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Original Research Article

# Lower urinary tract dysfunction symptoms by Modified Dysfunctional Voiding Scoring System in school age (6-12 years) children

**Maneesha Bhargava[1], Jitender Solanki[2], Amarjeet Mehta[3]**
[1]Assisant Professor, [2]Medical Officer, [3]Professor, Division of Pediatric Nephrology
SMS Medical College Jaipur, Rajasthan, India

***Corresponding author**
Maneesha Bhargava
Email: dr.maneesha321@gmail.com

**Abstract:** Main objective of the study was to identify lower urinary tract dysfunction (LUTD) symptoms in children aged 6-12 years by using Modified Dysfunctional Voiding Scoring System (DVSS) and the association of these symptoms with age, sex and other socio-demographic factors. It was an observational study done in 380 normal healthy children between 6-12 years of age attending pediatric OPDs of SMS Medical College jaipur in a period of one year. MODIFIED DVSS was applied in these children and their parents were interviewed. Cut off point considered as indicator of LUTD was >6 for girls and >9 for boys. Different proportions were compared with Chi-square test and Odds ratio. 92 children out of 380, had LUTD score >6 for females and >9 for males. Prevalence of LUTD was 24.2%. LUTD symptoms were more common in 6-9 years of age than the 9-12 yrs age group and the difference was significant statistically (p=0.000) (OR= 2.678, 95%CI= 1.611-4.451) .LUTD symptoms were more common in females (p= 0.018).Female sex was a risk factor for LUTD (OR= 1.662, 95% CI= 1.025-2.694). LUTD symptoms were not affected significantly by type of school, availability of separate toilet facilities in school and residential area of children (p> 0.05) Diurnal urinary incontinence, holding maneuvers, urinary urgency, voiding pain and straining were more commonly present with score 3(high symptom severity) whereas constipation and decreased urinary frequency were more commonly present with score 2 (low symptom severity).The prevalence of LUTD symptom was quite high (24.2%) in school age children. Prevalence of LUTD symptoms was high among children from lower age group and in females. LUTD symptoms must be investigated carefully at routine pediatric visits.
**Keywords:**Lower urinary tract dysfunction, Dysfunctional voiding scoring system.

## INTRODUCTION

In children, the complex composite structure of the lower urinary tract is functionally controlled at several levels of the central nervous system; co-ordination and communication between these levels are not fully developed until the age of 4 year[1]. Furthermore, owing to the impact of socio-cultural differences, the age-dependent neural control over lower urinary tract function in children is far less standard than in adults.

LUTD is characterized by symptoms of urinary urgency, urge incontinence without neurological evidence, urinary tract infection (UTI), vesicoureteral reflux (VUR), and intestinal constipation or in combination. It plays important role among causes of UTI in children more than 4yrs of age. These conditions are not only frequently misdiagnosed but also have impact on the psychological, emotional and social life of the child. Previous epidemiological studies have demonstrated incidence of continence and enuresis as high as 20% in school-age children. It is responsible for a significant percentage of visits to pediatricians and to nephrologists or urologists[2].Unfortunately many of these children with lower urinary tract dysfunction are diagnosed late and present with established renal damage.

The International Children's Continence Society (ICCS) has established standard definitions for urinary symptoms that are classified according to the phase of bladder function: storage and voiding[3] .As per ICCS, storage symptoms are defined as; increased or decreased urinary frequency, urinary incontinence, urinary urgency and nocturia. Voiding symptoms are classified as hesitation, straining, weak stream, and intermittency. Other symptoms are; holding maneuvers,

feeling of incomplete emptying, post micturition dribble, genital and lower urinary tract pain[3].

Prevalence of LUTD in children is variable, possibly affecting between 2 to 25 % of populations as described in various epidemiological studies [4].Though the association between LUTD and recurrent UTI has been established, the causal relationship is still not clear. Early diagnosis and therapeutic approach are essential and, therefore, knowledge of epidemiology and clinical manifestations of LUTD are important for selection of primary and secondary preventive measures.

Farhat *et al*[5] in 2000 devised and validated an instrument named as Dysfunctional Voiding Scoring System (DVSS) in children for reliable, reproducible and detectable monitoring of dysfunctional voiding. It was further modified by Giovana T vaz*et al*[6] in 2012. We planned to study the prevalence of LUTD symptoms in school age children of 6-12 years of age by modified DVSS score.

