

RESEARCH PAPER (ORIGINAL)

The person with urinary retention: student perception and scientific evidence on the use of portable ultrasound scanners

A pessoa com retenção urinária: percepção do estudante e evidências científicas da utilização do ultrassom portátil

La persona con retención urinaria: percepción del estudiante y evidencias científicas de la utilización del ultrasonido portátil

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Abstract

Background: In nursing care and teaching, ultrasound bladder scanners are rarely used for assessing urinary retention.

Objectives: To analyze nursing students' perception of proficiency, knowledge, and skill in the evaluation of urinary retention and performance of urinary catheterization, and to identify scientific evidence on the use of ultrasound bladder scanners to diagnose urinary retention.

Methodology: Two studies were conducted: 1) Descriptive, with the participation of 305 nursing students (data collected by questionnaire); 2) Integrative review of the literature.

Results: In study 1, students reported more confidence in the performance of urinary catheterization than in the evaluation of the person with urinary retention. Study 2 showed that the ultrasound bladder scanner is a technology that provides professional and patient safety, improving teaching and care delivery.

Conclusion: The use of ultrasound bladder scanners can improve the complexity of nursing care in urinary retention.

Keywords: nursing care; nursing; urinary retention; urinary catheterization; ultrasonics

Resumo

Enquadramento: Na assistência e ensino da enfermagem é infrequente o uso do ultrassom de bexiga na avaliação do paciente em retenção urinária.

Objetivos: Analisar a percepção do aluno de enfermagem sobre proficiência, conhecimento e habilidade na avaliação da retenção urinária e na execução do cateterismo urinário e identificar evidências científicas da utilização do ultrassom de bexiga na formulação do diagnóstico de retenção urinária.

Metodologia: Realizados dois estudos: 1) descritivo, tendo participado 305 estudantes de enfermagem (dados colhidos por questionário); 2) revisão integrativa da literatura.

Resultados: No estudo 1, verificou-se que os estudantes referem maior confiança para a realização do cateterismo urinário do que para a avaliação da pessoa em retenção urinária. No estudo 2, surge a evidência de que o ultrassom de bexiga é uma tecnologia que proporciona segurança ao profissional e ao paciente, qualificando o ensino e a assistência.

Conclusão: A complexidade da assistência de enfermagem na retenção urinária pode ser qualificada com o uso do ultrassom de bexiga.

Palavras-chave: cuidados de enfermagem; enfermagem; retenção urinária; cateterismo urinário; ultrassom

Resumen

Marco científico: En la asistencia y enseñanza de la enfermería no es muy frecuente el uso del ultrasonido de vejiga en la evaluación del paciente en retención urinaria.

Objetivos: Analizar la percepción del alumno de enfermería sobre la competencia, conocimiento y habilidad en la evaluación de la retención urinaria y en la ejecución del cateterismo urinario, e identificar evidencias científicas de la utilización del ultrasonido de vejiga en la formulación del diagnóstico de retención urinaria.

Metodología: Se realizaron dos estudios: 1) descriptivo, en el que participaron 305 estudiantes de enfermería (datos recogidos mediante cuestionario); 2) revisión integradora de la literatura.

Resultados: En el estudio 1, se verificó que los estudiantes muestran mayor confianza hacia la realización del cateterismo urinario que hacia la evaluación de la persona en retención urinaria. En el estudio 2, surge la evidencia de que el ultrasonido de vejiga es una tecnología que proporciona seguridad al profesional y al paciente, lo que cualifica la enseñanza y la asistencia.

Conclusión: La complejidad de la asistencia de enfermería en la retención urinaria puede ser cualificada con el uso del ultrasonido de vejiga.

Palabras clave: atención de enfermería; enfermería; retención urinaria; cateterismo urinario; ultrasonido

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Introduction

Urinary retention (UR) is defined as the accumulation of urine in the bladder due to the body's inability to empty the bladder. As the urine accumulates, the bladder walls stretch causing a sense of pressure, discomfort, tenderness over the bladder walls stretch minimally and value 2 to the maximum the symphysis pubis, restlessness, and diaphoresis. The worsening of UR can lead to loss of bladder muscle tone, urinary tract infections (UTIs), stone formation due to urinary stasis, and hydronephrosis (Mazzo et al., 2011). Adequate nursing care in UR depends on the accuracy and precision of nurses' clinical evaluation. The intervention should start with non-invasive methods, such as the use of warm compresses over the suprapubic region, the promotion of patient privacy, and providing the sound of running water for a spontaneous voiding, always bearing in mind that, in some cases, urinary catheterization is the necessary treatment (Fumincelli, Mazzo, Silva Pereira, & Mendes, 2011).

