

Intermittent Urethral Self-Catheterisation: Long Term Results (Bacteriological evolution, Continence, Acceptance, Complications)

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Summary

Forty six (9%) out of 520 patients from the years 1976 to 1982 who used intermittent urethral self-catheterisation (IUSC) as the method of bladder drainage at the moment of discharge from the Swiss Paraplegic Centre of Basel were analysed during their rehabilitation period, on discharge, 3, 6 months later and again 5 years later regarding bacteriological changes and urinary tract infections, behaviour of some problem germs such as *Proteus*, *Klebsiella* and *Pseudomonas*, sterile versus clean catheterisation, catheterisation frequency, complications, continence and acceptance of this method. Only 22 patients continue IUSC, 5 have died, 6 use indwelling catheters and 13 are voiding their neurogenic bladder with other methods.

Average time on IUSC was 6.6 years (0.5-13 years) in the women's group and 4.6 years (0.5-12 years) in the men's group. Of the remaining 22 patients on IUSC, 23% have sterile urines, 36.5% are infected with *E. coli* and Enterococci, 4.5% with Staphylococci and the remaining 36% still show the problem germs *Pseudomonas* (4.5%), *Proteus* (13.5%) and *Klebsiella* (18%), but there was a reduction from 19 cases with problem germs in 1983 to 11 cases in 1988.

In 1988 5% women and 4% men changed from sterile to clean IUSC (2 out of 11 men using the same catheter for at least 1 week and 2 out of 10 women).

The complication rate was astonishingly low during IUSC: being only 4.3% (2 male patients, one with stricture of the urethra and epididymitis, one with autonomous dysreflexia with bladder overdistension). No anti-cholinergic or alpha-stimulating agents were used nor continuous antibiotic-prophylaxis and only in one female patient was a bladder denervation procedure performed. No deterioration of the upper urinary tract was observed. The degree of continence remained stable throughout the follow-up, and the same applies to the acceptance of IUSC.

The authors conclude that IUSC can be of great help in neuropathic bladder rehabilitation provided that the patients are properly selected, motivated and well instructed and followed throughout the years.

Key words: Intermittent self-catheterisation; Bacteriological evolution; Urological outcomes; Neuropathic bladder; Spinal cord injury.

Sterile intermittent urethral self-catheterisation (IUSC), introduced some decades ago, is now a standard procedure for managing a neuropathic bladder in the post acute phase in Spinal Cord Injury Centres either as the sole method or in addition to other voiding techniques (Lapides, 1972; Zrubecky, 1973; Lapides *et al.*, 1976). IUSC is now one of the most common methods of bladder management at discharge from most Spinal Cord Injury Units (Young *et al.*, 1982 33%; Stover *et al.*, 1985 30%). In Switzerland there has been a gradual increase from 5% in the late 1970s now to around 25% at discharge. The aims of a long-term bladder rehabilitation in spinal cord injured patients are: (1) voluntarily induced bladder voiding without residual urine; (2) avoidance and reduction in urinary tract infections; (3) maintenance or reconstruction of continence, and (4) avoidance of urinary complications. (Kuhn, 1983, Opitz, 1984, Stöhrer *et al.*, 1984, Gardner *et al.*, 1986). The advantages of IUSC have been described by many workers (Joiner and Lindan 1982, Kuhn, 1983, Berard *et al.*, 1985, Gardner *et al.*, 1986, Burke *et al.*, 1987, Lindan *et al.*, 1987, Maynard and Glass 1987, Wyndaele, 1987, Hill and Davies, 1988, Stickler and Chawla, 1988). Although IUSC initially compares favourably to other bladder voiding methods (Young *et al.*, 1982, Maynard and Glass 1987, Hill and Davies 1988) a review of our 46 patient group analysed 5 years ago in 1983 allowed an assessment of the longer term results.

