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Relationship between body mass index and pediatric urologic diagnoses

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Abstract *Objective:* We had the clinical impression that children with certain urological diagnoses were thinner and others were heavier. We therefore reviewed body mass index (BMI) in children with a variety of urological diagnoses.
Materials and methods: The data from all pediatric patients treated as outpatients in our office between 1 Jan and 30 Sept 2004 were analyzed retrospectively. The patients were counted only once, even if they came back to the office several times. They were grouped by the principal billing diagnosis, but groups of less than nine patients were excluded. BMI percentiles were determined based on data from the Centers for Disease Control and compared to diagnosis codes.
Results: The data from 1054 patients were analyzed: 53% were female, mean age was 8.0 ± 3.7, mean BMI was 18.7 ± 5.1 and mean BMI percentile was $64 \pm 31\%$. BMI varied significantly by diagnosis. Children with hernias and penile problems had the lowest BMI percentile and those with urinary infection and incontinence the highest, e.g. the mean BMI percentile was $46 \pm 31\%$ for children with a hernia but $71 \pm 27\%$ for those patients with nocturnal enuresis.
Conclusions: The rate of obesity varied considerably based on pediatric urological diagnosis. Diet and personality may be part of the etiology for some urological disorders. It is possible that lifestyle changes may benefit urological patients who are obese.

Introduction

Childhood obesity is common in the United States. The Centers for Disease Control (CDC) reports that the prevalence of severe obesity (BMI percentile >95%) has doubled in the last two decades, so that from the latest surveys almost 34% of children are considered overweight [1].

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Although all the consequences of childhood obesity are not known, it has been reported that there are many negative effects [2–5]. Data are limited regarding the consequences of obesity for pediatric urologic diseases in particular. We had the clinical impression that children with urological diagnoses were not homogeneous with respect to their body habitus; for example, children with varicocele tended to be thinner and others, perhaps those with retractile testes, were heavier. We therefore reviewed body mass index (BMI) in children with a variety of pediatric urological patients seen in our office.

Patients and methods

The data of 1470 patients who were evaluated and treated in our pediatric urology office practice between 1 January and 30 September 2004 were analyzed retrospectively. A subset of these data had been analyzed separately for a different study [6]. All patients seen were included in the study, but patients who were seen more than once during the study period were counted only once. Each patient's age, gender, weight, height and urologic diagnosis were evaluated. The diagnosis was based on that used to code billing forms. Although many patients had multiple diagnoses, in our office the diagnosis felt to be primary is listed first, and it is this initial billing diagnosis that was chosen for this study. BMI was calculated using the formula: weight (lb)/stature (inch)^2*703. In children, 'normal' BMI varies with age and so BMI percentiles were determined. For defining the BMI percentile of each patient, gender- and age-specific growth charts of CDC and Prevention, 2000 were used [7]. The percentile BMIs were then analyzed based on diagnosis. BMI percentile $\geq$85% was defined as mild obesity and BMI percentile $\geq$95% was defined as severe obesity.

For purposes of statistical analysis, we excluded diagnoses in which less than 10 patients were seen during the study period. The data were displayed by diagnosis, but to allow for statistical analysis the diagnoses were divided into four groups. The groupings were based on a suggestion of similarity between diagnoses and their presumed relationship to BMI, but in the absence of data in the literature the groups were in practice somewhat arbitrary. The groups and the diagnoses included in the groups were as follows.

1) **Voiding Problems Group.** Included in this group were patients whose principal diagnoses were: abdominal pain, nocturnal enuresis, functional voiding disorders, urinary incontinence, UTI, constipation, urinary frequency, nocturia, urge incontinence or urgency of urination, and VUR.
2) **Undescended Testicle Group.** This group included only patients with undescended or retractile testes.
3) **Other Genital Group.** Included in this category were patients with a diagnosis of female genital anomalies, congenital urethral stenosis, hypospadias, hydrocele, scrotal varices, hernia or stricture (undescended and retractile testes were excluded).
4) **Miscellaneous Group.** This included patients with hydronephrosis, dysuria or hematuria.

Statistical analysis

Comparisons of BMI percentiles, ages and BMI between disease groups were by one-way analysis of variance test with multiple comparisons done by Tukey's test. Tests were performed using Minitab statistical software and significance was accepted at the 0.05 level.

Results

Excluding the patients whose principal diagnosis was uncommon (less than nine seen during the 9-month study period), there were 1054 patients for analysis. The BMIs of all diagnoses for which more than nine patients were seen are shown in Fig. 1. There is a strong apparent trend to increased obesity in children with some diagnoses. In particular, children with retractile testis, UTI, urinary incontinence, undescended testis and other functional disorders of the bladder were mildly obese, and children with nocturnal enuresis, miscellaneous male genital disorders (e.g. buried penis) and abdominal pain were severely obese.

As noted above, the selection of groupings was somewhat arbitrary, but because there is very little literature in this area it was based on a suggestion of commonality of pathophysiology. The number of patients in the groups, mean ages, BMIs and percentiles are summarized in Table 1. There was a statistical difference between groups with regard to age ($p = 0.027$), as the Undescended Testicle group was significantly younger (mean age $= 7.5 \pm 3.5$) than the Other Genital group (mean age $= 8.7 \pm 4.7$). The other differences between groups were not statistically significant, and it is unlikely that this significant difference has any clinical relevance.

When the BMI percentiles were compared, the Other Genital (55 ± 35%) and Miscellaneous (62 ± 30%) groups were relatively low and the Undescended Testicle (67 ± 32%) and Voiding Problems (68 ± 31%) groups were relatively high. The BMI percentile of the Other Genital group was found to be statistically significantly less than the Undescended Testicle ($p = 0.015$) and Voiding Problems groups ($p = 0.0001$). The results are summarized in Fig. 2.

We also evaluated the differences in BMI by comparing the groups according to the incidence of mild and severe obesity. The results are summarized in Fig. 3. The incidences of mild and severe obesity in the Other Genital group were 33% (95% confidence interval (CI): 25%–41%) and 17% (CI: 24–%11%), respectively. In the Miscellaneous group they were 34% (CI: 25%–42%) and 16.4% (CI: 9%–23% respectively). Neither group was statistically different from the 30% and 13% for mild and severe obesity usually quoted for normal controls [8]. In contrast, the incidences of mild and severe obesity in the Undescended Testicle group were 41% (CI: 31%–51%) and 25% (CI: 22%–29%), respectively, and in the Voiding Problems group they were 44% (CI: 40%–47%) and 26% (CI: 22%–29%), respectively. Both the Undescended Testicle and Voiding Problems groups had significantly higher mild and severe obesity levels than the normal population.