Lower Urinary Tract Symptoms from Childhood to Adulthood: A Population Based Study of 594 Finnish Individuals 4 to 26 Years Old

Kristiina Kyrklund,* Seppo Taskinen, Risto J. Rintala and Mikko P. Pakarinen

From the Department of Pediatric Surgery, University of Helsinki, Hospital for Children and Adolescents, Helsinki, Finland

Abbreviations and Acronyms

NE = nocturnal enuresis

UI = urinary incontinence

UTI = urinary tract infection

Submitted for publication December 1, 2011.

Study received institutional ethics board approval.

Supported by grants from the Finnish Medical Foundation and Foundation for Pediatric Research (Finland).

* Correspondence: Department of Pediatric Surgery, University of Helsinki, Hospital for Children and Adolescents, PL 281, 00029 HUS, Finland (telephone: 358-50-427-0450; FAX: 358-9-4717-6713; e-mail: kristiina.kyrklund@hus.fi).

Purpose: We evaluated voiding habits and lower urinary tract symptoms by age and gender in a large population of individuals from childhood to adulthood.

Materials and Methods: We studied a cross-sectional sample of 594 individuals 4 to 26 years old randomly selected from the population register of Finland. Participants anonymously answered a detailed postal questionnaire on lower urinary tract symptoms. Parents assisted respondents younger than 16 years. Results were analyzed by age group (4 to 7, 8 to 12, 13 to 17 and 18 to 26 years) and gender. A p value of less than 0.05 was considered statistically significant.

Results: The prevalence of urge incontinence significantly decreased with age (45% in respondents 4 to 7 years vs 10% in respondents 13 to 17 years, $p < 0.05$). Urinary tract infections and urge and stress incontinence were more common in females (16% to 32%) than in males (2% to 4%) older than 12 years ($p < 0.05$). The occurrence of some type of minor daytime urinary incontinence was reported by approximately a fourth of the study population, with a significant decline in prevalence between ages 4 to 7 years and 8 to 12 years ($p < 0.05$). Minor urinary incontinence was significantly more common in females older than 12 years. Frequent urinary incontinence affected only 4% of respondents, most of whom were younger than 12 years.

Conclusions: Bladder control and urinary function exhibit considerable variation with age and gender. Due to the imperfections in bladder control in the general population, the evaluation of urinary tract disorders and outcomes of surgery in children and adolescents should be conducted with reference to control data according to age and gender.

Key Words: lower urinary tract symptoms, child, diurnal enuresis, nocturnal enuresis

DESPITE extensive study of urinary incontinence in children, age related normal limits for bladder control in healthy individuals extending from childhood to adulthood have not been defined. Most studies of urinary incontinence have focused on primary school or preadolescent children,[1–9] and there are comparatively few series that include older participants.[10–13] Urinary incontinence is common in childhood but the reported prevalence rates have varied widely between series, reflecting differences in study design, definitions and participant selection. Daytime urinary incontinence is often associated with overactive bladder or voiding postponement, although reported risk factors also include female gender, history of urinary tract infection and constipation.[1,3] We hypothesized that the fine-tuning of urinary continence continues

0022-5347/12/1882-0588/0
THE JOURNAL OF UROLOGY®

http://dx.doi.org/10.1016/j.juro.2012.04.016
Vol. 188, 588-593, August 2012
Printed in U.S.A.

to develop beyond toilet training, and that certain functional symptoms may vary with age and gender. To this end, we performed a cross-sectional population based study of the voiding habits and bladder control of 594 Finnish children and young adults 4 to 26 years old.

METHODS

Sample

After institutional ethics board approval 1,840 individuals 4 to 26 years old were randomly selected from the population register of Finland and invited to answer a detailed postal questionnaire on lower urinary tract symptoms (see Appendix). To achieve an even age and gender distribution, questionnaires were mailed to 80 individuals (40 males and 40 females) of each year of age. Parents assisted children younger than 16 years with responses. Participation was voluntary and anonymous. Results were analyzed according to developmental stage (4 to 7, 8 to 12, 13 to 17 and 18 to 26 years) and gender. Statistical analysis was performed using the chi-square or Mann-Whitney U test, as appropriate. A p value of less than 0.05 was considered statistically significant.

