Spinal Cord (2003) 41, 667–672

www.nature.com/sc

Original Article

Flawed trial of micturition in cervical spinal cord injury patients: guidelines for trial of voiding in men with tetraplegia

S Vaidyanathan[1], BM Soni[1], P Sett[1], G Singh[1], T Oo[1], PL Hughes[2] and P Mansour[3]

[1]*Regional Spinal Injuries Centre, District General Hospital, Southport UK;* [2]*Department of Radiology, District General Hospital, Southport UK;* [3]*Department of Cellular Pathology, District General Hospital, Southport UK*

Study design: A retrospective study.
Objectives: (1) To raise awareness of flawed trial of micturition (TOM) in male spinal cord injury (SCI) patients; and (2) to present guidelines for trial of voiding in male SCI patients.
Setting: Regional Spinal Injuries Centre, Southport, UK.
Methods: Trial of micturition in male SCI patients refers to discarding indwelling catheters and establishing them on *balanced* voiding with penile sheath drainage. We describe seven SCI patients, whose trial of micturition was flawed.
Results: Two patients (C-6 and C-4 tetraplegia respectively) developed severe autonomic dysreflexia (headache, sweating, and increase in blood pressure) 2–3 h after removal of urethral catheter. A C-4 tetraplegic developed severe urinary infection after TOM. Four patients with tetraplegia started retaining increasing amounts of urine and developed urinary infections/autonomic dysreflexia/hydronephrosis 1–21 months after they were established on sheath drainage after TOM.
Conclusion: During TOM, patients with cervical SCI could develop autonomic dysreflexia, urinary infection, or hold progressively increasing volumes of residual urine. TOM should be guided by videourodynamics. SCI patients need α-blockers, and anticholinergics if voiding pressures are >40–$50\,cmH_2O$. If high urethral resistances are found, sphincterotomy and/or bladder neck incision will help the patients to void by triggering. SCI patients, who had undergone successful TOM, require meticulous follow-up including urodynamics. Intermittent catheterisation without adequate medications based on cystometrogram may be hazardous, and may result in upper tract damage. Facilities for supplementary catheterisation (three to four times a day) should be available in the community if a patient is unable to maintain complete, low-pressure, emptying of bladder.
Spinal Cord (2003) **41,** 667–672. doi:10.1038/sj.sc.3101519

Keywords: trial of micturition; neuropathic bladder; tetraplegia

Introduction

Wyndaele *et al*[1] reported high complication rate in spinal cord injury (SCI) patients, who were managed by an indwelling Foley catheter mainly during spinal shock. Histological changes such as follicular cystitis, cystitis glandularis, and varying degrees of inflammation were observed in the bladder biopsies taken from SCI patients, who were on long-term indwelling catheter drainage.[2] Therefore, SCI patients are encouraged to get rid of indwelling urethral or suprapubic catheters as soon as possible. Intermittent catheterisation is the best treatment available today if a large bladder capacity can be obtained, which fills without leaking and at low pressure.[3] SCI patients with tetraplegia, who have adequate hand dexterity, will be able to perform intermittent urethral catheterisation, but male patients with poor hand function, rely on reflex voiding with penile sheath drainage, if indwelling catheters are to be discarded.

Trial of micturition (TOM) in male SCI patients refers to discarding indwelling catheters and establishing them on balanced voiding with penile sheath drainage. Physicians should place emphasis on 'balanced bladder'. In the presence of detrusor–sphincter dyssynergia, a cervical SCI patient is likely to develop autonomic dysreflexia and progressive upper tract damage.

*Correspondence: S Vaidyanathan, Regional Spinal Injuries Centre, District General Hospital, Southport PR8 6PN, UK

Methods

We describe seven SCI patients, whose TOM was flawed. We propose guidelines for TOM in cervical SCI patients.