Patients and methods

In 1983 an analysis was made of 46 patients (9%) out of 520 patients of the years 1976 to 1982 who used IUSC at the time of discharge from the Basle Centre (Kuhn, 1983), and the same group of patients were re-examined 5 years later. Analysis included bacteriological evolution (kind of bacteria, moment of bacteriological changes, behaviour of some hospital problem germs (*Proteus*, *Klebsiella*, *Pseudomonas*) sterile versus clean IUSC, frequency of daily catheterisations, complications, continence and acceptance of this method.

All patients had a preliminary urodynamic examination and intravenous pyelography, no patient had long term additional anti-cholinergic or alpha-stimulating therapy (except one bladder denervation procedure in one female patient), nor were any long term antibacterial prophylaxis or acidifying agents regularly administered.

All 46 patients (or their relatives) learned a sterile non-touch method of IUSC, but were informed during their stay at the centre that a clean technique would be possible at home. The average fluid intake at the centre was 2 to 2.5 litres/day and patients without complications (stones and recurrent urinary tract infections) were allowed to reduce the daily fluid intake to 1.5 litres/day.

The indications for IUSC were the following:

- (1) As an additional and temporary method to other bladder voiding techniques;
- (2) In not yet defined neuropathic bladders, mixed lesions and incomplete lesions;
- (3) As a prophylactic measure to reduce incontinence mainly in unstable UMNL-lesioned women;
- (4) For men not wishing to wear a leg-bag and for men with sphincter detrusor dyssynergia or too high residual urine volumes, avoiding a transurethral resection of the external sphincter; mainly men with the intention to remain continent and without retrograde ejaculation, and
- (5) For well motivated

patients who were ready to take over the responsibility for an impaired body function by themselves.

Results

Age ranged from 18 to 64 years (mean age 37.3 years) two-thirds were between 25 and 50 years of age. Figure 1 shows the age groups of those patients on IUSC and the total patients. In the age group 30 to 40 years as well as in the group 40 to 50 years the percentage of patients on IUSC is higher than in the total 520 patients. Figure 2 shows the distribution of neurological levels and sex (19 female and 27 male patients), the men/women ratio in Basle being 1:2.59 (Kuhn *et al.*, 1983).

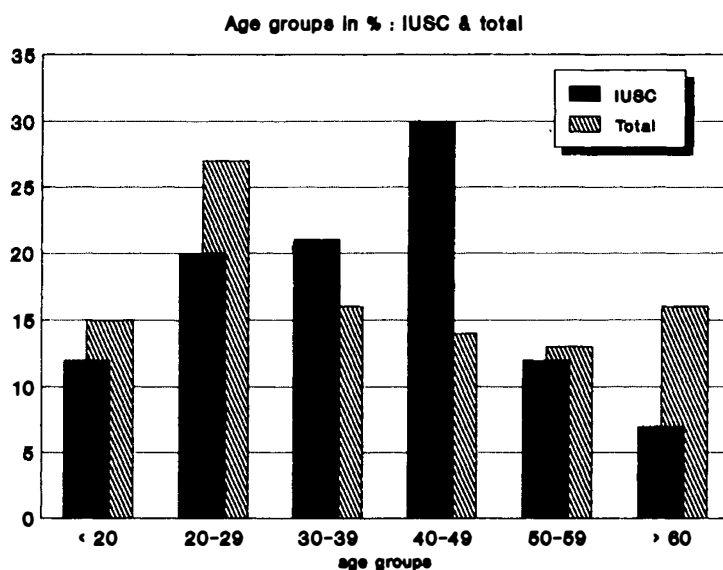


Figure 1 Age groups in %: IUSC and total.

