Ureteral substitution by an isolated ileal segment via novel antireflux technique: initial experience with 5 cases

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INTRODUCTION: With an aim to provide an optimal solution for the management of large defects of the distal ureter, we developed a novel antireflux technique of ileal ureteral substitution.

METHODS: The new method was applied in 5 female patients (mean age 39.4 years, range 29 - 53 years) with iatrogenic injury to the distal ureter that occurred as a complication after total hysterectomy and pelvic irradiation for gynaecological malignancies. Reconstructive surgery was done, and the damaged ureter was replaced by an isolated ileal segment. The ureteroileal anastomosis was created in an antireflux manner by the implementation of the serous-lined extramural tunnel technique, originally described in orthotopic bladder substitutes. To avoid mucus retention, the distal end of the isolated ileal segment was widely anastomosed with the bladder.

RESULTS: Surgery was performed without any major perioperative complications. The follow-up ultrasound and radiological studies confirmed that the procedure efficiently provided a nonobstructed unidirectional flow of urine. Optimization of the renal function and restoration of the previous patient quality of life were recorded in all cases treated by the new technique.

CONCLUSION: Ureteral substitution by an isolated ileal segment via novel antireflux technique could be a viable option when large defects of the distal ureter are encountered.

Key Words: ileum, ureter, ureteral substitution, antireflux technique

INTRODUCTION

Pelvic surgery, associated with irradiation of the female pelvis, is the most common cause of obstructive urological complications, mainly due to the formation of stenosis of the distal ureter(s). A number of surgical techniques are currently used to manage damages to the distal ureter(s), the most popular being Lich-Gregoir technique, psoas-hitch technique, Boari flap, and transureteroureterostomy. When large defects are encountered, ureteral substitution by an isolated intestinal segment (ileum, colon, or appendix) may become the preferred option.

With an aim to provide an optimal solution for the management of large defects of the distal ureter, we developed a novel antireflux technique of ileal ureteral substitution. The initial results of the application of this technique are herein presented.

MATERIAL AND METHODS

A total of 5 female patients (aged between 29 and 53 years, mean age 39.4 years) underwent uni- or bilateral ureteral replacement with isolated ileal segments at our institution between November 2004 and March 2007.

The main indication for this type of surgery was an iatrogenic injury to the distal ureter(s) that occurred as a complication after radical hysterectomy and pelvic external beam irradiation for metastatic (lymph node positive) gynaecological malignancies.

The right ureter was affected in 2 cases, the left one in other 2 cases, and in 1 patient the ureteral injury was bilateral (Table 1). One patient (RWP), who developed an ureterovaginal fistula after the gynaecological operation, underwent 2 additional pelvic operations in another hospital, aiming to correct the defect.

The physical examination at admission showed satisfactory common condition of all patients. Two of the patients had abnormal body weight, without any other significant comorbidity.

Most of the laboratory results were within the normal ranges. Two patients had anaemia at admission, and blood transfusion was required preoperatively in one of these cases.
Three patients had preexisting azotaemia with serum creatinine preoperatively above the normal ranges. In two of these cases, however, the creatinine levels normalized soon after placing a nephrostomic tube. Prior to surgery, nephrostomic tubes were placed percutaneously in 4 of the patients. The preoperative antegrade pyelographies confirmed the hydronephrotic transformation of the affected kidneys, caused by marked stenosis of the distal ureter (Fig. 1).

In all these cases the defect of the ureter was too large to be managed by either of the conventional surgical methods (e.g. Lich-Gregoir technique, psoas-hitch technique, Boari flap, etc.).

The surgical management of the reported cases via intestinal ureteral replacement was discussed and approved by the institutional human review board of "St. Marina" University Hospital within which surgery was undertaken. All procedures were carried out with the adequate understanding and written consent of the subjects.

The surgical technique of ileal ureteral substitution, developed at our institution, has been described previously[1].

Briefly, an ileal segment was isolated and used to replace the damaged ureter. Its length varied between 20 and 30cm, depending on the scope of ureteral damage in each individual case. The proximal end of the isolated ileal segment was folded and fixed close to its mesenteric border by a running sero-serosal 3-0 silk suture.

The ureter, cut above the stenosis site, was passed via a window in the mesoradix, and the intestine was opened along the suture by a diathermy knife to form 2 lateral flaps for the construction of the extramural serous-lined tunnel.

The 2 flaps were tailored according to the caliber of the ureter. The mucosal edges of the 2 flaps were approximated over the ureter by a continuous 3-0 polyglactin suture. A mucosa-to-mucosa anastomosis between the stented spatulated end of the ureter and the intestinal mucosa at the distal end of the trough was then performed.

