The Efficacy of Backflushing Suction Regulators as a Method of Internal Disinfection

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Background

Suction regulators are a common piece of equipment in the critical care setting. Clinicians at DEBORAH Heart & Lung Center were the principal investigators involved in an eleven hospital survey of suction equipment in 2009. This study showed that a high percentage of hospital suction controls contained hospital pathogens (~36%) and that the contamination inside the suction regulator may pose a risk to subsequent patients receiving intermittent suction.[1] Hospital protocols traditionally address external decontamination of suction regulators but they seldom mention fluid path disinfection.

Most regulators are set up in a manner wherein a catheter or tube is connected from the patient to a canister with another piece of tubing connected from the canister to the regulator. Materials removed from the patient are intended to be contained within the canister by a combination of gravity and the utilization of simple filters. These containment measures are not adequate to prevent suctioned waste from internally contaminating suction regulators.

Intermittent suction, which is commonly used by Respiratory Therapists for subglottic secretion drainage (SSD) and by the Nursing Staff for nasogastric drainage, allows for a backflow wherein atmospheric air is entrained through the suction regulator to vent the patient circuit during therapy. Both of these interventions can be postulated to effect contamination of the lower respiratory tract and can play a role in subsequent Ventilator Associated Pneumonia (VAP).[5]

Regulator manufacturers recommend "backflushing" to clean and decontaminate the internal passageways of their regulators; this process typically involves drawing 100cc of a cleaning agent through the suction regulator followed by a drying period. This is the most common means of attempting to address internal contamination in the regulator. This study aims to evaluate the efficacy of these procedures as a disinfection means in both simulated and actual clinical scenarios.

Methods and Materials

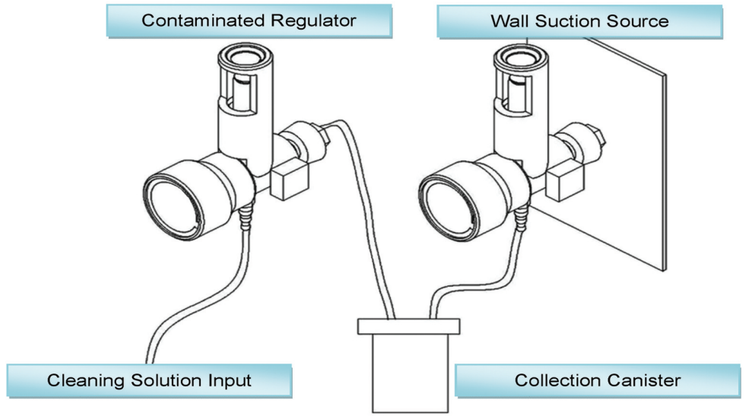
There are four major manufacturers of suction regulators in the US representing five common brands.[2]

Suction Regulators

Part 1 – Visual Cleaning Effectiveness

To visually assess cleaning effectiveness, each regulator was challenged with 5cc of a fluorescent bacterial simulation solution[3] commonly used to assess surface cleaning effectiveness. The material was drawn completely through the regulator to simulate an inadvertent flooding. These regulators were subsequently backflushed according to the manufacturers' recommendations. These regulators were then disassembled and inspected with a UV light for signs of remaining contamination.

Standard Backflushing Diagram



Part 2 – Simulated Infectious Agents

To simulate cleaning effectiveness against an antibiotic susceptible organism, each regulator was challenged with 100cc of 1x10^6 cfu/ml *E. coli* solution.[4] These regulators were immediately backflushed and allowed to sit for 8 hours. The regulators were disassembled and swabs were taken of the internal passageways to assess for the presence of *E. coli*.

Part 3 – Real World Contamination

Working suction regulators were removed from patient areas of acute care hospitals. These regulators were disassembled and swabbed to determine the presence of any hospital pathogens. Each regulator was backflushed and allowed to sit for 8 hours. Each regulator was subsequently swabbed to assess for the presence of pathogens.

Results

Part 1 – Visual Cleaning Effectiveness

All 5 regulators that were contaminated with fluorescent bacteria showed signs that the internal passageways were not adequately cleaned with backflushing.

