

Original Article

Neurogenic bladder management and cutaneous non-continent ileal conduit

EJ Chartier-Kastler^{*1,2}, P Mozer¹, P Denys², M-O Bitker¹, A Haertig¹ and F Richard¹

¹Department of Urology, Pitié-Salpêtrière Hospital, University Pierre et Marie Curie (Paris VI) Paris, France;

²Department of Neurological Rehabilitation, Raymond Poincaré Hospital, Université Paris-Ouest, Garches, France

Study design: Prospective monocentric follow-up study.

Objectives: To assess the results of cutaneous non-continent diversion for neurogenic bladder management.

Settings: Department of Urology (Pitié-Salpêtrière Hospital), Department of Neurological Rehabilitation (Raymond Poincaré Hospital), Assistance Publique-Hopitaux de Paris, University Paris VI and V.

Methods: We reviewed the charts of 33 consecutive patients (19 women, 14 men), operated between 1979 and 1999. Twenty-one patients had spinal cord injury (SCI), four had multiple sclerosis, three had various forms of myelitis and five had central neurological diseases. Diversion was indicated for upper urinary tract protection (17), perineal dryness (14) and/or functional or social reasons (20). Before the operation, 20 of the 33 patients (60.6%) presented urologic complications related to bladder management, including triggered micturition, indwelling catheter or intermittent catheterization: urethrocutaneous fistula (4), complicated enterocystoplasty (2), watering pot perineum and severe decubitus ulcerations (14). Ileal conduit (also named ileoureterostomy) was performed alone for 19 patients (57.6%), and in combination with simultaneous cystectomy in 14 patients. We reviewed patient outcome and early and late complications.

Results: Mean follow-up was 48 months (1 to 20 years). All problems related to catheters or incontinence had resolved. There were no deaths or early re-operations. Twelve patients (12 out of 33, 36%) had one or more peri-operative complication, including ileus (1), uretero-ileal anastomosis leak (1) and sepsis (1). During follow-up, four of the 19 patients who did not undergo cystectomy developed pyocystitis (3 secondary cystectomies performed between 6 and 56 months). All patients achieved perineal dryness.

Conclusions: The ileal conduit procedure is a safe and well-tolerated procedure in neurologically impaired patients. This procedure is suitable for most neurogenic patients with refractory lower urinary tract dysfunctions.

Spinal Cord (2002) 40, 443–448. doi:10.1038/sj.sc.3101346

Keywords: incontinence; cutaneous diversion; ileal conduit; neurogenic bladder; spinal cord injury; multiple sclerosis

Introduction

The ultimate goal of urologic management of patients with neurogenic bladder dysfunction is not only preservation of the upper urinary tract and renal function, but also prevention of urologic and general complications.¹ The introduction and widespread acceptance of clean self intermittent catheterization

(CSIC) have simplified long-term management.² However, there are always some patients unable or unwilling to perform self-catheterization. Quadriplegia, limited dexterity, devastating cognitive impairment or lack of ancillary support are the main causes for failure of intermittent catheterization in patients of both sexes. Women are even more difficult to manage due to lack of available external drainage systems.

One challenge is the establishment of low-pressure urinary drainage without the use of an indwelling

*Correspondence: E Chartier-Kastler, Service d'Urologie, G.H. Pitié-Salpêtrière 83, Boulevard de l'Hôpital 75013 Paris, France

urethral or suprapubic catheter. Such drainage may be accomplished by cutaneous diversion. Two major procedures have gained popularity: ileocystostomy, first described by Cordonnier in 1957,³ and ileal conduit (ureteroileostomy) or supravescical diversion, described by Bricker in 1950⁴ and 1956.⁵ Ileocystostomy is conservative: urine is collected in the bladder. Bladder neck closure must be performed in selected patients, but there is no need for ureteral dissection. The Bricker procedure diverts urine from the bladder regardless of whether or not cystectomy is performed.

Ileocystostomy has been widely used and the functional results are satisfactory. The ileal conduit has been largely reported after pelvic cancer surgery,^{6,7} but previous reports concerning neurogenic bladder management have not always been enthusiastic because of general complications.⁸⁻¹¹ However, more recently, Bennett¹² stressed that the Bricker procedure remained a good procedure in female spinal cord injury patients when necessary.