Urinary catheterization can be routinely or occasionally performed, and the catheter can remain inserted for a longer period of time. However, regardless of the procedure, the intervention involves risks and can cause damages in patients, namely UTIs and ureteral trauma (Umsheid, Agarwal, Brennan, & Healthcare Infection Control Practices Advisory Committee, 2010).

This study aims to analyze nursing students' perception of the complexity, proficiency, knowledge, and skill in the evaluation of patients with UR and the performance of urinary catheterization, as well as identify the best scientific evidence on the use of portable ultrasound (US) bladder scanners to diagnose UR.

Nurses are responsible for evaluating and diagnosing the patient with UR based on the assessment of clinical signs and symptoms; therefore, the use of both methods as a way to achieve the research objectives is justified.

Background

US scanners are available for the evaluation

of UR since the 1980s. It is a non-invasive device that creates an ultrasound bladder image to calculate urine volume in the bladder. The device calculates the exact urine volume in millimeters (Al-Shaikh et al., 2009).

With minimal training, nurses can diagnose the condition, assess the urine volume in the bladder, and make a more informed decision on urinary catheterization, thus contributing to safer and more substantiated decisions (Antonescu et al., 2013).

Studies conducted on the topic show that US is a reliable method to assess UR in patients with different diseases, that the calculation of urine volume after urinary catheterization is reliable, and that the use of US scanners in the patient's clinical evaluation reduces the number of unnecessary urinary catheterization procedures, improving nursing care delivery to patients with UR and reducing the prevalence of catheter-related UTIs (Antonescu et al., 2013; Daurat et al., 2015).

However, in many settings, the use of US scanners in the evaluation of patients with UR is still rare in nurses' practice and education and the evaluations are often carried out empirically, which compromises clinical reasoning and decision-making.

Research questions

What are nursing students' perceptions of proficiency, knowledge, and skill in the evaluation of UR and the performance of urinary catheterization?

What is the scientific evidence regarding the use of portable ultrasound bladder scanners to diagnose UR?

Methodology

Two studies were carried out, using different methodologies. These studies complement each other and add value to the findings.

Study 1 is a descriptive study which was conducted with the purpose of analyzing nursing students' perception of complexity, proficiency, knowledge, and skill in the evaluation of UR and performance of urinary catheterization.

The study was conducted with second-year students of the Bachelor's Degree in Nursing of a Polytechnic Institute of Coimbra, Portugal.

Students who agreed to participate in the study received a questionnaire with closed-ended questions that was divided into two parts: one aimed at student's characterization and another aimed at students' self-assessment on the complexity, proficiency, knowledge, and skill in the evaluation of UR and urinary catheterization. Students were also provided with a letter containing information about the study and asked to sign an Informed Consent Form. We delivered the questionnaires in the classroom, at the beginning of the class, after the teacher's authorization.

We applied the following inclusion criteria: students regularly enrolled in the second-year of the Bachelor's Degree in Nursing who accepted to participate in the study.

The study was conducted after receiving the favorable opinion of the Ethics Committee of the Health Sciences Research Unit: Nursing of the Nursing School of Coimbra (P129-12/2012). Students agreed to their voluntary participation and signed the Informed Consent Form. Data were anonymously collected and analyzed.

The questionnaire had several questions with the purpose of characterizing the sample and the perceptions of proficiency, knowledge, and skill in caring for patients with UR and performing urinary catheterization. The results obtained in this phase were analyzed using descriptive statistics and presented in a table and discursive report.

