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Childhood Urinary Symptoms Predict Adult Overactive Bladder Symptoms

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Abstract

Purpose—A relationship between childhood urinary symptoms and adult lower urinary tract symptoms in women is often clinically suspected. In this analysis we investigated the relationship between childhood and adult urinary symptoms in middle-aged women.

Materials and Methods—A population based cohort of 2,109 women 40 to 69 years old who were members of a large health maintenance organization was randomly selected from age and race strata. Through self-reported questionnaires, women recalled a childhood history of and current urinary lower urinary tract symptoms, including frequent daytime urination, nocturia, urinary incontinence, nocturnal enuresis and UTIs. Current incontinence was also classified as urge or stress incontinence. Multivariate analysis was used to evaluate the association between childhood and current lower urinary tract symptoms controlling for age, race, hysterectomy status, parity, oral estrogen use, body mass index and diabetes.

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Results—Women who reported childhood daytime frequency were more likely to report adult urgency (OR 1.9, 95% CI 1.3-2.6, $p < 0.001$). Frequent nocturia in childhood was strongly associated with adult nocturia (OR 2.3, 95% CI 1.5-3.5, $p < 0.001$). Childhood daytime incontinence was associated with adult urge incontinence (OR 2.6, 95% CI 1.1-5.9, $p < 0.05$), as was childhood nocturnal enuresis (OR 2.7, CI 1.3-5.5, $p < 0.01$). A history of more than 1 childhood UTI was associated with adult UTIs (OR 2.6, 95% CI 1.5-4.5, $p < 0.001$).

Conclusions—Childhood urinary symptoms and UTIs were significantly associated with adult overactive bladder symptoms. There is a need to investigate the significance of childhood symptoms as predictors of eventual adult disorders to determine whether treatment of childhood symptoms will alter the prevalence of eventual adult disorders, and if such a history should alter clinical care of the older adult with OAB symptoms.

Keywords

urinary incontinence; urinary tract; urination disorders; enuresis

Prior studies have identified an association between childhood urinary tract disorders and subsequent adult lower urinary tract symptoms in women. In particular, childhood nocturnal enuresis has been commonly reported by women with detrusor instability,¹ and associated with later adult urinary symptoms of urinary frequency, nocturia and urge incontinence.²⁻⁴ Prior studies have also demonstrated an increased risk of incontinence in family members of women with incontinence, suggesting a possible genetic basis for adult lower urinary tract symptoms.⁵⁻⁸ While a history of recurrent UTIs is well established as a risk factor for future health problems including hypertension, impaired renal function and renal related pregnancy complications,⁹⁻¹¹ to our knowledge no study has previously explored a link between childhood UTIs and adult urinary symptoms.

Establishing an association between childhood urinary symptoms and adult symptoms could help elucidate the etiology of adult urinary symptoms. It is possible that some individuals genetically predisposed to the development of urinary symptoms later in life may manifest urinary symptoms in childhood. Identification of such individuals may provide clinicians with opportunities for primary and secondary prevention of adult lower urinary tract symptoms. Our objective in the current analysis was to investigate childhood urinary symptoms of frequent daytime voids, nocturia, nocturnal enuresis, incontinence and UTIs as risk factors for adult urinary lower urinary tract symptoms in a population based sample of middle-aged American women.

MATERIALS AND METHODS

The RRISK enrolled women randomly selected from age and race strata, who had been members of KPMCP of Northern California, an integrated health care delivery system with more than 3 million members or about 25% of the population in the area served. Previous studies have shown that members of KPMCP are generally representative of the underlying geographic population served.¹² To be eligible for enrollment, women had to be between 40 and 69 years old, to have been members of Kaiser since age 18 and to have had at least half of their births within the Kaiser health care system. Women were randomly sampled within age and race strata with a goal of obtaining approximately equal numbers of women in each 5-year age group with a race/ethnicity composition of 20% black, 20% Latina, 20% Asian and 40% white. Details on the sampling process used to construct this cohort are described elsewhere.¹³ Approximately 65% of eligible women were enrolled. Enrolled women were more likely to be white and to be incontinent compared to nonenrolled women, but were similar with respect to age, parity and length of membership in KPMCP. This study was approved by the

Institutional Review Boards of University of California, San Francisco and Kaiser Foundation Research Institute.