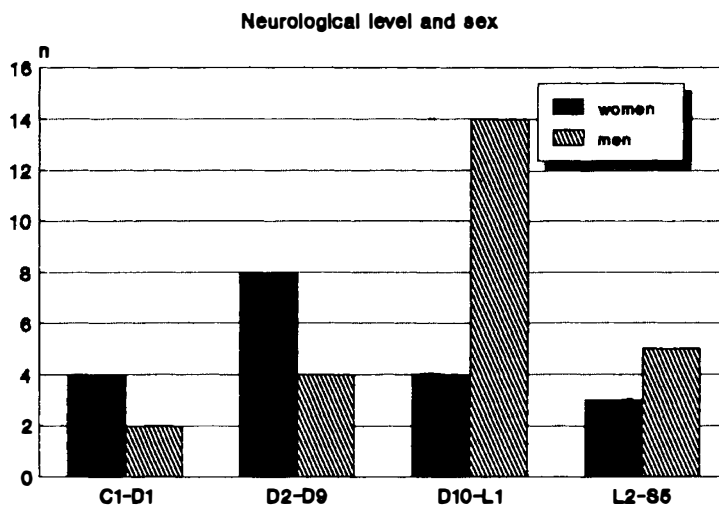


Figure 2 Neurological level and sex.

Only 1 incomplete tetraplegic woman out of 4 could catheterise herself, the other 3 were catheterised by their carers as were the 2 tetraplegic men in this series. 56.5% of the patients had an incomplete and 43.5% a complete lesion which corresponds to the normal distribution of complete and incomplete lesions of the whole spinal cord injury population throughout the years 1974–1982 (Zäch 1974–1982).

Thirty four patients (74%) had traumatic spinal cord lesions and 12 (26%) had lesions of non-traumatic origin (4 herniated disc-lesions, 4 vascular lesions, 3 transverse myelitis and 1 patient after radiotherapy).

Urodynamics revealed an upper motor neuron lesion (UMNL) in 52%, a lower motor neuron lesion (LMNL) in 31% and a so-called mixed lesion in 17%.

Twenty per cent started IUSC within 3 months after injury, 25% within 4 months, 45% within 7 months and the remaining 10% after 7 months (patients who arrived late at the centre: herniated disc patients, vascular disease lesions, myelitis and tumor patients) (Fig. 3). The frequency of daily IUSC was analysed according to the type of bladder and sex.

On discharge more than 60% of the UMNL women catheterised 3 to 5 times a day; the frequency was higher at the 3- and 6-month controls and after 5 years most of them are on a frequency of 3 to 5 times a day; 72% in this group remained faithful to IUSC.

Also in the UMNL-men group more than 60% catheterised 3 to 5 times per day in the beginning but 5 years later only 3 male patients continued self-catheterisation 1 to 5 times per day (1 was on indwelling catheter (hemiplegic), 1 died and 6 had no more need for catheterisation).

In the LMNL-women group all 4 patients catheterised 4 times a day on discharge, 2 died later (by suicide) and 2 remained on IUSC 4 and 5 times a day.

In the LMNL-men group with conus or cauda equina lesions 6 out of 10 patients

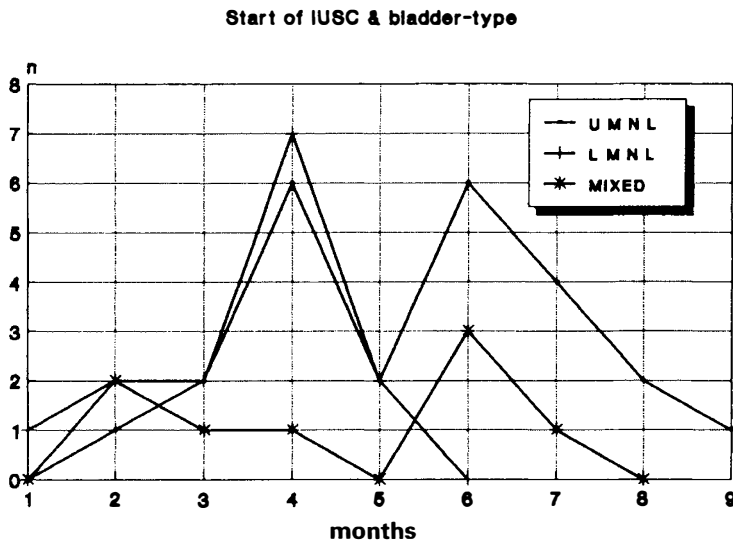


Figure 3 Start of IUSC and bladder-type.

performed IUSC twice a day (additional catheterisation) and the remaining 4 patients showed a frequency of 3 to 5 times per day and 5 years later still 7 patients catheterised 2 to 5 times a day.

