

The functional limitations of tetraplegic hands for intermittent clean self-catheterisation

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Since the introduction of intermittent self-catheterisation by Lapidès *et al.*,¹ low pressure voiding methods have been adopted actively in our centre. A retrospective review of 47 patients with cervical spinal cord injury (CSCI) who performed independent (self) clean intermittent catheterisation (CIC) on discharge is presented. Their functional abilities were evaluated by both the Frankel² and the Zancolli scales.³ Fourteen out of the 47 patients could manage independent CIC, 17 assisted CIC, nine tapped or voided voluntarily, two were discharged with a diaper, one with a suprapubic catheter, and four with an indwelling catheter. According to Frankel's classification, four patients were in A category, four in B, one in C and five in D among the group of complete CIC. C6A/C5B (right/left hand) by Zancolli's classification was the highest level of ability for all these 14 patients; and one patient (a 30-year-old male, Frankel B classification) could manage independent CIC with the aid of our special device. However, the practical limit of functional hands for independent CIC appeared to be about C6B1.

Keywords: cervical spinal cord injury; clean intermittent catheterisation; functional hand limitations

Introduction

In 1972, Lapidès *et al* advocated intermittent self-catheterisation to empty the neuropathic bladder. After a number of good results had been reported following this regimen,^{4–8} the concept of low pressure voiding has gained worldwide recognition. In the past, tetraplegic patients with limited hand function have been denied access to CIC, as it was considered to be both time consuming and impractical.⁹ However, as success in CIC among tetraplegic patients has been increasingly reported,¹⁰ it has been encouraged not only on urological grounds but also as being beneficial to the patient's morale, self esteem and as a means of reducing nursing time.

With a growing number of tetraplegic patients in our rehabilitation centre, we have encouraged them to manage CIC actively, whether independently or assisted. The purpose of long term CIC was to render patients continent and catheter free. In this study, we assessed the highest level of ability of tetraplegic patients to perform the technique taught by our staff (OT and/or nurse) according to their functional cord level.

Patients and methods

Forty-seven tetraplegic patients who had been admitted to our rehabilitation centre were studied. Eight patients had been transferred here within 7 days of injury. Most had been admitted with an indwelling urethral catheter. These were 42 males and five females with a mean age of 55.1 (ranging from 18 to 78). Forty-five patients had

spinal paralysis due to trauma, in four accompanied by an ossifying posterior longitudinal ligament. The degree of impaired hand function was categorised by Frankel's classification (Table 1) and evaluated in detail by Zancolli's classification. The urological status was assessed during hospitalisation by the use of intravenous pyelographics, urodynamics, and urethro-cystography. The patients were treated with anticholinergic medication if the urodynamic studies indicated that there was detrusor hyperreflexia.

Physical and occupational therapy (PT/OT) was continued throughout hospitalisation. The patients were taught to catheterise themselves or with assistance using a CIC set (Iwatsubo's set;¹¹ a sterile catheter set incorporated with a stylet on occasion, soaked in 10% iodine glycerine (Fuji Rasuramuzu Co Ltd, Tokyo, Japan)). All obstacles to carrying out clean catheterisation were addressed by OT staff, including such considerations as suitable pants, fixing self-help devices, CIC stands, seating, modified gloves and hand splints.

Table 1 Numbers and mean age of subjects listed according to the Frankel scale²

Frankel scale	No.	Age (mean \pm SD)
A	14	57.1 \pm 12.8
B	11	43.5 \pm 19.2
C	3	67.3 \pm 9.2
D	19	58.3 \pm 17.4

Results

Table 2 demonstrates the result of final methods of micturition. Of the 47 patients who had been taught CIC, 14 could perform CIC independently, but 17 required assisted CIC (mostly assisted by nursing staff or by family members such as a spouse). Nine patients became continent or occasionally dependent on diapers with preserved motor function below the injury level and independence in ADL (D category).

Table 3 illustrates 14 patients who were discharged successfully on independent CIC. Their hand function was evaluated in detail by Zancolli's classification. Most of these patients came to our centre with an indwelling catheter. C6A/C5B was the uppermost functional level among tetraplegic patients. The patient with this functional level could carry out independent CIC efficiently with the aid of a special device.

Table 4 shows 17 patients who required assistance to manage CIC at the time of discharge from the centre. Among various types of disabilities, according to Frankel's category, four patients had a central cord lesion. The others had higher lesions and ultimately required an assisted CIC regimen.

Five patients were discharged with an indwelling

Table 4 Patients with a CSCI discharged with assisted CIC

Type/level Zancolli scale	Frankel scale	Total number of patients
Central cord	D	4
C4/C4	A, B	2
C5A ~ C5B	A: 4, B: 2	6
Mixed paresis	C	1
C6A ~ C6B3	A: 2, B: 2	4

catheter. These included one male with a suprapubic catheter and four (two males, two females) who had declined CIC.