In study 2, an integrative review of the literature was conducted based on the following starting question: What is the scientific evidence regarding the use of portable ultrasound bladder scanners to diagnose UR? The Health Sciences Descriptors (DeCS) *enfermagem* (nursing), *retenção urinária* (urinary retention), and *ultrassom* (ultrasound) were used in the search on the following databases: CINAHL (Cumulative Index to Nursing and Allied Health Literature), MEDLINE (Medical Literature Analysis and Retrieval System Online), and Web of Science. A total of 324 studies answered the research ques-

tion. These studies were published between 2001 and 2016 in English, Portuguese, and Spanish. After reading the titles and abstracts, 24 articles were included which, after full-text reading, were analyzed regarding the classification of evidence (Stetler et al., 1998). Data were descriptively presented.

Results

Study 1

A total of 305 students participated in this study. Most of them 268 (87.9%) started their Bachelor's Degree in 2009. They were aged between 21 and 40 years, with a higher percentage in the age group 21-22 years (77.7%) and a mean age of 22.1 years. With regard to gender, 42 (13.8%) were men and 263 (86.2%) were women.

When asked about having evaluated a patient with UR, 270 (88.5%) reported having already performed that intervention, 34 (11.1%) had not yet performed it, and one (0.3%) did not answer. With regard to the level of difficulty in evaluating a patient with UR, 144 (47.2%) reported it as being low, 129 (42.3%) as high, and two (0.7%) as very high.

With regard to the performance of urinary catheterization, 301 (98.7%) reported that they had already performed the procedure, three (1.0%) had never performed it, and one (0.3%) did not answer. With regard to the level of difficulty in performing urinary catheterization, 13 (4.3%) reported it as being very low, 171 (56.1%) as low, 115 (37.7%) as high, and two (0.7%) as very high.

Table 1 shows students' perceptions of their proficiency, knowledge, and skill in the evaluation of the patient with UR and performance of urinary catheterization. Data analysis shows that around half of the students scored their proficiency, knowledge, and skill in both dimensions as 7 to 8 points (the response option ranged between 1 and 10 points). Overall, students reported greater proficiency, knowledge, and skill to perform urinary catheterization than to evaluate the patient with UR. A small number of participants scored themselves below 5 points.

Table 1

Students' perception of proficiency, knowledge, and skill in the evaluation of UR and performance of urinary catheterization. Coimbra, 2013

V	Evaluation of the patient with UR			Performance of urinary catheterization		
	Proficiency	Knowledge	Skill	Proficiency	Knowledge	Skill
1	1 (0.3%)	0(0.0%)	1(0.3%)	0(0.0%)	0(0.0%)	0(0.0%)
2	0 (0.0%)	2(0.7%)	0(0.0%)	1(0.3%)	0(0.0%)	1(0.3%)
3	4 (1.3%)	1(0.3%)	6(2.0%)	2(0.7%)	0(0.0%)	1(0.3%)
4	10 (3.3%)	7(2.3%)	10(3.3%)	0(0.0%)	0(0.0%)	1(0.3%)
5	43(14.1%)	26(8.5%)	43(14.1%)	21(6.9%)	4(1.3)	13(4.3%)
6	58(19.0%)	37(12.1%)	60(19.7%)	23(7.5%)	9(3.0%)	20(6.6%)
7	84(27.5%)	83(27.2%)	78(25.6%)	73(23.9%)	42(13.8%)	77(25.2%)
8	76(24.9%)	90(29.5%)	75(24.6%)	116(38.0%)	113(37.0%)	117(38.4%)
9	13(4.3)	38(12.5%)	14(4.6%)	57(18.7%)	101(33.1%)	62(20.3%)
10	3(1.0%)	8(2.6%)	5(1.6%)	11(3.6%)	35(11.5%)	12 (3.9%)

Note. ^aV = self-reported value, where 1 corresponds to the minimum value and 2 to the maximum value.

Study 2

The 24 (100.0%) sampled articles were published in English. Of these, 10 (41.7%) were published in nursing journals, 13 (54.1%) in medical journals, and one (4.2%) in an interdisciplinary journal. Table 2 shows the included articles, as well as their authors, year, country and

journal of publication, and level of evidence.

Table 3 shows the analysis of the included articles regarding the use of US scanners in terms of patient indications, procedure indications, considerations about the method, US reliability, impact on UTIs, cost-benefit aspects, expert recommendations for best practices.

