



Tae-Hoon Song¹, Seong-Yeol Kim^{1,2}, Da-Sol Kim^{1,2}, Yu Hui Won^{1,2},
Sung-Hee Park^{1,2}, Myoung-Hwan Ko^{1,2}, Jeong-Hwan Seo^{1,2}, Gi-Wook Kim^{1,2}

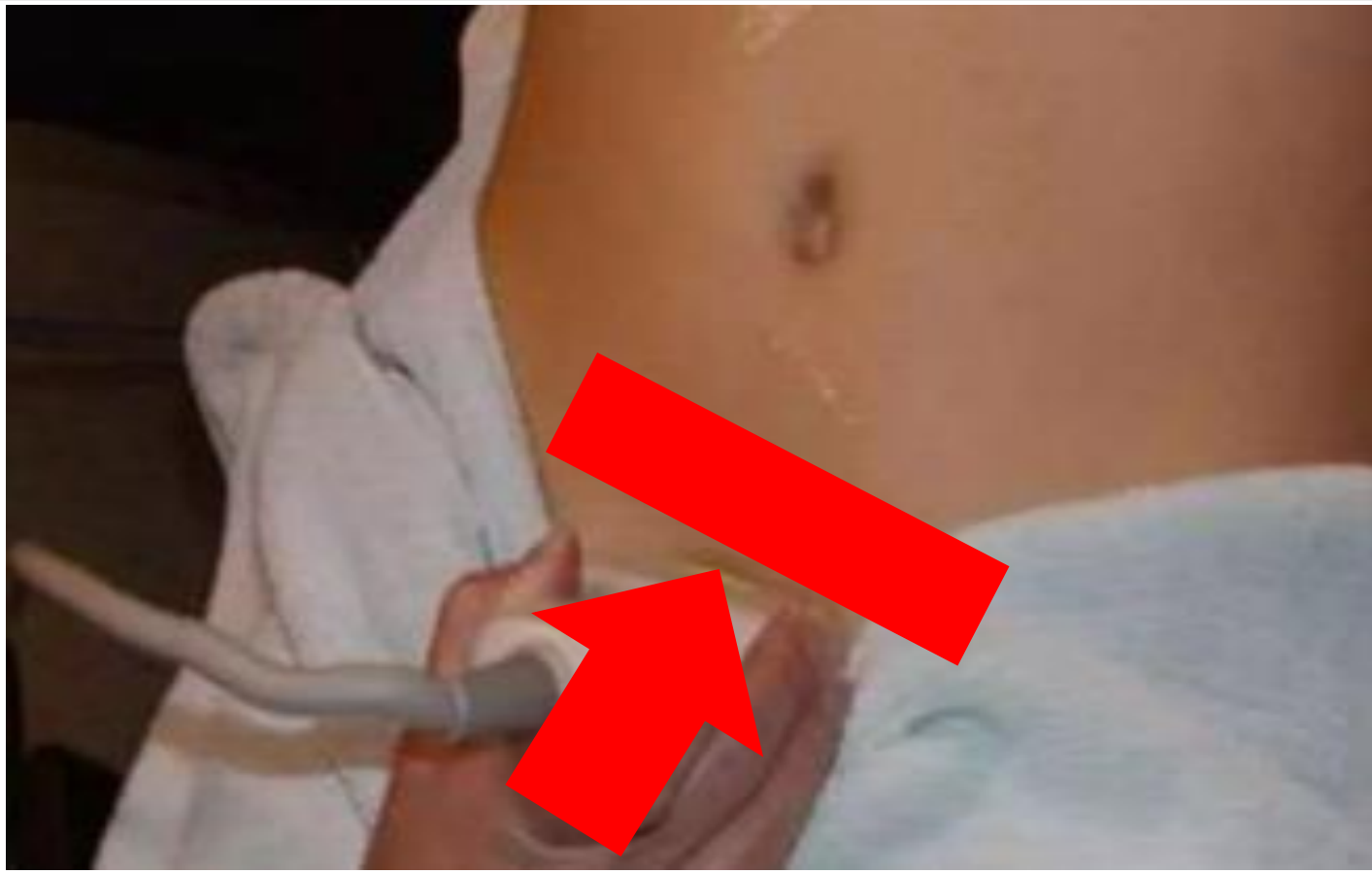
¹Department of Physical Medicine & Rehabilitation, Jeonbuk National University Medical School, Jeonju, Korea
²Research Institute of Clinical Medicine, Biomedical Research Institute of Jeonbuk National University Hospital

Introduction

- **Neurogenic bladder**
 - ✓ Common and significant complication in patients with spinal cord injury(SCI)
 - ✓ To evaluate neurogenic bladder, we perform voiding cystourethrography (VCUG) to assess bladder trabeculation (BT) and urodynamic studies (UDS) to evaluate bladder function
- **Voiding cytourethrography(VCUG)**
 - ✓ Limitations : two-dimensional evaluation and invasiveness
- **Purpose of this study**
 - ✓ To compare the three-dimensional grading of BT using ultrasound with BT grading from VCUG in SCI patients.
 - ✓ To compare the functional evaluation data of UDS based on VCUG versus BT grading on ultrasound.

