

## Recurrent Urinary Tract Infection and Functional Voiding Disorders

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*Manuscript received: May 14, 2007; Initial review completed: July 3, 2007;*

*Revision accepted: February 8, 2008.*

### ABSTRACT

*This study was carried out to determine the association of recurrent urinary tract infections with functional voiding disorders. Sixty eight children with suspected functional voiding disorders were prospectively evaluated clinically and by non-invasive urodynamics. Invasive urodynamics were carried out when indicated. Group I comprised 34 children with symptoms suggestive of functional voiding disorders and recurrent urinary tract infections (mean age  $6.3 \pm 2$  yr) and Group II comprised 34 children with symptoms suggestive of functional voiding disorders without recurrent urinary tract infections (mean age  $6.7 \pm 2$  yr). The underlying bladder abnormalities in Groups I and II were detrusor instability in 22 (64.7%) and 30 (88.2%), respectively ( $P > 0.05$ ) and dysynergic voiding in 10 (29.4%), and 1 (2.9%), respectively ( $P < 0.05$ ). Children with recurrent urinary tract infections are more likely to have a dysynergic voiding pattern than children presenting with other symptoms of functional voiding disorders.*

**Key words:** *Detrusor instability, Dysynergic voiding, Urinary tract infection.*

Functional voiding disorders are essentially functional and abnormal patterns of micturition in the presence of an intact neuronal pathway and absence of anatomical abnormality of the urinary tract. In children, these disorders may manifest as obvious incontinence or as nocturnal enuresis with day time symptoms or recurrent urinary tract infections (UTI). They are broadly classified as detrusor instability (DI) and dysynergic voiding (DV). DI (overactive bladder) is defined as a filling phase defect manifesting as frequent attacks of imperative urge to void, countered by the emergency 'brake' of voluntary pelvic floor contraction. DV (detrusor sphincter dysynergia) occurs due to over activity of the pelvic floor muscles during the voiding phase resulting in staccato voiding, fractionated voiding or lazy bladder syndrome(1). The association of UTI with voiding disorders is well established(2). This study determines the association of recurrent UTI with functional voiding disorders in children.

### METHODS

Children younger than 12 years presenting with complaints suggestive of voiding disorders (recurrent

UTI, secondary enuresis with day time dribbling, frequency, urgency or straining, posterior urethral valves on follow up after corrective surgery, and persistent vesicoureteric reflux) were prospectively studied during 2002 to 2005. Recurrent UTI was diagnosed in children with a second episode of UTI(3). Children with primary monosymptomatic enuresis, obvious neurological abnormalities (including those with occult neurological abnormality detected on invasive urodynamics studies) and anatomical anomalies were excluded.

History was taken regarding the mode of presentation, demographic parameters, associated symptoms of dysfunctional elimination (incontinence, constipation and infrequent voiding), developmental delay on history suggestive of congenital or neurological abnormalities. An informed written consent was obtained from the parents. The patients were examined for anatomical and neurological abnormalities. All patients underwent non-invasive urodynamic studies in the form of frequency volume charting and ultrasonographic scan of the kidneys, ureters and the urinary bladder. Invasive urodynamics studies were carried out only in children

with a large post-void residue on ultrasonography in the absence of vesicoureteric reflux, persistent grade III or more vesicoureteric reflux, abnormal bladder morphology, suspected occult neurological abnormality, frequency volume charting suggestive of DV and persistence of voiding symptoms after empirical treatment for one month in cases of suspected DI. The underlying voiding disorder was diagnosed by non-invasive as well as invasive urodynamic studies. The diagnostic criteria for DV and DI were as follows(4,5):

- (a) DI was diagnosed in children with nocturnal enuresis with day time urgency, small quantity frequent voiding and holding maneuvers.
- (b) DV was diagnosed in children with incontinence, small quantity infrequent voiding, large post-void residue in the absence of vesicoureteric reflux.

