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INTEGRATIVE REVIEW ARTICLE

RISK FACTORS FOR INFECTION AND INFECTIOUS AGENTS ASSOCIATED WITH VESICAL CATHETERIZATION: INTEGRATIVE REVIEW

FATORES DE RISCO DE INFECÇÃO E AGENTES INFECCIOSOS ASSOCIADOS AO CATETERISMO VESICAL: REVISÃO INTEGRATIVA

FACTORES DE RIESGO DE INFECCIÓN Y AGENTES INFECCIOSAS ASOCIADAS A CATETERISMO VESICAL: REVISIÓN INTEGRATIVA

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ABSTRACT

Objective*: to** identify the major risk factors of urinary tract infection and the infectious agent predominant in the scientific literature nationally and internationally. ***Method*:** descriptive study, integrative review, with 15 articles published between 2006 and 2011, from the question << ***"What are the main risk factors that cause UTI and the predominant infectious agent in this type of infection?" >>. The databases consulted were BIREME, SCOPUS, Virtual Universities Libraries and ISI Web of Knowledge. ***Results*:** the risk factors associated to the patient in the national scenario were intimate hygiene and advanced age. *Escherichia coli*, was the infecting agent found in most cases of urinary tract infection both in domestic and in international studies. ***Conclusion*:** vesical catheterization can substantially influence the occurrence of urinary tract infection, thus rendering the case of the patient who is already hospitalized even more critical. ***Keywords*:** Hospital Infection; Risk Factors; Urinary System; Urinary Catheterization.

RESUMO

Objetivo*:** identificar os principais fatores de risco da infecção do trato urinário e o agente infeccioso predominante na literatura cientifica nacional e internacional. ***Método*:** estudo descritivo, do tipo revisão integrativa, com 15 artigos publicados entre 2006 e 2011, a partir da questão << ***Quais os principais fatores de risco que causam ITU e o agente infeccioso predominante nesse tipo de infecção? >>. As bases de dados consultadas foram o BIREME, SCOPUS, Bibliotecas Virtuais de Universidades e ISI of Web Knowledge. ***Resultados*:** os fatores de riscos inerentes ao paciente no cenário nacional foram a higiene íntima e a idade avançada. A *Escherichia coli*, foi o agente infeccioso mais encontrado nos casos de infecção do trato urinário, tanto nos estudos nacionais quanto nos internacionais. ***Conclusão*:** o cateterismo vesical pode influenciar substancialmente para a ocorrência de infecção do trato urinário, tornando assim, o caso do paciente que já está hospitalizado ainda mais crítico. ***Descritores*:** Infecção Hospitalar; Fatores de Risco; Sistema Urinário; Cateterismo Urinário.

RESUMEN

Objetivo: identificar los principales factores de riesgo de la infección del tracto urinario y el agente infeccioso predominante en la literatura científica nacional e internacional. ***Método:*** estudio descriptivo, revisión integradora, con 15 artículos publicados entre 2006 y 2011, a partir de la Pregunta << ***¿"Cuáles son los principales factores de riesgo que causan la ITU y el agente infeccioso predominante en este tipo de infección"?*** >>. Las bases de datos consultados fueron BIREME, SCOPUS, Bibliotecas Virtuales de las Universidades e ISI Web of Knowledge. ***Resultados:*** los factores de riesgos inherentes a la paciente en el escenario nacional eran higiene íntima y edad avanzada. *Escherichia coli* fue el agente infeccioso encontrado en la mayoría de los casos de infección del tracto urinario tanto en estudios nacionales como en los internacionales. ***Conclusión:*** el cateterismo puede influenciar sustancialmente la ocurrencia de infección del tracto urinario, así transformando el caso del paciente hospitalizado aún más crítico. ***Descriptores*:** Infección, Factores de Riesgo; Sistema Urinario; Cateterismo Urinario.