Table 2

Analyzed studies and their authors, year, country and journal of publication, and level of evidence

Reference	Level of evidence
Wu, J., & Baguley, I. J. (2005). Urinary retention in a general rehabilitation unit: Prevalence, clinical outcome, and the role of screening. <i>Archives of Physical Medicine and Rehabilitation</i> , 86(9), 1772-1777. doi:10.1016/j.apmr.2005.01.012	III
Alstchuler, V., & Diaz, L. (2006). Bladder ultrasound. <i>Medsurg Nursing</i> , 15(5), 317-318.	VI
Stevens, E. (2005). Bladder ultrasound: Avoiding unnecessary catheterizations. <i>Medsurg Nursing</i> , 14(4), 249- 253.	VI
Teng, C. H., Huang, Y. H., Kuo, B. J., & Bih, L. I. (2005). Application of portable ultrasound scanners in the measurement of post-void residual urine. <i>Journal of Nursing Research</i> , 12(13), 216-224.	III
Rosseland, L. A., Stubhaug, A., & Breivik, H. (2002). Detecting postoperative urinary retention with an ultrasound scanner. <i>Acta Anaesthesiologica Scandinavica</i> , 46(3), 279-282. doi:10.1034/j.1399-6576.2002.t01-1-460309.x	III
Palese, A., Buchini, S., Deroma, L., & Barbone, F. (2010). The effectiveness of the ultrasound bladder scanner in reducing urinary tract infections: A meta- analysis. <i>Journal of Clinical Nursing</i> , 19(21-22), 2970-2979. doi:10.1111/j.1365-2702.2010.03281.x	I

Lee, Y. Y., Tsay, W. L., Lou, M. F., & Dai, Y. T. (2007). The effectiveness of implementing a bladder ultrasound programme in neurosurgical units. <i>Journal of Advanced Nursing</i> , 57(2), 192-200. doi:10.1111/j.1365-2648.2006.04080.x	III
Borrie, M. J., Campbell, K.E., Arcese, Z. A., Hesch, P. (2001). Urinary retention in patients in a geriatric rehabilitation unit: Prevalence, risk factors, and validity of bladder scan evaluation. <i>Rehabilitation Nursing</i> , 26(5) 187-191. doi:10.1002/j.2048-7940.2001.tb01950.x	III
Patraca, K. (2005). Measure bladder volume without catheterization. <i>Nursing</i> , 35(4), 46-47.	VI
Rigby, D., & Housami, F. A. (2009). Using bladder ultrasound to detect urinary retention in patients. <i>Nursing Times</i> , 105(21), 36-37.	VI
Gilbert, R. (2005). Using essence of care benchmarking to develop clinical practice continence care. <i>Nursing Times</i> , 101(54), 42-43.	VI
Van Os, A. F., & Van der Linden, P. J. (2006). Reliability of an automatic ultrasound system in the post partum period in measuring urinary retention. <i>Acta Obstetricia Gynecologica Scandinavica</i> , 85(5), 604-607. doi:10.1080/00016340600606992	III
Rosseland, L. A., Bentsen, G., Hopp, E., Refsum, S., & Breivik H. (2005). Monitoring urinary bladder volume and detecting post-operative urinary retention in children with an ultrasound scanner. <i>Acta Anaesthesiologica Scandinavica</i> , 49(10), 1456-1459. doi:10.1111/j.1399-6576.2005.00817.xi	III
Lamonerie, L., Marret, E., Deleuze, A., Lembert, N., Dupont, M., & Bonnet, F. (2004). Prevalence of postoperative bladder distention and urinary retention detected by ultrasound measurement. <i>British Journal of Anaesthesia</i> , 92(4), 544-546. doi:10.1093/bja/ae099	III
Alagiakrishnan, K., & Valpreda, M. (2009). Ultrasound bladder scanner presents falsely elevated postvoid residual volumes. <i>Canadian Family Physician Médecin de Famille Canadien</i> , 55(2),163-164.	IV
Baldini, G., Bagry, H., Aprikian, A., & Carli, F. (2009). Postoperative urinary retention: Anesthetic and perioperative considerations. <i>Anesthesiology</i> , 110(5),1139-1157.doi:10.1097/ALN.0b013e31819f7aea	VI
Addison, R. (2000). A guide to bladder ultrasound. <i>Nursing times</i> , 96(40), 14-17.	VI
Smith, A. (2002). Easing patient discomfort. <i>Rehab Management</i> , 14(9), 28-30	VI
Suardi, L., Cazzaniga, M., Spinelli, M., & Tagliabue A. (2001). From intermittent catheterization to time-volume dependent catheterization in patients with spinal cord injuries, through the use of a portable, ultrasound instrument. <i>European Journal of Physical and Rehabilitation Medicine</i> , 37(2), 111-114.	III
Balderi, T., & Carli, F. (2010). Urinary retention after total hip and knee arthroplasty. <i>Minerva Anestesiologica</i> , 76(2),120-130.	VI
Balderi, T., Mistraretti, G., D'Angelo, E., & Carli, F. (2011). Incidence of postoperative urinary retention (POUR) after joint arthroplasty and management using ultrasound-guided bladder catheterization. <i>Minerva Anestesiologica</i> , 77(11),1050-1057. Retrieved from https://www.researchgate.net/publication/51151266_Incidence_of_postoperative_urinary_retention_POUR_after_joint_arthroplasty_and_management_using_ultrasound-guided_bladder_catheterization	II
Joelsson-Alm, E., Ulfvarson, J., Nyman, C. R., Divander, M. B., & Svensén C. (2012). Preoperative ultrasound monitoring can reduce postoperative bladder distension: A randomized study. <i>Scandinavian journal of urology and nephrology</i> , 46(2), 84-90. doi:10.3109/00365599.2011.637959	I
Kin, C., Rhoads, K. F., Jalali, M., Shelton, A. A., & Welton, M. L. (2013). Predictors of postoperative urinary retention after colorectal surgery. <i>Diseases of the Colon and Rectum</i> , 56(6), 738-746. doi:10.1097/DCR.0b013e318280aad5	VI
Kim, H. J., Chun, M. H., Han, E. Y., Yi, J. H., & Kim, D. K. (2012). The utility of a bladder scan protocol using a portable ultrasonographic device in subacute stroke patients. <i>Disability and Rehabilitation</i> , 34(6), 486-490. doi:10.3109/09638288.2011.608147	III

