

Clean Intermittent Self-catheterisation for Quadriplegic Patients—A Five Year Follow-up

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Summary

We present the findings of clean intermittent self-catheterisation (CISC) as a long term method of bladder management for 36 quadriplegic spinal cord injured patients, primarily at C6/C7 level, who were taught CISC between 1983 and 1987. Success in CISC was assessed by a mail survey, a telephone interview, and current sterile urine status. Twenty nine (81%) of 36 patients continued to use CISC after a mean discharge period of 2.9 years ($p < 0.001$) with high levels of acceptance. Rao's V discriminant analysis showed success in CISC was affected by the interval between injury and initial self-catheterisation (Canonical Correlation Co-efficient=1.34). Results of urinalysis for patients continuing CISC were obtained for 18 (62%) patients, 16 (88%) of whom had sterile urine. Implications of these and other findings along with reasons for cessation of CISC are discussed.

Key words: Spinal cord injury; Intermittent self-catheterisation; Quadriplegia; Urinary bladder care; Australia.

In the 1970's Lapidès *et al.*, advocated self-intermittent catheterisation to empty the neuropathic bladder (Lapidès *et al.*, 1972). Although fears were held that patients would be placed at high risk of urinary tract infection (Guttmann and Frankel, 1966), clean intermittent self-catheterisation (CISC) was introduced to a large number of paraplegic patients with good results (Lapidès *et al.*, 1974). Despite growing acceptance of CISC as a technique for bladder management of the paraplegic spinal cord injured, quadriplegic patients who had gained an impressive level of independence in other areas of daily living were denied access to CISC (Dailey and Michael, 1977). It was felt that limited hand function of the quadriplegic patient would prevent maintenance of the clean technique (Erikson *et al.*, 1982) or would render the task so time consuming as to be impractical (Diokno

et al., 1983). With few exceptions (Kuhn *et al.*, 1988) the most recent studies addressing success in CISC have been highly favourable (Maynard and Glass, 1987; Hill and Davies, 1988).

Some 20% of the total quadriplegic patients admitted to the Spinal Injuries Unit of the Princess Alexandra Hospital were assessed and commenced on CISC. The procedure required the patient to insert a catheter from a sterile container into a plastic bag, and add lubricant to the catheter, using the plastic bag as a glove draped over the fingers to prevent contact with the catheter. The catheter is then inserted into the urethra. After use, the catheter is tied in a knot to indicate use, soaked in a 5% Hibitane solution overnight at home, and then placed in a plastic bag ready for re-use. Two pairs of forceps are used to maintain a clean technique with twelve catheters being replaced every 3 months (Steel, 1985). Variations to this procedure are cited by authors in the field with respect to the use of water rather than Hibitane solution (Anderson *et al.*, 1980, Maynard and Diokno, 1982), the use of a catheter lubricant (Orisaka, 1976), the frequency of catheterisation (Maynard and Dionko, 1984) and criteria for application of this method (Mcguire and Savastano, 1983).

The present study sought to assess the ability of the quadriplegic patients to execute the technique, as taught by a specialist Spinal Injuries Unit, in an efficient manner as tested by the following 4 hypotheses: (1) The percentage of patients continuing to perform CISC would be significantly higher than patients who have discontinued the procedure; (2) Demographic and diagnostic variables available at the commencement of CISC would be able to predict success of CISC; (3) The time elapsed between injury and initial catheterisation would have a significant effect on the outcome of patients trailed on CISC; and (4) A positive relationship would exist between high predischarge activities of daily living (ADL) scores as measured by the modified Barthel Index (Shah *et al.*, 1989; Granger *et al.*, 1979) and success in CISC.

Methods

The present retrospective study employed an *expost-facto*, pre-test, post-test design for ADL function assessment, and a descriptive survey.