In case of a bilateral damage /e.g. RBA – Case No 2/, the mobilized left ureter was passed via a window in the mesoradix of the sigma, and its distal end was spatulated and sutured to the spatulated end of the right ureter by Wallace technique. The ureteroileal anastomosis was then created by the same technique, as described above.

After definite closure of the proximal end of the intestinal segment, to avoid mucus retention, its distant end was anastomosed widely (in a reflux manner) with the bladder. The 7Fr plastic tube(s) used for ureteral stenting was (were) brought out via the anterior bladder wall. A 22Fr indwelling Foley catheter was inserted into the bladder.

RESULTS

Most patients tolerated the procedure well. The early postoperative period ran smoothly and uneventfully in most cases, without any major, life-threatening complications. In one patient (PJT) urinary leakage occurred immediately after removal of the ureteral intubation and required re-laparotomy and insertion of a double-J ureteral endoprosthesis, left in place for 2 months. There was a pro-
longed wound healing in this case that required additional wound treatment on an outpatient basis. The surgical wounds in all the rest of the cases healed primarily.

The ureteral intubation was removed between the 7th and 10th day, and the nephrostomy tube was removed 1 day later. The postoperative antegrade pyelographies confirmed the recovered passability of the ureter (Fig. 2), and the retrograde cystographies confirmed the unidirectional (antireflux) flow of urine (Fig. 3).

The urethral catheter was usually removed on the 10th day after surgery, and the patient was discharged from the hospital immediately thereafter.

The mean hospitalization period in our patient series was 14.6 days (range 11 - 18 days).

The patients were closely followed-up after surgery. During a mean follow-up of 12.2 months, the patients' laboratory results remained close to the normal ranges, without any significant alterations. All patients experienced improvement of renal function postoperatively. In all 5 cases the creatinine levels normalized after the reconstructive surgery and preserved within normal ranges during follow up. There were no significant metabolic derangements observed.

In two of the cases asymptomatic bacteriuria /Ps. aeruginosa 10^4 (MWT) and St. aureus 10^5 (PJT)/ persisted during the first month after surgery, but it was efficiently treated by proper antibiotic therapy.

The control image studies (ultrasound, IVP and renal scintigraphy), performed after surgery, confirmed the complete recovery of renal function and unobstructed upper urinary tracts in all patients (Fig. 4).

Unfortunately, despite the good functional results achieved, the oncological outcome in our patient series was poor (Table 1). The primary malignant disease progressed in three of our patients. One of them (RBA) rapidly developed multiple organ metastases and died of the disease 4 months after reconstructive surgery.

Other two patients also developed distant metastases during the follow up period - in the bones (MWT), and in the lungs (SMA), which required adjuvant systemic chemotherapy. These two patients are stable at the moment, under close surveillance.

**DISCUSSION**

Small intestine was first used for ureteral substitution by Schoemaker in 1906, but this procedure was not widely popularized and spread within the urologic community until Goodwin’s report in the late 1950s. The increasing use of intestine in reconstructive urology currently led to a renaissance in the use of intestinal segments for ureteral substitution. However, the optimal method of intestinal ureteral substitution remains to be defined.

Construction of the ureteroileal anastomosis is crucial for the success of the surgical procedure. Accumulated evidence from experimental and clinical studies shows that both urinary reflux and obstruction at the anastomotic site can be detrimental to the kidney. Hence, to permanently preserve renal function, a well-performed ureteroileal
anastomosis should be unidirectional (antireflux) and non-obstructive.

The serous-lined extramural tunnel technique, as an antireflux procedure, was first proposed by Abol-Enein and Ghoneim in 1994. Initially used in orthotopic neobladders, the technique was further applied in recto-sigmoid pouches, continent ileal reservoirs, ileum conduits, and most recently, in bladder augmentation.

We first applied the serous-lined extramural tunnel technique in ileal ureteral substitution in November 2004. Our first case with description of the novel antireflux technique was published recently. Within the first year of follow up, the functional results obtained with the novel technique were excellent - a complete recovery of renal function and the patient's previous quality of life was clearly demonstrated.

These excellent initial results encouraged us to continue to use the new technique in our clinical practice. Since April 2006 the method was further applied in four other patients, without any major perioperative complications. The follow up ultrasound and radiological studies confirmed that the procedure efficiently provided a nonobstructed unidirectional flow of urine. Optimization of the renal function and restoration of the previous patient quality of life were recorded in all treated cases.