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INTRODUCTION

The definition of urinary infection associated with the catheter varies between the published studies and the terms "bacteriuria" and "urinary tract infection" are often used indiscriminately. Levels of urinary infection or fungria >103 colony forming units (CFU) have shown to be highly predictive of urinary tract infection (UTI), because these increase the levels to 105 CFU between 24 and 48 hours. Other experts consider that the UTI is present when there is growth of the predominant pathogen, greater than or equal to 102 CFU, especially when associated with pyuria.[1]

UTI and the bacterial infection most common and the most frequent cause of bacteremia/sepsis in the elderly, and is often associated with urinary catheterization. Despite the UTI in elderly patients it is not associated with increased mortality in comparison with young patients the incidence of bacteremia/sepsis associated with the Intensive Care Unit (ICU) was four times more common in older women than in young women.[2]

The urinary tract is one of the most common sites for hospital infections, representing more than 30% of infections reported by hospitals for acute care. Of these infections 80% are attributed to the use of the urinary tract catheter, which had been used for the management of incontinence and urinary retention and on the measurement of urine production.[3-4]

A urinary tract infection is characterized by invasion of microorganisms in any tissue of the urinary tract and is in the group of the four most frequent types of hospital infections. According to epidemiological data, 35 to 45% of all hospital infections are acquired are urinary tract infections, 80% are related to the use of the vesical catheter.[5]

Within the UTI analysis, the role of vesical catheterization is well defined in clinical care, for the proper control of urinary volume during an acute disease and during a surgical procedure, to protect against injury and intra-operative treatment of urinary retention. The vesical catheterization, also performed in gynecological surgeries, it is associated with increased frequency of urinary tract infections. The UTI is characterized by the presence of infectious agents and tissue invasion in any part of the urinary tract, and is usually classified according to the infection site.[6]

Between the hospital infections, urinary tract infections associated with catheters are characterized by one of the highest occurrence rates. In the last three decades, the assessment of new devices to avoid infections has been the main focus of research on UTI prevention. Despite all the UTI prevention, guidelines from the Centers for Disease Control and Prevention, 1981 (Department of Health, UK, 2001) have emphasized the importance of care with the catheters, there is little evidence of their effectiveness in the reduction of UTI.[7]

The risk factors in UTI are divided into inherent to the patient and associated procedures. The risk factors inherent to the patient are: female gender, due to the size of the urinary tract; advanced age; severity of the pathology; diabetes mellitus, because the presence of glucose in urine facilitates the microbial proliferation; kidney transplant; poly-trauma; burns and immunocompromised.[8]

The factors associated with the procedures are: indications of the catheterization, because the catheter insertion can upload distal microorganisms to the interior of the bladder; continuous use of the catheter, because the probe retention balloon prevents the complete emptying of the bladder and cause multiplication of microorganisms; duration of catheterization, because the risk of acquiring bacteriuria and around 5% per day of catheterization; type of catheterization and drainage system, because the open drainage systems are totally contraindicated in prolonged catheterization; use or not of antimicrobials and concomitant errors in manipulation of the cathete.[8]

Given the performance of the Nursing team in executing the vesical catheterization, it is necessary that the ICU nursing management implants measures to minimize the incidence and risk of these infections, preventing them by the scientific technical improvement of their team, trying to find a balance between patient safety and the cost-effectiveness.[5]

Due to the high incidence and significance of UTI, preventive measures must be adopted with the aim of reducing complications and subsequent costs, since the current administrative policies aim at obtaining the best quality in service with the greatest cost reduction in the provision of services.[14] study conducted in a private hospital in the city of Belo Horizonte, has demonstrated the relationship between the presence of hospital infection (HI) and the cost of hospitalizations, as an example of extra expenses had: R$ 22,747.00 per patient with a urinary tract infection.[19]

The study of UTI associated with vesical catheterization has its importance in the identification of forms or technical procedures, intended to decrease the incidence of this type of infection, and also minimize the chances of hospitalized patients likely to evolve to the classification due to UTI. Among the main causes of urinary tract infection the following may be mentioned: prolonged use of vesical catheters, contaminated hands, handling error at the time of catheter insertion and inefficient cleanliness of the patient.

