Abstract

Clinical Problem: One of the severe complications among hospital patients are hospital-acquired infections (HAIs). The outcomes of HAI include an increase in patient morbidity and mortality, length of hospital stay, and healthcare cost. HAI also contributes to a decrease in a patient’s overall physical and mental well-being.

Objective: To evaluate if bathing daily with chlorhexidine will lessen the incidence of infections among hospitalized patients. PubMed, CINAHL, the National Guidelines Clearinghouse were accessed to acquire clinical studies and national guidelines about hospital-acquired infection prevention. Key terminology that was used during the search included: daily chlorhexidine bathing, chlorhexidine gluconate bathing, CHG bathing, hospital-acquired infections, infection prevention, and healthcare-acquired infections.

Results: Standards from the Centers for Disease Control and Prevention (CDC) recommends skin cleansing every day with 2% chlorhexidine gluconate to reduce hospital-acquired infections related to intravascular catheters. These guidelines came from evidence-based practice recommendations. The clinical studies in this paper prove that daily skin washing with chlorhexidine statistically reduces the development of hospital-acquired infections.

Conclusion: Hospitalized patients that received daily chlorhexidine baths have a statistically significant reduction in rates of hospital-acquired infections. However, there was no reduction in length of hospital stay. Further research is required to determine if the use of chlorhexidine has an effect on length of hospital stay and patient mortality.
Reducing Hospital-Acquired Infections

Nosocomial infections, also known as hospital-acquired infections, are infections that develop within 48-hours after admission to the hospital, (Stubblefield, 2014). According to Magill et al. (2014), there was an estimated 720,000 hospital-acquired infections (HAIs) in the United States in 2011, which is roughly 1 in every 25 hospitalized patients. HAIs cost hospitals billions of dollars and cause 75,000 patient deaths every year (Magill et al., 2014). Eighty percent of hospital-acquired infections include catheter-related bloodstream infections (CRBSI), catheter-associated urinary tract infections (CAUTI), surgical site infections (SSI), and ventilator-associated pneumonia (VAP) (Agency for Healthcare Research and Quality [AHRQ], 2014). Many hospital-acquired infections are due to multi-drug resistant organisms like methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin resistant *enterococcus* (VRE). Clinical processes to reduce HAIs will help to develop better patient outcomes, decrease hospital costs, and decrease lengths of hospital stay for patients. Hospitals are motivated to reduce HAIs because since 2008, they are no longer being reimbursed for hospital-acquired infections. The Centers for Disease Control and Prevention (CDC) recommends specific guidelines for daily use of 2% chlorhexidine wash for skin cleaning to decrease catheter-related bloodstream infections (O’Grady et al., 2011). In addition, chlorhexidine bathing is clinically recommended for the prevention of central line-associated bloodstream infections (CLASBI) and MRSA infections (CDC, 2012). Chlorhexidine is an antibacterial cleaning agent that defends against gram-positive and gram-negative bacteria and fungi. It eradicates bacteremia on human skin so as to reduce environmental contamination that causes secondary infections (Climo et al., 2013). The literature review in this paper examines the efficacy of daily washing with chlorhexidine
among hospitalized patients compared to no chlorhexidine use and how this affects the rate of HAIs at the end of six months?

**Literature Search**

PubMed, CINAHL, and the National Guidelines Clearinghouse were accessed to acquire clinical research studies and national recommendations about decreasing HAIs. The search terminology included: daily chlorhexidine bathing, chlorhexidine gluconate, CHG bathing, hospital-acquired infections, infection prevention, and healthcare-acquired infections.