**SUBJECTS AND METHODOLOGY**:

It was an observational study done in department of pediatric medicine, SMS Medical College Jaipur from April 2013 to March 2014. The study was done in 380 normal healthy children of 6-12 years age attending pediatric OPD for minor illnesses or as patients attendant admitted in medical pediatric wards. Children with renal disorders and neurological LUTD like neurological bladder, spina bifida occulta, and posterior urethral valve were excluded.

After a preliminary history and clinical examination, MODIFIED DVSS in the questionnaire form was applied in children[6]. There were 10 quantitative urological parameters translated into age appropriate questions for children, which were filled by researcher. Questionnaire was consisting of qualitative and quantitative questions about urinary symptoms, such as urinary incontinence, voiding habits, urgency, posturing, bowel habits and stressful life conditions. Questionnaire was translated in local language and validated.

In MODIFIED DVSS out of 10 questions 9 were assigned scores of 0 to 3 according to incidence in the month prior to inclusion. In the question number 10; yes for a score of 3 and no for score of 0 were allocated. A score of > 6 for girls and > 9 for boys was taken as cutoff point for Lower Urinary Tract dysfunction (LUTD). The study was approved by research review board of the institute. International Children's Continence Society (ICCS)standards were used to define various Lower urinary tract Dysfunctions [3].

**Statistical analysis**:

Continuous data like mean, standard deviation (SD), median and respective interquartile range (IQR) were used where appropriate. Qualitative data were summarized as proportions or percentage. The following variables were included in the analysis like Age, gender, location (rural or urban), type of school (government/private), and socio-economic status of family. Different proportions were compared with Chi-square test and Odds ratio. P-value <0.05 was taken as significant. All statistical analysis was done by using SPSS-16 software.

**RESULTS**

Out of 380 children; 199 (52.3%) children were in 6 to 9 years age group whereas 181(47.7%) children were in 9 to 12 years of age group. 214 (56.3%) were males and 166 (43.7%) were females. Male: female ratio was 1.29:1. 80% children were from urban area. 76.3% children were attending private schools with better toilet facilities whereas 23.7% were studying in government schools which were with poor toilet facilities. 70% Participants were from Upper lower class (39.2%) and Lower middle class (30.8%). 92 children out of 380, had LUTD score >6 for females and >9 for males.50 (54.3%) children with LUTD positive symptoms were females whereas 42 (45.7%) were males. Prevalence of LUTD was 24.2%.

In 6 to 9 year age group 27.9% males and 37.9% females had LUTD whereas in 9 to 12 year age group 11.7% males and 19.7% females had LUTD. Diurnal urinary incontinence, Holding maneuvers and urinary urgency were more common in 6 to 9 years of age group and difference was significant when compared with 9 to 12 years age($p < 0.05$) (Table 1).

Reduced diurnal urinary frequency was more common in 9 to 12 years age group and difference was significant ($p < 0.05$). Diurnal urinary incontinence, constipation, straining and stress conditions were more common in males whereas holding maneuvers, voiding pain were more common in females ($p<.005$). Urinary urgency was more common in 52% children from rural area than in 40 % children from urban area ( $p = 0.043$). Stressful conditions more commonly observed in children from rural area (8%) than in 2.5 % children from urban area ($p = 0.029$). Most common LUTD symptom was urinary urgency (42.3%) independent of LUTD score. 88% LUTD positive children had holding maneuvers and 89% LUTD positive children had urinary urgency. Diurnal urinary incontinence, holding maneuvers, urinary urgency, voiding pain and straining were more commonly present with score 3(high symptom severity) whereas constipation and decreased urinary frequency were more commonly present with score 2 (low symptom severity) (Table 2).

Lower urinary tract dysfunction symptoms were more common in females (30.1%) than males (19.6%) ($p=0.018$) and were more common in 6 to 9 years age group (32.7%) than >9 to 12 years age group (14.9 %,( $p=0.000$).LUTD symptoms were 2.6 times

more common in 6 to 9 years age group and difference was significant (p=0.001) and 1.6 times more common in females and difference was significant (p=0.039) (Table 3).

