

A PRELIMINARY ASSESSMENT OF THE EFFICACY OF A NOVEL CLOSED SUCTIONING SYSTEM TO REMOVE ENDOTRACHEAL TUBE BIOFILM

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Introduction: Following endotracheal intubation, biofilm forms on the internal surface of the endotracheal tube (ETT). A novel closed suctioning system was developed to dislodge and mechanically remove ETT biofilm through high-pressure jets of sterile saline and an inflatable distal balloon.

Objectives: We tested the efficacy of the novel closed suctioning system in an animal model of tracheal intubation and respiratory infection.

Methods: We studied 10 pigs (32.4±1.8 Kg) with severe *P.aeruginosa* pneumonia. In 5 animals (control group) standard tracheal suctioning was performed using the KIMVENT* Closed Suction Systems (Kimberly Clark, USA); in 5 animals (treatment group) tracheal suctioning was carried out with the novel catheter (Airway Medix Closed Suction System, Biovo Technologies, Israel). During suctioning, the novel catheter was advanced up to the proximal trachea to aspirate retained secretions. The catheter was then pulled back to the tip of the ETT and the balloon inflated to adhere against the ETT wall. Finally, the catheter was gently withdrawn, while saline jets and aspiration operated simultaneously to displace biofilm and remove biofilm debris. In both groups vacuum was set at 150-200 mmHg. Upon autopsy – following 76h from intubation – the animal was extubated and the ETT longitudinally cut open. A 3 cm and 1 cm–long hemi-sections of the dependent part of the ETT were dissected for quantitative microbiology studies and confocal microscopy, respectively. Representative biofilm accumulations were imaged and recorded. Biofilm area, maximal and minimal thickness were computed. During the analysis, investigators were blind to treatment allocation.

Results: In the control and study group 9.5±4.5 and 8.5±3.5 tracheal aspirations/day were carried out, respectively (N:30, p=0.50). Both suctioning systems were easy to use. ETT *P.aeruginosa* colonization in the control group was 5.8±0.9 log cfu/ml, in the study group was 4.5±2.6 log cfu/ml (N:10, p=0.41). We examined 3.4±1.5 and 2.6±1.7 pictures per pig in the control and treatment group, respectively (N:10, p=0.47). We found, in the control group, a greater mean biofilm mass of 78950±184111 μm^2 compared to the study group of 46098±74466 μm^2 (N:30, p=0.28). The maximal biofilm thickness in the control and study groups were 210±302 μm and 126±128 μm , respectively (N:30, p=0.17). The minimal biofilm thickness in the control group was over twice that of the study group - 79.1±146.7 μm and 35.9±86.9 μm , respectively, (N:30, p=0.04).

Conclusions: This preliminary assessment shows that the novel closed suctioning system was slightly more effective in reducing biofilm accumulation from the ETT lumen in intubated and ventilated swine with *P.aeruginosa* colonization.

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