**Literature Review**

Three clinical trials including a randomized controlled trial (RCT), quasi-experimental study, and time series methodology study and one recommendation guideline were used to assess the efficacy of daily bathing with chlorhexidine (see Table 1). Climo et al. (2013) conducted a cluster-randomized crossover study to evaluate the efficacy of daily chlorhexidine bathing to reduce the incidence of HAIs. The study focused on multi-drug resistant organisms (MDROs) including MRSA and VRE and how they affect hospital-acquired bloodstream infections. The study involved 7,727 patients in eight intensive care units (ICUs) and a bone marrow transplant unit and the patients were divided at random into two groups. The experimental groups implemented 2% Sage chlorhexidine gluconate washcloths into daily bathing over the first six months of the study followed by the use of a different cleaning product for the subsequent six months. The control group used nonantimicrobial washcloths for daily bathing during the study period. Mild skin reactions were reported during the studies; 2% during the intervention compared to 3.4% during the control and all were said to be unconnected to bathing. The results demonstrated 6.60 cases of HAIs during the control and 4.78 cases during the chlorhexidine intervention over 1,000 patient-days. Overall, these outcomes marked a significant statistical
reduction in hospital-acquired bloodstream infections of 28% ($p=0.007$). Furthermore, there was a considerable decrease in the incidence of MDROs ($p=0.03$) and VRE ($p=0.05$). The strengths of the study included randomization, large number of participants, and similar demographics and baseline clinical variables. Another strength was the crossover design implemented over two six month study periods. A weakness of the study was that neither participants nor providers were blind to the study. Another weakness was a national recall on chlorhexidine-impregnated washcloths was initiated during the study due to a *Burkholderia cepacia* bacterial contamination. However, the data collected during the recall was censored out of the study. This study receives a recommendation grade (A) due to the evidential strengths and its randomized crossover design.

Kassakian, Mermel, Jefferson, Parenteau, & Machan (2011) led a quasi-experimental study to evaluate bathing with chlorhexidine daily as opposed to soap and water baths to decrease HAIs due to MRSA and VRE in a non-ICU setting. The study examined a control sample ($n=7,102$) from January 1 through December 31, 2008 that bathed with soap and water. Subsequently, from February 1, 2009 through March 31, 2010, the experimental sample ($n=7,699$) bathed with 2% chlorhexidine-impregnated washcloths. Certified nursing assistants were educated on proper technique and performed the chlorhexidine baths. Six chlorhexidine washcloths came in one package and were kept in specified warmers until use. One package was used per patient daily. Chlorhexidine was used to wash all body surface areas except for the face, which was washed with soap and water. Active surveillance screening was initiated within 48 hours after admission to test for MRSA and VRE. MRSA and VRE testing is performed with a cotton swab of the nares or rectum, respectively. According to the studies results, the number of hospital-acquired infections from MRSA and VRE decreased from 20 in the control group to 10 in the intervention group ($p=0.06$). Overall, there was 64% reduced risk in developing MRSA
and VRE hospital-acquired infections with the daily use of chlorhexidine as opposed to soap and water ($p=0.01$). The strengths of the study included a large sample of participants, consistency of hospital personnel, gender and length of hospital stay of patients between the two study periods, active surveillance screening, and no reports of adverse effects related to the chlorhexidine gluconate. Weaknesses of the study included lack of randomization, lack of blindness to the study, and lack of concurrent study periods. Another weakness was the limited data compliance on VRE screening, which resulted in its termination during the experimental trial. Also, testing bathing compliance was unreliable because it was based on an estimation of quantity of chlorhexidine cloths divided by the number of days patients were observed on the units. A recommendation grade of (C) is given to this study due to the nonrandomized design, lack of patient and provider compliance, and the nonconcurrent nature of the two study periods.

