

## Use of ultrasound by intensive care nurses to assess urinary volume and invasive bladder devices

*Uso do ultrassom pelo enfermeiro intensivista para avaliar o volume urinário e dispositivo vesical invasivo*  
*Uso de ultrasonido por enfermeras de cuidados intensivos para evaluar el volumen urinario y el dispositivo vesical invasivo*

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### Abstract

**Objective:** To describe the experience of the use and applicability of ultrasound by intensive care nurses in the assessment of urinary volume and invasive bladder devices. **Method:** Experience report on the use of ultrasound by nurses in the adult Intensive Care Unit of a public hospital between July and December 2021, after the participation of about 20 nurses in a theoretical-practical course focused on ultrasound-guided urinary volume assessment. **Results:** The course covered handling the ultrasound device, assessing and quantifying urinary volume, as well as discussing clinical reasoning and decision-making. In care practice, ultrasound is a tool that has come to be used by nurses to analyze permanent bladder catheter obstruction, urinary retention, cystostomy clearance, and in decision-making regarding tube replacement. **Conclusion:** It can be concluded that the use of ultrasound by nurses in the Intensive Care Unit is extremely important, as it is a useful, practical, non-invasive, and easy-to-use tool. This tool and approach were only possible after the course, which brought benefits to the patient through safer and more qualified care, as well as strengthening the nurse's autonomy in the process of clinical reasoning and decision-making.

**Descriptors:** Ultrasound; Nursing Care; Intensive Care Unit; Urinary Catheterization

#### What is already known on this?

The literature shows that the use of ultrasound is a tool used more and more frequently by nurses, in the constant search to improve and offer excellent care.

#### What this study adds?

It highlights the importance of using ultrasound in the care of critically ill patients, optimizing professional time, supplies, and materials, and providing safe, evidence-based care.



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### Resumo

**Objetivo:** Descrever a experiência do manuseio e aplicabilidade do ultrassom pelo enfermeiro intensivista na avaliação do volume urinário e do dispositivo invasivo vesical. **Método:** Relato de experiência sobre o uso do ultrassom por enfermeiros na Unidade de Tratamento Intensivo adulta de um hospital público, entre julho e dezembro de 2021, após a participação de cerca de 20 enfermeiros em um curso teórico-prático, voltado à avaliação do volume urinário guiado por ultrassom. **Resultados:** No curso foi abordado sobre o manuseio do aparelho de ultrassom, avaliação e quantificação do volume urinário, bem como discutido sobre o raciocínio clínico e tomada de decisão. Na prática assistencial a ultrassom é uma ferramenta que passou a ser utilizada pelos enfermeiros para analisar obstrução de cateter vesical permanente, retenção urinária, desobstrução de cistostomia e na tomada de decisão quanto à troca de sonda. **Conclusão:** Conclui-se que a utilização do ultrassom pelo enfermeiro na Unidade de Tratamento Intensivo é de suma relevância, configura-se como ferramenta útil, prática, não invasiva e de fácil manuseio. Tal ferramenta e abordagem só foram possíveis após o curso, o que trouxe benefícios para o paciente por meio de uma assistência mais segura e qualificada, bem como fortaleceu a autonomia do enfermeiro no processo de raciocínio clínico e na tomada de decisão.

**Descritores:** Ultrassom; Cuidados de Enfermagem; Unidade de Terapia Intensiva; Cateterismo Urinário.

### Resumen

**Objetivo:** Describir la experiencia de manejo y aplicabilidad de la ecografía por enfermeras de cuidados intensivos en la evaluación del volumen urinario y del dispositivo vesical invasivo. **Método:** Relato de experiencia sobre el uso de la ecografía por enfermeras de la Unidad de Cuidados Intensivos adultos de un hospital público, entre julio y diciembre de 2021, tras la participación de aproximadamente 20 enfermeras en un curso teórico-práctico, centrado en la evaluación del volumen urinario guiado por ecografía. **Resultados:** El curso abarcó el manejo del ecógrafo, valoración y cuantificación del volumen urinario, así como discusiones sobre razonamiento clínico y toma de decisiones. En la práctica sanitaria, la ecografía es una herramienta que ha pasado a ser utilizada por enfermeras para analizar la obstrucción de catéteres vesicales permanentes, retención urinaria, desobstrucción de cistostomías y en la toma de decisiones respecto al recambio de sondas. **Conclusión:** Se concluye que el uso de la ecografía por parte de enfermeras en la Unidad de Cuidados Intensivos es de suma relevancia, por ser una herramienta útil, práctica, no invasiva y de fácil utilización. Esta herramienta y enfoque sólo fueron posibles después del curso, que trajo beneficios al paciente a través de una atención más segura y calificada, además de fortalecer la autonomía del enfermero en el proceso de razonamiento clínico y toma de decisiones.

