EDITORIAL

Ventilator-associated Pneumonia: Is the Dilemma Still "Open" or "Closed"?

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In patients with mechanical ventilation, ventilator-associated events remain a serious complication, as the mortality rate is high in such patients. The occurrence of ventilator-associated pneumonia (VAP) is affected by multiple factors, including the etiology, host factors, comorbid conditions, infection control practices of the unit, and prevalence of microorganisms/drug resistance.

Numerous checklists and practices have been advocated to reduce incidence of VAP. Use of open or closed tracheal suction system (OTSS or CTSS) techniques, to reduce the incidence of VAP, has been compared by various authors. The closed suctioning technique, which was introduced in 1980s, has also complications associated with conventional suctioning technique, like environmental contamination and cross infection,[1,2] hypoxia, and alveolar derecruitment.[3,4] Closed suctioning technique has been proposed in checklist for reducing the risk of VAP.[5] This is believed to be due to lesser breaks in the continuity of the circuit and hence reduced risk of contamination as well as lessened exposure of healthcare personnel to respiratory pathogens.[2] However, the suction catheter of the in-line system may become heavily colonized by patient's microorganisms carrying the risk of autocontamination when bacterial aggregates are dislodged into the airway, for example, during catheter cleansing with saline.[2] This may contribute to explain the higher rate of tracheal colonization observed with the closed system than with the open technique.[6–8]

The systematic review and meta-analysis on comparison of closed versus open suction in prevention of VAP by Sarvin et al., published in the current issue, have shown that OTSS was associated with a significant increase (57%) in VAP frequency compared with CTSS. This finding differs from several old studies conducted in this aspect.

In a systematic review and meta-analyses, it becomes imperative to exclude biases in the study design and result interpretation. As per the authors (Sarvin et al.), all previous meta-analyses have included research papers mostly before year 2000 and those had flaws of being smaller trials with reporting bias and incomplete data set.

The authors have done a comprehensive literature search from year 2000 to June 2020, a time interval of almost two decades. Their inclusion and exclusion criteria are quite elaborative. Reporting quality assessment of included articles was performed according to the CONSORT statement, a tool which is used worldwide to improve the reporting of randomized controlled trials. Though the studies with 10 points or more were considered studies with "moderate-to-good study" quality, for unclear reasons, however, all the selected studies were included in the systematic review, regardless of their score. Therefore, it could be a flaw in the methodology which might have contributed to the bias. The statistical analysis applied also is very elaborative.

As a result, out of 59 publications, 10 were included for this systematic review and meta-analysis. Risk of bias assessment of included studies based on the Cochrane RoB2 tool in RevMan 5.3 for RCTs has been mentioned. As per the authors' description, there is evident "selection bias" as well among the chosen studies. All the included articles had risk of bias for "not being blinded" both for participants and for outcomes. The data are "incomplete" in 9 out of 10 studies, and "selective reporting" is done for all the studies which accounts for reporting bias. These aspects raise questions on the results of the meta-analysis.

Heterogeneity was tested by the heterogeneity statistic Q and quantified using I^2. Results showed almost a high heterogeneity among the studies ($I^2 = 49\%$, $p = 0.04$). Therefore, the use of random effect model in this study was correct and appropriate. It means the studies used have been extracted from different communities. This is a favorable point regarding this meta-analysis. The authors extracted data on the outcomes measured from each study. The data synthesis has been performed using random effect models.

Similar VAP rates have been reported with both suction techniques,[6,9–11] although one study had reported the incidence of VAP 3.5 times higher with use of open technique.[11] In 2004, the relationship between closed-suction systems and VAP was still considered as an unresolved issue by the Centres for Disease Control and Prevention.[12] In addition, further trials in this aspect have been published.[8,13–15] There was no difference in the rate of

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VAP with the closed- and open-suctioning systems in these trials. Only one small study suggested a decrease in VAP incidence with use of the closed system.[14]

In a randomized control trial by Lorente et al.,[15,16] 457 mechanically ventilated patients were assigned to the open-suctioning technique or to a closed system. The closed system was changed only when soiled or nonfunctional, but not routinely. No difference was found between groups in the rate and incidence of VAP or in the pattern of respiratory pathogens associated with VAP. Costs of suctioning were similar between open and closed suctioning, but they varied according to the length of mechanical ventilation. In the current study, the authors have not analyzed the cost effectiveness of use of closed suction systems.

Though there is a derivation of a significant reduction (57%) for occurrence of VAP with the use of CTSS compared to OTSS in ventilated patients, the meta-analysis by Sarvin et al. published in the current issue has several limitations. The quality of the studies included and inherent biases of these studies point toward bias of conclusions. The authors have been cognizant of these crucial points and have correctly proposed for larger-size trial with good quality for better understanding of the continued dilemma.

To conclude, most of the trials, systematic reviews, and meta-analyses centered on impact of open vs closed suction systems on incidence of VAPs have several limitations. There is abundance of literature to state that there is no superiority of CTSSs in terms of prevention of VAP. Infection control practices of the unit and compliance of healthcare personnel in intensive care unit are among important modifiable factors to reduce incidence of nosocomial infections, like VAP.

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