The objective of our prospective follow-up study was to evaluate outcome and assess early and late complications of cutaneous ileo-ureterostomy in the management of neurogenic bladder for patients who failed CSIC and other methods of bladder drainage.

Materials and methods

Thirty-three patients with neurogenic bladder dysfunction unable to use CSIC, either because of their neurologic disease or lack of motivation, underwent an incontinent cutaneous urinary diversion between March 1979 and March 1999. The technique has been stable throughout the follow-up period and has always been a non-continent ileo-ureterostomy. Neurogenic bladder was due to spinal cord injury (SCI) in 21 patients (14 between C1 and T10, six from T11 to L1, one below L2), multiple sclerosis in four, sacral agenesis in one, and other diseases in four (including various forms of myelitis and cerebral palsy) (Table 1). Mean age of patients at operation was 40.6 ± 15.2 years. Neurourologic disease was 16.1 ± 10.7 years when the surgical decision was made. The mean age of onset of neurological disease was 24.5 ± 1.2 years.

Indications

All patients were incontinent. Surgery was decided for social or functional requests, upper urinary tract protection, or severe perineum alteration (Table 2). Ten men (10 out of 14, 71.5%) had severe refractory perineal problems with skin ulcers and four of these had urethrocutaneous fistula with indwelling catheters. Thirty-seven per cent (7 out of 19) of female patients had an isolated request for cutaneous diversion because self-intermittent catheterization was either very difficult to perform (multiple sclerosis and cerebellar syndrome) or impossible due to wheelchair position for orthopedic reasons (previous hip resection) or tetraplegia. One low-level SCI tetraplegic female patient (C8-D1) also requested diversion as she wished to become pregnant and wanted to avoid recurrent acute pyelonephritis (three to six episodes per year). A total number of 17 patients had previous upper urinary tract dilatation.

Twenty patients had urologic complications before diversion was decided. Two patients lost one kidney due to neurogenic bladder. Seven had vesico-ureteral reflux with previous failed surgery and recurrent pyelonephritis. Two had previously undergone ileoenterocystoplasty (11 and 13 years before) and were unable to perform regular SCIC (recurrent fever, infections and hospitalizations). Three men (SCI) had had previous multiple endoscopic sphincterotomies and/or urethrotomies, which failed to eliminate infections and related autonomic dysreflexia (AD). Multiple procedures had been performed in other centers over many years for the four men with recurrent urethrocutaneous fistula either of the perineum or scrotum leading to complete failure and watering pot colostomy. Two patients had a previous permanent colostomy for the same reasons as the urinary diversion (perineal skin ulcers). Fifty per cent of patients (16 out of 33) had either indwelling or suprapubic catheters. Condom catheters were used by one male patient (Table 3).

Simultaneous cystectomy was decided with the patient and no bladder was removed without the patient's consent. The final choices and the procedures performed are listed in Table 4. Cystectomies were

Table 1 Sex and neurological handicap by disease category (complete handicap: confined to a wheelchair or confined to bed; incomplete handicap: patient able to move by himself and walk with or without assistance)

Neurologic disease	Number of patients	Sex distribution		Completeness of lesion	
		Female	Male	Complete	Incomplete
Spinal cord injury (C1 to T10)	14	9	5	12	2
Spinal cord injury (T11 to L1)	6	2	4	4	2
Spinal cord injury below L2	1	–	1	1	–
Multiple sclerosis	4	3	1	–	4
Cerebral palsy	3	1	2	–	3
Various forms of myelitis	3	2	1	1	2
Sacral agenesis	1	1	–	1	–
Cervical spinal cord astrocytoma	1	1	–	–	1
Total	33	19	14	19	14

Table 2 Indications for incontinent urinary diversion

Indication for diversion according to neurological disease	No.	SCI (C1 to T10)	SCI (T11 to L1)	SCI below L2	MS	Cerebral palsy	Various forms of myelitis	Sacral agenesis	Cervical spinal cord astrocytoma
Functional	7	3	1	–	–	1	1	–	1
Social	1	–	–	–	–	–	1	–	–
Upper urinary tract protection	7	2	2	–	2	–	1	–	–
Functional and upper urinary tract protection	4	2	–	–	1	1	–	–	–
Perineal skin ulcers and severe isolated urethral lesions (men or women)	5	2	2	–	1	–	–	–	–
Functional and upper urinary tract protection and perineal skin ulcers	5	2	–	1	–	1	–	1	–
Functional and perineal skin ulcers	3	3	–	–	–	–	–	–	–
Upper urinary tract protection and perineal skin ulcers	1	–	1	–	–	–	–	–	–
Total	33	14	6	1	4	3	3	1	1

