WATER EFFECT VERSUS ANTISEPTIC FOR PERIURETHRAL CLEANING IN THE PERFORMANCE OF INDWELLING URINARY CATHETERIZATION: A SYSTEMATIC REVIEW

ABSTRACT

Urinary tract infections related to indwelling urinary catheterization are among the most frequent in hospitals. There are many recommendations for the prevention of infections, but the need to use antiseptics for periurethral cleaning is still questioned. **Objective:** this study aimed to analyze the evidence on the theme in the literature. **Method:** a systematic review was performed using the following databases: Biblioteca Virtual em Saúde, Medline, Embase, Web of Science and Cumulative Index to Nursing & Allied Health Literature. Clinical trials were included which assessed the infection rates of the urinary tract/bacteriuria and which used antiseptic solutions and water in the periurethral cleaning. **Results:** of 211 studies, three were considered as methodologically adequate according to the Jadad Scale. All of the studies showed that there is no significant difference in the rates of UTI/bacteriuria when compared to the use of water with antiseptic (chlorhexidine or povidone-iodine). **Conclusion:** it was concluded that the use of water in the periurethral cleaning seems not to augment the risk of acquiring infections/bacteriuria.

Keywords: Urinary Tract Infections; Urinary Catheterization; Water; Chlorhexidine; Povidone-Iodine.

RESUMO

As infecções do trato urinário relacionadas ao cateterismo urinário de demora estão entre as mais frequentes em hospitais. Existem várias recomendações para a prevenção de infecções, porém ainda se questiona a necessidade de utilizar antissépticos para a limpeza periuretral. **Objetivo:** este estudo objetivou analisar as evidências, na literatura, acerca do tema. **Método:** foi realizada revisão sistemática utilizando-se as bases de dados Biblioteca Virtual em Saúde, Medline, Embase, Web of Science e Cumulative Index to Nursing & Allied Health Literature. Foram incluídos ensaios clínicos que avaliaram as taxas de infecção do trato urinário/bacteriúria e que utilizaram soluções antissépticas e água na limpeza periuretral. **Resultados:** de 211 estudos, três foram considerados metodologicamente adequados de acordo com a Escala de Jadad. Todas as estudos mostraram que não há diferenças significativas nas taxas de UTI/bacteriúria quando comparado o uso de água com antisséptico (clorexidina ou povidona-iodine). **Conclusão:** concluiu-se que o uso de água na limpeza periuretral parece não aumentar o risco de adquirir infecção/bacteriúria. **Palavras-chave:** Infecções Urinárias; Cateterismo Urinário; Água; Clorexidina; Povidona-Iodio.

RESUMEN

Las infecciones del tracto urinario relacionadas con el cateterismo urinario de demora están entre las más frecuentes en los hospitales. Existen varias recomendaciones para la prevención de infecciones, pero aún se cuestiona la necesidad de usar antissépticos para la limpieza periuretrial. **Objetivo:** analizar la evidencia en la literatura sobre el tema. **Método:** se realizó una revisión sistemática utilizando las bases de datos de la Biblioteca Virtual de Salud, Medline, Embase, Web of Science y Cumulative Index to Nursing & Allied Health Literature. Se incluyeron ensayos clínicos. **Resultados:** de 211 estudios, tres fueron considerados metodológicamente adecuados de acuerdo con la Escala de Jadad. Todos los estudios mostraron que no hay diferencias significativas en las tasas de UTI/bacteriúria cuando se compara el uso de agua con antisséptico (clorexidina o povidona-iodine). **Conclusión:** concluyó que el uso de agua en la limpieza periuretral no aumenta el riesgo de adquirir infección/bacteriúria. **Palabras clave:** Infecciones Urinarias; Cateterismo Urinario; Agua; Clorexidina; Povidona-Iodio.
against the protocols in the literature is not observed. It is the hygiene of the periurethral region is an important action. Water or with ordinary antiseptic soap, with 0.9% saline or recommended that the periurethral region be cleaned with different solutions, such as chlorhexidine gluconate (CHG), soap and water, povidone-iodine (PVP-I) and sterile water, did not find statistically significant differences in the UTI-IUC rates.9-11

INTRODUCTION

Urinary Tract Infections (UTIs) are among the most prevalent in hospital settings, and 70-80% of these infections are related to Indwelling Urinary Catheterization (IUC).1 Urinary tract infections associated with indwelling urinary catheterization (UTI-IUC) are related to increased mortality, length of stay2 and a spending of about $2837 per UTI-IUC.3

UTI-IUC is believed to occur by inoculating colonizing microorganisms from the periurethral region at the time of urinary catheter insertion.4 Thus, the stage of the IUC that contemplates the hygiene of the periurethral region is an important action.

