Ultrasonography for the evaluation of urinary retention in patients in post-anesthesia recovery

Ultrassonografia para avaliação de retenção urinária em pacientes em recuperação anestésica

Ultrasonografía para evaluación de retención urinaria en pacientes en recuperación anestésica.

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ABSTRACT: Objective: To describe the results of the investigation of urinary retention in patients in post-anesthesia recovery using ultrasonography. **Method:** This is a descriptive observational study in which the bladder content of patients in the post-anesthesia recovery room was estimated using ultrasonography to detect urinary retention. Twenty adult and aged patients with one hour of stay in the post-anesthesia recovery room of a large university hospital in Northeast Brazil were included between June and October 2022. **Results:** The urinary volume measured through this imaging exam had a mean of 588.3±327.6 mL, ranging from 80 to 1,275.4 mL. Urinary retention was identified in 45% of cases in this series, although only the complaint of pain associated with the need to urinate was a statistically significant indicative symptom of retention. There was no statistically significant difference between genders, and it was not possible to observe the influence of opioid use on urinary retention. **Conclusion:** Perioperative nurses should seek training for advanced techniques, including the use of ultrasonography, to assist in their practice.
Keywords: Ultrasonography. Surgicenters. Perioperative nursing.

RESUMO: Objetivo: Descrever os resultados da investigação de retenção urinária em pacientes em recuperação anestésica com uso da ultrassonografia. **Método:** Trata-se de um estudo observacional descritivo, no qual o conteúdo vesical de pacientes em sala de recuperação pós-anestésica foi estimado por meio da ultrassonografia para detectar retenção urinária. Foram incluídos 20 pacientes adultos e idosos com uma hora de permanência na sala de recuperação pós-anestésica de um hospital universitário de grande porte do Nordeste do Brasil, entre junho e outubro de 2022. **Resultados:** O volume urinário mensurado por meio desse exame de imagem teve média de 588,3±327,6 mL, variando de 80 a 1.275,4 mL. A retenção urinária foi identificada em 45% dos casos desta série, embora apenas a queixa de dor associada à necessidade miccional tenha sido um sintoma indicativo de retenção estatisticamente significativo. Não houve diferença estatisticamente significativa entre os sexos e não foi possível observar a influência do uso de opioides na retenção urinária. **Conclusão:** Os enfermeiros perioperatórios devem buscar formação para técnicas avançadas, incluindo o uso da ultrassonografia, como auxiliar na sua prática.
Palavras-chave: Ultrassonografia. Centros cirúrgicos. Enfermagem perioperatória.

RESUMEN: Objetivo: Describir los resultados de la investigación sobre retención urinaria en pacientes en recuperación anestésica utilizando ultrasonografía. **Método:** Se trata de un estudio observacional descriptivo, en el cual se estimó el contenido vesical de pacientes en la sala de recuperación postanestésica mediante ultrasonografía para detectar retención urinaria. Se incluyeron 20 pacientes adultos y ancianos con una hora de permanencia en la sala de recuperación postanestésica de un hospital universitario de gran tamaño en el noreste de Brasil, entre junio y octubre de 2022. **Resultados:** El volumen urinario medido mediante este examen de imagen tuvo un promedio de 588,3±327,6 mL, variando de 80 a 1.275,4 mL. La retención urinaria se identificó en el 45% de los casos de esta serie, aunque solo la queja de dolor asociada a la necesidad de micción fue un síntoma indicativo de retención estadísticamente significativo. No hubo diferencias estadísticamente significativas entre los sexos y no se pudo observar la influencia del uso de opioides en la retención urinaria. **Conclusión:** Los enfermeros perioperatorios deben buscar formación en técnicas avanzadas, incluido el uso de ultrasonografía, como apoyo en su práctica.
Palabras clave: Ultrasonografía. Centros quirúrgicos. Enfermería perioperatoria.

INTRODUCTION

Perioperative nursing has been evolving alongside advancements in surgical-anesthetic techniques and general care technologies. Nurses are now empowered to utilize technologies to prevent hypothermia, injuries from positioning, and accidents during electrosurgery. In this context, the use of ultrasonography (USG) as a tool for nurses is a frontier that has been crossed in recent years and is expected to become more prevalent in the operating room routine[1].

The post-anesthesia care unit (PACU) is an extremely important area designed to receive patients in the immediate postoperative period. Here, patients are monitored until they regain consciousness and their vital signs stabilize.

PACU nurses must be knowledgeable about the primary complications associated with anesthetic-surgical procedures, including urinary retention (UR), which is a common and well-documented issue in the literature.