Patients

Following ethical approval, all quadriplegic patients taught CISC by the Princess Alexandra Hospital Spinal Injuries Unit in Brisbane, Australia between January 1983 and December 1987 (inclusive) who were identified as having limited hand function (42), were contacted for the purposes of the study. The patients selected had either complete spinal cord lesions below C5, C6, or C7, or incomplete lesions with only the functional grasp facilitated through natural tenodesis action, with or without the Engen wrist driven flexor hinge hand orthosis (Kay, 1969).

Six of the 42 patients were not interviewed. Two of these 6 patients did not wish to participate in the study, 4 patients had moved interstate or overseas and could not be traced. Of the 36 patients, 35 were male. Sixteen (44%) had complete lesions and the remaining 20 (56%) had sustained incomplete lesions.

Procedure

A self administered questionnaire accompanied by letters of explanation, and a request for urinalysis were sent to all 42 patients. Patients were surveyed as to their current method of bladder management, their degree of satisfaction and independence with this method and other ADL, as assessed by the Modified Barthel Index (MBI), reasons for cessation of CISC (if ceased), number and purpose of hospitalisations, frequency of contact with local medical officer and Spinal Injuries Unit, and current use of adaptive equipment. The MBI consisted of 15 items replacing the original 10 (Granger *et al.*, 1979). The present study utilised the 3 point scale of the MBI, and excluded the walking and propelling or pushing wheelchair. Thus the highest possible score was 80 not 100. The range of 90 to 100 in the MBI, signifying minimal dependence was now 72 to 80. Relevant demographic data, pre-discharge ADL status, and urological complications were extracted from the occupational therapy records, medical summaries and/or charts. Patients continuing to self-catheterise were also requested to undergo urinalysis. A follow-up interview by phone was conducted three weeks following distribution of surveys.

Statistics

Relevant means, standard deviations and descriptive statistics; and, conventional Chi-squares were calculated. Data obtained was then subjected to Rao's stepwise discriminant analysis.

Results

Demographic and relevant diagnostic variables for the 36 patients are presented in Tables I and II. As of December 1987, 29 (81%) of the 36 patients surveyed continued to use CISC as their method of bladder management while the remaining 7 (19%) converted to external drainage. Thus hypothesis 1, that the frequency of patients performing the CISC will be significantly higher than those who have discontinued the use of CISC, is supported. In the present study success was viewed as continuation in CISC with a high level of patient satisfaction, and use of external drainage devices as failure. As all patients recorded high levels of satisfaction despite the method currently used, satisfaction was disregarded as a measure of success or failure.

Reasons for cessation of CISC, as stated by the 7 patients now managed by external drainage, are outlined in Table III.

Information extracted from occupational therapy records, medical charts and summaries, and questionnaires as displayed in Tables I and II was subjected to discriminant analysis. Of all the variables, Rao's V stepwise discriminant analysis selected 9 variables forming the canonical discriminant function. In descending order of importance the variables are: hospitalisation for bladder infection, spasticity level on discharge, time interval between injury and CISC, living with spouse/defacto, number of hospitalisations, occupation, living with parents, living with spouse/defacto and family, and last appointment with local doctor. These variables were, cumulatively, able to effectively predict group membership. Thus

Table I Demographic variables for all subjects

Variables	Absolute Frequency (%)
Sex:	
Male	35 (97.2)
Female	1 (2.8)
Age: (Mean 31.5 SD+8.1)	
Education:	
Started secondary	8 (27.2)
Completed Gr 10	13 (36.1)
Completed Gr 12	6 (16.7)
College	4 (11.1)
University	3 (8.3)
Other	2 (5.6)
Occupation:	
Fully employed	11 (30.6)
Self-employed	4 (11.1)
Unemployed	3 (8.3)
On pension	15 (41.7)
Student	2 (5.6)
Homemaker	1 (2.8)
Type of Occupation:	
Professional	2 (5.6)
Propr./Manager	2 (5.6)
Office/Sales	12 (33.3)
Farmer	2 (5.6)
Semi-skilled	2 (5.6)
Unskilled/Other	16 (44.4)
Living Situation:	
Alone	6 (16.6)
Spouse/defacto	6 (16.6)
Spouse/defacto and family	12 (33.3)
With parents	8 (22.2)
With friends	4 (11.1)

hypothesis 2 is accepted. The low Wilk's Lambda obtained (0.244) corresponded to the Chi-squared value of 39.534 and indicates a high degree of separation between groups with a probability of <0.001 . The standardised canonical discriminant co-efficients for these variables predicting outcome are displayed in Table IV. The variables excluded from predictive function by the discriminant analysis are in Tables I and II.