**Table -1: LUTD Symptoms verses Age groups:**

| S. No. | Symptoms n=380 | 6 to 9 years n=199 | 9 to 12 years n =181 | Pearson Chi-Square (Value) | P- Value |
|---|---|---|---|---|---|
| 1 | Wet cloths during day, n=57 | 42 (21.1%) | 15(8.3%) | 12.215 | 0.000 |
| 2 | When wet, cloths soaked, n=18 | 16(8.0%) | 2(1.1%) | 10.103 | 0.001 |
| 3 | Miss bowel movement/day, n=56 | 30(15.1%) | 26(14.4%) | 0.038 | 0.845 |
| 4 | Push to bowel movement to come out/day, n=57 | 30(15.1%) | 27(14.9%) | 0.002 | 0.966 |
| 5 | Go to bathroom/day, n=110 | 48(24.1%) | 62(34.2%) | 4.732 | 0.030 |
| 6 | Hold onto pee, n=136 | 84(42.2%) | 52(28.7%) | 7.497 | 0.006 |
| 7 | Cannot wait for pee, n=161 | 97(48.7%) | 64(35.3%) | 6.954 | 0.008 |
| 8 | Push to pee, n=43 | 27(13.6%) | 16(8.8%) | 2.111 | 0.146 |
| 9 | Hurt during pee, n=61 | 38(19.1%) | 23(12.7%) | 2.871 | 0.090 |
| 10 | Stressful condition, n=14 | 9(4.5%) | 5(3.0%) | 0.828 | 0.363 |

**Table-2: Frequency of each LUTD symptom:**

| S. No. | Symptoms | LUTD positive n = 92 | LUTD negative n = 288 |
|---|---|---|---|
| 1. | Wet cloths during day | 46 (50.0%) | 11 (3.8%) |
| 2. | When wet cloths soaked | 16 (17.4%) | 2 (0.7%) |
| 3. | Miss bowel movement/day | 29 (31.5%) | 25 (8.7%) |
| 4. | Piss to come out bowel movement/day | 29 (31.5%) | 26 (9.0%) |
| 5. | Go to bathroom/day | 36 (39.1%) | 74 (25.7%) |
| 6. | Hold onto pee | 81 (88.0%) | 55 (19.1%) |
| 7. | Cannot wait for pee | 82 (89.1%) | 79 (27.4%) |
| 8. | Piss to pee | 35 (38.0%) | 8 (2.78%) |
| 9. | Hurt during pee | 49 (53.3%) | 12 (4.17%) |
| 10. | Stressful condition | 8 (8.7%) | 6 (2.1%) |

**Table-3: Factors affecting lower urinary tract dysfunction:**

| Factors | | LUTD Positive n=92 | Pearson Chi-Square (value) | p-value |
|---|---|---|---|---|
| Age group | 6 to 9 years, n=199 | 65(32.7%) | 16.268 | .000 |
| | 9 to 12 years, n=181 | 27(14.9%) | | |
| Sex | Male, n=214 | 42(19.6%) | 5.611 | .018 |
| | Female, n=166 | 50(30.1%) | | |
| School type | Government, n=90 | 19(21.1%) | .617 | .432 |
| | Private, n=290 | 73(25.2%) | | |
| Separate toilet Facility | Not available, n=48 | 10(20.8%) | .341 | .559 |
| | Available, n=332 | 82(24.7%) | | |
| Residential area | Rural, n=76 | 20(26.3%) | .229 | .632 |
| | Urban, n=304 | 72(23.7%) | | |

## DISCUSSION

Present study was undertaken with the objectives of finding prevalence of lower urinary tract dysfunction (LUTD) symptoms in school age children and various related factors . A total of 380 school age children (6 to 12 years age) were included in the study. Male: female ratio was 1.29: 1. In most of the other studies male female ratio were either equal or more [6,7,8,9] whereas in present study males out-numbered females. Males are better cared and are brought to the hospital early in this male dominated society. This could explain the dominance of males in the present study. 80% children were from urban area. Area-wise observation was not made in other studies

In the schools Separate toilet facilities were available for 87.4% children. LUTD symptoms were not affected by school type, availability of separate toilet facilities in schools and residence of children (p> 0.05) (Table-3).

Lack of toilet facilities may lead to various symptoms like; prolonged holding, urinary urgency and urinary tract infection .Chung *et al* in their study in a developed country focused on separate toilet facility and found that 3.09% children had poor toilet facilities. Poor toilet facilities may lead to holding urine for longer period there by lazy bladder and increased frequency of urinary tract infections.

