CLEAN INTERMITTENT CATHETERIZATION IN SPINAL CORD INJURY PATIENTS: LONG-TERM FOLLOWUP OF A HYDROPHILIC LOW FRICTION TECHNIQUE

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ABSTRACT

Clean intermittent self-catheterization is an established option in bladder management of spinal cord injury patients. Several early and a small number of long-term studies have reported good preventive or therapeutic effects on hydronephrosis, vesicourethral reflux, urinary tract infection and incontinence. Most reports describe the use of small catheters and liberal use of jelly but urethral complications, such as strictures and false passages, seem to increase with the length of followup.

All 30 spinal cord injury patients in this retrospective study had used disposable hydrophilic, low friction catheters from the early shock phase to a median of 7 years (range 5 to 9). There were 26 upper motor neuron and 4 lower motor neuron lesions. After tap water soaking, the surface layer of the catheter coating has a friction constant more than 10 times lower than that for a regular plastic catheter (Nélaton) with chlorhexidine jelly.

There was no hydronephrosis, pyelonephritis or renal scarring. In 3 patients who had decreased the clean intermittent self-catheterization regimen, signs of upper tract dilatation developed but the excretory urogram returned to normal after correction of the regimen. Of 30 patients 12 (40%) maintained sterile urine, while 4 of the remaining 18 with bacteriuria had episodes of urinary sepsis and chronic infections. Two patients had epididymitis. Of 6 men with occasional insertion difficulties when the clean intermittent self-catheterization regimen started after the indwelling catheter had been removed 4 showed yielding signs of strictures during the subsequent clean intermittent self-catheterization regimen. In 1 patient 2 dilation attempts had failed but the patient can perform the clean intermittent self-catheterization regimen. One patient with Crohn’s disease had advanced urethral changes in the acute phase but could perform clean intermittent self-catheterization with a small catheter. One patient has had recurrent modifications of the urethral wall but no development of a false passage.

The study indicates that patients who use hydrophilic low friction catheters do as well as or better than patients using conventional catheters. Above all, there is no increase in severe urethral complications with time after injury. Progression towards strictures after early urethral trauma seems to be preventable by the use of this catheter.

KEY WORDS: spinal cord injuries, urinary catheterization, urethral stricture

More than 20 years have passed since clean intermittent self-catheterization was introduced as an option in the bladder management of spinal cord injury patients. After a slow acceptance by physicians during the first decade, the method has now gained worldwide recognition, and can offer a clear rationale and rules for patient compliance. Thus, it is established as a safe, effective and convenient treatment modality for select patients.

Several early reports presented reassuring results as to potential complications, especially urinary sepsis and renal deterioration. The long-term clinical experience confirms the overall good results but local traumatic reactions of the urethral wall induced by repeated introduction of the catheter have been reported, and strictures and false passages seem to appear after several years. Wyndaele and Maes concluded that the use of small catheters (14 to 16F) and liberal use of lubricants do not seem to prevent urethral irritation and trauma in the long-term in patients who perform clean intermittent self-catheterization. They also asked for evidence on whether patients using a hydrophilic catheter would do better during long-term followup. This retrospective study was performed to determine how spinal cord injury patients on low friction, hydrophilic catheter drainage do during long-term followup, thereby also answering the question of Wyndaele and Maes.

METHODS AND MATERIALS

All 30 spinal cord injury patients (4 women and 26 men) in this retrospective study from February 1983 to August 1992 had been injured and on clean intermittent catheterization for 5 to 9 years (median 7). Median patient age was 37 years (range 24 to 61). The majority of the patients used a low friction, hydrophilic type of catheter since the day of injury but 9 patients had had indwelling catheters during emergency treatment for up to 1 week after injury and before use of the hydrophilic catheter began, with the philosophy being minimal use of an indwelling catheter. There were 29 traumatic lesions and 1 ischemic spinal cord injury caused by surgery for a ruptured aortic aneurysm. A total of 14 patients was classified at hospital discharge as having Frankel type A or B (complete motor and sensory) lesions, while the other 16 had Frankel type C or D (incomplete sensory and motor) lesions. There were 26 upper and 4 lower motor neuron lesions.
Urological evaluation during the shock phase included urinalysis and urine cultures twice weekly, and excretory urography (IVP), cystoscopy, cystometry, chromium-ethylenediaminetetraacetic acid clearance and radiorenography after this phase before the decision on bladder management modality was made. A total of 26 patients had detrusor-sphincter dyssynergia, while 4 had detrusor areflexia. Six patients with a reflex bladder were on individualized doses of oxybutynin and/or propantheline to maintain continence. Intravesical pressures greater than 40 cm. water occurred in 11 of our patients and were also routinely treated with anticholinergics.

Six patients had been on phenoxbenzamine during periods of autonomic dysreflexia. These blockers could often be slowly tapered out without new attacks occurring. Otherwise, no anticholinergics or prophylactic antibacterial treatment was given unless required for specific reasons as reported.