Case number 1 (SB)
A male patient sustained C-6 tetraplegia in a motor bike accident when he was 17 years old. His wife had been performing intermittent catheterisation for him. He decided to undergo sphincterotomy, 16 years after he had sustained tetraplegia, so that his lifestyle would not be restricted by the need to perform catheterisation at regular intervals. Video-urodynamics showed a very hyper-reflexic bladder with an open bladder neck and significant detrusor–sphincter dyssynergia. Transurethral sphincterotomy was performed and he was discharged home with an indwelling urethral catheter. After 12 weeks, he was admitted for TOM. He was taking tolterodine 2 mg once a day. Tolterodine was discontinued prior to TOM. Tolterodine has a terminal half-life of 2–3 h only.[4]

He was prescribed amoxicillin as a prophylactic antibiotic for urinary infection. He was also prescribed modified-release alfuzosin, a selective α-adrenergic blocker (Xatral XL, Sanofi-Synthelabo, 10 mg once a day) to relax urethral sphincter and to control autonomic dysreflexia. His blood pressure was 78/48 mmHg. The urethral catheter was removed at 06.45 h. After 2 h, he developed headache. Blood pressure rose to 165/80 mmHg. As he developed autonomic dysreflexia, intermittent catheterisation was carried out to empty the urinary bladder. It was then realised that he had not taken alfuzosin. Following administration of Xatral XL 10 mg, he developed only slight headache while passing urine and headache subsided straight away. During the next day, he passed urine while lying in bed but not while he had sat up on the chair with a standard, medium, Quickie cushion. Therefore, an indwelling urethral catheter was inserted.

Case number 2 (SD)
A 24-year-old male sustained C-4 complete tetraplegia in a motor bike accident. He underwent cystoscopy, electrohydraulic lithotripsy of bladder stones, and bladder biopsy 4 months after he sustained tetraplegia. A month later, this patient was given catheter-free trial on a Saturday morning. About 2–3 h later, he was sweating profusely; he could feel pressure building up. He started getting headache. Blood pressure was 204/80 mmHg. He was given nifedipine 10 mg sublingually. Blood pressure decreased to 137/67 mmHg. Indwelling urethral catheter was inserted. He continued to have headache until the following Monday morning. He was upset that a TOM was given during a weekend when his sister was coming to see him from London. In the past, he had been getting autonomic dysreflexia during manual evacuation of bowel and sometimes, without any obvious reason.

Case number 3 (SU)
A 21-year old male sustained C-6 complete tetraplegia after he jumped off a motorway bridge. An indwelling urethral catheter provided drainage of his neuropathic bladder. About 3 years after SCI, he had a catheter-free trial in November 2001. He was prescribed terazosin 2 mg at night. On 24 November 2001, the urethral catheter was removed at 07.00 h. He passed urine in good volumes while lying in bed as well as while sitting up on the chair. Ultrasound scan of urinary bladder revealed small amount of urine in bladder. On the next day, ultrasound scan of urinary bladder performed after he passed urine while sitting up, showed residual urine of 108 ml. At 17.00 h, he developed headache. He returned to bed. Blood pressure settled and he passed large volumes of urine. On catheterisation, only 50 ml of urine was drained. Subsequently, he was voiding satisfactorily and he was discharged home. However, in February 2002, he started developing urinary infections. Intravenous urography (IVU) showed normal kidneys and ureters. Dilute contrast was seen in the bladder. He was advised at least two catheterisations a day. However, there were problems in arranging intermittent catheterisation to be performed twice a day in his home by community health professionals.

