Bladder Management After Spinal Cord Injury in the United States 1972 to 2005

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Purpose: Studies have shown that bladder management with an indwelling catheter for patients with spinal cord injury is associated with more urological complications such as stones, urinary infection, urethral strictures and bladder cancer. However, little is known about actual bladder management for these patients in clinical practice.

Materials and Methods: Using the National Spinal Cord Injury Database the bladder management method was determined at discharge from rehabilitation and at each 5-year followup period for 30 years.

Results: At discharge from rehabilitation (24,762 patients) the selection of bladder management with a condom catheter decreased steadily from a peak of 34.6% in 1972 to a low of 1.50% in 2001. The use of clean intermittent catheterization increased from 12.6% in 1972 to a peak of 56.2% in 1991. Indwelling catheter use initially decreased from 33.1% in 1972 to 16.5% in 1991 but increased to 23.1% in 2001. Of 12,984 individuals with followup data those originally using an indwelling catheter for bladder management were unlikely to switch to another method, with 71.1% continuing to use an indwelling catheter at 30 years. Individuals using clean intermittent catheterization and condom catheterization at discharge home did not continue to use these methods with only 20% and 34.6% remaining on the same management, respectively.

Conclusions: With time bladder management with clean intermittent catheterization has increased in popularity. However, only 20% of patients initially on clean intermittent catheterization remained on this form of bladder management. More research on the safety of each of these methods needs to be performed to provide better guidance to aid with this decision.

Key Words: spinal cord injuries; urinary bladder, neurogenic; urinary catheterization; catheters, indwelling

Abbreviations and Acronyms

CIC = clean intermittent catheterization

IC = indwelling catheter

NSCID = National Spinal Cord Injury Database

SCI = spinal cord injury

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THE prevalence of spinal cord injury in the United States is approximately 250,000 people with an incidence of roughly 11,000 new cases per year.[1] Although it is not a common cause of disability in this country, it carries a high rate of medical, economic and social complications for patients and families. In the past renal disease was the major cause of death in paraplegics.[2]

The introduction of clean intermittent catheterization by Lapides et al revolutionized the care of spinal cord injured patients.[3] Many studies have confirmed that bladder management with an indwelling catheter vs no indwelling catheter for patients with SCI results in more urological complications such as bladder and renal stones, urinary tract infection, ure-

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thral fistulas, strictures and erosions, and bladder cancer.[4–9] In a contemporary series the cause of death in descending order in a cohort of patients with SCI was pneumonia and influenza, septicemia, cancer, ischemic heart disease, diseases of the urinary system and suicide, indicating that modern urological care has improved morbidity and mortality in these patients.[10] A recent review of several publications on suprapubic catheterization by Feifer and Corcos questions the increased risk of complications with this form of management.[11]

Published guidelines regard CIC as the gold standard for bladder management.[12–14] A survey of 160 neurourology specialists indicated that most prefer that patients with neurogenic bladder from spinal cord injury be treated with clean intermittent catheterization.[15] However, this survey was one of preferences rather than of actual practice patterns. Many studies have indirectly reported bladder management methods with the use of CIC ranging from 16% to 96%.[7–9,16] However, little is known about what the actual bladder management for the majority of spinal cord injured patients is in everyday practice. Therefore, we determined how bladder management is accomplished in patients with SCI in the United States and what factors influence the type of management used.

MATERIALS AND METHODS

The NSCID has collected medical and demographic data on patients with SCI since 1972 in designated Model Spinal Cord Injury Systems facilities. As of 2003 there were 30,532 patients enrolled in the database and 26 centers have participated since the inception. When a center is no longer funded the data are no longer contributed but the cohort is kept in the database. To date there are 16 systems currently funded.[17,18] Detailed information about the participating sites may be found at the NSCID web site.[18]

The database exists in 2 separate data sets. The initial data set (Form I) is administered following traumatic SCI during rehabilitation before discharge home. Form I includes medical and demographic data, neurological status, surgical interventions and complications. A followup questionnaire (Form II) is administered every 5 years thereafter and contains similar data. Some questions have been modified during the 30-year existence of the database and some project periods recorded more urological data than others. However, all versions include a detailed question on bladder management and are verbally administered by a trained individual.

Patients had the option of selecting only 1 bladder management type which they identified as primary. These management types were categorized as normal voiding, condom catheters, clean intermittent catheterization, indwelling catheters (urethral and suprapubic), urinary diversion and other (including voiding into a diaper or voiding using the Credé maneuver).

