Published in final edited form as:

BJU Int. 2011 November ; 108(9): 1452–1458. doi:10.1111/j.1464-410X.2010.10014.x.

Prevalence of post-micturition symptoms in association with lower urinary tract symptoms and health-related quality of life in men and women

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Abstract

- To estimate the prevalence of post-micturition symptoms (a feeling of incomplete emptying following urination and post-micturition dribble) in a population-based sample of men and women, and to examine overlap with storage and voiding LUTS and associations with health-related quality of life (HRQL).
- Data were obtained by in-person interview in the Boston Area Community Health survey, a population-based random sample of 2301 men and 3202 women aged 30–79 years in the USA.
- Lower urinary tract symptoms (LUTS) were defined using the International Prostate Symptom Score and standardized terminology.
- Multivariate linear regression was used to evaluate associations between urological symptoms and validated HRQL measures (SF-12 and activities interference) cross-sectionally.
- The overall prevalence of post-micturition symptoms was 11.8% in men and 8.5% in women.
- The prevalence increased with age in men but not women.
- In men, post-void dribbling contributed to much of the post-micturition symptoms, whereas, in women, incomplete emptying was more common.
- For both genders, over 50% with voiding symptoms also had post-micturition symptoms, compared to less than 50% of respondents who reported storage symptoms.
- The presence of post-micturition symptoms, particularly incomplete emptying, was indicative of mildly impaired physical HRQL and activities interference in men and women, and mental HRQL in men ($P < 0.01$).
- Post-micturition symptoms were more prevalent than any individual voiding symptom and commonly overlapped with other LUTS.
- Over half of men and women with a voiding symptom also had a post-micturition symptom.
- The presence of post-micturition symptoms was indicative of impaired HRQL.

Keywords

urological diseases; urination disorders; urinary incontinence; urinary retention; prevalence; post-micturition symptoms; health-related quality of life

Introduction

Population-based studies have shown that LUTS are highly prevalent in both men and women and are associated with considerable personal and societal burden [1–4]. LUTS have conventionally been classified into storage, voiding and post-micturition symptoms [5]. However, a new terminology for standardization of reporting pelvic floor dysfunctions in women grouped post-micturition symptoms with voiding symptoms, without providing specific justification [6]. Overall, urological research to date has focused on voiding (e.g. hesitancy, straining) or storage (e.g. urinary incontinence, frequency, urgency) symptoms, whereas post-micturition symptoms (a feeling of incomplete emptying following urination and/or post-micturition dribble) have received relatively little attention, despite their potential burden on daily health-related quality of life (HRQL).

Possibly contributing to this discrepancy is that post-micturition symptoms, on their own, may be less common than voiding or storage symptoms, as was observed in two large population-based urological studies, EPIC and EpiLUTS [2,7]. Indeed, few people in the EpiLUTS study (3.0% of men and 0.9% of women) reported post-micturition symptoms in isolation from other LUTS. However, post-micturition symptoms were frequently reported to occur alongside other storage and voiding symptoms [2]. Despite their relatively low personal impact when occurring in isolation, the additional burden of post-micturition symptoms in the presence of storage and voiding symptoms substantially diminished both physical and mental HRQL and personal bother, relative to having storage and voiding symptoms without post-micturition problems [2,8]. In addition, an apparent gender difference in the extent of overlap between symptom groups as well as bother suggests that the underlying pathophysiology differs by gender, despite similar prevalence proportions. Whether post-micturition symptoms should be grouped with voiding symptoms in men, as was recently recommended for women, remains unclear. More detail on gender differences in the overlap between post-micturition and individual storage and voiding symptoms would help increase our understanding of the mechanisms and clinical relevance of post-micturition symptoms.

To help improve clinical and epidemiological understanding of symptom profiles given the ICS/International Urogynecological Association classifications [5,6], the present study aimed to: (i) estimate the prevalence of post-micturition symptoms in a racially and ethnically diverse population-based sample of men and women; (ii) examine overlap between post-micturition symptoms and other individual voiding and storage LUTS by gender; and (iii) evaluate the association between post-micturition symptoms and HRQL, with consideration of other co-occurring LUTS.

Patients and methods

Study population: the Boston Area Community Health (BACH) survey

BACH is a population-based, random sample epidemiological survey of urological symptoms and risk factors. From 2002–2005, BACH used a multistage stratified random sample to recruit 2301 men and 3202 women aged 30–79 years of three race/ethnic groups from Boston (MA, USA). Data were obtained during a 2-h, in-person home interview by a trained phlebotomist-interviewer. Participants provided their written informed consent. The

study was approved by the New England Research Institutes' Institutional Review Board. Details on the methods used by BACH are available elsewhere [9–11].

