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A STUDY OF THE RELATIONSHIP BETWEEN BLADDER COMPLIANCE, DETRUSOR PRESSURE AND UPPER URINARY TRACT DILATION AT DIFFERENT BLADDER FILLING STAGES

Hypothesis / aims of study

In 1983, McGuire reported that 70% patients will suffer from upper urinary dilation (UUTD) when the detrusor leak point pressure (DLPP) increased higher than 40cmH_2O in children with neurogenic bladder (NB). Thereafter, Kurzrock demonstrated that bladder compliance (BC) lowers than 9ml/cmH_2O was a risk factor for UUTD. However, it is difficult to explain that some cases of NB children vesicoureteral reflux happened during filling phase although their detrusor pressure was less than 40cmH_2O. Therefore, we hypothesized that bladder filling pressure less than 40cmH_2O couple with low BC may be more accurate to predict UUTD in NB children. Therefore, we explore the relationship between BC, detrusor pressure (P_{det}) and UUTD at different bladder filling stages and whether they were more accurate in predicting UUTD in NB children.

Study design, materials and methods

One hundred and thirty eight children (3~16y) with NB were included in this study. They were divided into 2 groups: UUTD group (n=32) and control group (n=106), according to whether complicated with UUTD. Their urodynamic parameters were retrospectively analyzed. BC and Pdet of different filling volume (1/3, 2/3 and full of the total filling volume, they were defined as early, middle and end filling stage) were recorded. Then, we analyzed their sensitivity and specificity to predict UUTD. Data of different filling stages was analyzed by one-way ANOVA and Receiver Operating Characteristic (ROC) Curve.

Results

Compared with the control group, BC of UUTD group significantly decreased in middle and end filling stages (Table 1), Pdet significantly increased in all filling stages (Table 2).

ROC curve showed BC lower than 8ml/cmH_2O in middle and end filling stage was more specific than that lower than 9ml/cmH_2O in the end stage, and Pdet separately higher than 8cmH_2O, 20cmH_2O and 25cmH_2O in early, middle and end filling stage were more sensitive than that higher than 40cmH_2O in the whole filling phase. Pdet higher than 20cmH_2O in middle filling stage showed a good prediction of UUTD according to the area under the ROC curve criterion. The details are shown in Table 3, 4 and Figure 1 and 2.

Table 1. BC (ml/cmH_2O) in different filling stages in UUTD and control group (mean±SD)

Group	n	early stage	middle stage	end stage
UUTD	32	14.6±29.3	10.2±14.5	10.5±14.2
Control	106	22.8±22.4	26.5±34.1	27.7±41.3
t		1.684	2.628	2.310
P		0.095	0.01*	0.02*

*P<0.05

Table 2 Pdet (cmH_2O) in different filling stages of UUTD and control group (mean±SD)

Group	n	early stage	middle stage	end stage
UUTD	32	15.6±10.7	28.1±13.2	37.8±16.9
Control	106	6.1±4.9	12.3±9.3	18.8±14.3
t		7.050	7.591	6.308
P		0.00 *	0.00*	0.00*

*P<0.05

Table3 The sensitivity and specificity of BC in different filling stages to predict UUTD

middle filling phase					end filling phase				
BC (ml/cmH2O)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	BC (ml/cmH2O)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
<4	41	93	76	70	<4	31	93	75	67
<6	67	84	73	79	<6	66	84	74	79
<8*	75	73	63	81	<8*	75	71	63	81
<9	78	64	59	77	<9	75	62	57	79
<10	78	60	57	81	<10	78	61	57	81
<12	81	57	54	82	<12	81	55	55	81
<16	88	50	51	86	<16	88	44	51	85

* Most accurate PPV= Positive Predictive Value NPV= Negative Predictive Value

early filling phase					middle filling phase				
Pdet (cmH2O)	sensitivity (%)	specificity (%)	PPV (%)	NPV (%)	Pdet (cmH2O)	sensitivity (%)	specificity (%)	PPV (%)	NPV (%)
>20	25	99	94	66	>40	13	98	81	63
>15	50	94	85	74	>30	44	93	84	71
>10	66	83	72	79	>25	53	91	82	75
>8*	81	71	65	85	>20*	84	80	80	88
>6	81	67	62	84	>18	84	74	78	88
>4	84	49	52	83	>16	88	69	70	89

end filling phase				
Pdet (cmH2O)	sensitivity (%)	specificity (%)	PPV (%)	NPV (%)
>40	50	88	74	73
>30	69	79	70	79
>25*	84	75	70	88
>20	88	61	60	89
>18	88	59	60	90
>16	88	55	56	90

Table 4 The sensitivity and specificity of Pdet in different filling stages to predict UUTD
* Most accurate PPV= Positive Predictive Value NPV= Negative Predictive Value

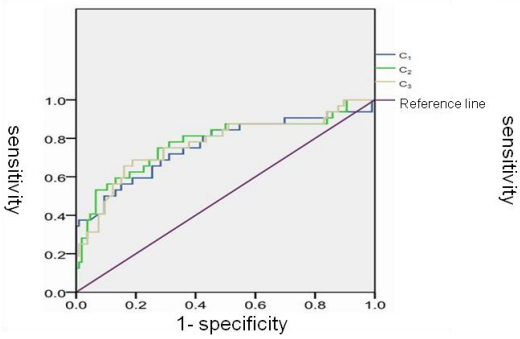

Figure 1 ROC curve of BC in different filling stages

C_2 curve point of tangent is 7.5, AUC=0.779;
C_3 curve point of tangent is 8, AUC=0.770.

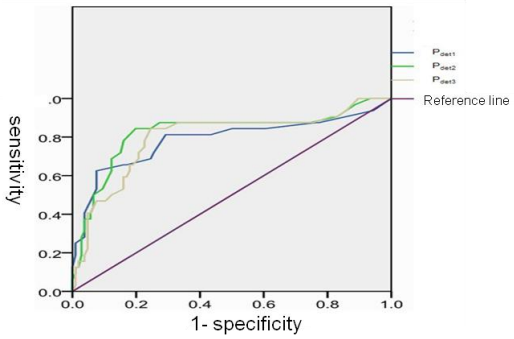

Figure 2 ROC curve of P_{det} in different filling stages

P_{det1} curve point of tangent is 8, AUC=0.786;
P_{det2} curve point of tangent is 20, AUC=0.895;
P_{det3} curve point of tangent is 25, AUC=0.797.

Interpretation of results

The lower BC in middle and end filling stages and the higher Pdet in early, middle and end stages are more relevant to UUTD. The Pdet higher than 20cmH_2O in middle filling stage had a good prediction of UUTD.

Concluding message

BC and Pdet at different bladder filling stages are more relevant to UUTD, and they are more accurate in predicting UUTD in NB children.

Disclosures

Funding: NONE **Clinical Trial:** No **Subjects:** HUMAN **Ethics Committee:** Ethics Committee of The First Affiliated Hospital of Zhengzhou University **Helsinki:** Yes **Informed Consent:** Yes