Data were collected by self-reported questionnaire and in-person interview. During the interview the interviewer reviewed the woman's answers on the self-reported questionnaire for completeness and internal consistency, and administered additional study instruments including questions about current urinary incontinence, hormone use and reproductive history.

Women were asked to recall the time between first grade and high school. Reflecting on that period, they were asked to remember how often (never, seldom, sometimes or often) each of several events occurred, namely frequent urination during the day, accidental leakage of urine during the day, frequent urination after going to bed, accidental leakage of urine in bed, and more than 1 bladder or kidney infection a year. Participants were defined as having the childhood urinary symptom if they answered "sometimes" or "often" to the questionnaire item.

Women also reported current symptoms of incontinence and urinary urgency, frequency of daytime and nighttime voids, and number of UTIs in the last year. Women were classified as having current urinary incontinence if they answered "monthly," "weekly" or "daily" to the question "During the past 12 months, on average, how often have you leaked urine, even a small amount?" Incontinence type was ascertained using previously validated questions similar to those used in other large observational studies.¹⁴⁻¹⁶ Women with at least weekly incontinence were asked to recall the number of incontinence episodes in the last 7 days that occurred "with an activity like coughing, lifting, sneezing or exercise" (stress incontinence), and the number of episodes accompanied by a physical sense of urgency (urge incontinence). Incontinence not associated with either an activity or sense of urgency was characterized as other incontinence. Women were classified as having stress incontinence if they reported only stress incontinence or mixed incontinence with the majority of episodes being stress in the last 7 days, and as having urge incontinence if they reported only urge incontinence or mixed incontinence with the majority of the episodes being urge related. Women with only other incontinence (34) were excluded from analyses by incontinence type.

Current frequency of daytime voids and nocturia were elicited by response to the 2 questions, "During the past 7 days, on average, how many times did you go to the bathroom to urinate (empty your bladder, pass water, 'pee')?" during the day, and a separate question "during the night (after going to bed)". Frequent daytime urination was defined as a daytime frequency of more than 7 voids while nocturia was defined as present when a woman reported more than 1 void per night. Women were defined as experiencing urinary urgency if they answered "monthly" or more often to the question, "During the past 12 months, on average, how often have you felt a strong urge or pressure to urinate, without actually leaking urine?" Participants were defined as experiencing frequent UTIs if they reported being told by a doctor that they had a UTI at least 2 times in the last 12 months. We also obtained demographic characteristics, past medical conditions, prior hysterectomy (yes/no), current hormone use and parity. Body mass index was calculated from weight and height measured at the time of the interview.

Multiple logistic regression was used to evaluate the association between childhood urinary tract symptoms and current urinary symptoms while controlling for potential confounding covariables. Age, race, parity and body mass were included in all multivariate models a priori because of their established association with adult incontinence. Other variables were evaluated as potential confounders in multiple logistic regression analyses if they were associated at $p < 0.20$ with any of the 6 adult urinary symptoms examined. Variables which changed the OR for any association between childhood and adult urinary symptoms by 10% or more were retained in the multivariate models for all associations to simplify presentation of results. Therefore, the final multiple logistic regression model included covariables for age, race,

parity, body mass index at age 25, hysterectomy, oral estrogen use, diabetes, chronic lung disease and stroke. In all risk factor analyses, women with urinary incontinence were compared to continent women, defined as participants who reported never having had incontinence at least once per month for at least 3 months in a row. For simplicity of presentation, all covariables were included in all multivariate models. Results are presented as ORs and 95% CIs. Statistical significance was defined by $p < 0.05$. All analyses were performed using SAS® version 8.02.

RESULTS

The 2,109 female participants were racially diverse (48% white, 18% black, 16% Latina and 16% Asian) with a mean age of 56 ± 9 years. Additional participant characteristics are shown in table 1. The frequency of current and childhood urinary symptoms is detailed in table 2. The most common childhood symptom reported was daytime frequency while the most common current symptom was urgency. Current incontinence at least weekly was reported by 29% of participants and daily incontinence by 12%.

