







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

EFICÁCIA DA ÁGUA VERSUS ANTISSEPTICO PARA LIMPEZA PERIURETRAL NA REALIZAÇÃO DO CATETERISMO URINÁRIO DE DEMORA: REVISÃO SISTEMÁTICA

EFICACIA DEL AGUA VS. EL ANTISPTICO PARA LA LIMPIEZA PERIURETRAL EN EL CATETERISMO URINARIO: REVISIÓN SISTEMÁTICA

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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; Povidona-Iodo.

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. Todos os estudos mostraram que não há diferenças significativas nas taxas de ITU/ bacteriúria quando comparado o uso de água com antisséptico (clorexidina ou povidona-iodo). **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-Iodo.

RESUMEN

Las infecciones del tracto urinario relacionadas con el cateterismo urinario permanente se encuentran entre las infecciones hospitalarias más comunes. Existen recomendaciones para la prevención de infecciones, pero aún se cuestiona la necesidad de usar antisépticos para la limpieza periuretral. **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

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que evaluaron las tasas de infección urinaria / bacteriuria y el uso de soluciones antisépticas y agua para la limpieza periuretral. **Resultados:** de 211 estudios, tres se consideraron metodológicamente adecuados según la escala de Jadad. Todos los estudios mostraron que no hay diferencias significativas en las tasas de infección urinaria / bacteriuria en comparación con el uso de agua antiséptica (clorhexidina o povidona yodada). **Conclusión:** el uso de agua para la limpieza periuretral no parece aumentar el riesgo de contraer infección / bacteriuria.

Palabras clave: Infecciones Urinarias; Cateterismo Urinario; Agua; Clorhexidina; Povidona Yodada.

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.⁸

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

Base	Strategy
BVS	((("Cateterismo Urinário" OR "Cateterismo Urinario" OR "Urinary Catheterization") AND ("Infeções Urinárias" OR "Infecciones Urinarias" OR "Urinary Tract Infections" OR "Infeções do Sistema Urinário" OR "infeções do trato urinário")) AND (Água 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-I" OR "PVPI" OR "Iodo Povidine" OR MH: D02.078.370.141.100 OR Chlorhexidine OR Clorhexidina OR Clorexidina)
PubMed	(((((("Urinary Catheterization"[Mesh]) OR "Urinary Catheterization"[Title/Abstract])) AND (("Urinary Tract Infections"[Mesh:noexp]) OR "Urinary Tract Infections"[Title/Abstract]))) AND (((("Water"[Mesh:noexp]) OR "Soaps"[Mesh]) OR "Povidone-iodine"[Mesh]) OR "Chlorhexidine"[Mesh]) OR ((Water[Title/Abstract] OR Soaps[Title/Abstract] OR "Povidone-iodine"[Title/Abstract] OR Chlorhexidine[Title/Abstract] OR "PVP-I"[Title/Abstract] OR "PVPI"[Title/Abstract])))

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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	"urinary catheterization" AND "urinary tract infections" AND ("povidone-iodine" OR "chlorhexidine" OR water OR soap)
EMBASE	('bladder catheterization'/exp OR 'bladder catheterisation' OR 'bladder catheterisations' OR 'bladder catheterization' OR 'bladder catheterizations' OR 'urinary bladder catheterisation' OR 'urinary bladder catheterizations' OR 'urinary catheterisation' OR 'urinary catheterizations' OR 'urine bladder catheterisation' OR 'urine bladder catheterizations') 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 i' OR 'iodine povidone' OR 'iodopovidone' OR 'polyvidone iodine' OR 'polyvinylpyrrolidone iodine' OR 'polyvinylpyrrolidone iodine' OR 'povidone iodine' OR 'povidone-iodine' OR 'pvp iodine' OR 'chlorhexidine'/exp OR 'chlorhex' OR 'chlorhexidin' OR 'chlorhexidine' OR 'chlorhexidine chlorhydrate' OR 'chlorhexidine dihydrochloride' OR 'chlorhexidine glutamate' OR 'chlorohex' OR 'chlorohexidine' OR 'chlorohexydine' OR 'clohexidine') AND ('urinary tract infection'/exp OR 'infection, 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.

