

Urinary Retention in Hospitalised Older Women

T L Tan,*^{MRCP (UK)}, P K Lieu,**^{FAMS, M Med (Int Med)}, Y Y Ding,**^{FAMS, MRCP (UK), DGM (Glas)}

Abstract

Introduction: Information about urinary retention in women is scarce. We conducted a case-control study to identify the symptoms and risk factors associated with urinary retention in hospitalised older women. **Materials and Methods:** Targeted history (especially lower urinary tract symptoms) and physical examination of 60 women (65 years or older) who had post-void residual urine volume (PRUV) (determined using a portable ultrasound Bladder Scan BVI-2500) of more than 100 mL were studied and compared with 60 controls. **Results:** Symptoms of voiding difficulties had low positive predictive value (PPV) and negative predictive value (NPV), except for poor stream, which has a PPV of 100%. Only one-third of the patients with high PRUV had a palpable bladder. Associated with high PRUV were: 1) constipation [odds ratio (OR), 4.12; 95% confidence interval (CI), 1.90 - 8.91; P = 0.0004]; 2) urinary tract infection (UTI) (OR, 3.36; 95% CI, 1.58-7.12; P = 0.002); 3) impaired mobility (OR, 2.37; 95% CI, 1.12-4.97; P = 0.02); 4) past history of UTI (OR, 3.5; 95% CI, 1.34-9.14; P = 0.014); 5) past history of urinary retention (OR, 6.33; 95% CI, 1.72 - 23.33; P = 0.004); 6) stroke (OR, 2.5; 95% CI, 1.24-5.41; P = 0.017); 7) diabetes mellitus with microvascular complications (OR, 2.76; 95% CI, 1.08-7.04; P = 0.042). Applying logistic regression analysis, the three best predictive variables for high PRUV were constipation, UTI and past history of urinary retention. **Conclusion:** Symptoms (except for positive history of poor stream) and signs were unreliable in diagnosing urinary retention in hospitalised older women. Patients with the above risk factors should have their PRUV ascertained, which can be done reliably non-invasively. Early detection with appropriate intervention can potentially prevent the morbidity and mortality associated with urinary retention.

Ann Acad Med Singapore 2001; 30:588-92

Key words: Geriatric, Residual urine, Risk factors, Voiding dysfunction

Introduction

Voiding dysfunction is a relatively common problem in hospitalised older patients. Up to one-third of hospitalised elderly were reported to have post-void residual urine volume (PRUV) of more than 50 mL.¹ High PRUV represents urinary retention which in turn can have potential adverse consequences such as recurrent urinary tract infection (UTI), urinary incontinence, upper urinary tract diseases or even death.¹⁻⁵ It is therefore important to identify patients with this problem in order to reduce morbidity and to prevent premature mortality.

While urinary retention in older men had been extensively studied and reported, information in older women is scarce.² Hence, we conducted a case-control study to assess the reliability of symptoms and signs of voiding difficulties in the hospitalised older women, and to determine the associated factors that may help us to identify patients at risk of inadequate emptying.

Materials and Methods

Design

We carried out a case-control study from July 1998 to

February 1999. Consecutive hospitalised women patients over 65 years of age admitted to the Department of Geriatric Medicine, Tan Tock Seng Hospital within 72 hours of their hospitalisation were considered for enrolment into the study. Patients were excluded if they were terminally ill and already on long-term catheter due to chronic retention of urine catheterised for reasons other than retention of urine (e.g., for monitoring of urine output).

Assessment

All patients enrolled were assessed for the presence of lower urinary tract symptoms based on a standard questionnaire. History of constipation, mental status, mobility status, past urinary complaints (retention and/or infection), other medical history (such as diabetes mellitus, stroke or other neurological diseases) and history of drug intake were recorded. Microvascular complications of diabetes mellitus (nephropathy, retinopathy, neuropathy)⁶ were noted. Significant neurological and urogynaecological signs (such as uterovaginal prolapse, clinically detectable bladder, presence of impacted stool) were recorded.

Diagnosis of dementia and delirium was based on DSM

* Registrar

** Consultant

Department of Geriatric Medicine

Tan Tock Seng Hospital

Address for Reprints: Dr T L Tan, Department of Geriatric Medicine, Tan Tock Seng Hospital, 11 Jalan Tan Tock Seng, Singapore 308433.