Out of 380 children 92 had symptoms of lower urinary tract dysfunction by DVSS. The overall prevalence of LUTD was 24.2%. Our results were in accordance with two similar studies [6,10].

92 out of 380 children had LUTD. 32.7% children were in 6 to 9 year age group whereas 14.9% were in 9 to 12 year age group among LUTD positive children. Prevalence of LUTD was 2.6 times more common in children between 6 and 9 years and difference was significant (p = 0.001) (OR= 2.678, 95% CI= 1.611-4.451). The similar results were shown in previous studies [6,10].

LUTD was present in 19.6% of males and 30.1% in females. Prevalence of LUTD was 1.6 times more common in females and difference was significant (p-value= 0.018) (OR= 1.662, 95% CI= 1.025-2.694).These results were similar to the previous studies [11,12]. In one study the elevated LUTD score was 1.5 times higher in 6-9 years when compared to 9-12 years of age group (OR= 1.5, 95% CI= 1.02-2.2) and 3.7 times higher in girls when compared to boys (OR= 3.7, 95% CI= 2.5-5.8) [6].

LUTD symptoms were seen in 26.3% children from rural area and in 23.7% from urban area. LUTD symptoms were not affected by place of residence. No specific difference was observed between these two groups, though the findings could not be generalized due to unequal distribution of population under study. Urinary urgency was more common in children from rural area (52%) than children from urban area ( 40%, p = 0.043). Stressful conditions were more common in children from rural area than urban area ( p = 0.029).

Separate toilet facilities were available for 332 children, among them 82(24.7%) children had LUTD symptom. Separate toilet facilities were not available for 48 children where 10 (20.8%) children had LUTD symptoms. LUTD symptoms were not affected by availability of separate toilet facilities in their schools. Chung at aldetected that overactive bladder (urinary urgency with or without urge incontinence, usually with increased daytime frequency and nocturia) was significantly associated with poor toilet facilities (p=.006) [7].

By using updated kuppuswmi's scale-2007; 91.3% children with lower urinary tract dysfunction were from lower and middle classes. Similar studies also observed that the presence of LUTD symptoms were most common in children with the lowest social level (p<0.001) [6, 10]. In an environment of poverty, there is a greater possibility of domestic problem, lack of financial resources, unemployment, split families, and learning difficulties. Children from stressful environments are at a greater risk of a variety of development and behavior problems, which also cause LUTD symptoms.

In our study most common urinary symptoms in LUTD positive children were urinary urgency (89.1%), holding maneuvers (88%), voiding pain (53.3%) and diurnal urinary incontinence (50%). Another study observed that most common urinary symptoms in children (6-12 years) with an elevated LUTD score were diurnal urinary incontinence (30.7%), holding maneuvers (19.1%), and urinary urgency (13.7%)[6]. Loening-Baucke V observed that out of 234 children with constipation; 29% had day-time urinary incontinence[12]. After treatment of constipation 89% day-time urinary incontinence improved .The prevalence of urinary incontinence reported in literature varies from 1.8% to 20% [12,13,14] and diminishes with age :10% in children aged 5-6, 5% from 6-12 and 4% from 12 to 18 [15].

The differences may be explained on the basis of clear understanding of each of these symptoms by parents and children who were made more understandable by researcher in the present study.

Out of 380 children; 57 (15%) had history of constipation (<5 times/week). Out of these 57 children; 30 (52.6%) were between 6 and 9 years of age group whereas 27 (47.4%) were between 9 and 12 years of age group. For constipation, difference between two groups and genders was not significant statistically (p= 0.966). Among the 92 LUTD positive children; 29 (31.5%) had history of constipation. Prevalence of constipation in other studies was 6.7% to 30.7%[6,7,11) Different dietary habits could explain the higher incidence of constipation in this study. The effect of constipation on bladder function is related to direct effect of retained fecal material distending the recto sigmoid colon. Treatment of constipation has an importance for resolution of diurnal incontinence, nocturnal enuresis and fecal incontinence. So it's important to discuss stooling history from children and parents.