The inclusion criteria included randomized controlled trials (RCTs), adult and elderly patients, and studies in Spanish, French, English, Italian, and Portuguese.

Studies with children, those involving intermittent urinary catheterization or suprapubic catheterization and those whose theme did not fit the guiding question were excluded.

The initial selection of studies involved the participation of four reviewers, who independently assessed the titles and abstracts of all the articles retrieved in the databases. The selection for full reading occurred after applying the inclusion and consensus criteria among the reviewers.

Data read in full were extracted for the data collection instrument prepared by the main reviewer. The data extracted included the following: study identification information (year of publication, authors, journal, title), authors' profession, language, country of realization, design, objective, sample size, sample size, comparative solutions, statistical tests performed, results, Jadad Scale score, authors' conclusion, and reviewer's conclusion. Then, the descriptive analysis of the data extracted from the selected articles was performed.

The evaluation of the methodological quality of the studies included in the SR was made using the Jadad scale,¹⁴ 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.

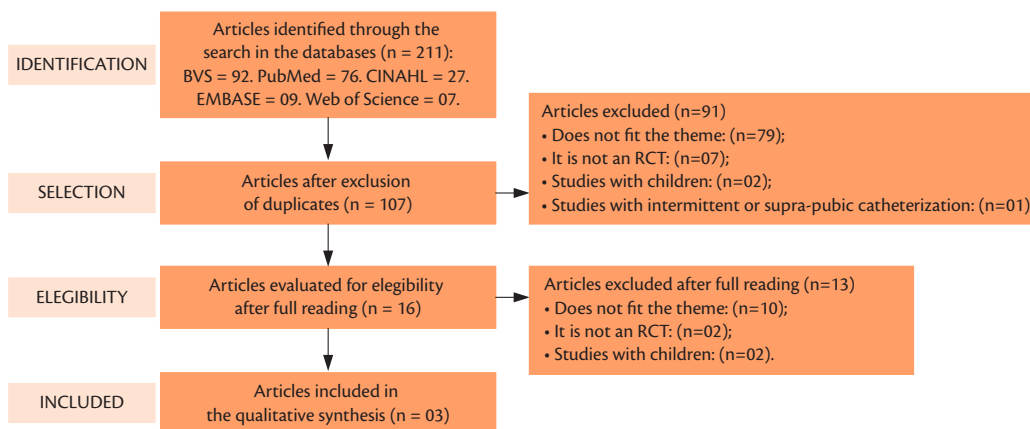


Figure 1 - Flow diagram of search and selection of the studies.

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.

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, definition criteria for 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 ¹⁵	Iran	- Tap water (30) - 10% PVPI (30)	02	1 st : 0h 2 nd : 24h	Bacteriuria: $\geq 10^3$ ITU: $\geq 10^5$	<i>Escherichia coli</i> . No differences between the groups	3
Cheung et al., 2008 ¹⁶	China	- Sterile water (08) - 0.05% CHG (12)	04	1 st : before catheter replacement 2 nd : 0h (after catheter change) 3 rd : 07 days 4 th : 14 days	High symptomatic bacteriuria: $>10^5$ Low symptomatic bacteriuria: $\leq 10^5$	<i>Escherichia coli</i> . No differences between the groups	3
Webster et al., 2001 ¹⁷	Australia	- Tap water (219) - 0.1% CHG (217)	01	24h	ITU: $\geq 10^3$	<i>Enterococcus</i> . 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		Results	Conclusions
			Experimental (n)	Control (n)		
Nasiriani et al., 2009 ¹⁵	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 ¹⁶	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 st : Water: 25%; CHG: 0 2 nd : Water: 0; CHG: 0 3 rd : Water: 75%; CHG: 60% 4 th : 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 ¹⁷	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%	Periurethral 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.⁹⁻¹⁰

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.^{8,20} In the cited cohort,¹⁹ urinary catheter permanence time was 11.39 days, while in the studies involved in this research it was one day^{15,17} 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 ($>10^5$ CFU/mL) and low ($\leq 10^5$ CFU/mL).

The literature^{16,17} addressed the UTI, but with different counts in urine culture: UTI $\geq 10^5$ CFU/mL and UTI $\geq 10^3$ 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 studies^{15,16} 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,²⁵ 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 skin^{25,26} 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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