Table 3
Main recommendations of the analyzed articles regarding the use of US scanners

Recommendations
Patient Indications Patients in the perioperative period; elderly patients with several comorbidities; patients with neurogenic bladder; patients with prostatic hyperplasia; patients using anticholinergic drugs; patients with urinary catheter blockage; patients undergoing urodynamic testing; patients with multiple sclerosis Procedure Indications Unreliable palpation or percussion; evaluation of UR after urinary catheterization delay; identification of urinary catheter blockage; estimate of residual urine volume in the bladder; assessment of the presence of UR; assessment of the need for urinary catheterization Considerations about the method Positioning the patient in Fowler's position; considering urine volume as adequate for catheterization if $\geq 100\text{ml}$; observing errors in urine volume readings in the presence of cysts, obesity, anatomic changes, bladder stones or clots, and/or other pelvic diseases US reliability Accurate, reliable, safe, and non-invasive method; reduces the use and risks of intermittent urinary catheters; 95% reliability regarding the difference between the urine volume calculated using a US bladder scanner and the urine volume calculated after urinary catheterization; false results in the presence of urine volume $>1000\text{ml}$ or $<100\text{ml}$ Impact on UTIs Solid evidence on the reduced rates of UTIs in patients; reduces the number of urinary catheterization procedures and UTI risks Cost X Benefit Reduces the incidence of urinary catheterization, the rates of UTIs and nosocomial infections, hospital length-of-stay, team workload; Low cost and highly beneficial Expert recommendations for best practices Improving nursing practices; Identifying adequate equipment; Defining processes and evaluation; Team training