The scientific knowledge of professionals and academics in the health area on the risks of urinary tract infections associated with vesical catheterization at the time and after the insertion of the catheter and the etiologic agents related to this type of involvement is of extreme importance. Since, they are phenomena that can substantially contribute to the development of a possible pathology and/or worsening of the health status of patients.

This study aims to identify the major risk factors of urinary tract infection and the main infectious agents predominant in the national and international scientific literature.

METHOD

Descriptive study, integrative review, performed in online electronic databases containing publications based on the national scenario extending to the international, and a review of the literature with quantitative approach carried out in the period of January to March 2012. In all of the databases were used the descriptors DeCS/MeSH "Cross Infection " ("Nosocomial Infection"), "Risk Factors" ("Fatores de Risco"), "Urinary Tract" ("Sistema Urinário") and "Catheterization" ("Cateterismo").

In the research 220 articles were found, of which 136 were in BIREME, 69 in SCOPUS, 10 in Virtual Libraries of Universities (1 UNESP, 3 UM.ES 3 UFG and 3 UFMA) and 5 in ISI Web of Knowledge. Fifty publications were selected, being 26 from SCOPUS, 10 from BIREME (SCIELO), 5 from Virtual Libraries of universities and 2 from ISI Web of Knowledge. Fifteen studies were submitted to analysis, being 5 articles were in BIREME (SCIELO), 5 in SCOPUS, 4 in Virtual Libraries of Universities (1 of UNESP, 1 from UM.ES 1 from UFMA and 1 from UFG) and 1 from ISI Web of Knowledge.

For the fifteen manuscripts submitted to analysis, they were used as references for the inclusion criteria, which were: the level of evidence classified between the levels "A " and "B" (the classification level of evidence was in accordance with the "Oxford Center for Evidence-based Medicine")[9]; the chronological order between the years of 2006 and 2011; full text; free access; the scenario of publication, from national to international and referring to the guiding question of the study, which consists of: "What are the main risk factors that cause UTI and the predominant infectious agent in this type of infection?".

The collected data were analyzed and categorized in data tables using the program Microsoft Office Excel 2010. At this stage the following variables were used: Scenario and object of study, level of evidence, main results of the risk factors that predispose the UTI and main infectious agents present in the infection.

The publications that met the object of the study were charted in the selected and analyzed articles. The selected articles were the publications which did not have the variables required to respond to the objective of the study, and the analyzed ones were articles that corresponded to all selection criteria raised in the research and all of the variables that comprised the instrument, and thus the data analyzed, categorized and compared. The results will be presented in the form of tables and charts.

RESULTS AND DISCUSSION

Fifteen studies were analyzed and used, all published in journals and virtual libraries of Universities. According to the number of analyzed articles, the database that had the largest number of publications which answered the research problem were the BIREME and SCOPUS both with 5 publications, followed by Virtual Libraries of Universities (UNESP, UM.ES , UFMA and UFG) with 4, and finally, ISI Web of Knowledge only with 1 study.

Main author, reference no. and year	Study Scenario	Database	Title of article
Alves MVFF[10] 2006	São Paulo	Virtual Library of UNESP	Approaches taken by nurses related to the urinary catheterization procedure
Fernandes MVL[11] 2006	São Paulo	BIREME	Construction and validation of indicators for the assessment of practices for the control and prevention of urinary tract infection associated with the catheter
Almeida MC[12] 2007	São Paulo	BIREME	Occurrence of urinary tract infection in patients in a university hospital
Lima LS[13] 2007	Pernambuco	Virtual Library of UM.ES	Urinary tract infections in patients with indwelling urinary catheters hospitalized in an intensive care unit of Recife (PE), Brazil
Souza ACS[14] 2007	Goiás	Virtual Library of UFG	Urinary Catheterization: knowledge and adherence to infection control by nursing professionals
Neto JLS[15] 2008	São Paulo	BIREME	Urinary tract infection related to vesical catheter usage: results of the bacterium and microbiota studied
Tsuchida T[7] 2008	Japan	SCOPUS	Relationship between catheter care and catheter-associated urinary tract infection at Japanese general hospitals: a prospective observational study
Hinrichsen SCA[6] 2009	Pernambuco	ISI Web of Knowledge	Factors associated with bacteriuria after vesical catheterization in gynecologic surgery
Vieira FA[5] 2009	Minas Gerais	BIREME	Nursing actions for the prevention of urinary tract infection related to the indwelling vesical catheter
Esquivel JG[1] 2009	Mexico	SCOPUS	Bacteria sensitivity and resistance in patientes with chronic catheter
Patrizzi K[4] 2009	United States	SCOPUS	A collaborative, nurse-driven initiative to reduce hospital-acquired urinary tract infections
Rothfeld AF[3] 2010	United States	SCOPUS	A program to limit urinary catheter use at an acute care hospital
Oliveira ACC[16] 2010	Maranhão	Virtual Library of UFMA	Prevalence of urinary tract infection related to the vesical catheter in ICU patients
Oliveira AC[17] 2010	Minas Gerais	BIREME	Nosocomial Infection in the intensive care unit of a Brazilian university hospital
Chin BS[8] 2011	South Korea	SCOPUS	Risk factors of all-cause in-hospital mortality among Korean elderly bacteremic urinary tract infection (ICU) patients

