

VIDEO-URODYNAMIC PATTERNS IN NEUROLOGICALLY NORMAL INFANTS WITH AND WITHOUT VESICoureTERAL REFLUX

Aims of study

Although there are few reports on the urodynamic characteristics in infants [1, 2], the significance of lower urinary tract dysfunction in infants with various urinary tract disorders is uncertain because the urodynamic pattern in healthy infants has not been fully established. In order to increase our knowledge of the normal infantile urodynamic pattern and possible relations between urodynamics and vesicoureteral reflux (VUR), in the present study, we evaluated findings of video-urodynamic studies (V-UDS) in infants with either congenital renal abnormalities or episodes of urinary tract infection, but without any detectable neurological or other urinary tract abnormalities.

Materials and methods

A total of 79 infants (61 boys and 18 girls) with either congenital renal abnormalities (30 infants with hydronephrosis and 2 with multicystic dysplastic kidney) or episodes of urinary tract infection (47 infants), but without any neurological or lower urinary tract symptoms, were studied video-urodynamically when aged 12 days to 34 months (mean 10.4 months). Bladder filling and intravesical pressure recordings were obtained via a double lumen 18G (1.15mm in outer diameter) transurethral catheter. Contrast medium (room-temperatured, 30% meglumine iotalamate: Conray[®]) was instilled into the bladder at a rate of 10 ml/min. Intravesical, abdominal, and subtracted detrusor pressures were recorded simultaneously with pelvic floor muscle EMG activity through surface electrodes placed on the perineal skin. All examinations were carried out without any anesthesia or sedatives with the infants lying supine. When the recordings were interfered by lack of cooperation, such as crying, the study was repeated until interpretable data was obtained. Of these infants, 49 infants (37 boys and 12 girls) were diagnosed to have primary VUR after V-UDS. The urodynamic findings in the infants with VUR (VUR(+)) were compared with those obtained in 30 infants (24 boys and 6 girls) without VUR (VUR(-)) group). Assessment of V-UDS included detrusor overactivity (DO), detrusor compliance, bladder capacity, end filling detrusor pressure (threshold pressure), maximum voiding detrusor pressure ($P_{\text{det max void}}$), detrusor contraction pattern during voiding, and post-void residual urine volume (PVR). However, in the group with VUR, detrusor compliance, bladder capacity and PVR were excluded for evaluation since these parameters were affected by the presence of VUR. The values are expressed as mean \pm SD. An unpaired two-tailed Student *t*-test was used for comparisons between groups of subjects. A linear regression was used for the analysis of the relationship between parameters and age. Chi-square test was used to compare the incidence of DO and of each detrusor contraction pattern during the voiding phase between groups. The significance level was $p < 0.05$.

Results

Twenty-five % of infants had DO in VUR(+) group, whereas 11 % in VUR(-) group. However, the incidence of DO between the two groups was not significantly ($p = 0.29$) different. Bladder capacity significantly increased with age: bladder capacity(ml) = $3.17 \times \text{age}(\text{month}) + 21.75$ ($R^2 = 0.36$ $P < 0.01$ $n = 54$). The end filling detrusor pressure was 5.7 ± 3.1 1-19 cmH₂O and 6.1 ± 3.9 1-20 cmH₂O in VUR(-) and VUR(+) groups, respectively. And this pressure was less than 10 cmH₂O in 93 of infants. The detrusor compliance (median 9.5 ml/cmH₂O, ranged 2.8-27.0, $n = 33$) had no significant correlation with age, but it significantly correlated with bladder capacity: detrusor compliance (ml/cmH₂O) = $0.11 \times \text{bladder capacity (ml)} + 3.71$ ($R^2 = 0.48$ $P < 0.01$ $n = 33$). $P_{\text{det max void}}$ was significantly ($p < 0.01$) higher in boys (mean 89.9 cmH₂O, ranged 44-171) than that in girls (mean 49.8 cmH₂O, ranged 22-87). In boys, $P_{\text{det max void}}$ showed a significant negative correlation with age ($R^2 = 0.06$ $P = 0.04$ $n = 70$, Fig. 1), as well as bladder capacity ($R^2 = 0.12$ $P = 0.04$ $n = 36$, Fig. 2). In girls, $P_{\text{det max void}}$ did not change with age. EMG recordings were interpretable in 81 subjects. In 90 % (73/81) of subjects, pelvic floor EMG activity increased intermittently during the voiding phase. The interrupted voiding pattern, which is characterized as a polyphasic (Fig. 3) or intermittent (Fig. 4) detrusor

contraction pattern during the voiding phase, was observed in 75% (55/73 voiding cycles) of VUR(+) group, which was significantly ($p=0.017$) less frequent in VUR(-) groups (46% (46/79 voiding cycles)). In boys, the mean $P_{det\ max\ void}$ in those who showed the interrupted voiding pattern was significantly higher than that in the infants with monophasic detrusor contraction pattern (97.9 vs. 84.7; $p=0.029$). Mean PVR was 5.0ml (range 0-35) and 8.7ml (range 0-20) in boys and girls, respectively. PVR was less than 10 ml in 68% of infants (74% of boys and 50% of girls), and only 5 infants had more than 20 ml of PVR.