**Descritores:** Ultrasonido; Atención de Enfermería; Unidades de Cuidados Intensivos; Cateterismo Urinario.

## INTRODUCTION

Nursing is conceptualized as the art and science of care, characterized by a holistic and humanized vision. When thinking and talking about advanced practice nursing, the evolution throughout history is notorious, from the Crimean War with Florence Nightingale to the present day, where the profession is increasingly seeking improvement, using technologies to guide its care and the nursing process, based on evidence and the constant search for improvements.<sup>(1,2)</sup>

Thus, when thinking about advanced nursing, based on current scientific evidence and widely used by developed countries, also thinking about the autonomy of the profession, evidence-based practice, whether in the hospital or out-of-hospital setting, makes the use of technologies essential in care. In this context, ultrasound (US) is a low-cost complementary tool to the physical examination, with real and practical results, enabling the professional to make decisions to provide safe, quality care.<sup>(3-5)</sup>

Point-of-care US (POCUS) represents in practice the use of diagnostic and care technology applied at the bedside. Its availability and accessibility, coupled with the fact that the patient can't move around, are the main advantages of its use and applicability.<sup>(6,7)</sup> It is a health care tool used by many professionals in the Intensive Care Unit (ICU) in a positive way since its method is non-invasive and quick to perform.<sup>(8)</sup>

The ICU is a hospital sector dedicated to the care of critically ill patients at risk of death or with systemic alterations who require highly complex care, specialized staff, and technologies. These are patients who have lost their self-regulatory mechanisms and require intensive support; on the other hand, the complexity and clinical characteristics of each patient's severity make the environment susceptible to risks.<sup>(9)</sup>

The critical patient is most often tied to the use of invasive devices, such as the Indwelling Bladder Catheter (IBC), requiring actions aimed at good insertion practices, handling, early removal, as well as the prevention of infection and urinary retention.

In the ICU, bladder catheterization is one of the procedures most often performed by nurses, and they have the knowledge and skills to assess the need for and the type of catheterization, relief, or indwelling, as well as monitoring urinary retention without indicating an invasive procedure.<sup>(10)</sup>

Point-of-care US is one of the assessment strategies currently used by nurses, which complements the physical examination as well as assists in decision-making regarding bladder catheterization, making it essential to avoid unnecessary invasive procedures, reflecting a reduction in urethral trauma, infection rates, and length of hospital stay.<sup>(11)</sup>

Thus, in parallel with the complexity of critical patient care, the incorporation of technologies such as POCUS has become a necessary reality and is increasingly used by nurses as a care strategy in the process of systematizing nursing care.

In this context, the aim of this study is to describe the experience of handling and applying US by intensive care nurses in assessing urinary volume and invasive bladder devices.

## METHODS

This is a qualitative study, of the experience report type with a descriptive approach, contextualized with theoretical bases and based on current scientific literature, referring to the use of bedside US by ICU nurses at a Public Hospital in Teresina (Piauí) Brazil.

The hospital has three ICUs, two with 10 beds each and one with five beds. It treats patients with various pathologies, mainly infectious diseases such as COVID-19, Acquired Immune Deficiency Syndrome (AIDS), Tuberculosis (TB), meningitis, and leishmaniasis, among others.

This report is part of the actions and interventions carried out by the hospital's nursing team, based on the experience of care nurses in the use of bedside US in the ICU. The use of US in nursing practice came about after the professionals took part in the course: "Assessment and calculation of urinary volume using US in the context of advanced practice nursing", organized by the hospital's nursing management in conjunction with the *Amib – Associação de Medicina Intensiva Brasileira* postgraduate course.

