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Original Article

Use of point-of-care ultrasonography by nurses to identify urinary retention in intensive care

Uso da ultrassonografia point-of-care por enfermeiros na identificação da retenção urinária em terapia intensiva

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Milena Leal Bastos de Souza[1]
Cláudio José de Souza[1]
Raquel Dias dos Santos Dantas[2]
Alessandra Cristina de Oliveira Aquino[2]
Caroline Pereira Ribeiro Tomaz[2]
Rodrigo Leite Hipolito[1]
Weslei Cabral Dias[2]

[1]Universidade Federal Fluminense. Niterói, RJ, Brazil.
[2]Hospital Universitário Antônio Pedro. Niterói, RJ, Brazil.

Corresponding author:
Milena Leal Bastos de Souza
Avenida Alberto Lamego, 405, Bloco B3, Apto 401.
Parque Califórnia, Campos dos Goytacazes .
CEP: 28016-811. Niterói, RJ, Brazil.
E-mail: mibastos@id.uff.br

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ABSTRACT

Objective: to analyze the use of point-of-care ultrasonography by nurses in identifying urinary retention among patients admitted to an intensive care unit. **Methods:** a cross-sectional, descriptive-analytical study conducted at a university hospital with 22 patients and 9 nurses. Clinical characterization and ultrasonographic evaluation questionnaires were used, alongside descriptive statistical analysis and association tests, setting a significance level at 5%. **Results:** 27 ultrasonographic evaluations were performed. Urinary retention was identified in 13 evaluations (48.1%), with a mean bladder volume of 313.5 ± 108.45 mL. The most frequent indications for bladder ultrasonography were decreased urine output and absence of postoperative voiding. The median time to perform the technique was 5 (IQR: 5–10) minutes. A significant association (p = 0.049) was observed between urinary retention and a prior history of retention during hospitalization. **Conclusion:** point-of-care ultrasonography performed by qualified nurses proved viable in supporting the identification of urinary retention in critically ill patients. **Contributions to practice:** ultrasonography serves as a healthcare technology that assists nurses in preventing urinary retention in critically ill patients by enabling rapid bedside assessment of bladder volume, thereby promoting more precise clinical decisions and timely interventions. **Descriptors:** Ultrasonography; Intensive Care Units; Urinary Retention; Nursing Care.

RESUMO

Objetivo: analisar o uso da ultrassonografia *point-of-care* por enfermeiros na identificação da retenção urinária em pacientes internados em unidade de terapia intensiva. **Métodos:** estudo transversal, descritivo-analítico realizado em hospital universitário com 22 pacientes e 9 enfermeiros. Utilizou-se questionários de caracterização clínica e avaliação ultrassonográfica, com análise estatística descritiva e testes de associação, adotando-se um nível de significância de 5%. **Resultados:** foram realizadas 27 avaliações ultrassonográficas. A retenção urinária foi identificada em 13 avaliações (48,1%), com volume vesical médio de 313,5±108,45mL. As indicações para a realização da avaliação vesical ultrassonográfica mais frequentes foram a redução do débito urinário e ausência de micção pós-operatória. A mediana do tempo para execução da técnica foi de 5 (IIQ:5-10) minutos. Houve associação significativa (p=0,049) entre retenção urinária e o histórico prévio de retenção na internação. **Conclusão:** a ultrassonografia *point-of-care*, realizada por enfermeiros qualificados, mostrou-se viável para apoiar a identificação da retenção urinária em pacientes críticos. **Contribuições para a prática:** a ultrassonografia é uma tecnologia assistencial que auxilia o enfermeiro na prevenção da retenção urinária em pacientes críticos, por permitir avaliação rápida do volume vesical à beira leito, favorecendo decisões clínicas mais assertivas e intervenções precoces. **Descritores:** Ultrassonografia; Unidades de Terapia Intensiva; Retenção Urinária; Cuidados de Enfermagem.

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Introduction

Bedside ultrasonography, designated point-of--care ultrasound (POCUS), currently stands out as a care technology that, when integrated with knowledge management and organizational processes, serves as a supportive device for clinical and managerial decision--making, thereby qualifying healthcare in the clinical assessment of critically ill patients. Its use enables the identification and monitoring of various organ systems, offering dynamic and immediate bedside information that contributes to more agile clinical decisions[1].