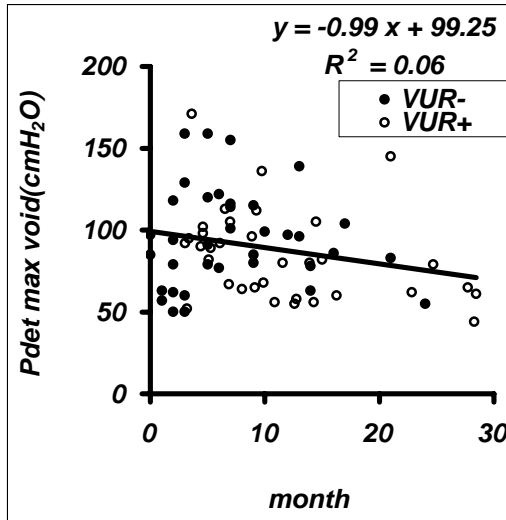


Fig. 1

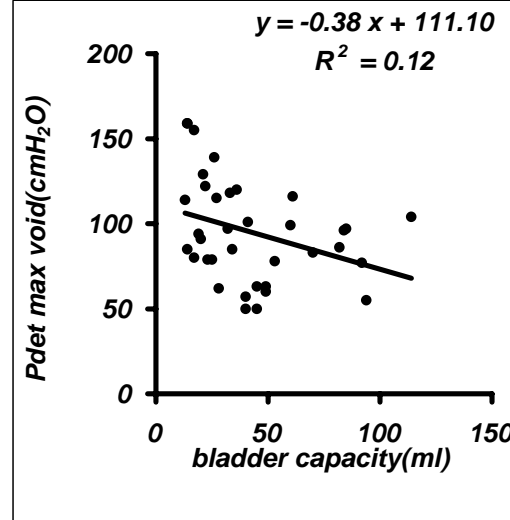


Fig. 2

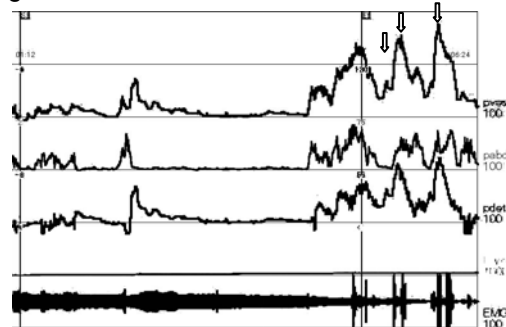


Fig. 3 Polyphasic contraction pattern
Arrows shows occurrence of voidings.

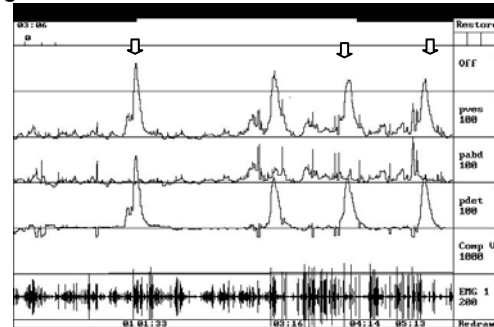


Fig. 4 Intermittent contraction pattern
Arrows shows occurrence of voidings

Interpretation of results

An interrupted voiding pattern with concomitant pelvic floor overactivity is commonly observed in V-UDS in young infants. This abnormal voiding pattern is more common in the infants with VUR than those without VUR. Male infants void with a higher pressure than female infants. In male infants, those who showed the interrupted voiding pattern had significantly higher voiding pressure than those with normal monophasic voiding pattern. The high voiding pressure observed in boys gradually decreases with maturation, which is also associated with an increase in bladder capacity. This gender difference may reflect the anatomical difference of the bladder outlet and/or possible gender difference of maturation.

Concluding message

The present results support the view that detrusor-sphincter dyscoordination is physiological phenomenon even in normal young infants, representing immature neural control of the lower urinary tract. This dyscoordinated voiding pattern is more likely to occur in infants with VUR, and may lead high pressure voiding especially in male infants. Therefore, this dyscoordinated voiding pattern may have important implication for concepts about the genesis and persistence of VUR.

References

1. Urodynamic patterns in infants with normal lower urinary tract or primary vesico-ureteric reflux. Br J Urol, 81: 461-467, 1998.

2. Urodynamic pattern in asymptomatic infants: siblings of children with vesico-ureteral reflux. *J Urol*, 162: 1733-1738, 1999.