IV criteria. Abbreviated mental test (AMT), a 10-question cognitive screening instrument, was used to assess cognition. A score of 6 or below was deemed to have cognitive impairment at the point of assessment.⁷

Post-void Residual Urine Volume

All suitable patients had their PRUV determined using the portable Bladder Scan BVI-2500 within the first 72 hours of hospitalisation. Based on 2 consecutive PRUV measurements or 2 out of 3 measurements, patients were classified as having normal or high PRUV:

1. Normal PRUV: when PRUV was less than 100 mL on 2 or more occasions
2. High PRUV:
 - a. patient presented with acute retention of urine
 - b. PRUV >100 mL on 2 consecutive occasions
 - c. PRUV >100 mL on 2 out of 3 occasions.

Statistical Analysis

Chi-square test was used to analyse the relationship between the various risk factors and high PRUV. *P* values quoted were all based on Fisher's exact test. Statistical Package for Social Sciences (SPSS version 8) was used to sort the data and to carry out the statistical analyses. Logistic regression analysis was used to construct the best predictive model for high PRUV based on this study population.

Results

Sixty women patients with high PRUV were identified, and they were compared with 60 controls (normal PRUV). The mean age of patients with high PRUV was 81.1 years (median 81, range 65 to 97), while that of the control group was 82.1 years (median 83, range 68 to 99). The age distributions were similar in both groups (Mann-Whitney *U* test, *P* = 0.221). The distributions by race were also comparable between the patients with high PRUV (Chinese, 85.0%; Malay, 3.3%; Indian, 8.3%; Others, 3.3 %) and those with normal PRUV (88.3%; 3.3%; 6.7%; and 1.7%, respectively).

Functional Characteristics

There was a high prevalence (55.4%) of cognitive impairment in the study population. Seven (5.8%) had acute confusion, 19 (15.8%) suffered from acute or chronic confusional state, and 40 (33.8%) had dementia at the time of assessment. Mean and median AMT scores of the studied population were 4.5 [standard deviation (SD), 3.0] and 5.0, respectively. On admission, only 32 patients (26.7%) were able to ambulate independently. Of the remaining, 35 (29.2%) were ambulating with assistance, 27 (22.5%) were chair-bound and 25 (20.8%) were bed-bound.

Urinary Symptoms and Physical Examination

On interview, 45 (37.5%) patients were not able to elaborate on their urinary symptoms. The inability to give an account of any lower urinary tract symptoms was significantly associated with an acute confusional state (Fisher's exact test *P* < 0.001) and low AMT score (AMT of 6 or below; Fisher's exact test *P* = 0.002).

Of the remaining 75 patients, 23 complained of urinary incontinence (stress and/or urge incontinence). The symptom of urinary incontinence was not statistically associated with high PRUV (*P* = 0.077). Thirteen of these 75 patients who could elaborate on their urinary complaints had symptoms of voiding difficulties (intermittency, incomplete emptying, hesitancy, poor stream, straining or manual compression). The positive predictive value (PPV) for the presence of any symptoms of voiding difficulties was 69.2% and the negative predictive value (NPV) was 61.3% in this subset (Table I). Looking at the individual symptoms of voiding difficulty, only poor stream and sensation of incomplete emptying were found to be statistically associated with high PRUV (*P* = 0.006; PPV, 100%; NPV, 60.9% and *P* = 0.051; PPV, 72.7%; NPV, 60.9%, respectively).

TABLE I: CROSS TABULATION OF PRESENCE OF SYMPTOMS OF VOIDING DIFFICULTY WITH PRUV

	High PRUV	Normal PRUV	Total
Voiding difficulties	9	4	13
No voiding difficulties	24	38	62
Total	33	42	75

PRUV: post-void residual urine volume
 Positive predictive value (PPV) = 69.2%
 Negative predictive value (NPV) = 61.3%

In the presence of high PRUV, the bladder was clinically detectable in only one-third of the patients (18 out of 60). Minimum bladder volume of a clinically detectable bladder was 186 mL. It was more likely to detect the bladder clinically if PRUV was more than 300 mL (*P* = 0.003; OR, 14.0; 95% CI, 1.7-115.7). None of the patients with normal PRUV had a clinically detectable bladder.

