Influence of tracheal suctioning systems on health care workers’ gloves and equipment contamination: A comparison of closed and open systems

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The impact of tracheal suctioning with an open or a closed system on equipment and health care workers contamination with multidrug-resistant pathogens was compared. Only the closed system reduced hand and equipment contamination during tracheal suctioning. This equipment could be systematically used to reduce risk of cross contamination in the intensive care unit.

Key Words: Mechanical ventilation; cross contamination; airway secretion management; nosocomial infections; Acinetobacter; Staphylococcus aureus; Pseudomonas aeruginosa.

Health care-associated infections represent a major challenge for clinicians and institutions. These infections often result from cross contamination. In these instances, transmission of causatives microorganisms by the hands of health care workers (HCW) is the major route.1

Duration and type of care affect hand contamination,2 and respiratory care is associated with the highest number of bacteria acquired by HCWs.2 Reducing exposure to bacteria is thus a major challenge to reduce cross contamination. In this respect, closed suction systems (CSS) as opposed to open systems (OSS) offer an attractive alternative for tracheal suctioning (TS) of intubated patients. However, most studies on CSS focused solely on ventilator-associated pneumonia (VAP) and failed to find a positive impact.3 Hence, use of CSS is not recommended.4 Surprisingly, effect of CSS on hand contamination has never been evaluated, although CSS could help reduce the burden of bacterial transmission, especially in presence of multidrug-resistant bacteria (MDR).3 Thus, we aimed to compare glove and airway equipment contamination during TS with either OSS or CSS.

METHODS

In our unit, patients are routinely screened for MDR by regular culture of tracheal aspirates. Before obtaining results of the screening, patients are suctioned with an OSS (Unomedical, Birkerod, Denmark). In case of tracheal colonization (either with MDR or a high burden of other pathogens such as Pseudomonas aeruginosa), OSS is abandoned and a CSS is set up (Ty-Care Exel, Covidien, Elancourt, France).

Study design

Two consecutive TS were studied each time: the last one performed before removal of OSS and the first one performed with the newly installed CSS. The amount of secretions suctioned during TS was checked to ensure that differences in contamination were not the consequence of smaller volumes of secretions.

Bacteriologic study. The immediate environment of respiratory care (swivel of the flex tube, suction valve, rinsing port and rotating valve) was swabbed for microbiologic culture before and after TS. Gloves were used for the suctioning procedures as recommended.4 If the HCW was already in the room wearing gloves, these
were changed before performing TS. Just after the TS, HCW applied their gloved hands on appropriate agar plates, gloves were then discarded, and hands were cleansed. To compare microorganisms isolated in aspirates with those isolated on gloves and environment, colonies isolated on plates were systematically identified with the methods routinely used in the laboratory: identification galleries for gram-negative rods (API 20E, API20NE; BioMérieux, Lyon, France) and coagulase test for staphylococci.

Ethical aspects

The study was approved by the French Society of Intensive Care’s Ethics Committee. Because no change was done to our intensive care units (ICU) usual practices, informed consent was not required, but patients and/or their proxies were informed of the study’s purpose.

Statistical analysis

Results are expressed as median (25th-75th percentiles) colony-forming units (CFU) per plate. Mann-Whitney test compared glove contamination between the 2 systems. Wilcoxon matched pairs test compared equipment contamination before and after TS. Categorical data were assessed using Fisher exact test.

RESULTS

Nineteen TS were studied (9 OSS and 10 CSS). MDR isolated in the aspirates were Acinetobacter baumannii, meticillin-resistant Staphylococcus aureus, and extended-spectrum betalactamase Escherichia coli. Microorganisms that grew more than 10⁶ CFU/mL in the aspirates were P aeruginosa, coagulase negative staphylococci, Klebsiella oxytoca, and Serratia marcescens.

Glove contamination

OSS led to glove contamination during all TS procedures (9/9) and in only 3 of 10 TS with CSS (P < .004). Median glove contamination after TS was 40 (13-105) CFUs per plate with OSS and 0 (0-0) CFUs with CSS (P = .0002). Maximum glove contamination was 240 CFU with OSS compared with 15 CFU with CSS.

Airway equipment contamination

There was no significant difference in median levels of equipment contamination before TS between OSS and CSS (P = .14). With OSS, median level of contamination significantly increased after TS from 0 (0-2) to 5 (0-30) CFU (P < .01). This was not the case with CSS (0 vs 0, respectively, P = .31). After TS, overall number of positive samples was 74% with OSS with a maximum level of contamination of 300 CFU as compared with 6% (P < .0001) with CSS and only 10 CFU as maximum level.

DISCUSSION

Our results indicate that the use of CSS significantly reduces both glove contamination of HCWs and airway equipment during TS of patients with MDR. Because respiratory care is the most frequent care performed by HCW and the one associated with the highest risk of contamination, efforts should be directed to reduce this risk during this procedure. This is all the more important because cross contamination is the major route to nosocomial infection in the ICU. Based on our results, reducing the bacterial burden on HCW hands with CSS should be considered an important part of nosocomial infection prevention. They are not often used however, a meta-analysis having failed to demonstrate a positive impact of CSS on VAP. Their systematic use is not recommended. We believe, however, that use of CSS should not be solely looked upon in terms of VAP reduction but more generally as a means to reduce risk of cross contamination. HCW become contaminated through direct contact with the patients or their biologic fluids and indirect contact with environmental surfaces. We show that CSS may help reduce both routes. Cobley et al showed that TS with OSS was associated with significant air contamination, which was reduced with CSS. We expand these results by showing the frequent glove contamination with OSS, which is noticeably reduced with CSS.

Because glove removal is associated with hand contamination and hand hygiene compliance is low in the ICU, use of CSS may help reduce risk of cross contamination. Finally, CSS protect HCW against exposure to virulent bacteria that are disseminated during OSS, and that can sometimes lead to potentially blinding microbial keratitis.

CSS provide an additional help in the struggle against nosocomial infection by reducing risk of cross contamination and protecting HCW. Their use should be recommended in that perspective rather than that of VAP reduction, without relieving HCW from obligation of rigorous hand hygiene with alcohol-based solutions.

References

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