



Clinical Case of the Month

Urological management of tetraplegic patients

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Introduction

Urological care of patients with spinal cord injury (SCI) is one of the important factors to define their prognosis and quality of life. I have sought the expert opinion of four senior urological specialists in the management of such a patient who was aged 22 years and was tetraplegic, being discharged from hospital after several months of treatment for his SCI and who had independent living except for his urological condition.

Case presentation

A 20-year-old Japanese male automobile mechanic sustained a SCI causing tetraplegia from an automobile accident in January, 1996. Early in the morning, on his way back home from a new year party, he lost control of his car when he saw a cat on the road and his car struck a tree. He was rendered unconscious and on regaining consciousness in the ambulance he was unable to move his extremities. He was admitted to the LWC Spinal Injuries Center in Japan 5 h after the accident. On arrival he was found to be alert, respiration was normal, there were no associated injuries. Radiographs revealed a C5 anterior dislocation on fractured C6 vertebra without facet locking. There was complete tetraplegia at the C6/7 level without sacral sparing. Posterior laminar fusion with C5/C6 wiring to stabilize his neck was done in the afternoon of the same day as the accident. Aseptic intermittent catheterization was introduced four times a day from the third day following the surgery.

Nine days later he began full rehabilitation. Eighty-one and 82 days after his SCI the ice water

test became positive and reflex urinary incontinence was noted between each catheterization. Thereafter, he developed hyperhydrosis, part of autonomic dysreflexia which was relieved after each catheterization.

Four days later a cystometrogram revealed a hyperreflexic bladder of 200 ml capacity with a leak point of 96 cmH₂O. Training for trigger voiding was instituted by nursing staff, by his mother and then by himself.

As the residual urine remained at 150 ml with occasional urinary infections a more elaborate urodynamic study was done 2 days later. Maximal urethral pressure was 80–90 cmH₂O on the filling phase. Bladder contractions started at a bladder volume of 250 ml. The type of bladder was diagnosed as UMN (upper motor neuron) bladder normoactive (50–60 cmH₂O pressure of bladder contraction finishing in 120 sec) with synergic sphincter (Figure 1). Residual urine at this examination was 150 ml. A cystogram and excretory urogram were within normal limits. Bladder training was continued but residual urine remained at 100 ml. Sweating before and during trigger-voiding remained the same. He used a condom urinal during day time for his urinary incontinence and a glass urinal was kept in place during bed time as the penile skin could not tolerate condom application for whole day periods.

His neurological level improved by one segment below what it was when he was first admitted; had moderate spasticity below waist level which had increased. He could extend and flex his wrist but could not move his fingers. Hand function was C6BII using the Zancoli's classification. He could push his body up and transfer himself without help. He was diagnosed as C7/8 complete tetraplegia and had a total motor index score with IMSOP/ASIA classification of 34. At this point, training for self-catheterization was considered.

Five months following the SCI, training for self-catheterization was started using a self-catheterization kit specially designed for tetraplegic patients (Figure 2). Within 2 weeks he could catheterize himself in 10 min when on his bed but some assistance to discard the catheterized urine was required. Gradually he acquired self-catheterization when he was in his wheelchair. This self-catheterization made the sweating and the sign of autonomic hyperreflexia disappear but the reflex urinary incontinence continued. He can not tolerate anticholinergic agents such as oxybutinine hydrochloride or propiverine hydrochloride to control this. He still required to wear a condom or diaper during day time. He cannot apply or remove the condom himself. He insists that he wishes to catheterize himself in his bed and to wear a condom in his wheelchair. He has recurrent urinary infections.

Ten months following his SCI a follow-up urodynamic study showed a UMN hyperactive bladder (80–100 cmH₂O of bladder pressure sustained until the urethral monitoring catheter was removed) with dysynergic sphincter. Bladder wall disconfiguration was noted in the voiding cystourethrogram (Figure 3). Since all rehabilitation goals for a C7 level spastic tetraplegic patient were met, except for the urological problems, he was discharged to this home; what will happen in the near future?

Questions

- 1 What is your choice for the final urological management for this young male tetraplegic patient before he is finally discharged?
- 2 In such a patient who would not accept your advice of his urological care before discharge, how would you respond to him?

Please give me your standard idea of the urological management for these young male tetraplegic patients who are returning to society with a partially unbalanced bladder or with a remaining urinary tract problem?