UV prolapsed was detected in 5 patients. Four of them had high PRUV. Chi-square analysis did not show any statistical significance (*P* = 0.364).

Factors Associated with High PRUV

Factors found to be associated with high PRUV were constipation, UTI on admission, impaired mobility, past history of UTI, past history of urinary retention, stroke disease (both new and old) and diabetes mellitus with

TABLE II: FACTORS ASSOCIATED WITH HIGH PRUV

	Odds ratio	95% CI	P value*
Past history of urinary retention	6.33	1.72-23.33	0.004
Constipation	4.12	1.90-8.91	0.0004
Past history of UTI	3.50	1.34-9.14	0.014
UTI on admission	3.36	1.58-7.12	0.002
Diabetes mellitus with microvascular complications	2.76	1.08-7.04	0.042
Stroke disease	2.50	1.72-5.41	0.017
Impaired mobility	2.37	1.12-4.97	0.020

PRUV: post-void residual urine volume; UTI: urinary tract infection

* Fisher's exact test

microvascular complications (Table II). Increasing impairment of mobility was associated with increasing risk of high PRUV (Fig. 1). Low AMT (6 or below) was not statistically associated with high PRUV, although it approached significance ($P = 0.061$; OR, 2.11; 95%CI, 0.99-4.47).

Predictive Model for High PRUV

Using a logistic regression model of analysis, the 3 best predictive variables for high PRUV were UTI, constipation and past history of urinary retention (PRU). The predictive model can be mathematically written as:

$$\ln \left(\frac{P}{1-P} \right) = 1.081 (\text{UTI}) + 1.221 (\text{Constipation}) + 1.510 (\text{PRU}) - 1.523$$

The predicted risks of our patients with the presence of any 1, 2 or all 3 factors in the formula were 39%-50%, 69%-77% and 91%, respectively (Table III). Using this model, the overall accuracy of prediction of high PRUV in our study population was 72.4%.

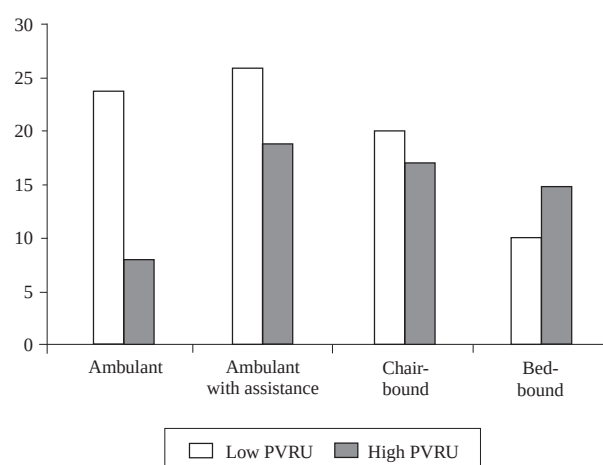


Fig. 1. Ambulatory status of patients on admission and post-void residual urine volume. Chi-square test $P = 0.011$. Linear-by-linear association $P = 0.005$.

TABLE III: RISK OF HIGH PRUV DERIVED FROM PREDICTIVE MODEL BASED ON PRESENCE OF ANY OF THE 3 VARIABLES (CONSTIPATION, UTI, PAST HISTORY OF UTI)

No. of variables present	Variables present	$\ln \left(\frac{P}{1-P} \right)$	P
0	None	-1.523	0.179
1	UTI	-0.442	0.391
	Constipation	-0.302	0.425
	Past history of urinary retention	-0.013	0.497
2	Constipation + UTI	-0.779	0.685
	UTI + past history of urinary retention	1.068	0.744
	Constipation + past history of urinary retention	1.208	0.770
3	All three	2.289	0.908

PRUV: post-void residual urine volume; UTI: urinary tract infection

Overall correct prediction = 72.4%

Discussion

Dysfunctional voiding in women is less well defined than in men, due to the lack of potentially obstructive anatomic structure analogous to the prostate. However, in spite of the rarity of anatomic obstruction, symptoms of impaired voiding are common in women.³ The problem is likely to be more among older adults due to increasing PRUV with age.⁸ In 1986, Diokno et al⁹ reported that in the non-institutionalised older women above 60 year old, the prevalence of symptoms of difficult bladder emptying was 9.1% (as opposed to 18.3% in elderly men). More recently, Bonde et al¹⁰ found that in 48 elderly women in the community, the PRUV ranged from 0 to 180 mL with a median PRUV of 45 mL. Grosshans et al¹ performed a PRUV measurement amongst 100 hospitalised elderly patients and found that 34% had PRUV of more than 50 mL.

