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REAL-TIME FIVE-GRADE BLADDER SENSORY MEASUREMENT

Hypothesis / aims of study

Bladder sensation during filling cystometry has been measured using various grades of sensation: e.g., first sensation (FS), first desire to void (FDV), strong desire to void (SDV), etc. However, a definitive sensory measure to detect detrusor overactivity (DO) has yet to be established. Therefore, we devised a five-grade bladder sensory measurement and used it in real time to discriminate normal-detrusor and DO patients.

Study design, materials and methods

A total of 161 patients (78 men, 83 women, mean age 67.5 years) were enrolled in the study. We excluded patients who had marked dementia, spinal cord disorders and peripheral neuropathy, since this study requires intact sensory function. We administered a urinary questionnaire and performed simultaneous electromyography-cystometry. During medium-rate filling (50 ml/min), we instructed the patients to indicate their bladder sensation in five degrees: 1, FS; 2, obviously greater than 1 but less than 3; 3, FDV when he or she usually goes to toilet; 4, obviously greater than 3 but less than 5; and 5, SDV as he or she cannot hold urine any more, bladder capacity. During an event of DO, a 'realistic relation between detrusor pressure and sensory grade' was defined when a 10 cmH_2O increase/decrease in detrusor pressure was accompanied by a one-grade increase/decrease in sensory grade. We repeated the test once for reproducibility. Statistics were analyzed by the Student's *t*-test.

Results

Five-grade bladder sensory measurement was feasible and reproducible in all patients. Seventy-four patients had normal detrusors and 87 patients had DO; the latter were subdivided into terminal DO (n = 51) and phasic DO (n = 36). Seventy-seven percent of DO patients (terminal DO 75%, phasic DO 81%) had a realistic relation between DO and sensory grade increase. The 5th (4 to 5) sensory grade was most reliable for predicting DO; both terminal DO and phasic DO patients had significantly lower volume increase (52.2 ml and 47.4 ml, respectively) than that (70.0 ml) in normal-detrusor patients ($p<0.05$). In the first (0 to 1) sensory grade, phasic DO tended to have lower volume increase, although it was not statistically significant.

Interpretation of results

Previous studies have employed a two-grade method (traditional FS and SDV/bladder capacity), a three-grade method (the ICS recommended method), a four-grade method (FS, FDV, SDV, and compelling/urgent desire to void), and a continuous-grading method (visual-analogue scale). However, three grades or less is thought to be too small to detect DO in real time. Real-time five-grade bladder sensory measurement in the present study is a feasible and reproducible test to detect DO, although a realistic relation between DO and sensory grade increase was seen in only 77% of patients. DO provoked a more rapid than normal increase of bladder sensation, particularly at the end of bladder filling.

Concluding message

Real-time five-grade bladder sensory measurement is a feasible and reproducible test to detect DO, although a realistic relation between DO and sensory grade increase was seen in only 77% of patients. DO provoked a more rapid than normal increase of bladder sensation, particularly at the end of bladder filling.

sensation grade		0 to 1	1 to 2	2 to 3	3 to 4	4 to 5	average
DO- (n=74)		123.8 ml	39.8 ml	46.2 ml	36.7 ml	70 ml	72.5 ml
DO+ (n=87)	terminal DO (n=51)	120.1 ml	40.3 ml	30.8 ml	36.7 ml	52.2 ml*	73.3 ml
	phasic DO (n=36)	90.9 ml▲	35.9 ml	32.6 ml	36.7 ml	47.4 ml*	60.8 ml
	total (n=87)	108.1 ml	38.6 ml	31.5 ml	36.7 ml	50.4 ml*	68.1 ml

*: p<0.05
▲: not significant

Table 1 Bladder volume increase in each sensation grade.
DO: detrusor overactivity.

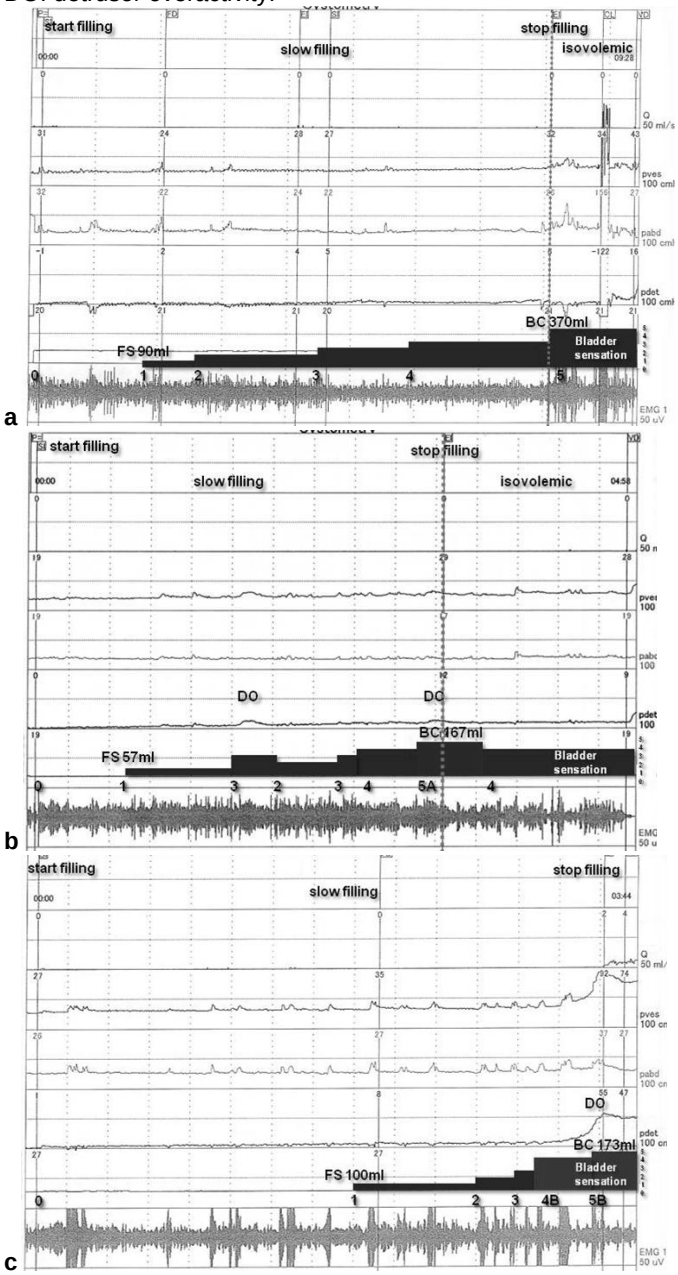

Figure 1 Examples of the real-time five-grade bladder sensory measurement.
A. normal detrusor,
B. phasic detrusor overactivity (DO),
C. terminal DO.

FS, first sensation (equivalent to grade 1); BC, bladder capacity (equivalent to grade 5); Q, flow rates; Pves, vesical pressure; pabd, abdominal pressure; pdet, detrusor pressure; EMG, electromyography.

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Was this study approved by an ethics committee?	**Yes**
Specify Name of Ethics Committee	**Ethics Committee in Sakura Medical Center, Toho University**
Was the Declaration of Helsinki followed?	**Yes**
Was informed consent obtained from the patients?	**Yes**