In this perspective, POCUS has been utilized as a complementary resource in bladder assessment by nurses, as it constitutes a non-invasive, safe, fast, and painless method for measuring urinary volume, fostering decision-making grounded in objective data. Its implementation has demonstrated meaningful benefits in reducing the frequency of urinary catheterizations, preventing infections, enhancing patient comfort, and saving hospital resources. Recent studies highlight its applicability in nursing practice, with the potential to expand professional autonomy and elevate care quality, particularly in critical care units[2-3].

In intensive care nursing practice, bladder assessment to identify urinary retention is fundamental for preventing complications. However, traditional propedeutic evaluation methods—such as inspection, palpation, and percussion—even when combined with fluid balance monitoring, exhibit limitations, especially in clinical conditions that complicate physical examination, such as generalized edema, neurological alterations, and the presence of invasive devices[4-6].

Furthermore, research on urinary retention focuses predominantly on surgical patients, particularly during the immediate post-anesthesia period, where the incidence of urinary retention varies widely, ranging from 2% to 60%, depending primarily on the type of surgery, the anesthetic regimen employed, and the administration of anticholinergic or analgesic medications. National studies indicate an incidence rate of urinary retention between 40% and 56% among patients evaluated via POCUS, demonstrating the relevance of this assessment in critically ill patients[5-7].

Despite international recognition of POCUS implementation by nurses, this practice remains recent in Brazil and faces challenges related to institutional consolidation, professional training, and integration into routine care workflows[8]. Notably, regulatory backing by the Brazilian Federal Nursing Council (COFEN) supports nurses in performing bedside ultrasonography[9].

Although the use of POCUS in intensive care units has expanded and gained traction, nurses still encounter barriers to its incorporation into clinical practice[8], underscoring the need for studies that explore this topic in greater depth.

Nonetheless, gaps persist in the national literature regarding nursing performance in identifying urinary retention through this technology in critically ill patients, especially concerning the indications for evaluation, ultrasonographic findings, procedure duration, and post-examination management. In this context, it is relevant to analyze the use of POCUS by nurses in intensive care units as a supportive strategy for clinical assessment and decision-making in critical care[2,5,10-11].

Therefore, this study aims to analyze the use of point-of-care ultrasonography by nurses in identifying urinary retention among patients admitted to an intensive care unit.

Methods

Study design

This was a cross-sectional, descriptive-analytical study, structured according to the recommendations of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist, to ensure greater transparency and consistency in data reporting.

Study setting

The study was conducted at a high-complexity university hospital in the municipality of Niterói, Rio de Janeiro, Brazil. The setting was the intensive care unit (ICU), which comprises 16 beds, with an emphasis on immediate postoperative care.

Sample and selection criteria

A non-probability, consecutive convenience sampling strategy was employed, consisting of two participant groups: 1st group: patients; and 2nd group: nurses. It is worth noting that the number of participants does not necessarily correspond to the number of ultrasonographic evaluations performed, as a single patient could undergo more than one bladder assessment using POCUS during the collection period based on clinical need.

To calculate the sample size for the patient group, a urinary retention proportion of 0.4054 and a sampling error of 20% were used, estimating a sample of 23 patients[5]. During the data collection period, 26 eligible patients were identified. Of these, three declined participation and one did not meet the eligibility criteria, resulting in the inclusion of 22 patients by convenience.

The first group included medical, neurological, and surgical patients aged 18 years or older admitted to the ICU, monitored by the nursing team during the study period, and subjected to bladder POCUS for volume assessment due to suspected urinary retention or a need for urinary monitoring, performed by nurses qualified in the use of this technology. Patients with severe hemodynamic instability at the time of data collection, a prior diagnosis of severe neurogenic bladder dysfunction, conditions that hindered or prevented ultrasonographic evaluation (e.g., extensive suprapubic dressings, extreme obesity, or significant abdominal distension from other causes), and those subjected to bladder POCUS performed by other healthcare professional categories were excluded. Extreme obesity was defined as Class III Obesity, characterized by a Body Mass Index (BMI) ≥ 40 kg/m^2 according to World Health Organization criteria. These patients were excluded due to the technical limitations inherent to ultrasonography, as excessive abdominal adipose tissue thickness causes greater acoustic beam attenuation, impairing image resolution and the accuracy of bladder volume measurement.

