Use of the Memokath[®] for detrusor-sphincter dyssynergia after spinal cord injury – a cautionary tale

AI Low and PJ McRae

Department of Urology, Sir George Bedbrook Spinal Unit, Royal Perth Rehabilitation Hospital, Shenton Park, Perth, Western Australia

We report on the intraurethral insertion of the Memokath in 24 patients (26 stents) to combat detrusor-sphincter dyssynergia developing after spinal cord injury. Most patients have high tetraplegia for whom self-catheterisation is very difficult, if not impossible. Our results have been disappointing in that 19 stents have had to be removed, mainly because of persisting urinary infection, migration of the stent, or because of failure to improve emptying, usually associated with poor detrusor function. Caution is therefore advised in the use of this stent for detrusor-sphincter dyssynergia and it is not recommended in patients with chronic urinary infection. With better patient selection however, perhaps aided by modifications to stent design, the Memokath[®] may still prove to be a simple and reversible alternative to sphincterotomy in this difficult group of patients.

Keywords: spinal cord injury; detrusor-sphincter dyssynergia; neuropathic bladder; urinary tract infection; stents; Memokath stent

Introduction

Several articles have been published on the usefulness of the Wallstent (Urolume[®]) in spinal injury patients with detrusor-sphincter dyssynergia (DSD) with one recent paper reporting on medium to long term efficacy.^{1–3} While this latter paper by McFarlane *et al*³ states that ‘stenting is an effective alternative to sphincterotomy in the long term...’ only six of 11 patients remained satisfactory at the time of last review, and two of these had required bladder neck incision, and one had recurrent urinary tract infection (UTI), and one had died (of unrelated cause). Thus, only two out of 11 have had no significant problems and are currently well with the stent *in situ*.

Between 1990 and 1992 we inserted ten Wallstents in nine patients and five of these are still in place and working well, though it has been necessary to remove encrustations endoscopically in one patient on two occasions, and two have experienced increased but not disabling dysreflexic symptoms. Five of these stents had to be removed (in four patients) because of a combination of encrustation, endothelial ingrowth, recurrent UTI, continuing inadequate voiding and increased dysreflexia. Despite attempts to resect the endothelial tissue from the lumen to facilitate removal, this has often proven to be a very difficult and bloody procedure involving piecemeal removal of multiple short lengths of wire, and we have abandoned the use of the Wallstent in this situation for this reason. Two

of the above authors have expressed similar concerns in regard to removal (McFarlane *et al*,³ Stephenson TP (personal communication)).

The Memokath[®] (Engineers & Doctors A/S, Hornback, Denmark) is a coiled stent made of NiTiNol, a titanium/nickel alloy which is thermo-expandable and has ‘shape’ memory. Installation of fluid at 50°C causes expansion of several coils at one end from 22 Ch to 34 Ch size, allowing its retention within the urethra or prostate. Cooling with fluid at 10°C or less renders the stent ‘soft’ and allows easy removal.

Three papers have appeared describing the use of thermoexpandable NiTiNol stents in the prostatic urethra. The first two of these have utilised the Memokath[®] and have reported promising results but with short follow-up.^{4,5} The third, by Williams and White,⁶ reporting on the Memotherm[™], showed poor outcome due mainly to incontinence, irritative symptoms, migration and infection, with epithelial hyperplasia or calcification being noted in about one third of the patients. They did not recommend its continuing use, but did note that removal of the stent was easily achieved.

Soni *et al*⁷ have reported on the use of the Memokath[®] in ten patients with spinal injury and retention secondary to DSD. The stent was sited with the expanded end in the proximal bulbar urethra, and no problems were seen in a short follow-up of 3 to 7 months. An abstract of a presentation at a recent conference on stents by Foley *et al*⁸ describes the use

of 13 Memokaths with short review of up to 1 year. Six of seven stents placed across the sphincter alone were unsuccessful and had to be removed, while five of six inserted through both the bladder neck and sphincter have worked well and remain *in situ*. They currently see this stenting as a temporary procedure early in the management of such patients.

Materials and methods

This paper reports on 26 Memokath insertions in 24 spinal cord injury patients with DSD followed up until removal or for at least 12 months.