Case number 4 (DD)
A 56-year-old male sustained C-4 complete tetraplegia after a fall from the bed. A routine IVU, which was performed 4 months after he sustained tetraplegia, revealed normal kidneys and ureters. About 8 months later, he was given TOM. Although he passed urine, he retained 300–400 ml of urine. He was advised intermittent catheterisation once a day. He noticed increased spasms, which was probably due to incomplete emptying of urinary bladder. The dose of intrathecal baclofen was increased to control spasms. Then he developed high fever (40°C). He was prescribed gentamicin. Later that night, he became very unwell. He was cold, clammy and agitated. Clinical impression was septicaemia. Ultrasound scan of urinary bladder showed a large bladder. A Foley catheter was inserted and it drained 600 ml of custard-like, nasty smelling, urine. After 10 days, he was given another TOM. As he was still retaining large amounts of urine, catheterisation was advised in the morning and at night. Ultrasound scan of the urinary bladder showed residual urine varying from 500 to 600 ml. He did not pass urine when he sat up on the chair. He again developed high fever (40°C). A Foley catheter was inserted and cloudy urine was drained. Urine microbiology showed growth of *Pseudomonas aeruginosa* resistant to gentamicin, amikacin, tazocin, netilmicin, ciprofloxacin, and ceftazidime. The organism was moderately sensitive to imipenem. He was prescribed meropenem, 500 mg 8 hourly. C-reactive protein was high at 151.2 mg/l. White cell count was 13.1×10^9/l. He was taking 7 mg of warfarin a day to prevent deep vein thrombosis. The international normalised ratio (INR) was 2.4. The dose of meropenem was increased to

2 g 8 hourly. Warfarin was omitted in anticipation of performing any invasive procedure in this patient. The INR was still high at 1.9. 4 days after stopping warfarin. Haemoglobin had dropped from 13.1 to 5.8 g/dl. He received 8 U of blood. An urgent IVU revealed prompt excretion of contrast by the left kidney. The right kidney was enlarged and nonfunctioning. MAG-3 renogram demonstrated normal uptake and excretion by the left kidney. The right kidney showed poor uptake of 0.1% at 2 min. CT scans of kidneys revealed normal left kidney. There was right subcapsular haematoma extending into the retroperitoneum. Ultrasounds scan of right kidney revealed perinephric fluid collection measuring $10 \times 9 \times 5$ cm. Percutaneous drainage was performed under fluoroscopy. About 100 ml of blood was drained. Microbiology of aspirated blood revealed a heavy growth of *Pseudomonas aeruginosa*, which was sensitive to colistin. This patient was prescribed colistin, 2×10^6 U every 8 h for 10 days.

Case number 5 (MH)
A 25-year-old male sustained C5/6 tetraplegia in a diving accident in 1989. The neuropathic bladder was managed by indwelling urethral catheter drainage. He was started on terazosin in 1998. Then he had a successful TOM and was passing urine via the penile sheath. About 8 months later, he started sweating while passing urine even while taking 4 mg of terazosin. X-ray of pelvis revealed a faintly opaque shadow in the region of urinary bladder. IVU revealed a filling defect in the bladder, which was probably due to a stone. Flexible cystoscopy confirmed the presence of a calculus in the urinary bladder. Electrohydraulic lithotripsy was performed. Thereafter, he could pass urine satisfactorily without getting symptoms of autonomic dysreflexia.

Case number 6 (LS)
A 25-year-old male sustained burst fracture of C-6 and tetraplegia with motor level at C-5 and complete sensory cord injury at C-8 level. A routine IVU showed normal kidneys and ureters. The bladder outline appeared normal. About 7 months after he sustained SCI, he was given TOM. He was passing urine with penile sheath drainage, but required two to three catheterisations a day as he developed sweating when the bladder was full. He was taking terazosin 5 mg and tamsulosin 400 μg a day to prevent autonomic dysreflexia and to facilitate bladder emptying, as α-blockers decrease urethral resistance. After 5 months, he was discharged home. Intermittent catheterisation was discontinued. The dose of terazosin was increased to 7 mg and he continued to take tamsulosin 400 mg a day. About a month later, he noticed increased spasms and sweating especially during night. After 4 months, he had urinary infection and was prescribed trimethoprim. IVU revealed dilute contrast in the bladder. There was mild hydronephrosis and hydroureter on both sides. He developed recurrent episodes of sweating and shivering. With some difficulty, arrangements were made for catheterisation to be performed twice a day (one at morning and another at night) in his home.