Methods

- **Participants** : 17 patients diagnosed with neurogenic bladder in patients with spinal cord injury
- **Position in ultrasound**
 - ✓ Holding the pubic symphysis as the center and moving the ultrasound probe upward
 - ✓ Selected largest diameter area and measured both BT grade and bladder wall thickness
- **BT grade system through VCUG**
 - ✓ Grade 0: no trabeculation in the bladder
 - ✓ Grade 1: trabeculation area < 1/2 of bladder
 - ✓ Grade 2: ≥1/2 of bladder and depth ≥5mm and <10mm
 - ✓ Grade 3: ≥1/2 of bladder and depth >10mm
- **UDS datas**
 - ✓ Detrusor-sphincter dyssynergia (DSD)/Peak detrusor pressure (Pdet)/Detrusor leak point pressure (DLPP)
- **Statistics Analysis**
 - ✓ Chi-square test was used to compare BT grades between VCUG and ultrasound
 - ✓ Kruskal-Wallis test of variance was used to compare UDS data according to BT grade between ultrasound and VCUG



Results

Table 1. Demographics of subject

Number	Male	11
	Female	6
	Total	17
Level of injury	Cervical	3
	Thoracic	7
	Lumbar	0
AIS impairment scale	A	3
	B	2
	C	5
	D	7

Table 2. Comparison of BT grade between VCUG and US

	VCUG (n=17)	US (n=17)	P value
Grade 0	10	4	0.008*
Grade 1	5	10	
Grade 2	2	3	

*p<0.05, significance of the Chi-square test; BT: bladder trabeculation; VCUG: voiding cystourethrogram; US: ultrasound.

Figure 1. BT grade through VCUG



Figure 2. BT grade through US

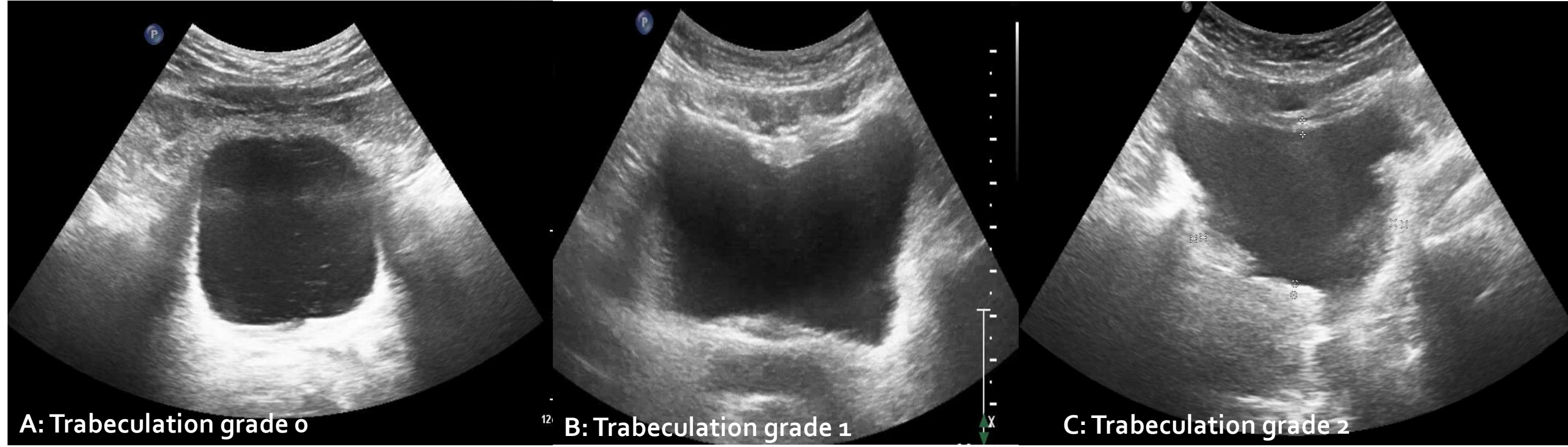


Table 3. Comparison of UDS Measurements according to BT grade through VCUG

BT grade by VCUG	Grade 0 (n=10)	Grade 1 (n=5)	Grade 2 (n=2)	P value
Measurements				
Pdet	34.50±13.88	26.40±20.37	3.00±0.00	0.120
DLPP	24.70±8.36	27.80±24.91	25.00±9.89	0.964
DSD	60%	80%	100%	

*p<0.05, significance of the Kruskal-Wallis test; BT: bladder trabeculation; UDS: urodynamic study VCUG: voiding cystourethrogram; Pdet: peak detrusor pressure DLPP: detrusor leak point pressure; DSD: detrusor-sphincter dyssynergia.

Table 4. Comparison of UDS Measurements according to BT grade through US

BT grade by US	Grade 0 (n=4)	Grade 1 (n=10)	Grade 2 (n=3)	P value
Measurements				
Pdet	34.75±22.98	31.80±14.35	8.66±9.81	0.130
DLPP	26.00±10.89	26.20±17.49	23.33±7.57	0.839
DSD	25%	80%	100%	

*p<0.05, significance of the Kruskal-Wallis test; BT: bladder trabeculation; UDS: urodynamic study US: ultrasound; Pdet: peak detrusor pressure; DLPP: detrusor leak point pressure; DSD: detrusor-sphincter dyssynergia.

- **Comparison of BT grade between VCUG and US**
 - ✓ there were significant differences in BT grade between ultrasound and VCUG in 7 patients (Table 2, p=0.008)
 - ✓ In all 7 patients, ultrasound indicated a higher grade of BT compared to VCUG.
 - ✓ Specifically, six patients had BT grade 0 on VCUG but grade 1 on ultrasound, while one patient had grade 1 on VCUG and grade 2 on ultrasound
- **Comparison of UDS measurements according to BT grade of US and VCUG**
 - ✓ US Pdet tended to decrease with increasing grades, while DLPP and DSD exhibited similar trends in both US and VCUG groups (Table3,4).

Conclusion

- Ultrasound can be a diagnostic method reflecting both structural and functional aspects, comparable to VCUG
- Further data is needed to enhance the diagnostic value of ultrasound.