
Lower Urinary Tract Dysfunction in Ambulatory Patients With Incomplete Spinal Cord Injury

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Purpose: We evaluated urinary tract dysfunction in individuals with spinal injury who remained able to ambulate. We observed changes with time in urological management.

Materials and Methods: All patients attending outpatient clinics with traumatic, incomplete (American Spinal Injury Association grades D and E) spinal cord injury during a 2-year period were identified. All patients had their hospital notes reviewed retrospectively and salient urological data extracted.

Results: A total of 43 men and 21 women were identified during this period. Mean age was 46 years (range 18 to 70). Mean followup was 7 years (range 1 to 18). At the time of inpatient discharge 40 of the 64 patients (62.5%) could void spontaneously, 20 required CSIC and 4 had a suprapubic catheter. In 19 of these 40 patients (47.5%) who had been initially assessed as having a bladder that was safe to void spontaneously the condition deteriorated, such that CSIC was required. Conversely 5 of 20 patients (25%) who initially required CSIC improved, such that it became redundant. At last followup 68.7% of the patients had abnormal urodynamics and 24 of the 64 (37.5%) required a change in urological management despite no appreciably detectable neurological change.

Conclusions: Despite relatively near total neurological recovery patients with incomplete SCI have neuropathic bladder unless proved otherwise. Salient deterioration in bladder dysfunction is not uncommon. Regular urological monitoring and appropriate treatment changes are required in the long term.

Key Words: bladder, neurogenic; spinal cord injuries; catheterization

SCI results from various traumatic and nontraumatic reasons with an annual incidence in developed countries of 11.5 to 53.4 cases per million population.^{1,2} Adults who are 16 to 30 years old are predominantly affected with an overall average age at injury of 32.6 years.³ In this young population the morbidity associated with the urological sequelae of SCI has a significant impact on quality of life.⁴

When there is partial preservation of sensory and/or motor function below the neurological level, including perianal sensation and anal tone, injury is defined as incomplete.⁵ Spinal injuries are commonly graded using the ASIA scale and they are divided almost equally between neurologically complete (ASIA grade A, 45%) and incomplete (ASIA grades B to D, 55%) injuries (table 1).⁶ The most frequent neurological presentation of SCI is incomplete quadriplegia with an incidence of 30.8%, followed by complete paraplegia in 26.6% of cases.³

Spinal control of micturition is located at the S2 to S4 level of the spinal cord. This correlates to vertebral levels of T12 to L2 but it may vary slightly depending on the habitus of the individual.⁷ A significant association exists between the level of a spinal cord lesion, and its correlating bladder and sphincter behavior. In the majority of cases suprasacral

lesions present with NDO with or without DSD and lower lesions are areflexic. There is only a broad understanding of bladder dysfunction based on clinical neurological examinations. Neurological tests, such as perianal pinprick sensation and the bulbocavernous reflex, are moderately sensitive indicators of the return of bladder function after SCI. They are not predictive of the presence or absence of coexistent urodynamic abnormalities.⁸

Watanabe et al evaluated the incidence of bladder dysfunction in patients with thoracolumbar spinal fractures in the acute setting, that is up to 14 days after injury.⁹ They found that, even in neurologically intact (ASIA E with perianal pinprick sensation and bulbocavernous reflex present) patients with SCI, 41% had occult urinary tract dysfunction. To our knowledge there are no published data on the long-term outcome of urinary tract management and the development of sequelae in ambulatory patients with incomplete SCI. This is the first such study to uncover neuropathic bladder behavior in ambulatory patients with SCI in the longer term.

MATERIALS AND METHODS

In a 2-year period we identified patients from our neurourology outpatient clinics who had had traumatic and incomplete SCI but remained able to walk with or without aid (ASIA grades D and E). Their hospital records and urological investigations were sequentially reviewed. Patients were divided according to the level of injury into those with cer-

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TABLE 1. ASIA impairment scale showing relative trend of complete v/s incomplete injuries⁶

Neurological Injury Severity	Clinical Description	% Incidence
Complete ASIA A	No sensory/motor function below neurological level	45
Incomplete ASIA B	Sensory (S4–S5) but no motor function below neurological level	15
Incomplete ASIA C	Less than grade 3 motor function below neurological level	10
Incomplete ASIA D	Grade 3 or more motor function below neurological level	30
Incomplete ASIA E	Neurologically intact	

vical, thoracic and lumbar SCI. Baseline VCMG, subsequent followup VCMG, USS results and current bladder management at each visit were recorded.