Despite the relevance of this stage, its standardization against the protocols in the literature is not observed.5 It is recommended that the periurethral region be cleaned with water or with ordinary antiseptic soap,6 with 0.9% saline7 or with antiseptics or sterile solution.8 Clinical studies conducted with children comparing different solutions, such as chlorhexidine gluconate (CHG), soap and water, povidone-iodine (PVP-I) and sterile water, did not find statistically significant differences in the UTI-IUC rates.9-11

There is still no evidence to indicate the need for the use of antiseptics for periurethral cleaning prior to insertion of the indwelling urinary catheter. However, it is recommended that daily cleaning of the patients’ already catheterized urinary meatus should be performed routinely at the time of the bath, without the need for antiseptics.4

Considering the disagreements between the recommendations of the solutions for performing periurethral DUC cleaning and also the need to look for evidence to support the practice in performing this procedure, the question is: Is the use of antiseptic solution more effective when compared to use of soap and water on periurethral cleaning prior to urinary catheter insertion in adult patients with a view to reducing urinary tract infection?

METHODOLOGY

This is a Systematic Review (SR) registered with PROSPERO International Prospective Register of Systematic Reviews (Registration number CRD42017055155).

The sages for the development of the SR were a) construction of the protocol; b) definition of the question; c) search for studies; d) selection of studies; e) critical evaluation of studies; f) data collection; g) data synthesis.12

The protocol was prepared by the researcher and contained the step-by-step review, objectives, inclusion and exclusion criteria, and search and analysis methods, among other information.

For the research question construction, the PICO strategy was used, which represents an acronym for patients, intervention, comparison and outcomes:13

- P – Patients undergoing indwelling urinary catheterization;
- I – PVP-I or chlorhexidine;
- C – water;
- O – urinary tract infection;

Then the following question was asked: Is the use of antiseptic solution more effective when compared to the use of water and/or soap in periurethral cleaning prior to urinary catheter insertion in adult patients, with a view to reducing urinary tract infection?

The search for references was performed in Biblioteca Virtual em Saúde (BVS), US National Library of Medicine (PubMed), Web of Science and Cumulative Index to Nursing & Allied Health Literature (CINAHL), via the CAPES Portal, and in Embase, from December 2017 to January 2018. The following detailed search strategies were used in each database, as presented in Table 1.

Table 1 - Description of the search strategies in the databases

| Strategy |
| --- |
| BVS (("Cateterismo Urinario" OR "Cateterismo Urinario" OR "Urinaria Catheterization") AND ("Infecciones Urinarias" OR "Infecciones Urinarias" OR "Urine Catheter Infections" OR "Infecciones del Sistema Urinario" OR "infecciones del trato urinario") ) AND (Agua OR agua OR Water OR Sabões OR Jabones OR sabão OR Soaps OR MH: D01.475.557.500 OR "Povidone-Iodine" OR "Povidona Yodada" OR "Povidona-Iodo" OR "PVP-F" OR "PVP" OR "Iodo Povidine" OR MH: D02.078.370.141.100 OR Chlorhexidine OR Clorhexidina OR Clorexidina) |
| PubMed ((("Urine Catheterization"[Mesh]) OR "Urine Catheterization"[Title/Abstract]) AND ("Urine tract Infections"[Meshexp] OR "Urinaria Catheterization"[Title/Abstract])) AND ((("Water"[Meshexp]) OR "Soaps"[Mesh]) OR "Chlorhexidine"[Mesh]) OR ("Water"[Title/Abstract] OR Soaps[Title/Abstract] OR "Povidone-Iodine"[Title/Abstract] OR Chlorhexidine[Title/Abstract] OR "PVP"[Title/Abstract] OR "PVP"[Title/Abstract])) |
The evaluation of the methodological quality of the studies included in the SR was made using the Jadad scale, which consists of a numerical scale to assess the quality of randomization, masking and follow-up of patients included in clinical trials. Only studies with a Jadad score ≥ 3 were included in the SR.