In the mixed group there is only 1 woman left on IUSC 6 times a day and none of the initial 6 men continued self catheterisation.

Great variations in the frequency of daily IUSC were found, but it was very satisfactory to find 55% of the men IUSC-free already 6 months after discharge. The other men continue IUSC in a frequency of 1 to 5 times per day. In the female group only one patient was IUSC-free in 1988 and the others continue IUSC in a frequency between 1 to 6 times per day. At 5 years all the tetraplegic women were on indwelling catheter for 'convenience or continence' reasons.

The average daily IUSC frequency of 3.3 for all patients is rather low compared with our recommended fluid intake of 1.5 to 2.5 litres per day, but one third are using IUSC as an additional technique to tapping or Cr  d  . Twenty two patients continued IUSC in 1988 (5 patients died of non-urologic disorders, (2 women by suicide); 6 have indwelling catheters (tetraplegics, elderly patients with additional handicaps such as hemiplegia and mental disorders) and 13 patients were IUSC-free.

Compared with other publications our complication rate on IUSC is surprisingly low (4.3%): 2 male patients, one with a urethral stricture and epididymitis, and 1 patient with autonomous dysreflexia as a sign of chronic bladder over-distension. These symptoms disappeared under beta-blocking agents and consequent IUSC. In no case IUSC had to be stopped and no female patient showed a complication throughout the years.

Sterile versus clean IUSC

We found a slight decrease in the use of the sterile technique of 5% in women and of 4% in men in favour of the clean technique illustrating the impression made by our strict teaching of the no-touch-technique.

Two out of 11 men (and 2 out of 10 women) used the same catheter for 1 week or longer. Both sexes described a more or less clean or sterile variation of IUSC and the choice of either clean or sterile IUSC often depended on whether an insurance paid for all items such as single-use catheters and sterile gloves.

The degree of continence

Continence was analysed according to sex and to neurogenic bladder dysfunction (Table I).

Complete continence was defined as dry during 3 hours; partial continence: dry 2 hours (pad-wearers); incontinence: significant loss of urine between catheterisation and suffering from this fact (diaper-wearers).

The degree of complete continence seems to be rather low compared with other publications, but one has to consider that most other centres use anticholinergics and alpha-stimulating agents whereas none of our patients used such medicaments regularly. Only 1 female patient with a mixed bladder, had a bladder denervation procedure but to be completely dry she is on a daily IUSC frequency of six times. It is a general observation that our patients do not accept medicaments or further surgery after the onset of the paralysis.

Table I

| | | 1983 | 1988 |
|-------|---------------------|------|-------|
| Women | Complete continence | 37% | 40% |
| | Partial continence | 57% | 30% |
| | No continence | 6% | |
| | Not using IUSC | | 10% |
| | Indwelling catheter | | 20% |
| Men | Complete continence | 59% | 26.5% |
| | Partial continence | 33% | 12% |
| | No continence | 8% | |
| | Not using IUSC | | 46% |
| | Indwelling catheter | | 11.5% |

In comparing acceptance of IUSC according to sex and bladder function, many women of the UMNL-bladder-type find this method very acceptable and this judgement remained the same throughout the next 5 years. The 20% non-accepting women are all on an indwelling catheter in 1988; but the 10 women with an UMNL-lesion found IUSC very good or good and consider it preferable to the permanent state of being wet. In the male group, where 46% had no further need for IUSC in 1988, one can note that the non-accepting group wore leg-bags.

Urinary tract infections, bacteriology

After IUSC, in 13 out of 46 patients (28%) the type of bacteria in the urine did not change from that of the first bacteriological control. Half of the patients had changes within 8 weeks and another 10% changed 4 weeks later. Those 50% of patients who had bacteriological changes in a relatively short lapse of time subsequently remained very faithful to their acquired germs.

