Role of body mass index in school-aged children with lower urinary tract dysfunction: Does weight classification predict treatment outcome?

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Summary

Introduction
Lower urinary tract (LUT) dysfunction comprises a large percentage of pediatric urology referrals. Childhood obesity is a major health concern, and has been associated with voiding symptoms. We assessed the impact of body mass index (BMI) on treatment outcomes of children presenting with LUT or bladder—bowel dysfunction (BBD).

Study design
Children aged 5—17 years diagnosed with non-neurogenic LUT dysfunction and no prior urologic diagnoses were identified. Patient demographics including BMI, lower urinary tract symptoms, constipation, medical and psychologic comorbidities, imaging, and treatment outcomes were evaluated. BMI was normalized by age and gender according to percentiles: underweight < 5th, healthy 5th to <85th, overweight 85th to <95th, and obese > 95th percentile. Uni- and multivariate analyses were performed to identify predictors of treatment response.

Results
During an 18-month period, 100 children (54 girls, 46 boys) met the inclusion criteria. The mean age at diagnosis was 7.7 ± 2.4 years, and mean length of follow-up 15.3 ± 13.1 months. Sixty-nine patients were a normal weight, 22 were overweight, and nine were obese. Fifteen percent of the children had complete treatment response, 63% partial response, and 22% non-response. On univariate analysis, children with elevated BMI ($p = 0.04$) or history of urinary tract infection ($p = 0.01$) were statistically more likely to not respond to treatment. Controlling for all other variables, children with BMI > 85th percentile had 3.1 times (95% CI 1.11—8.64; $p = 0.03$) increased odds of treatment failure (Table).

Discussion
BBD management includes implementation of a bowel program and timed voiding regimen, with additional treatment modalities tailored on the basis of the prevailing symptoms. We observed that school-aged children with a BMI $\geq$ 85th percentile were over three times more likely to experience treatment failure when controlling for all other patient characteristics including constipation and a history of urinary tract infection. Limitations of the study include the relatively small sample size, lack of uroflow with electromyography to confirm the presence or the absence of detrusor sphincter dyssynergia, and inconsistent anticholinergic dosing.

Conclusions
Nearly one-third of school-aged children presenting to our institution with LUT or BBD were overweight or obese when normalized for age and gender. Children with LUT dysfunction and elevated BMI are significantly less likely to experience treatment response.

Table Multivariate analysis. Relationship between specific patient characteristics and treatment outcome using logistic regression.

Variable	Beta (SE)	OR	95% CI for OR	p
Intercept	−4.53 (1.57)	—	—	0.004
Sex	0.52 (0.54)	1.68	0.58—4.85	0.33
Age (years)	0.05 (0.11)	1.05	0.85—1.29	0.66
BMI	1.13 (0.52)	3.09	1.11—8.64	0.03
UTI	1.33 (0.52)	3.78	1.35—10.56	0.01
Medical comorbidities	−0.90 (0.63)	0.41	0.12—1.39	0.15
Psych comorbidities	0.43 (0.56)	1.53	0.51—4.56	0.45

BMI = body mass index; UTI = urinary tract infection.

Introduction

Lower urinary tract (LUT) and voiding dysfunction make up a large percentage of pediatric urology referrals. A wide range of storage and voiding symptoms contribute to numerous elimination disorders. The cornerstone of bladder—bowel dysfunction (BBD) management in children remains implementation of a bowel program and timed voiding regimen, with additional treatment modalities employed depending on the prevailing symptomatology. Despite the generally benign nature of lower urinary tract symptoms, improved self-esteem, socialization, and independence have been observed in children undergoing bladder therapy, emphasizing the importance of treatment [1].

The prevalence of overweight and obese children has risen substantially in recent decades [2,3]. Childhood obesity is accompanied by increased prevalence of secondary obesity-related chronic diseases such as hypertension, dyslipidemia, and insulin resistance, as well as psychosocial consequences. The association between lower urinary tract symptoms (LUTS), particularly nocturnal enuresis, and obesity has been documented [4,5]. Successful management of LUT dysfunction and BBD necessitates a comprehensive treatment strategy that includes screening for and addressing concomitant comorbidities. In the current study, we assessed the impact of body mass index (BMI) on treatment outcomes of children presenting with LUT dysfunction and hypothesized that overweight children with voiding symptoms would be less likely to respond to treatment.