**TABLE I** CLINICAL CHARACTERISTICS AND INVESTIGATIONS IN PATIENTS WITH SUSPECTED FUNCTIONAL VOIDING DISORDERS

Clinical Features	Group I	Group II	P
Age (Mean $\pm$ SD) yr	6.29 $\pm$ 2.8	6.74 $\pm$ 2.5	
Male : Female Ratio	1:1.5	1:1.3	
Constipation	12 (35.2%)	19 (55.8%)	0.08
Holding maneuvers	18 (52.9%)	20 (58.8%)	0.6
Frequency volume charting			
Small frequent voiding*	21 (61.7%)	31 (%)	0.01
Infrequent voiding†	6 (17.6%)	6 (17.6%)	0.7
Ultrasonography			
Post void residue‡	14 (41.1%)	13 (38.2%)	0.8
Pelvic/lyceal dilatation	10 (29.4%)	7 (20.5%)	0.4
Contracted kidney §	2 (05.8%)	2 (5.8%)	0.7
Vesicoureteric reflux	8 (23.5%)	11 (32.3%)	0.4

\* Voiding more than 9 times in 24 hours and volumes less than 65% of expected bladder capacity(5);

† Voiding less than 4 times in 24 hours(5);

‡ Significant residue, on repeated occasions, post void residual bladder volumes of >20 mL, or volumes of >10% of the expected bladder capacity(5);

§ Kidney size below the normal range for age, estimated by ultrasonographic scan; Expected bladder capacity(4); Age < 2 yr: weight (kg)  $\times$  7 mL; >2 yr old: [age (yr) + 2]  $\times$  30 mL.

Group I comprised of children presenting with symptoms of voiding disorders and recurrent UTI and Group II comprised of those with such symptoms but no recurrent UTI. The data were analyzed by Chi square test of significance (Epi 6 software).

## RESULTS

Of 97 children presenting with various voiding problems, 68 were included in the study; 34 each in groups I and II. Their clinical features and investigation results were comparable (**Table I**). The commonest underlying voiding disorder in group I was DI in 22 (64.7%), followed by DV in 10 (29.4%); two (5.8%) patients had normal bladders. In group II, 30 (88.2%) had DI and one (2.9%) had DV; three (8.8%) patients had normal bladders. A significantly higher proportion of patients in group II showed DV ( $P=0.0006$ ). The proportion of patients showing DI was similar in the two groups ( $P=0.6$ ) (**Table II**).

## DISCUSSION

Functional voiding disorders in recurrent UTI are not uncommon, but often overlooked in children. This problem is compounded by the paucity of data and lack of awareness of the condition amongst pediatricians. Voiding disorders include DI (63% to 77%) and DV (0.8%)(6,7). Almost one-half of patients with voiding disorders present with recurrent UTI in addition to voiding symptoms(7), which is comparable to 50% in the present study. The commonest voiding disorder reported in patients with recurrent UTI is DI (45%-57%) followed by DV (7%)(8,9). In the present study, we noted a similar trend, but the prevalence of DV in patients with recurrent UTI was higher (29.4%) (**Table II**). In a study on voiding disorders in girls, 40.6% had UTI, 66.7 % of these showed recurrent UTI on follow up(10). But the precise voiding disorder was not examined. In the present study, a significantly higher

**TABLE II** FUNCTIONAL VOIDING DISORDER WITH RECURRENT URINARY TRACT INFECTIONS

Bladder disorder	Group I	Group II	P
Detrusor instability	22 (64.7%)	30 (88.2%)	0.6
Dysynergic voiding	10 (29.4%)	01 (2.9%)	0.0006
Normal bladder	2 (5.8%)	3 (8.8%)	

### WHAT THIS STUDY ADDS?

- Children with symptoms suggestive of voiding disorders and urinary infection are more likely to have a dysynergic voiding.

incidence of DV in patients with recurrent UTI was found. The treatment of DV is prolonged and more difficult compared to DI(11). This study highlights the fact that, children with recurrent UTI and voiding disorders are likely to have DV. The limitations of this study are that all patients were not subjected to invasive urodynamic studies. Non-invasive urodynamic assessment has been used successfully by other workers(4) but needs further validation before it can be applied to general population.

This study also reveals a higher prevalence of DV in Indian children with symptoms of voiding disorder and recurrent UTI as compared to Western studies. Early voiding problems like mild detrusor instability and dysfunctional elimination problems may progress to a lazy bladder or non-neurogenic neurogenic bladder (Hinman's bladder) without treatment. They tend to develop complications such as persistent UTI and chronic renal insufficiency(12).

*Contributors:* HRR collected the data, analyzed the data, did literature review; drafted the manuscript and will act as the guarantor of the paper. MK designed the study, critically reviewed the manuscript and gave final approval for publication.

*Funding:* None.

*Competing Interests:* None stated.

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