The course was held in July 2021 and lasted 12 hours, both theoretical and practical. It was taught by a nurse with a degree in intensive care, a professor of ICU postgraduate studies, and extensive experience in the use of US in care practice. Around 20 nurses from the hospital's nursing staff took part. The course covered the anatomy and physiology of the urinary system, the objectives, and applicability of US for nurses in practice, handling the US device, as well as a practical simulation of how to assess and quantify urinary volume using US.

One of the participants made himself available to simulate urinary retention by drinking free water for about two hours, after which the teacher demonstrated how to identify and quantify urinary volume. Concerning the evaluation of the invasive bladder device, they discussed decision-making based on the quantification of urinary volume, the clinical aspects of the patient, and the severity and objectives of bladder catheterization. This approach aimed to enable nurses to intervene based on clinical findings associated with the US image and the patient's needs, making nursing care safer and more evidence-based.

After the course, the nursing department and the hospital management began to encourage the nurses to use the US as a complementary tool in the care of critically ill patients, and the devices were made available for use by the professionals. The experience of the nurses was observed and recorded through reports during visits with the nursing supervisor, and the idea was to describe the experience in an article. The report described the situations in which nurses use US as a complement to their care and how this tool contributes to improving nursing care for critically ill patients.

The results were discussed based on the literature collected from the Virtual Health Library, MEDLINE/PubMed, using the following descriptors: ultrasound, nursing care, intensive care unit, nurse, and urinary catheterization.

As this is an experience report, it did not need to be submitted to a Human Research Ethics Committee. However, it followed all the principles set out in Resolution 466/2012 of the National Health Council.

## RESULTS AND DISCUSSION

The use of POCUS has proved to be promising and relevant in the practical work of nurses. The use of US spread worldwide around the 1980s, however, its use at the point of care or at the bedside is recent and has been gaining ground more and more among the various health professional categories, as it obtains data and carries out the evaluation in real-time, which favors rapid interpretation and complements the findings of the physical examination, facilitating more assertive and timely conduct.<sup>(12,13)</sup>

The use of US is based on advanced, evidence-based nursing practices, characterized in a complementary way and with technological support resources in the Systematization of Nursing Care (SNC) in all its stages. It is also a low-cost tool, since it is already available in the institution, easy to use after training, and useful for taking immediate action.<sup>(14-16)</sup>

Resolution No. 679/2021 of the Federal Nursing Council (COFEN) regulates the use of bedside ultrasound by nurses, which is private to nurses as part of the nursing team, providing legal support for

the use of US as a complementary tool in their care.<sup>(17)</sup> The course covered aspects of anatomy and physiology, as well as clinical reasoning and decision-making skills, with the aim of strengthening the nursing process and decision making.

The course covered aspects of anatomy and physiology, handling the US device, as well as clinical reasoning and decision-making skills, with the aim of strengthening the nursing process and nurse autonomy.

After the training course for nurses, these professionals began to use US as a complementary tool at the bedside in the assessment of critically ill patients. POCUS became an auxiliary tool in decision-making regarding bladder catheterization, choice of catheter, relief or delay, as well as monitoring urinary retention and its possible causes.

US is now frequently used by the institution's nurses to analyze Permanent Bladder Catheter (PBC) obstruction, urinary retention, cystostomy clearance and in decision making regarding PBC replacement, relief bladder catheterization, bladder volume measurement, among other possibilities according to the patient's needs.

The decision to change the PBC based on bladder assessment through US was one of the skills and critical questions discussed during the course, it was improved in care practice and the benefits for the patient, professional, and institution can be seen since it contributes to the management of the nurse's "time", avoids exposing the patient to an unnecessary invasive procedure and wastes supplies.

Nurses at the hospital also began to assess urinary retention in patients after PBC removal, renal patients who had previously been anuric or oligomeric, who had recovered their renal function and returned to urinating, using US to make decisions about whether to choose relief catheterization or delayed bladder catheterization.

It can be seen that US has become a useful tool not only for the professional, but also for the institution and, above all, for the patient.

