

# Effect of Endotracheal Tube with Subglottic Suction Port vs Standard Endotracheal Tube on Incidence of Ventilator Associated Pneumonia in Patients of Organo-Phosphate Poisoning

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## Abstract

*Background:* Ventilator associated pneumonia is a hospital acquired infection that develops after 48 hours or more after a patient is intubated with an endotracheal or tracheostomy tube and is put on mechanical ventilation [1]. Ventilator associated pneumonia is most common nosocomial infection in ICU and associated with prolonged hospitalization, increased health care costs, and high attributable mortality. Intubation independently increases the risk of developing nosocomial pneumonia at least seven fold with a peak incidence occurring around day five of ventilation [2]. Tracheal intubation thwarts cough reflex, compromises mucociliary clearance, injures tracheal epithelial surface, provides a direct conduct for rapid access of bacteria from upper into lower respiratory tract and allows formation of biofilm on Endotracheal tube surface. The combination of these factors puts mechanically ventilated patient at great risk of developing VAP. *Aims and Objectives:* To study incidence of VAP in ET tube with subglottic suction port versus standard ET tube in cases of O.P poisoning in J.J.M Medical college, Davanagere from December 2015-June 2017. *Material and Methods:* A prospective observational case control study of 80 patients admitted to Red Zone/ICU of J.J.M. Medical College, Davanagere. *Results:* Patients who have presented with Organo-phosphorous poisoning between the age group of 18 to 60 years who require ventilator support, intubated with standard ET tube and another sub set of patients intubated with ET tube with subglottic suction port were analysed. In this study we found that distribution of various organisms with regards to sputum culture in both groups were pseudomonas being maximum and proteus was found in minimum percentage. When subglottic suction port is used we observed improved patients were 70% and death were 30%. When subglottic suction port is not used we observed improved were 55% and death were 45%. *Conclusion:* VAP is common in patients who are intubated in ICU, which has higher morbidity and mortality among these patients. In our study we observed that atropine usually decreases secretions, but here in this study patient population who were admitted developed secretions instead of adequate atropine dosage and also developed VAP. Use of ET tube with Subglottic suction drainage may prevent VAP in cases of Organo Phosphorous poisoning and also improves patient outcomes.

**Keywords:** Ventilator Associated Pneumonia; Endotracheal Tube; Subglottic Suction Port.

## Introduction

Ventilator associated pneumonia is defined as

pneumonia occurring in a mechanically ventilated patient after 48 hours of endotracheal intubation.

Ventilator associated pneumonia is most common

nosocomial infection in ICU and associated with prolonged hospitalization, increased health care costs, and high attributable mortality. Tracheal intubation thwarts cough reflex, compromises mucociliary clearance, injures tracheal epithelial surface, provides a direct conduct for rapid access of bacteria from upper into lower respiratory tract and allows formation of biofilm on Endotracheal tube surface. The combination of these factors puts mechanically ventilated patient at great risk of developing VAP. Many preventive strategies have arisen from this understanding- control of intracuff pressure, aspiration of subglottic secretions, decontamination of subglottic area, use of antiseptic impregnated ETT and elimination or prevention of ETT biofilm formation.

The two most important mechanisms implicated in development of VAP are microaspiration and biofilm formation. Microaspiration occurs when there is distal margination of micro-organisms present in secretions accumulated above ETT cuff. Biofilm formation is development of network of secretions and attached micro-organisms that migrate along ETT, facilitating transfer to sterile bronchial tree.

Interventions directed at preventing microaspiration have focused on limiting the secretions that pass ETT cuff, whether by removing secretions via aspiration, optimizing cuff pressure to keep cuff constantly inflated or changing ETT cuff materials to prevent microchannel formation.

The subglottic secretion drainage was designed to evacuate secretions that accumulate on top of cuff when a good seal is provided by pressure or material or shape of ETT cuffs. Therefore a method that intermittently or continuously suction secretions in the subglottic area may decrease the aspiration risk and prevent VAP. This system is known as Subglottic suction drainage and consists of an ETT with a separate dorsal lumen port that opens above ETT cuff, in which a negative pressure is applied in order to aspirate secretions.