UR is the total or partial physiological inability to empty urine accumulated in the bladder, making it one of the most common complications in the PACU and may be related to various factors[2-5]. It presents acutely or chronically, permanently or temporarily, depending on the causative mechanism, characterized by specific symptoms and urine volume[5]. Although there is no consensus in the literature on the standard volume that defines UR, some studies suggest a volume between 300 and 600 mL[2,5-8].

Studies conducted in Brazil, with larger samples than those used in this series of evaluations, have found that the occurrence of UR ranged from 7.39 to 33.2% of the analyzed cases, with retention defined as volumes greater than 600 mL[2,5]. The definition of the volume considered as UR significantly impacts the incidence rates reported in the research findings.

The nurses' role in the PACU care context is centered on the systematization of nursing care through the nursing process, with the primary objective of providing quality service to patients. Professionals must possess theoretical-practical knowledge, develop critical reasoning during their workday, and effectively utilize available resources, tools, and technologies to assist in this process[2,7].

The use of portable USG equipment to evaluate bladder urine volume enables professionals to safely detect UR in a non-invasive and rapid manner without using ionizing radiation. This approach also facilitates early management and intervention, helping to prevent the sequelae of prolonged bladder distension[3-7].

OBJECTIVE

To describe the results of investigating UR in patients recovering from anesthesia using USG.

METHOD

This is an observational, descriptive study with a quantitative approach. Data collection took place in the PACU of a large university hospital in Northeast Brazil between July and October 2022.

In the hospital's operating room, major surgeries across various specialties, including orthopedics, neurology, cardiology, vascular, and transplantation, are performed. Patients are then referred to one of the six beds in the PACU. Those requiring intensive care after surgery are transferred directly to the intensive care unit.

Prior to the study, surgical nursing residents and nurses in the sector underwent training conducted by a qualified nurse proficient in USG use and possessing significant experience. Sampling used a non-probabilistic convenience method, with the first 20 patients meeting the inclusion criteria and consenting to participate in the research immediately after the training phase. These ultrasound examinations were supervised, and the cases were studied and discussed by professionals as part of their learning process.

Patients aged 18 years old or older admitted to the PACU, undergoing either general anesthesia or spinal anesthesia, and remaining in the PACU for more than one hour were included in the study. Exclusion criteria comprised patients with any kidney disease undergoing urological surgeries in general, as well as those utilizing indwelling bladder catheters, continuous bladder irrigation, cystostomy tubes, urostomies or nephrostomies, or presenting any anatomical alterations that rendered the examination impossible.

Patients were pre-informed and approached in the operating room admission area to receive instructions about the research and provide consent. Subsequently, in the PACU, patients who had been in bed for more than an hour underwent evaluation using ultrasound imaging, with intraoperative data collected from their medical records.

The data collection instrument was a form devised by the authors encompassing clinical data, details of the anesthetic-surgical procedure and recovery, along with recording information from the ultrasound evaluations

conducted by the researchers. Sociodemographic and clinical variables, including age, gender, presence of urinary symptoms in the pre-anesthetic history, type of surgery, surgical duration, anesthesia type, use of opioids, and volume of intraoperative fluids administered, were gathered. This information was extracted from the medical records and PACU records.

An ultrasound device equipped with a 2–5 MHz convex transducer (Sonoace 8000 SE, Medison, South Korea), designated exclusively for use in the sector, was utilized. Measurements were conducted with patients in the supine position, with the head of the bed inclined between 30 and 45°. Initially, the transducer was positioned over the suprapubic region in both transverse and longitudinal directions to ascertain the laterolateral, anteroposterior, and superoinferior diameters of the bladder. Urinary volume calculation was automatically performed by the USG device using these three measurements. The gel utilized for the examination was preheated for 30 seconds at high power in a microwave device available in the sector.

Patients were evaluated using screens to ensure their privacy and to avoid disrupting the routine care in the sector. No images of the exams were archived.

The data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 26.0, and subsequently presented using descriptive statistical methods. Normality of the main outcome, urinary volume, was confirmed using a Q-Q plot. Parametric tests were selected for data analysis: Fisher's exact test was employed to compare proportions between groups, and Student's t-test was used to compare means. Both tests were considered statistically significant at $p < 0.05$.

The research adhered to the ethical principles outlined in Resolution No. 466/2012 of the National Health Council and was evaluated and approved by the institution's Human Research Ethics Committee under Opinion No. 5.330.744. The Informed Consent was presented to participants in the admission room of the operating room prior to surgery.