In agreement with the above, Ceratti and Beghetto (2021) reported on the use of POCUS as a working tool in the assessment of urinary retention; an adult normally produces an average of 1,200 ml of urine daily, the usual capacity of the bladder varies from 300 ml to 500 ml, but when it reaches between 200 ml and 300 ml, the neuro receptors of the micturition reflex are incited and trigger the need to urinate. For various reasons, patients may have total or partial impairment of bladder emptying, causing urinary retention.<sup>(18)</sup> US-guided assessment of urinary volume has therefore been tested and shown to be a reliable and relevant method for detecting urinary retention, facilitating timely decision-making.

In the work of Silva *et al.* (2023), an experience report of four nursing residents showed that the POCUS practiced by the nurse, in addition to assisting in the diagnosis of urinary retention, enabled the residents to confirm the positioning of the indwelling bladder catheter when performing this procedure, ensuring patient safety and reducing the risk of trauma to the urinary system, as well as identifying the possible causes of catheter obstruction such as the presence of sedimentation, which may be indicative of an inflammatory and/or infectious process.<sup>(19)</sup>

Guadarrama *et al.* (2018) showed the relevance of using portable US during the insertion and management of urinary catheters through bladder volumetric assessment in pediatric patients in the emergency room.<sup>(20)</sup>

Sozzi, Donati, and Neri (2019) pointed out that the use of POCUS is associated with a decrease in the incidence of healthcare-related infections since it enables the assessment of the need for insertion of invasive devices, positioning, and functionality assessments, can also be used as a guide for procedures and the performance of early diagnoses, as well as contributing to the decrease in the incidence of errors and complications during invasive procedures.<sup>(21)</sup>

A study conducted by Lopes *et al.* (2023), whose objective was to quantify urinary volume by means of bladder ultrasound, performed by nurses during the care of critically ill patients, after removal of the permanent bladder catheter, and to analyze the factors related to retention, showed that the volumes of urine measured by ultrasound were around 950 ml and a percentage of 40.54% of urinary retention. In a significant proportion of those who had spontaneous urination, the urinary volume observed was over 400 ml, suggestive of overflow incontinence. These findings reinforce the importance of careful assessments by nurses, since volumes of more than 400 ml can be the cause of urinary complaints and suggest complications such as urinary retention.<sup>(22)</sup>

The relevance and applicability of bedside US by nurses is notorious. This practice is based on science, linked to clinical reasoning, and is being included in critical patient care as a complementary tool. Some authors have even indicated that insonation through US is the 5th element in the propaedeutic

physical examination, traditionally known as inspection, palpation, percussion, and auscultation. Ultrasound can also be used by nurses to guide the identification of nursing diagnoses, as well as to monitor outcome indicators that are susceptible to nursing action.<sup>(23)</sup>

Although the report addresses a successful experience and contributes to the applicability of the use of US by nurses in other institutions, its limitations are the fact that it is a qualitative discussion based on experience, which proved to be relevant and impactful in the care context of the professionals and institution involved. However, it reinforces the need for studies using other scientific methods and with significant samples that can highlight the relevance of the use of US by nurses in direct care for critically ill patients.

## CONCLUSION

The conclusion is that the use of US by nurses in the ICU is of the utmost importance for direct patient care, as well as US being a useful, practical, non-invasive tool that is easy to handle and contributes to safe, quality care, while also providing patients with advanced nursing care based on scientific evidence. This tool and approach were only possible after the course devised by the Nursing supervision. Initially, the idea was to update nurses on US technology in clinical practice, but it went further and became a frequent practice in the hospital's ICU, which brought benefits to the patient through safer and more qualified care, as well as strengthening nurses' autonomy in the process of clinical reasoning and decision-making.

## CONTRIBUTIONS

Contributed to the conception or design of the study/research: Pereira MCC. Contributed to data collection: Pereira MCC. Contributed to the analysis and/or interpretation of data: Pereira MCC, Araújo AVL. Contributed to article writing or critical review: Pereira MCC, Cabral IM, Alencar VP. Final approval of the version to be published: Pereira MCC, Araújo AVL, Cabral IM, Alencar VP.

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