Viray et al. (2014) designed a time series methodology study to demonstrate if daily skin washing with a chlorhexidine-based soap would decrease the spread of MRSA and ICU-acquired S. aureus infections among patients in the intensive care unit compared to a non-medicated soap. The study consisted of 53,526 patients with the surgical ICU (SICU) as the intervention group containing 35,124 patients and medical ICU (MICU) as the control group containing 18,402 patients. MRSA testing via nares was conducted on all patients admitted into ICU for more than 12 hours and any patient admitted over 48 hours after admission had weekly and at discharge cultures tested. Clinical ICU nurses were trained to collect the specimens. One four-ounce container of 4% chlorhexidine-based soap solution was mixed in 4 quarts of water. Standard bathing methods applied to the experiment, except for the face, perineum, and wounds. During the study period, the intervention group had a 41.37% reduction in ICU-acquired MRSA infections ($p=0.001$). The control group had no significant change in infections. The strengths of
this study included active surveillance testing, consistent collection of data during admission, controlling trends related to MRSA and its colonization pressure, and similar baseline clinical variables. Since the study was a time-series analysis methodology, a weakness was the lack of randomization; however, it remains a well-designed study. Another weakness was the lack of data related to the length of hospital stay for patients and patient mortality. The study also did not involve testing different strains of MRSA. The recommendation for this study is given a grade (B) because although, it was not a randomized study, its strengths and similar clinical measures were exemplary.

Hospital-acquired infections include multiple different kinds of infections, which all warrant their own recommended guidelines for prevention. According to the CDC, the national guidelines recommend daily skin bathing with 2% chlorhexidine gluconate to decrease hospital-acquired bloodstream infections (O’Grady et al., 2011).

**Synthesis**

Climo et al. (2013) confirmed that with the introduction of 2% chlorhexidine-impregnated washcloths for daily skin bathing, hospital-acquired bloodstream infections were significantly reduced \((p=0.007)\). Kassakian et al. (2011) demonstrated that the risk of developing hospital-acquired infections from MRSA and VRE significantly diminished by 64% with the use of 2% chlorhexidine gluconate cloths for washing \((p=0.01)\). Furthermore, Viray et al. (2014) proved a statistically important reduction in the incidence rate of ICU-acquired MRSA infections among ICU patients with chlorhexidine-based soap \((p=0.001)\). Lastly, the recommended guidelines from the CDC to help reduce the rate of catheter-related bloodstream infections included daily bathing with 2% chlorhexidine gluconate (O’Grady et al., 2011). Overall, the recommended grade of all the researched literature earned a grade (B) because of the lack of
randomization in two of the three clinical studies and the fact that neither subjects nor healthcare personnel were blind in all of the studies. Additionally, in the studies by Kassakian et al. (2011) and Viray et al. (2014), the instruments to measure the outcomes were unreliable and invalid.

The complete results based on all three of the studies indicated that the use of chlorhexidine gluconate for daily bathing was statistically significant in reducing HAIs. However, each of the trials used diverse methodology to analyze their subjects within each group. Climo et al. (2013) and Viray et al (2014) used subjects in the ICU setting to determine the positive benefits of using chlorhexidine in daily bathing. Climo et al. (2013) was the single randomized controlled trial, which tested for reduction in hospital-acquired bloodstream infections and MDROs over seven hospitals. Viray et al (2014) tested specifically for ICU-acquired MRSA infections in only one hospital. On the other hand, Kassakian et al. (2011) evaluated patients among four general hospital units within one hospital and the effects of daily washing with chlorhexidine to reduce MRSA and VRE HAIs. This specific study lacked an appropriate controlled group because the time frame was not synonymous to the experimental group.

The studies have proven that the use of chlorhexidine wash for daily bathing resulted in an overall decrease in hospital-acquired infections. However, these results did not seem to have a corresponding reduction in length of hospital stay for patients. Also, since patient compliance rates were mainly based off of estimation or observation, additional studies should be performed to establish methods to improve patient compliance. Additionally, it is necessary to further investigate the use of chlorhexidine gluconate and its correlation with patient mortality in regard to hospital-acquired infections. Few adverse reactions were reported during the intervention periods with chlorhexidine-soaked washcloths and primarily surrounded the use of topical
chlorhexidine. Additional studies are needed to examine possible resistance to the antibacterial chlorhexidine over time.

