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IMPACT OF POSTERIOR URETHRAL DIAMETER / EXTERNAL URETHRAL DIAMETER RATIO AS A NEW TOOL TO PREDICT HIGH DETRUSOR PRESSURE IN VOIDING PHASE IN CHILDREN

Hypothesis / aims of study
Since lower urinary tract (LUT) dysfunction can cause vesicoureteral reflux and urinary tract infection in children, we often need to evaluate LUT function in urodynamics including videourodynamics (VUDS). However, VUDS is invasive for children and it is necessary to develop a more useful tool to evaluate LUT function. To evaluate lower urinary tract abnormalities in children, voiding cystourethrography has been widely used as a diagnostic procedure and less invasive compared to VUDS(1). In the present study, we measured ratio of posterior urethra diameter to external urethral sphincter diameter (PUD/EUSD ratio), which could be measured on voiding cystourethrography as well, and investigated the relation of PUD/EUSD ratio to detrusor pressure (Pdet) during voiding on VUDS.

Study design, materials and methods
Sixty children, who were less than 3 years old and underwent VUDS, were enrolled in the present study. Gender was 35 boys and 25 girls. Of 60 children, 19 had neurological disease that may cause LUT dysfunction and the other 41 children had no apparent neurological abnormalities. We measured PUD and EUSD at the time of the widest EUS during voiding in VUDS (Fig.1). PUD/EUSD ratio was investigated comparing to Pdet at the time of the widest EUS during voiding. Statistical analysis was performed using the Student t-test to compare data in different groups and p-value <0.05 was considered to indicate a statistically significant difference.

Results
Seventy-five VUDS was done in 60 patients. Median age at VUDS was 11.1 months old (0.5-33 months). This study revealed a significant correlation between PUD/EUSD ratio and Pdet ($r=0.670$, $p<0.001$, Fig. 2-A). However, a significant correlation was not identified between PUD/EUSD ratio and age ($r=0.180$). Defining more than 80cmH_2O in Pdet as a high voiding pressure, 2.4 of PUD/EUSD ratio was a good predictor as a cut-off value of high voiding pressure as following: sensitivity 87.5%, specificity 98.5%, positive predictive value (PPV) 87.5%, negative predictive value (NPV) 98.5%(Fig. 2-B). Further, Pdet during voiding was significantly higher in children with ≥2.4 of PUD/EUSD ratio (110.7 cmH_2O) compared to <2.4 of PUD/EUSD ratio (49.7 cmH_2O). Focused on 19 children who had neurological disease, a significant correlation was also identified between PUD/EUSD ratio and Pdet ($r=0.842$, $p<0.001$). Using 2.4 of PUD/EUSD ratio as a cut-off value of high pressure voiding, Pdet during voiding was significantly higher in children with ≥2.4 of PUD/EUSD ratio (Fig.3-A) and 2.4 of PUD/EUSD ratio was a useful cut-off value to predict high pressure voiding as well: sensitivity 100%, specificity 96.3%, PPV 83.3%, NPV 100% (Fig.3-B).

Interpretation of results
Focused on LUT function, high Pdet during voiding reflects impaired coordination between the detrusor and the urethral sphincter. The present study indicated that PUD/EUSD ratio can be used for screening of high Pdet during voiding in voiding cystourethrography, especially in children who had neurological disease.

Concluding message
PUD/EUSD ratio was a valuable tool to predict high pressure voiding in pediatric patients. We recommend from the present study that ≥2.4 of PUD/EUSD ratio in voiding cystourethrography is suitable for indication to perform the more invasive test such as VUDS.

Fig. 1 PUD/EUSD ratio

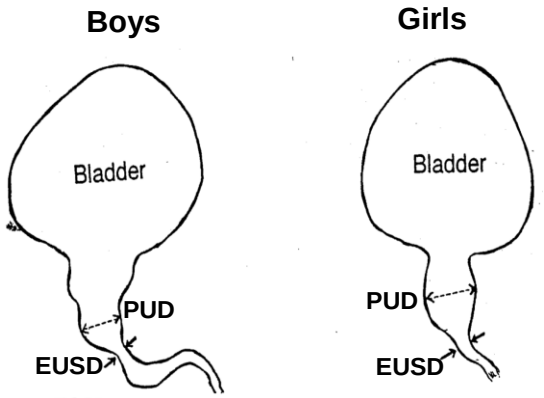
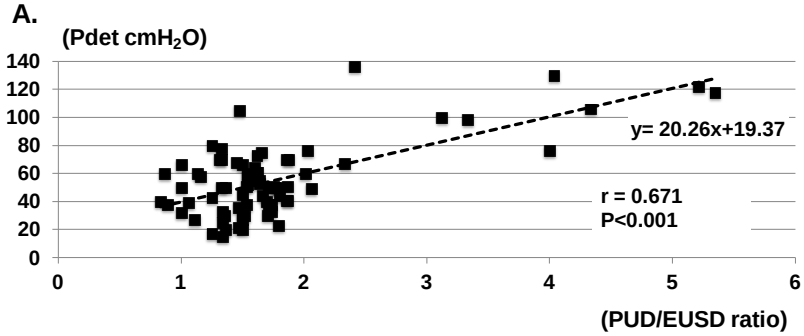


Fig. 2 Pdet versus PUD/EUSD ratio

A.



B.

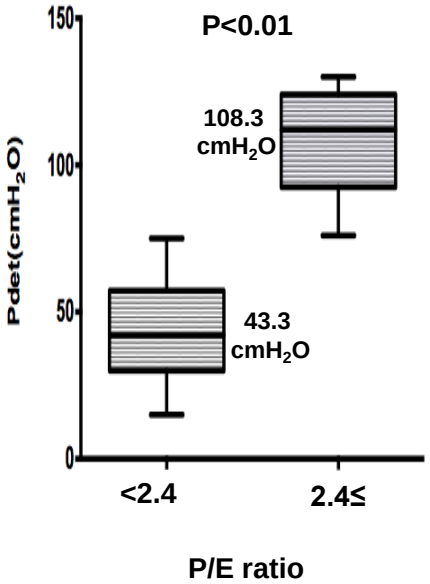
PUD/EUSD ratio

Pdet (cmH_2O) Cut-off	<2.4	2.4≤	total
80<	1	7	8
≤80	66	1	67
total	67	8	75

Sensitivity: 87.5%
Specificity: 98.5%
PPV: 87.5%
NPV: 98.5%

Fig. 3 Pdet versus PUD/EUSD ratio: Neurological Disease

A.



B.

PUD/EUSD ratio

Pdet (cmH_2O)	<2.4	2.4≤	total
80<	0	5	5
≤80	26	1	27
total	26	6	32

Sensitivity: 100%
Specificity: 96.3%
PPV: 83.3%
NPV: 100%

References
1. Kakizaki, et al., J Urol., 169:655-658 (2003)

Disclosures
Funding: None **Clinical Trial:** Yes **Public Registry:** No **RCT:** No **Subjects:** HUMAN **Ethics Committee:** Ethics Committee, Hokkaido University Hospital **Helsinki:** Yes **Informed Consent:** Yes