The second group included nurses providing direct care to critically ill patients in the ICU with documented qualification in bladder evaluation using POCUS and a minimum of one year of ICU practice. Qualification for bladder assessment via POCUS was verified through participation in theoretical and practical training provided by the institution's continuing education team. Nurses who were on medical leave, vacation, or other forms of leave during the data collection period were excluded. In the nurse group, 12 professionals were eligible, of whom nine met the inclusion criteria and three were excluded due to absence from work during collection (two on vacation and one on medical leave). Notably, the participation of these professionals was restricted to performing the ultrasonographic assessments. Thus, they did not constitute the main population of interest, as the study objective was to analyze the use of POCUS in identifying urinary retention in patients admitted to an intensive care unit.

Recruitment

Patients or their legal representatives were approached consecutively, following the admission flow and clinical indication for bladder evaluation using POCUS in the ICU. The invitation was extended directly to the patient whenever possible. In cases where patients could not provide consent due to lack of decision-making capacity, sedation, or coma, their legal representatives were approached by a research team member during visiting hours.

Nurses were invited to participate via an invitation letter prepared by the research team outlining the study objectives and phases. Confidentiality re-

garding data from the ultrasonographic evaluations was guaranteed, as was autonomy to accept or decline participation, with written informed consent obtained upon acceptance.

Study variables

Variables collected encompassed sociodemographic, clinical, and ultrasonography-related data. Sociodemographic variables included sex and age. Clinical variables comprised admission diagnosis, abdominal physical examination findings, use of sedative, anesthetic, or analgesic medications, history of urinary retention during hospitalization, overflow urinary incontinence, history of constipation, prior indwelling urinary catheter use during hospitalization, days of catheter use, and presence of an indwelling urinary catheter at the time of evaluation. Ultrasonography-related variables included the indication for evaluation, estimated bladder volume, procedure duration, ultrasonographic findings, and post-assessment management. Neurological status was evaluated using the Glasgow Coma Scale (GCS)[12], while sedation and agitation levels were assessed using the Richmond Agitation-Sedation Scale (RASS)[13]. Pain was assessed using the Visual Analog Scale (VAS)[14] or the Behavioral Pain Scale (BPS)[15] in conscious or sedated patients, respectively. Additionally, bed rest restriction status was recorded. Regarding specific urinary management data, spontaneously voided volume and volume drained following catheterization (intermittent or indwelling) were documented to serve as comparative parameters for bladder volume measured via point-of-care ultrasonography.

Data collection

Data collection was conducted over three months, from January to March 2025. Data were gathered using two questionnaires: the first containing patient characterization data and the second containing ultrasonographic evaluation data.

The patient characterization questionnaire, which gathered clinical data, was completed by a research team member using medical records. Following the bladder POCUS assessment, the participating nurse who performed the technique completed the ultrasonographic evaluation questionnaire, which was subsequently retrieved by a member of the research team.

Bladder assessment using POCUS was conducted by nurses qualified in the technology. The examination was performed at the bedside with the convex transducer placed in the suprapubic region, using the formula "Width × Height × Depth × 0.52" to calculate estimated bladder volume. Urinary retention was defined as a bladder volume equal to or greater than 300 mL, according to clinical-institutional criteria. Each ultrasonographic evaluation was recorded individually, allowing for the description of the total number of evaluations, indications for the exam, estimated bladder volume, procedure execution time, identified findings, and post-evaluation management.

Data analysis and management

Collected data were tabulated in an Excel® spreadsheet using double-entry verification and subsequently imported for analysis in IBM SPSS version 23.0. A significance level of 5% was adopted.

Numerical data were tested for normality using the Shapiro-Wilk test. Following this analysis, they were expressed as mean and standard deviation or median and interquartile range (IQR: p25–p75), depending on data distribution. Categorical data were presented as absolute frequencies and percentages. To evaluate the association between urinary retention and clinical and sociodemographic variables—such as age, sex, history of urinary retention during hospitalization, history of overflow urinary incontinence, history of constipation, and bed rest restriction—Fisher's exact test was used.

