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Original Article

Bladder management and urological complications in patients with chronic spinal cord injuries in Taiwan

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ABSTRACT

Objectives: Neurogenic voiding dysfunction (NVD) results in lower urinary tract symptoms and upper urinary tract complications. Management of urinary tract dysfunction in patients with spinal cord injury (SCI) must be based on patient needs and urological complications. This study surveyed the bladder management and urological complications in patients with SCI in Taiwan.

Materials and methods: A total of 894 patients with SCI were surveyed throughout Taiwan over a period of 5 years (2007–2011). All patients received neurological and urological examinations, renal sonography, bladder sonography, and urinalysis. They were further requested to report urinary tract infections (UTI), voiding conditions, and bladder management in the past 3 years. The bladder management and urological complications were analyzed based on different SCI levels and duration of disease.

Results: Among all patients, 39.7% voided spontaneously or by reflex, 23.8% used percussion to void, 20.9% voided by abdominal pressure, 18.1% used clean intermittent catheterization (CIC), and 22.9% had indwelling catheters or cystostomy. Detrusor sphincter dyssynergia (DSD) was noted in 39.7% of patients and autonomic dysreflexia (AD) in 19.9%. UTI was noted in 483 (54%) patients, hydronephrosis in 110 (12.3%) patients, and severe urinary incontinence in 257 (28.7%) patients. UTI occurred significantly more often in patients without, than with normal voiding. CIC was more frequently used in patients with duration of SCI $<$ 1 year, but the rate of CIC significantly decreased as the duration of SCI increased.

Conclusion: The rates of urological complications in patients with chronic SCI remained high in this survey in Taiwan. Patients with a duration of SCI $>$ 5 years chose indwelling catheters or a cystostomy more often than CIC.

1. Introduction

Neurogenic voiding dysfunction (NVD) includes dysfunction of the urinary bladder and urethra, due to central nervous system or peripheral neurogenic lesions. Cerebrovascular accidents, Parkinson's disease, cerebral palsy, multiple sclerosis, transverse myelitis, and spinal cord lesions can result in NVD [1]. Among all types of NVD, spinal cord injury (SCI) can lead to the most difficult to manage voiding disorders. A significant association between the level of injury and the type of voiding dysfunction has been noted in patients with a single level of SCI. Management of the urinary tract in patients with SCI must be based on urodynamic findings rather than inferences from neurologic evaluation [2].

The main problems of NVD are failure to store due to detrusor overactivity (DO) or urethral incompetence, and failure to empty due to detrusor areflexia, bladder neck dysfunction, or detrusor sphincter dyssynergia (DSD), and combined failure to store and empty due to DSD or DO and impaired contractility [3]. The priorities in the management of NVD should be preservation of renal function, freedom from urinary tract infection (UTI), and efficient bladder emptying [3]. It is important to screen patients at high risk, including those with complete neurological lesions, cervical spinal cord paraplegia, prolonged indwelling catheters, high detrusor leak-point pressure, presence of DSD and autonomic dysreflexia (AD), large postvoid residual, and vesicoureteral reflux [4]. Correction of urological complications and improving the quality of life in urination are the two main goals in the management of NVD. In addition, individualized treatment strategies for each patient should be carefully evaluated.

The worldwide incidence of SCI reported in the literature ranges from 12.1 to 57.8 per million [5]. Bladder dysfunction occurs

Conflicts of interest: none.

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Table 1
The level of spinal cord injury and vesicourethral dysfunction.

Level of SCI	*N*	Normal	Detrusor areflexia	Detrusor hyperreflexia	DSD	Autonomic dysreflexia
Total	894	115 (12.9)	232 (26.0)	534 (59.7)	355 (39.7)	178 (19.9)
Cervical	395	49 (12.6)	21 (5.4)	320 (82.1)	238 (61)	151 (38.7)
Thoracic	344	23 (6.9)	131 (39.1)	187 (55.8)	109 (32.5)	26 (7.8)
Lumbar	148	38 (26.8)	79 (55.6)	26 (18.3)	8 (5.6)	1 (0.7)
Sacral	7	5 (71.4)	1 (14.3)	1 (14.3)	0	0
p		<0.001	<0.001	<0.001	<0.001	<0.001

Data are presented as *n* (%).
DSD = detrusor sphincter dyssynergia; SCI = spinal cord injury.

depending on the level and location of the SCI [6]. One study of neurogenic DO (NDO) in SCI in Taiwan from 2006 to 2008 revealed that the prevalence rate over the 3 years was 855 per million, and the incidence rate was 241 per million person-years, similar to a previous study and much higher than in other countries [7]. Eighty-two percent of all patients with SCI and NDO used catheterization with (46%) or without (36%) pharmacological treatment.

We previously reported a survey of urological complications in SCI patients in Taiwan from 1995 to 1998 [8]. In that report, the overall complication rate was 40%. This study reported a recent survey of the voiding management and urological complications in patients with chronic SCI in Taiwan from 2007 through to 2011.

2. Materials and methods

Beginning in 2007, the authors conducted a cross national survey of SCI patients in Taiwan. We performed health education and urological examinations for SCI patients in 14 counties of Taiwan, in conjunction with the SCI association of each county. All patients in the 28 surveys were visited and only the data from the first visit were collected in this study.

