

Prevalence and Predictive Factors of Urinary Retention Assessed by Ultrasound in the Immediate Post-anesthetic Period

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Summary: Dal Mago AJ, Helayel PE, Bianchini E, Kozuki H, Oliveira Filho GR – Prevalence and Predictive Factors of Urinary Retention Assessed by Ultrasound in the Immediate Post-anesthetic Period.

Background and objectives: Urinary retention is a common condition in the post-anesthetic care unit (PACU). Vesical overdistension and consequent damage of the detrusor muscle of the urinary bladder represent situations that can be prevented. The ultrasound allows the reliable measurement of the urinary volume, determining the prevalence of postoperative vesical distension. The objective of the present study was to determine the prevalence of postoperative urinary retention and identify independent predictive factors.

Methods: Two-hundred and fifty-seven patients admitted to the PACU were included prospectively in this study. Parameters collected included: age, gender, physical status, site of surgery, type of anesthesia, time of the surgery and anesthesia, use of opioids, volume of fluids administered, and history of urinary symptoms. Vesical volumes were measured by ultrasound after admission and upon discharge from the PACU. The criteria to characterize urinary retention were: vesical volume equal or higher than 600 mL associated with incapacity of spontaneous micturition for 30 minutes after the diagnosis. Univariate and multivariate analyses were used to identify independent predictive factors.

Results: Urinary retention was observed in 19 patients (7.39%), independent predictive factors identified included urinary volume equal to or greater than 360 mL upon admission to the PACU (Mantel-Haenszel Chi-square test (1 dF) = 18.76; $p < 0.01$), with an odds ratio of 9.82 (95% confidence interval = 3.26-29.55) and surgeries of the lower limbs (Mantel-Haenszel Chi-square test (1 dF) = 5.33; $p = 0.02$), with odds ratio of 4.33 (95% confidence interval = 1.34-14.02).

Conclusions: Due to the prevalence of urinary retention, we suggest that a systematic evaluation of the urinary volume at the PACU should be done, especially in those patients with predictive factors.

Keywords: COMPLICATIONS: urinary retention; EQUIPMENT: ultrasound; POST-ANESTHETIC RECOVERY.

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INTRODUCTION

Urinary retention is a common post-anesthetic complication associated with painful vesical distention and the risk of permanent damage of the detrusor muscle, and it might culminate on motility and atony problems especially in patients with advanced age ¹. Cardiovascular reactions such as bradycardia, asystole, hypertension, tachycardia, and arrhythmias can result from the activation of the autonomous nervous system related to vesical distension ².

In the past, the diagnostic hypothesis of urinary retention in the immediate post-anesthetic period was suspected due

to symptoms and clinical signs such as pain, agitation, tachycardia, hypertension and by palpating the distended bladder, and the diagnosis was confirmed by vesical catheterization. Currently, ultrasound allows a fast diagnosis and it is a reliable, non-invasive, painless method with good reproducibility, which allows the precise and early diagnosis of the urinary volume, therefore avoiding excessive bladder distension ³.

Postoperative urinary distension is defined as the incapacity to empty out a urine volume greater than 600 mL in 30 minutes after the diagnosis ¹. Prior studies identified several risk factors for the development of post-anesthetic urinary retention: anorectal surgeries, inguinal herniorrhaphies, history of urinary retention, neuroaxis block, anticholinergic medications, opioids, advanced age, and excess of fluids administered in the perioperative period ^{1,3-5}.

The objective of this study was to determine the prevalence of postoperative urinary retention and identify independent predictive risk factors.

METHODS

After approval by the Ethics on Research Committee of the Hospital Governador Celso Ramos and signing of the informed consent, 257 patients, ages between 15 and 96 years of

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both genders, scheduled for elective surgeries were enrolled in this study. Exclusion criteria were urgent surgeries and perioperative vesical catheterization.

The anesthetic technique was the choice of the anesthesiologist responsible for the patient.

Each patient was evaluated at the time of admission and discharge from the post-anesthetic care unit (PACU). The following parameters were collected: age, gender, physical status (ASA), presence of urinary symptoms in the pre-anesthetic history, site of the surgery, duration of the surgery, duration of anesthesia, use of opioids, urinary volume upon admission to the PACU (measured by US), urinary volume upon discharge from the PACU (measured by US), and volume of fluids administered during the transoperative period.