For association analyses between urinary retention and patient clinical variables, only the first registered ultrasonographic evaluation for each par-

ticipant was analyzed to avoid duplicate observations. Repeated evaluations were used solely to describe the indications, findings, execution time, and management related to POCUS use.

Spearman's correlation test (adjusted for data normality) was used to analyze the correlation between bladder volume estimated by ultrasonography and volume drained following catheterization.

Ethical considerations

This research complied with Brazilian Resolution No. 466/2012 and was submitted to and approved by the research ethics committee of the College of Medicine at Universidade Federal Fluminense, under certificate of ethical consideration No. 83562324.0.0000.5243 and opinion No. 7.306.811/2024.

Generative artificial intelligence technology, specifically a Large Language Model (LLM), was used as a supportive tool for manuscript drafting, reference formatting, and text standardization. This tool served a strictly complementary role without replacing critical analysis, data interpretation, or the intellectual responsibility of the authors, who guarantee the originality, veracity, and integrity of the presented content.

Results

The study included 22 patients and nine nurses. For participant characterization and association analyses, the total of 22 patients was evaluated. For descriptions regarding indications for evaluation, ultrasonographic findings, procedure duration, and post-assessment management, all 27 evaluations were considered.

Regarding the nine participating nurses, sociodemographic and professional profile data were not collected in this study, as these professionals were not the primary population of interest. Their participation was limited to performing the ultrasonographic technique, having been included because they met the previously established theoretical and practical qualification criteria, thereby ensuring standardization and reliability of the ultrasonographic assessments during data collection. Furthermore, the focus of this investigation was restricted to analyzing the feasibility and clinical outcomes of bladder assessment via POCUS in critically ill patients.

A female predominance was observed (12; 54.5%), with a mean age of 66.8 (±8.0) years. Most patients had no history of urinary retention during hospitalization, overflow urinary incontinence, or constipation. Regarding indwelling urinary catheter use, 12 patients had previously used the device during hospitalization, with a median duration of 1 (IQR: 0–4) days, whereas 14 patients were not using an indwelling urinary catheter at the time of evaluation. Postoperative care was the predominant reason for admission, followed by septic shock and preoperative care (Table 1).

Table 1 – Clinical characterization of evaluated patients (n=22). Niterói, RJ, Brazil, 2025

Variables	n (%)
Age in years, mean ± standard deviation	66.8 ± 8.0
Sex	
Female	12 (54.5)
Male	10 (45.5)
History of urinary retention during hospitalization	
Yes	5 (22.7)
No	17 (77.3)
History of overflow urinary incontinence	
Yes	1 (4.5)
No	21 (95.5)
History of constipation	
Yes	8 (36.4)
No	14 (63.6)
Prior use of indwelling urinary catheter during hospitalization	
Yes	12 (54.5)
No	10 (45.5)
Use of indwelling urinary catheter at the time of evaluation	
Yes	8 (36.4)
No	14 (63.6)
Reason for admission	
Respiratory failure	0 (0.0)
Pneumonia	0 (0.0)
Septic shock	3 (13.7)
Acute kidney injury	0 (0.0)
Postoperative	18 (81.8)
Preoperative	1 (4.5)
Days of indwelling urinary catheter use, median (interquartile range)	1 (0–4)

Table 2 presents the findings regarding the clinical context of the 27 bladder ultrasonographic evaluations. Most evaluations were performed in patients with RASS classified as "not applicable", GCS of 15, and VAS of zero. Most assessments occurred in patients with normal abdominal physical examination findings, without the use of sedative or anesthetic medications, and under bed rest restriction. The median bladder volume estimated by ultrasonography was 292 (IQR: 70–424) mL, and the median time required to perform the procedure was 5 (IQR: 5–10) minutes.