Figure 1. Characterization of the analyzed studies Natal, 2012.

Making reference to the year, the research published in the years 2010 and 2009 were respectively 3 (20 %) and 4 (26.7 %) articles; with the analysis of the results, it was shown that the number of publications is quite variable during the last 5 years.

Analysis of the evidence hierarchy level was classified according to the "Oxford Centre for Evidence-based Medicine".[9]

Reference no. and study scenario	Object of the study	Level of Evidence	Main results
[6]Recife (Pernambuco)	Bacteriuria after VC in women undergoing gynecologic surgery.	B	Withdrawal of VC, decreased the number of positive urine cultures. There was no relevant association with the external risk factors.
[5]Minas Gerais	Preventive actions and Nursing intervention to reduce the occurrence of UTI related to the use SVD in patients in the ICU.	B	Team training for the VC insertion technique, aseptically, washing hands, intimate hygiene of the patient, use and changing of glove procedure and criterion for VC indication and permanence.
[10]São Paulo	Epidemiology of nosocomial infection occurrence in university hospitals.	B	UTI prevention measures: catheter evaluation, use of the closed drainage system, limiting VC usage, professional training and guidance for patients on intimate hygiene.
[12]São Paulo	UTI research for patients admitted to university hospitals.	B	Majority of the community UTI is in females (between 0 and 15 years); hospital UTI prevailed in males (over 50 years) while using CVD Predominant Infectious agents: *Escherichia coli* and Klebsiella *spp*.
[11]São Paulo	Evaluation of UTI quality control practices associated with the VC in a general hospital.	B	The method contained 3 indicators; the first two were validated by showing that the applied UTI prevention method is effective.
[13]Recife (Pernambuco)	Analysis of urinary tract infection occurrence in the ICU and the main etiologic agents	B	The time of catheterization was 20 days and of 25 patients in the ICU, 14 presented UTI. Predominant Agents: *Pseudomonas aeruginosa* and *Candida sp*.
[14]Goiânia (Goiás)	Knowledge and adoption of preventive measures and	A	Effectively adopted preventive measures: inserting the VC with the aseptic technique,

	control of UTI by nursing professionals.		closed drainage system and hand washing. Sterile gloves were rarely used.
[16]São Luís (Maranhão)	Prevalence of UTI in the ICU.	B	Predominately over 41 years of age, female gender and the presence of *Escherichia coli*.
[15]São Paulo	Patients hospitalized in the ICU and Surgical Clinic at the University Hospital, submitted to VC.	B	Negative urine cultures, because patients were using antibiotics as a preventive.
[17] Minas Gerais	Patients in the ICU of a University Hospital.	B	UTI was the most frequent in the ICU, and 76.4% (110) asymptomatic and 33.6% (34) symptomatic.

Figure 2. Analysis of UTI risk factors through the use of vesical catheters in the studies that had the research done in the national scenario. Natal, 2012.