The 24 patients chosen for the 26 Memokath insertions have had spinal cord injuries at the levels indicated in Table 1. Fifteen are complete tetraplegics for whom self-catheterisation is difficult if not impossible (the four who are incomplete have some sensory sparing only, ie American Spinal Injuries Association (ASIA) Impairment Scale B⁹, and over half have had previous sphincterotomies (Table 2). A further sphincterotomy would have been their alternative form of management. The five paraplegics have complete lesions and are not willing to self-catheterise because of previous difficulties. One tetraplegic patient with bilateral 'fixed' hips and knees had had a total (not radical) prostatectomy, sphincterotomy and Prostakath[®], and finally a Wallstent; and another tetraplegic patient had also had a Wallstent inserted.

All patients obviously are male, ranging in age from 31 to 65 years with an average of 45 years. Most patients are at least a number of years post-accident, but in recent times a few stents have been placed during the initial hospital admission. The average time since injury is 14 years with a range of 6 months to 30 years.

Table 1 Level and degree of spinal cord injury

	Complete	Incomplete	Total
C5	6	2	8
C6	6	1	7
C7	3	1	4
T4	1		1
T10	1		1
T11	1		1
L1	2		2
	20	4	24

Table 2 Previous surgical procedures

	Sphincterotomy (one or more)	TUR(P)	Other
Nil			
10	13	4	4
Other	Total Prostatectomy	1	
	Prostakath [®]	1	
	Wallstent [™]	2	

The indications for stent insertions are set out in Table 3 and in general are a combination of those associated with DSD, ie high intravesical pressure associated with sphincteric obstruction leading to increasingly high residual urine and resultant UTI which becomes more and more difficult to eradicate. These UTI's nearly always produce symptoms, sometimes with fever and rigors, but more often general malaise associated with offensive, cloudy urine. One patient whose initial treatment was elsewhere and who had been 'lost to follow-up' had secondary bilateral hydronephrosis. Nine patients had difficulty voiding because of relatively poor detrusor contractility, this being the main problem in four of them. Three men experienced problems with self-catheterisation, and one patient with retained sensation was fearful of incontinence following sphincterotomy, and opted for reversible stent placement.

Previous reports have described insertion of the Memokath under ultrasonic control, and more recently under direct vision, using the stent mounted on a flexible (028-S) or rigid (028-T) cystoscope. We carried out the procedures under image intensification after putting 200 ml of contrast into the bladder, and in the latter 028-S and 028-T insertions, this is combined with direct vision using the flexible or rigid cystoscope. We have found this combination useful as there is often a tendency for the Memokath to move distally, even after expansion, when removing the cystoscope, and this is readily observed on the X-ray screen and can be easily corrected at the time. Our initial eight operations were carried out with the 'upside down' 044 Memokath with the expanded end placed proximally in the prostatic urethra. Subsequent installations have been with the 'normal' 028 stent with the expanded coils placed distally beyond the external urethral sphincter.

Results

As can be seen in Table 4, only seven of the 26 procedures have resulted in a successful outcome, defined as improved bladder emptying (usually with a residual urine less than 80 ml) without any urinary infection or dysreflexic symptoms. The reasons for failure, often in combination, are set out in Table 5. All the 044 model installations have failed and we no

Table 3 Indications for Memokath installation, often in combination

Recurrent UTI	High residual	DSD	Other
16	22	21	9
Other	Difficulty voiding		4
	Problems with CISC		3
	Fear of incontinence		1
	Hydronephrosis		1

longer use this type of stent. Five out of eight of them have migrated proximally, two up into the bladder (Figure 1) contributing to the failure—most were good outcomes until this migration occurred. One 028 stent has also migrated proximally, and in two patients who employ abdominal straining to void, the stent has moved distally (one of these had previously experienced proximal migration of the 044 variety) (Figure 2). This unwanted mobility of the stent tends to occur relatively soon after replacement, and has been detected as early as 1 week post-operatively, though it has taken up to 12 months to come to light—the average time interval has been 5 months.