RESULTS

Twenty patients participated in the study, of whom 14 (70.0%) were women and 6 (30.0%) were men. The mean age was 54.6±15.9 years. Table 1 displays data pertaining to the surgeries conducted.

In Table 1, opioids such as morphine, fentanyl, ropivacaine, and bupivacaine were identified among those used.

Table 1. Intraoperative data and fasting time. (n=20). Recife (PE), Brazil, 2022.

Surgical specialty	n	%
Vascular	3	14.3
General	6	28.6
Thoracic	1	4.8
Oncological	3	14.3
Otorhinolaryngological	4	19
Orthopedic	3	14.3
Plastic	1	4.8
Type of anesthesia	**n**	**%**
General + spinal anesthesia	3	14.2
General	12	57.1
General + nerve block	1	4.8
Spinal anesthesia	2	9.5
Epidural	3	14.3
Use of opioids in neuraxial blockade	**n**	**%**
Yes	6	28.6
No	15	71.4
	Mean	**Standard deviation**
Volume administered (mL)	867.5	350.7
Fasting time (hours)	13.75	2.5

Table 2 presents data on anesthetic recovery. The administered volume is linked to parenteral medications and intravenous therapy, with no recorded oral intake (Table 2).

The Bromage scale serves as an indicator of the reversal of neuraxial blockade, while the Aldrete scale assesses the overall post-anesthetic state, guiding discharge from the PACU.

The urinary volume measured by ultrasound exhibited a mean of 588.3±327.6 mL, ranging from 80 to 1,275.4 mL. Considering the cutoff for postoperative urinary retention of 500 mL, Table 3 presents comparisons of the incidence of urinary retention based on independent variables, such as gender and opioid use. Pain associated with the urge to urinate was the sole variable demonstrating a statistically significant association with urinary retention (Table 3).

Finally, Table 4 displays a correlation analysis of the volume measured by USG with theoretical variables that could potentially affect urinary output. No variable showed a significant correlation with the measured urinary volume.

Table 2. Post-anesthetic recovery data. Recife (PE), Brazil, 2022.

	Mean	Standard deviation
Mean arterial pressure upon admission (in mmHg)	93.3	16.4
Mean arterial pressure at the end of the first hour after admission (in mmHg)	88	16.9
Blood glucose level at the end of the first hour after admission (in mg/dL)	120.8	36.4
Volume administered in the first hour (in mL)	251.1	232.4
Temperature upon admission	35.6	0.4
Temperature at the end of the first hour after admission	35.9	0.3
	Median	**Interval**
Bromage scale upon admission	1	0–4
Bromage scale at the end of the first hour after admission	1	0–1
Aldrete scale upon admission	8	4–10
Aldrete scale at the end of the first hour after admission	10	8–10

Table 3. Incidence of urinary retention based on independent variables. Recife (PE), Brazil, 2022.

Characteristics	Urinary retention		p*
	No (%)	Yes (%)	
Gender			
Female	7 (35)	7 (35)	0.492
Male	4 (20)	2 (10)	
Opioid use			
No	6 (30)	4 (20)	0.319
Yes	5 (25)	5 (30)	
Pain associated with the need to urinate			
No	4 (20)	1 (5)	0.017
Yes	7 (35)	8 (40)	
Request for spontaneous urination			
No	10 (50)	6 (30)	0.178
Yes	1 (5)	3 (15)	
Recognizes full bladder			
No	9 (45)	5 (25)	0.202
Yes	2 (10)	4 (20)	
Indifferent to bladder perception			
No	7 (35)	7 (35)	0.492
Yes	4 (20)	2 (10)	
Painless palpation			
No	3 (15)	1 (5)	0.369
Yes	8 (40)	8 (40)	
Required relief catheterization			
No	9 (45)	7 (35)	0.822
Yes	2 (10)	2 (10)	

*p-value for Fisher's exact test.

Table 4. Correlation of measured volume with variables that may alter urinary output. Recife (PE), Brazil, 2022.

Characteristics	r*	p†
Mean arterial pressure at the end of the first hour of admission	-0.01	0.986
Volume administered in the first hour	-0.28	0.205
Volume administered intraoperatively	0.08	0.706
Body mass index	-0.02	0.939
Age	-0.32	0.167

*Pearson correlation coefficient; †p-value.

DISCUSSION

Postoperative urinary retention is an occurrence more commonly observed in medium to large, prolonged surgeries, and becomes more apparent the longer the patient remains in the PACU.

