Sterile water versus antiseptic agents as a cleansing agent during periurethral catheterizations

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Introduction

Research shows that approximately 40% of all nosocomial infections are catheter-associated urinary tract infections (UTIs) (Elvy & Colville, 2009). Health care providers attempt to prevent these infections with the use of antiseptic cleansing agents for periurethral catheterizations. However, there has been reporting of adverse effects regarding the use of antiseptic such as chlorhexidine (Ebo, Bridts, & Stevens, 2004) and povidone-iodine (Al-Farsi, Oliva, Davidson, Richardson, & Ratnapalan, 2009). The purpose of this paper is to review the current literature related to use of sterile water and normal saline versus current antiseptic agents such as chlorhexidine and povidone-iodine for cleaning urethral meatus prior to urinary catheterization.

Methods

A review of the literature was conducted using MEDLINE and Cumulative Index of Nursing and Allied Health Literature (CINAHL) online database. The search was limited to articles published between the years of 2000 and 2010, written in English. In MEDLINE, an additional limit was set on articles related to humans only. The MeSH search terms used in MEDLINE were "urinary catheterization" and with either "water", "povidone-iodine" or "chlohexidine". The same search terms and combination were used in CINAHL database. MEDLINE database generated 101 articles, and CINAHL generated a total of 18 articles. The two search results were combined and eliminated for duplicates using RefWork. The result was 91 articles that were screened manually based on titles and abstracts, which were reflective of the research purpose. Koskeroglu and colleagues article was excluded due to lack of clarity as to whether water or normal saline was used as the control solution.

Research findings

A total of five articles were found to be significant to this literature review. A summary of the findings are illustrated in Table One. The current clinical study that compares cleansing solutions was reviewed.

Webster, Hood, Burridge, Doidge, Phillips, and George (2001) compared the use of water and chlorhexidine in cleansing the perineum before the insertion of a urinary catheter. Four hundred and thirty-six obstetric patients were part of this trial. Women were randomly assigned via opaque sealed-envelope technique to two treatment groups, one with the use of sterile water and the other with the use of chlorhexidine. Protocols for the catheter insertion and hand washing remained the same for the two groups. Approximately 24 hours after the catheter insertion, a 10 mL sample of sterile urine was collected for microscopy and culture. The microbiologist was blinded to the treatment group assigned for the culture. It was found that the infection rates between sterile water and chlorhexidine were similar at 8.2% versus 9.2% respectively. In this study, a power analysis was done, decreasing the chance of having a type two error. This study concluded that there was no significant decrease in the rate of bacteriuria by using chlorhexidine.

Cheung et al.'s (2008) article examined the use of sterile water and chlorhexidine among 20 residents of a long-term care facility. The subjects were recruited voluntarily after an information session was held on the study. These subjects were assigned randomly to the treatment group. A total of four urine samples were collected from each subject: first sample before insertion, second sample on day one, third sample at one week later during catheter change and the fourth two weeks after insertion. This study was limited by its small sample size. Also, the author made no comment regarding if either the microbiologist or the nurse collecting the sample were blinded by the treatment given to the subjects. It was unclear as to what information and exclusion criteria were given at the information session. The study excluded two subjects, one with an UTI infection and the other taking an antibiotic for fever. It was unclear in this article at what point in the experiment these subjects were excluded. This article concluded that there is no significant difference between the use of antiseptic agents and sterile water.

Ibrahim and Rashid's (2002) study compared the use of cleansing the urethral meatus before insertion of a urinary catheter with normal saline and povidone-iodine, and administration of 1 g of IV cephradine among 167 patients who

required TURP procedure. The patients were randomly assigned to the treatment group via sealed envelope. For every two patients assigned in both the normal saline and povidone-iodine treatment group, there was only one patient for injection of cephradine. The study excluded patients with prostate carcinoma, urinary stone, immunosuppression disease, pyuria and severe hepatic or renal dysfunction. The study also excluded a patient who had already received antibacterial administration prior to surgery due to another medical reason. A total of three urine samples were collected for each subject. The first sample was taken in the operation room prior to the TURP procedure, second sample was taken at the time of catheter removal and third sample was taken at two weeks to three month later, during out-patient visit. The authors concluded that there is no significant difference between the use of administering antibacterial prophylaxis, and using local antisepsis when compared to normal saline. The author suggested that removing the catheter is the best way to decrease bacteriuria.