Assessment of post-micturition symptoms and other LUTS

Methods and definitions of LUTS conform to the standards recommended by the ICS [5], with additional consideration of the frequency of symptom occurrence. Post-micturition symptoms were assessed by two questions:

‘During the last month, how often have you had a sensation of not emptying your bladder completely after you have finished urination?’ (incomplete emptying);

‘During the last month, how often have you experienced dribbling after urination?’ (post-micturition dribble).

Those reporting a frequency of fairly often or more for either question were considered to have post-micturition symptoms, allowing an analysis of clinically relevant moderate-to-severe symptoms. Storage and voiding LUTS were assessed in a similar manner, using questions from the validated IPSS [12] (for frequency, urgency, nocturia, weak stream, intermittency and straining to begin urination), the validated Sandvik incontinence severity scale to assess weekly leakage [13] and a question on hesitancy (‘difficulty starting to urinate’). Nocturia was defined as getting up to urinate more than once nightly to allow analysis of moderate-to-severe symptoms.

Assessment of HRQL

HRQL was assessed using the Medical Outcomes Study 12-item Short Form Survey (SF-12) [14]. The SF-12 obtains both a physical component and a mental health component score, each standardized (mean $\pm$ SD) to 50 ± 10 . Activities interference as a result of LUTS was measured by a validated quality of life scale, which obtains a score by summing the scores from seven questions, with each question score ranging from 0 (none of the time) to 4 (all of the time), on the interference of urinary symptoms with various activities (e.g. driving long distances, getting enough sleep at night, going out to places, etc.) [15].

Statistical analysis

Prevalence of post-micturition symptoms was estimated by gender and age group. The impact of post-micturition symptoms was assessed by comparing the means of the SF-12 and activities interference scores from multivariate models that included relevant sociodemographic, lifestyle and health characteristics (selected from those listed in Table 1). Variables were included in the multivariate models if they remained statistically significant at the $\alpha = 0.15$ level (Fig. 3) to maintain parsimonious models.

The sampling design of BACH requires weighting observations inversely proportional to their probability of selection so that the results are generalizable to the Boston population. Multiple imputation methods were used to impute values for variables with missing values [16]. All statistical tests were two-sided, performed at $\alpha = 0.05$, and conducted in SUDAAN, version 10.0 (Research Triangle Park, NC, USA).

Results

The overall prevalence of post-micturition symptoms was 10%, with 11.8% of men and 8.5% of women reporting a feeling of incomplete emptying or post-micturition dribble. Figure 1 displays the prevalence by gender and age groups. In men, the prevalence dramatically increased after the age of 50 years, rising to 22% for the oldest men. In women, the prevalence increased at the age of 40 years, but then remained level at $\approx 10\%$ for older

ages. Age trends in the prevalence of individual symptoms of incomplete emptying or post-void dribbling followed parallel trajectories as the prevalence of total post-micturition symptoms. Incomplete emptying was reported by similar percentages of all men and women (5.5% and 5.7%, respectively), whereas men more frequently reported post-micturition dribble (8.7% vs 4.6%).

Only one-fifth of men (21.0%) and women (19.7%) who were classified as having post-micturition symptoms reported both incomplete emptying and post-void dribbling. Among men, over half (53.4%) of the post-micturition symptomatic cases were the result of reports of only post-void dribble alone, and 25.6% were the result of only incomplete emptying alone. By contrast, among women with post-micturition symptoms, incomplete emptying alone (46.7%) was more commonly reported than was post-void dribble alone (33.6%).

Post-micturition symptoms without any other individual voiding or storage symptoms were uncommon in men ($n = 39$; 4.5%) and women ($n = 29$; 1.5%). Gender differences were apparent, however, in that 24.8% of men with post-micturition symptoms had no other LUTS compared to 9.8% of women (chi-squared: $P = 0.03$). Figure 2 depicts the overlap between post-micturition symptoms and other individual LUTS. Figure 2a is limited to men and women with post-micturition symptoms, aiming to examine which other urinary symptoms frequently presented alongside post-micturition symptoms. The results suggest that there are gender differences in the extent of overlap with storage symptoms; women with post-micturition symptoms more often had co-occurring storage symptoms than did men, whereas the prevalence of voiding symptoms was similar among men and women with post-micturition symptoms. Figure 2b shows the prevalence of post-micturition symptoms among men and women with other specified LUTS. The extent of co-occurring post-micturition symptoms was slightly greater among men but, overall, there was a similar pattern of overlap for men and women. Over half of those with voiding symptoms also had post-micturition symptoms, whereas less than half of those with storage symptoms also had post-micturition symptoms.