Table 2 – Characteristics of bladder ultrasonographic evaluations performed by Point-of-Care Ultrasound (n=27). Niterói, RJ, Brazil, 2025

Evaluation	n (%)
Richmond Agitation-Sedation Scale	
Not applicable	20 (74.1)
0	1 (3.7)
1	1 (3.7)
3	1 (3.7)
4	1 (3.7)
5	3 (11.1)
Glasgow Coma Scale	
Not applicable	7 (25.9)
3	1 (3.7)
6	1 (3.7)
15	18 (66.7)
Visual Analog Scale	
Not applicable	6 (22.2)
0	16 (59.3)
3	1 (3.7)
5	1 (3.7)
6	1 (3.7)
7	1 (3.7)
8	1 (3.7)
Behavioral Pain Scale	
Not applicable	21 (77.8)
3	5 (18.5)
9	1 (3.7)
Abdominal physical examination abnormality	
Yes	9 (33.3)
No	16 (59.3)
Unable to evaluate	2 (7.4)
Use of sedative or anesthetic medications	
Yes	8 (29.6)
No	19 (70.4)
Bed rest restriction	
Yes	26 (96.3)
No	1 (3.7)
Bladder volume found on USG (in mL), median (interquartile range)	292.0 (70.0–424.0)
Technique execution time (in minutes), median (interquartile range)	5.0 (5.0–10.0)
Findings	
Urinary retention	13 (48.1)
Urinary retention with IUC / obstruction	3 (11.1)
Insufficient urinary volume to indicate urinary retention	6 (22.2)
Absence of urinary volume in the bladder	5 (18.5)
Drained volume in case of catheterization post-evaluation (in mL), median (interquartile range)	475.0 (362.5–695.0)
Spontaneously voided volume after non-invasive stimulation (in mL)*	430

*Only one valid data entry; USG: Ultrasonography; IUC: Indwelling urinary catheter

Regarding the ultrasonographic findings, urinary retention was identified in 13 evaluations. A bladder volume equal to or greater than 300 mL was defined as urinary retention. The median volume drained during catheterization following the evaluation was 475 (IQR: 362.5–695.0) mL. Spontaneously voided volume after non-invasive stimulation was 430 mL, reflecting a single valid observation. Notably, among patients presenting with findings indicative of urinary retention, the mean bladder volume detected via ultrasonography was 313.5 (±108.45) mL.

Table 3 illustrates the assessment of urinary retention alongside clinical variables. A statistically significant association was observed between urinary retention and a prior history of urinary retention during hospitalization. No statistically significant associations were identified between urinary retention and age, sex, history of overflow urinary incontinence, history of constipation, or bed rest restriction.

Table 3 – Assessment between urinary retention and clinical variables. Niterói, RJ, Brazil, 2025

Variables	Urinary retention		p-value
	Yes (n=13)	No (n=9)	
Age (years)			
< 60	2 (15.34)	1 (11.1)	0.642
≥ 60	11 (84.6)	8 (88.9)	
Sex			
Female	8 (61.5)	4 (44.4)	0.361
Male	5 (38.5)	5 (55.6)	
History of urinary retention during hospitalization			
Yes	5 (38.5)	0 (0.0)	0.049*
No	8 (61.5)	9 (100.0)	
History of overflow urinary incontinence			
Yes	1 (7.7)	0 (0.0)	0.591
No	12 (92.3)	9 (100.0)	
History of constipation			
Yes	5 (38.5)	3 (33.3)	0.584
No	8 (61.5)	6 (66.7)	
Bed rest restriction			
Yes	12 (92.3)	9 (100.0)	0.591
No	1 (7.7)	0 (0.0)	

*Fisher's Exact Test, significant association (p<0.05)

In the 27 bladder ultrasonographic evaluations performed, 35 indications were documented, as some evaluations presented more than one reason. The most frequent indication was a decrease in urine output

over the previous 12 hours (n=9; 25.7%), followed by absence of postoperative spontaneous voiding (n=7; 20.0%), suspected IUC obstruction (n=6; 17.1%), absence of spontaneous voiding (n=5; 14.3%), patient complaint of discomfort (n=4; 11.4%), urine output below 50 mL in 24 hours with IUC (n=2; 5.7%), and absence of spontaneous voiding within 24 hours following IUC removal (n=2; 5.7%).

A total of 34 post-assessment management actions were documented by nurses across the 27 bladder ultrasonographic evaluations, with multiple interventions recorded in certain instances. Serial bladder assessment using POCUS was the most frequent action (n=11; 32.4%), followed by communication with the medical team to define management strategies (n=9; 26.5%), intermittent urinary catheterization (n=6; 17.6%), implementation of non-invasive measures to stimulate voiding (n=4; 11.8%), IUC replacement (n=3; 8.8%), and IUC insertion (n=1; 2.9%).