No.: number of patients, SCI: Spinal Cord Injury, MS: Multiple Sclerosis, T: Thoracic, C: Cervical, L: Lumbar

Table 3 Pre-operative status for bladder drainage

Bladder drainage before diversion	Sex distribution		
	Number	Female	Male
Indwelling catheter	15	10	5
SCIC	4	3	1
Intermittent catheterization	5	3	2
Supra-pubic catheter	1	–	1
Triggering and pads	5	1	4
Condom catheter	1	NA	1
Pads	1	1	–
Crede maneuver	1	1	–
Total	33	19	14

NA: not available

performed at the same time as cutaneous urinary diversion in 14 patients (14 out of 33, 42.4%). Two of them (women) were conversions of diversion ileo-enterocystoplasties. One woman had complete abdominal wall repair at the same time using a synthetic prosthesis. She was an obese SCI paraplegic patient and colostomy had been performed for the same indication 8 years previously. One other woman requested to keep her bladder despite a tetraplegic situation related to cervical spinal astrocytoma (neurologically stable for 4 years). At the time of surgery, she was incontinent with intermittent catheterization and had good bladder neck competence. Open cervicotomy was performed to prevent retention of bladder secretions.

Pre-operative assessment included intravenous urography (IVU), serum creatinine ($70.44 \pm 47.27 \mu\text{mol/l}$), two patients had levels greater than $150 \mu\text{mol/l}$ with creatinine clearance $>50 \text{ ml/min}$) and cystoscopy (to

Table 4 Procedures performed in the 33 patients and sex distribution

Procedures	Number	Female	Male
Bricker alone*	19	13	6
Bricker and cystectomy	12	4	8
Neo-cystectomy and cutaneous urinary diversion	2	2	0
Total	33	19	14

*One procedure was associated with abdominal wall repair and another with transvesical cervicotomy (female patient)

detect stone and tumors). Urine cultures and past urinary tract infections were documented. Antibiotics were prescribed according to culture results. All patients had bacteriuria before the operation and received antibiotics for at least two full days prior to surgery.

Procedure

The cutaneous diversion was performed via a midline incision (after retroperitoneal cystectomy, when requested) and according to Bricker's description.^{4,5} Both ureters were prepared for a Wallace 1 or 2^{13,14} anastomosis according to presentation and length. Sutures were performed with absorbable suture material. Catheters intubating the ureters were fixed to the new distal ureteral plate and passed through the ileal lumen.

Long-term patient satisfaction was assessed by means of a visual analog scale (0 = worse situation than before and high level of regret to 10 = high level of satisfaction in terms of quality of life and wishes according to choice of urinary diversion).

Results

All patients were reviewed, with follow-up ranging from 12 to 240 months (mean: 48 months; 14 patients operated on after or during year 1998, seven between 1996 and 1997, 12 before or during year 1995). No patient died, either from surgery or disease. There were no cases of deterioration of renal function, and serum creatinine at last follow-up was $65 \pm 53 \mu\text{mol/l}$.

All patients were dry after diversion, and perineal skin ulcers were all cured either spontaneously or with specific surgical excision and coverage. All patients (100%) were satisfied with stomal appliances and had a well functioning cutaneous diversion. There were no cases of leakage around the stoma. Two patients (6%) described local problems without any leakage or appliance adaptation problems. One had ulceration around the stoma, which resolved spontaneously (3 years after surgery) and another had cutaneous retraction of the stoma without necrosis of the ileal loop or local problems (obese patient).

There were no cases of ureteral anastomosis or stoma cutaneous stenosis requiring re-operation, and no cases of bowel obstruction or incisional hernia. The overall incidence of non-urological complications was low in this high-risk population with limited treatment options. Among the 17 patients who had a pre-operative hydronephrosis, 10 showed either a decrease or disappearance of dilatation.

A total of 12 patients (12 out of 33, 36%) developed one or more, minor or major, early or late, complications during follow-up (Table 5).