Case number 7 (JA)
A 21-year old male sustained C-3 tetraplegia while playing rugby. He had an indwelling urethral catheter. He was prescribed terazosin (7 mg a day) and given a trial of voiding 14 months after SCI. He passed reasonable amount of urine via penile sheath. Intermittent catheterisation was conducted early morning and at night. After 2 days, he developed severe headache and nifedipine 10 mg was administered sublingually. Subsequently, he became unwell; temperature was 38.5°C. A catheterisation, performed at 19.15 h, yielded 575 ml of urine. Blood test showed C-reactive protein of 155.4 mg/l. An indwelling urethral catheter was inserted. This patient had another TOM after 5 months. He was voiding well. Ultrasound scan of kidneys, performed 10 months after TOM, showed normal kidneys with no evidence of hydronephrosis. However, an ultrasound scan, performed a year later, showed hydronephrosis of right kidney. The left kidney appeared normal. IVU demonstrated dilatation of distal ureters.

Discussion

After encountering these seven patients, who had flawed TOM, we developed guidelines for TOM in our centre. Hopefully, these guidelines will help health professionals to provide optimum care to SCI patients, who undergo TOM.

Guidelines for selection of cases for TOM and best practice for trial of voiding in male patients with cervical SCI and tetraplegia

Selection of cases for TOM TOM is indicated in male SCI patients, who have recovered reflex activity in the lower limbs after the initial period of spinal shock and whose clinical condition is well stabilised. There is no place for TOM in a person with a minor SCI immediately after trauma. However, TOM should not be tried in all patients with cervical lesion, as some tetraplegic patients may not develop a sufficient bladder activity; some may have another pathology, for example, chest infection; some may not wish to change from chronic catheter drainage. In the patients with high tetraplegia (C-5 or above), compliance with intermittent catheterisation performed by a carer must be established before deciding voiding strategies.

First TOM should be considered during urodynamics - TOM, considered the first time during urodynamics, has several advantages.[5] Cystometry will reveal whether an SCI patient has a noncontracting detrusor, in which case TOM should not be given. If a detrusor contraction is weak or unsustained, this information will indicate that

the patient may be at risk of developing retention after a while.[6] Depending on the circumstances of the patient, the spinal unit, and the home situation, intermittent catheterisation by carers with close follow-up should be begun and patients should not be simply left with indwelling catheter drainage.

Bladder pressure developed spontaneously or on provocation, duration of detrusor contraction, frequency of detrusor contractions, detrusor–sphincter interaction, and detrusor–bladder neck interaction, which will become evident if videourodynamics are used, provide useful information in management of SCI patients, who undergo TOM.

If a patient gets sweating, headache or a rise in blood pressure with bladder filling, the physician should prescribe α-adrenergic blockers or, increase the dose of α-blocker, if the patient has been taking an α-blocker. Such patients require repeat urodynamics before undergoing a trial of voiding to ensure that they do not develop autonomic dysreflexia with bladder filling or during reflex voiding.

Urodynamics should preferably be carried out by an experienced investigator, who knows the technique well, but is also familiar with the special features related to a specific pathology, for example, tetraplegia, must perform urodynamics. To make the best value of the test, the investigator should know the patient well and should know the patient's clinical condition.

Role of urodynamics in optimising medications to achieve balanced voiding in SCI patients The TOM should always be guided by urodynamic studies. The dose of anticholinergics must be titrated by urodynamics. If the voiding pressures are >40–$50\,cmH_2O$, these SCI patients need a titrated dose of anticholinergics.[7] Sphincterotomy or anticholinergics and intermittent catheterisation may be a suitable option depending on patient's compliance. If an SCI patient has been advised supplementary intermittent catheterisations, he requires periodic follow-up with urodynamics, as intermittent catheterisation without adequate medications based on urodynamics may be hazardous and may result in reflux and upper tract damage, as indeed happened to three patients described in this report.

Checklist for TOM Before an SCI patient is considered for TOM during urodynamics, the following checklist must be completed.

