

# CLOSED SUCTION SYSTEM VERSUS OPEN SUCTION

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## ABSTRACT

**Background:** Catheter suction is used to remove tracheal secretions through the endotracheal tube in mechanically ventilated patients, which may be either closed suction system (css) or open one. In css the catheter is a part of ventilator circuit and there is no need disconnect the ventilator and it seems that the css prevent soiling and spraying of respiratory secretion into the ICU.

**Objective:** To compare css system in comparison with an open tracheal suction system in adult patients receiving mechanical ventilation for more than 24 hours in terms of VAP (ventilator associated pneumonia) incidence, length of stay in the intensive care unit and mortality.

**Materials & Methods:** We prospectively recruited all mechanically ventilated patient in our general ICU, Dar El Shefa hospital between January 2012 and January 2013. Group A are those with open tracheal suction system (OTSS) and group B with closed tracheal suction system (CTSS), comparing VAP incidence, length of stay in the intensive care unit and mortality between the two groups.

**Results:** There is no statistically significant difference in OTSS group and CTSS group, as regard the incidence of VAP, the mortality rates and the causative organisms. In spite of this, the CTSS group had a statistically significant decline in average length of stay than OTSS group.

**Conclusion:** There was absence of infection caused by, MRSA, Acintobacter species and Staphylococcus Aureus as a causative organism of VAP in patients with CTSS group. While the incidence of Pseudomonas Spp. as a causative organism of VAP in patients with CTSS group increased markedly.

**Keywords:** suction, ventilator associated pneumonia (VAP), endotracheal tube

## INTRODUCTION

Mechanical ventilation (MV) and endotracheal suction are contributing risk factors for ventilator associated pneumonia (VAP), which is associated with high morbidity and mortality and is considered one of the most difficult infections to diagnose and prevent.

The endotracheal suctioning technique is classically performed by means of the open tracheal suction system (OTSS). During the late 1980s, the closed tracheal suction system (CTSS) was introduced to more safely suction patients on MV.

**Aim of the study:** is to compare closed tracheal suction system with an open tracheal suction system in adult patients receiving mechanical ventilation for more than 24 hours in terms of VAP incidence, length of stay in the intensive care unit and mortality.

## MATERIALS AND METHODS

This study was conducted on 141 patients who were mechanically ventilated from January 2012 to December 2012 in medical-surgical intensive care unit at Dar El Shefa hospital. ICU consisted of three centers: Center (A) with 6 beds, Center (B) with 5 beds and Center (C) with 3 beds.

Patients were divided into two groups, Group (A) Included mechanically ventilated patients admitted to intensive care unit during the period of January 2012 to June 2012 with open tracheal suction system (OTSS) and Group (B) Included mechanically ventilated patients during the period of July 2012 to December 2012 with closed tracheal suction system (CTSS).

**VAP diagnosis depends on three criteria, first is Radiological signs** where two or more serial chest radiograph with at least one of the following; New or progressive versus persistent infiltrates, Consolidation or cavitation. *The microbiological criteria* with at least one of the following; Positive growth in the blood culture not related to another source of infection, Positive growth in tracheal aspirate or pleural fluid or Positive culture from BAL. and the *Clinical signs* included one of the following; Fever (temperature  $>38^{\circ}\text{C}$ ), Leucopenia ( $<4000\text{WBCs}$ ) or leukocytosis ( $>12000\text{WBCs}$ ), Altered mental status, for adults 70 years or older with no other recognized cause Plus at least 2 of the following; New onset of purulent sputum or change in the character of sputum, Increased respiratory secretions or increased suctioning requirements, New onset or worsening cough or dyspnea, rales (lung sounds) or bronchial sounds, Worsening gas exchange, Increased oxygen requirements.