RESULTS

Considering all the databases researched, 211 articles were obtained, which were exported to the EndNote Web bibliographic reference manager. After evaluation by EndNote Web, 104 articles were excluded because they were duplicates, leaving 107 to be evaluated according to title and abstract. 91 articles were excluded according to the exclusion criteria, leaving 16 for full reading. Of the 16 articles read in full, three were selected to compose the SR sample (Figure 1).

Three studies (100%) included in the SR had a score of ≥ 3 on the Jadad scale and were published between 2001 and 2009. Australia, China and Iran were the countries where the studies were conducted, all of which published in English.

Table 1 - Description of the search strategies in the databases

| Base                     | Strategy                                                                 |
|--------------------------|--------------------------------------------------------------------------|
| Web of Science           | “urinary catheterization” AND “urinary tract infections” AND (“povidone-iodine” OR “chlorhexidine” OR water OR soap) |
| CINAHL                   | (‘bladder catheterization’/exp OR ‘bladder catheterisation’ OR ‘bladder catheterisations’ OR ‘bladder catheterisation’ OR ‘bladder catheterisation’ OR ‘urinary catheterisation’ OR ‘urine bladder catheterisation’ OR ‘urine bladder catheterization’) AND (‘water’/exp OR ‘pur wash’ OR ‘washing water’ OR ‘water’ OR ‘tap water’/exp OR ‘distilled water’/exp OR ‘soap’/exp OR ‘soap’ OR ‘soaps’) AND (‘povidone iodine’/exp OR ‘pvp’ OR ‘iodine povidone’ OR ‘iodopovidone’ OR ‘polyvidone iodine’ OR ‘polividone iodine’ OR ‘polyvinylpyrrolidone iodine’ OR ‘polyvinylpyrrolidone iodine’ OR ‘povidone iodine’ OR ‘povidone-iodine’ OR ‘pvp iodine’ OR ‘chlorhexidine’/exp OR ‘chlorhex’ OR ‘chlorhexidine’ OR ‘chlorhexidine chlohydrate’ OR ‘chlorhexidine dihydrochloride’ OR ‘chlorhexidine glutamate’ OR ‘chlorhex’ OR ‘chlorhexidine’ OR ‘chlorhexidine’ OR ‘chlorhexidine’) AND (‘urinary tract infection’/exp OR ‘infection, urinary tract’ OR ‘lower urinary tract infection’ OR ‘urinary tract’ OR ‘lower urinary tract infection’ OR ‘urinary infection’ OR ‘urinary tract infection’ OR ‘urinary tract infections’ OR ‘urine infection’ OR ‘urine tract infection’ OR ‘bacteriuria’/exp OR ‘bacteriuria’) |
| EMBASE                   | (‘bladder catheterization’/exp OR ‘bladder catheterisation’ OR ‘bladder catheterisations’ OR ‘bladder catheterisation’ OR ‘bladder catheterisation’ OR ‘urinary catheterisation’ OR ‘urine bladder catheterisation’ OR ‘urine bladder catheterization’) AND (‘water’/exp OR ‘pur wash’ OR ‘washing water’ OR ‘water’ OR ‘tap water’/exp OR ‘distilled water’/exp OR ‘soap’/exp OR ‘soap’ OR ‘soaps’) AND (‘povidone iodine’/exp OR ‘pvp’ OR ‘iodine povidone’ OR ‘iodopovidone’ OR ‘polyvidone iodine’ OR ‘polividone iodine’ OR ‘polyvinylpyrrolidone iodine’ OR ‘polyvinylpyrrolidone iodine’ OR ‘povidone iodine’ OR ‘povidone-iodine’ OR ‘pvp iodine’ OR ‘chlorhexidine’/exp OR ‘chlorhex’ OR ‘chlorhexidine’ OR ‘chlorhexidine chlohydrate’ OR ‘chlorhexidine dihydrochloride’ OR ‘chlorhexidine glutamate’ OR ‘chlorhex’ OR ‘chlorhexidine’ OR ‘chlorhexidine’ OR ‘chlorhexidine’) AND (‘urinary tract infection’/exp OR ‘infection, urinary tract’ OR ‘lower urinary tract infection’ OR ‘urinary tract’ OR ‘lower urinary tract infection’ OR ‘urinary infection’ OR ‘urinary tract infection’ OR ‘urinary tract infections’ OR ‘urine infection’ OR ‘urine tract infection’ OR ‘bacteriuria’/exp OR ‘bacteriuria’) |