Despite its prevalence, urinary retention in women is not well understood and not well managed.⁴ In the 1950s, bladder neck obstruction was thought to be the main cause of urinary retention.¹¹ The increasing use of urodynamic measurements has shown that true bladder neck obstruction in women is very rare.^{2,3,12} In most series, detrusor failure had been the common cause of female retention.⁴

Regardless of the aetiology, retention of urine is not a benign condition. Other than distressing symptoms, it can result in recurrent UTIs and renal complications,²⁻⁴ and was associated with higher mortality.^{1,13}

However, this potentially serious problem is difficult to diagnose among hospitalised elderly who, due to cognitive

impairment, may not be able to elaborate on their symptoms. In our study, a large proportion (one-third) of our patients were unable to provide an accurate account of their lower urinary tract symptoms. In the same study population, there was a high incidence of cognitive impairment (55% had delirium or dementia and mean AMT score of 4.5). We had shown in the study that patients who were not able to elaborate on their symptoms were more likely to be cognitively impaired.

Even for patients who could elaborate on their urinary complaints, symptoms of voiding difficulties have been repeatedly shown to be unreliable in both male and female populations.¹⁴⁻¹⁸ It had been reported that urinary retention of up to 1500 mL in the elderly female could be asymptomatic.¹⁸ This could be related to age-associated changes in detrusor sensory function.¹⁹ In our study, only two-thirds of our patients were able to give details of any urinary complaints. For these patients, symptoms of voiding difficulties were poorly predictive of PRUV, except for poor stream, which had a PPV of 100% (but NPV of 60.9%).

Physical examination appears to be inaccurate in diagnosing urinary retention. Nygaard et al²⁰ reported that the sensitivity and specificity of bimanual palpation to identify PRUV of more than 50 mL was 14% and 67%, respectively. Only one-third of our patients with high PRUV had clinically detectable bladder, which further illustrated the difficulty in identifying patients with urinary retention by physical examination. However, we should not disregard the importance of physical examination: when signs such as UV prolapse are present, they may indicate a possible cause for urinary retention.

PRUV measurement remains an important initial assessment of patients with voiding difficulties. While catheterisation is the gold standard for PRUV measurement, it carries the risk of discomfort, infection and even bladder perforation.²¹ A non-invasive method using a portable ultrasound scanner is safe and has been demonstrated to be highly accurate—particularly in identifying patients with high PRUV.²²⁻²⁵

Review of the literature failed to identify a specific maximum PRUV volume that would be considered normal. The AHCPR guideline on urinary incontinence (1996 update) stated that PRUV less than 50 mL indicates adequate bladder emptying and repeated PRUVs of 100 to 200 mL or higher indicate inadequate emptying.²⁶ Based on the above, we defined high PRUV as above 100 mL (in repeated measurements), and normal as below 100 mL for the purpose of this study.

It is not practical to assess every patient with PRUV measurement. To date, risk factors associated with high PRUV in older women have been poorly documented. Our

study identified some of the risk factors in hospitalised female geriatric women—namely, constipation, UTI on admission, impaired mobility on admission, past history of UTI, past history of urinary retention, stroke (both recent and old) and diabetes mellitus with microvascular complication. Constipation had been shown to cause reversible urinary tract dilatation and high bladder residue in children.²⁷ The exact mechanism is not clear, and whether this can be extrapolated to older adults is debatable. With regards to impairment in mobility, our data showed that there was a trend towards increasing risk of high PRUV with worsening mobility. While the pathophysiology behind this is again uncertain, our results confirmed the common clinical suspicion that immobility is a factor associated with urinary retention. As in our study, stroke disease and other central nervous system lesions had been described to be associated with retention of urine.²⁸⁻³¹

On analysing patients with diabetes mellitus, we found that only those with microvascular complications were associated with high PRUV. This is consistent with the description by Neumann and Schmid³² about the statistically significant association observed between the degree of autonomic involvement and the presence of symptoms such as numbness and hyperaesthesia of the feet or legs and urinary retention. The prevalence rates of retinopathy and nephropathy were also increased among patients with more severe degrees of autonomic neuropathy.