The urinary volume measured by imaging in this study had a mean of 588.3±327.6 mL, ranging from 80 to 1,275.4 mL. Considering the cutoff for postoperative urinary retention of 500 mL, nine (45%) cases of this disorder were identified. There was no significant difference between gender or opioid use. However, although the difference in proportions was not statistically significant, four (20%) cases of patients with UR recognized a full bladder, compared to only two (10%) among those without UR. Among the eight (40%) who experienced pain associated with the urge to urinate, only two (10%) required bladder catheterization for relief; the remainder achieved spontaneous urination while still in the PACU, prior to discharge.

Although not the primary focus of this research, it is noteworthy to mention another study conducted with pediatric patients, where postoperative UR was identified in 74% of cases, with an incidence of 18.5% of volumes exceeding double the bladder capacity[9]. The authors suggest that protocols utilizing USG can potentially reduce the need for urinary catheterization in children[9].

The association between signs and symptoms of UR and urinary volume is often influenced by the residual effect of anesthesia. In a study conducted in France, at the time of discharge from the anesthetic recovery, 44% of patients undergoing major surgery had a urinary volume greater than 500 mL, and signs of bladder distension were recorded in only 54% of cases[8].

In this case series, among the signs and symptoms evaluated for UR, only the complaint of pain associated with the need to urinate showed a statistically significant association with a higher incidence of UR (p=0.017). It is worth noting that the professional's assessment may not be as precise and subjective, potentially influenced by anatomical factors. In another study, the incidence of UR assessed by palpation was 1.4%, compared to a 19.4% incidence when assessed by USG[10].

Despite the high rates observed in adults, urinary retention exhibited a higher incidence among children in the studies analyzed[2,5,8-11]. Two studies proposed risk classification for urinary retention and protocols incorporating routine USG evaluation for high-risk patients[11,12]. Another study highlighted the disparity in the incidence of UR recorded over one year without ultrasonography compared to nine months with the technology[10].

In another survey involving Brazilian nurses, participants (n=34) indicated that USG facilitated the identification of urinary retention and reported a high level of confidence and security. All participants expressed satisfaction with the technology and considered its use important for nurses' autonomy[7].

Finally, numerous authors advocate for the systematic evaluation of patients recovering from anesthesia using USG, based on well-designed protocols that guide routine practices in recovery units, taking into account patients' individual risk factors[2,6,7,12,13].

In this study, the total volume of parenteral medications and intravenous therapy was regarded as the volume administered intraoperatively and in the PACU. These variables may not have been associated with the measured volume because urinary output is primarily influenced by water balance — and losses were not considered here. Additionally, preoperative factors such as patients' kidney function were not considered, although individuals with any previously diagnosed kidney disease were excluded from the research.

In addition to the logistical considerations for the study, it should be noted that changes in the operating room environment significantly impeded reaching a larger sample size.

Although the reduced sample size limited the possibility of a more comprehensive statistical analysis and broader generalization, the aim of the research was to raise awareness of the high incidence of UR and the effectiveness of USG utilization by nurses.

The presented research has the potential to underscore the importance of ongoing assessment for urinary retention in patients within the post-anesthesia recovery room. Additionally, it emphasizes the necessity to train nurses in utilizing ultrasound imaging as an advanced practice in perioperative nursing.

CONCLUSION

Among the 20 patients evaluated, UR was identified in 45% of cases. However, only the complaint of pain associated with the urge to urinate was a statistically significant symptom indicative of difficulty emptying the bladder. There was no significant difference between genders, and it was not possible to evaluate the effect of opioid use on the incidence of UR.

The utilization of ultrasonography as a resource in nursing practice should be reinforced. Training programs and protocol development are suggested, as this technology, being non-invasive, low-cost, free of ionizing radiation, and requiring minimal time to use, is likely to be integrated and make a significant contribution to the advanced practice of perioperative nursing.

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CONFLICT OF INTERESTS

The authors declare there is no conflict of interests.

AUTHORS' CONTRIBUTION

ETG: Project administration, Formal analysis, Conceptualization, Data curation, Investigation, Methodology, Resources, Writing – original draft, Writing – review & editing, Supervision, Validation, Visualization. SDVNA: Project administration, Formal analysis, Conceptualization, Data curation, Investigation, Methodology, Resources, Writing – original draft, Writing – review & editing, Supervision, Validation, Visualization. RIS: Project administration, Formal analysis, Conceptualization, Data curation, Investigation, Methodology, Resources, Writing – original draft, Writing – review & editing, Supervision, Validation, Visualization. EMLMM: Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Supervision, Validation, Visualization. JANO: Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Supervision, Validation, Visualization.

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