Early complications included severe life-threatening perioperative infection and septic shock, leading to

Table 5 Complications of ileal conduit procedure in 33 patients. (18 complications in 12 patients, some patients presented more than one complication)

Complications	Number of patients
<i>Early:</i>	
Peri-operative septic shock	1
Uretero-ileal anastomosis leak	1
Cystectomy wound hematoma	1
Prolonged ileus	1
Lower limb thrombophlebitis	1
<i>Late:</i>	
Permanent urethral leak (males with bladder left in place)	2
Recurrent suprapubic collection (male, cystectomy without prostatectomy)	1
Pyocystitis (three males, one female): three secondary cystectomies	4
Re-operation for shortened ileal loop	1
Acute non-complicated pyelonephritis	4
Extracorporeal shock wave lithotripsy for renal stones*	1

*Two sessions/20 years of follow-up in the same patient for uncomplicated stones

prolonged hospital stay in the intensive care unit (2 months) and severe pneumonia. All resolved with medical treatment and without renal impairment. One leaking uretero-ileal anastomosis was treated by prolonged ureteral drainage (21 days), without stenosis on IVU 8 years later. The ileal loop was shortened (after 6 years) in one patient because of urine stagnation causing urinary tract infection.

Long-term complications occurred in six out of 33 patients (18.2%). Among the 19 patients in whom the bladder was preserved at the time of the diversion procedure, four (four out of 19, 21%) (three men and one woman) had recurrent pyocystitis leading to three secondary cystectomies. The woman had undergone unsuccessful cervicotomy and requested secondary cystectomy 2 years after diversion. Two men (SCI, paraplegic) also had secondary cystectomies, 6 and 56 months after the initial procedure. Only one had cystectomy without prostatectomy because of local technical reasons. A suprapubic collection (genital secretions) appeared 1 year later, and punctures had to be performed twice a year as an outpatient procedure. Two other men who had undergone primary cystectomy with preservation of the prostate and seminal vesicles (intentionally because of difficult dissection of chronic infected bladder and prostate) complained of chronic urethral leakage. However, erections were preserved and patients were able to maintain sexual intercourse. At latest follow-up, 48% of patients (16 out of 33) have been able to keep their bladder without any related complications.

Among other long-term complications, acute pyelonephritis (four out of 33) had no major consequences, and IVU of the upper urinary tract and ileal loop were normal. Patient satisfaction was evaluated on a visual analog scale: 9.1 ± 2.8 . No patient regretted his or her choice as they were all dry, skin ulcers had resolved and catheters or pads were no longer required. Patients with pyocystitis were less satisfied because of recurrent problems or re-operations.

Discussion

Preservation of renal function is the main long-term goal of management of neurogenic bladder dysfunction. Low-pressure urinary storage and appropriate drainage system are the two key-points. Over the last 20 years, drug therapy² and surgical improvements¹⁵ have been able to decrease bladder pressure and increase bladder capacity and compliance in neurogenic bladders. However because of striated sphincter dyssynergia, emptying must be ensured by clean self-intermittent catheterization.

Unfortunately, a few patients are unable or unwilling to perform self-catheterization. Complications include urethral erosions, bladder neck dilatation, urethro-cutaneous fistula, stones, vesicoureteral reflux, infection and sepsis, and impaired renal function.^{1,2} When wet perineum or decubitus skin ulcers are present, impairment of quality of life, and general or

life-threatening complications can occur. For most of these patients, urinary diversion is still the final solution in order to achieve perineal dryness and stable upper urinary tract function.

We reviewed our experience with these types of neurogenic patients and the use of a non-continent diversion procedure (ileo-ureterostomy). In view of the literature, and including all minor and major urologic and general complications, we achieved a low complication rate (36%) for this population. No early re-operation for complications related to surgery was performed, and perfect local stomal management and perineal dryness were obtained in 100% of cases. We achieved the main objective of renal function protection and patient satisfaction. It has now been clearly established that long-term indwelling urethral or suprapubic catheters lead to serious morbidity (16 out of 33 in this series) and should be avoided.^{2,16,17} Moreover, long-term indwelling catheter can lead to bladder cancer.¹⁸ Catheters should be removed before the onset of irreversible complications. Some patients do not agree for SCIC or sphincterotomy (men) despite continuous improvements of appliances. They must be clearly informed about the risks of high pressure bladders and the consequences of long-term indwelling catheter. Another group of patients is unable to perform SCIC: it is the medical and especially the urology team's work to inform them about available choices for urinary tract protection and improvement of everyday life. Once major complications have occurred, there is no longer any room for discussion and a majority of these patients will require incontinent urinary diversion.