Urinary frequency is not generally investigated in clinical practice. The consensus published by the International Children's Continence Society states that a normal urinary frequency is between four and seven times per day [3]. Numbers below and above these values would be classified as reduced and increased frequency, respectively. In our study 28.9% children had decreased urinary frequency. Decreased urinary frequency was more common in 9 to 12 years age group

and difference was statistically significant (p= 0.030) but gender difference was not (p= 0.990). Among the LUTD positive children; 39.1% had history of decreased urinary frequency. Other studies showed lower prevalence of this symptom from 4.4 to 10.7% [6, 7]. The higher prevalence of this symptom could be due to lack of hygienic facilities in school, leading to delay in voiding, also due to intense concentration on playing or watching television. Behaviour modification should be intense part of child's voiding regimen. Some children delay voiding, generally in special situations, such as when the hygienic conditions at school are poor. However, some develop a decreased voiding frequency that results in an increase in bladder capacity. With this increase in bladder repletion, the detrusor muscle distends excessively and may become underactive. These children are at an increased risk of UTI, vesicoureteral reflux, and damage to the upper urinary tract [1].

136 (35.8%) children had history of holding maneuvers. 61.76% were from 6 to 9 years of age group. (p= 0.006). Among the LUTD positive children 88% had history of holding maneuvers . We did not observe a difference for holding maneuvers between genders (p=0.899). Our study was quite similar to Study done by Chung *et al*[7] who found that out of 16516 children; holding maneuvers were present in 3888 (23.5%). Giovana T Vaz *et al* [6] detected that holding maneuvers was present in 19.1% children (15.4% males, 22.2% females).Therefore holding maneuvers should be treated.

42.3% of total children had history of urinary urgency. Out of these 60.2% were from 6 to 9 years of age whereas39.8% were from 9 to 12 years of age. Urinary urgency was more common in 6 to 9 years of age group and difference was significant statistically (p= 0.008).

Out of 161 LUTD positive children 56.5% were males whereas 43.5% were females. For urinary urgency sex difference was not significant (p= 0.945). Among LUTD positive children; 89.1% had urinary urgency. Giovana T Vaz *et al*[6] detected that urinary urgency was present in 13.7% children (11.2% males, 15.7% females). Kajiwara M *et al*[8] detected that out of 331 children with DUI; 313 (94.6%) children had urinary urgency and 18 (5.4%) children wet themselves due to urge

43 (11.3%) children had straining. 62.8% were between 6 and 9 years. Difference was not significant (p= 0.146). Out of 43 children; 30 (69.7%) were males whereas 13 (30.3%) were females. For straining sex difference was not significant (p= 0.059).Among the 92 LUTD positive children; 35 (38%) had history of straining. Giovana T Vaz *et al*found that straining was present in 4.5% children (3.6% males, 5.2% females) [6].

Voiding pain was present in 16% of children. Out of these 61 children; 38 (62.3%) were between 6 and 9 years. Sex difference was not significant (p= 0.507). Among the 92 LUTD positive children; 49 (53.3%) had voiding pain. Giovana T Va z *et al*[6] found that voiding pain was present in 4.2% children (3.3% males, 5.0% females).

The difference in above symptoms can be explained on the basis of clear understanding of these terms by participants by researcher in the present study whereas in previous studies questionnaire were given to participants to be filled by them.

Out of 380 children; 14 (3.7%) children had stressful conditions. Age and sex difference was not significant. Among the 92 LUTD positive children; 8 (8.7%) had stressful condition.. Giovana T Vaz *et al* [6] found that stressful conditions were present in 28.5% children (30.5% males, 26.9% females) with lower urinary tract dysfunction (LUTD) symptoms. Sureshkumar P *et al* [9] found that daytime urinary incontinence was significantly associated with social concerns (OR 3.4, 95% CI 1.4 to 8.3).

Study conducted by Malhotra S *et al* [16]detected that prevalence of psychiatric disorders was 6.3% in 4-11 years old school children in Chandigarh Children from stressful environments are at a greater risk of a variety of developmental and behavioral problems, which could also cause LUT symptoms

Symptom score indicated the severity of symptom when the particular symptom was positive (score more than1). Diurnal urinary incontinence, holding maneuvers, urinary urgency, voiding pain and straining were more commonly present with score 3(high symptom severity) whereas constipation and decreased urinary frequency were more commonly present with score 2 (low symptom severity).

## CONCLUSIONS

Our study showed a high prevalence of urinary tract symptoms among school-age children. These symptoms being more prevalent in younger children, girls and those from lower socioeconomic class. Such findings must be taken into consideration while investigating children with LUTD.

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