Experts' opinion

Prof JJ Wyndaele (Belgium)

In my opinion, the biggest danger for this man is the high intravesical pressure present during the major part of bladder filling. I would explain this to him. As he has problems taking two of the anticholinergics, I would try other drugs with anticholinergic activity first. If, after 3 weeks, the pressure has not improved to safe standards, I would warn the patient that a more aggressive approach would probably become necessary in order to get the bladder pressure down. I would explain the three major different possibilities we use, their advantage and eventual disadvantages.

- 1 Getting an acontractile large volume/low pressure bladder to be emptied by intermittent catheterization through surface electrodes, enterocystoplasty.
- 2 Brindley stimulator.
- 3 If he agrees on wearing a condom, sphincterotomy.

We would discuss together which method is reversible, which gives continence, which incontinence, which affects other visceral functions, etc. The

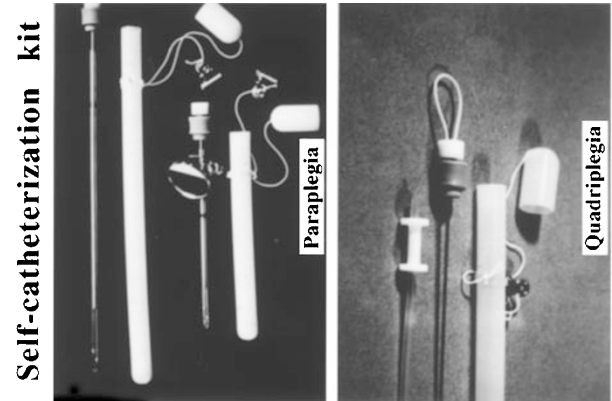


Figure 2

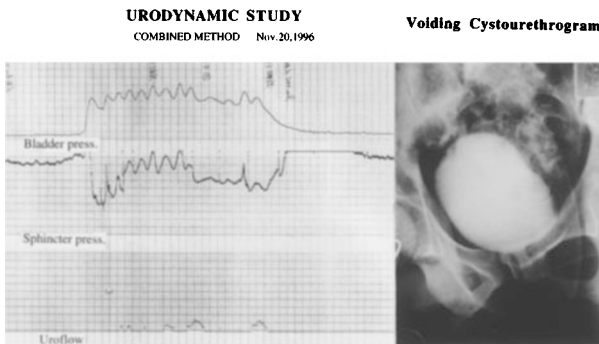


Figure 1

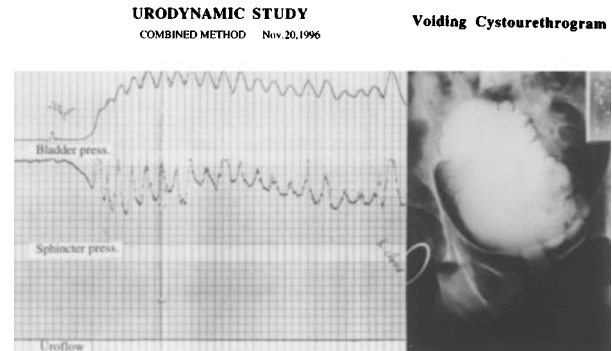


Figure 3

patient then decides which solution he favors and treatment is directed to this solution. The use of some other techniques such as bladder over-distension, phenolization of sacral nerves, neuromodulation for this indication, are not well known to me, so they don't find a place in my therapeutic approach. If a patient refuses any of the proposed treatments, I would again explain the danger and the need for close follow up. I would also warn the family and the family doctor. Such refusal is almost never experienced in our practice. The standard goals for any SCI patient going back to society are to try to get to a safe urodynamic situation in order to protect the kidneys, and to keep the patient without infection and if possible dry. The final decisions are made with the patient, taking into account the patient's individual physical, emotional and social situation.

Mr El Masri (England)

This man with complete traumatic tetraplegia below C6 developed symptoms of autonomic dysreflexia which responded to self intermittent catheterization. He is however incontinent in between catheterization: he cannot easily tolerate a penile sheath for an incontinence appliance and cannot tolerate oral oxybutinin. My first line of management would be to exclude or treat vesical calculi and/or post traumatic syringomyelia. Both conditions could be responsible for this problem. If by exclusion of these conditions or following treatment the problem is not solved, I suggest the following: Intravesical oxybutinin with intermittent catheterization may be effective in making him dry in-between intermittent catheterization without giving him the side effects of the oral administration. Alternatively, intravesical capsaicin may achieve the same result. In my experience, he has at least a 50% chance of responding to one of the two intravesical agents and remaining dry in-between. Should both intravesical agents fail to solve the problem of the incontinence in between intermittent catheterization, I would discuss with the patient the various management options and my advice would be the following sequence:

- 1 Bladder dilatation following exclusion of urinary reflux and with very close monitoring of blood pressure.
- 2 The insertion of a suprapubic catheter which would be regularly/intermittently clamped from an early stage for periods which could be adjusted by the patient to avoid urethral leak. Intravesical oxybutinin may enable the patient to prolong the period of clamping of the suprapubic catheter without urethral leakage. The patient will require regular, urinary tract monitoring with an annual cystourethroscopy and upper urinary tract investigations.
- 3 If the patient declines a suprapubic catheter or in the unlikely event that this does not solve the patients problem, I would consider the patient for

augmentation cystoplasty followed by self intermittent catheterization probably for life.