(1) Informed consent must be obtained from SCI patients for TOM.
(2) Check whether the patient will be able to wear a penile sheath and the sheath will stay in place when the patient is sat up on the chair. A subset of SCI patients remains unable to maintain a condom catheter securely due to inadequate penile shaft length and disappearance of the corpora beneath the pubic fat pad when in the sitting position.[8]
(3) Stop sympathomimetics such as ephedrine hydrochloride[9] and midodrine.[10] SCI patients with high cervical lesion may be taking sympathomimetics to control postural hypotension. The sympathomimetic drugs close the bladder neck and, therefore, should be omitted before TOM.
(4) Stop cyclooxygenase-2 inhibitors, if feasible. There are case reports of acute urinary retention associated with the use of cyclooxygenase-2 inhibitors.[11]
(5) Send a specimen of urine for microbiology. SCI patients should receive appropriate antibiotic for at least 48 h before catheter-free trial. Wyndaele *et al*[1] observed that the risk of urinary sepsis is very high at this precise moment. In SCI patients, the dose of potentially nephrotoxic antibiotics should be adjusted on an individual basis.[12]
(6) Beware of possible interaction between antibacterials and warfarin. If an SCI patient, who is undergoing TOM, has been taking warfarin, check INR at more frequent intervals. These SCI patients may require a reduction in warfarin dose temporarily, if the anticoagulant effect of warfarin is enhanced by antibacterials. Prolongation of INR due to interaction between warfarin and antibacterials may result in haemorrhagic complications as happened in case number 4, who developed spontaneous subcapsular haematoma of kidney.
(7) SCI patients are at risk for developing bladder stones while on indwelling urethral catheter drainage. When an indwelling urethral catheter is removed, the catheter should be examined for the presence of calcifications. Flexible cystoscopy should be performed prior to TOM in the patients, in whom calcifications are present around the tip of Foley catheter. Bladder stones, especially the eggshell type, which forms around the tip of Foley catheter, may not be visible in X-ray, or may be obscured by bowel gas/faeces. If cystoscopy shows stone(s) in the urinary bladder, TOM should be deferred until bladder stones are removed.
(8) Ensure that the SCI patient is emptying the bowels satisfactorily. A loaded sigmoid colon may cause extrinsic pressure on the urinary bladder.
(9) Avoid TOM if an SCI patient is planning to go on holidays or take weekend leave or expecting visitors. During catheter-free trial, SCI patient may become unwell due to autonomic dysreflexia or may develop acute urinary infection following an unsuccessful TOM.
(10) Start α-blocker at least a week before TOM. Currently, we prescribe modified-release alfuzosin (Xatral SR, 10 mg once a day, Sanofi-Synthelabo). α-Blockers prevent the occurrence of severe degree of autonomic dysreflexia.[13] α-Blockers also decrease maximum urethral pressure and thereby facilitate bladder emptying.[14] Before commencing α-blocker therapy, the SCI physician should discuss potential side effects of α-blockers, for example, postural hypotension, with SCI patients and their carers.

(11) Before TOM, it is desirable to obtain baseline urinary tract imaging (preferably ultrasound scan).
(12) During TOM, the health professional should:

- Consider renal scan with empty and full bladder to evaluate the risk of hydronephrosis.
- Perform ultrasound scans of urinary bladder frequently to check whether the SCI patient is retaining urine.
- Record blood pressure when bladder is full and when the patient passes urine in order to detect any rise in blood pressure due to autonomic dysreflexia.

(13) Arrangements for intermittent catheterisation should be available during TOM so that an SCI patient is not allowed to get overdistension of urinary bladder. Perform intermittent catheterisation if the

- SCI patient has passed <50 ml of urine over a period of 3 h.
- SCI patient develops features of autonomic dysreflexia, for example, sweating, headache, rise in blood pressure, and blotches over the face and upper chest.
- Ultrasound scan shows volumes greater than 200 ml residual urine in the bladder.

(14) After a successful TOM, SCI patients require meticulous follow-up.