## Materials and Methods

This is an observational cross sectional prospective study.

### Source of Data

Patients admitting in Red Zone/ICU of J.J.M. Medical College, Davangere.

### Duration of Study

18 months (December 2015 - June 2017)

### Sample Size

80 patients

### Inclusion Criteria

Patients who have presented with Organo-phosphorous poisoning between the age group of 18 to 60 years who require ventilator support, intubated with standard ET tube and another sub set of patients intubated with ET tube with subglottic suction port.

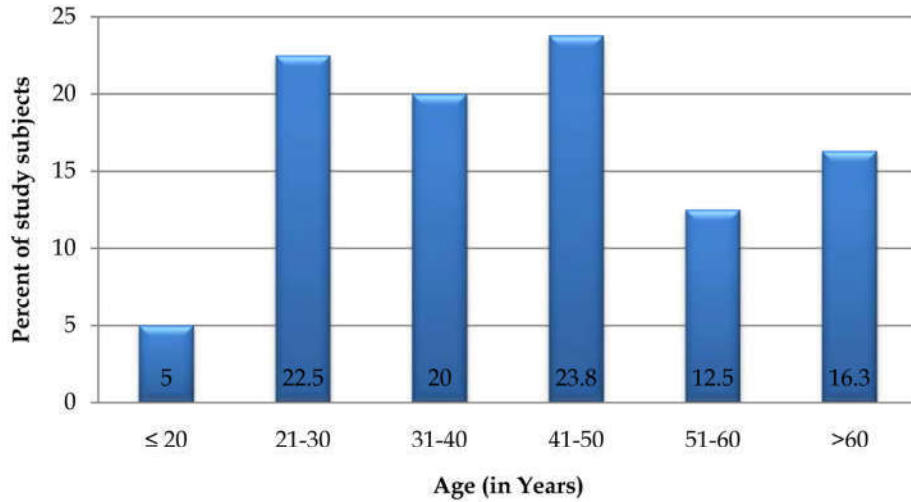
### Exclusion Criteria

Patients who have consumed Organo-phosphorous compounds and do not require any ventilator support associated with no comorbidities.

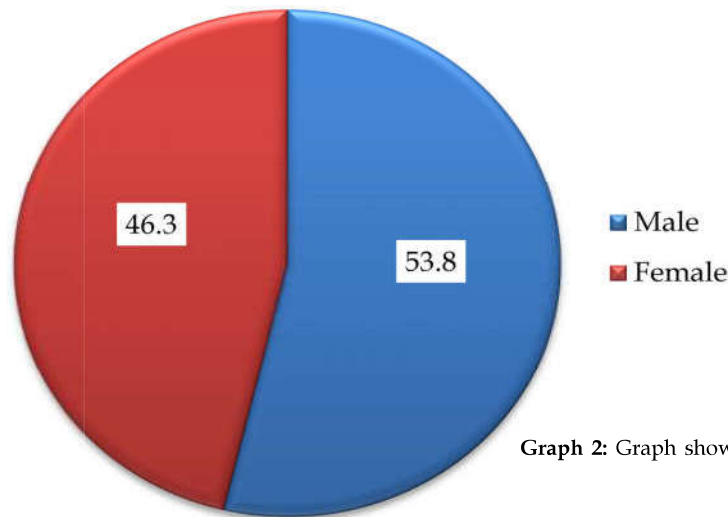
## Results

- Minimum age group in our study is 18 and maximum age group is 80 years. In our study we found that maximum number of cases were between age group of 41-50. Mean age group in our study is 43.55 (16.72).
- Among total 80 patients, it was found that 43 patients were males and 37 patients were females i.e 53.8% were males and 46.3% were Females
- In our study we found that association between subglottic suction port usage and gender in males it was used in 22 (55%) patients, not used in 21 (52.5%) whereas in females used in 18 (45%), not used in 19 (47.5%) patients p-value <0.001 is significant.
- We observed that among 80 patients, we found pseudomonas species of 22 in number i.e 27.5%, followed by Klebsiella and acinetobacter each of 13 in number i.e 16.3%, e.coli 10 in number i.e 12.5%, hemophilus 9 in number i.e 11.3%, enterobacter 5 in number i.e 6.3%, staphylococcus aureus 4 in number i.e 5%, streptococcus 3 in number i.e 3.8%, proteus species 1 in number i.e 1.3% have been observed.
- We equally divided the patients into two groups one subset of 40 patients receiving subglottic suction port and other remaining 40 patients where subglottic suction port was not used.