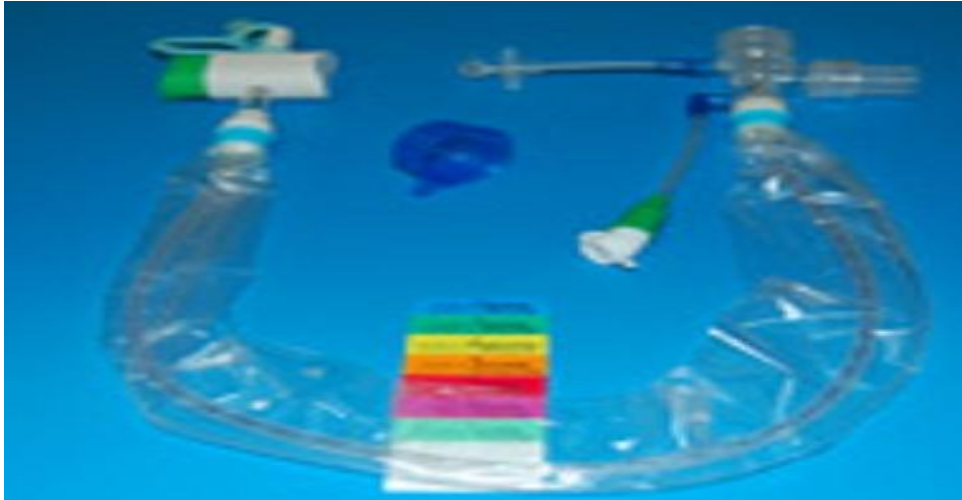


Figure 1: Set of closed tracheal suction system.

## RESULTS

Table 1. Demographic characteristics, length of ICU stay among the surveyed RICU patients during the period January 2012 till Dec 2012.

Variable	Estimate
Age	
Mean (SD)	58.3 (14.5)
Min - Max	18 - 75
Sex: N (%)	
•Male	75 (53.2%)
•Female	66 (46.8%)
Length of Hospital Stay	
Median (IQR)*	9.5 (5-14)

(IQR)\* Interquartile Range

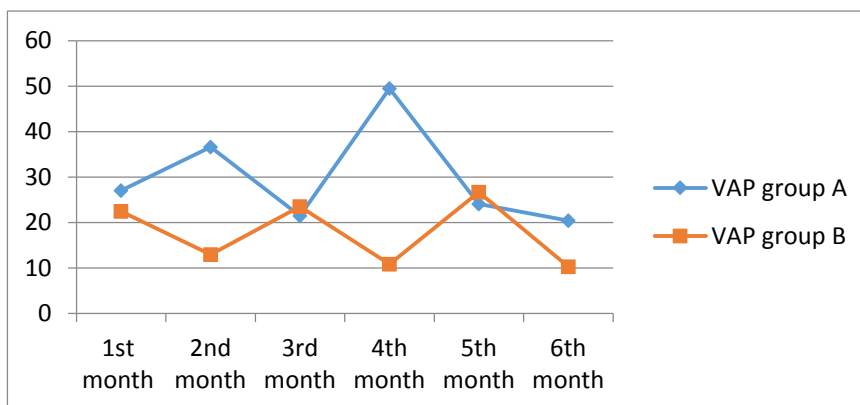


Figure 2. Comparison between Group A & B as regards monthly incidence of ventilator associated pneumonia

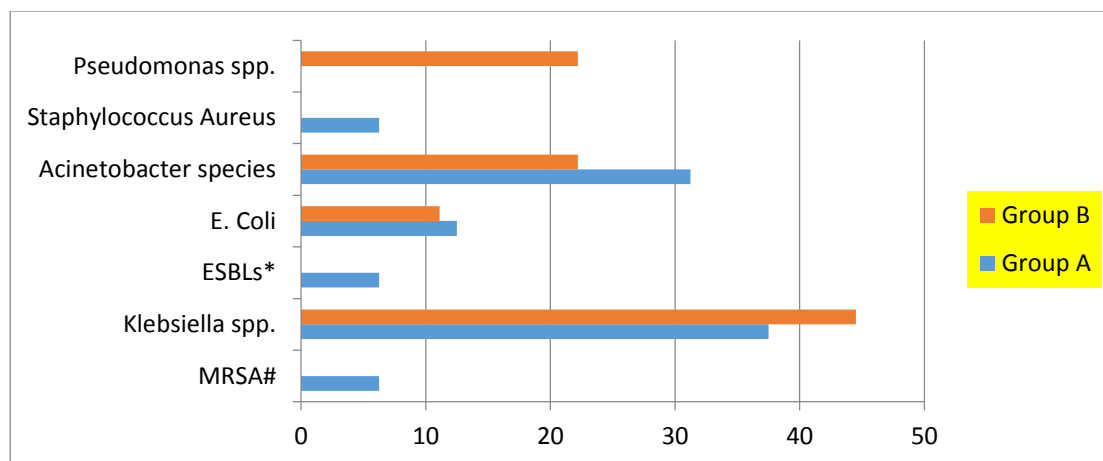


Figure 3. Comparison between group A & B patients as regards incidence of the causative organism