- Urodynamics must be repeated after 3 months to ensure that the patient is not developing detrusor failure or, detrusor–sphincter dyssynergia. If voiding pressures are >40–50 cm H_2O, titrated doses of anticholinergics must be prescribed.[7]
- Cervical SCI patients, who are prescribed α-blockers to achieve balanced voiding, should continue α-blockers on a long-term basis.
- The status of the upper urinary tracts must be checked 3 months after a successful TOM. Subsequently, these patients need follow-up investigations every 12 months by ultrasound scan, cystography preferably combined with urodynamics, and IVU, if needed. (Decide after ultrasound and cystography.) The clinically important vesicoureteric reflux seems to be predictable from the urography films alone in children with urinary tract infections.[15] In the patients followed-up after SCI, a wide ureter on IVU should arouse suspicion that reflux or lower urinary tract dysfunction might be present. However, these conditions are not necessarily excluded by the finding of a ureter of normal size in the IVU.[16,17] In our centre, we perform tailored imaging studies, which include IVU, ultrasound imaging and MAG-3 renogram. We believe that these imaging studies provide valuable information and are often complementary.
- Patients, who have undergone implantation of a pump for intrathecal baclofen therapy, require close observation while undergoing TOM, as these patients may be at risk for retaining urine. In the patients with spastic bladder, intrathecal baclofen produced a decrease of detrusor hypertonia and hyperactivity in 50% of cases, with reduction of leakage and increase in functional bladder capacity.[18]
- After a seemingly successful TOM, some SCI patients may not be able to maintain complete emptying of the urinary bladder. Increased spasms and sweating may be the only symptoms of incomplete emptying of the urinary bladder. SCI patients, who retain increasing amounts of urine, will require supplementary catheterisation. Before considering TOM, this eventuality should be anticipated, and SCI physician should discuss possible need for supplementary intermittent catheterisation with the patient and his carer. The community nursing staff and/or carers should be willing to perform intermittent catheterisation once, twice, three, or four times a day as per the requirements of individual patient.[19] The carers should be motivated to learn the technique of urethral catheterisation and facilities should be available in the spinal injuries unit to provide such training to carers. Urethral catheterisation can be performed in the morning when the carers change penile sheath. Before applying a new sheath, it should be easy to perform catheterisation. Subsequent catheterisations can be performed without removing penile sheath if SCI patient used a see-through penile sheath. The transparent sheath allows visualisation of the external urethral meatus for catheterisation.
- SCI patients with long-term indwelling catheters often develop flakes of calcification around the balloon of a Foley catheter. After removal of a Foley catheter, the debris in the bladder and calcified flakes contribute to formation of a bladder stone over a period of time, especially in male patients who do not empty completely. The vesical calculus causes obstruction to outflow of urine, as shown by case number 5. Therefore, if an SCI patient, who had a successful TOM, subsequently develops symptoms of autonomic dysreflexia during voiding, bladder stone must be suspected.

Conclusion

Chronic catheter drainage of urinary bladder in SCI patients is associated with complications such as bladder stones, recurrent urinary infection, and rarely bladder cancer. Therefore, TOM, if successful in achieving balanced voiding, is a desirable procedure. TOM must be guided by urodynamics. The health professionals caring for SCI patients with tetraplegia should be aware of possible complications of TOM, for example, autonomic dysreflexia. After an unsuccessful catheter-free trial, SCI patients are at high risk for developing acute urinary infection. Following an apparently successful TOM, some patients may retain progressively increasing volumes of urine in the bladder over a period. The symptoms of unsatisfactory bladder emptying are nonspecific and include (1) urinary infection, (2) sweating, and (3) increased spasms. Facilities should be

made available in the community for performing intermittent catheterisation two to three times a day (as per individual requirements) in patients with cervical SCI, who are unable to maintain complete emptying of bladder following a successful TOM. If this is not possible, indwelling catheter drainage should be established promptly before a patient develops complications such as hydronephrosis or urinary infection. After a successful TOM, SCI patients must have a meticulous follow-up. Urine microbiology, urodynamics and ultrasound scan of urinary tract must be performed at regular intervals.

Acknowledgements

We express our sincere thanks and gratitude to Dr Inder Perkash, Director, Regional Centre for Spinal Cord Injuries, Veterans Affairs Health Care System, Palo Alto, California, USA, and Professor Jean-Jacques Wyndaele, Professor of Urology, University of Antwerpen, Belgium.

Dr Inder Perkash and Professor Jean-Jacques Wyndaele made valuable comments, which greatly helped in formulating the above guidelines for trial of micturition in the patients with cervical spinal cord injury.

