomized. Seven patients in the control group and 8 patients in the study group were discharged against medical advice.

In every case, the infecting microorganism was isolated from the tracheal aspirate. Bacterial isolates in tracheal secretions is depicted in Table 4.Two patients with subglottic secretions drainage had VAP develop. In both the patients, tracheal aspirate showed infection with acinetobacter baumanii. The following organisms were isolated from the 12 patients in the control group: Klebsiella pneumonia, Pseudomonas aeruginosa, Acinetobacter baumanii, Methicillin Resistant staphylococcus aureus (MRSA).

The antibiotic susceptibility of endotracheal aspirate is shown in Table 5. Tracheal aspirate was multi drug resistant in six patients in the control group and in two patients in patients on ssd endotracheal tube.

DISCUSSION

In this study, 100 patients with an expected duration of mechanical ventilation > 48 hours were randomized to receive conventional endotracheal tube or a ssd tube. VAP developed in fourteen patients (14%); twelve patients on endotracheal tube (23%) and two patients (4%) on ssd tube had VAP develop (p=0.006). Patients who were intubated with ssd tube had a statistically lower incidence of VAP than patients intubated with the conventional endotracheal tube. No significant difference was found in the duration of mechanical ventilation between both the groups. Endotracheal aspirate culture grew klebsiella pneumonia in 4% of patients, pseudomonas aeruginosa in 3% and staphylococcus aureus in 5% of patients with VAP. Acinetobacter baumanii was cultured in 9% of patients who had VAP develop. The two patients on ssd tube who developed VAP, had

acinetobacter baumanii cultured in the endotracheal aspirate. Thus, the most frequent pathogen identified was acinetobacter baumanii.

Studies from the West[9] have shown gram positive cocci mainly staphylococcus aureus and streptococcus pneumonia as the most frequently isolated organisms in VAP. However, unlike Western data, in India, gram negative organisms are the most common etiological agents of VAP, the most common being acinetobacter, pseudomonas and Escherichia coli[10,11]. Multidrug resistant endotracheal aspirate was seen in 8% of patients in our study group.

Our results are in agreement with several earlier studies. Kees Smulders et al[12] studied the incidence of VAP in patients receiving mechanical ventilation for more than 72 hours. They found that patients randomized to intermittent subglottic secretions drainage had a statistically lower incidence of VAP than patients intubated with the conventional endotracheal tube. John Muscedere et al[13] in their meta-analysis of mechanically ventilated patients, comparing standard endotracheal tubes to those with subglottic secretions drainage, reported that the use of ssd tubes reduces the occurrence of VAP and maybe associated with reduced duration of mechanical ventilation.

Pierre Damas et al[14] randomized adult patients intubated with a tracheal tube allowing subglottic secretions drainage (Group 1) or not (Group 2). They found that subglottic secretions suctioning resulted in a significant reduction of VAP prevalence (21.8% in Group 1 and 22.5% in Group 2).

A limitation of our study was the relatively small sample size. We studied patients who were expected to receive mechanical ventilation for more than 48 hours and several patients had to be excluded from the study as they were extubated/died before 48 hours.

CONCLUSION

We conclude from our study that regular drainage of subglottic secretions in patients expected to receive mechanical ventilation for more than 48 hours maybe useful in prevention of VAP, and recommend intermittent drainage of subglottic secretions as part of routine care of mechanically ventilated patients.

REFERENCES:

1. American Thoracic Society, Infectious Diseases Society of America. Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia. Am J Respir Crit Care Med. 2005;171:388-416.
2. Greene R, Thompson S, Jantsch H, et al. Detection of pooled secretions above endotracheal-tube cuffs: value of plain radiographs in sheep cadavers and patients. AJR Am J Roentgenol 1994; 163:1333–1337 15
3. MahulP,AuboyerC,JospeR,etal.Preventionofnosocomial pneumonia in intubated patients: respective role of mechanical subglottic secretions drainage and stress ulcer prophylaxis. Intensive Care Med 1992; 18:20–25 16
4. Joshi N, Russell L, Bruce HH. A predictive risk index for nosocomial pneumonia in the intensive care unit. Am J Med 1992; 93:135–142
5. Valles J, Artigas A, Rello J, et al. Continuous aspiration of subglottic secretions in preventing ventilator-associated pneumonia. Ann Intern Med 1995; 122:179–186 13
6. Kollef MH, Nikolaos J, Thoralf M. A randomized clinical trial of continuous aspiration of subglottic secretions in cardiac surgery patients. Chest 1999; 116:1339–1346
7. Jordan K.C. Hudson, Bernard J. McDonald, john C. MacDonald. Impact of Subglottic Suctioning on the Incidence of Pneumonia After Cardiac Surgery: A Retrospective Observational Study. Journal of Cardiothoracic and Vascular Anesthesia, Vol 29, No 1(February), 2015: pp 59-63
8. Souza CR, Santana VT. Impact of supra-cuff suction on ventilator – associated pneumonia prevention. Rev Bras Ter Intensiva. 2012; 24(4): 401-406
9. Gastmeier P, Sohr D, Geffers C, Ruden H, Vonberg RP, Welte T. Early- and late-onset pneumonia: Is this still a useful classification? Antimicrob Agents Chemother 2009;53:2714-8
10. Dey A, Bairy I. Incidence of multidrug-resistant organisms causing ventilator-associated pneumonia in a tertiary care hospital: A nine months' prospective study. Ann Thorac Med 2007;2:52-7
11. Golia S, Sangeta KT, Vasudha CL. Microbial profile of early and late onset VAP. J Clin Diagn Res 2013;7:2462-6
12. Smulders, Kees & van der Hoeven, Hans & Weeres-Pothoff, Ineke & Vandenbroucke-Grauls, Christina. (2002). A Randomized Clinical Trial of Intermittent Subglottic Secretion Drainage in Patients Receiving Mechanical Ventilation. Chest. 121. 858-62. 10.1378/chest.121.3.858.
13. John Muscedere, Oleska Rewa, Kyle Mckechnie. Subglottic secretion drainage for the prevention of ventilator associated pneumonia: A systematic review and meta-analysis. Crit Care Med 2011; Vol.39 No.8
14. Pierre Damas, Frederic Frippiat, Arnaud Ancion. Prevention of Ventilator-Associated Pneumonia and Ventilator-Associated Conditions : A Randomized Controlled Trial with Subglottic Secretion Suctioning. Crit Care Med 2014; Vol XX: 00 No XXX