Using logistic regression analysis, we found that the 3 best predictive variables of high PRUV were constipation, UTI and past history of urinary retention. The predictive model derived can be used as a clinical tool for assessing risk for high PRUV. Based on the model, patients with 1, 2 and 3 of the variables have the predicted risk for high PRUV of 39%-49%, 69%-77% and 90%, respectively. However, this has not been validated in other populations as yet.

There were several limitations in our study. Firstly, the study population represented a highly selected group of hospitalised frail older women and therefore our findings may not be able to be extrapolated to populations with differing characteristics. Secondly, the associations found do not necessarily imply the presence of any causal relationships. However, the aim of our study was not to determine the causes of the high PRUV, but rather to help identify risk factors so that necessary follow-up action can be taken.

Despite these limitations, our study had demonstrated that PRUV measurement, which can be done safely with a non-invasive portable ultrasound machine, was a more reliable method in assessing voiding function in hospitalised women than the usual process of history taking and physical

examination. We recommend that all hospitalised older women should have their risk for urinary retention (as ascertained by our study) assessed, and those at risk should have their PRUV assessed via a portable ultrasound machine so that appropriate intervention can be implemented.

Conclusions

Symptoms (except for positive history of poor stream) and signs are unreliable in identifying urinary retention in hospitalised older women. Patients with the risk factors (namely constipation, UTI, impaired mobility, past history of UTI, past history of urinary retention, stroke disease and diabetes mellitus with microvascular complications) should have their PRUV ascertained. This can be done reliably and accurately in a non-invasive way. Our study had also derived a mathematical model for risk assessment based on three most predictive factors (UTI, constipation, past history of urinary retention), which can further help us to ascertain the risk quantitatively. These simple measures (that is, risk assessment and PRUV measurement) coupled with appropriate intervention where indicated can potentially prevent the morbidity, and perhaps, mortality associated with urinary retention.