Figure 1 illustrates the correlation between the bladder volume estimated by ultrasonography and the volume drained following catheterization. A moderate positive correlation was observed between the variables, which did not reach statistical significance (r=0.548; p=0.160).

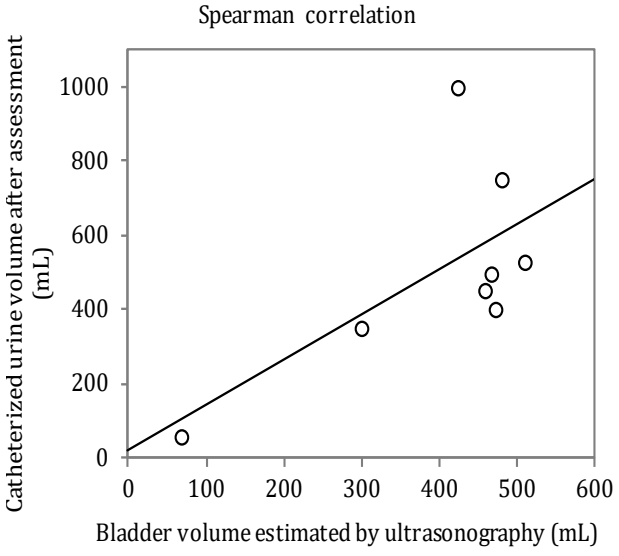

Figure 1 – Correlation between bladder volume estimated by ultrasonography and the volume drained after catheterization. Niterói, RJ, Brazil, 2025

Discussion

The present study demonstrated that bladder assessment using POCUS, as conducted by ICU nurses, represents a feasible strategy to support the identification of urinary retention in clinical practice. The integration of POCUS into clinical practice is advocated as the fifth pillar of bedside physical examination, complementing classic propedeutic techniques and transforming subjective clinical assessment into a diagnosis grounded in objective data.

This technological evolution not only complements traditional semiology and semiotechnics but also underpins clinical reasoning for recognizing the defining characteristics of nursing diagnoses and monitoring outcomes sensitive to nursing interventions[16-17].

Combining technology with physical examination to inform nursing diagnoses adds value to clinical care and the nursing process. In this regard, it is evident that the use of POCUS by nurses aims to increase clinical assessment accuracy while enhancing safety during nursing interventions[18]. Consequently, incorporating POCUS into the clinical practice of intensive care nurses renders evaluation more objective, facilitating decision-making and the determination of management strategies.

POCUS is a safe, non-invasive, and accurate method, with an estimated sensitivity and specificity of 97% and 91%, respectively. It can minimize the limitations of bladder palpation and percussion, provide greater agility in decision-making, and strengthen the autonomy of intensive care nurses[19-20].

Although no statistically significant association was identified between age and urinary retention in this study, the literature describes older adults over 60 years of age as a higher-risk population for developing this condition. Physiologically, this predisposition may be related to detrusor muscle hypocontractility, which impairs complete bladder emptying and increases the reliance on interventions such as catheterization[21-22].

The environment surrounding critically ill patients is characterized by multiple clinical and care-related variables. In this context, a systematic evaluation

of urinary elimination becomes crucial for delivering structured, high-quality care grounded in scientific evidence, ensuring greater efficiency, therapeutic efficacy, and patient safety[23].

Immobility and bed rest restriction may be associated with the inhibition of the micturition reflex, a hypothesis supported by authors who observed a higher frequency of urinary retention in patients undergoing orthopedic surgeries compared to less mobility-limiting surgical procedures[22,24].

The reasons underlying the increased rates of urinary retention among bedridden patients are not yet fully understood. One hypothesis suggests that patients, particularly males, experience greater difficulty voiding in the supine position, which could contribute to micturition reflex inhibition. This serves as an additional limiting factor for the recovery of urinary elimination functions in critically ill patients and must be carefully evaluated whenever urinary retention is suspected[18,21].