To measure the urine volumes on admission and upon discharge from the PACU an ultrasound equipment with a convex transducer of 2-5 MHz (Sonoace 8000 SE, Medison, South Korea) was used. Measurements were done with patients in dorsal decubitus. The transducer was placed on the suprapubic region in the transversal and longitudinal direction to determine the transverse, anteroposterior, and supero-inferior diameters of the bladder (Figure 1). The urinary volume was calculated automatically by the ultrasound equipment.

If a urine volume greater than 600 mL was identified the patient remained in the PACU and he/she was stimulated to urinate, guaranteeing a calm and isolated environment for 30 minutes. In case spontaneous micturition was not present, the patient underwent vesical catheterization and was considered as having post-anesthetic urinary retention.

For the statistical analysis the presence or absence of urinary retention according to the criteria established was considered the dependent variable. Based on this parameter, patients were divided in groups for univariate and multivariate analyses according to what is described below.

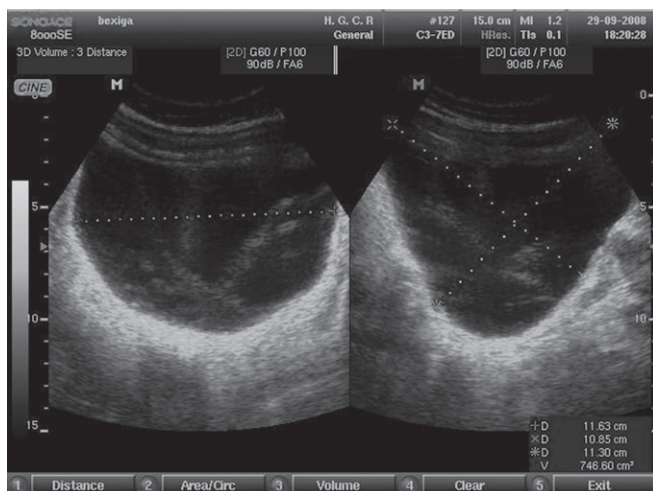


Figure-1 – Ultrasound Images of the Urinary bladder in Two Views. On the left, an image obtained with the transducer aligned to the transversal plane of the bladder. The dotted line represents the greater transversal diameter. The image on the right was obtained with the transducer aligned to the longitudinal axis of the bladder. The dotted lines represent the anteroposterior and supero-inferior diameters of the bladder.

Univariate analyses constituted of the Chi-square test for categorical parameters, and Student t test for continuous variables were used to compare the groups of patients who developed and those that did not develop urinary retention.

A curve of the characteristics of the receptor and operator (ROC curve) was plotted for variables containing the volume of urine upon admission to the PACU in order to determine the presence of a volume that would be a cutting point to be included as a predictive parameter of urinary retention.

The Fisher exact test was used to identify significant differences in contingency tables greater than 2 x 2, in which the Chi-square test showed significant dependency between cells.

Parameters that differed between the groups underwent the Cochran and Mantel-Haenszel association dependency tests. The level of statistical significance was established at 5%.

RESULTS

Table I shows the demographic data of the study sample.

Thirty-seven patients (14.39%) presented urine volumes higher than 600 mL upon admission to the post-anesthetic

Table I – Demographic Data of the Study Population

Continuous parameters	Population
Age (years) *	44.28 (15-96)
Duration of the surgery (min) *	75 (5-225)
Duration of the anesthesia (min) *	109 (15-470)
Gender#	
Male	142 (55)
Female	115 (45)
Physical status #	
ASA I	105 (40.87)
ASA II	135 (52.53)
ASA III	16 (6.22)
ASA IV	1 (0.003)
Site of surgery#	
Head and neck	49 (19.06)
Thorax	3 (1.16)
Abdomen	35 (13.61)
Upper limb	39 (15.17)
Lower limb	114 (44.35)
Perineum/genitals	17 (6.61)
Type of anesthesia#	
General	89 (34.63)
Neuroaxis	91 (35.4)
General + neuroaxis	3 (1.16)
Peripheral block	57 (22.17)
General + peripheral block	17 (6.61)
Opioids#	
Intravenous	176 (68.48)
Intrathecal	2 (0.77)
No	78 (30.35)
Urinary symptoms#	
Yes	14 (5.44)
No	243 (94.56)

*Parameters presented as mean and extremes;

#Parameters presented as frequency in the sample and percentages.

care unit. Out of those, 19 patients (7.39% of the total sample) were not able to urinate spontaneously within 30 minutes, and it was considered that they had developed post-anesthetic urinary retention.

