Journal of Pediatric Urology (2017) 13, 387.e1–387.e6

Obesity and lower urinary tract dysfunction in children and adolescents: Further research into new relationships

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Keywords
Obesity; Constipation; Enuresis; Incontinence; Voiding dysfunction; Lower urinary tract dysfunction

Received 4 January 2017
Accepted 8 March 2017
Available online 2 April 2017

Summary

Introduction
Lower urinary tract dysfunction (LUTD) involves faults in the filling and emptying phases of bladder function in toilet-trained children with no previous infection or any other obvious pathology. Lower urinary tract dysfunction is associated with conditions such as vesicoureteral reflux, recurrent urinary infection, behavioral alterations and decreased quality of life. The literature suggests an association between LUTD and obesity; however, the association between each individual symptom and obesity has yet to be evaluated.

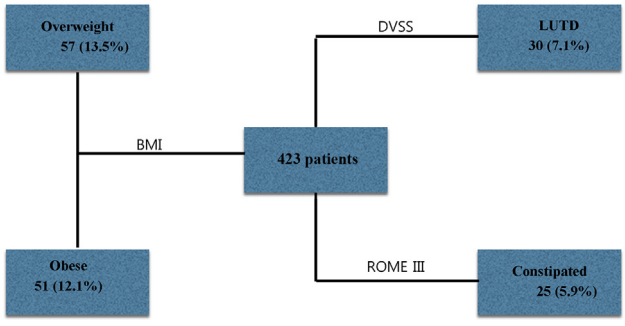
Objective
To evaluate the association between excess weight and LUTD in children and adolescents in a community-based sample.

Study design
This cross-sectional study included 423 children and adolescents aged 5–17 years, and randomly selected in public places and schools between May and July 2015. The participants and their mothers completed the Dysfunctional Voiding Scoring System (DVSS) questionnaire, except for the questions on constipation and with the addition of a question on enuresis. They also completed the Rome III questionnaire, in which two positive responses defined the presence of constipation. Participants were classified as being of normal weight, overweight or obese, which was based on the BMI-for-age indicator.

Results
Mean age was 9.7 years (SD 2.9), with girls comprising 50.6% of the sample and adolescents 52.5%. The prevalence of LUTD was 7.1%, with 13.5% of participants being overweight and 12.1% obese (Figure). Constipation was present in 5.9% of participants and enuresis in 10.8%. In the multivariate analysis, three factors were independently and significantly associated with a positive DVSS: age <10 years ($\beta = 0.76$; 95% CI: 0.34–1.18), constipation ($\beta = 1.79$; 95% CI: 0.88–2.70) and obesity ($\beta = 0.89$; 95% CI: 0.25–1.52).

Discussion
Only bladder filling symptoms were associated with obesity. This may be explained by the fact that both obese individuals and those with emptying symptoms were shown to have activation alterations in the same brain regions. One limitation of this study was the use of questionnaires alone to diagnose LUTD and constipation.

Conclusion
Only the bladder-emptying symptoms of LUTD appear to be associated with obesity. This hypothesis may serve as a basis for future studies.



BMI, body mass index; DVSS, Dysfunctional Voiding Scoring System; LUTD, lower urinary tract dysfunction; ROME III, Rome III questionnaire

Summary Fig Distribution of patients ($n = 423$) according to weight, constipation and lower urinary tract dysfunction (LUTD).

http://dx.doi.org/10.1016/j.jpurol.2017.03.014

Introduction

Lower urinary tract dysfunction (LUTD) is characterized by functional alterations in the bladder filling and/or emptying phases in toilet-trained children with no urinary infection or any other obvious pathology such as neurological or anatomical abnormalities of the urinary tract [1]. This type of dysfunction may result in various urinary symptoms such as urgency, incontinence and changes in urinary frequency, as well as the presence of holding maneuvers, nocturia, hesitancy, straining, or intermittent stream. Lower urinary tract dysfunction is associated with conditions such as VUR, recurrent UTI [2], emotional and behavioral alterations, and poorer quality of life in children [3,4].

Obesity and being overweight in children and adolescents constitute a common and growing problem worldwide, affecting a third of children and young adults in the United States [5]. Excess weight is associated with cardiovascular risk factors such as hypertension, insulin resistance and dyslipidemia, in addition to impaired lung function [6]. It has also been suggested that obese children are more likely to suffer from gastrointestinal problems such as constipation, gastroesophageal reflux disease and fecal incontinence [7—9].