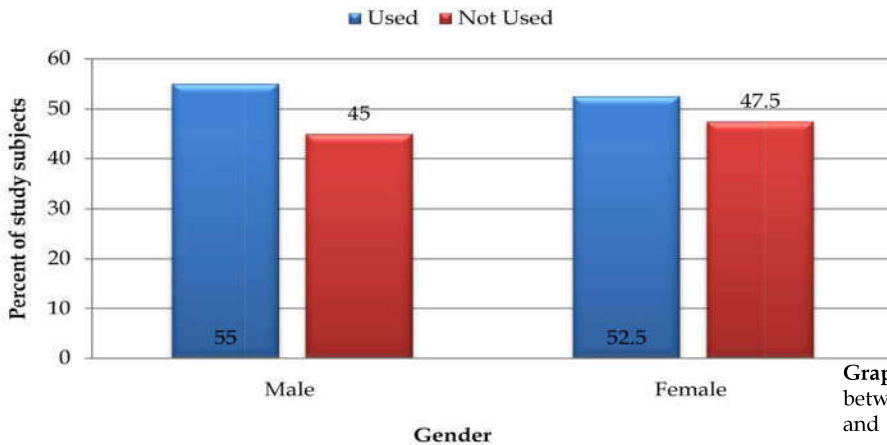
- We had compared between patients where subglottic suction port is used in 40 patients and in patients where subglottic suction port is not used 40 patients, we found that in the patients where subglottic suction port is used, improved were 28 patients (70%) death were 12 (30%) in patients where subglottic suction port is not used improved were 22 patients (55%) and death were 18 (45%) patients.



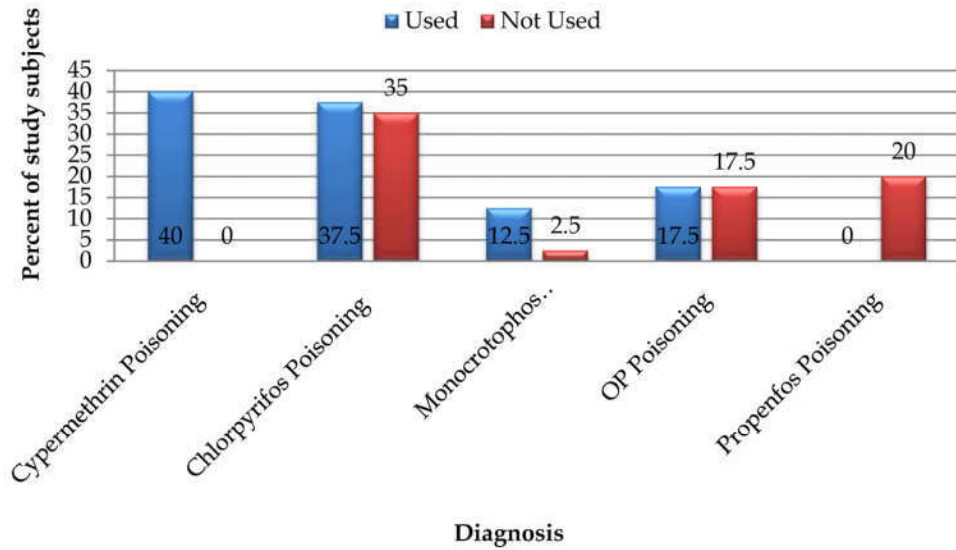
Graph 1: Graph showing distribution of age group



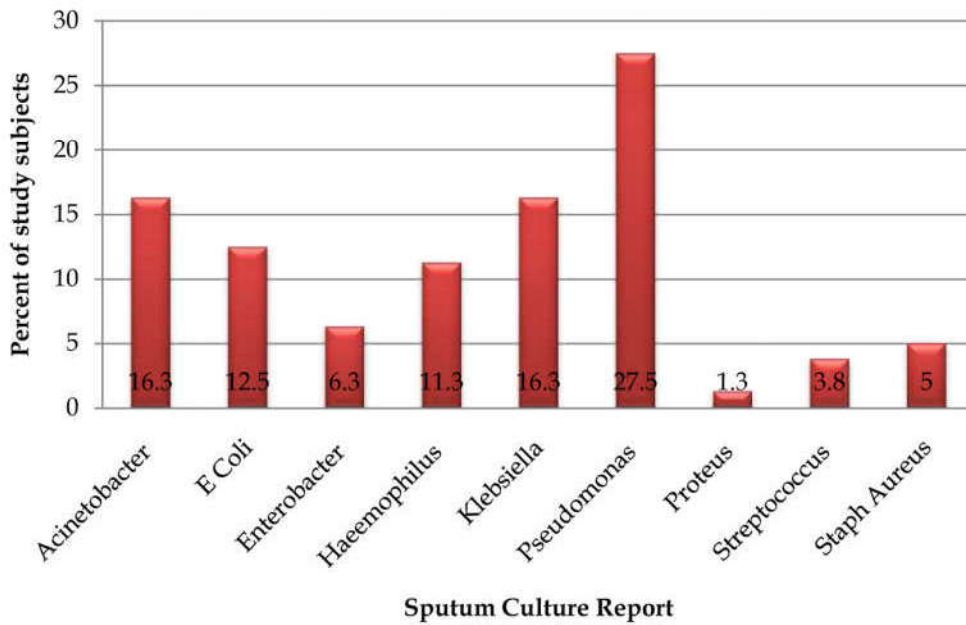
Graph 2: Graph showing distribution of gender



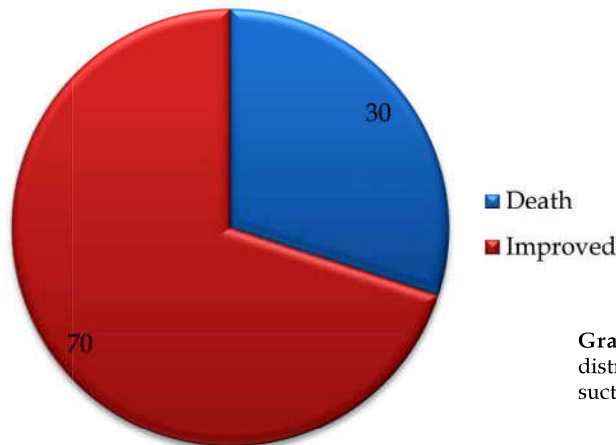
Graph 3: Graph showing association between subglottic suction port usage and gender



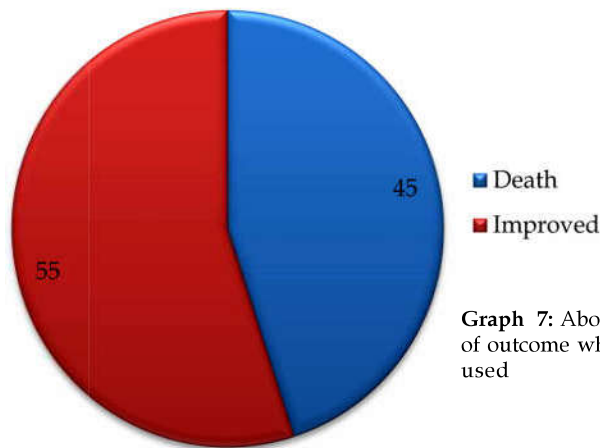
Graph 4: Graph showing association between subglottic suction port usage and diagnosis