Results of a classification matrix (Table V) indicate 100% of cases were able to be correctly classified.

Time in months between injury and initial self-catheterisation of all patients with a range of 3 to 257 months, and a mean of 72 months reflects the different stages in rehabilitation at which quadriplegic patients were taught CISC. Fourteen (39%) patients discharged prior to the availability of CISC for quadriplegics were re-admitted in order to learn the technique. The remainder were taught at a point prior to their initial discharge from the Spinal Injuries Unit. No advantage, with respect to

Table II Important diagnostic variables for all subjects

Variables	Absolute Frequency (%)
Level of Injury:	
C5	10 (27·8)
C6	11 (30·6)
C7	14 (38·9)
C8	1 (2·8)
Type of Injury:	
Complete	16 (44·4)
Incomplete	20 (55·6)
Tendon Transfer:	
Yes	10 (27·8)
No	26 (72·2)
When Taught CISC:	
First admission	22 (61·0)
At later date	14 (39·0)
Interval (Injury & initial catheterisation): (Mean—Months, 33·806 SD+51·788)	
Satisfaction:	
Moderate	11 (30·6)
High	13 (36·1)
Very high	12 (33·3)
Urinalysis:	
Sterile	18 (62·0)
Infected	2 (0·1)
No response	11 (37·9)
Why Ceased CISC:	
Infection	1 (2·8)
Inconvenient	2 (5·6)
Physical status	1 (2·8)
Choice	1 (2·8)
Other	2 (5·6)
Not ceased	29 (80·6)
Self-catheterise frequency in 24 hours: (Mean 6·139 SD+1·313)	
Prepare Equipment:	
Independent	25 (86·2)
With help	4 (13·8)
Pass Catheter:	
Independent:	29 (100·0)
Prep. for Reuse:	
Independent	26 (89·7)
With help	1 (3·4)
Dependent	2 (6·9)
Device Used:	
Engen splint	7 (19·4)
Thumb strap	1 (2·8)
No strap	28 (77·8)

Table III Reasons for cessation, for those subjects who discontinued CISC.

Subject	Reason for cessation
1	Procedure too inconvenient
2	Recurrent urinary tract infection
3	Personal preference for external drainage device
4	Incontinence
5	Incontinence
6	Recurrent urinary tract infection, inconvenience
7	Deterioration in physical condition

Table IV Variables predicting success in CISC using canonical discriminant function

Variables	Standardised Co-efficients
Hospitalised for bladder infection	2.92914
Spasticity level on discharge	-2.11154
Interval between injury and CISC	-1.59943
Presently living with spouse/defacto	1.12505
Number of hospitalisations	-0.94181
Occupation	-0.76115
Presently living with parents	-0.58646
Presently living with spouse/defacto and family	0.57271
Date of last appointment with local doctor	0.39360

Table V Outcome groups (CISC or external drainage) classification matrix

Outcome group	No of cases	Predicted group membership	
		1	3
External drainage Devices	7	7 (100.0%)	0 (0.0%)
Clean intermittent Self-catheterisation	29	0 (0.0%)	29 (100.0%)

outcome of CISC, was offered to either group of patients, however time in months between injury and initial catheterisation was found to have a positive canonical correlation co-efficient (1.34) and as such hypothesis 3 is accepted. As regards to the association between the ADL status and success in CISC, no correlation was found to exist between pre-discharge ADL scores (mean 62.5 SD+17.2), post-discharge ADL scores (mean 71.0 SD +16.3) and success in CISC. Therefore hypothesis 4 is rejected in both cases.