An association has been reported between LUTD and obesity in children [7—11]; however, the studies in question failed to include an evaluation of constipation as a potential confounding factor in the causal model. Given the relationship between obesity and constipation, this variable must be taken into consideration in the analysis. Furthermore, because LUTD encompasses a large spectrum of symptoms that may not share the same pathophysiology, clinical consequences and outcome, any form of association with LUTD should be contextualized for the type of urinary condition that is present. In fact, since LUTD may include abnormalities in the bladder filling and emptying phases, each symptom needs to be evaluated individually. It is believed that no studies have yet been published on the association between urinary symptoms and obesity.

The objective of the present study was to evaluate the effect of obesity on the presence of LUTD in children and adolescents in a community, taking constipation and other potential confounding factors into consideration. Another aim was to identify whether certain specific urinary symptoms are associated with obesity.

Material and methods

A cross-sectional, community-based study was conducted with 423 children and adolescents aged 5—17 years and living in the city of Salvador, Bahia, Brazil. The population of this city is multi-ethnic, with a total of 521,588 inhabitants aged 5—17 years [12]. The study was conducted in public spaces (in city squares and in front of schools) and the interviews were all held between May and July 2015. Potentially eligible children and adolescents were approached by the interviewers and invited to participate in the study. Children and adolescents aged 5—17 years and who agreed to sign an informed consent and/or assent form or whose mothers agreed to their participation were included in the study. Those with any neurological or anatomical pathology of the lower urinary tract diagnosed previously and identified at the interview were excluded from the study. The institution's internal review board approved the study protocol under reference number 41223514.3.0000/5577.

Based on 9.1% prevalence of LUTD in the local population [13], the study sample size was calculated to capture a difference in the prevalence of LUTD of 100% between the groups, with a power of 80% and an alpha error of 5%. The number of participants required was estimated at 458 children or adolescents: 153 with excess weight and 305 with normal weight.

The presence and severity of LUTD were evaluated using a modified version of the Dysfunctional Voiding Scoring System (DVSS) questionnaire, validated for use in Brazilian Portuguese [14]. The questionnaire, which was answered by the participants and their mothers together, contains 10 questions: nine of which are related to clinical symptoms and one to environmental factors (social and family related issues). For questions 1—9, answers were scored according to the presence and severity of symptoms using a Likert-type scale with scores ranging from 0 (complete absence of the symptom) to 3 (of the utmost severity). For question 10, a score of 0 was given if there were no stress-related events and a score of 3 if such events were present. Since questions 3 and 4 of the DVSS deal with the presence of constipation, which was evaluated in the present study using ROME III criteria, it was decided to remove these questions from the DVSS. Each individual urinary symptom was considered to be present when the DVSS score was $\geq$1. The questions taken into consideration were: (1) I have had wet clothes or wet underwear during the day; (2) When I wet myself, my underwear is soaked; (5) I only go to the bathroom one or two times each day; (6) I can hold onto my pee by crossing my legs, squatting or doing the 'pee dance'; (7) When I have to pee, I cannot wait; and (8) I have to push to pee. Two or more positive answers to the questions in the Rome III questionnaire defined the presence of constipation [15].

After completion of the data collection instruments, measurements of weight and height were taken. Body mass index (BMI) was calculated using the Quetelet index: weight in kilograms divided by height in meters squared (kg/m^2). Participants were then classified in accordance with the z-score obtained from the BMI-for-age indicator as: normal weight ($-2 \geq$ z-score <1); overweight ($1 \geq$ z-score <2); or obese (z-score ≥ 2), in accordance with the World Health Organization classification [16]. Prior to weighing the participants, all objects and any excess clothing were removed.

The STATA® statistical software program, version 13.0 (StataCorp, USA) was used for the statistical analysis. Age was described as mean and standard deviation, and the scores obtained from the modified DVSS questionnaire (excluding questions 3 and 4 on constipation) were described as medians with interquartile ranges. Sex, other individual urinary symptoms, anthropometric classification and the presence of constipation were described as relative and absolute frequencies. Bivariate analysis was performed using the Mann—Whitney non-parametric test to evaluate associations between the modified DVSS scores and sex, age group (children aged 5—9 years and adolescents aged