

# Bladder first-sensation-volume increase is primary in diabetic neuropathy: a five-grade measure

<sup>1</sup> **Ryuji Sakakibara**, <sup>2</sup> Megumi Sugiyama, <sup>2</sup> Haruka Nishimura, <sup>2</sup> Osamu Takahashi, <sup>1</sup> Fuyuki Tateno, <sup>1</sup> Masahiko Kishi, <sup>1</sup> Yohei Tsuyusaki, <sup>1</sup> Yosuke Aiba, <sup>3</sup> Housei Lee, <sup>4</sup> Tatsuya Yamamoto, <sup>5</sup> Chiharu Shibata, <sup>5</sup> Tomoyuki Uchiyama, <sup>5</sup> Tomonori Yamanishi

<sup>1</sup> Neurology, Internal Medicine, <sup>2</sup> Clinical Physiology Unit, <sup>2</sup> Urology, **Sakura Medical Center, Toho University, Japan** <sup>1</sup> Neurology, Chiba University, <sup>2</sup> Continence Center, Dokkyo Medical College

## Objectives

■ Diabetes commonly affects bladder nerves including the sensory nerves. However, bladder sensory impairment is not well recognized even by patients until it may lead to overflow urinary incontinence. We recently devised the five-grade measurement of bladder sensation, which we applied in diabetic patients, showing severe bladder sensory impairment.

## Methods

■ Total 177 subjects were enrolled in the study, comprising 16 diabetic distal neuropathy (without detrusor overactivity), 74 control, and 87 detrusor overactivity (DO) due mainly to brain diseases. We performed standard urodynamics, and we asked the patients as to bladder sensation in five degrees; 1: first sensation, 2: obviously greater than 1 but less than 3, 3: normal desire to void when he or she usually goes to toilet, 4: obviously greater than 3 but less than 5, 5: strong desire to void as he or she cannot hold urine any more, bladder capacity). Statistics was performed using *t*-test.

## Results

■ Five-grade bladder sensory measurement was feasible and reproducible in all patients. As compared with control group, diabetic neuropathy group showed markedly larger 0-1 grade (274.5 ml vs 123.8 ml,  $p < 0.05$ ), while other parameters (grades 1-2, 2-3, 3-4, 4-5) did not change significantly.

Sensation grade	Bladder volume increase in each sensation (mL)					Mean 1to5
	0 to1	1 to 2	2 to 3	3 to 4	4 to 5	
Diabetic neuropathy (n=16)	274.5	73.2	27.3	49.4	67.7	98.4
control (n=74)	123.8	39.8	46.2	36.7	70	72.5
DO (n=87)	108.1	38.6	31.5	36.7	50.4	68.1

\*P<0.05

•Table 1 Five-grade bladder sensory measurement in diabetic neuropathy, control and detrusor overactivity groups.

•Statistical significance was noted in the first sensation volume between diabetic neuropathy group with control group ( $p < 0.05$ ) and detrusor over-activity group ( $p < 0.05$ ).

•DO: detrusor over-activity

## Interpretation & Conclusion

■ **(Pathophysiology)** over-distension injury (due to polyuria), postganglionic Adelta (myelinated) and C (unmyelinated) small fiber denervation, and hyperglycemia itself result in various molecular changes in the bladder smooth muscles and urothelium: these changes represent reduced afferent nerve activity, due in part to intra-neuronal polyol cascade changes and ischemia.

■ **(Clinical relevance)** Pattern of bladder sensory disturbance might aid in neurological diagnosis in various diseases affecting the bladder. Since impaired bladder sensation affects quality of life in patients, it is worth looking at in diabetic patients.

■ We showed by the five-grade measurement that bladder first-sensation-volume increase is the primary sensory impairment in diabetic distal neuropathy. Therefore regular PVR measurement seems necessary.