URODYNAMIC STUDY OF CHILDREN WITH VOIDING PROBLEMS

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ABSTRACT

Twenty high risk children aged 5-12 years with various voiding problems were studied prospectively by urodynamics to evaluate the function of their urinary bladder and' its continence mechanism. None of them had neuropathic bladder or any obstruction distal to bladder neck, fourteen out of twenty (70%) had abnormal findings on urodynamics evaluation; 8 (40%) had non-neurogenic neurogenic bladder (NNNB); 3 (15%) *had small capacity hypertonic bladder* (SCHB); 2 (10%) *had atonic bladder (AB) and 1 (5%) had hyperreflexic bladder (HB). We conclude that urodynamic abnormalities are as frequent in high risk Indian children as they are in developed countries. The high risk children should be subjected to urodynamic studies more frequently than being done hitherto and be directed to proper therapeutic modality.*

Keywords: *Dysfunctional voiding, Non-neurogenic neurogenic bladder, Small capacity hypertonic bladder, Atonic bladder, Hyper-reflexic bladder.*

Unexplained voiding problems (other than primary nocturnal enuresis) secondary to dysfunction of urinary bladder and its sphincter mechanism are not uncommon in children(l-4). The affected children can present in various ways such as inability to void completely, *i.e.,* void in an interrupted or intermittent manner, secondary enuresis or infrequent voiding with distended bladder. In the western literature, various names have been given to this entity such as detrusor sphincter dyssynergia(5), non-neurogenic neurogenic bladder (NNNB)(6), unstable bladder(l), occult neuropathic bladder(7), *etc*. The only accepted method to study the micturition process is urodynamics(8-10). This being invasive and time consuming, the population in general cannot be subjected to it. Moreover it requires patient co-operation which is difficult to obtain in children. Hence, the exact prevalence and incidence of dysfunctional voiding in the general population remains unknown. Even in the developed countries such studies are confined to high risk population only among whom its prevalence is reported to be appreciably high(l,6). Socio-cultural factors are known to influence dysfunctional voiding significantly. Since data about prevalence of dysfunctional voiding is not available in our country, the present prospective

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study was undertaken to assess the magnitude of the problem in our set up.

Material and Methods

The high risk population included children with: *(a)* Urinary frequency/ urgency in absence of urinary tract infection (UTI) or bladder stone; *(b)* Secondary enuresis; (c) Interrupted/intermittent voiding; *(d)* Cases of recurrent UTI; and (e) Cases of chronic renal failure in absence of proved anatomical obstruction. Those with obvious neuropathic bladder such as spinal meningomyelocele, Pott's spine, poliomyelitis, *etc.;* children with primary nocturnal enuresis; those with post-vesical obstruction such as posterior urethral valve (PUV), metal stenosis, *etc.* were excluded from the study. All high risk children in the age group of 5-12 years who attended the Pediatric OPD of LNJPN Hospital, New Delhi between August '92—June '93 were taken up for the study. A detailed voiding history was taken from the child as well as from the parents and physical examination was done with emphasis on lower limbs, lumbo-sacral area, central nervous system examination besides assessing distension of urinary bladder clinically. A general assessment of psychological make up of the child was made during the interview. Parents were taken into confidence. As an excellent rapport was built up, history of alcoholism, divorce, *etc.* in the family was elicited. The parents were watched for their domineering behavior throughout the interview.

A detailed urine examination including culture, blood urea introgen, serum creatinine, plain X-ray abdomen, ultrasound of kidney, ureter and bladder; micturating cystourethrogram (MCU) and urodynamics was done. Written parental consent was obtained before urodynamics/MCU study.

Out of 31 patients who belonged to high risk population, 3 had to be excluded due to nephrolithiasis, 5 for PUV and 3 dropped out leaving behind 20 children for study. Urodynamic study was carried out by 2100 URO system (DISA). The abdominal pressure was recorded by a rectal catheter, the intravesical pressure by a transurethral catheter and electromyography of pelvic floor musculature was recorded using anal plug electrode. In urodynamics methods, definitions and units conformed to the standards proposed by the International Continence Society(3,8). The data was fed into personal computer using dbase III+ programme and analyzed by using EPI-INFO software developed by WHO. Chi square test or, Fisher exact test was applied to test the significance of symptomatology and urodynamic findings in various groups. Anova F test or Kruksal Wallis H test was applied to test significance of mean values of various groups.

Results

Twenty children (12 boys and 8 girls) aged between 5-12 years participated in the study. Their presenting complaints were as follows : secondary enuresis-9, intermittent/interrupted voiding-5, recurrent UTI-1, chronic renal failure-1. However, most patients had multiple symptomatology such that 70% had frequency, 40% nocturia, 50% secondary enuresis; dysuria, urgency, history of recurrent UTI 25% each; post micturition

dribbling, incontinence 20% each, poor stream with straining 15%. Of all symptoms, only nocturia was significantly more frequent in younger children (<9 years age group). There was no difference in symptomatology between boys and girls. Blood urea, serum creatinine, serum electrolytes, plain X-ray abdomen and ultrasonography of kidney, ureter and bladder were within normal limits in all these patients. MCU showed Grade-IV reflux in one boy and atonic bladder in another. Their urodynamic findings are presented in *Table I.*