- 4 An alternative choice would be to implant a Brindley Anterior root stimulator following rhizotomy of the posterior roots of S2,3,4 bilaterally. The patient should give informed consent, as in the unlikely event major complications arise he may not be able to obtain reflex erections.

Prof T Koyanagi (Japan)

Although initially his bladder was normoactive with synergetic sphincter at 3 months post-injury, the most recent urodynamic studies almost 1 year post-injury revealed deterioration with a hyperactive and poorly compliant bladder with insufficient relaxation of the urethral sphincter on voiding. Compatible with these clinically he continued to experience autonomic dysreflexia with sweating, reflex urinary incontinence and urinary infection, while objectively his bladder began to disfigure, a probably sequela of sustained hyperactive bladder.

- 1 He can not be left, because if untreated the chances are very likely that urinary deterioration continues to the extent that eventual renal deterioration ensues. The high pressure system in his bladder must be controlled. To do this detrusor hyperreflexia (DH) needs to be controlled as well as poor compliance (Cves). If he can not tolerate oral anticholinergics how about trying intravesical instillation of oxybutynin hydrochloride¹ or capsaicin.² An alpha-adrenergic blocker is also worthy of trial with its known effect on detrusor hyperreflexia (DH) and compliance,³ not to mention autonomic dysreflexia.⁴ Nerve block is another alternative to control DH. The chance of losing potency has to be discussed with the patient, though. Extradural phenol block has more chance of selectively suppressing DH without paralyzing activity of the external urethral sphincter than subarachnoidal phenol block, this being more effective in controlling urinary incontinence.⁵ Hopefully these conservative modalities would control DH and restore Cves. Sometimes when it is too late though, poor Cves remains despite control of DH, product of irreversible organic change in bladder wall. In those circumstances surgical interventions may be indicated. The least invasive is simple suprapubic cystostomy (SPC) drainage. A favourable response to this continuous drainage, albeit intubated, continues to emerge in recent literature including ours.^{6,7}

Another alternative is detrusor myolysis (auto-augmentation).⁸ Needless to say all these excepting SPC require strict adherence to clean intermittent self catheterization. Modified sphincterotomy in a manner of radical transurethral resection of prostate⁹ is one other alternative by which he could potentially become catheter-free by regaining

near normal voiding function. We have documented underlying mechanisms with detailed urodynamic studies based on 89 spinal cord injury patients: detrusor sphincter dyssynergia was ameliorated thus improving voiding, while DH was suppressed and Cves improved regaining or preserving urinary control. But if fertility problem is an issue this may not be a choice. Obviously classic sphincterotomy to render him totally incontinent is not indicated when an application of condom is already troubled.

- 2 Competence and compassion of the physician in charge (urologist in this case) is the surest way to gain the trust of this patient. Thorough discussion on modalities described above including benefit, potential risk and outcome is mandatory. With this full information and his confidence and trust in you he will follow your advice and abide by what he thinks the best for him.

Prof A Diokno (USA)

My first choice of managing all paraplegics with upper motor neuron bladder (hyperreflexic detrusor with synergistic or dysynergistic external sphincter) is clean intermittent catheterization to empty the bladder periodically, and anticholinergics to inhibit detrusor hyperreflexia and prevent high intravesical pressure and reflex incontinence.^{10,11} My second choice is the use of reflex voiding without or with reduction of urethral sphincter resistance with alpha blocker, stent or sphincterotomy. They will be informed and tested for ability to use external condom catheter and leg bag. In this particular patient, I agree with the goal of teaching this tetraplegic patient self-catheterization with a special assistance kit. For bladder relaxants, oxybutynin is my first choice, but if the patient is unable to tolerate the side effects or reflex incontinence persists despite high doses, I will switch to other drugs such as hyoscyamine, bentlyl, etc., and even imipramine. I will use a low dose alpha blocker for his autonomic hyperreflexia. I will monitor his fluid intake and catheterized volume. If he continues to have reflex incontinence, I will settle with using 1–2 pads per day in addition to self-catheterization and bladder relaxants.¹² Communication with the patient and family is essential to inform them that perfection (no incontinence, no drug side effects, normal voiding) may not be attainable, but is better than the alternative such as condom catheter that may lead to penile irritation and excoriation, leg bags, surgery (sphincterotomy and possible complications including impotency), foreign inserts (stents) and its possible complications. If the patient is not willing to do self-catheterization or the patient cannot learn self-catheterization, or the reflex incontinence is severe in spite of or inability to tolerate bladder relaxants, then I will consider the second and even third option. I will present to the patient the options of:

- 1 Encourage reflex voiding (involuntary emptying, induced or spontaneous) and use of external condom catheter and leg bag. To facilitate voiding, I will consider alpha blockers and skeletal muscle relaxants. If the dysynergia is persistent (high PVR), sphincterotomy and/or stent at the membranous urethra will be considered.
- 2 Creation of ileovesicostomy conduit, especially for those with no hand function. A short segment of ileum is connected to the dome of the bladder and the other end of the ileum attached to the skin as a stoma.¹³ The patient wears a urostomy bag that is replaced approximately every 5 days. In this set up, autonomic hyperreflexia may be observed and controlled with an alpha blocker.

Treatments proposed by five experts

	Wyndale	Masri	Koyanagi	Diokno	Iwatsubo
Clean intermittent catheterization (CIC) with					
Other drugs	1			1 pad	1 pad
Instillation	1	1	1		
Bladder over-distension	*	2			
Surface electrodes	2				
Phenolization	*		2		
Enteroplasty	2	4			
Sphincterotomy	4		4	2	2
Urethral stent				2	
Surapubic cystostomy			3	3	
Ileovesicostomy conduit					3
Brindley stimulator	3	5			

Discussion

The main goal of urinary care is to prevent complications and to get a better quality of life, if possible, free from urinary incontinence. Bladder function, hand function and mental ability are the main factors to define this goal. Urinary retention in the acute phase should be managed by intermittent catheterization to avoid infection and over-distention of the bladder, then any treatment should be conservative in the recovery phase.

Bladder training or self-catheterization is a standard regimen unless it fails. If neurological recovery is insufficient for prevention of bladder complications, surgical options would be considered. The neurourologist should tell the patient of the practical and desirable regimen most fitted for him. Self-catheterization^{14,15} became more popular than the traditional trigger voiding¹⁶ with or without sphincterotomy.^{17–19} Electrical stimulation^{20,21} to facilitate control voiding is used in some countries, while urethral indwelling catheter or suprapubic cystostomy⁷ is a world-wide way of management. Most of the experts firstly

recommended self-catheterization with instillation of oxybutinine hydrochloride or capsaicin. This patient, who barely achieved CIC with no finger function, may not be able to instill oxybutinine hydrochloride²² in each catheterization by himself. If capsaicin instillation² works for long-standing inhibition of detrusor hyperreflexia it may be indicated. However, it is not well known to me. In my experience, over-distention of the bladder²³ never works at all in a patient who has once acquired detrusor hyperreflexia, even under spinal anesthesia. Surface electrodes to get an acontractile large volume/low pressure bladder have been applied for incontinent patients with spina bifida or radical hysterectomy but few for tetraplegics. Nerve block with either subarachnoidal or with extradural phenol block may be an alternative to control incontinence and autonomic dysreflexia at the same time, however the chance of losing reflex erections and defecation may be very serious for these young adults, as Drs Koyanagi and Diokno commented. I would not choose this indication excepting the female with complete paraplegia. Self-catheterization with augmentation seems too much for a tetraplegic patient. Sphincterotomy has been indicated as a procedure for balanced bladder function. It allows low pressure voiding, less autonomic dysreflexia and prevents further bladder disconfiguration. A catheter free state with external condom may allow him an active daily life in society. Urodynamic studies can disclose voiding pathologies which should be corrected with surgical intervention. However, some patients, who believe they will recover from their paralysis, would not accept the explanations of the situation. A urethral stent may produce a pressure sore in the denervated or decentralized urethral tissue and be a focus of UTI. Suprapubic cystostomy is sometimes indicated for the female, who cannot tolerate self-catheterization. The catheter should be irrigated regularly and be changed every 1 or 2 weeks for good drainage. Catheter blockage is a frequent cause of urosepsis. A Brindley stimulator may not be indicated since he may have difficulty in handling the stimulator.