Tables II and III shows the results of the univariate analyses. Significant differences were observed between patients who developed urinary retention and those who did not in univariate analyses of the following parameters: urinary volume upon admission in the PACU and surgeries of the lower limbs.

In multivariate analyses, both parameters were considered independent predictive factors. The urine volume equal to or higher than 360 mL upon admission to the PACU showed

an odds ratio of 9.82 (95% confidence interval = 3.26-29.55) (Mantel-Haenszel Chi-square test (1 dF) = 18.76; $p < 0.01$). Surgeries of the lower limbs were also independent predictive factors, with odds-ratio of 4.33 (95% confidence interval = 1.34-14.02) (Mantel-Haenszel Chi-square test (1 dF) = 5.33; $p = 0.02$).

DISCUSSION

The prevalence of urinary retention ranges from 5% to 52%^{1,3-5}. This variation could be explained by the different criteria adop-

Table II – Comparison of Continuous Parameters Between Patients Who Developed and those Who did not Develop Urinary Retention

	Without retention	With retention	p
Age	44.29 ± 18.63	44.21 ± 15.67	0.99
Duration of the surgery	80.38 ± 43.18	76.32 ± 47.55	0.70
Duration of the anesthesia	119.37 ± 62.75	110.26 ± 61.83	0.54
Urine volume upon admission to the PACU	247.03 ± 159.02	540.58 ± 237.66	0.00
Urine volume upon discharge from the PACU	351.69 ± 184.91	779.11 ± 166.69	0.00
Transoperative fluids	1342.44 ± 544.79	1289.47 ± 480.62	0.68

Parameters expressed as Mean ± SD.

Table III – Comparison of Categorical Parameters between Patients Who Developed Urinary Retention and those Who did not

	Without retention	With retention	χ^2
Gender			(1 dF) = 0.23; $p = 0.63$
Male	12 (63)	130 (53)	
Female	7 (37)	108 (45)	
Physical status			(3 dF) = 0.42; $p = 0.93$
ASA I	9 (47)	96 (40)	
ASA II	9 (47)	126 (53)	
ASA III	1 (5)	15 (6)	
ASA IV	0 (0)	1 (0,42)	
Site of the surgery			(5 dF) = 11.36; $p = 0.04$
Head and Neck	3 (16)	46 (19)	
Thorax	0 (0)	3 (1)	
Abdomen	0 (0)	35 (15)	
Upper limbs	1 (5)	38 (16)	
Lower limbs	15 (79)	99 (42)	
Perineum/Genitals	0 (0)	17 (7)	
Type of Anesthesia			(4 dF) = 8,53; $p = 0,07$
General	3 (16)	86 (36)	
Neuroaxis	12 (63)	79 (33)	
General + Neuroaxis	0 (0)	3 (1)	
Peripheral block	2 (11)	55 (23)	
General + Peripheral block	2 (11)	15 (6)	
Opioid use			(1 dF) = 0.019; $p = 0.89$
No	5 (26)	73 (31)	
Yes	14 (74)	165 (69)	
Urinary symptoms			(1 dF) = 0.3; $p = 0.62$
No	18 (95)	225 (95)	
Yes	1 (5)	13 (5)	
Urine volume upon admission to the PACU			(1 dF) = 20.89; $p < 0.01$
< 360 mL	5 (29)	192 (81)	
> 360 mL	12 (71)	46 (19)	

Results presented as frequency and percentage
 χ^2 = Chi-square; dF = degrees of freedom.

ted in the different studies to define urinary retention. Another relevant factor is the difference in the diagnostic methods used. In prior studies, predictive factors for urinary retention were age, gender, physical status, type of anesthesia, history of urinary symptoms, amount of fluids administered, inguinal herniorrhaphies, and anorectal surgeries. The present study adds to those criteria surgeries of the lower limbs and urinary volume equal to or higher than 360 mL upon admission to the PACU as independent predictive factors for urinary retention.