Using the NSCID Form I and Form II data sets from 1972 to 2005 the bladder management method was determined at discharge from rehabilitation and at each 5-year followup period. A total of 899 patients missing bladder management information were excluded from this analysis. Cross-sectional associations and trends among demographic and health characteristics, and bladder management methods were examined, and tested using the Pearson chi-square test of association and Cochran-Armitage test for trend. Logistic regression was used to estimate odds ratios and 95% CI for bladder management. Longitudinal analyses were performed on those individuals initially on CIC, IC or condom catheterization at discharge from rehabilitation. All statistical analysis was performed using SAS® 9.2.

RESULTS

Bladder Management After Initial SCI Rehabilitation

Data were available for 24,762 individuals at discharge from rehabilitation (Form I). With time the number of patients who could void spontaneously remained stable between 18.1% and 22.1%. The percentage of individuals with SCI whose bladder was managed with a condom catheter decreased steadily from a peak of 34.6% in 1972 to 1975 to a low of 1.50% in 2001 to 2005. The use of CIC increased from 12.6% in 1972 to 1975 to a peak of 56.2% in 1991 to 1995 and decreased to 49.6% in 2001 to 2005. Indwelling catheter use initially decreased from 33.1% in 1972 to 1975 to 16.5% in 1991 to 1995 but increased to 23.1% in 2001 to 2005, while the rate of ileal conduit use remained stable (0 to 0.08%)

Table 1. *Trends in bladder management at discharge from rehabilitation*

Injury Yr	No. None/Other (%)	No. Voiding (%)	No. Indwelling Catheter (%)	No. Condom Catheter (%)	No. CIC (%)	No. Urinary Diversion (%)
1972–1975	17 (1.4)	219 (18.2)	399 (33.1)	416 (34.6)	152 (12.6)	1 (0.08)
1976–1980	47 (1.0)	892 (19.9)	1,222 (27.2)	1,006 (22.4)	1,324 (29.5)	0 (0.0)
1981–1985	84 (1.8)	932 (19.4)	1,116 (23.3)	874 (18.2)	1,789 (37.3)	2 (0.04)
1986–1990	79 (2.3)	764 (22.1)	572 (16.5)	357 (10.3)	1,691 (48.8)	1 (0.03)
1991–1995	150 (4.5)	603 (18.1)	550 (16.5)	157 (4.7)	1,875 (56.2)	2 (0.06)
1996–2000	247 (6.7)	691 (18.9)	821 (22.4)	86 (2.4)	1,816 (49.6)	1 (0.03)
2001–2006	265 (7.0)	715 (18.8)	880 (23.1)	57 (1.5)	1,887 (49.6)	3 (0.08)

Table 2. *Prevalence of bladder management after injury*

Yrs After Injury	No. None/Other (%)	No. Voiding (%)	No. Indwelling Catheter (%)	No. Condom Catheter (%)	No. CIC (%)	No. Urinary Diversion (%)	Totals
0	317 (2.4)	1,733 (13.4)	3,009 (23.2)	1,969 (15.2)	5,954 (45.9)	2 (0.02)	12,984
5	586 (6.2)	1,733 (18.4)	2,447 (26.0)	2,148 (22.8)	2,455 (26.1)	49 (0.5)	9,418
10	254 (5.5)	660 (14.2)	1,463 (31.5)	1,066 (22.9)	1,154 (24.8)	50 (1.1)	4,647
15	144 (5.1)	365 (12.9)	1,071 (37.9)	536 (19.0)	678 (24.0)	30 (1.1)	2,824
20	80 (3.9)	308 (14.9)	890 (43.0)	331 (16.0)	430 (20.8)	31 (1.5)	2,070
25	56 (4.9)	169 (14.9)	471 (41.5)	193 (17.0)	221 (19.5)	26 (2.3)	1,136
30	19 (7.0)	35 (12.8)	123 (45.1)	50 (18.3)	39 (14.3)	7 (2.6)	273

(table 1). Female gender, age at injury older than 43 years, tetraplegia and cervical level motor injury significantly increased the odds of management with IC vs CIC at initial discharge from rehabilitation, while race/ethnicity, marital status, place of residence, etiology of the injury, employment status and education had no significant impact on bladder management. Of the 5,560 patients using an IC for bladder management there were significantly more women and higher level injuries treated with a urethral catheter than with a suprapubic catheter, and the suprapubic group was on average 9 years younger.