Al-Farsi et al. (2009) compared the urinary infection rates among 186 children whose periurethral area was cleansed with water (92 children) or 10% povidone-iodine (94 children) prior to urinary catheterization. The children were randomly selected from the emergency room. Children with congenital abnormalities of the genital area, such as those where it was difficult to identify a urethral opening and female children with labia adhesions or gross infection in the genital region were all excluded. Children requiring intermittent catheterization, and those who were immunocompromised were also excluded from the study. All children were randomly assigned to the treatment group via computer generation. It was found that there was more insignificant bacterial growth in the water group (n = 22) than in the povidone-iodine group (n = 10). "Only one child with insignificant growth on the culture developed a persistent fever and grew urinary pathogens on the second day" (Al-Farsi et al., 2009, p. 659). The author suggested that further research should investigate if insignificant growth was hindered by the antiseptic solution. It was noted that this was not a double-blinded study. However, the laboratory and physician completed follow-up calls that were blinded. Also, due to staff limitation, not all of the qualifying children were screened. This article concluded that there is no significant association between the solution preparation, povidone-iodine, or sterile water.

Nasiriani et al.'s (2009) study compared the effect of cleansing with water and povidone-iodine on bacteriuria and UTIs among 60 subjects. These subjects were all females who required urinary catheterization after undergoing gynecologic surgery. The study excluded women who were taking antibiotics during the week before surgery, who had a catheter removed within 24 hours post-surgery, and/or who had the presence of a bacteriuria in the first urine sample. The patients were randomly assigned to water or povidone-iodine treatment. Two urine samples were taken from each patient, first at the time of insertion and second at the time of catheter removal. This was a single-blinded study. The mean age of the women was 48.18 years. However, 11 subjects were diagnosed with asymptomatic bacteriuria in the water group compared to the five subjects diagnosed in the povidone-iodine group. This article concluded that antiseptic agents do not significantly reduce the incidence of bacteriuria between the treatment groups.

Table 1. Current clinical studies that compare cleansing solutions reviewed

Researcher	Solutions Compared	Type of Patients (Total included in study/water treatment/antiseptic treatment)	Number of patients developing bacteriuria / P-Value
Al-Farsi et al., 2009	Sterile Water, 10% Povidone-Iodine	Children in the emergency department (186/92/94)	Sterile Water (18%) 10% Povidone-Iodine (16%) P=0.5. No significant association between solution preparation and positive cultures.
Cheung et al., 2008	Sterile Water, 0.05% Chlorhexidine Gluconate	Home care patients (20/8/12)	Sterile Water (100%) 0.05% Chlorhexidine (88.9%) P=0.36. No significant difference in colonization count (.105 cfu/mL) between the two groups.
Ibrahim & Rashid, 2002	Normal Saline, Povidone-Iodine (Third treatment group received injection of Cephradine)	Patient who has BPH undergoes TURP procedure (167/66/64/37 received injection of Cephradine)	Normal saline (29.6%) Povidone-Iodine (27%) and Cephradine (27%) P= 0.94. No significant difference in bacteriuria between groups.
Nasiriani et al., 2009	Water, Povidone-Iodine	Women requiring an indwelling catheter prior to gynecological surgery (60/30/30)	Water (20%) Povidone-Iodine (16.7%) P=0.5. No significant difference in the rate of bacteriuria or UTIs between the two groups.
Webster et al., 2001	Water, 0.1% Chlorhexidine	Obstetric patients who required routine urinary catheterization (436/219/217)	Water (8.2%) 0.1% Chlorhexidine (9.2%) P=0.58–2.21. No significant difference in the rates of bacteriuria between the two groups.