Since routine follow up urinalysis results from the general medical practitioner visits were unavailable, all patients who continue to use CISC were asked to undergo urinalysis. Of the 29 patients in this group results of 18 (62%) were obtained. Urine samples from 16 (88%) of those 18 patients who responded were sterile, 2 were found to be infected.

The patients' level of independence in the 3 stages of CISC, preparing the catheter for use, passing the catheter, and preparing the catheter for re-use, was investigated to establish the level of efficiency with this method. All patients were independent in passing the catheter. Of the 4 patients requiring assistance in the preparation of equipment; 2 were independent with respect to the preparation of the equipment for reuse, one required some assistance, and the fourth was dependent on an assistant. A fifth subject although independent in the first 2 phases of CISC was dependent for preparing the equipment for reuse. Of the 29 patients who continue to use CISC, 7 utilised an Engen wrist driven flexor hinge hand orthosis and 1 subject continued to use a thumb strap.

Discussion

Of the 36 quadriplegic patients discharged using CISC, 29 (81%) continue to use this method of bladder management at the time of follow-up. This compares favourably with an 82% continued use-rate of chronic clean intermittent catheterisation in a paraplegic and quadriplegic population found by Maynard and Glass (1987). The 7 patients who ceased CISC, discontinued after 1987.

Not only were patients shown to continue CISC over a period of 2.9 years, 24 of the 29 patients (83%) completed the procedure with total independence. In addition 89% of patients screened by urinalysis were shown to have sterile urine using the standard biochemical methods. Although data could only be obtained for 62% of patients successful in CISC, and although the results are based on one specific micro-urine culture, these results remain impressive. Thus the fear of high risks of urinary tract infection as a direct result of CISC is not supported. In the practice of CISC, an occasional problem of incontinence between catheters may become evident. However, this can usually be traced to infection or overdistention (Hill and Davies, 1988). This can be rectified by anticholinergic therapy, fluid intake, and increased frequency to catheterise. Further advantages of this method stem from the avoidance of irreversible urethral sphincterotomy; firstly a shorter time spent in a hospital; and secondly, reduced risk of retrograde ejaculation (Hill and Davies, 1988). These results support CISC as a method of bladder management for cervical spinal cord injured patients of C6/C7 level, and highlight the fact that once assessment and trial are successful, there are no more than 19% failures. Of the 36 patients studied, it was noted that only 8 continue to use a device such as an Engen orthosis or Thumb Strap to carry out their bladder management regime. It appears that following discharge patients were able to discard these aids, lending support to the argument of delaying self-catheterisation for a period of time to allow patients to gain maximum use of the remaining hand function. Alternatively patients can be encouraged to gain independence in CISC with the use of Engen orthosis or following tendon transplants, in the case of a poor tenodesis grasp, thereby eliminating the dangers associated with use of indwelling catheters throughout the period of acute management.

Interpretation of results presented, must address possible limitations of the study, the first of which is sample size. Despite the relatively small sample size (36), these patients comprise 86% of the total number of patients discharged from the spinal injuries unit of a large community based hospital, over a 5 year period, who met the criteria outlined. Although results concerning the continuation or

cessation of CISC are highly significant, many of the other issues addressed, such as the significance of pre-discharge levels of ADL independence, may become clearer with larger sample sizes. Secondly, the sample was drawn from a single institution and may therefore not be representative of the method of CISC and patient care throughout Australia and spinal units in general.

Conclusion

Until 1983, quadriplegic patients in Australia were denied access to CISC. Alternate methods of bladder management were instituted, presenting problems for female patients in particular. With the introduction of the method into Australian spinal injury units, many patients realised the freedom, aesthetic appeal, and independence afforded to them by use of self-catheterisation. In 1988, 29 of 36 quadriplegic patients of C6/C7 level from the Princess Alexandra Hospital Spinal Injuries Unit, continue to self catheterise. With the addition of CISC to the established methods of quadriplegic bladder management, patients and staff are conjointly able to decide upon the most appropriate method for each individual.

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