All but 2 patients with high spinal cord lesions and impaired dexterity had been taught and trained to perform clean intermittent self-catheterization after the initial aseptic catheterization performed by specialized staff. Community home nurses helped to catheterize the 2 patients with severely impaired hand function in their apartments as part of a 6-hourly handicap service. A total of 18 patients had kept to the clean intermittent self-catheterization regimen since the shock phase, while the other 12 had attempted suprapubic tapping and/or straining (in 6 combined with clean intermittent self-catheterization) but they had all returned to the regular clean intermittent self-catheterization regimen within 6 weeks. The reason for resuming the prior regimen had been upper tract dilatation in 2 cases, and increasing residual volumes with pyuria and/or acute infections in 10.

In all patients the catheterization was performed as a clean procedure. Disposable sterile plastic (polyvinyl chloride) catheters (LoFric©) were used only 1 time. These polyvinyl chloride catheters are coated with a nonreactive hydrophilic polymer, polyvinylpyrrolidone, furnished with sodium chloride to raise the osmolarity and enhance the water binding ability. Soaked in water, the polyvinylpyrrolidone chains bind the lubricating liquid with approximately the same osmolarity as exists in the urethral epithelium. Thus, a greatly decreased friction between the catheter and urethral mucosa is achieved by a contact area mainly consisting of water molecules. The friction of this catheter soaked in water was more than 10 times lower than that for a catheter lubricated with chlorhexidine jelly.

Bacteriological examination of the hydrophilic catheters soaked in tap water over a wide geographical area showed no colonization by bacteria or accumulation of pathogens. After 3 years of careful clinical evaluation at 3 centers in Gothenburg and Stockholm, the catheter was approved as a technical aid on the free tariff in Sweden, that is it is given free of charge to the patients. The cost of the hydrophilic catheter in the United States presently is approximately $2 each, which is about the same as in Europe and slightly higher than that of regular rubber or polyvinyl chloride catheters. However, no additional lubricant is needed with a hydrophilic catheter. Because the hydrophilic catheter is recommended for single use only, a significant difference in material cost depends on whether the regular catheters are reused or not. However, the difference in catheter cost may be compensated to some degree by decreased cost for treating complications, as we believe is indicated by the results of our study.

A randomized study on dogs showed marked epithelial damage in the urethral mucosa after a catheterization regimen using polyvinyl chloride catheters with chlorhexidine jelly, compared to discrete regional hyperemia and mild superficial reactions after using the low friction catheters. The traumatic effect of the tested catheters seems highly dependent on the friction of the catheter. These low friction catheters have also been used for clean intermittent catheterization after internal urethrotomy for treatment of urethral strictures.

During hospitalization, patients with clinical infections and those with asymptomatic bacteriuria routinely receive antibacterial treatment according to the resistance pattern. After hospital discharge, only symptomatic infections are treated. Patients with bacteriuria only in combination with elevated intravesical pressure or vesicoureteral reflux. Urine cultures are recommended every 2 months and results are reported to the unit. After 1986 bacteriuria was defined at our hospital as 10,000 or more colony-forming units per ml. (before then as 100,000 per ml in 24% of the cultures in our study). All spinal cord injury patients are scheduled for urological evaluation every 1 or 2 years, including cystometry, cystoscopy, chromium-ethylenediaminetetraacetic acid, radiorenography, IVP, blood tests and urine cultures. A complete blood count, and serum creatinine, electrolyte and liver function analyses are also performed. Maintenance of a low pressure bladder reservoir is especially controlled during cystometry.

RESULTS

Upper urinary tract. No patient had hydrourephrosis after injury, or showed radiographic signs of pyelonephritis or renal scarring. The patient who underwent surgery for an aortic aneurysm had a ureteral stricture postoperatively followed by unilateral hydrourephrosis. After dilation of the stricture, the hydrourephrosis resolved to almost normal and presently is controlled by a 4-hour clean intermittent self-catheterization regimen.

Three patients had signs of upper urinary tract dilatation on an IVP. In 1 patient the signs disappeared with improved compliance, while in the other 2 who had changed the regimen for reasons of convenience to suprapubic tapping (plus straining in 1), there was also a shift to high intravesical pressures. One patient resumed clean intermittent self-catheterization and regained low pressure and a normal IVP. In the other patient the pressure decreased after combining the tapping with clean intermittent self-catheterization once a day, and the upper tracts became normal with clean intermittent self-catheterization twice a day.

Vesicoureteral reflux. Radiorenography revealed signs indicative of possible reflux in 9 patients. The clean intermittent self-catheterization regimen was then reviewed, and antibacterial and anticholinergic treatment was introduced. These measures resulted in normal radiorenography findings and further diagnosis regarding reimplantation seemed unnecessary.

Urinary tract infection. A total of 12 patients (40%) maintained sterile urine during followup. Of the remaining 18 patients with recurrent bacteriuria 14 were predominantly asymptomatic but 4 with positive cultures more than twice a year were treated for recurrent clinical infections. All 4 patients had acute pyelonephritis at least twice, and several episodes of pyuria and cystitis. Those with pyuria were treated with appropriate antibacterial drugs, while the others underwent frequent catheterization and bladder rinsing using chlorhexidine or saline solution. Two patients with recurrent acute pyelonephritis for more than 2 years were prescribed long-term prophylaxis (trimethoprim at 300 mg. per day for 6 months) 1 who had recurrent epididymitis was free of infection for 3 years and 1 still has recurrent episodes of pyelonephritis.