The proposed novel surgical technique has distinct advantages that make it fully compatible to other techniques of ileal ureteral substitution:
- The technique allows substitution of large ureteral defects, where the use of other alternative methods is hardly feasible.
- The method provides good quality of life with fully physiologic miction and totally avoids the necessity of drainage tubes and/or outer urinary collectors.
- The wide anastomosis between the bladder and the isolated intestinal segment avoids mucus retention and all related complications.
- The novel technique proposed herein is versatile and reproducible and might be applied to ureters of various length and diameter.
- Placement of the ureter in a serious-lined extramural tunnel reliably prevents the reflux of urine and its devastating effect on the renal parenchyma and function.
- The direct mucosa-to-mucosa anastomosis between the bladder and the intestine significantly reduces the risk of stenosis at the anastomotic site.
- The achievement of unidirectional, nonobstructive flow of urine guarantees good functional results.

In conclusion, ureteral substitution by an isolated ileal segment via the novel surgical technique of antireflux ureteroileal and reflux ileovesical anastomosis could be a viable option when large defects of the distal ureter are encountered.

**SUMMARY**

**ZAMENA URETERA IZOLOVANIM ILEALNIM SEGMENTOM KORIŠĆENJEM NOVE ANTIREFLUKSNE TEHNIKE: POČETNO ISKUSTVO SA 5 SLUČAJEVA**

Cilj rada je da se obezbedi optimalno rešenje za defekte distalnog uretera. Razvijena je nova antirefluksna tehnika pri zameni uretera ileumom. Nova metoda je primenjena kod 5 bolesnica (srednja starost 39.4 godine, najmladja 29, najstarija 53 godine) sa jatrogenim povredama distalnog uretera koje su nastale kao komplikacija posle totalne histerektomije i pelvične iradijacije zbog ginekoloških maligniteta. Primjenjena je rekonstruktivna hirurgija i oštećeni ureteri su zamenjeni izolovanim ilealnim segmentom. Ureteroilealna anastomozna je kreirana antirefluksno, primenom seroznog kanala, tzv. tunel tehnike originalno opisane kod ortotopskih zamena bešike. Da bi se izbegla retencija mukusa, distalni kraj izolovanog ilealnog segmenata je široko anastomoziran sa ureterom. Nije bilo većih perioperativnih komplikacija. Praćenje je po-

**TABLE 1**

<table>
<thead>
<tr>
<th>Patients initials, gender, age</th>
<th>Med. record/admission date</th>
<th>Side of injury</th>
<th>Complications</th>
<th>Functional results</th>
<th>Oncological outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>MWT, f, 34 yrs</td>
<td>21812/10.11.2004</td>
<td>Right</td>
<td>None</td>
<td>Excellent</td>
<td>Bone meta (remission)</td>
</tr>
<tr>
<td>RBA, f, 35 yrs</td>
<td>9595/12.04.2006</td>
<td>Bilateral</td>
<td>None</td>
<td>Excellent</td>
<td>Multiple meta (ex.letalis)</td>
</tr>
<tr>
<td>SMA, f, 29 yrs</td>
<td>20174/28.08.2006</td>
<td>Left</td>
<td>None</td>
<td>Excellent</td>
<td>Lung meta (remission)</td>
</tr>
<tr>
<td>RWP, f, 46 yrs</td>
<td>2626/26.01.2007</td>
<td>Right</td>
<td>None</td>
<td>Excellent</td>
<td>Free of disease</td>
</tr>
<tr>
<td>PJT, f, 53 yrs</td>
<td>7873/19.03.2007</td>
<td>Left</td>
<td>Urinary leakage, prolonged wound healing</td>
<td>Good</td>
<td>Free of disease</td>
</tr>
</tbody>
</table>

- The novel technique proposed herein is versatile and reproducible and might be applied to ureters of various length and diameter.
- Placement of the ureter in a serious-lined extramural tunnel reliably prevents the reflux of urine and its devastating effect on the renal parenchyma and function.
- The direct mucosa-to-mucosa anastomosis between the ureter and the intestine significantly reduces the risk of stenosis at the anastomotic site.
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drazumevalo ultazvuk i radiološko ispitivanje kojim je potvrdjeno da je ovom tehnikom obezbedjen protok urina bez refluka i bez opstrukcije. Optimizacija renalne funkcije i povratak pacijenta na prethodni nivo kvaliteta života je zabeležen u svim slučajevima koji su tretirani novom tehnikom. Zamena uretera izolovanim ilealnim segmentom pomoću antirefluksnog ureteroilealnog anastomoza i refluxne ileovezikalne anastomoze može biti dobra opcija za velike defekte distalnog uretera.

Ključne reči: Ileum, ureter, zamena uretera, antirefluksnas tehnika

REFERENCES: