



## INTERMITTENT SUBGLOTTIC SECRETIONS DRAINAGE & VENTILATOR ASSOCIATED PNEUMONIA

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**ABSTRACT** **Background:** Ventilator associated pneumonia (VAP) is an important health issue in any Intensive Care Unit (ICU). It is necessary to reduce overall incidence of VAP in ICU patients. Aspiration of tracheal secretions into lungs is the main cause of VAP. To prevent this aspiration, different strategies are employed. Out of which, intermittent subglottic secretion drainage is newer one & needs to be studied.

**Objective:** TO determine whether subglottic secretion device (SSD) reduces incidence of VAP.

**Materials & Methods:** The present study was undertaken to determine whether SSD reduces incidence of VAP. 35 adult patients intubated with ETT (endotracheal tube) & expected to require mechanical ventilation for more than 48 hours was included.

**Results:** Out of total 100 patients, 50 were having SSD ETT & 50 patients had ETT without SSD. Out of these 100 patients, 18 patients had microbiologically confirmed VAP. Out of these 18 patients 7 patients were from SSD tube study group & 11 patients from control group.

**Conclusion:** Use of SSD ETT can reduce incidence of early VAP. Also it act in unison with other methods to prevent VAP but more studies are required to demonstrate its effect on length of ICU stay and duration of mechanical ventilation.

**KEYWORDS :** Subglottic suction drainage, Ventilator associated pneumonia

### Introduction:

VAP (Ventilator Associated Pneumonia) is an important health issue in ICU, as it carries significant morbidity, increase in duration of mechanical ventilation, hospital stay & overall mortality.

VAP is defined as pneumonia that develops 48 hours after mechanical ventilation is initiated & characterized by

- 1) Presence of new /progressive infiltrate,
- 2) Signs of SIRS like  $>10000$  TLC  $<3000$ , fever,
- 3) Changes in Endotracheal Tube secretions color & consistency
- 4) Detection of causative agent

Confirmation of pneumonia by finding causative microbiological agent in all patients ET samples may not be possible in all patients. One may require protected telescopic catheter sample or BAL (bronchoalveolar lavage) fluid.

VAP is also divided into early onset VAP ( $<5$ days) & late onset VAP ( $>5$  days).

### Materials & Methods:

This study was conducted in surgical ICU of teaching hospital in western Maharashtra. Inclusion criteria is 100 elective and emergency patients who came to SICU intubated above age of 18 years who required mechanical ventilation for more than 5 days.

### Exclusion criteria

- 1) Patients with tracheostomy
- 2) Patients with mechanical ventilation requirement less than 48 hours
- 3) Patients intubated after cardiac arrest or received CPR.

Patients requiring mechanical ventilation were intubated using either portex ETT or portex SSD (subglottic suction device) ETT. In the SSD group, subglottic secretions were suctioned manually with a 10 ml syringe, every 2 hourly. Oropharyngeal & intratracheal close suctioning of secretions done in both groups every 4 hourly & also whenever required. Total volume of secretions suctioned were noted.

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### RESULTS-: Demographic data

**Table 1**

Parameter	Group SSD	Group C	P Value
Age (yrs)	56.35+/- (14.5)	58.41+/- (21.6)	0.576
Sex (M/F)	26/24	23/27	0.689
Type of surgery			
Elective	38	41	0.6234
Emergency	12	9	
Specialty wise			
Surgery	29(58%)	24(48%)	0.423
Neurosurgery	4(8%)	3(6%)	0.695
Orthopedics	11(11%)	18(9%)	0.186
Maxillofacial	2(4%)	2(4%)	1.00
OBGY	4(8%)	3(6%)	0.6951
Previous co-morbidities			
IHD	16(32%)	13(26%)	0.6594
COPD	11(22%)	7(14%)	0.434
DM	14(28%)	19(38%)	0.394
Malignancy	6(12%)	8(16%)	0.773
CRF	2(4%)	1(2%)	0.557
No Co-morbidities	14(28%)	12(24%)	0.819

Mean +/- (standard deviation)

IHD- ischemic heart disease, COPD- Chronic obstructive pulmonary disease, DM –diabetes mellitus, CRF-chronic renal failure

**Table 2-** VAP rate, Duration of mechanical ventilation, and survival outcome

	Group SSD	Group C	P Value
Early VAP			
No. of patients with early VAP (%)	2(4%)	5(10%)	0.4331
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Late VAP			
Late VAP rate*	14.7/1000	16.9/1000	
No of patients with Late VAP (%)	5(10%)	6(12%)	0.7501
Average duration of MV (days)	6.8+/- (2.8)	7.1+/- (3.9)	0.6596
No. of deaths (%)	2(4%)	3(6%)	0.646

\*Cases/ 1000 ventilator days  
MV- mechanical ventilation

### Discussion:-

Ventilator Associated Pneumonia (VAP) results from leakage of oropharyngeal secretions around the endotracheal tube cuff which enters the normally sterile lower respiratory tract and lung parenchyma resulting in invasion of bacteria.<sup>14</sup> Different methods have been used to prevent VAP but still 9-27% of patients who are mechanically ventilated in ICU develop VAP and it remains an important cause of morbidity and mortality.<sup>5,6</sup>

There are two methods to reduce incidence of VAP, one which reduces the time at risk of VAP such as early extubation & reducing duration of mechanical ventilation and secondly interventions which reduce the volume of secretions aspirated e.g. use of Subglottic Suction endotracheal tubes and semi recumbent position<sup>7</sup> Third intervention which reduces the inoculum of bacteria in secretions are chlorhexidine mouthwash & selective digestive decontamination (SDD)<sup>8</sup>.