Table 3 presents the association between childhood symptoms and adult lower urinary tract symptoms including daytime frequency, urgency, incontinence and frequent UTIs, adjusted for age, race, parity, body mass index, hysterectomy, diabetes, stroke and chronic lung disease. Strong associations were found between reports of frequent daytime voids in childhood and adult urgency (OR 1.9, 95% CI 1.3-2.7), and between childhood and adult nocturia (OR 2.3, 95% CI 1.5-3.5). Childhood daytime incontinence and nocturnal enuresis were associated with a more than 2-fold increased association with adult urge incontinence (OR 2.6, 95% CI 1.1-5.9 and OR 2.7, 95% CI 1.3-5.5, respectively). Childhood UTI was the only childhood factor strongly associated with adult UTIs (OR 2.6, 95% CI 1.5-4.5). No childhood urinary symptom was significantly associated with stress incontinence, although the association between childhood UTI and adult stress incontinence was of borderline significance.

DISCUSSION

In our population based study of community dwelling women we found that childhood urinary symptoms were independently associated with adult lower urinary tract symptoms. Specifically the adult lower urinary tract symptoms of OAB that include urinary urgency, frequent daytime voids, nocturia and urge incontinence were significantly associated with childhood urinary symptoms.

Prior studies have also demonstrated a strong association of childhood urinary symptoms and adult OAB symptoms. In prospective and retrospective studies childhood nocturnal enuresis has been strongly associated with adult OAB symptoms.²⁻⁴ As in our study no association was found with childhood nocturnal enuresis and adult stress incontinence.

Pathophysiological mechanisms underlying adult overactive bladder symptoms may first manifest in childhood. Detrusor instability and urge incontinence have been attributed to neurological and myogenic causes. Increased neuronal susceptibility, tenuous bladder receptor balance and smooth muscle cell junctional alterations may result in childhood urinary symptoms, and later manifest as OAB symptoms in women.

Prior twin and familial studies support genetic factors as having a significant role in OAB symptoms.^{5,6} Nocturnal enuresis has been extensively studied and twin studies have estimated approximately 70% of the risk for nocturnal enuresis is due to heritable risk factors.^{16,17} In contrast, current evidence does not support a genetic component for stress incontinence, and we did not find a significant association between childhood urinary symptoms and adult stress incontinence.

Additionally, we found childhood UTIs were associated with adult frequent UTIs and urge incontinence. In younger and older women urinary tract infection history is a major risk factor for current infections.¹⁸ In older women prior studies have identified urinary incontinence, specifically urge incontinence and not stress incontinence, as an independent risk factor for UTI.^{18,19} A bidirectional causal relationship has been suggested in that UTIs have been identified as risk factors for urge incontinence.²⁰

Although this study has many strengths including a large population based sample size, use of self-report and in-person interview to maximize the ascertainment of outcomes, and adjustment for multiple confounding risk factors, we cannot exclude the possibility that the presence of current urinary symptoms results in recall bias. However, it is not clear why such a bias, if it existed, would differentially affect only a few of the associations between childhood and adult symptoms. In addition, we asked about childhood urinary symptoms during a single, broad period (first grade to high school) and used a Likert-type response scale (from never to often) because we believed that asking women to recall more precise information such as the presence of symptoms at a specific age or a specific frequency of symptoms would not be realistic. Finally, the study participation rate of approximately 65% may have resulted in a selection bias that could affect the estimated prevalence of childhood urinary symptoms.

CONCLUSIONS

The OAB symptoms so prevalent in American women may become manifest in childhood. Childhood symptoms of daytime urinary frequency, nocturia, urinary incontinence, nocturnal enuresis as well as urinary tract infections are strongly associated with OAB symptoms in middle-aged and older women. This observation raises the possibility of early identification of a population at risk for adult OAB symptoms. If further studies confirm these observations, prevention or early intervention may be possible, reducing the significant burden of adult OAB. Long-term longitudinal studies are too costly to perform for this purpose alone. However, ongoing long-term pediatric studies (such as the proposed National Institutes of Health National Children's Study) may benefit from including a urinary tract focus to further study the relationship between childhood and adult urinary symptoms.

Abbreviations and Acronyms

CI, confidence interval; KPMCP, Kaiser Permanente Medical Care Program; OAB, overactive bladder; OR, odds ratio; RRISK, Reproductive Risks for Incontinence Study at Kaiser; UTI, urinary tract infection.