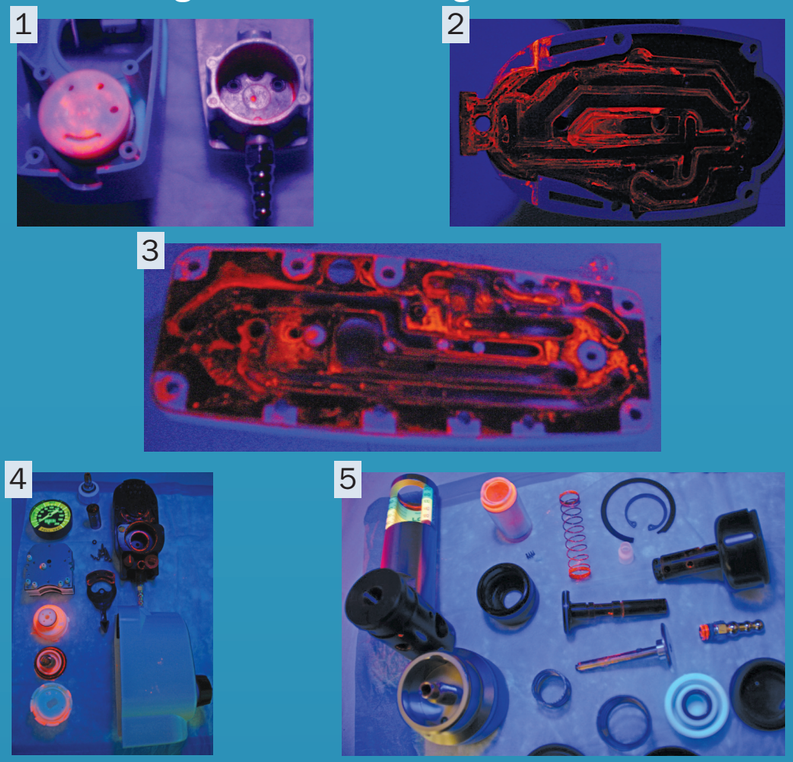
Part 2 – Simulated Infectious Agents

Each regulator that was contaminated with *E. coli* still produced a positive culture for *E. coli* after the regulators were backflushed according to the manufacturers' recommendations.

Part 3 – Real World Contamination

Thirty six percent (36%) of the regulators from acute care settings cultured positive for contamination after back flushing. Bacteria found included *S. aureus, S. epidermidis, P. aeruginosa, and B. cereus.*

Location of Contaminants Within Suction Regulators After Being Backflushed



Conclusions

Suction Regulators have the potential to spread infectious agents between patients, thus contributing to the spread of hospital-acquired infections. In addition, gastric colonization which is directly affected by intermittent suction attached to nasogastric circuits, has been linked to respiratory and systemic infections.[5] Most hospital protocols do not adequately address the routine cleaning, decontamination and disinfection of hospital suction controls. This may lead to a false sense of security for the hospital and the patient.

This study demonstrated that manufacturer recommended backflushing does not adequately disinfect internal suction regulator passages. The novel approach to device sterilization offered by the Boehringer Regulator, wherein traditional, well accepted autoclave techniques are employed to optimize device disinfection, would appear to offer substantial clinical advantage in prevention of nosocomial infections.

References

1. Kaye, Smialowicz, et. al. "An Investigation Into the Potential Transmission of Infection via Vacuum Regulators." presented at the 2009 APIC Conference
2. Ohio Medical Corporation (Ohio & Amvex brands)/ Allied Healthcare (Chemetron brand) /Precision Medical Corporation/ Boehringer Laboratories, LLC
3. Glo Germ, Powder Simulated Germs; Glo Germ Co. Moab, UT 84532
4. Escherichia coli ATCC 29425
5. Zhang QL, Liu MH, et al. "Prospective study of the gastro-pulmonary infection route of ventilator-associated pneumonia". Zhonghua Shao Shang Za Zhi. 2004 Feb; 20(1):20-2.