As far as frequency of symptomatic urinary tract infection is concerned, the percentage of patients with 4 to 8 infections per year decreased from 28% to 12%, and the 46% showing an infection frequency of 1 to 3 per year rose to 68% in 1988. Patients who were chronically infected doubled (7% in 1983, 15% in 1988); at discharge from the centre 20% of the patients had sterile urines, and the last bacteriological examination in 1988 revealed sterile urines in 23%, but only 5% had permanent sterile urines during the last 5 years. Compared with the sterility rate of the Basle patients on all bladder voiding techniques (16%) (Kuhn, 1982) the permanent sterility rate on IUSC seems rather low, but no patient on IUSC showed deterioration of the upper urinary tract and there was no vesico-ureteral reflux. Two men had three complications which disappeared on consequent IUSC and no woman showed any complications after tens of thousands of catheterisations and for both sexes we noted less aggressive urinary tract infections (Fig 4).

Bacteriological evolution

The first bacteriological examination after taking up IUSC showed a reduction of the problem organisms *Klebsiella*, *Pseudomonas* and *Proteus* from 25 to 16. Before IUSC 16 patients were infected with *E. coli* and *Enterococci* and after IUSC there

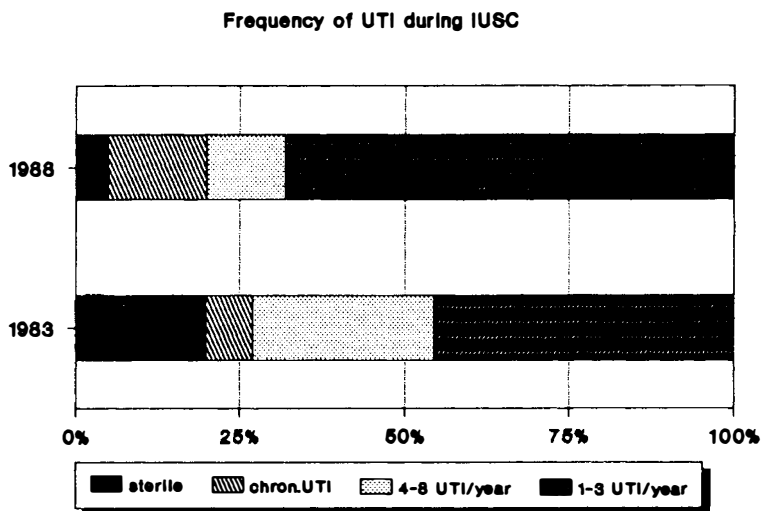


Figure 4 Frequency of UTI during IUSC.

were 24 patients infected with those germs. Two patients formerly infected with *E. coli* and *Enterococci* revealed an infection with *Pseudomonas* and *Klebsiella*. In both groups we found new problem germs although the patients never catheterised themselves outside their homes. A relapse (from bladder wall, prostate etc.) seems to be the most probable explanation.

One aim of this study was also to see if consequent IUSC could reduce problem-germs like *Pseudomonas*, *Proteus* and *Klebsiella*.

In the group of 6 patients infected with *Proteus* 2 became *Proteus*-free after the first IUSCs, but two other problem germs, one *Klebsiella* and one *Pseudomonas* appeared. On discharge *Proteus* completely disappeared but reappeared in one case at the 3- and 6-months-control and 5 years later two *Proteus*-infections had to be noted (plus 1 *Enterococcus*, 2 *E. coli* and 1 *Klebsiella*-infection).

In the group of 6 patients infected with *Pseudomonas* before starting IUSC we found an impressive reduction to only one *Pseudomonas*-infection after having taken up IUSC. One patient was chronically infected with *Pseudomonas* and at the 3- and 6-months after discharge controls one additional *Pseudomonas* re-appeared in 1988 together with one *Staphylococci*, one *E. coli*, one *Enterococci*, one *Proteus* and one *Pseudomonas*.