Followup Data

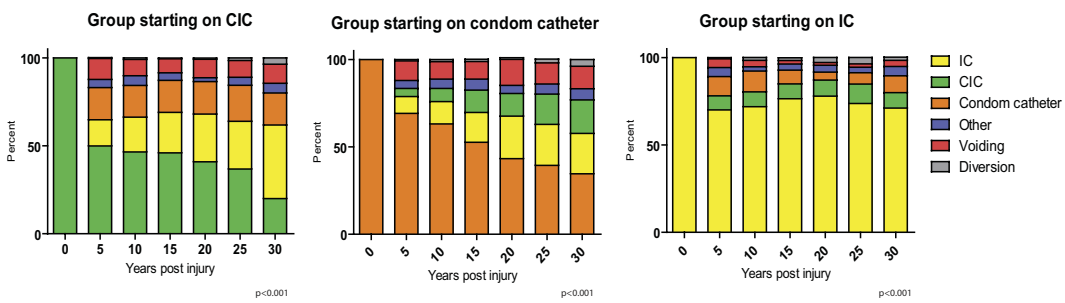
Complete followup data ranging from 5 to 30 years after injury were available for 12,984 individuals. Condom catheter use initially increased during followup but later decreased. There was a significant decrease in the use of CIC with time since discharge from rehabilitation, particularly in the first 5 years. IC use increased steadily from 23.2% to 45.1% during 30 years of followup (table 2).

In each of the 5-year periods patients with an IC were significantly more likely to be white, live in a nursing home or hospital, have a higher anatomical level of injury, be injured at an earlier date and be functionally tetraplegic compared to those who perform CIC. On longitudinal analysis individuals who originally used an IC as bladder management were the least likely to switch to another method with 71.1% continuing to use an IC at 30 years. Of the individuals initially using CIC and condom catheterization only 20% and 34.6%, respectively, remained on the same management at 30 years of followup (see figure).

DISCUSSION

In this analysis of the NSCID 33.1% of patients were treated with indwelling catheters at discharge from rehabilitation in 1972 to 1975 but this number varied through the years reaching a low of 16.5% in 1991 to 1995. At long-term followup 41.8% of patients initially on CIC and 23.1% of those initially on condom catheters switched over to an IC, whereas 71.1% of patients using an IC continued to do so for 30 years, indicating its popularity. An IC is used more often by individuals with higher level injuries, female patients and older persons.

Few other studies have focused on describing bladder management after SCI but many outcomes studies have indirectly described the typical management at their center. In these studies the method of management varies widely depending on the population, the center and the time since injury. Of 316 almost exclusively male patients from a Veterans Administration Spinal Cord injury unit 47% were treated with an indwelling catheter.[8] This figure is similar to our results with 32% of men being treated with an IC at discharge home and that number increasing during followup. In a study of the incidence of bladder cancer in 3,670 patients with SCI at Craig Hospital 44% were treated without an in-



Bladder management longitudinally at discharge from rehabilitation

dwelling catheter.[7] In a longitudinal study of 8,314 patients enrolled in the NSCID from 1986 to 1999 only 16% were treated with an indwelling urethral or suprapubic catheter. However, these are cross-sectional data at the time of hospital discharge without longitudinal followup.[9]

There are several published guidelines on bladder management after SCI.[12–14] CIC is considered the ideal management or gold standard for the neurogenic bladder if the patient is willing, physically and mentally able to perform the task or has caregivers who are able to assist. These guidelines are based on reviews of current literature showing that there are significantly more serious complications associated with indwelling catheterization compared to CIC. Compared to clean intermittent catheterization, the use of an indwelling catheter (suprapubic or urethral) significantly increases the risk of renal failure, bladder and renal stones, urethral fistulas, strictures and erosions, and bladder cancer.[4,5,7] This increased risk of complications with indwelling catheters is also observed in studies limited to the female population with SCI.

In a long-term study of bladder management and complications in 70 women with SCI major complication rate was 17% in the group treated with CIC, 40% in the incontinence/pads group and 200% in the indwelling catheter group.[19] However, there was little increase in the risk of complications with suprapubic tubes compared to CIC in a recent review of contemporary management in which antimuscarinics, frequent catheter changes and bladder washes were used.[11] Unfortunately these data only reflect bladder management over time and complications were not obtained from the data set in this analysis.