Semirecumbency is always not possible in postoperative patients e.g. spine surgeries & cannot be implemented continuously so subglottic suction devices are advantageous in such circumstances to prevent VAP. SDD is expensive & there is concern of developing microbial resistance. Similarly chlorhexidine mouthwash does not completely sterilize the upper airway, so cannot prevent VAP completely.<sup>10</sup>

So decreasing the amount of secretions aspirated remains the important method for VAP prevention, which can be achieved by using SSD<sup>11, 12</sup>. Also Muscendere & Rewa et al in their meta-analysis suggested that SSD and chlorhexidine mouthwash are complementary to each other in VAP prevention rather than using only one method either<sup>14</sup>. A recent study by Kollef et al<sup>15</sup> found 36% reduction in incidence rate of VAP by using silver coated endotracheal tubes but doesn't found any effect on reduction of duration of mechanical ventilation and length of ICU stay.

Specially designed endotracheal tube with sub-glottic secretion drainage (SSD) was first described in 1992<sup>16</sup> to prevent VAP. It has separate dorsal lumen that opens just above the endotracheal tube cuff. A meta-analysis of studies using SSD to prevent VAP has shown SSD is useful in preventing Early VAP<sup>17</sup> but whether it is useful in preventing late VAP is still controversial<sup>18,19</sup>. In our study intermittent SSD resulted in significant reduction in overall incidence of Early VAP rate i.e. 5.8 vs. 14/1000 ventilator days with p value of 0.4331 which is significant, but we didn't find significant difference in incidence of late VAP Rate i.e. 14.7 vs. 16.9/1000 ventilator days with p value of 0.7501 which is not significant.

There is variation in volume of secretions suctioned & according to one study the volume ranges between 0.3-15 ml<sup>20</sup>. These variations are because of variable amount of secretions present above the cuff, secretion viscosity, suction pressure and related to difficulties in maintaining patency of subglottic suction line and cuff inflation pressure<sup>21</sup>. Manual, Automatic, intermittent or continuous suction methods are proposed in literature<sup>22</sup> but most effective method is still unclear.

Not only there is marked decrease in the incidence of microbiologically confirmed VAP with the use of SSD in our study but also Duration of mechanical ventilation and length of ICU stay. Mortality benefits are not significant. Meta-analysis by Dezfullian et al showed significant reduction in duration of mechanical ventilation & ICU stay in patients with SSD<sup>17</sup>. According to systemic review & meta-analysis by Muscendere & Rewa et al<sup>18</sup> there is more than 50% reduction in incidence of VAP with use of SSD, but its strength of association with reduction in duration of mechanical ventilation and length of ICU stay is weak as various surgical factors and co-morbidities play crucial role in these outcomes<sup>16,23,24,25</sup>.

ETT with SSD are not widely utilized<sup>24</sup> because of cost & inability to judge which patients will require prolonged mechanical ventilation & are at risk of VAP. According to Shere et al<sup>26</sup> & Muscendere and Rewa et al using SSD is cost effective than treating VAP with costly antibiotics and prolonging duration of ICU stay and mechanical ventilation. Regarding second issue all patients who are intubated in ER, ICU, and Ward should have SSD ETT. According to Bouza et al<sup>27</sup> all operative patients who are expected to require post operative mechanical ventilation should have SSD ETT but whether to change the ETT is not clear.

There are some drawbacks of using SSD as secretion properties & malposition of suction port which may lead to decreased suction<sup>28, 29</sup>. Larente et al<sup>30</sup> demonstrated that new cuff design can reduce micro aspiration with SSD with polyurethane cuff. Complications like post-extubation stridor and re-intubation are found in only 3 out of 13 studies which used SSD in meta-analysis by Muscendere & Rewa et al<sup>14</sup> also it is only reported in animal models<sup>31</sup>. Some case reports<sup>32</sup> which described tracheal injuries after prolonged use of SSD are present but no studies.

Described airway injuries with use of SSD<sup>33</sup>. In our study there were no complications related to airway as well as no difference in incidence of post-extubation dyspnoea, or re intubation rate in two groups.

### Conclusion:-

Use of SSD ETT can reduce incidence of early VAP. It is cheap, easily available harmless option. It can be implemented in all patients who might require prolonged mechanical ventilation. Also it act in unison with other methods to prevent VAP but more studies are required to demonstrate its effect on length of ICU stay and duration of mechanical ventilation as co-morbidities and other confounding factors may play a significant role in these outcomes.

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