Discussion

CIC has been the advocated regimen for patients with a neuropathic bladder resulting in dysuria and incontinence. The CIC procedure had been originally applied to paraplegic patients. However, it has now also been widely applied to tetraplegic patients whose ability to carry out CIC depends mostly upon the residual ability of hand function. We have encouraged every patient

Table 2 The type and the number of micturition methods used when the patients were discharged utilising the Frankel scale

Frankel scale	Indwelling catheter	Assisted CIC	Independent CIC	Tapping or voluntary voiding	Diaper
A	3	7	4		
B	2 + (1 ^a)	5	4		
C		1	1		1
D		4	5	9	1
Total	5	17	14	9	2

^aSuprapubic catheter

Table 3 The demographic characteristics and method of urine evacuation on admission in patients with CSCI who were discharged with independent CIC

Patient	Age	Duration ^a of morbidity at discharge	Frankel scale	Zancolli scale (right/left hand)	Micturition on admission
SU	56	4Y/10M	A	C6B2/C6B2	Indwelling catheter
AR	62 ^b	2Y/7M	A	C8B/C8B	Indwelling catheter
KA	27	5Y/0M	A	C6B3/C6B3	Indwelling catheter
AR	59	2Y/3M	A	C7B/C7B	Indwelling catheter
HI	18	4Y/5M	B	C6B2/C6B2	Indwelling catheter
YA	20	5Y/10M	B	C6B1/C6B1	Indwelling catheter
KI	18	1Y/2M	B	C6B2/C5B	Indwelling catheter
II	30	2Y/2M	B	C6A/C5B	Indwelling catheter
HA	62	1Y/8M	C	C8B/C8B	Assisted CIC
IN	42	3Y/8M	D		Assisted CIC
NI	66	15Y/0M	D		Indwelling catheter
KO	50	2Y/0M	D		Indwelling catheter
KI	75	2Y/7M	D		Assisted CIC
HI	55	1Y/1M	D		Assisted CIC

^aDuration: the time from injury to being discharged from the centre

^bAll patients except one were male

with spinal cord damage to perform CIC, regardless of his or her injury level. Assisted CIC, if necessary, has been actively applied by the nursing staff or by an attendant such as a spouse.

For independent CIC, a comprehensive rehabilitation approach was imperative for tetraplegic patients. It included pharmacological management, PT/OT exercises, and psychological and social assessment. Furthermore, bedside set-up and various devices designed by the OT staff were necessary for individual self-catheterisation. The CIC set (commercially available) was convenient for this purpose.

Among complete CSCI who could manage independent CIC, C6A/C5B was the highest functional level. The patient with this functional level was highly dependent in ADL, but for CIC he was provided with a special hand device (Figure 1). At the tip of this device, an eyelet was installed on the metal plate fixed to a cock-up splint which he could put on using his mouth. The catheter can be inserted through the eyelet and led into the urethra with the frictional force of the forearm.

With a bilateral functional level below C6B1, no specific hand devices were required for CIC. As such patients no longer required indwelling or assisted catheterisation, the treatment was highly successful both urologically and as a means of reducing nursing time. It also provided a great boost to the patient's morale and self esteem.

If we exclude nine relatively continent cases in Frankel's D category from the present study, 36.8% of tetraplegic patients could become independent with CIC. With the increasing number of aged tetraplegics, bladder rehabilitation has become more important as the influence of age has revealed several disadvan-

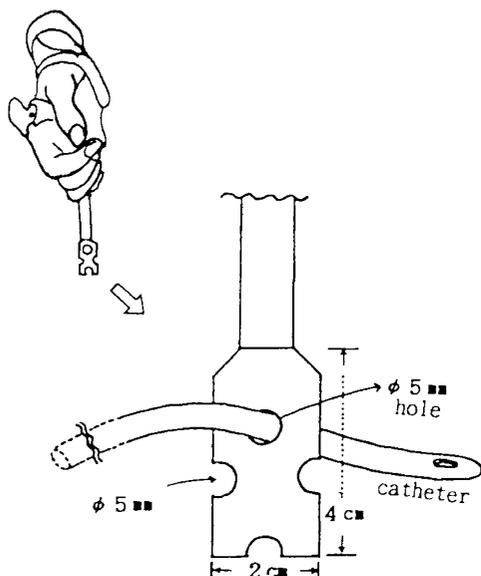


Figure 1 A special terminal device for CIC used with the highest level of CSCI (C6A1/C5B). A catheter is inserted through a hole and then led into the urethra by a pronation/supination motion of the patient's forearm (Ikeda, 1994)

tages.⁵ Hill *et al*¹² taught tetraplegic patients with lesions at the level of the 6th cervical segment and below to perform CIC. However, they discontinued independent CIC when a patient had less than grade 2 power of the triceps, due to a high rate of failure long term. Sutton *et al*¹⁰ selected tetraplegic patients with their level at C6/C7 to teach them independent CIC. Because of the classification difference, it is difficult to determine the functional level by muscle strength only. Other factors have also to be taken into consideration to carry out independent CIC. But good dorsiflexion of the wrist (C6B1 by Zancolli) appears to be essential for CIC. During CIC, no specific devices were used.¹⁰

Regarding CIC in female patients, one such patient (C8B/C8B) out of five cases could manage CIC, but seemed unwilling to continue with it. In deciding the method of bladder management for females, many factors, including the patient's wish for CIC, should be assessed.¹³ A higher incidence of aversion and distress among female patients was reported,¹⁴ and fewer continued with CIC.¹⁵

Controversy exists about the necessity for a strict aseptic technique and the prophylactic use of antibiotics in catheterising hospitalised patients.¹⁶ However, CIC for hospitalised patients with CSCI has the potential to reduce the nursing time spent in performing catheterisation.

Conclusion

The CIC procedure has become a generally accepted method of bladder management following spinal cord injury. Recently in our centre, a CIC teaching programme has been given to every patient after her or his admission. With the increasing number of CSCI patients, CIC has become more important. A comprehensive team approach is essential to achieve independent CIC in CSCI. We tried to clarify the functional upper limit of CSCI necessary to carry out independent CIC. Fourteen out of 47 tetraplegic patients succeeded in independent CIC on discharge. Our results showed that more than one third of all patients admitted with a CSCI could become independent CIC if near continent tetraplegics were excluded. Although the practical functional level appeared to be about C6B1, the highest level achieved was C6A1/C5B. This patient required the use of a special device, but his treatment was highly successful, both urologically and psychologically.

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