Discussion

Current research supported that the use of sterile water or normal saline compared to current antiseptic agents, such as povidone-iodine and chlorhexidine, did not cause a significant increase in UTIs or the presence of bacteriuria in the urine samples taken. The articles have shown that microorganisms, *Eschericia coli*, *Staphylococcus satrophylius, Pseudomonas aeruginosa,* and *Entero coccus,* associated with the use of sterile water are consistent with the use of povidone-iodine and chlorhexidine (Al-Farsi et al., 2009; Cheung et al., 2008; Nasiriani et al., 2009).

The use of water, sterile water and normal saline are more economical than the use of chlorhexidine and povidone-iodine. Al-Farsi et al.'s (2009) article also supports that cleaning with sterile water is safe, readily available, inexpensive, and has minimal side effects. With the use of antiseptic agents comes an increased chance of adverse reactions. Povidone-iodine can cause skin irritation and burns (Al-Farsi et al., 2009) and chlorhexidine can cause skin irritation and burns and anaphylactic reactions (Ebo, Bridts, & Stevens, 2004). There is a relatively low chance (2%) of experiencing a chlorhexidine anaphylactic reaction, but given its ubiquitous use and the severity of an anaphylactic reaction, it needs to be taken seriously (Krautheim, 2004). Knight et al. (2001) suggested that during an anaphylactic reaction in the hospital, there needs to be a protocol that includes an investigation of not just latex, but also the possibility of a chlorhexidine-caused reaction. The reaction to chlorhexidine may not occur immediately, and it may take time to progress to a more severe reaction with contact via mucosal exposure (Ebo et al., 2004; Knight, Puy, Douglass, O'Hehir, & Thien, 2001). The use of sterile water to cleanse the periurethral area can eliminate these problems, thus, making it a cost-effective and safe alternative to antiseptic cleansing solution (Al-Farsi et al., 2009).

Some of the studies were limited by the difficulty in the detection of a difference within the subgroups, and a possible type two error due to the small sample size. Some individuals are more susceptible to UTIs. Parker et al. (2009) identified that risk factors for catheter-associated urinary tract infections include: females; pregnant women; people with chronic illness, azotemia, urethral stent; or other site of infection; malnourished or frail; immunosuppressed; have a catheter in place; and have a postfractured hip and reside in a nursing home. Even though Webster et al.'s (2001) study included pregnant women, other studies excluded subjects with high-risk factors for catheter-associated UTIs. For instance, in Al-Farsi et al.'s (2009) study, immunocompromised children and children who were on antibiotics were excluded. Cheung et al.'s (2008) study only included a total of 20 subjects from a long-term care facility who had the cognitive capacity to be able to understand an information session and give consent. Future studies should include a larger sample size, and focus on the subgroup most at risk for UTIs to decrease the chance of a type two error.

Webster et al. (2001) noted that there were nurses and staff who were opposed to the use of sterile water for periurethral cleansing before urinary catheter insertion. The staff believed that the sterile water was ineffective and to use it would be "breaching [their] duty of care" (p. 393). Moreover, Webster et al. (2001) cautions that the practices surrounding catheter care are entrenched, and it will take a consistent and persistent messages based on research evidence about the efficacy of sterile water, as opposed to antiseptic agents, in order to create a change. Nasiriani et al.'s (2009) study met similar challenges when trying to gain both patient and staff acceptance for the use of sterile water. "Because the staff routinely used an antiseptic solution prior to catheter insertion, extensive education was required prior to implantation of the protocol" (Nasiriani et al., 2009, p. 121). Therefore, to promote the use of water as a cleansing agent, clinical nurses need to be informed of the strong research evidence. It is recommended that the facility change the policy for urinary catheterization, provide education and research evidence to nurses, and collaborate with the hospital's infection control committee to endorse the practice.

Conclusion

After a significant amount of literature review on periurethral catheterization and the various cleansing solutions available, it was found that water, sterile water and normal saline are safe, effective, readily available, environmentally friendly, and inexpensive cleansing agents as compared to chlorhexidine and povidone-iodine. The research findings show that there is no significant difference in the use of sterile water versus antiseptic agents on the growth of bacteria within the particular populations studied.

About the authors

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