It is shown that the base pathologies generate a large predisposition for UTI development in patients undergoing indwelling vesical catheterization in Brazil.[16] The majority of community UTI occurrences was observed in female patients and the infectious agent most frequently found was the *Escherichia coli*. [12.16]

Unlike other studies,[5,10,14] external or inherent factors with the professionals, such as hand washing and aseptic techniques at the moment of VC insertion, are taken into consideration but has no influence on the UTI in Brazil.[6] On the other hand, it was proven that such factors strongly influence UTI development in the national scenario.[5,10,14]

The lack of intimate hygiene for the catheterized patient is a predisposing factor for the evolution of UTI in Brazil. [5.10] The prolonged use of the VC significantly increases the risk of UTI [5] and care in maintaining the vesical catheterization for the prevention of UTI, include maintenance of the drainage system and catheter connection/ closed collection tube, continuous and spontaneous down flow.[14]

The role of the vesical catheterization is well defined in clinical care, for the proper control of urinary volume during an acute disease and during a surgical procedure, for protection against intraoperative injuries, prevention and treatment of urinary retention. However, there is still a high number of catheterizations, perhaps unnecessary.[6]

Reference No. and study scenario	Object of the study	Level of Evidence	Main results
[1]Colima - Mexico	Analysis of microorganisms present in patients with VC in a public hospital.	A	Predominance of *Escherichia coli* in urocultures.
[3]California - United States	Limitation of catheter usage, minimizing the UTI.	B	Control in the use of VC (application only in patients who actually needed it). Decrease in the occurrence of UTI.
[4]Pennsylvania - United States	Planning for UTI reduction associated with the use of the VC in a university hospital.	B	Reduction of UTI in monitoring use of the VC.
[7]Kansai - Japan	Identification of risk factors associated with the misuse of the VC in a general hospital.	B	Fecal Incontinence and long duration VC usage. Cleaning of the perineal region is very effectivefor the prevention of UTI.
[8]South Korea	Clinical and microbiological analysis in elderly patients with bacteremia in the ICU.	B	Most females with community infection. Prevalence of *Escherichia coli*.

Figure 3. Analysis of UTI risk factors by vesical catheters usage in the studies that had the research performed in the international scenario. Natal, 2012.

The use of sterile techniques at the time of catheter insertion is not relevant to the UTI prevention in the United States,[18] as well as in Brazil.[6] However, it was observed that contaminated hands was the main inherent factor in the procedure for the UTI occurrence in the United States,[18] as it occurs in other cases in the national scenario, [5.10] weakening some result findings in Brazil.[6]

In the international scope (South Korea), it was shown that the female gender is predominant in UTI occurrences,[8] thus corroborating, with the idea expressed in the Brazilian scenario.[12.16]

Studies made in the USA [3.4] and in Mexico [1], agree with the idea expressed nationally [5] while portraying that the control and the reduction in catheterization time decreases the risk of UTI.

Agreeing with the results obtained in Brazilian research [5.10] which demonstrate that

cleaning the intimate region is very effective for the prevention of UTI in Japan.[7]

In studies performed in national and international scenarios, it is observed that the *Escherichia coli* is the predominant etiologic agent, but there were also reports of the presence of other bacteria in urine cultures of patients subjected to the use of vesical catheterization such as Klebsiella *pneumoniae*, *Pseudomonas aeruginosa* and *Candida sp*.

In spite of all the proliferation risks of UTI causing bacteria, the vesical catheter is still widely used in situations in which it is possible to adopt other non-invasive methods and that would have a result similarly satisfactory as, for example, VC replacement by the use of super absorbent disposable diapers.

Table 1. Distribution of the external and internal UTI risk factors associated with catheterization in the national and international scope. Natal, 2012.