Table 1 compares men and women with and without post-micturition symptoms with respect to sociodemographic and health characteristics. Men with post-micturition symptoms were more likely to be white than black, whereas race/ethnicity was not associated with post-micturition symptoms in women but lower socioeconomic status was. For both genders, those with post-micturition symptoms were more likely to report other medical conditions, particularly cardiac disease, and have depression symptoms. In multivariate models that adjusted for associated sociodemographic and medical conditions, the results showed that men and women with post-micturition symptoms had a statistically significant lower HRQL. On average, men with post-micturition symptoms had SF-12 scores 4.7 points lower for mental health ($P < 0.001$), and 3.4 points lower for physical health ($P = 0.003$), compared to men without these symptoms. Among women with post-micturition symptoms, on average, multivariate-adjusted SF-12 scores were 2.5 points lower for mental health ($P = 0.009$), and 3.6 points lower for physical health ($P < 0.001$), compared to women without these symptoms. Despite statistical significance, these SF-12 differences may be of small magnitude regarding clinical significance, particularly those observed in women. However, post-micturition symptoms were also associated with scores on the activities interference scale ($P < 0.001$), and more so for women ($\beta = 6.87$; SE 0.65) than for men ($\beta = 2.07$; SE 0.49), indicating greater levels of personal daily bother for women with post-micturition symptoms at all ages.

To compare the impact on HRQL from the presence of post-micturition symptoms with the presence of other LUTS, Fig. 3 displays the multivariate adjusted mean physical and mental health SF-12 scores for individual post-micturition, storage and voiding symptoms (not

accounting for co-occurring LUTS). The relative level of impairment associated with each urinary symptom is apparent and strong particularly for incomplete emptying, although CIs frequently overlap across symptoms.

To explore the possibility that another co-occurring urinary symptom better accounted for the association between the presence of post-micturition symptoms and impaired HRQL, the presence of other storage and voiding symptoms was then entered into the previously described multivariate models. Post-micturition symptoms remained a statistically significant predictor of mildly impaired HRQL after individually adjusting for other symptoms, with one exception: the association with mental health in women lost statistical significance. In models that included all individual LUTS simultaneously, the results showed that both incomplete emptying and post-micturition dribble retained statistically significant impacts on worsening daily activities interference in women. Furthermore, the symptom of incomplete emptying remained a statistically significant predictor of physical health in men ($\beta = -5.14$; 95% CI, -9.15 to -1.13 ; $P = 0.01$) and women ($\beta = -2.77$; 95% CI, -4.93 to -0.61 ; $P = 0.01$) and mental health in men ($\beta = -3.75$; 95% CI, -6.35 to -1.15 ; $P = 0.005$).

Discussion

In recent years, the BACH survey has greatly increased our understanding of LUTS using its racially and ethnically diverse population-based random sample. The present analysis is the study's first detailed examination of post-micturition symptoms as was recommended in the 2002 ICS classification of LUTS [5]. Overall, approximately one in ten participants reported either a feeling of incomplete emptying and/or post-micturition dribble at least fairly often in the past month. This prevalence was greater than that of any individual voiding symptom and approximately equal to that of urgency in men and urinary incontinence in women. However, post-micturition symptoms infrequently occurred in isolation, particularly for women. Women with post-micturition symptoms more frequently had co-occurring storage (vs voiding) symptoms, most likely because there is a higher background prevalence of storage symptoms in the general population. Among men and women with voiding symptoms, over half also had post-micturition symptoms. The presence of post-micturition symptoms was indicative of mildly impaired quality of life in both men and women.

The finding of the present study that 11.8% of men and 8.5% of women have post-micturition symptoms is lower than that reported in two previous population-based surveys. The EPIC study found that 16.9% of men and 14.2% of women had post-micturition symptoms [7], whereas the EpiLUTS study indicated upwards of 39.7% of men and 32.5% of women were symptomatic [2]. A likely explanation for the greater prevalence in the EpiLUTS study is that participants were defined symptomatic if they reported having symptoms at least 'sometimes', whereas the present analysis included at least 'fairly often', with the aim of investigating a more clinically relevant problem. Another difference is that the protocol in the present study used face-to-face interviews, which may increase the validity of responses, compared to the computer-assisted surveys used in previous studies.