During the SCI survey, all patients received neurological and urological examinations, including a physical examination, renal sonography, bladder sonography, and urinalysis. The level of SCI was classified as cervical, thoracic, lumbar, and sacral based on the history and neurological examination. Patients' voiding dysfunction was classified as normal, reflex, detrusor areflexia, detrusor hyperreflexia, or DSD, according to the history and neurological examination. If patients had symptoms of headache, hypertension, and sweating at full bladder, they were considered to have AD.

Current bladder management was also recorded including normal spontaneous voiding, reflex voiding, percussion, abdominal pressure to void, clean intermittent catheterization (CIC)/clean intermittent self-catheterization (CISC), indwelling urethral catheter, cystostomy, or urinary diversion with a neobladder or ileostoma. Urological complications included symptomatic UTIs, hydronephrosis, renal stones, contracted kidneys, trabeculated bladder, and bladder stones. Symptomatic UTI was defined if patients had documented acute pyelonephritis, acute cystitis, or urosepsis during the previous 3 years. Hydronephrosis was defined if renal sonography disclosed dilatation of the renal pelvis and calyces. The patients were further requested to report episodes of UTI, voiding conditions, and bladder management in the past 3 years.

The types of bladder management and urological complications were analyzed according to SCI level and disease duration. Episodes of UTI were further analyzed according to the type of bladder management. For all analyses, the variables are presented as patient number and percentage of the group. Categorical data were analyzed using the Chi-square test with Fisher's exact probability test as appropriate. A p value of <0.05 was considered statistically significant. The statistics program used for the analysis was SPSS version 17.0 (SPSS, Chicago, IL, USA) for Windows.

3. Results

A total of 894 patients with SCI completed the survey and urological examinations. Their mean age was 43.4 ± 13.3 years (range, 14–80 years). Among the patients, 395 (44.2%) had cervical SCI, 344 (38.5%) had thoracic SCI, 148 (16.6%) had lumbar SCI, and 7 (0.8%) had sacral SCI. No significant difference was noted in the mean age and sex distribution among different levels of SCI. The duration of SCI was <1 year in 77 patients, ≥1–10 years in 391 patients, 11–20 years in 284 patients, and ≥20 years in 142 patients.

The vesicourethral dysfunction at different levels of SCI is shown in Table 1. Detrusor hyperreflexia was noted significantly more in patients with cervical and thoracic SCI than in those with lumbar or sacral SCI, whereas significantly more patients with lumbar SCI had detrusor areflexia. DSD was noted in 61% of patients and AD was noted in 38.7% of patients with cervical SCI.

Table 2 shows the bladder management in patients with different levels of SCI. Among all patients, 18.2% used CIC or CISC to empty the bladder, 11.4% used indwelling Foley catheters, and 11.5% had a cystostomy. Patients with SCI for <5 years used CIC/CISC more often than an indwelling catheter to empty the bladder, but indwelling catheters or cystostomies were used more often by those with SCI for >5 years (Fig. 1). The rate ratios of CIC/CISC to indwelling catheter/cystostomy were 3.31 for a duration of SCI of <1 year, 1.35 for 2–5 years, 0.75 for 6–10 years, 1.0 for 11–15 years, 0.59 for 16–20 years, and 0.68 for ≥20 years. Indwelling catheters/cystostomies were chosen because of frequent UTIs and hydronephrosis ($n = 72$, 35.1%), convenience in daily working life ($n = 65$, 31.7%), tetraplegia and lack of a care giver ($n = 42$, 20.5%), and severe urinary incontinence ($n = 26$, 12.7%).

We also surveyed urological complications in SCI patients in the past 3 years. Symptomatic UTI (>1 episode per year) was reported by 54.0% of patients, hydronephrosis was detected in 12.3%, severe urinary incontinence in 28.7%, and urolithiasis in 4.0%. The occurrence of symptomatic UTI ($p = 0.343$) and hydronephrosis

Table 2
Bladder management in patients with different levels of spinal cord injury.

SCI level	*N*	Normal/reflex voiding	Percussion to void	Abdominal pressure	CIC/CISC	Foley catheter	Cystostomy	Neobladder
Total	894	355 (39.7)	213 (23.8)	187 (20.9)	163 (18.2)	102 (11.4)	103 (11.5)	7 (0.8)
Cervical	395	191 (48.4)	109 (27.6)	31 (7.8)	66 (16.7)	42 (10.6)	55 (13.9)	5 (1.3)
Thoracic	344	102 (29.7)	79 (23.0)	94 (27.3)	73 (21.2)	51 (14.8)	31 (9.0)	2 (0.6)
Lumbar	148	57 (38.5)	23 (15.5)	61 (41.2)	22 (14.9)	9 (6.1)	17 (11.5)	0
Sacral	7	5 (71.4)	2 (28.6)	1 (14.3)	2 (28.6)	0	0	0
p		<0.001	0.030	<0.001	0.230	0.026	0.152	0.460

Data are presented as *n* (%).
Patient may use more than one bladder management.
CIC/CISC = clean intermittent catheterization/clean intermittent self-catheterization; SCI = spinal cord injury.