Questionnaires

Participants answered a 9-item lower urinary tract symptoms questionnaire (see Appendix). History of UTI, urinary frequency and urge symptoms were assessed. The questionnaire included 3 items on daytime UI and 1 on bedwetting. For most items responses were given according to the frequency of symptoms (never/seldom/often/always). Items 3 to 7 of the questionnaire were adapted from the Danish Prostatic Symptom Score.[14] Parents of children up to age 12 years were also asked the age at which daytime and nighttime diapers for urine were discontinued.

RESULTS

Participants

A total of 594 individuals (32%) responded. Median age was 15.0 years and 263 (44%) subjects were male. Of the respondents 133 were 4 to 7 years old (median 6.0, 76 males), 159 were 8 to 12 (10.5, 80 males), 124 were 13 to 17 (15.5, 55 males) and 178 were 18 to 26 (22.5, 52 males). There were no significant age or gender differences between respondents and nonrespondents, except in the 18 to 26 age group, where a significantly greater percentage of females responded (71%).

Urinary Tract Infections

Overall 28% of females and 5% of males reported having experienced at least 1 UTI ($p < 0.0001$). In females self-reported rates of UTI steadily increased with age, from 10% in 4 to 7-year-olds to 52% in 18 to 26-year-olds ($p < 0.0001$).

Urinary Frequency

The majority of 4 to 7-year-olds (88%) urinated 4 to 8 times daily. Of 13 to 17-year-olds 67% urinated 4 to 8 times daily and 31% urinated 1 to 3 times daily ($p = 0.002$). Six children 4 to 17 years old (1.4%) urinated more than 8 times daily. Of young adults 72% urinated 4 to 8 times daily and 6% urinated more than 8 times daily ($p = 0.004$ compared to younger age groups). There were no gender differences in responses.

Straining to Initiate/Continue Voiding

Infrequent/seldom straining to void was reported by 13% of respondents 4 to 17 years old (p not significant between age groups) and 44% of young adults ($p < 0.0001$ compared to younger age groups). Only 2% of participants strained often or always in association with voiding (range 0% to 2.8% within age groups, p not significant between age groups). Straining was equally common in both genders apart from 4 to 7-year-olds, where parents reported straining more often in males (26% vs 9% of females, $p = 0.001$).

Urinary Urgency

Infrequent/seldom urinary urgency was reported by 306 respondents (table 1). A total of 23 respondents had urgency more often but no respondent experienced urgency in association with every void. Frequent urgency was more common in the youngest and oldest age groups. Urge symptoms were equally common in both genders.

Urge Incontinence

Urge incontinence decreased significantly with age, as outlined in table 1. Most respondents reported infrequent urge incontinence, and no participant older than 12 years had urge incontinence often or always. Up to age 12 there was no significant difference between males and females (fig. 1). Thereafter, urge incontinence declined significantly in males to 2% to 4% ($p \leq 0.05$ compared to females and younger males) while remaining constant (16% to 17%) in

Table 1. *Urinary urgency and urge incontinence*

	4–7 Yrs	8–12 Yrs	13–17 Yrs	18–26 Yrs	Overall
No. urgency (%):					
Never	56 (42)*	89 (55)	61 (49)	59 (33)†	265 (45)
Seldom	68 (51)	67 (43)	62 (50)	109 (61)	306 (52)
Often	9 (7)‡	3 (2)	1 (0.8)‡	10 (6)	23 (4)
Always	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
No. urge incontinence (%):					
Never	73 (55)‡	127 (80)‡	112 (90)‡	155 (87)	467 (79)
Seldom	55 (41)	30 (18)	12 (10)	23 (13)	120 (20)
Often	5 (4)‡	1 (0.6)	0 (0)	0 (0)‡	6 (1)
Always	0 (0)	1 (0.6)	0 (0)	0 (0)	1 (0.1)

* $p = 0.02$ compared to 8 to 12-year-olds.

† $p \leq 0.007$ compared to 8 to 12-year-olds and 13 to 17-year-olds.

‡ $p < 0.05$ between age groups for symptom frequency.