**Clinical Recommendations**

The CDC recommends the daily use of 2% chlorhexidine to reduce the incidence rate of intravascular catheter-related bloodstream infections (CRBSI) (O’Grady et al., 2011). The literature supports this position, particularly among hospitalized patients in the intensive care units. Research demonstrates that daily bathing with 2% chlorhexidine-impregnated washcloths or chlorhexidine-based soap compared to using nonantimicrobial washing cloths or soap and water has reduced the incidence rates of HAIs and MDROs in the hospital setting. Therefore, due to the statistically significant research from the literature, daily bathing with chlorhexidine should be implemented within all medical units to prevent HAIs. Hopefully, decreasing the occurrence of HAIs will ultimately decrease hospital and patient costs and increase overall patient satisfaction.
References


### Table 1

**Literature Review**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Aims</th>
<th>Design and Measures</th>
<th>Sample</th>
<th>Outcomes/Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climo, et al (2013). Effects of daily Chlorhexidine bathing on hospital-acquired infection. <em>New England Journal of Medicine</em>, 368(6), 533-542</td>
<td>To examine if daily washing by chlorhexidine-impregnated washcloths reduces the occurrence rate of hospital-acquired bloodstream infections compared to the control group who received daily baths with nonantimicrobial washcloths.</td>
<td>Randomized control trial (RCT) - Nonblinded, crossover study Measures: - Two six-month periods for both the control and experimental group. - Active surveillance monitoring performed for MDROs and hospital-acquired bloodstream infections - Poisson regression analysis testing was used to compare the incidence rates between the two periods</td>
<td>7,727 patients from nine ICUs and a bone marrow transplant unit</td>
<td>Incidence rates of hospital-acquired bloodstream infections among experimental patients reduced by 28% with the use of chlorhexidine-impregnated washcloths $(p=0.007)$.</td>
</tr>
<tr>
<td>Kassakian, et al. (2011). Impact of chlorhexidine bathing on hospital-acquired infections among general medical patients. <em>Infection Control &amp; Hospital Epidemiology</em>, 32(3), 238-243.</td>
<td>To demonstrate the effects of bathing every day with chlorhexidine decreases the number of hospital-acquired infections triggered by MRSA and VRE bacteremia compared to water and soap.</td>
<td>Quasi-experimental -Nonblinded Measures: - The soap and water control sample study was conducted from January 1 through December 31, 2008 - The chlorhexidine experimental sample was from February 1, 2009 through March 31, 2010 - Cox proportional hazard regression and Kaplan-Meier survival analysis compared the studies on incidence rates and compliance.</td>
<td>Four general inpatient hospital units at a tertiary-care facility in Providence, RI, patients in the control group equaled 7,102 and the experimental sample consisted of 7,699 participants.</td>
<td>Daily use of chlorhexidine for bathing showed a 64% reduction in hospital-acquires infections due to MRSA and VRE (<em>p</em>=0.01).</td>
</tr>
<tr>
<td>Viray, et al. (2014). Daily bathing with chlorhexidine-based soap and the prevention of staphylococcus aureus transmission and infection. <em>Infection Control &amp; Hospital Epidemiology</em>, 35(3), 243-250.</td>
<td>To study the effectiveness of using chlorhexidine-based soap with daily bathing compared to non-medicated soap to reduce the occurrence of ICU-acquired <em>Staphylococcus aureus</em> infections among patients in the intensive care units.</td>
<td>Time-series analysis study Measures: - The surgical ICU (SICU) had about 1,400 ICU admissions annually. The intervention group was studied from January 2002 – December 2007. - The medical ICU (MICU) was the control group studied from January 2005 – December 2007 and had about 1,500 admissions per year.</td>
<td>Patients in medical and surgical intensive care units. Control group consisted of 18,402 patients in the medical ICU (MICU) and the intervention group consisted of 35,125 patients in the surgical ICU (SICU). A total of 53,526 patients during both study periods.</td>
<td>ICU-acquired <em>S. aureus</em> infections reduced by 41.37% among the experimental SICU patients ((p=0.001)).</td>
</tr>
</tbody>
</table>