The study has limitations imposed by the sampling method. In our cohort, the surgical procedures did not have a homogenous representation. For example, anorectal surgeries represented only 7% of the sample while surgeries of the lower limbs represented 45%. The period of evaluation of the patients was restricted to the immediate postoperative period (period of staying in the PACU). In a study in which patients were followed-up for the 24 postoperative hours, 25% of the patients developed urinary retention increasing the incidence of 5% originally observed⁴. A standardization regarding the volume of perioperative fluids was not used in this study, which made it impossible to stratify the sample according to this parameter unlike another study which identified the volume of fluids administered as a risk factor¹.

The use of the ultrasound as an evaluation and monitoring instrument of the urine volume showed to be a very reliable

method. According to Keita et al.¹, it has a sensitivity of 97%, specificity of 91%, and accuracy of 94% in the identification of urine volumes greater than or equal to 100 mL. Pavlin et al.^{4,5} observed a difference of only 15 mL between the urine volume estimated by ultrasound and the volumes drained by vesical catheterization.

The low sensitivity of the palpation method on the diagnosis of a vesical globe and the presence of urinary retention without pain in up to 61% of the cases are easily overcome by ultrasound^{4,5}. The relevance of the early identification of vesical distention resides in the fact that prolonged distension of the bladder can cause damage of the detrusor muscle and vesical dysfunction.

We conclude that urine retention in the immediate postoperative period observed in 7.39% of the patients in the present study was associated with two independent predictive factors: surgeries of the lower limbs and vesical volume equal to or higher than 360 mL upon admission to the PACU. Considering the clinical repercussions that non-diagnosed urine retention can cause, and the advantages that the ultrasound has to this end, we suggest that the systematic evaluation of the vesical contents of patients at the time of admission to the PACU should be done especially in those patients who have any risk factor.

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Resumen: Dal Mago AJ, Helayel PE, Bianchini E, Kozuki H, Oliveira Filho GR – Prevalencia y Factores Predictivos de Retención Urinaria Diagnosticada por Ultrasonido en el Período Postanestésico Inmediato.

Justificativa y objetivos: La retención urinaria es una condición frecuente en la sala de recuperación postanestésica (SRPA). La sobredistensión vesical y la consecuente lesión del detrusor de la vejiga son situaciones que se pueden prevenir. El ultrasonido permite una medida confiable del volumen urinario, determinando la prevalencia de la distensión vesical postoperatoria. Este estudio tuvo el objetivo de determinar la prevalencia de retención urinaria postoperatoria e identificar los factores independientes de previsión para su apareamiento.

Método: Doscientos cincuenta y siete pacientes admitidos en la SRPA fueron prospectivamente incluidos en el estudio. Las variables recolectadas incluyeron: edad, sexo, estado físico, local de la cirugía, tipo de anestesia, tiempos quirúrgico y anestésico, uso o no de opioides, volumen de fluidos administrados, e historial previo de síntomas urinarios. Las medidas del volumen vesical fueron realizadas por ultrasonido, en la entrada y en el alta de la SRPA. El criterio para caracterizar la retención urinaria fue el volumen vesical igual o mayor que 600 mL, asociado a la incapacidad de micción espontánea 30 minutos después del diagnóstico. Los análisis univariados y multivariados fueron utilizados para identificar los factores predictivos independientes.

Resultados: Ocurrió una retención urinaria en 19 pacientes (7,39%). Los factores predictivos independientes identificados fueron el volumen urinario igual o mayor que 360 mL en la admisión a la SRPA (Cui-cuadrado de Mantel-Haenszel (1 gl.) = 18,76; $p < 0,01$), con razón de chances de 9,82 (intervalo de 95% de confianza = 3,26 – 29,55) y las cirugías sobre los miembros inferiores (Cui-cuadrado de Mantel-Haenszel (1 gl.) = 5,33; $p = 0,02$), con razón de chances de 4,33 (intervalo de un 95% de confianza = 1,34 – 14,02).

Conclusiones: dada la prevalencia de la retención urinaria, se sugiere una evaluación sistemática del volumen urinario en la SRPA, particularmente en los pacientes portadores de factores predictivos.