According to our data, recently published long-term results of such diversions are very satisfactory in terms of renal function preservation.^{1,10,19–21} Past reports on the Bricker procedure were not so enthusiastic,^{11,22} but good renal function protection was masked by high complication rates due to the poorer quality of perioperative and post-operative care and to high-risk patients with severe pre-operative renal impairment. Månsson,²³ in his study on renal function after urinary diversion, showed that the functional outcome was neither related to the method of diversion nor to the type of ureteral anastomosis (anti-reflux or not) for patients with cutaneous incontinent diversion. We recommend urinary diversion early before irreversible renal complications in patients in whom no other modality of incontinence management is available. Information, strict follow-up, specific multidisciplinary neuro-urological care units must strive to achieve this objective. Regarding these results, the rate of patients using this diversion is increasing with years in our neuro-urology unit. Regardless of level of spinal cord injury or type of neurologic disease, it can be explained both by age of onset of neurological disease and by a high request of quality of life for these patients.

By diverting urine from the bladder, supravescical diversion can achieve complete perineal protection (as

in our series). Ileovesicostomy^{1,19,21} avoids bladder management problems, but still requires bladder neck and urethral closure. Pubovaginal slings have been used^{1,19,24} and chosen because of the documented incidence of post-operative fistula information after transabdominal or transvaginal bladder neck closure. More recently, Moreno *et al.*²⁵ and Andrews²⁶ stated that one of the most challenging problems in the management of women with neurogenic vesical dysfunction is destroyed urethra secondary to chronic urethral catheterization.

The issue of whether cystectomy should be performed at the same time as urinary diversion is still controversial. The risk of significant pyocystitis can cause serious future complications. During follow-up, only 37% of women (seven out of 19) required cystectomies (either primary or secondary) *versus* 71.4% of men (10 out of 14). The decision to perform cystectomy at the time of diversion is a difficult one. After careful information of the patients, we selected patients for cystectomy with consideration of bladder risks (retention, carcinoma), quality of life, and nursing and perioperative risks (bleeding, duration of surgery). We made the wrong decision in three cases due to the patient's initial request to preserve the bladder. However, about 50% (16 out of 33) of our patients preserved their bladder without any problem.

This Bricker-like procedure has had a poor reputation on the basis of reports published more than 25 years ago, mostly concerning children operated on for urologic malformations and upper urinary tract dilatation. The analysis by Shapiro *et al.*,⁹ based on 90 children, reported good results in terms of renal preservation, but a significant number of long-term complications. However, patients in this series had very poor renal function condition. Kambouris,¹⁰ at the same time, was more optimistic, despite a high complication rate related to end-stage patients. Our experience led us to believe that the adult ileal conduit is a useful technique in bladder management of neurogenic bladder patients. In 1995, Bennett¹² reported more encouraging results on women in the same indication. Avoiding pyocystitis by means of good bladder management led to no major sepsis being observed during follow-up. Stomal stenosis did not occur and the rate of this complication should not be different from that of other ileal diversions. Stomal stenosis rates as high as 15%¹⁹ are probably more specific to ileovesicostomy (fascial stenosis). A wide-mouthed vesical anastomosis, a pre-marked stomal placement, and an adequate diameter of the fascial window are the main points of local success.²¹

There were no instances of electrolyte disturbances, either in the immediate post-operative or late follow-up. This is probably due to the short segment used as a conduit and to the wide stoma that prevents urinary stasis and re-absorption. The shortest segment was always used, although length must be adapted to the quality of the blood supply to avoid very short

segment ischemia. We did not observe any case of necrosis of the ileal segment, as has been reported when a very short segment of ileum was used.⁷

Conclusion

We conclude that the ileo-ureterostomy procedure, based on Bricker's report, is still²⁷ a safe and well-tolerated procedure in neurologically impaired patients. This procedure is suitable for most of these end-stage patients with poor lower urinary tract conditions or as a definitive choice of patients to manage their neurogenic bladder dysfunction. This technique must still be part of armamentarium.