Intestinal constipation has been identified in the literature as a contributing factor to urinary retention, given that the bladder and rectum share embryonic origins and neural innervation responsible for urinary and anal sphincter control. This neuroanatomical connection increases the likelihood of urinary retention. Furthermore, the frequent administration of opioids, sedatives, and neuromuscular blocking agents in critically ill patients reduces bowel motility, predisposing this population to constipation[24-25].

Unlike other studies that identify age, sex, bed rest restriction, and constipation as independent risk factors, the results of this research demonstrated no statistically significant association between these variables and the occurrence of urinary retention. This divergence may reflect the extreme complexity of critically ill patients, whose overlapping clinical and pharmacological variables can obscure traditional risk indicators[18,26].

Previous episodes of retention induce excessive stretching of detrusor muscle fibers. This process elevates intravesical wall pressure, which can trigger muscular hypertrophy followed by a decompensation phase, ultimately resulting in functional alterations, detrusor injury, and compromised contractile capacity that predispose patients to recurrent episodes of urinary retention[5,22,25].

A significant association was observed between urinary retention and a prior history of retention during hospitalization. This finding highlights the need for continuous vigilance and dedicated assessment in patients with a history of urinary retention; in this context, POCUS can facilitate early detection even in the absence of overt clinical signs.

The lack of clear criteria and standardized tools for managing urinary retention in ICUs substantially impairs timely identification of this condition. Patients who appear to void spontaneously may actually be experiencing post-void urinary retention, which often goes unrecognized by the nursing team due to insufficient monitoring mechanisms[19,26].

In this setting, overflow incontinence can distort clinical interpretation, leading nurses to incorrectly assume that urinary function has normalized following indwelling urinary catheter removal. Failures in detection can perpetuate urinary retention and escalate the risk of complications, including urinary tract infections, detrusor muscle damage, vesicoureteral reflux, and, in severe cases, renal failure[22].

In a teaching hospital setting involving critically ill patients, urinary retention demonstrated a significant association with spontaneous overflow diuresis[5], contrasting with the present study, which found no statistically significant association between these variables.

Decreased urine output emerged as the primary indication for bladder volume assessment, followed by the absence of postoperative voiding and suspected indwelling urinary catheter obstruction, underscoring the vital role of clinical evaluation, fluid balance monitoring, and volume status assessment in critically ill patients. These indications align with reported literature, in which the postoperative period and invasive device removal predominate as reasons for bladder assessment[7,19,23].

Continuous monitoring of urine output represents an essential parameter for assessing renal function and detecting acute kidney injury, shock, and hemodynamic instability in the ICU. It enhances diagnostic precision and enables targeted management strategies to mitigate organ dysfunction in critical care settings[27].

Thus, POCUS can provide nurses with greater decision-making confidence regarding the optimal timing for performing invasive procedures. In this study, insertion of an intermittent urinary catheter was recorded less frequently among management strategies, suggesting that ultrasonographic evaluation can inform more judicious decisions regarding the need for catheterization. This capability is significant, as rapid, objective assessments of bladder volume can minimize unnecessary exposure to invasive procedures, reduce patient discomfort, and enhance care safety for critically ill patients[17,28].

In the present study, the clinical feasibility of POCUS implementation was demonstrated by a median execution time of 5 (IQR: 5–10) minutes, a duration substantially below the 15-minute upper limit established in literature describing a nursing intervention using bladder ultrasonography according to the Nursing Interventions Classification (NIC). The brief duration required to perform the procedure at the bedside aligns well with ICU dynamics, which demand rapid and objective decision-making[7-8,11,29]. Consequently, integrating POCUS into the nursing physical examination can be accomplished in a matter of minutes, increasing diagnostic precision without compromising overall direct care time in critical care.

A universally accepted definition of urinary retention remains lacking, with diagnostic parameters ranging between 300 mL and 600 mL, or persistent post-void residuals exceeding 300 mL. This absence of standardized criteria leads to substantial variability in reported incidence rates across studies[2,6,11,29]. Reported urinary retention rates typically range from 30.6% to 40.54%, defined as a bladder volume exceeding 400 mL measured by ultrasonography or intermittent catheterization, although recorded urinary volumes in the literature vary from 332.3 to 950 mL[5-6].