Continence. A total of 22 patients reported no problems with leakage. Six of them could remain dry on oxybutynin (in 2 combined with propantheline) with a fluid intake not exceeding 2,000 ml. per day. Seven patients used a uridom at
night to be safe. Of the remaining 8 patients who remained incontinent between catheterizations (at least once a day) 2 had stopped using anticholinergics due to side effects and 2 had stopped for unknown reasons. All 8 patients deliberately lowered the daily intake of fluids to less than 2 l.

Complications. Of 6 men with occasional insertion difficulties when the clean intermittent self-catheterization regimen began after the indwelling catheter had been removed 4 showed yielding signs of strictures during the subsequent clean intermittent self-catheterization regimen. In 1 patient 2 dilation attempts failed but the patient can perform the clean intermittent self-catheterization regimen. One patient with Crohn's disease had advanced urethral changes in the acute phase but could perform clean intermittent self-catheterization with a small catheter. One patient has shown recurrent modifications of the urethral wall but no development of a false passage. No operations were required. No incidents of false passages, meatitis or meatal stenosis were detected.

DISCUSSION

Spinal cord injury subjects today have a greatly improved life expectancy, with morbidity and mortality characteristics similar to those of the general population. Recent epidemiological spinal cord injury studies illustrate that the improved health and life span became possible only when the renal insufficiency and mortality rate could be successfully prevented. It is worth remembering that intermittent catheterization and its long-term clean intermittent self-catheterization variant, now spread worldwide, constitute fundamental elements in this prevention. We thought 10 years ago that compliant spinal cord injury patients, knowledgeable of the rationale, rules and need for long-term surveillance, should try to use a hydrophilic low friction catheter because it should logically decrease urethral trauma during long-term use and lead to a minor but important revision of the traditional use of catheters with lubricant jellies.

The clean intermittent self-catheterization regimen in our study began in the acute phase after the spinal cord injury, not as treatment of acute or chronic complications. As a preventive measure for upper urinary tract dilatation, our clean intermittent self-catheterization regimen may have been successful but the transient upper urinary tract findings prove that strict compliance with the clean intermittent self-catheterization regimen for several years after injury does not eliminate the subsequent risk of renal pressure injuries with less careful compliance. Furthermore, hydronephrosis can, in fact, occur despite regular bladder emptying. However, no such observations were made in our population. Patients who had abandoned the regimen seemed less inclined to attend regular followup, which prompted us to increase our efforts to achieve close surveillance. Transition to a high pressure bladder is still a silent hazard without clinical predictors.

The signs of possible vesicoureteral reflux resolved promptly on clean intermittent self-catheterization. In some of these cases early diagnosis may have prevented damage to the vesicoureteral ostium. A benign and transient reflux should validate the absence of hydronephrosis in our material.

Evidence from many sources has supported the view that intermittent catheterization diminishes the rate of urinary tract infection in a neurogenic bladder. The individual resistance of the patient to infection and a regimen preventing bladder over distention were more important for low rates of chronic infection than aseptic catheterization. Exact comparable data on urinary tract infection are difficult to extract from reports on intermittent catheterization but the differentiation between bacteriuria and clinical urinary infection seems to provide a useful basis for clinical assessment of urinary tract infection. Further differentiation by using scores for bacteriuria and clinical urinary tract infection presents well known difficulties, including weighting problems and memory bias. Therefore, we refrained from supplementary studies of this type. The use of this hydrophilic catheter seems to decrease the urinary tract infection rates. The 12 patients (40%) with sterile urine, 14 (47%) with asymptomatic, probably benign, bacteriuria and 4 (13%) with recurrent urosepsis appear to be fewer than reported in other comparable studies when other catheters with lubricating jelly were used.

The socially most appreciated effect of clinical intermittent self-catheterization may be that it provides good continence in the majority of patients. However, in spinal cord injury women, in whom clean intermittent self-catheterization and anticholinergic treatment prove to be insufficient to control hyperreflexic incontinence, there are still major problems. Repeated daily catheterization for many years should logically exert mechanical strain on the urethral wall. Urethritis in a few per cent of the patients was identified after 1 year in 1976. Subsequent reports exhibit higher but varying rates of severe urethral complications. The variation may relate to lack of a uniform definition of strictures and false passages but these complications tend to increase with the period of clean intermittent catheterization. Urethral damage could also be found in our study but it was induced before the clean low friction regimen had begun and no new urethral trauma was identified during the 5 to 9-year followup. Valid clinical comparisons of urethral trauma are still rare but a recent report that compared urethral cytology as a result of minor trauma after the use of hydrophilic or polyvinyl chloride catheters in spinal cord injury patients showed significantly less inflammation with the hydrophilic catheter. It seems reasonable and is indicated by our study that the hydrophilic catheter regimen has a preventive effect on urethral traumatic complications and that it can facilitate the healing of minor epithelial damage as reported by Bakke et al.

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REFERENCES

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