Table 2: Comparison between group A & B patients as regards the monthly mortality rate:

	Group A	Group B	$\chi^2$	p	Difference	95% CI
1 <sup>st</sup> month	46.2%	50%	0.06	0.7	14.2%	-23.07% to 47.2%
2 <sup>nd</sup> month	28.6%	43.75%	0.04	0.8	15.1%	-25.9 to 45.9
3 <sup>rd</sup> month	12.5%	36.4%	0.4	0.5	23.9%	-16.6 to 53.9%
4 <sup>th</sup> month	25%	20%	0.1	0.7	5%	-30.8% to 42%
5 <sup>th</sup> month	46.2%	27.3%	0.2	0.5	18.9%	-18.3 to 49.19
6 <sup>th</sup> month	25%	50%	0.2	0.6	25%	-19.4 % to 58.6%

Table 3: Comparison between group A and B as regards the monthly ventilator days and monthly ALOS:

	Group A (n=75)	Group B (n=66)	t	p
Monthly ventilator days				
Range	74-101	75-97		
Mean	88.5	85.8	1.6	0.09
SD	10.4	8.5		
Monthly ALOS#				
Range	5-14	7-14	2.04	0.04*
Mean±SD	10.3±3.2	9.3±2.5		

#Average Length of Stay

P<0.05\* significant

## DISCUSSION

This study was done on 141 patients who were mechanically ventilated from January 2012 to December 2012 in medical-surgical intensive care unit at Dar El Shefa hospital, their mean age group was 58.3, 53.2% were males and 46.8% were females. The median length of stay of those patients in ICU was 9.5 days.

Patients were divided into two groups, group A with open tracheal suction system (OTSS) where the incidence of VAP was 30.13/1000 ventilator days not statistically significant in comparison with patients in group B with closed tracheal suction system (CTSS) with VAP incidence 17.48/1000 ventilator days.

This was in agreement with the study done by Zeitoun et al<sup>1</sup>. and Topeli et al<sup>2</sup>. They concluded that the closed suction system didn't decrease the incidence of nosocomial pneumonia.

Also it was in agreement with the studies done by Lorente et al<sup>3</sup>. and Rabitsch et al<sup>4</sup>. There were no significant differences in percentages of patients receiving CTSS and OTSS who developed VAP (13.9 vs 14.1).

In the present study, the causative organisms causing VAP changed in OTSS group than that at CTSS group, the incidence of *MRSA*, *Acintobacter species* and *Staphylococcus Aureus* as a causative organism of VAP in group A were totally absent in group B while *Pseudomonas Spp.* appeared in group B and was completely absent as a causative organism of ventilator associated pneumonia in group A. This may be due to less handling of mechanically ventilated patients with CTSS, so that *MRSA* and *Staphylococcus Aureus* markedly decreased. The *Pseudomonas Spp.* appeared to be one of the important causative organisms in VAP in patients with CTSS group this may be due to the colonization of the catheter with *Pseudomonas Spp* as the catheter is changed every 3 days.

There was no statistically significant difference in decrease of mortality rates mean  $\pm$  SD (88.5 $\pm$  10.4) in OTSS vs. (85.8 $\pm$ 8.5) in CTSS between two groups.

The present study showed statistically significant decline in mean average length of stay in ICU  $\pm$  SD (10.3 $\pm$ 3.2) in OTSS vs. (9.3 $\pm$ 2.5) in CTSS group.

Furthermore, we have limitations in our study that we didn't mention the risk factors of patients who developed VAP; this may be the cause that patients with OTSS have shorter length of stay than patients with CTSS.

In the light of the previously mentioned data, there is no statistically significant difference in OTSS group and CTSS group, as regard the incidence of VAP, the mortality rates and the causative organisms.

In spite of this, the CTSS group had a statistically significant decline in average length of stay than OTSS group.

## CONCLUSION

- There is no difference in the incidence of ventilator associated pneumonia between OTSS group and CTSS group.
- Along the period of the study, there was no difference as regard mortality rates of patients between the two groups.
- There was absence of infection caused by, *MRSA*, *Acintobacter species* and *Staphylococcus Aureus* as a causative organism of ventilator associated pneumonia in patients with CTSS group.

- On the other hand, the incidence of *Pseudomonas Spp.* as a causative organism of ventilator associated pneumonia in patients with CTSS group increased markedly.
- As such, there was no advantage of CTSS over OTSS, but furthermore, there was a reduction in the average length of stay declined in patients with OTSS group.

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