In the largest problem-germ group *Klebsiella*, an impressive reduction from 13 to 4 cases was noted shortly after taking up IUSC, but the evolution shows that this germ remains very stable throughout the years. No change to *Pseudomonas* was observed but a change to *Proteus* in two cases. In this group we also noted the highest sterile urine rate in 1988. We found 3 patients with sterile urines, 2 with *E. Coli*, 1 with *Staphylococci* and 3 with *Klebsiella*. Four patients did not continue IUSC and no bacteriological examination was available.

The last available bacteriology of the remaining 22 patients on IUSC showed sterile urine in 25% of the patients (32.5% at discharge); 36.5% showed *E. coli*- or *Enterococci*-infections (39% at discharge), 18% (15%) *Klebsiella*; 13.5% (6.5%) *Proteus*; 4.5% (2%) *Pseudomonas*, and *Staphylococci* 4.5% (2%).

At discharge 23.5% of the patients were infected with the problem germs *Proteus*, *Pseudomonas* and *Klebsiella* and in 1988 36%; the separate analysis of the bacteriological evolution of *Proteus*, *Pseudomonas* and *Klebsiella* showed a total reduction from 25 to 8 problem germs. We can conclude that IUSC is able to individually reduce the problem germs but generally speaking these germs may be expected to continue in one third of patients, *E. coli* and *Enterococci* will be present in one third and organisms of skin origin in about 5%. Permanent sterile urine may be anticipated in about 5% of patients on IUSC. The reduction of the germs of the intestinal flora and of the skin seems for us not to be a question of technique (either clean or sterile) of IUSC but rather a question of the patients' personal hygiene. It is not likely that disinfection of the perineum or the meatus urethra could resolve this problem.

Discussion and conclusions

Analysis of 40 publications from 1972 to 1989 where the authors report on 408 women, 864 men, 256 girls and 130 boys on IUSC indicates that proportionally there are more women than men on IUSC (1:2.2). The average age in these publications is 35.7 years (range 1 week to 89 years) which correlates well with our average age of 37.3 years. Age does not seem to be a restriction for IUSC which is also confirmed by Madersbacher and Oberwalder (1987).

Although the percentage of patients on IUSC now on discharge is actually around 30%, only about 10% of these patients will remain permanently on IUSC. This proportion correlates well with the findings of Burke *et al.* (1987), Wyndaele and Maes (1989) Maynard and Glass (1987) and Hill and Davies (1988).

Many authors have concluded that the UMNL-bladder of women is a preferred indication for IUSC, although the statements in the literature are somewhat controversial; Wyndaele and Maes, (1989) state 'that most of their patients' had an UMNL-lesion, Bakke, (1986) describes 10.5% on IUSC; Maynard and Diokno, (1984) 44%; McGuire and Savastano, (1983) 46% (most of them being men); all 60 patients of Iwatsubo *et al.*, (1983) had UMNL-lesions (their paper was about overdistention therapy to allow better continence via denervation which we rather consider a decompensation procedure). Maynard and Diokno report on 58.5% UMNL-bladders on IUSC and Mathe *et al.*, (1981) on 59%.

Thirty one per cent of our patients had a LMNL-lesioned bladder and used IUSC mainly as an additional technique to become residual urine free at least twice a day. LMNL-bladders theoretically seem to be ideal for IUSC if one considers the findings of Madersbacher (1976) who reports that the forces during Valsalva- and Cr  d  -manoeuvres are rather high and complications such as diverticulosis even vesico-ureteral reflux can occur due to increased outlet resistance created by the sinking down of the pelvic floor and thus changing the mechanical properties of the urethra. Observations on 2 patients (not analysed in this study) confirm the findings to Madersbacher. Both patients had a false passage (in one case after 5 years and a catheterisation-frequency of 5 times a day=9125 catheterisations and the other patient after 11 years 3.5 times a day=14 052 catheterisations. In both patients a temporary fine-bore suprapubic deviation was administered and they continued IUSC after 4 and 6 weeks). We therefore allow the LMNL-lesioned

patient to tolerate a certain amount of residual urine volume and to perform IUSC additionally in the morning and in the evening.