Given these fundamental methodological differences, the results obtained in the present study are still consistent with the EPIC study in that a positive trend was observed between prevalence of post-micturition symptoms and increasing age in men but not in women [7]. This gender discrepancy is also in accordance with a previously reported gender difference in general voiding and storage LUTS, which remained stable after the age of 50 years in women but continued to increase in men [1].

The finding that post-micturition symptoms were more consistently present in cases of voiding rather than storage symptoms provides some support for the new International Urogynecological Association/ICS classification of female pelvic floor disorders, which groups post-micturition together with voiding symptoms [6]. Clinical implications of the findings of the present study emphasize the need to routinely assess for post-micturition problems in patients complaining of voiding symptoms, keeping in mind that patients who report a feeling of incomplete emptying may be among those most bothered by their urinary problems. A limitation of our population-based epidemiological study was the lack of objectively measured urodynamic data to confirm symptom occurrence (particularly a feeling of incomplete emptying in women, which has been unassociated with post-void residual volume in clinical urodynamic studies) [17–19].

Incomplete emptying was among the most strongly associated with diminished physical and mental health in both men and women among all LUTS. On the basis of the standard usage of the SF-12, the observed degree of impairment suggested mild clinical importance [20]. It is important to note, however, that impairment in HRQL may be more clinically substantial for men and women with multiple co-occurring LUTS, as has been observed in previous publications from BACH and EpiLUTS [8,21]. In additional analyses (not shown), we found that, compared to men and women with storage and voiding symptoms but no post-micturition symptoms, respondents with all three symptoms subgroups (storage, voiding and post-micturition) had statistically and clinically significant decreases in physical and mental HRQL (e.g. additional burden of post-micturition symptoms on physical health score in men, $\beta = -5.10$; SE 1.79; $P = 0.005$). Thus, our analysis of symptoms occurring at least 'fairly often' corroborates findings from the EpiLUTS analysis of symptoms occurring at least 'sometimes' [8,21]. A limitation of the HRQL analyses in the present study is that the overlapping urinary symptoms impair the ability to determine whether associations were a result of post-micturition symptoms, a combination of post-micturition and other symptoms, or some other unknown underlying pathology.

In summary, the present population-based survey, post-micturition symptoms were present in $\approx 10\%$ of the population, with a dramatic increase in prevalence with age in men but not in women. Symptoms were the result of post-micturition dribble more often in men compared to women. For both genders, post-micturition symptoms infrequently occurred alone. Those with post-micturition symptoms were likely to have co-occurring storage symptoms, particularly those that are highly prevalent in the population. However, a higher proportion of people with voiding (vs storage) symptoms consistently had co-occurring post-micturition symptoms. Thus, the data obtained in the present study provide support for new classifications that group voiding and post-micturition symptoms in women [6]. The extent of symptom overlap may confound efforts to pinpoint specific pathophysiological mechanisms behind individual post-micturition symptoms. It is possible that clusters of symptoms are a more appropriate focus for research and clinical practice [9,22,23]. Nonetheless, the presence of post-micturition symptoms was indicative of mildly impaired physical HRQL and activities interference in both men and women and diminished mental health in men.

Acknowledgments

This work was supported by the National Institute of Diabetes and Digestive and Kidney Diseases (R21DK081844 and U01DK056842). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Diabetes and Digestive and Kidney Diseases or the National Institutes of Health.

Abbreviations

BACH	Boston Area Community Health survey
HRQL	health-related quality of life

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Fig. 1.

Prevalence of post-micturition symptoms, by gender and age group, in the Boston Area Community Health Survey, 2002–2005. Post-micturition symptoms were: (i) a feeling of incomplete emptying after having finished urination and/or (ii) dribbling after urination, occurring fairly often, usually or almost always during the last month. The overall prevalence of post-micturition symptoms was 11.8% among men, 8.5% among women and 10.0% across both genders.

Fig. 2.

Overlap in post-micturition symptoms and other individual LUTS. (a) Showing, among men and women with post-micturition symptoms, the percentage with the specified co-occurring storage or voiding symptom. The percentage of those with post-micturition but no other co-occurring LUTS was 24.8% of men and 9.8% of women (gender: $P = 0.03$). (b) Showing, among men and women with the specified storage or voiding symptom, the percentage with cooccurring post-micturition symptoms.

Fig. 3.