Patients with recurrent infection pre-insertion have in general remained infected, despite our attempts to render them sterile pre-operatively along with the perioperative systemic antibiotics. One is then left with persisting infection, now in the presence of a 'foreign body', and if the infections are symptomatic, as is usually the case, microbiological advice inevitably leads to its removal. Of 18 men with recurrent UTI prior to stent insertion 14 (78%) have already failed, leaving only four (22%) who are currently satisfactory, while three of the eight who were uninfected (38%) are still working well.

Four patients have developed dysreflexic type symptoms (sweating, headache, mild hypertension, 'pain') following insertion of their Memokath—three with the 044 and one with the 028 (we have had similar problems with three patients with a Wallstent including one in this series). We surmise that the constant expansion of, and pressure on, the external urethral sphincter stimulates afferent nerves leading to unopposed sympathetic stimulation, noting that this occurrence has been in patients prone to these dysreflexic symptoms prior to stent placement.

Table 4 Results of Memokath insertions according to type of stent (028, 028-S and 028-T models combined)

Type of implant	044	028	Total
Success	0	7	7
Failure	8	11	19
Total	8	18	26

Table 5 Causes of stent failure, usually in combination

Type of implant	044	028	Total
Migration	5	3	8
Recurrent UTI	6	9	15
Dysreflexia	3	1	4
Inactive Detrusor	4	5	9
Encrustation	1	4	5

Bladder emptying has not been improved in 11 patients, nine of whom have a relatively poorly functioning detrusor.

Finally, in five patients, after a good early result, increasing problems have arisen leading to the discovery of marked encrustation of the Memokath necessitating its removal. This has been achieved endoscopically on four occasions, once assisted by a small open urethrotomy, but in one patient open cystotomy was needed to remove a large calculus extending up into the bladder (Figure 3). The average time to the development of encrustation has been 13 months (range 5–18) months), and it has been associated with recurrent infection in four of the five patients.

Figure 1 (a) 044 Memokath in good position with expanded portion just below bladder neck as demonstrated by contrast in the bladder. (b) Same Memokath having migrated proximally, lying transversely within the bladder

The above problems have led to removal of the Memokath on 19 occasions. Usually this has been accompanied by a sphincterotomy, though on two occasions, another stent has been put in position. This second stent has subsequently been removed in both patients. We have twice inserted a Memokath with its proximal end within a previously placed Wallstent but this has been unsuccessful on both occasions, after early improvement, because of migration.

Only seven of the 26 insertions have resulted in a good outcome, and these have all been with the 028 model, all of the 044 type having failed in due course. Most patients have had a good initial result only to

find that their stent has had to be removed for one or more of the reasons enumerated above.

Follow-up of these spinal patients is as shown in Table 6. Removal has been necessary between 2 and 18 months after insertion with a mean interval of 7 months. Those with a good result have been followed for an average of 16 months (range 12–24 months). Further problems may well arise and continuing close follow-up is obviously essential.

Discussion

The main causes of failure have been the persistence of recurrent UTI, encrustation, migration of the stent and the presence of a relatively acontractile detrusor (Table 5). Ejaculation may be compromised, and there is the potential for problems with urodynamic studies and catheterisation.

Unless infection can be eradicated prior to insertion (and this is often not possible where there is a significant residual urine) use of the Memokath cannot be recommended. We would now be very reluctant to insert this stent into a patient with recurrent UTI unless it could be eradicated prior to surgery, and are now tending to use it much earlier in the course of treatment, often during the initial admission when chronic infection is much less likely. Encrustation has occurred on five Memokaths, usually associated with UTI, and is another reason for being wary of its use under these circumstances.

Figure 2 (a) 028 Memokath in good position with expanded end in bulbous urethra and proximal end just below bladder neck as demonstrated by contrast in the bladder. (b) Distal migration of Memokath into penile urethra

Figure 3 Two examples of stone formation on the Memokath causing obstruction. The larger stone required open removal

Table 6 Time to removal of Memokath and follow-up of those remaining *in situ*

Time to removal (19)
2–18 months (average 7 months)
Good result (7)
12–24 months (average 16 months)

Migration of the Memokath has led to failure, usually after an initial successful result on eight occasions. Marked translocation at the stent has been the sole reason for removal in four men, with lesser movement being a contributing factor in the other four. The 'upside down' 044 model with the expanded end proximally in the prostatic urethra, is particularly prone to this problem, and is no longer used. Many of these spinal injury patients have a relatively dilated prostatic urethra above their area of sphincteric obstruction such that there is insufficient 'purchase' for the expanded end of the Memokath in this region. Even the 028 variety is prone to migrate because of inadequate 'grip' of the expanded distal end in the urethra. This problem may be overcome by a larger diameter stent, or having the entire length expansile, both of which possibilities are under consideration by the manufacturers (Engineers & Doctors A/S).