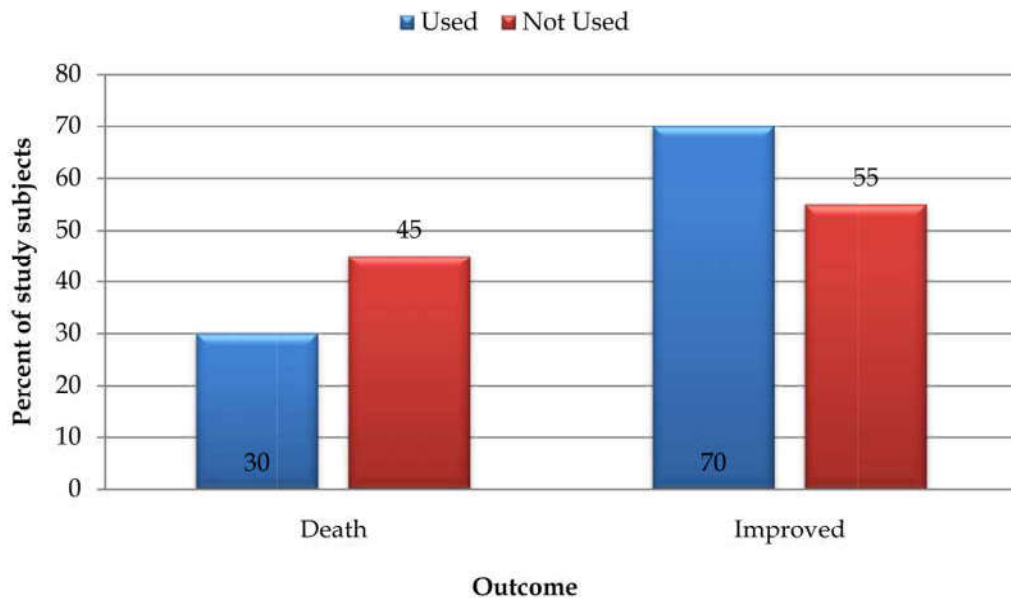
Graph 5: Graph showing distribution of sputum culture



Graph 6: Above diagram showing distribution of outcome when subglottic suction port is used



Graph 7: Above diagram showing distribution of outcome when subglottic suction port is not used



Graph 8: Above graph showing association between subglottic suction port usage and outcome

**Discussion**

In our study we compared morbidity and mortality among ICU patients who are on ventilator and presented with VAP in cases of Organophosphorous poisoning we collected data of 80 patients, divided into two groups each of 40 patients each in which one subset of patients we used subglottic suction port and in another subset of 40 patients we did not use subglottic suction port.

Various studies had been done in the past, which assessed the prevalence of VAP in intubated patients who are on ventilator and also the most common organism isolated in VAP, other studies have shown incidence of subglottic suction drainage in incidence of VAP.

Dezfulian et al conducted a study in 2005 followed five randomized controlled trials which enrolled 896 patients who met selection criteria.

These patients (435) who received subglottic suction drainage had a reduced incidence rate of VAP when compared to control patients (461) who did not receive subglottic suction port, in our study we observed out of 40 patients who received subglottic suction port drainage, improved were 28 patients and death were 12 and in patients where subglottic suction port is not used improved were 22 patients and death were 18 patients Davis et al (2006) describes the ETI as an anatomical barrier and a direct conduit that allows for rapid access of pathogens into the lower respiratory tract [3].

Studies by Fabinjames et al. (2007) found male predominance where 72% of VAP patients were male

and 28% were female and Kuo-Tung Huang et al. (2010) found 67% of male and 33% of female patients in their VAP study, in our study we found males who received subglottic suction port were 55% males did not receive subglottic suction were 52.5% males, females were subglottic suction used was 45% did not used was 47.5%

In studies done by Rakshit et al reported that half of cases developed VAP with *P. aeruginosa* [4] and Panwar et al reported that significant incidence of 47.5% VAP predominantly caused by *P. aeruginosa* [5], in our study we found that predominant organism involved was *pseudomonas* species (27.5%).

Similar to our study Chittawatanarat et al reported that gram negative organisms were the major pathogens (94.7%), the first three most common organisms were *acinetobacter*, *K. pneumoniae* and *P.aeruginosa*, in our study we found first three organisms isolated were *pseudomonas*, *klebsiella* and *acinetobacter*.

### Conclusion

VAP is common in patients who are intubated in ICU, which has higher morbidity and mortality among these patients.

In our study we observed that atropine usually decreases secretions, but here in this study patient population who were admitted developed secretions instead of adequate atropine dosage and also developed VAP. Use of ET tube with Subglottic suction drainage may prevent VAP in cases of Organo Phosphorous poisoning and also improves patient outcomes.

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