Source: Research protocol.

Figure 1 - Flow diagram of search and selection of the studies.
Two were performed only with women and one study included patients of both genders.

All three studies (100%) compared the use of antiseptic solution and water for periurethral cleaning before urinary catheter insertion. The antiseptic solutions compared were 10% PVPI and 0.1% chlorhexidine. The water used in the research was sterile or tap water. The use of the aseptic technique for performing IUC was described in two articles.

There were differences in the criteria used to define UTI and bacteriuria. In two studies (66.7%), UTI was defined by the presence of more than 100,000 colony forming units per milliliter (CFU/mL) of urine. And in another (33.3%), UTI was defined by more than one thousand CFU/mL.

In two surveys (66.7%), the most prevalent isolated organism in urine cultures was *Escherichia coli* and, in another (33.3%), it was *Enterococcus*.

The methodological characteristics of the studies are detailed in Table 2.

All studies (100%) showed that there were no statistically significant differences in the incidence of bacteriuria and UTI, as shown in Table 3.

**DISCUSSION**

In accordance with the guiding question, the present investigation focused on periurethral cleaning prior to the insertion of the indwelling urinary catheter.

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**Table 2** - Presentation of the articles included in the systematic review regarding year/author, country, type of intervention, number of urine cultures, time to perform urine culture after IUC, criteria for defining bacteriuria or UTI, micro-organisms and Jadad scale

| Author/Year | Country | Type of intervention (number of patients) | Number of urine cultures | Time to perform urine culture after IUC | Criteria for defining bacteriuria or UTI (CFU/ml) | Most prevalent micro-organisms | Jadad Scale |
|-------------|---------|----------------------------------------|--------------------------|---------------------------------------|-----------------------------------------------|-----------------------------|-------------|
| Nasiriani et al, 2009 | Iran | Tap water (30) - 10% PVPI (30) | 02 | 1st: 0h  2nd: 24h | Bacteriuria: ≥10⁵  UTI: ≥ 10⁵ | *Escherichia coli*. No differences between the groups | 3 |
| Cheung et al, 2008 | China | Sterile water (08) - 0.05% CHG (12) | 04 | 1st: before catheter replacement  2nd: 0h (after catheter change)  3rd: 07 days  4th: 14 days | High symptomatic bacteriuria: >10⁵ Low symptomatic bacteriuria: ≤10³ | *Escherichia coli*. No differences between the groups | 3 |
| Webster et al, 2001 | Australia | Tap water (219) - 0.1% CHG (217) | 01 | 24h | UTI: ≥ 10⁵ | *Enterococcus*. No differences between the groups | 5 |

Source: Review data.

**Table 3** - Presentation of the articles included in the systematic review regarding authors/year, population, interventions, results, and conclusions