Previous outflow surgery, usually sphincterotomy, carried with it a significantly greater risk of failure. Only two of 16 patients (12.5%) with a preceding operation at the bladder neck or external urethral sphincter are in the successful category, compared with five out of ten (50%) of those in whom the Memokath was their first procedure. All nine of the men with poor detrusor function fall into the group having had previous surgery and all have failed to improve. If the bladder does not generate reasonably high voiding pressure, and particularly if the bladder neck remains 'competent', emptying is often still incomplete despite a correctly placed Memokath. Such patients tend not to respond very well to any form of treatment, especially if they are high tetraplegics with an acontractile detrusor, and even sphincterotomy taken from the bladder neck to the 'bulb' of the urethra may fail to achieve good emptying. Placement of the proximal end of a Memokath through the bladder neck has proven effective in two recent cases (not included in this study because of short follow-up), but we are concerned this may increase the risk of encrustation, and they are being carefully monitored. It is noteworthy that this is the preferred site in the abstract of Foley *et al.*⁸

Placement of a Memokath through the sphincter with the proximal end just below, or even through, the bladder neck is obviously likely to interfere with ejaculation. It is easily removed for a short period however, if fertility and conception are sought by the patient.

Finally on the 'down side', it is often difficult, if not impossible, to pass a urethral catheter when the stent is in place. In our experience, urodynamic studies have proven impossible in seven out of 13 patients (54%) in whom it has been attempted, though with care and persistence, a small catheter can often be inserted into the bladder. It is mandatory that the patient be aware of the possibility that a catheter may not go in, and have this documented in writing on his person to avoid traumatic attempts at catheterisation and

possible dislodgement of the stent as has occurred to two of our patients when they have presented themselves to other staff with voiding difficulty.

On the positive side, insertion of the Memokath as described above is simple, can be done as a 'day case' procedure, often requires minimal if any anaesthesia (dictated largely by the presence of dysreflexic symptoms with bladder filling, and 'spasm' of peripheral muscles), and is easily reversible by removal with endoscopic grasping forceps after instillation of cold irrigant solution. This ease of removal is the principal reason that we prefer it to the Wallstent which can be very difficult to get out if it has been *in situ* for any length of time, though the latter is less prone to migration. The Memokath costs about \$1200 in Australia, which is quite expensive, but it is cost effective when done as a day procedure compared with at least several days in hospital for a transurethral sphincterotomy which carries the added risk of primary or secondary haemorrhage. Use of the Memokath in no way compromises the use of subsequent surgical procedures such as sphincterotomy, and indeed in those cases where removal has been necessary, sphincterotomy has usually been carried out at the same time. It must be said that often this second operation has been no more successful than the Memokath, especially in the presence of poor detrusor contractility. Only five of the 17 patients whose Memokaths have been taken out have benefited from its removal, and despite sphincterotomy at the same time in 14 of them, 12 are no better, and in nine of these the bladder function is poor.

Conclusion

Our experience with intraurethral stents for sphincteric obstruction following spinal cord injury has been disappointing. While Wallstents have better long term efficacy, their removal is often very difficult and we have stopped using them in these patients.

Most of the Memokaths have had to be removed because of recurrent urinary infection, sometimes associated with other complications and they should not be introduced if infection is a problem. Their ease of removal still makes them a useful, reversible and cost effective alternative to sphincterotomy, but installation should be reserved for infection-free patients with adequate detrusor function, probably early in the course of their rehabilitation. As in patients with DSD treated by sphincterotomy (which in our experience has to be repeated at least once in about 50% of cases), careful follow-up is mandatory as encrustation or other problems may develop, and the stent may have to be replaced from time to time.

We look forward to gaining experience with newer prototypes of larger calibre, or with expansion of the coils throughout the length of the stent.

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