

## BLADDER MANAGEMENT AFTER SPINAL CORD INJURY IN THE UNITED STATES 1973-2005

### Hypothesis / aims of study

Many studies have confirmed that bladder management in spinal cord injury (SCI) with an indwelling catheter (IC) versus no indwelling catheter (sphincterotomy, clean intermittent catheterization (CIC), or spontaneous voiding) is associated with more urologic complications such as renal failure, bladder and renal stones, urinary infection, urethral fistulas, strictures and erosions, and bladder cancer. Several published guidelines on bladder management after SCI all consider CIC to be the ideal management or gold standard for the neurogenic bladder if patient is physically and mentally able [1]. Despite this published data, little is known about the actual bladder management patterns of these patients in clinical practice. Many studies have indirectly reported bladder management method, with the use of CIC ranging from 16 to 96% depending on the population studied [2,3]. The goals of the current study were to examine patterns of bladder management at discharge from rehabilitation and over the long term in SCI patients in the United States and determine factors associated with these patterns.

### Study design, materials and methods

The National Spinal Cord Injury Statistical Center (NSCISC) has collected medical and demographic data on spinal cord injured patients since 1973 in twenty six designated Model Spinal Cord Injury Systems facilities. As of 2003 there were 30,532 patients enrolled and sixteen systems currently funded and enrolling individuals after traumatic SCI. The database exists in two separate data sets. The Form I data collects medical and demographic data as well as information on complications, neurologic status and surgical interventions during rehabilitation after the traumatic SCI. Form II data collects similar information via questionnaire administered every five years thereafter. Some questions have been modified over the thirty year period with some project periods recording significantly more urologic data than others. All versions contain detailed questions on bladder management. Using the NSCISC Form I and Form II data, bladder management method was determined at the time of discharge from rehabilitation and at each five year follow-up period. Associations between demographic and health characteristics and bladder management methods were examined and tested using the chi square test. All statistical analysis was performed using SAS 9.0 (Cary, NC).

### Results

The study population for the current study was comprised of two groups. The first included individuals with complete Form I discharge data and the second included individuals with complete Form I discharge data and Form II follow up data. Data was available for 24,762 individuals at discharge from rehabilitation (Form I). Over time, the selection of bladder management with a condom catheter has decreased steadily from a peak of 34.6% in 1973-75 to a low of 1.50% in 2001-05. The number of patients who can spontaneously void has remained stable between 18.1 and 22.1%, as has the rate of ileal conduit use (0-0.08%). The use of CIC has increased from 12.6% in 1973-75 to a peak of 56.2% in 1991-95 and has decreased to 49.6% in 2001-05. Indwelling catheter use initially decreased from 33.1% in 1973-75 to 16.5% in 1991-95, but has risen to 23.1% in 2001-05. Since CIC and IC were the most common bladder management choices we examined the associations between several demographic factors and bladder management (indwelling catheter vs. CIC) at discharge from rehabilitation. Female gender, age at injury above 43, tetraplegia, and cervical level motor injury all increased the odds of management with an IC vs. CIC. Race, ethnicity, marital status, place of residence, aetiology of the injury, employment status and education did not influence bladder management choice at discharge from rehabilitation.

