184 Can the severity of bladder deformity predict storage bladder pressure, and does it relate to upper urinary tract damage in neurogenic bladder patients?

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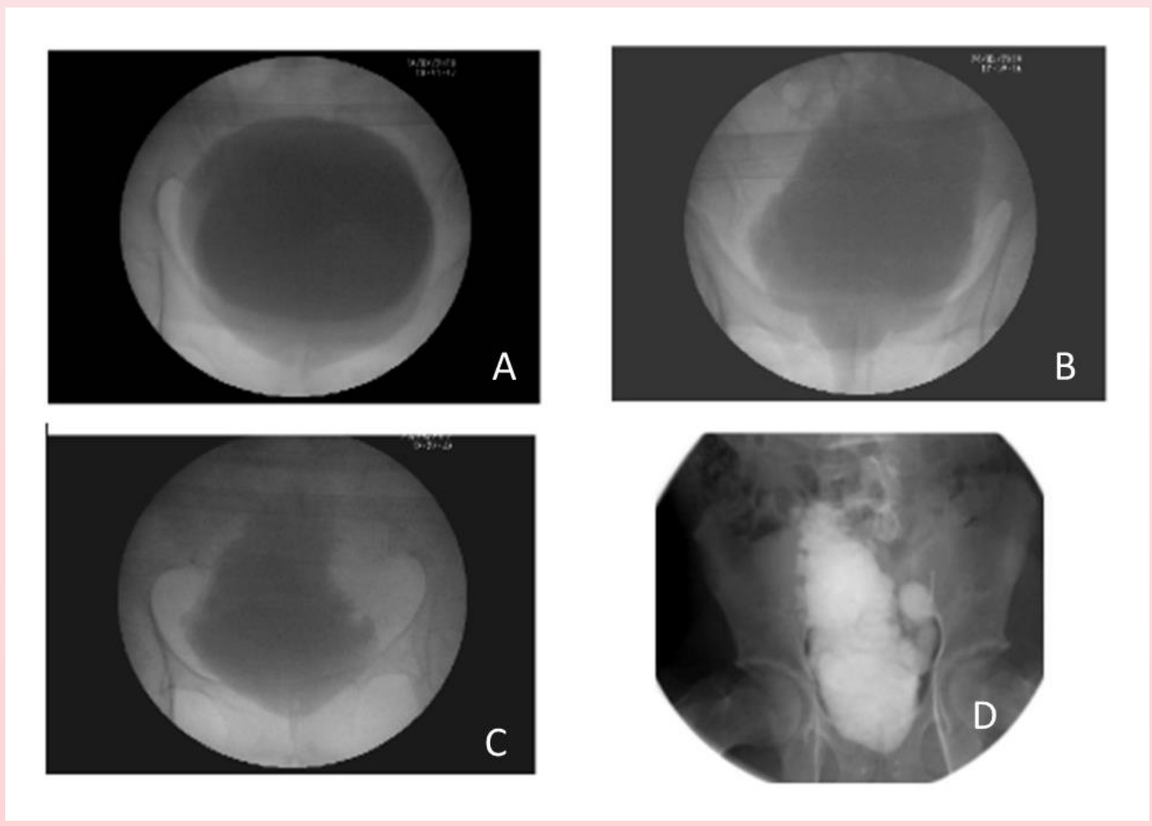
Aim of Study

This original study is the first that demonstrates the association between the severity of bladder deformity in patients with neurogenic lower urinary tract dysfunction (NLUTD) and the level of the storage detrusor pressure (Pdet). One of the goals of bladder management in patients with NLUTD is to maintain low storage pressure to preserve the upper urinary tract (1). A urodynamic study is undoubtedly helpful in monitoring the bladder status and evaluating the storage bladder pressure. However, there are limitations to performing this study in many areas worldwide, especially in underdeveloped and developing countries where the equipment might not be available. On the other hand, cystography is a basic investigation, as it is easy to perform and available in most areas. Previous studies have demonstrated that severe bladder deformity is associated with upper urinary tract damage (UUTD) and urinary tract infection (2,3). This study aimed to evaluate the severity of bladder deformity relating to the level of storage detrusor pressure and the risk of developing UUTD in patients with NLUTD.

The severity of bladder deformities



A, normal; B, mild (elongate shape, smooth wall); C, moderate (pine shape with multiple diverticulum); D, severe (small and contracted bladder with multiple diverticulum).

Interpretation of results

After excluding nine patients from the study (four patients had previous pelvic irradiation, five patients had concomitant brain lesion), 102 patients met the eligible criteria. Age, sex, underlying diseases, bladder drainage patterns, spinal cord lesion level, type of spinal cord pathology, cystometric capacity, and detrusor overactivity were not significantly different between the two groups, Group 1 had 77 patients with significantly lower storage detrusor pressure at 9 cmH_2O. In comparison, group 2 had 25 patients with storage detrusor pressure at 29 cmH_2O (p-value <0.001). Group 2 had more patients who had low compliance bladder (70.8%, p-value <0.001) and detrusor sphincter dyssynergia (76%, p-value 0.022) than Group 1. 60% of patients in Group 2 needed to do CIC. In comparison, in Group 1, there were only 32%. After performing both univariable and multivariable analysis for the risk ratio related to UUTD, Group 2 had a higher risk of developing UUTD when compared to Group 1 (Risk ratio[RR] 3.08 and 3.45, respectively [p <0.05]).

