A study of the prevalence of various lower urinary tract symptoms in children with analysis of comorbidities and uroflowmetry

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ABSTRACT

Background: The International Children's Continence Society (ICCS) in its standardization article in 2006 and subsequent revision in 2014 have provided guidelines for the diagnosis and management of lower urinary tract symptoms (LUTS) in children. However, the terminologies are still not in common parlance and colloquial terms are being heavily used in India. **Objective:** The objective of the study was to evaluate the clinical spectrum of LUTS and their comorbidities in children. **Materials and Methods:** This was an observational cross-sectional study conducted in a tertiary care hospital in Northern India. Children, included in the study, aged 5–12 years who presented with LUTS as defined in the ICCS 2014 updated guidelines. A simultaneous analysis of uroflowmetry graphs was also done in these children and the observations presented in this paper. **Results:** Enuresis was the most common LUTS with which children presented to the OPD (78% cases) followed by increased frequency of micturition (42%). Among comorbidities, constipation was present in one-third patients of LUTS. Uroflowmetry done in LUTS often yields a normal "bell-shaped" graph in majority of the patients (71%). The study shows that many enuretics have underlying other LUTS and comorbidities that we should be aware of and uroflowmetry, if not coupled with urodynamic studies, is not a game changer. **Conclusion:** There are not many studies post the standardization of the ICCS conducted in India and this study aims at increasing the awareness of the same among physicians and researchers alike.

Key words: *Enuresis, International Children's Continence Society, Lower urinary tract symptoms, Uroflowmetry*

Urination or micturition is a complex activity and needs coordination between brain, spinal cord, nerves, urinary bladder, and sphincters for smooth conduct of the act of micturition. There are two distinct phases of micturition in the form of storage and voiding. Storage deals with filling up of the urinary bladder with urine and the sphincteric control to hold back the urine and voiding deals with contraction of bladder, relaxation of sphincter, and passage of urine of the body [1]. Disorders of urination can affect either phase of micturition; however, they do not occur in isolation and there is considerable overlap of storage and voiding abnormalities.

The International Children's Continence Society (ICCS) in their standardization article in 2006 has unambiguously defined various lower urinary tract symptoms (LUTS), and we have adhered to their terminology in this study [2]. Until the first publication of the society in 1998 [3] and the subsequent revision in 2006 of standardized terminology for LUT dysfunction, there was sufficient variability in the definition of LUTS in children. There was also an update on the terminologies in 2014 [4]. This study was conducted to evaluate the clinical spectrum of LUTS and their comorbidities in children. Uroflowmetry was done in all patients and the graphs obtained were analyzed.

MATERIALS AND METHODS

This was an observational cross-sectional study conducted in a tertiary care hospital in Northern India during the period from May 2015 to Aug 2016. Children included in the study were aged 5–12 years who presented with LUTS as defined in the ICCS 2014 updated guidelines. All the patients fulfilling the inclusion criteria were enrolled in the study after obtaining informed consent from parents. Ethical clearance was obtained from the Institutional Ethical Committee.

The subjects excluded were children having central neurological illness such as cerebral palsy and other neurodegenerative disorders, known spinal deformity such as myelomeningocoele, tethered cord, and spina bifida, children with any dysfunction developed post-surgery or diagnosed with diseases known to cause urinary symptoms such as diabetes mellitus, diabetes insipidus, renal failure, or children on diuretic drugs.

A detailed history was obtained from the parents/caregiver and patients were grouped into LUTS groups. Positive family history information was sought if a child had enuresis. Systemic examination was done to rule out neurologic causes. A 48 h bladder diary was obtained from the patient. Urinary tract infection (UTI)

was diagnosed on urine culture as per IAP guidelines 2010 [5]. Constipation and functional fecal incontinence (FFI) were diagnosed as per Rome III criteria [6]. Adenoid hypertrophy was diagnosed on lateral radiograph of the neck. Obesity was diagnosed as per the WHO criteria in children using body mass index (BMI). Uroflowmetry study was done in all children. The uroflowmetry analysis was done by urologist. All the data were entered in a self-designed proforma.

RESULTS

A total of 111 children were enrolled in the study, of which 12 children were lost to follow-up, leaving 99 children, in whom these data were analyzed. Uroflowmetry readings in another 10 could not be analyzed due to lack of cooperation/inadequate volume of void. The mean age of the study participants was 8 years. These data carry significance in the sense that it is around this time that most parents seek treatment for enuresis. Often pediatricians choose to use nonpharmacological methods of the treatment for enuresis in age groups <8 years and think of pharmacotherapy beyond that age.

Of 99 children, 72 were boys and 27 were girls with a male to female ratio of 2.7:1. The outright difference might be because households in India still consider the topic of UT issues in young girls a taboo and, therefore, hesitate to approach a clinician for the same. Enuresis was the most common symptom with which children presented (78%), and it was followed by frequency (42%) and urgency (39%) (Table 1). Among the children who had enuresis, 30% had a positive family history (father, mother, or sibling had enuresis in the past).

The updated ICCS standardization document mentions various comorbidities that are commonly associated with LUTS. We found constipation to be presented in one-third of the patients with LUTS. Other comorbidities include UTI (11%), adenoid hypertrophy (10%), obesity (3%), and FFI in 2% cases.

Uroflowmetry was done without pelvic electromyography (EMG). Recordings with voided volume <50% of the EBC were considered misrepresentative and hence discarded. Its data were analyzed in 89 patients. Bell-shaped curve was seen in 71% of patients which is considered as normal. Among the abnormal curves, plateau-shaped curve was obtained in 13% patients, followed by staccato (7%), tower-shaped (7%), and interrupted (2%) curves.