Six children had significant residual volume (>10% of expected bladder capacity) detected by bladder catheterization whereas ultrasonography failed to detect any one of these. Large capacity bladder (>60ml of expected bladder capacity) was seen in 3. The abnormal urodynamic pattern was classified into the following 4 groups as per the criteria described by Stuart *et al*.(6%). Fourteen of the 20 children had abnormal voiding pattern of some form or other, commonest being NNNB-8 followed by SCHB-3, AB-2 and HB-1. There was history of delayed toilet training in 8, domineering parents in 9, parental alcoholism in 6, parental death in 4. Nine belonged to poor socio-economic status. There was no significant statistical difference of symptoms between the two sexes, the various uroflometric and cystometric parameters or the different bladder types. Hence, the data of whole group of 20 children were taken together to calculate the following uroflometric parameters which revealed PFR-10.5 ± 2.8 ml/sec, mean flow rate 6.4 ± 1.9 ml/sec, TP-10.45 ± 8.1 sec, VT 38.1 ± 18.9 sec, and the cystometric parameters : FS 82.9 ± 62.5 ml, BC 246.5 ± 119.9 ml, IPFS 11.2 ± 8.0 cm H_2O, IPBC 18.6 ± 14.7 cm H_2O, and MDP 36.7 ± 11.9 cm H_2O.

Since no pediatric series is available which has excluded primary enuresis, we found it difficult to compare the present series with others.

Discussion

The present study reveals the prevalence of dysfunctional voiding to be quite high in high risk Indian children. Its overall prevalence compares favourably with those reported by Stuart *et al*.(l) though the individual groups show wide variation. These discrepancies could be partly explained by inclusion of cases of primary enuresis in Stuart's series as prevalence of SCHB, HB are known to be very high in this condition.

The study shows that ultrasonography is an unreliable method to determine residual urine volume. Due to non-availability of facilities most high risk children in developing countries are deprived of urodynamic studies. Untreated, such cases suffer from recurrent UTIs and are at increased risk of developing back pressure changes in the kidneys besides remaining symptomatic. They may even progress to chronic renal failure. Hence, it becomes imperative that these children be diagnosed early and be guided to proper therapeutic modalities. It seems sensible that the high risk children be subjected to urodynamic studies more frequently than currently.

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TABLE I—*Summary of Urodynamic Findings*

Sr No.	EBC (ml)	RUV (ml)		Uroflowmetry				Cystometry						Remarks
		USG	CAT	VV	PFR	VT	TP	FS	BC	IPFS	IBPC	MDP	EMG	
1.	210	Nil	03	106	10.0	23	4	40	200	20	70	27	N	N
2.	210	Nil	Nil	120	12.0	25	6	40	110	4	4	34	N	NB
3.	210	7.5	Nil	104	9.5	22	8	90	182	5	8	30	D	NNNB
4.	210	16.0	40	118	5.3	39	11	40	136	20	31	55	D	NNNB
5.	210	Nil	10	200	11.0	40	18	40	210	2	6	10	N	N
6.	240	Nil	05	112	11.0	23	3	45	110	4	8	50	D	NNNB
7.	270	Nil	Nil	160	8.3	77	38	40	180	16	20	22	N	SCHB
8.	300	Nil	54	302	8.1	99	-	180	367	2	7	28	N	AB
9.	315	22.0	15	302	15.8	38	5	170	278	8	13	47	N	N
10.	315	Nil	Nil	229	12.7	35	11	83	300	4	11	43	N	N
11.	330	Nil	20	129	6.6	33	4	50	423	16	20	30	D	NNNB
12.	330	Nil	Nil	108	9.2	23	15	23	110	10	13	35	D	NNNB
13.	330	Nil	Nil	119	9.5	28	16	70	243	18	25	45	D	NNNB
14.	360	Nil	10	193	8.7	34	10	95	203	17	19	37	D	NNNB
15.	360	Nil	60	109	8.8	25	8	30	136	2	4	18	N	SCHB
16.	375	Nil	40	207	14.1	35	7	270	385	16	17	44	N	N
17.	390	Nil	Nil	250	15.0	36	9	80	220	25	29	48	D	NNNB
18.	390	Nil	30	388	12.7	4.8	14	139	370	18	20	36	N	N
19.	420	Nil	30	210	8.7	41	16	70	209	25	29	46	N	SCHB
20.	420	Nil	56	320	13.2	38	6	64	552	9	18	48	N	AB

EBC—Expected bladder capacity (Age in years x 30 ± 60 ml); RUV—Residual Urine Volume (ml); Significant if >10% of the bladder capacity; USG—Ultrasonography; CAT—Volume measured by catheter; W-Voided volume (ml); VT-Voiding time (sec); PFR-Peak flow rate (ml/sec); TP—Time to peak flow (sec.); FS—Bladder volume at first sensation (ml); BC—Maximum bladder capacity (ml); IPFS-Tntravesical pressure at first sensation (cm of water); IPBC—Intravesical pressure at maximum bladder capacity (cm of water); MDP—Maximum detrussor pressure (cm of water); EMG—Electromyography; D—Dyssynergia; N—Normal.

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