REFERENCES

- Grosshans C, Passadori Y, Peter B. Urinary retention in the elderly: a study of 100 hospitalised patients. *J Am Geriatr Soc* 1993; 41:633-8.
- Deane A M, Worth P H L. Female chronic urinary retention. *Br J Urol* 1985; 57:24-6.
- Bowen L W. Voiding dysfunction. *Obstet Gynaecol Clin North Am* 1989; 16:869-82.
- Wheeler J S, Culkin D J, Walter J S, Flanigan R C. Female urinary retention. *Urology* 1990; 35:428-32.
- Mustonen S, Ala-Houhala I, Tammela T L. Proteinuria and renal function during and after acute urinary retention. *J Urol* 1999; 161:1781-4.
- Reichard P, Nilsson B Y, Rosenquist U. The effect of long term intensified insulin treatment on the development of microvascular complications of diabetes mellitus. *N Engl J Med* 1993; 329:304-9.
- Sahadevan S, Lim P P, Tan N J, Chan S P. Diagnostic performance of two mental status tests in the older Chinese: influence of education and age on cut-off values. *Int J Geriatr Psychiatry* 2000; 15:234-41.
- Madersbacher S, Pycha A, Schatzl G, Mian C, Klinger C H, Marberger M. The aging lower urinary tract: a comparative urodynamic study of men and women. *Urology* 1998; 51:206-12.
- Diokno A C, Brock B M, Brown M B, Herzog A R. Prevalence on urinary incontinence and other urological symptoms in the non-institutionalised elderly. *J Urol* 1986; 136:1022-5.
- Bonde H V, Sejr T, Erdmann L, Meyhoff H H, Lendorf A, Rosenkilde P, et al. Residual urine in 75-year-old men and women. A normative population study. *Scand J Urol Nephrol* 1996; 30:89-91.
- Emmett J L, Hutchins S P, McDonald J R. The treatment of urinary retention in women by transurethral resection. *J Urol* 1950; 63:1031-42.
- Axelrod S L, Blaivis J G. Bladder neck obstruction in women. *J Urol* 1987; 137:497-9.
- Smith M K, Albazzaz M K. A prospective study of urinary retention and risk of death after proximal femoral fracture. *Age Ageing* 1996; 25:150-4.
- Poulsen A L, Schou J, Puggaard L, Torp-Pedersen S, Nordling J. Prostatic enlargement, symptomatology and pressure/flow evaluation: interrelations in patients with symptomatic BPH. *Scand J Urol Nephrol Suppl* 1994; 157:67-73.
- Reynard J M, Yang Q, Donovan J L, Peters T J, Schafer W, de la Roette J J, et al. The ICS-'BPH' Study: uroflometry, lower urinary tract symptoms and bladder outlet obstruction. *Br J Urol* 1998; 82:619-23.
- Groutz A, Gordon D, Lessing J B, Wolman I, Jaffa A, David M P. Prevalence and characteristics of voiding difficulties in women: are subjective symptoms substantiated by objective urodynamic data? *Urology* 1999; 54:268-72.
- Ding Y Y, Lieu P K, Choo P. Is the bladder "an unreliable witness" in elderly males with persistent lower urinary tract symptoms? *Geriatr Nephrol Urol* 1997; 7:17-21.
- Williams M P, Wallhagen M, Dowling G. Urinary retention in hospitalised elderly women. *J Gerontol Nurs* 1993; 19:7-14.
- Collas D M, Malone-Lee J G. Age associated changes in detrusor sensory function in women with lower urinary tract symptoms. *Int Urogynecol J Pelvis Floor Dysfunct* 1996; 7:24-9.
- Nygaard I E. Post-void residual volume cannot be accurately estimated by bimanual examination. *Int Urogynecol J Pelvis Floor Dysfunct* 1996; 7:74-6.
- Reisman E M, Preminger G M. Bladder perforation secondary to clean intermittent catheterisation. *J Urol* 1989; 142:1316-7.
- Fuse H, Yokoyama T, Muraishi Y, Katayama T. Measurement of residual urine volume using a portable ultrasound instrument. *Int Urol Nephrol* 1996; 28:633-7.
- Bent A E, Nahhas D E, McLennan M T. Portable ultrasound determination of urinary residual volume. *Int Urogynecol J Pelvic Floor Dysfunct* 1997; 8:200-2.
- Coombes G M, Millard R J. The accuracy of portable ultrasound scanning in the measurement of residual urine volume. *J Urol* 1994; 152:2083-5.
- Ding Y Y, Sahadevan S, Pang W S, Choo P W. Clinical utility of a portable ultrasound scanner in the measurement of residual urine volume. *Singapore Med J* 1996; 37:365-8.
- Fantl J A, Newman D K, Colling J, DeLancey J O L, Keays C, Loughery R, et al. Urinary incontinence in adults: acute and chronic management. Clinical Practice Guideline, No. 2, 1996 Update. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, Agency for Health Care Policy and Research; 1996 Mar. AHCPR Publication No. 96-0682.
- Dohil R, Roberts E, Jones K V, Jenkins H R. Constipation and reversible urinary tract abnormalities. *Arch Dis Child* 1994; 70:56-7.
- Arena M G, Di Rosa A E, Arcudi L, Ruella C, Magaudo A, Meduri M. Voiding disorders in patients with cerebrovascular disease. *Funct Neurol* 1992; 7:47-9.
- Burney T L, Senapati M, Desai S, Choudhary S T, Badlani G H. Effects of cerebrovascular accidents on micturition. *Urol Clin North Am* 1996; 23:483-90.
- Sakahibara R, Hattori T, Yasuda K, Yamanishi T. Micturition disturbance in acute disseminated encephalomyelitis. *J Auton Nerv Syst* 1996; 60:200-5.
- Lang E W, Chestnut R M, Hennerici M. Urinary retention and space occupying lesions of the frontal cortex. *Eur Neurol* 1996; 36:43-7.
- Neumann C, Schmid H. Relationship between the degree of cardiovascular autonomic dysfunction and symptoms of neuropathy and other complications of diabetes mellitus. *Braz J Med Biol Res* 1995; 28:751-7.