In this study, urinary retention was identified in 48.1% of the ultrasonographic evaluations performed, with a mean bladder volume of 313.5 mL among retention cases. Although sample size limits the generalizability of these findings, the observed rate is higher than those reported in previous studies, which may be explained by the patient profile, characterized predominantly by individuals in the immediate postoperative period.

In the immediate postoperative period, the incidence of urinary retention ranges from 2% to 60%, depending primarily on the type of surgical procedure, the anesthetic regimen employed, administration of anticholinergic or analgesic agents, bed rest restriction, and baseline patient characteristics[5].

Although no statistically significant association was observed between ultrasonography-estimated volume and volume drained via catheterization, a moderate positive correlation was identified, supporting the clinical utility of the tool as an extension of physical examination.

These findings differ from earlier trials with larger samples, in which a strong correlation was demonstrated between the same variables[7,11]. Small sample sizes tend to exhibit greater variance in statistical estimates, which can influence the magnitude of observed correlations and requires cautious interpretation. Notably, the directional trend observed aligns with the literature, suggesting that an expanded sample size could reveal stronger correlations.

Thus, the findings of this study do not contradict the existing body of evidence but rather emphasize the need for investigations with larger sample sizes to consolidate this correlation in critical care populations.

The use of POCUS by nurses to identify urinary retention represents an advancement in clinical practice. Its advantages demonstrate the feasibility of implementing this technique as both a care and managerial technology in critical care; however, formal training, qualification, and protocol standardization grounded in best evidence remain essential to solidify its contribution to optimal clinical outcomes and patient safety[19,30].

Therefore, nurse-performed POCUS integrates technical-scientific knowledge, practical skill, and clinical reasoning to support robust evaluation and identification of urinary retention, transcending traditional care to achieve superior outcomes for critically ill patients.

Study limitations

This study presents limitations inherent to its cross-sectional design, which precludes longitudinal follow-up and the evaluation of temporal or causal relationships among the analyzed variables. The small sample size, collected at a single hospital institution using convenience sampling, may have introduced selection bias, as participant inclusion was conditioned on patient availability and accessibility, thereby limiting sample representativeness and the generalizability of the findings.

The occurrence of repeated evaluations in certain patients must also be considered, as this may have influenced descriptive estimates regarding the frequency of findings, indications for evaluation, and management actions implemented. Furthermore, the limited sample size may have reduced statistical power, affecting the ability to detect significant associations and correlations while increasing the likelihood of Type II errors.

The absence of a formal diagnostic accuracy assessment limits inferences regarding the precision of this method for identifying urinary retention. Future studies incorporating larger sample sizes, probability sampling strategies, and study designs that permit greater methodological control are necessary to confirm and expand upon these findings.

Contributions to practice

The incorporation of POCUS ultrasonography into intensive care nursing practice facilitates rapid, non-invasive assessment of bladder volume. This technology enhances professional autonomy, elevates care quality, and informs clinical decision-making, aiding in the early identification of urinary retention and guiding management strategies related to bladder monitoring, voiding stimulation, and the judicious indication of catheterization when necessary.

Conclusion

Nurse-performed point-of-care ultrasonography proved to be a feasible strategy to support the identification of urinary retention in critically ill patients. This technology enables rapid bedside assessment of bladder volume, informing clinical management strategies such as serial monitoring, interprofessional communication, non-invasive micturition stimulation, and the indication of catheterization when necessary. The findings suggest a potential contribution toward refining nursing clinical decision-making, although studies with larger sample sizes and comparative designs are required to evaluate accuracy, impact on clinical outcomes, and the reduction of invasive procedures.

Authors' contributions

Conception and design or analysis and interpretation of data; Drafting of the manuscript or critical revision for important intellectual content: **Souza MLB, Souza CJ, Dantas RDS.** Final approval of the version to be published; Agreement to be accountable for all aspects of the manuscript in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved: **Souza MLB, Souza CJ, Dantas RDS, Aquino ACO, Tomaz CPR, Hipolito RL, Dias WC**.

Data availability

The authors declare that the data presented in this study are available within the article. Individualized raw data are not publicly available due to participant confidentiality considerations but may be made available upon reasonable request to the corresponding author.

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