Bladder dysfunction was treated to achieve a low pressure reservoir and complete emptying at inpatient discharge. This management served as the baseline with which to compare subsequent urological evaluations. Standard urological followup consisted of reassessment within 6 months of the discharge date with VCMG and USS, followed by yearly outpatient evaluation with VCMG and USS. However, if the patient reported new urinary symptoms, VCMG was performed earlier than the scheduled followup date. Changes in bladder management made in response to the results of VCMG and USS were recorded. After the initial estimation of renal function further evaluation, ie creatinine clearance, was done only following indicators of upper tract changes.

RESULTS

Of the 64 patients 43 were male and 21 were female with a mean age of 46 years (range 18 to 70). All patients had traumatic SCI that was classified by injury level as cervical in 29, thoracic in 9 and lumbar in 26. Patients were grouped according to the ASIA classification as ASIA D (39) and ASIA E (25). All patients were on regular followup with a mean followup of 7 years (range 1 to 18).

Following recovery from spinal shock urodynamic assessment showed that 40 patients (62.5%) could void to completion spontaneously with a mean MDP of 65.7 cm water (range 20 to 89), 20 (31.2%) were on CSIC with a mean MDP of 33.5 cm water (range 6 to 50) and 4 (6.3%) were on SPC drainage with a mean MDP of 44.6 cm water (range 35 to 64). Of the patients 64% were receiving anticholinergic medications at a daily range of 10 to 20 mg oxybutynin and/or 4 to 8 mg tolterodine (table 2).

At last followup 26 patients (40.7%) were spontaneously voiding with a mean MDP of 54.4 cm (range 21 to 73), 34 (53%) were on CSIC with a mean MDP of 49 cm water (range

8 to 89) and 4 (6.3%) were on SPC drainage with a mean MDP of 47 cm water (range 34 to 75). Overall NDO was diagnosed in 25 patients (39%) and an acontractile detrusor was seen in 19 (29%). Abnormal urodynamic results were noted in 32% ASIA E and 92% ASIA D cases. Of the patients 73% were receiving anticholinergic medications at a daily range of 10 to 30 mg oxybutynin and/or 4 to 8 mg tolterodine.

Bladder management changed to CSIC in 19 of the 40 patients (47.5%) who had been initially spontaneously voiding by urge (see figure). Four of these 19 patients reported persistent urinary incontinence. This was subsequently investigated with VCMG, which confirmed NDO plus DSD and incontinence. Three of the 5 spontaneously voiding patients with lumbar injury experienced culture proven, recurrent urinary tract infections 3 to 5 times yearly, in addition to increasing residual urine volume on regular followup VCMG. The remainder of the 12 patients was found to have NDO plus DSD or incomplete bladder emptying with increasing residual urine (greater than 30% of functional bladder volume or more than 200 ml). Similarly 5 of the 20 patients on CSIC (25%) started to void spontaneously by urge with a mean MDP of 34.6 cm water with residual volume remaining consistently less than 50 ml and without evidence of any urinary tract infection. Overall 24 patients (37.5%) required a change in bladder management to maintain a low pressure reservoir, complete emptying and consistent low residual urine volume without evidence of any urinary tract infection at the last followup.

Of the patients with cervical injury 75.8% could spontaneously void at the time of discharge home but at followup 6 (27.2%) required a change in bladder management. Of the patients with lumbar injury 61.5% performed CSIC at discharge home and only 5 required a change in bladder management. No upper tract changes were seen on regular USS in cervical and lumbar cases of SCI. One of the 9 patients with thoracic injury had VUR up to the lower third of the ureter without upper tract changes. Oxybutynin was subsequently increased to 30 mg daily, which appeared to resolve

TABLE 2. Bladder management in ASIA E and ASIA D groups

Bladder management	No. ASIA E		No. ASIA D		Total No.
	Anticholinergics	No Anticholinergics	Anticholinergics	No Anticholinergics	
At inpt overall discharge:					
Spontaneous voiding	2	12	20	6	40
CSIC	7	4	4	5	20
SPC	—	—	4	—	4
Totals	9	16	28	11	64
At last followup:					
Spontaneous voiding	5	12	5	4	26
CSIC	8	—	21	5	34
SPC	—	—	4	—	4
Totals	13	12	30	9	64

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