Materials and methods

Institutional review board approval was obtained (University of Iowa Hospitals & Clinics IRB 2014-04766). We reviewed the electronic medical records of 100 children, aged 5—17 years, who were diagnosed with non-neurogenic LUT dysfunction in the pediatric urology clinic during an 18-month period (January 1, 2013, to June 30, 2014). Patients were identified by ICD-9 diagnostic codes. Patient demographics, medical and psychiatric diagnoses, significant symptoms, past medical history, imaging, and treatment and management outcomes were abstracted. Patients were assigned weight status categories according to age and sex, as defined by the Centers for Disease Control and Prevention, based on BMI percentiles, including underweight < 5th, healthy weight 5th to <85th, overweight 85th to <95th, and obese > 95th or greater percentile [6].

Patients underwent a screening renal bladder ultrasound to assess for renal anomalies such as duplex collecting system, upper tract dilation and elevated post-void residual as well as urinalysis and uroflow/bladder volume index when appropriate. Specifically, urinalysis was obtained when symptoms were concerning for urinary tract infection (dysuria, LUT pain, or change in voiding frequency or urgency). Uroflow was obtained when children had a full bladder at the time of initial presentation. Patients were diagnosed and treated by one of four pediatric urologists. Children were managed with education about their condition, a bowel regimen consisting of polyethylene glycol 3350 (MiraLAX; Bayer Pharmaceuticals) or fiber and a minimum of 5—10 min of toilet time to allow for complete rectal evacuation. All patients were also counseled on strict timed voiding every 2 h and dietary modifications. Anticholinergics, pelvic physical therapy, and referral to additional specialists (gastroenterology, psychology) were employed as necessary. Treatment success was defined as per the International Children's Continence Society (ICCS) [7,8]. An 18-item four-point BBD questionnaire (score range 0—72) was completed at initial consultation and each subsequent clinic visit [9]. All items were weighed equally and each question probes a single symptom. The questionnaire was self-administered and completed electronically by patients and/or parents using a tablet. Diagnosis of constipation was made using the Rome III criteria [10], and was based on questionnaire items regarding bowel habits including frequency, consistency, and associated discomfort. The severity of constipation was not determined separately from the severity of LUT dysfunction. Children in whom initial height and/or weight were not obtained and those with known urologic or neurologic diagnoses were excluded from study.

Correlation between patient characteristics, including BMI, and treatment response was determined using ANOVA for continuous variables and the chi-square test (or Kruskal—Wallis when appropriate) for categorical variables. Logistic regression was utilized to calculate the odds ratios and 95% confidence intervals with the outcome being the presence of stable symptoms. Statistical analysis was performed using SAS 9.3 (SAS Institute Inc., Cary, NC, USA) with $p < 0.05$ representing statistical significance.

Results

One hundred and eleven patients met inclusion criteria; however, 11 did not have completed pre- and/or post-treatment questionnaires, resulting in a study cohort of 100 children (54 girls, 46 boys). The mean age at diagnosis was 7.7 ± 2.4 years, and the mean length of follow-up was 15.3 ± 13.1 months (median 13 months, IQR 14 months). At the time of initial presentation, 69 patients had a normal weight, 22 were overweight, and nine were obese. Fourteen children had ultrasound anomalies at presentation including bladder wall thickening (8%), urachal remnant (4%), and renal asymmetry (2%). Seventy-seven patients had uroflowmetry at the time of initial presentation; of those, 14.3% had a plateau voiding curve and 13% had a staccato curve consistent with detrusor sphincter dyssynergia. The remaining 72.7% had a normal parabolic curve. Eight patients had an elevated post-void residual. The majority of patients (84%) had concurrent constipation. Thirty-one children had concomitant medical comorbidities, and 37% had a documented psychiatric comorbidity with 26 children diagnosed with attention-deficit/hyperactivity disorder (ADHD). Other psychiatric diagnoses included oppositional defiant disorder in seven, anxiety in five, autism in four, and conduct disorder in two. Seven children had multiple psychiatric comorbidities. All children were treated with a bladder and bowel regimen including polyethylene glycol 3350 (MiraLax) or fiber, and