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The bladder wall thickness measured by ultrasound in patients with spinal cord injuries

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Introduction

Spinal cord injury (SCI) causes permanent neurologic deficits and leads to damage across all body systems including bladder function. Increased bladder wall thickness (BWT) can be useful parameter to evaluate the voiding dysfunction. Diagnosis of dysfunctional voiding is possible from bladder volume-pressure data such as parameters of cystometry. However it is bothersome for the patient, time-consuming, and associated with a considerable morbidity. Therefore, noninvasive test such as ultrasound measurement of BWT has recently been a growing interest. Our aim was to investigate whether measurement of BWT correlates with parameters of cystometry and compare the BWT in SCI groups according to the ASIA classification.

Methods

Twenty one patients with SCI were enrolled in the study. The manual cystometry was performed by infusion of a room temperature saline solution and intravesical pressure was measured. Patients were divided into 3 groups (underactive, normoactive, and overactive bladder) according to the intravesical pressure. Overactive bladder was defined as a phasic pressure change of more than 15cmH2O in filling phase. Underactive bladder was defined as no urgency until 500ml of saline infusion. The anterior bladder wall was measured by ultrasound on midway between the anterior wall midline and the lateral bladder wall. The bladder wall was represented by all 3 layers: mucosa/submucosal, detrusor and adventitia, and we defined BWT to the thickness of detrusor layer (Figure 1). The ultrasound was performed when the patients felt the desire to void or just before the CIC was performed. We analyzed the following 3 points. First, we classified the patients to motor-complete (ASIA-A and –B), and motor-incomplete (ASIA-C, and –D) groups, and evaluated the difference of BWT between the 2 groups. Second, we evaluated the difference of BWT in underactive, normoactive, and overactive bladder groups. Third, we analyzed the correlation between BWT and bladder compliance.

Results

Of 21 patients, 6 were in motor-complete group and 15 were in motor-incomplete group. According to intravesical pressure, 9 were in underactive, 5 were in normoactive, and 7 were in overactive bladder group. The mean BWT was 19.07mm and significantly higher in patients with motor-complete group ($p<0.05$) (Table 1) and overactive bladder group ($p<0.05$) (Table 2). Negative correlation between BWT and bladder compliance (Pearson's $r = -0.88$) was shown, however it was not statistically significant ($p=0.704$).

Conclusion

This study reveals that increased BWT present in patients with motor-complete SCI and overactive bladder. In patients who are difficult to be performed by invasive tests such as urodynamic study, the noninvasive ultrasound measurement of BWT could give information of voiding function to physicians.

Table 1. Comparison of the BWT of motor-complete (ASIA-A and –B) vs motor-incomplete (ASIA-C, and –D) groups

Variables	Motor-complete (ASIA-A, ASIA-B)	Motor-incomplete (ASIA-C, ASIA-D)	p-value
Number	5	16	
BWT	24.80±7.03	17.28±6.11	0.031*

Values are mean ± standard deviation.

**p<0.05: comparison of 2 groups in student's t-test.*

Table 2. Comparison of the BWT of underactive, normoactive, and overactive bladder groups

Variables	Underactive bladder	Normoactive bladder	Overactive bladder	p-value
Number	9	5	7	
BWT	18.91±6.56	13.52±3.72†	23.22±7.05†	0.048*

Values are mean ± standard deviation.

**p<0.05: comparison of 3 groups in one-way ANOVA*

† p=0.040: comparison of overactive bladder group and underactive bladder group in post analysis (Tukey's HSD test)

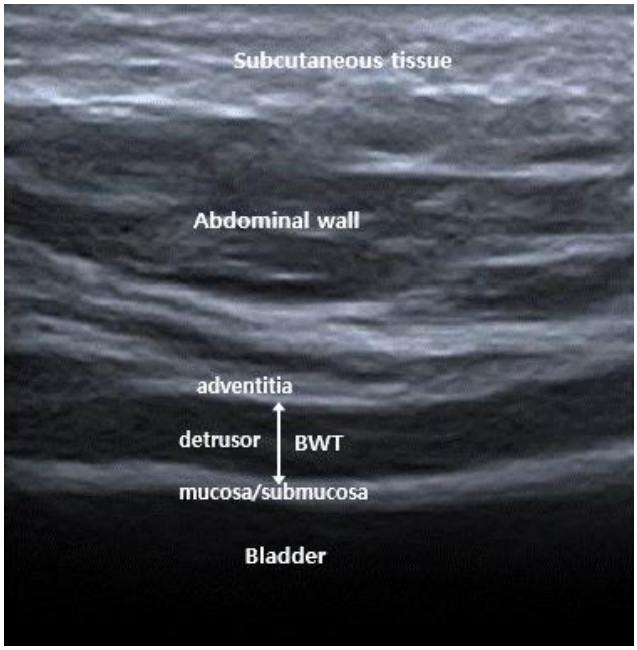

Figure 1. Ultrasonographic measurement of BWT of the anterior bladder wal