Risk Factors		National Scenario		International Scenario		Total	
		n	%	n	%	n	%
Internal	Advanced age	3	21.4	2	14.3	5	35.7
	Female	2	14.3	2	14.3	4	28.6
	Lack of intimate hygiene	2	14.3	1	7.1	3	21.4
	Base pathology	1	7.1	1	7.1	2	14.3
Total		**8**	**57.1**	**6**	**42.9**	**14**	**100**
External	Prolonged VC usage	6	46.2	3	23.1	9	69.2
	Contaminated hands	1	7.7	1	7.7	2	15.4
	Errors in handling catheter	1	7.7	1	7.7	2	15.4
Total		**8**	**61.5**	**5**	**38.5**	**13**	**100**

The predisposing risk factors to UTI development mentioned above are the result of a comparison made between the national and international literature.

A higher prevalence is shown in the national literature considering the internal or inherent risk factors to patients as, for example, the age of the individual. It was understood that as age advances, the greater the risks for the patient to acquire a UTI due to the increased fragility of the body, immunosuppression and the presence of base pathologies related to the urogenital tract, a situation further aggravated if the individual is in a hospital or ICU.

The female gender and the presence of any underlying pathology were the internal factors that were equal in the results of the national and international studies. The female gender is more susceptible to the development of UTI than male due to the anatomical conditions: shorter urethra and its greater proximity with the vagina and anus.[13]

The quality of the patient's intimate hygiene was relevant both on the national and international scenarios, presenting a minimum difference between the findings, and taking into account the need for improvement in hygiene as a preventive measure to prevent UTI.

In the national and international scenarios it was found that the external or inherent risk factor to the procedure most relevant was the prolonged time in the use of the VC, followed by contaminated hands and, finally, handling error at the time of catheter insertion. Putting on gloves does not substitute the need to wash hands, and the hands should be washed before and after use.[14]

Table 2. Distribution of the main infectious agents found in UTI occurrences associated with the VC on the national and international scope. Natal, 2012.

Main infectious agents	No. of infectious agents				Total	
	National		International			
	n	%	n	%	n	%
Escherichia Coli	4	26.7	3	20.0	7	46.7
Klebsiella pneumoniae	2	13.3	1	6.7	3	20.0
Pseudomonas aeruginosa	2	13.3	1	6.7	3	20.0
Candida sp.	2	13.3	0	0	2	13.3
Total	10	66.7	5	33.3	15	100

Among the infectious agents that were most mentioned in the studies, the *Escherichia coli* , was pointed out in studies as the micro-organism that was most present in the UTI cases associated with vesical catheterization. The UTI occurrences have had a strong relationship with failures in biosecurity and the lack of professional training for the procedure. In addition to the *Escherichia coli , which* is a gram-negative bacterium and is present in the healthy intestinal tract, it was observed that the

presence of other infectious agents that also had their relevance - *Klebsiella pneumoniae, Pseudomonas aeruginosa* and *Candida sp.*[8]

The predominance of *Escherichia coli*, female gender and intimate hygiene are related to the proximity of the urethral meatus to the anus and the size of the short female urethra, being a port of entry for bacteria. The risks of UTI can be minimized if there is effective intimate hygiene.

CONCLUSION

According to the comparison made between the studies carrie out in national and international scenarios, it was observed that the intimate hygiene and advanced age were the inherent risk factors in the patient that emerged in the national scenario. It was equal in both scenarios regarding the results of female gender predominance. *Escherichia coli*, was the infectious agent found in most UTI cases both in national and international studies.

According to the analysis of the studies, the most important procedures for the reduction in the rate of hospital infections are: care with the patient's intimate hygiene; care in catheter manipulation; use of standard precautions during the vesical catheterization procedure; assessment of the need for vesical catheterization; hand washing, training of staff in relation to the care with the catheterization and decrease the time of catheterization.

The nurse can promote educational actions with patient /family/caretaker, showing on the importance of a good intimate hygiene and self-care, instructing the need for adequate intake of fluids, showing to the patients the main UTI symptoms and indicate under what circumstances they should seek clinical assistance.

Vesical catheterization can substantially influence the occurrence of UTI, thus rendering, the case of the patient which is already hospitalized even more critical, making treatment difficult and resulting in increased budgetary costs for the hospital institutions. However, this procedure is still used, even in cases that alternative non-invasive measures can be applied such as the use of disposable diapers absorbent.

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