Title:
Recommended Antiseptics for Killing Bacterial Growth in Neonatal Blue Bulb Syringes: Addressing a Clinical Issue

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Session Title:
Rising Stars of Research and Scholarship Invited Student Posters

Keywords:
Blue Bulb Syringe, Disinfection and Oronasopharyngeal suctioning

References:
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Abstract Summary:
Blue Bulb Syringes (BBSs) are multi-use devices for clearing oronasal secretions in neonates and children. BBSs are known to harbor pathogenic bacteria; effective methods for disinfection are critical to prevent possible transmission of disease. This pilot experimental study identified three low-cost, widely-available antiseptics for killing bacterial growth in a BBS.

Learning Activity:

LEARNING OBJECTIVES	EXPANDED CONTENT OUTLINE

The learner will be able to identify common pathogenic bacteria growing in a neonatal Blue Bulb Syringe.	Common pathogenic bacteria known to grow in a Blue Bulb will be identified, along with the diseases they cause.
The learner will be able to identify effective antiseptics for disinfecting bacterial growth in a neonatal Blue Bulb Syringe.	Experimental results will be presented to identify which antiseptics are effective in disinfecting bacterial growth.
The learner will be able to compare the efficacy of different antiseptics in disinfecting bacterial growth in a neonatal Blue Bulb Syringe.	Comparative results for several antiseptics will be presented.

Abstract Text:

Blue bulb syringes (BBSs) have long been used to remove oral and nasal secretions from newborns to promote airway clearance. The BBS is provided to parents at hospital discharge and may be purchased by parents for home use in removing secretions during times of respiratory illness. Consequently, the BBS is a multi-use device. Current protocol recommends rinsing in warm, soapy water to clean the BBS between uses. No research studies have identified the efficacy of cleaning methods for killing bacteria growing in secretions inside the BBS. This experimental pilot study identifies antiseptics effective in killing bacterial growth within a BBS.

Using clinical isolates of *Escherichia coli* from BBSs collected at a large urban hospital (Damron, O'Neal, Adams, & Leahy, 2015), disinfection experiments, along with a control, were conducted using several antiseptics. Intervention consisted of application of specific concentrations of each antiseptic to the isolate. Antiseptics tested included dish detergents with Triclosan or l-lactic acid as their active ingredient, hydrogen peroxide, povidone-iodine, and chlorhexidine gluconate mouthwash. Experiments were conducted in triplicate to ensure validity and integrity of results.

Kerur, Bhat, Harish, Habeebullah, and Kumar (2006) evaluated the role of maternal genital bacteria and baby's surface colonization in early onset neonatal sepsis and found correlation between maternal genital bacteria, baby's surface colonization and neonatal sepsis, particularly when membranes were ruptured more than 24 hours prior to delivery or in low birth weight (LBW) or very low birth weight (VLBW) infants.

Labor and delivery units now routinely screen for and treat Group B *Streptococcus* (GBS). As a result, *Escherichia coli* has replaced GBS as the leading cause of neonatal sepsis (Bizzarro et al., 2015) as well as Early Onset Neonatal Bacterial Meningitis (May, Daley, Donath, & Isaacs, 2005; Voller & Myers, 2016).

Effective disinfection of pathogenic bacteria growing in a BBS is critical to preventing possible transmission from mother to baby during the birth process, and again later if the BBS is reused during the neonate's hospital stay. Transmission can also potentially occur if a BBS used during delivery is reused at home or if a BBS used during a time of respiratory illness is reused.

Five antiseptics were tested. Two, Triclosan and hydrogen peroxide, were ineffective in killing bacteria in the BBS within one minute. Failure of Triclosan to effectively kill bacteria in the BBS suggests that reconsideration of current protocol is critical. L-lactic acid, povidone-iodine, and chlorhexidine gluconate each achieved a 2-log kill, meaning 99 percent of existing bacteria was killed, in under one minute using concentrations at least four times the minimum inhibitory concentration.

Different settings, however, potentially require different antiseptics. For example, povidone-iodine is not currently approved by the Food and Drug Administration (FDA) for use on mucosal surfaces, but is

commonly used in other countries as part of oral care to prevent ventilator-associated pneumonia (VAP) (Li, Ai, Longzhu, Zheng, & Jie, 2015). Consequently, povidone-iodine, which has been identified as an effective antiseptic for killing *Escherichia coli* growth in a BBS, could be used in other countries which permit its mucosal contact.

L-lactic acid, the active ingredient in Palmolive Ultra® antibacterial dish detergent, effectively killed more than 99.99 percent of *Escherichia coli* growing in a BBS in under a minute. Parents could use a solution of Palmolive Ultra® in the home setting for disinfecting a BBS used on their children during periods of respiratory illness. Parents would not have to search for specialty products to disinfect any BBSs used at home; Palmolive Ultra® and similar products containing l-lactic acid are available in grocery and discount stores nearly everywhere. Its primary drawback is its viscosity; clean or sterile water needs to be added to reduce the viscosity for practical use.

Chlorhexidine gluconate lends itself better to hospital use, despite its higher expense, since healthcare professionals would not have to use valuable time to mix up a solution. Chlorhexidine gluconate is already used in the hospital setting for oral care in preventing ventilator-associated pneumonia (VAP) (Li et al., 2015). It killed more than 99.99 percent of *Escherichia coli*growing in a BBS in under a minute. Chlorhexidine gluconate could be used in the hospital setting to disinfect BBSs in between uses during a neonate's or child's hospital stay.

A fourth option, hydrogen peroxide, was also effective in disinfecting *Escherichia coli* in a BBS, but is not recommended as a primary selection as an antiseptic. Hydrogen peroxide required ten minutes to achieve the same results that povidone-iodine, l-lactic acid and chlorhexidine gluconate each achieved in under one minute. It was, by far, the lowest-cost option; as such, it warrants consideration as a secondary antiseptic despite the longer time needed for effective disinfection. The user needs to be willing to soak the BBS for a minimum of ten minutes to ensure adequate disinfection. A ten-minute soak is not likely to be feasible in the hospital setting, but may be feasible in the home setting. Hydrogen peroxide lends itself particularly well to use in a third-world or medical mission setting since it would not require the addition of clean or sterile water to reduce viscosity; it could be used as is.

Triclosan is not recommended as an effective antiseptic for disinfecting a BBS. This pilot study supports the FDA's recent ban on Triclosan in home cleaning products, as it was merely bacteriostatic. While it did not allow further bacterial growth during the length of the experiment, neither did it significantly kill existing bacteria.

This pilot study looked only at the efficacy of antiseptics at disinfecting growth of *Escherichia coli* in a BBS. Other bacteria were not considered due to time and funding. Further study is needed to determine if the recommended antiseptics would be effective in killing other common pathogenic bacteria known to be growing in a BBS, such as *Staphylococcus* and *Streptococcus* species. Nor were viruses, mold or parasites considered in this pilot study. Further investigation is needed to determine effective methods for disinfecting these organisms as well.

This pilot study indicates that healthcare providers, parents and caregivers have several low-cost, widely-available options for effective disinfection of the BBS; these products should be recommended for effective bactericidal outcomes.