

# Autonomic Dysreflexia Severity between Urodynamics and Cystoscopy in Patients with Spinal Cord Injury above T6

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## Abstract

**Objective:** The objective is to evaluate autonomic dysreflexia (AD) severity between urodynamics and cystoscopy in patients with spinal cord injury (SCI) above thoracic 6 (T6). **Design:** It is a cross-sectional survey. **Subject and methods:** The study was carried out in 22 patients with SCI above T6 who underwent both procedures of urodynamics and cystoscopy; all patients developed episodes of AD. The systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured and recorded at the beginning and during the various stages of the two examinations. AD was defined as a rise in SBP above 20 mm Hg. **Results:** There was no significant difference in SBP and DBP at baseline before urodynamics and cystoscopy. Both urodynamics and cystoscopy triggered episodes of AD. The volume of water instilled during cystoscopy was typically standard and smaller (150 mL) in comparison with urodynamics, where volume varied depending on cystometric bladder capacity (the mean bladder volume in our study was  $234.86 \pm 139.06$  mL). The SBP was significantly different between cystoscopy and urodynamics ( $49.23 \pm 23.07$  mm Hg and  $35.14 \pm 15.75$  mm Hg, respectively;  $P = 0.023$ ). **Conclusions:** Although bladder distension during cystoscopy was less than that in urodynamics, the severity of AD was more pronounced during cystoscopy. It is recommended that monitoring of cardiovascular parameters during these procedures should be routinely performed.

## Keywords

Autonomic Dysreflexia, Spinal Cord Injury, Urodynamics, Cystoscopy

## 1. Introduction

Spinal cord injury (SCI) is a significant cause of morbidity and mortality in developed nations, with a global annual incidence of 1:25,000 [1] [2]. Bladder dysfunction and autonomic dysreflexia (AD) are common outcomes of cervical and high thoracic SCI. AD is clinically defined as an elevation in systolic blood pressure (SBP)  $\geq 20$  mm Hg from baseline in response to noxious or innocuous stimuli below injury level [3]. It is an acute disease with symptoms ranging from mild, such as headache, sweating, hot flashes, piloerection, and anxiety, to severe [4] [5] [6] [7] [8], such as arrhythmia, including atrial fibrillation, and high SBP above 300 mmHg, which may lead not only to cerebral hemorrhage but also to convulsions and death [9] [10] [11]. Several stimuli can lead to AD, but the most common triggering factor is bladder distension, which accounts for up to 85% of cases [12]. The commonest urological procedures that can lead to AD are cystoscopy and urodynamics, secondary to bladder filling. The risk of inducing AD has been shown to be reduced with flexible cystoscopy in a cohort of six of 39 patients who had previously had AD during rigid cystoscopy [13] [14]. Considering the differences in the technique of cystoscopy and urodynamics, including the filling rate and method of filling, the severity of AD might be also difference between these two procedures. In this study, we evaluate the severity of AD in individuals with SCI at or above thoracic 6 (T6) level performed both urological procedures of urodynamics and cystoscopy.

## 2. Materials and Methods

A total of 22 consecutive patients with SCI at or above the T6 neurological level underwent both urodynamic and cystoscopic examinations during a 1-year period were screen. Only individuals who developed episodes of AD were selected included into this study. Exclusion criteria were the presence of additional neurological disorder or history of cardiovascular or genitourinary system disorder. The sex, age, duration of injury, the SCI level and class according to the American Spinal Cord Injury Association (ASIA) Impairment Scale (AIS) classification of the patients were recorded.

The urodynamics examination was performed following the standards of the International Continence Society. The examination consisted of cystometry with warm sterile water (37.1°C) filled at a fixed 30 mL per minute rate through a pump to a double lumen catheter (6 Fr, Laborie,) while patients were supine. Abdominal pressure was measured with an intrarectal balloon catheter (10 Fr, Laborie). Filling was stopped when the patient subjectively reported the sensation of fullness, urine leakage occurred or bladder filling reached 400 mL.

Cystoscopy was conducted with the patient in a lithotomy position; 150 mL of warm sterile water (37.1°C) were instilled into the bladder. The filling rate varied from 30 to 50 mL per minute through gravity filling while a rigid cystoscope was introduced into the urethra. When the scope entered the bladder, a systematic inspection of the bladder mucosa was carried out. Once cystoscopy was completed, the scope was withdrawn and bladder was emptied.

Before both of the two procedures, 10 mL of 2% lidocaine jelly was introduced intra-urethrally. The systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured and recorded at the beginning and every 1 minute infused during urodynamic and cystoscopic examinations. AD was defined as a rise in SBP above 20 mm Hg.

Statistical analysis Statistical analyses were performed by using SPSS 13.0 software (SPSS Inc., Chicago, IL, USA). The paired t test was used in the comparison of filling beginning and end SBP, DBP values of the patients. A P-value below 0.05 was considered statistically significant.