| Authors/Year | Population (age mean) | Sample | Interventions | Experimental (n) | Control (n) | Results | Conclusions |
|--------------|-----------------------|--------|---------------|-----------------|-------------|---------|-------------|
| Nasiriani et al, 2009 | Women undergoing gynecological surgery (48.18) | 60 | Tap water (n=30) - 10% PVPI (n=30) | | | There were no statistically significant differences UTI: No patient presented Bacteriuria: 18.6% presented. Water: 20% CHG: 16.7% | The use of antiseptics does not seem to reduce UTI and Bacteriuria rates |
| Cheung et al, 2008 | Patients of both genders in home care (78.4) | 20 | Sterile water (n=8) - 0.05% CHG (n=12) | | | There were no statistically significant differences Symptomatic bacteriuria: No patient presented Asymptomatic bacteriuria: No significant differences at all collection times: 1°: Water: 25%  CHG: 0  2°: Water: 0  CHG: 0  3°: Water: 75%  CHG: 60%  4°: Water: 100%  CHG: 88.9% | Using sterile water for periurethral cleaning in home patients does not increase the risk of UTI |
| Webster et al, 2001 | Obstetric patients (28.06) | 436 | Tap water (n=219) - 0.1% CHG (n=217) | | | There were no statistically significant differences Water: 8.2% Chlorhexidine: 9.2% | Perurethral cleaning with antiseptic does not decrease bacteriuria rates and is probably not necessary |

Source: Review data.
There is a strong recommendation that daily urinary meatus cleaning should be performed routinely in the patient’s hygiene, without the need for antiseptic solutions.8 Regarding periurethral cleaning prior to the insertion of the indwelling urinary catheter, the need for antiseptic solutions is still questioned.8-18

The three RCTs included in this study showed that the use of water for periurethral cleaning prior to the insertion of the indwelling urinary catheter, when compared to the use of antiseptic solutions, does not increase the rates of UTI and bacteriuria.15-17 Similar findings have been reported by authors who compared clean and sterile techniques for performing the DUC11 and in clinical trials conducted with children.8-10

In a cohort whose periurethral cleaning was performed with 10% PVPI compared with soap and water, there was a 5.01-fold risk of acquiring UTI when no antiseptic solution was used.19 However, the length of stay of the urinary catheter of the patients in this study and of the patients approached in this review should be considered.

Urinary catheter length of stay is the major risk factor for UTI.3,20 In the cited cohort,29 urinary catheter permanence time was 11.39 days, while in the studies involved in this research it was one day15,17 and seven days.16 Also related to the catheter length of stay, the risk of developing bacteriuria increases by 3 to 7% each day.21 Although most studies have evaluated the incidence of bacteriuria with a similar time (24h after urinary catheter insertion), there were differences in the criteria for defining bacteriuria.

The criteria for defining bacteriuria and UTI differed in the studies included in this paper. The differences were in terms of both nomenclature and counting of colony forming units in the urine cultures. Cheung’s study15 addressed symptomatic bacteriuria as an outcome, being classified as high (≥10⁵ CFU/mL) and low (≤10⁵ CFU/mL).

The literature16,17 addressed the UTI, but with different counts in urine culture: UTI ≥10⁵ CFU/mL and UTI ≥10⁴ CFU/mL respectively. This difference in the criteria for defining the study outcomes did not allow for a meta-analysis to be performed, which would enable a more consistent result to be presented.

Regarding the causative agents of UTI, in two studies15,16 the most prevalent microorganism was *Escherichia coli*. Gram-negative bacilli are the main causes of UTI, including *Escherichia coli*.21,22 The microorganisms present in the periurethral region may ascend to the bladder at the time of urinary catheter insertion,23 which reinforces the importance of hygiene.

It is noteworthy that in the three RCTs evaluated there were no statistically significant differences between the microorganisms found in urine cultures.15-17 Therefore, it can be inferred that in the short-term performance of the IUC, the use of antiseptic solutions does not appear to reduce the risk of inoculation of periurethral colonizing bacteria.

Thus, using water for periurethral cleaning prior to urinary catheter insertion may be an effective, less expensive alternative,11 less likely to irritate and burn the skin23,26 and to allow for the emergence of chlorhexidine resistant microorganisms27 and colistin.28

The authors of this investigation believe that, if periurethral cleaning prior to catheter insertion is performed using a standardized technique with water prior to the insertion of the indwelling urinary catheter, it does not place the patient at increased risk for UTI or bacteriuria.

Our findings, coupled with the impossibility of performing meta-analysis and the lack of information comparing solutions for periurethral cleaning prior to urinary catheter insertion in adults of both genders, demonstrate the need for further primary studies on this subject.

CONCLUSION

The use of water for periurethral cleaning prior to the insertion of the indwelling urinary catheter seems to be an effective, safe and more economical alternative to perform the indwelling urinary catheterization.

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