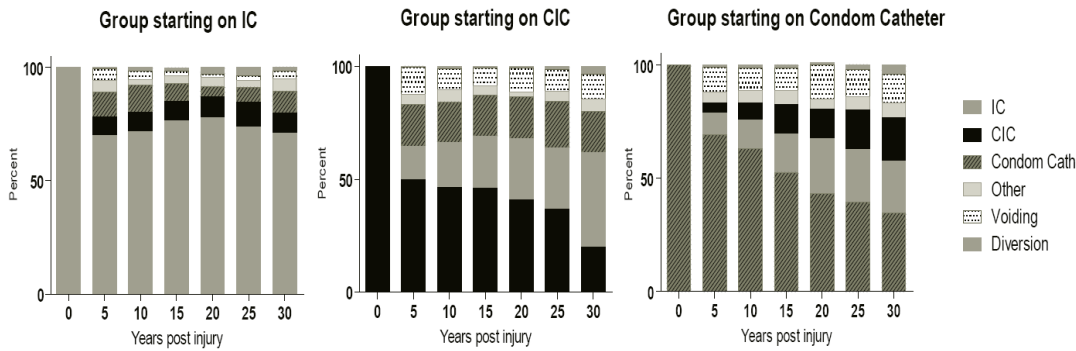
Among those individuals with follow up data 5 to 30 years post injury (n=12,984) a significant drop in use of clean intermittent catheterization (CIC) with increasing time since discharge was observed, particularly in the first five years. Condom catheter use initially increased during follow up, but later decreased. Indwelling catheter (IC) use rose steadily from 23.2% to 45.1% over thirty years of follow up (Table I). In each of the five year time periods, those with an IC were significantly more likely to be Caucasian, live in a nursing home or hospital, have a higher anatomic level of injury, be injured at an earlier date and be functionally tetraplegic compared to those who perform CIC.

Looking specifically at adherence to original bladder management method, those individuals who were originally assigned IC as bladder management were the least likely to switch to another method, with 71.1% remaining with an IC at thirty years (Figure 1). Individuals assigned CIC and condom catheterization at discharge had more variability in bladder management, with only 20% and 34.6% of individuals remaining on the same management at 30 years of follow up respectively (p<0.001).

**Table I:** Bladder management over time in all patients with follow-up information available

Years post injury	None/other		Voiding		Indwelling catheter		Condom catheter		Clean intermittent catheterization		Urinary diversion		Total
	n	%	n	%	n	%	N	%	n	%	n	%	
0	31	2.4	1733	13.4	3009	23.2	1969	15.2	5954	45.9	2	0.02	12984
5	58	6.2	1733	18.4	2447	26.0	2148	22.8	2455	26.1	49	0.5	9418
10	25	5.5	660	14.2	1463	31.5	1066	22.9	1154	24.8	50	1.1	4647
15	14	5.1	365	12.9	1071	37.9	536	19.0	678	24.0	30	1.1	2824
20	80	3.9	308	14.9	890	43.0	331	16.0	430	20.8	31	1.5	2070
25	56	4.9	169	14.9	471	41.5	193	17.0	221	19.5	26	2.3	1136
30	19	7.0	35	12.8	123	45.1	50	18.3	39	14.3	7	2.6	273

**Figure 1:** Bladder management over time in those patients initially assigned indwelling catheter (IC), clean intermittent catheterization (CIC) or condom catheterization at discharge from rehabilitation (p<0.001).



**Interpretation of results**

Over time bladder management with CIC has increased in popularity. However, in older persons, females and tetraplegics, it is infrequently employed. Moreover, only 20% of those persons initially on CIC remained on the same form of bladder management over time.

**Concluding message**

These findings indicate that patients may not receive adequate urologic support once discharged. The establishment of clear guidelines for bladder management in this population is warranted.

**References**

1. Consortium for Spinal Cord Medicine. Bladder management for adults with spinal cord injury: a clinical practice guideline for health-care providers. J.Spinal Cord Med. 2006;29(5):527-573
2. Chen Y, DeVivo MJ, Roseman JM. Current trend and risk factors for kidney stones in persons with spinal cord injury: a longitudinal study. Spinal Cord 2000 Jun;38(6):346-353
3. Singh G, Thomas DG. The female tetraplegic: an admission of urological failure. Br.J.Urol. 1997 May;79(5):708-712

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<b>What were the subjects in the study?</b>	<b>HUMAN</b>
<b>Was this study approved by an ethics committee?</b>	<b>Yes</b>
<b>Specify Name of Ethics Committee</b>	<b>University of Michigan Institution Review Board number HUM 27603</b>
<b>Was the Declaration of Helsinki followed?</b>	<b>Yes</b>
<b>Was informed consent obtained from the patients?</b>	<b>Yes</b>