In conclusion, I have recommended him to undergo sphincterotomy to relieve autonomic dysreflexia and to avoid further bladder disconfiguration. If he can get help to wear his external condom, he may have no restriction on wheelchair work during the daytime, though he may need a glass urinal applied during bedtime. Since he would not have accepted sphincterotomy, he was discharged with incomplete self-catheterization, wearing diaper. He should be put on close observation in the outpatient clinic.

References

- Brendler C, Radebaugh B, Lisa C, Mohler J. Topical oxybutynin chloride for relaxation of dysfunctional bladder. *J Urol* 1990; **144**: 270–273.
- Geirsson G, Fall M, Sullivan L. Clinical and urodynamic effects of intravesical capsaicin treatment in patients with chronic traumatic spinal detrusor hyperreflexia. *J Urol* 1995; **154**: 1825–1829.
- Jensen Jr D. Uninhibited neurogenic bladder treated with prazosin. *Scand J Urol & Nephrol* 1981; **15**: 229–233.
- McGuire EJ, Wagner FM, Weiss RM. Treatment of autonomic dysreflexia with phenoxygenzamine. *J Urol*, 1976; **115**: 53–55.
- Kubota M, Koyanagi T. The experience of nerve blocks in the management of urinary incontinence. *Jap J Urol* 1985; **76**: 865–873.
- Dewire DM et al. A comparison of the urological complications associated with long-term management of quadriplegics with and without chronic indwelling urinary catheters. *J Urol* 1992; **147**: 1069–1072.
- Tanaka H, Taniguchi A, Morita H, Koyanagi T. Long-term urinary prognosis of spinal cord injury patients with suprapubic cystostomy. *J of Jap Soc Paraplegia* 1995; **8**: 280–281.
- Kennelly MJ, Gormley EA, McGuire EJ. Early clinical experience with adult bladder autoaugmentation. *J Urol* 1994; **152**: 303–306.
- Koyanagi T et al. Radical transurethral resection of the prostate in male paraplegics revisited. Further clinical experience and urodynamic considerations for its effectiveness. *J Urol* 1987; **137**: 72–76.
- Lapides J, Diokno AC. Clean intermittent self-catheterization. In: Raz S (ed) *Female Urology* Philadelphia, WB Saunders. 1983; **16**: 259: 344–348.
- Maynard FM, Diokno AC. Urinary infection and complications during clean intermittent catheterization following spinal cord injury. *J Urol* 1984; **132**: 943–946.
- Diokno AC. Clean intermittent catheterization in children and adults. Seidman, EJ Hanno, PM eds. *Current Urologic Therapy* 1994; **4**: 322–327.
- Hollander JB, Diokno AC. Urinary diversion and reconstruction in the patient with spinal cord injury. *Urol Clin N Am* 1993; **20**: 465–474.
- Lapides J, Diokno AC, Silber SJ, Lowe BS. Clean intermittent self-catheterization in the treatment of urinary tract disease. *J Urol* 1972; **107**: 458–461.
- Lapides J, Diokno AC, Lowe BS, Kalish MD. Follow up on unsterile, intermittent self-catheterization. *J Urol* 1974; **111**: 184–187.
- Guttmann L, Frankel H. The value of intermittent catheterization in the early management of traumatic paraplegia and tetraplegia. *Paraplegia* 1966; **4**: 63–84.
- Ross JC, Gibbon NO, Damkansky M. Division of the external urethral sphincter in the treatment of the paraplegic bladder. *Brit J Urol* 1958; **30**: 204–212.
- Yalla SV, Fam BA, Gabilondo FB, Jacobs S, Benedetto MD, Rossier AB. Anteromedian external urethral sphincterotomy. Technique, rationale and complications. *J Urol* 1997; **117**: 489–493.
- Rossier AB, Ott R. Urinary manometry in spinal cord injury: a follow-up study. Value of Cysto-sphincterometry as an indication for sphincterotomy. *Brit J Urol* 1974; **46**: 439–448.
- Tanagho EA, Schmidt RA. Electrical stimulation in the clinical management of the neurogenic bladder. *J Urol* 1988; **140**: 1331–1339.
- Brindley GS. The first 500 patients with sacral anterior root stimulator implants: general description. *Paraplegia* 1994; **32**: 795–805.
- Madersbacher H, Jilg, G. Control of detrusor hyper-reflexia by the intravesical instillation of Oxybutynin Hydrochloride. *Paraplegia* 1991; **29**: 84–90.
- Iwatsubo E, Komine H, Yamashita H, Imamura A, Akatsu T. Over-distension therapy of the bladder in paraplegic patients using self-catheterization. A preliminary study. *Paraplegia* 1984; **22**: 210–215.