Table 1: Presenting symptoms

Lower urinary tract symptoms	Percentage
Enuresis	78
Frequency	42
Urgency	39
Daytime incontinence	20
Genital/lower abdomen pain	16
Dysuria	11
Intermittency	8
Weak stream	4
Hesitancy	3
Holding maneuver	3
Post micturition dribble	3

DISCUSSION

The findings of the present study are comparable to the similar studies conducted in the past. The mean age of the study population was 8 years. These data differ from a study done by Akil *et al*. in Turkey [7], where they had a mean age of 10 years. The fact that only children until 12 years were considered in the study was a strong determinant in the low mean age compared to the other study. In our study, the sex distribution was 2:7:1 where boys were more than girls. In the study by Akil *et al*. [7], there was an equal distribution of symptoms in terms of gender, whereas Vaz *et al*. reported higher incidence of LUTS in girls [8].

The most common LUTS noted in the study was enuresis (78%), followed by frequency (42%), urgency (39%), and daytime incontinence (20%). Vaz *et al*. [8] reported diurnal urinary incontinence in 30.7% cases followed by holding maneuvers (19.1%) and urinary urgency (13.7%) [8]. Akil *et al*. [7] observed frequency in 6.7% cases, nocturnal incontinence 16.6% cases, and combined daytime and nocturnal incontinence in 4.1% cases. The thing to note is that the terminology was not standardized at that time and hence the varied colloquial terms being used.

One-third of the patients with enuresis in the study had positive family history. Gene foci for enuresis have been found on chromosomes 8, 12, 13, and 22 [9-11]. An autosomal dominant mode of inheritance has also been suggested. In the Avon Longitudinal Study of Parents and ChildrenF, von Gontard *et al.* [12] reported significant associations between parental and child nocturnal enuresis. The odds ratios for severe child nocturnal enuresis were 3.63 times higher in maternal and 1.85 times higher in paternal nocturnal enuresis.

Among the various comorbidities mentioned in the ICCS standardization document, the association of constipation with incontinence and enuresis has been the most extensively studied. In a study done by Dehghani *et al.*, among 120 children with chronic constipation, enuresis was present in 22.5% cases [13]. In our study, 33% of children who presented with LUTS had constipation. In children with functional fecal incontinence, it has been reported that daytime urinary incontinence could occur in up to 24%, and night-time incontinence in 31% [14].

Weintraub *et al*. have studied the association of obesity with enuresis. They have reported enuresis in 14 (8.8%) normal weight, 6 (16%) overweight, and 26 (30%) obese youth. They have observed that each increment of one BMI-Z score unit was associated with an increased risk of enuresis [15]. The previous studies have demonstrated a very high prevalence of ADHD in children with enuresis. The comorbid ADHD rate of children with enuresis in a primary or secondary care setting was 10.3% and those in a specialized tertiary care setting were 28.3% [16].

Several retrospective studies have addressed the beneficial effects of adenotonsillectomy in improving nocturnal incontinence in children with simultaneous adenotonsillar hypertrophy and preoperative enuresis [17,18]. A strong correlation has been found by van Gool *et al*. between recurrent UTI and bladder

sphincter dysfunction [19]. In this study, uroflowmetry alone has been used for the evaluation of lower UT symptoms in children. Uroflowmetry as a stand-alone investigation might be inadequate as it gives no information on the pelvic floor activity during voiding. However, the ICCS recommends uroflowmetry without EMG as the initial mode of investigation in children with LUTS. After this noninvasive screening, patients should be selected who will benefit from further urodynamic investigation.

Uroflowmetry was done in all children in the study, of which whom 10 recordings were deemed unsatisfactory and, hence, not included in the analysis. The major types of flow curves obtained in uroflowmetry are: (i) Bell-shaped curve – the urinary flow curve of a healthy child is bell-shaped regardless of gender, age, and voided volume. (ii) Tower-shaped curve – this is a sudden and high-amplitude curve of short duration suggestive of overactive bladder. (iii) Staccato-shaped curve – this flow pattern is irregular and fluctuating throughout voiding, but the flow is continuous, never reaching zero during voiding suggestive of dysfunctional voiding. (iv) Interrupted-shaped curve – this flow displays discrete peaks with spikes similar to a staccato shaped curve, but unlike the latter pattern, there are segments where zero flow with complete cessation between these peaks exists suggestive of underactive bladder. (v) Plateau-shaped curve – this is a flattened, low amplitude prolonged flow curve suggestive of bladder outlet obstruction which could either be dynamic or obstructive and needs urodynamic studies to distinctly distinguish between them.

In our study, bell-shaped or normal curve was the most common type seen in 71% cases, followed by plateau shaped (13%), tower-shaped (7%), staccato shaped 7%, and interrupted shaped (2%) curves. In a study by Wenske *et al*., staccato pattern of flow was observed in 51% of children with LUTS and interrupted pattern in 25% [20]. The limitation of the study was that children beyond 12 years of age were not enrolled.

CONCLUSION

This study is one of the first of its type in India after the standardization by the ICCS. The ICCS has streamlined the various terminologies being used and provided excellent guidelines to approach the subject. LUTS is a very common and often neglected complaint in the outpatient setting. Uroflowmetry stand alone is of less significance in LUTS and needs to be coupled with pelvic-EMG for better diagnostics.

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