Patients with mixed lesions of the bladder seem to be for us ideal for the IUSC-method as an additional and temporary method until the neurogenic bladder is better defined and has become either of the two other bladders or has returned to normal.

Regarding the daily frequency of IUSC we agree with Buzelin *et al.*, (1979) that catheterisation every 3 hours during daytime and once during the night would be ideal. The 3 hours interval correlates also with the definition of social continence (Dechesne *et al.*, 1981, Madersbacher and Weissteiner, 1977). Since the remarks of Lapidès, (1972) that bladder over-distension is the main cause for ischaemic lesion of the bladder mucosa thus reducing the host-resistance with consecutive decompensation of the neurogenic bladder, we concluded that frequent intermittent self-catheterisation was appropriate. Hinman, (1977) found that increasing the catheterisation frequency is better than increasing diuresis. Reducing the residual urine volumes has therefore to be considered as one of the main aims of IUSC.

Our complication rate of 4.3% is very low compared with other publications: Maynard and Diokno, (1984) have: 'many patients with bladder-stones'; Berard *et al.*, (1985): 9% urolithiasis (a good result which compares favourably with 25% of urolithiasis in the non-IUSC paraplegic population of Berard *et al.* Maynard and Glass, 1987; 9% epididymitis, 18% cystolithiasis; Hill and Davies, (1989): 234 patients: 3 × bladder-stones, 2 × orchid-epididymitis, 20 × vesico-urethral-reflux); Wyndaele and Maes, (1989) report only on 'not severe' complications in 37.5% with urethral problems in 17.5%; Joiner and Lindan, (1982): 25% bladder over-distension, 8% dilatation of ureters and upper urinary tract and in one case a reflux; urethritis and haematuria were reported by almost all the authors. Lapidès *et al.*, (1976) report on 2% with this complication and state that the aetiology is not only bad catheter quality but also too big catheter calibre. The new self-catheterisation material should be able to reduce these complications further and Cranne and Kvaslerud, (1986) suggest a 'clean intermittent catheterisation check nurse' to reduce problems and complications and improve compliance of the patients on IUSC.

Our continence rate is satisfactory without recourse to anticholinergic or alpha-stimulating agents. Other authors (Trieschmann, 1980, Dechesne *et al.*, 1981) have stated that the indwelling catheter is the only solution for women to be socially continent. If an indwelling catheter has to be inserted, it is due to the lack of motivation of such patients and has to be considered as a failure of the rehabilitation team and not of the patient. Further development in special surgical techniques like bladder-augmentation or perhaps transdermal sacral root stimulation will help to achieve better continence.

Our patients seemed to be very conservative in not accepting additional pharmacotherapy but perhaps it is due to the fact that they do not take anticholinergics that they have such a low incidence of complications. A bladder denervation was performed in one female patient, she is now on a catheterisation frequency of 6 times and is mostly continent.

We agree with McDermott *et al.*, (1989) that lack of understanding of an impaired body-function is the main reason which leads to failure in patients on IUSC. Better education and instruction programmes are the aims for the future not

only for patients on IUSC. If a female is more continent via IUSC, acceptance is excellent, and many of our female UMNL-lesion patients confirm that IUSC performed in a prophylactic manner was the only method enabling a continent state. For the male patient we agree with Hill and Davies, (1989) that there is a gradual decrease of leg-bags due to improved social integration and improved possibilities in sexuality and fertility. For both sexes we agree with Graham (1988) that the method of IUSC is 'the best one available for patients who lead an active social life'.

Regarding bacteriology and urinary tract infections and even for clean IUSC we conclude that in the still existing light of many controversies in bacteriology and management of infections, IUSC is an acceptable way of voiding a neuropathic bladder, enabling a voluntarily induced balanced micturition within a shorter period of bladder training, having less aggressive urinary tract infections by reducing the residual urine volume and last but not least assisting continence and avoiding unaesthetic leg-bags, aggressive indwelling catheters or irritating external urine collecting devices such as diapers.

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