Physical and mental health component scores for post-micturition (PM) and other lower urinary tract symptoms in men (a) and women (b). Adjusted mean Medical Outcomes Study 12-item Short Form Survey (SF-12) standardized scores. The SF-12 obtains both a physical component and a mental health component score, each standardized to have a mean of 50 points and a standard deviation of 10 points in the general population. The multivariate models included age, race/ethnicity, socioeconomic status, waist circumference, alcohol, cigarette smoking, physical activity, diabetes, diuretic use, cardiac disease, cancer, diabetes, arthritis or rheumatism, use of diuretics, α -blockers and 5- α -reductase inhibitors, antispasmodics or anticholinergics and, in women, menopausal/hormone use status.

Table 1

Weighted characteristics, overall and by post-micturition symptoms status in the Boston Area Community Health survey, 2002–2005[†]

	No/minimal post-micturition symptoms (<i>n</i> = 4916) (2053 men, 2863 women)	Post-micturition symptoms (<i>n</i> = 587) (248 men, 339 women)
Men		
Age (years), mean (SE)**	47.1 (0.4)	51.7 (1.6)
Race (%)*		
Black	26.3	16.0
Hispanic	13.3	11.0
White	60.5	73.1
Socioeconomic status (%) [‡]		
Lower class	24.7	21.3
Middle class	47.8	58.8
Upper class	27.5	20.0
Cigarette smoker (%)		
Never	38.8	39.5
Former	29.2	26.5
Current	32.0	34.0
Alcohol intake (g/day), mean (SE)	15.2 (1.1)	16.5 (3.3)
BMI, mean (SE)***	28.5 (0.1)	29.4 (1.5)
Waist circumference (cm), mean (SE)***	97.4 (0.5)	101.8 (4.1)
Physical activity (%) [§]		
Low	26.3	30.4
Medium	46.9	51.0
High	26.8	18.6
Diabetes (%)	9.0	11.5
Cardiac disease (%)*	9.2	17.0
History of cancer (%)*	6.2	11.0
Arthritis or rheumatism (%)	16.4	23.7
Depression symptoms (%) ^{¶***}	11.9	29.8
Diuretic use (%)	7.6	11.2
α-Blocker or 5-α reductase inhibitor use (%)	3.3	5.2
Antispasmodic or anticholinergic use (%)	0.5	0.9
Women		
Age (years), mean (SE)**	48.9 (0.5)	52.0 (1.1)
Race (%)		
Black	29.6	33.0
Hispanic	13.1	15.2
White	57.2	51.8
Socioeconomic status (%) ^{‡***}		

	No/minimal post-micturition symptoms (<i>n</i> = 4916) (2053 men, 2863 women)	Post-micturition symptoms (<i>n</i> = 587) (248 men, 339 women)
Lower class	28.9	52.2
Middle class	45.9	37.9
Upper class	25.2	9.8
Cigarette smoker (%)		
Never	50.3	45.2
Former	27.2	26.1
Current	22.6	28.7
Alcohol intake (g/day), mean (SE)	5.6 (0.4)	7.7 (4.2)
BMI, mean (SE) ***	29.0 (0.3)	32.8 (0.6)
Waist circumference (cm), mean (SE) ***	89.6 (0.6)	98.2 (1.3)
Physical activity (%) [§] ***		
Low	26.4	43.2
Medium	53.9	50.5
High	19.7	6.3
Diabetes (%) *	9.0	15.6
Cardiac disease (%) ***	7.0	17.1
History of cancer (%)	8.8	10.8
Arthritis or rheumatism (%) ***	27.3	47.0
Depression symptoms (%) [¶] ***	18.5	37.7
Diuretic use (%) *	13.2	20.2
Antispasmodic or anticholinergic use (%) ***	1.1	8.7
Menopausal status **		
Premenopausal	24.9	14.4
Perimenopausal	21.5	23.6
Postmenopausal	21.6	24.6
Surgically postmenopausal	14.9	24.9
Hormone use	14.4	8.0
Undetermined	2.8	4.6
Vaginal child delivery ever (%)	61.3	67.8

BMI, body mass index (kg/m²).

[†]Post-micturition symptoms include a feeling of incomplete emptying after having finished urination and/or dribbling after urination, occurring fairly often, usually, or almost always during the last month [5].

[‡]Socioeconomic status was determined by a combination of education and income [24].

[§]Physical activity was assessed using the Physical Activity Scale for the Elderly, divided into low (score < 100), medium (100–250) and high (> 250) physical activity [25].

[¶]Depression symptoms were assessed using the abbreviated eight question Center for Epidemiologic Studies Depression scale [26].

* $P < 0.05$

** $P < 0.01$

 $P < 0.001$.