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Table 1

Characteristics of women in the RRISK cohort

	No. (%)
Age:	
40–49	598 (28)
50–59	796 (38)
60+	713 (34)
Race:	
White	1,003 (48)
Black	383 (18)
Hispanic	350 (17)
Asian	345 (16)
Other	28 (1)
Married/living as married	1,464 (69)
Education:	
High school or less	421 (20)
Some college or technical school	948 (45)
College graduate	473 (22)
Graduate school	265 (13)
Total household income:	
Less than \$40,000	471 (22)
\$40,000 to \$59,999	436 (21)
\$60,000 to \$79,999	411 (20)
\$80,000 to \$99,999	263 (12)
Greater than \$100,000	368 (17)
Occupation:	
Employed outside of home	1,364 (65)
Retired/student/homemaker/other	742 (35)
Parity:	
0	416 (20)
1 or 2	847 (40)
3+	846 (40)
Current estrogen use	642 (30)
Hysterectomy	468 (22)
Diabetes	174 (8)
Chronic lung disease	121 (6)
Body mass index (kg/m ²) at age 25 yrs:	
Less than 25	709 (34)
25–30	656 (31)
Greater than 30	704 (33)

Table 2

Women who reported current and childhood lower urinary tract symptoms

	No. (%)
<i>Current lower urinary tract symptoms</i>	
Frequent daytime voids (more than 7/day)	501 (24)
Nocturia more than once/night	638 (30)
Urgency*	721 (34)
Incontinence at least weekly:	601 (29)
Stress	282 (13)
Urge	206 (10)
Mixed/other	113 (5)
2 or More UTIs in last 12 mos	264 (12)
<i>Childhood urinary symptom</i> [†]	
Frequent daytime voids	299 (14)
Nocturia	220 (10)
Daytime urinary incontinence	103 (5)
Nocturnal enuresis	164 (8)
Frequent UTI (more than 1/yr)	100 (5)

* Urgency defined as present when women reported the presence of a strong urge or pressure to urinate without actually leaking, monthly, weekly or daily.

[†] Childhood symptoms defined as present when women reported that the symptom was present sometimes or often between first grade and high school.

Table 3
Childhood urinary symptoms as risk factors for adult lower urinary tract symptoms

	Adult Urinary Symptoms					More Than 1 UTI in last 12 Mos
	Daytime Void Frequency [†]	Nocturia [‡]	Urgency [§]	Stress UI Weekly or More	Urge UI Weekly or More	
<i>Childhood Urinary Symptoms</i>						
Daytime frequency:						
Adjusted OR ^{//}	1.30	1.36	1.88 ^{//}	0.97	0.76	1.08
95% CI	0.91–1.86	0.96–1.92	1.32–2.69	0.59–1.58	0.41–1.41	0.68–1.71
Nocturia:						
Adjusted OR ^{//}	1.63 [*]	2.27 ^{//}	1.14	1.26	0.69	1.48
95% CI	1.05–2.54	1.47–3.5	0.71–1.83	0.66–2.41	0.19–1.44	0.85–2.57
Daytime UI:						
Adjusted OR ^{//}	0.82	0.50 ^{**}	0.96	1.60	2.56 ^{**}	0.87
95% CI	0.46–1.47	0.27–0.93	0.55–1.68	0.72–5.59	1.11–5.9	0.41–1.85
Nocturnal enuresis:						
Adjusted OR ^{//}	1.09	0.67	0.94	0.57	2.68 ^{††}	0.65
95% CI	0.66–1.79	0.41–1.10	0.58–1.53	0.25–1.34	1.32–5.46	0.33–1.29
UTIs (1 more than yr):						
Adjusted OR ^{//}	1.19	1.59	1.47	2.00 ^{**}	2.03	2.80 ^{//}
95% CI	0.70–2.05	0.95–2.66	0.86–2.52	1.00–3.90	0.93–4.46	1.60–4.90

^{||}Odds ratios with 95% confidence intervals adjusted for age (10-year intervals), race, parity (0, C-section only, 1 vaginal delivery, 2+ vaginal delivery), body mass index at age 25 (less than 25/25–30/greater than 30) kg/m² hysterectomy (yes/no), current oral estrogen use, diabetes, chronic lung disease and prior stroke (yes/no).

^{*} Childhood urinary symptoms defined as present when participant recalled that the symptom was present sometimes or always between first grade and high school.

[†] Daytime frequency defined as present when reported daytime voiding frequency was greater than 7 voids daily.

[‡] Nocturia defined as present when reported nighttime voiding frequency was greater than 1 void nightly.

[§] Strong urgency defined as present when participant reported presence of a strong urge or pressure to urinate without actually leaking, monthly, weekly or daily.

^{||} p < 0.001.

^{**} p < 0.05.

^{††} p < 0.01.