References

- Rivas D, Karasick S, Chancellor M. Cutaneous ileocystostomy (a bladder chimney) for the treatment of severe neurogenic vesical dysfunction. *Paraplegia* 1995; **33**: 530–535.
- Madersbacher H et al. Conservative management in the neuropathic patient (Committee 19). In: Abrams P, Khoury S, Wein A (eds). *Incontinence*. London: Health Publication Ltd, 1999, pp 755–812.
- Cordonnier J. Ileocystostomy for neurogenic bladder. *J Urol* 1957; **78**: 605–610.
- Bricker E. Bladder substitution after pelvic exenteration. *Surg Clin North Am* 1950; **30**: 1511–1521.
- Bricker E. Substitution for the urinary bladder by the use of isolated ileal segments. *Surg Clin North Am* 1956; **36**: 1117–1730.
- Nurmi M, Puntala P, Alanen A. Evaluation of 144 cases of ileal conduits in adults. *Eur Urol* 1988; **15**: 89–93.
- Pfister C et al. Technique et résultats du “Mini-Bricker” dans la dérivation des voies urinaires après cystectomie totale pour tumeur de vessie. *Prog Urol* 1994; **4**: 953–958.
- Schmidt J et al. Complications, results, and problems of ileal conduits diversions. *J Urol* 1973; **109**: 210–216.
- Shapiro S, Lebowitz R, Colodny A. Fate of 80 children with ileal conduit urinary diversion a decade later: analysis of complications, pyelography, renal function and bacteriology. *J Urol* 1975; **114**: 289–295.
- Kambouris A et al. Ileal loop ureteroileostomy in patients with neurogenic bladder. Personal experience with 54 patients. *Am J Surg* 1976; **131**: 224–227.
- Moeller B. Some observations of 31 spinal cord injury patients on whom the Bricker procedure was performed. *Paraplegia* 1977; **15**: 230–237.
- Bennett C et al. Comparison of bladder management complication outcomes in female spinal cord injury patients. *J Urol* 1995; **153**: 1458–1460.
- Wallace D. Ureteric diversion using a conduit. A simplified technique. *Br J Urol* 1966; **38**: 522–527.
- Wallace D. Ureteroileostomy. *Br J Urol* 1970; **42**: 529–534.
- Barrett D et al. Surgery for the neuropathic patient (Committee 20). In: Abrams P, Khoury S, Wein A (eds). *Incontinence*. London: Health Publications Ltd; 1999, pp 813–816.
- Jacobs S, Kaufman J. Complications of permanent bladder catheter drainage in spinal cord injury patients. *J Urol* 1978; **119**: 740–744.
- McGuire E, Savastano J. Comparative urological outcome in women with spinal cord injury. *J Urol* 1986; **135**: 730–731.
- Stonehill W, Dmochowski R, Patterson A. Risks factors for bladder tumors in spinal cord injury patients. *J Urol* 1996; **155**: 1248–1251.
- Schwartz S et al. Incontinent ileo-vesicostomy urinary diversion in the treatment of lower urinary tract dysfunction. *J Urol* 1994; **152**: 99–102.
- Singh G, Thomas D. The female tetraplegic: an admission of urological failure. *Br J Urol* 1997; **79**: 708–712.
- Leng W et al. Long-term outcome of incontinent ileovesicostomy management of severe lower urinary tract dysfunction. *J Urol* 1999; **161**: 1803–1806.
- Comarr A. Renal complications of the ileal conduit and cutaneous vesicostomy among patients with traumatic cord bladders. *J Urol* 1972; **107**: 762–765.
- Månsson W et al. Renal function after urinary diversion. A study of continent caecal reservoir, ileal conduit and colonic conduit. *Scand J Urol Nephrol* 1984; **18**: 307–315.
- Rivas D, Chancellor M. Neurogenic vesical dysfunction. *Urol Clin North Am* 1995; **22**: 579–591.
- Moreno J et al. Improved quality of life and sexuality with continent urinary diversion in quadriplegic women with umbilical stoma. *Arch Phys Med Rehabil* 1995; **76**: 758–762.
- Andrews H, Shah P. Surgical management of urethral damage in neurologically impaired female patients with chronic indwelling catheters. *Br J Urol* 1998; **82**: 820–824.
- Zinman L. Editorial: Challenging concepts in orthotopic urinary diversion. *J Urol* 1999; **161**: 1807–1808.