We thank the reviewers of this manuscript. The reviewers made valuable remarks and we are grateful to the reviewers for very helpful suggestions.

References

1 Wyndaele JJ, De Sy WA, Claessens H. Evaluation of different methods of bladder drainage used in the early care of spinal cord injury patients. *Paraplegia* 1985; **23:** 18–26.
2 Vaidyanathan S *et al*. The method of bladder drainage in spinal cord injury patients may influence the histological changes in the mucosa of neuropathic bladder – a hypothesis. *BMC Urol* 2002; **2:** 5.
3 Madersbacher H *et al*. Conservative management in neuropathic urinary incontinence. In: Abrams P, Cardozo L, Khoury S, Wein A (eds). *Incontinence, second International Consultation on Incontinence*, Paris, 1–3 July 2001 2nd edn. Plymbridge Distributors Ltd: Estover Road, Plymouth 2002, pp 697–754.
4 Brynne N *et al*. Pharmacokinetics and pharmacodynamics of tolterodine in man: a new drug for the treatment of urinary bladder overactivity. *Int J Clin Pharmacol Ther* 1997; **35:** 287–295.
5 Wyndaele JJ. Urethral sphincter dyssynergia in spinal cord injury patients. *Paraplegia* 1987; **25:** 10–15.
6 Wyndaele JJ. A critical review of urodynamic investigations in SCI patients. *Paraplegia* 1984; **22:** 138–144.
7 Perkash I, Giroux J. Clean intermittent catheterisation in spinal cord injury patients: a follow-up study. *J Urol* 1993; **149:** 1068–1071.
8 Kabalin JN, Rosen J, Perkash I. Penile advancement and lengthening in spinal cord injury patients with retracted phallus who have failed penile prosthesis placement alone. *J Urol* 1990; **144**(2 Part 1): 316–318.
9 Maynard FM. Posttraumatic cystic myelopathy in motor incomplete quadriplegia presenting as progressive orthostasis. *Arch Phys Med Rehabil* 1984; **65:** 30–32.
10 Barber DB, Rogers SJ, Fredrickson MD, Able AC. Midodrine hydrochloride and the treatment of orthostatic hypotension in tetraplegia: two cases and a review of the literature. *Spinal Cord* 2000; **38:** 109–111.
11 Gruenenfelder J, McGuire EJ, Faerber GJ. Acute urinary retention associated with the use of cyclooxygenase-2 inhibitors. *J Urol* 2002; **168:** 1106.
12 Vaidyanathan S *et al*. Dosage of once-daily gentamicin in spinal cord injury patients. *Spinal Cord* 2000; **38:** 197–198.
13 Vaidyanathan S *et al*. Pathophysiology of autonomic dysreflexia: long-term treatment with terazosin in adult and paediatric spinal cord injury patients manifesting recurrent dysreflexic episodes. *Spinal Cord* 1998; **36:** 761–770.
14 Vaidyanathan S *et al*. Possible use of indoramin in patients with chronic neurogenic bladder dysfunction. *J Urol* 1983; **129:** 96–101.
15 Lanning P, Seppanen U, Huttunen NP, Uhari M. Prediction of vesico-ureteral reflux in children from intravenous urography films. *Clin Radial* 1979; **30:** 67–70.
16 Scher AT. Changes in the upper urinary tract as demonstrated on intravenous pyelography and micturating cysto-urethrography in patients with spinal cord injury. *Paraplegia* 1975; **13:** 157–161.
17 Arnold EP, Cowan IA. Clinical significance of ureteric diameter on intravenous urography after spinal cord injury. *Br J Urol* 1988; **62:** 131–135.
18 Mertens P *et al*. Long-term clinical, electrophysiological and urodynamic effects of chronic intrathecal baclofen infusion for treatment of spinal spasticity. *Acta Neurochir Suppl (Wien)* 1995; **64:** 17–25.
19 Vaidyanathan S *et al*. Community-care waiting list for persons with spinal cord injury. *Spinal Cord* 2001; **39:** 584–588.