In our analysis the increasing number of patients using CIC at discharge from rehabilitation increased until the mid 1990s when it reached a peak, and has decreased slightly ever since. The biggest change was use of condom catheterization, which decreased from 34.6% in 1972 to 1975 to 1.5% currently. The question arises as to why there was such a dramatic decrease. In a large series Pan et al reviewed their experience treating detrusor-sphincter dyssynergia after SCI with surgical sphincterotomy and condom catheters.[20] They found that sphincterotomy frequently needs to be repeated at a median of 36 months and viewed sphincterotomy as a staged procedure requiring active urological followup. This intensive surveillance is perhaps too cumbersome for most patients and physicians. Sphincterotomy also fails in many patients due to detrusor hypocontractility.[21] An alternative explanation may be related to the composition of the NSCID, from which this analysis was performed.

Based on funding awards the composition of the participating centers varies with time. It is possible that certain centers favor the use of condom catheters and changes in the participating centers may result in changes in bladder management trends. This decrease with time can also be explained by the fact that rehabilitation length of stay becomes shorter with time.[22] It is possible that many patients were transitioned to a condom catheter (with or without sphincterotomy) at a later date instead of during acute rehabilitation immediately following the injury (see figure).

Based on discharge data, there was an initial decrease in indwelling catheterization use with the increasing popularity of CIC but indwelling catheterization has had a resurgence at the expense of CIC with 23.1% of patients treated with an IC at discharge in the most recent cycle. The followup data indicate that 80.0% of those patients initially assigned CIC eventually switch to another management method with the greatest dropout occurring at the 5-year mark and most switching to IC. A similar result was seen for condom catheter use with 65.4% of those treated with condom catheterization switching to other management methods, the majority being indwelling catheterization. In contrast 71.1% of patients with an IC are still using it 30 years later. These trends may reflect the fact that CIC requires additional effort that may not be feasible for certain patients in the long term.

There are many plausible reasons a person would switch to an IC from CIC such as incontinence between catheterizations, autonomic dysreflexia, obesity interfering with the ability to catheterize, architectural barriers and clothing making CIC difficult.[19] Female tetraplegics especially have many barriers to effective CIC such as the urethra being difficult to access, poor hand function, inability to transfer and not having a caregiver willing or able to assist. Clinicians also often believe that CIC is bothersome and too difficult for many patients. However, of 101 patients who perform CIC 78% believed that it was easy or very easy to perform and 87% thought that it interfered only a bit or not at all with work or daily activities.[23]

Bladder management is not only important in preventing medical complications but it also greatly affects quality of life. Of female tetraplegics who underwent surgery to create a continent catheterizable stoma the time spent on catheterization decreased from a mean of 27 minutes per catheterization to 7.8 minutes, and quality of life parameters such as continence, body image, independence, convenience, time saving and satisfaction improved after surgery.[24] In our study women, older persons and tetraplegics were all at high risk for treatment with an IC, likely for the same reasons listed.

There are several limitations to our analysis that must be considered. The NSCID encompasses only 16 clinical sites and approximately 15% of the SCI population in the United States and, therefore, the findings may not reflect the care that is given at other centers. In addition, because this study encompasses 30 years many patients were lost to followup and more than 30% have not been present in the database for more than 10 years, which may result in biased estimates (table 1). It is possible that patients who were lost to followup were different than those who remain in the system in terms of bladder management and related characteristics. For instance patients in an institutional setting or who have a caregiver may be more likely to respond to the questionnaires. In addition, followup is performed only at 5-year intervals and changes in bladder management between surveys or the reasons for the changes cannot be identified. Finally this database was not designed to evaluate bladder management methods comprehensively and, therefore, it does not provide information on relevant modalities such as antimuscarinic agents or botulinum toxin, or outcomes such as renal function or urinary tract infections. Even in the presence of these limitations the large number of patients with SCI included in the NSCID provides a unique data source that has the potential to provide valuable information about national trends in urological spinal cord injury care.

CONCLUSIONS

The majority of patients with SCI at discharge from rehabilitation are currently using clean intermittent catheterization as bladder management, whereas in the past most were treated with an IC and condom catheters. However, during followup 80% of patients on CIC switched to an IC. Women, tetraplegics and older persons are at highest risk for an IC at discharge from rehabilitation and at followup.

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