Conclusion

Our study suggests moderate to severe bladder deformity relates to high storage detrusor pressure at 29 cmH_2O and low compliance bladder. Also, moderate to severe bladder deformity is significantly related to upper urinary tract damage. We therefore suggest using the severity of bladder deformity obtained from cystography to estimate the storage bladder pressure together with surveillance of the risk of developing UUTD.

Reference

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3.Shigemura K, Kitagawa K, Nomi M, Yanagiuchi A, Sengoku A, Fujisawa M. RIsk factors for febrile genito-urinary infection in the catheterized patients by with spinal cord injury-associated chronic neurogenic lower urinary tract dysfunction evaluated by urodynamic study and cystography: a retrospective study. World J. Urol. 2020;38:733-40.

Demographic Data

Patient Characteristic	Group 1[a] (N = 77)	Group 2[b] (N = 25)	p-value[f]
Age, year			
Mean (SD)	49 (22)	51 (21)	0.630
Sex			
Male, n (%)	44 (57.14)	14 (56.00)	
Female, n (%)	33 (42.86)	11 (44.00)	1.000
DM, n (%)			
Yes, n (%)	46 (59.74)	15 (60.00)	
No, n (%)	31 (40.26)	10 (40.00)	1.000
Bladder drainage pattern			
Spontaneous void, n (%)	39 (50.65)	8 (32.00)	
CIC, n (%)	25 (32.47)	15 (60.00)	
Indwelling catheter, n (%)	13 (16.88)	2 (8.00)	0.059
Level of spinal cord lesion			
Suprasacral, n (%)	58 (75.32)	17 (68.00)	
Sacral, n (%)	19 (24.68)	8 (32.00)	0.602
Spinal cord pathology			
Spinal dysraphism, n(%)	7 (9.09)	4 (16.00)	
Spinal cord disease[c], n (%)	44 (57.14)	12 (48.00)	
Spinal cord injury[d], n (%)	26 (33.77)	9 (36.00)	0.597
Cystometric capacity, mL			
Mean (SD)	275(146)	245(104)	0.351
Low compliance[e]			
Yes, n (%)	17 (22.08)	17 (70.83)	
No, n (%)	60 (77.92)	7 (29.17)	<0.001
DO			
yes, n (%)	30 (38.96)	8 (32.00)	
no, n (%)	47 (61.04)	17 (68.00)	0.637
Storage detrusor pressure[g], cmH_2O	9, 4 - 15	29, 20 - 35	<0.001
Median, IQR			
DSD			
yes, n (%)	38 (49.35)	19 (76.00)	
no, n (%)	39 (50.65)	6 (24.00)	0.022
UUTD			
yes, n (%)	14 (18.18)	14 (56.00)	
no, n (%)	63 (81.82)	11 (44.00)	0.001

Study design, materials and methods

We retrospectively reviewed hospital records of 111 patients diagnosed with NLUTD from traumatic spinal cord injury, spinal dysraphism, and spinal cord diseases (disc disease, ruptured AVM, infection, etc.) visiting our Neurogenic Bladder clinic between 2016 to 2020. The inclusion criteria were patients who had been subjected to both videourodynamic evaluation and renal ultrasound. The exclusion criteria were patients who had previous pelvic irradiation, other concomitant neurological diseases (stroke, Parkinson's, etc.), other urological diseases (stone, tumor, etc.). We defined UUTD as patients who had vesicoureteral reflux or hydronephrosis.

Using radiographic images from videourodynamic studies, we categorized the severity of bladder deformities according to cystometric capacity, into normal, mild, moderate, and severe groups according to Ogawa's classification (2). The storage detrusor pressure was defined as the detrusor pressure at cystometric capacity. Then, we identified the median of storage detrusor pressure in each group, including association with the UUTD. After using the Kruskal-Wallis test, we found that normal and mild groups were not significantly different in storage detrusor pressure. Neither were moderate and severe groups significantly different. Therefore, we combined normal and mild deformity into Group 1 and moderate and severe deformity into Group 2. The median storage detrusor pressure between these two groups was significantly different. Previous study showed the incidence of upper tract deterioration was 8% in mild bladder deformity and 52% in moderate bladder deformity (2). In calculating the sample size between groups 1 and 2 with type 1 error, power 80% and two-sided test, we found the required sample size was 20 for each group. For continuous parametric data, we used the student t-test for analysis and Mann–Whitney U test for non-parametric data, which were reported by using median and interquartile ranges. We used the exact test for categorical data. To identify the association between bladder deformity and upper urinary tract damage, we used binary regression analysis.

Box plot demonstrating median storage pressure in Groups 1 and 2