Discussion

The evaluation of the patient with UR is a complex procedure that involves clinical signs and symptoms, leading to different degrees of reliability, and urinary catheterization is the most common treatment (Balderi, Mistraletti, D'Angelo, & Carli, 2011; Mazzo et al., 2011). In nurses' daily practice, urinary catheterization is an intervention that should not be performed to diagnose UR without careful evaluation, due to its high risk of trauma and infection, which can have economic repercussions and lead to sequels, complications, and immeasurable patient damage (Mazzo et al., 2012). According to the data obtained from the questionnaire, nurses receive training in urinary catheterization and UR; however, students seem to

have different perceptions regarding the complexity of the procedures, and self-reported values showed a high level of confidence in their proficiency, knowledge, and skill to evaluate UR and even higher levels of confidence in the performance of urinary catheterization. It should be also emphasized that some participants reported having performed urinary catheterization procedures without having evaluated UR. Thus, it was possible to observe that, even in the teaching setting (as the sample was composed of students), the patient's clinical evaluation was not performed before urinary catheterization. Besides being potentially unnecessary, it is an invasive procedure, which may lead to urethral trauma and UTIs. US scanners are easy to handle and eliminate unnecessary catheterization procedures, which have

a strong impact on the reduction of the rates of UTIs and systemic infections and hospital length-of-stay (Palese, Buchini, Deroma, & Barbone, 2010), leading to low costs and high-value benefits resulting from the small initial investment in equipment, reduction in the number of urinary catheterization procedures, reduction in nurses' workload, reduction of costs related to material resources, lower rates of UTIs and nosocomial infections, among others (Balderi & Carli, 2010). Therefore, it is important to provide scientific evidence about new technologies that facilitate the evaluation of patients with UR. According to Tables 2 and 3, examples of the use of US scanners can be found in the international literature, namely in studies with a high level of scientific evidence, mainly published in English. This equipment is a reliable, low-cost, safe, non-invasive, and painless measure that is easily accepted by patients, allowing for the early diagnosis of UR (Kin, Rhoads, Jalali, Shelton, & Welton, 2013). The reliability of the equipment has been confirmed by the proximity between the estimated urine volume in the bladder measured by the equipment and the urine volume measured after emptying the bladder through catheterization (Van Os & Van der Linden, 2006). False results must be taken into account when the urine volume is more than 1000ml or less than 100ml, or even in the presence of cystic lesions, extreme obesity, anatomic changes, bladder stones or clots, and/or pelvic pathologies (Alagiakrishnan & Valpreda, 2009). US scanners have proven to be a more effective method when compared to the clinical examination through bladder palpation when urine volume is greater than or equal to 100ml (Mago, Helayel, Bianchini, Kozuki, & Oliveira Filho, 2010). Its potential has been demonstrated in patients in the perioperative period, elderly patients, patients with neurogenic bladder, patients with prostatic hyperplasia, patients with multiple sclerosis, patients using anticholinergic drugs, patients with urinary catheter blockage, and patients undergoing urodynamic testing (Balderi et al., 2011; Rigby & Housami, 2009). Participants reported higher levels of self-confidence in proficiency, knowledge, and skill in the performance of urinary catheterization than in the evaluation of UR, which can be explained by the fact that teaching about urinary elimi-

nation is still focused on urinary catheterization. Although UR is a nursing diagnosis, the evaluation of patients with UR is a complex intervention to the extent that suprapubic examination, palpation, and percussion techniques do not provide an accurate measurement of bladder urine volume. This difficulty, combined with other aspects such as patient obesity (even if low), consciousness alterations, or agitation, leads to a subjective evaluation.

Since US technology is available and evidence shows its reliability, its use in the evaluation of UR brings objectivity and contributes to an improved care delivery and increased patient safety.

Limitations

This study has some limitations that should be considered when interpreting the results: the sample was not randomly selected, being composed of students from a single nursing school, which may not represent other nursing schools.

Conclusion

Most participants reported a high level of self-confidence in evaluating patients with UR and performing urinary catheterization. In this context, nursing care is complex and involves clinical reasoning and decision-making skills, thus nursing schools should focus their curricula on the importance of evaluating patients with UR and not only on teaching and training urinary catheterization.

US scanners are an essential tool for nurses' evaluation to the extent that evidence points to a technology that is available and low-cost and that provides safety for both professionals and patients, thus improving teaching and clinical practice.

The findings of this research suggest the need for further studies with a special focus on raising the professionals' awareness, since care delivery to patients with UR has often been neglected in nurses' daily practice and based on low-level scientific evidence. Nurses are responsible for seeking strategies to effectively implement the use of US scanners in their professional practice, as well as for ensuring protocols to improve their use.

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