### 3. Results

Demographic and clinical features of the patients in the study were presented in **Table 1**. The mean age was  $40.73 \pm 14.43$  years, mean injury duration  $1.05 \pm 1.60$  years. Of the 22 patients, 16 (72.7%) were cervical and 6 (27.3%) were thoracic. The distribution of the American Spinal Injury Association Impairment Scale (AIS) scores were: 12 (54.5%) Grade A, 3 (13.6%) Grade B, 6 (27.3%) Grade C and 1 (4.5%) Grade D.

**Table 2** displays the SBP, DBP at baseline and changes during the urodynamics and cystoscopy. SBP and DBP at baseline before the two examinations were similar in these individuals. Both urodynamics and cystoscopy triggered episodes of AD. The volume of water instilled during cystoscopy was typically standard and smaller (150 mL) in comparison with urodynamics, where volume varied depending on bladder capacity (the mean bladder volume in our study was  $234.86 \pm 139.06$  mL). The SBP change were significantly different between cystoscopy and urodynamics ( $49.52 \pm 23.07$  mm Hg and  $35.14 \pm 15.75$  mm Hg respectively;  $P = 0.023$ ). Though DBP increase during AD, there are no different change between cystoscopy and urodynamics ( $P = 0.052$ ).

**Table 1.** The demographic and clinical features of the patients in the study.

Variables	n =22
Age, year	
Mean $\pm$ SD	$40.73 \pm 14.43$
Sex, N (%)	
Male	21 (95.5%)
Femal	1 (4.5%)
Disease duration, year	
Mean $\pm$ SD	$1.05 \pm 1.60$
Level of spinl cord injury, N (%)	
Cervical	16 (72.7%)
Thoracic	6 (27.3%)
AIS grade, N (%)	
A	12 (54.5%)
B	3 (13.6%)
C	6 (27.3%)
D	1 (4.5%)

SD: standard deviation; SCI: spinal cord injury; AIS: American spinal injury association impairment scale.

**Table 2.** The SBP, DBP at baseline and changes during the urodynamics and cystoscopy.

	Urodynamics	Cystoscopy	P-value
SBP baseline(mm Hg)	109.09 ± 8.76	109.27 ± 9.19	0.947
SBP changes (mm Hg)	35.14 ± 15.75	49.23 ± 23.07	0.023
DBP baseline(mm Hg)	69.77 ± 7.43	69.95 ± 7.61	0.936
DBP changes (mm Hg)	16.95 ± 9.579	23.41 ± 11.68	0.052

SBP: systolic blood pressure; DBP: diastolic blood pressure.

#### 4. Discussion

AD might not been aware well by the physicians and healthcare professionals who were outside of specialist spinal injury centres, leading to delays in treatment and potentially life-threatening consequences for patients [15]. Especially some patients might not be aware of being at risk [16] as AD can occur asymptotically, also known as silent AD, *i.e.*, without any clinical symptoms. Neurogenic lower urinary tract dysfunction (NLUTD) is a common consequence after SCI [17]. As stimuli from the lower urinary tract are the most common causes of AD, reportedly in 75% - 85% of cases [12]. Urodynamic investigation is the gold standard to evaluate lower urinary tract function and routine urodynamic study of SCI patients is crucial for clinical decision making [18] [19]. Cystoscopy is not only a normal inspection for NLUTD, but also is required when performed the treatment of bladder stone or Botulinum Toxin A bladder injection.

In our study though the volume of water instilled during cystoscopy was smaller in comparison with urodynamics, the increase in SBP during cystoscopy was significantly higher than urodynamics. Differences in the technique of each procedure, including the filling rate and method of filling, could be one reason explain the difference in severity of AD between cystoscopy and urodynamics. Other stimuli in addition to bladder distention might also be contributing to the development of AD during cystoscopy, such as urethral stimulation during cystoscopy [20]. The physiology of urethral afferents was different from bladder, it could be excited by low-threshold mechanical stimulation induced by movements of a urethral catheter, but not respond sensitive to bladder distension [21]. In our study when perform cystoscopy we uses a rigid cystoscope (21 Fr) which was larger in size than catheters required for urodynamics (6 Fr). So cystoscopy includes greater stimulation of the urethra and bladder neck afferents during the procedure through urethral/prostate/internal sphincter passage and dilation, which could then provides more intense afferent stimulation to the spinal cord and trigger more pronounced episodes of AD.

AD is a diagnosis of which all health professionals interacting with patients with SCI should be aware. In particular, as the commonest cause is genitourinary, the urologist should also be particularly careful whilst investigating patients with SCI.

## 5. Conclusion

Although bladder distension during cystoscopy was less than that in urodynamics, the severity of AD was more pronounced during cystoscopy. It is recommended that monitoring of cardiovascular parameters during these procedures should be routinely performed.

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## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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