Presentation of the first successful ureter excision and replacement by a synthetic pyelo-cystic bypass graft (detour) in a patient with solitary kidney

Panagiotis Nikolopoulos, Vasilios Tzelepis, Anastasios Kontaxis, Ioannis Garbis, I. Chalnaridis, Ioannis Papandropoulos

Urology Clinic, 417 Army Pension Fund Nursing Foundation (Nimts), Athens, Greece

Abstract

Introduction: The use of subcutaneous pyelo-cystic bypass grafts (detours) has been described as a minimally invasive method for treating extensive ureteral lesions, usually of oncological, radiation-induced or iatrogenic aetiology. We present the first case of use of this graft in open surgery, for ureter replacement.

Material & Methods: An 81 year-old patient with a solitary left kidney visited us with signs of obstructive anuria. He was managed in an emergency setting by placement of a pig tail catheter, while the ensuing investigation revealed the presence of a tumour in the upper tertile of the left ureter, covering an area that did not allow a conservative operation. Given its increased morbidity and the patient’s refusal to be set on permanent extrarenal dialysis, we concurrently executed an extensive ureterectomy, from the level of the ureteropelvic junction to the vesicoureteral junction and replacement of the affected ureter by a synthetic detour graft, anastomosed at both ends with the pelvis and the urinary bladder. Intraoperatively, we checked the pyelocalyx system to rule out the presence of any other tumour and placed a prophylactic nephrostomy.

Results: The patient was discharged on the 12th postoperative day in good overall condition. On the 30th postoperative day and after a nephrostomography to rule out possible leaks, the nephrostomy, the drain and the urinary catheter were removed. This was followed by a chemotherapy regimen, which was not completed. Six months after surgery, the patient is disease-free based on imaging criteria and has borderline normal renal function.

Conclusions: Synthetic pyelo-cystic bypass grafts (detours) designed for subcutaneous use can safely be used in open oncological or other operations for ureter replacement in carefully selected patients.
Introduction

Urothelial tumours are the fourth most common tumour type in humans, localised in the upper (pyelocalyceal system and ureter) or lower (urinary bladder and urethra) urinary tract. Although rarer than those of the urinary bladder (5-10% vs. 90-95%), urothelial tumours of the upper urinary tract are invasive at diagnosis at a rate of 60%. They are also more frequent in men between the ages of 70 and 90, while in 17% of cases there is a coexisting tumour in the bladder at diagnosis. Tumour recurrence after treatment occurs in 22-47% of patients in the urinary bladder and in 2-6% in the drainage system of the other kidney. The main risk factors are chronic smoking and occupational exposure to aromatic amines. The treatment of choice is open or laparoscopic radical nephroureterectomy. An alternative for patients with solitary kidney or low risk tumors is kidney sparing surgery, using endoscopic or open conservative techniques.

We present the case of a patient with a tumour in the ureter of a functional solitary kidney, where, due to the existence of comorbidity and the local extent of the disease, we decided to perform ureterectomy and replacement of the ureter by a synthetic pyelo-cystic bypass graft (detour).

Material and method

A 82 year-old patient was admitted to the Emergency Department of the Hospital with anuria that had started twenty-four hours ago. He also reported intermittent episodes of painless macroscopic haematuria that had started three months ago. The laboratory tests confirmed the presence of acute renal failure (urea: 104 mg/dl and creatinine 5.9 mg/dl), while the ultrasound revealed significant dilatation of the left kidney, a small size, not functional right kidney and an empty urinary bladder. His past medical history reported diabetes mellitus, coronary artery disease, an unclear history of a non-functional right kidney after endovascular placement of an aortoiliac graft for the restoration of an aortic aneurysm, incipient Parkinson’s disease and overall impaired mobility in his legs after spinal surgery. The patient was urgently taken to the operating room, where, under general anaesthesia and fluoroscopic guidance, a pig tail No 7Fr/24 cm catheter was successfully placed (figure 1). The patient entered a polyuric phase and within 48 hours his urea and cre-
The visual image and the extent of the disease ruled out any endoscopic treatment, as well as the possibility of segmental ureterectomy and end-to-end anastomosis. On the other hand, the patient’s impaired general condition, together with his refusal to be set directly on permanent extrarenal dialysis, meant that radical surgery was not an option. Given our experience in using synthetic pyelo-cystic grafts (detours) as a minimally invasive method of bypassing usually malignant ureteral obstructions, we opted to attempt to place one, not via the subcutaneous route, which is designed and established, but with anastomosis in the ureteropelvic junction and the urinary bladder, in the already open surgical field.

Under combined general endotracheal anaesthesia and epidural analgesia and with the patient in a kidney surgery position, we directly accessed the retroperitoneum via a standard lateral lumbar incision, identified and prepared the affected ureter (figure 4, 5). At a distance of 1 cm distally of the ureteropelvic junction, we noted a distended section of the ureter (about 4 cm long), hard at palpation, containing a tumour, which visually gave the impression of extramural extension. Given that the endoscopy of the pyelocalyx system was not possible in the preceding ureteroscopy and in order to rule out a coexisting lesion in a more central position, we made a small incision in healthy tissue, at the level of the ureteropelvic junction, through which we advanced the flexible cystoscope and examined the pyelocalyx system, to the extent possible, which was disease-free. This was followed by the preparation of the entire length of the ureter, to the level of the iliac vessels, by a cross-section at the level of the ureteropelvic junction and its thorough ligation, to prevent the dispersion of tumour cells. For safety reasons, a nephrostomy tube was then placed, as planned, via the open pelvis, firstly to allow the postoperative contrast study of the pyelocalyx system and the graft, and secondly, so that it would remain there to provide a final solution, if the attempt failed.

The pyelo-cystic graft (Detour - Porges) consists of an outer polytetrafluoroethylene (PTFE) tube with
a diameter of 27 Fr, reinforced with plastic rings to avoiding bending and an inner silicone tube with a diameter of 17 Fr, which protrudes through the outer tube into both ends of the graft (figure 6). The upper end of the detour was placed inside the pelvis and was anastomosed thereto using individual Vicryl 3/0 sutures, following a technique similar to that of Hynnes - Anderson pyeloplasty, paying special attention to ensure the needle of the suture passed only through the PTFE layer of the outer tube, without piercing the underlying silicone tube (figure 7). The distal end of the detour was left free in the retroperitoneum, in parallel with the prepared ureter, which was cut at its upper end, to be anastomosed with the urinary bladder through another incision and access. We placed a drainage tube in the area of the pelvis-graft anastomosis, and the lumbar incision was then typically closed.

With the patient supine, we performed a Phanesteil incision, with a slight leftwards extension, according to the Gibson approach (figure 8). We prepared the urinary bladder and, after the peritoneum was pushed back, we identified the iliac vessels, and above these we palpated and gently pulled the ureter - with its central end ligated and free - and the distal end of the graft into the surgical field. There followed the incision and ligation of the ureter at the level of the vesicoureteral junction and the removal of the specimen (figure 9). The urinary bladder was then opened, through two guide sutures, at the level of the dome and the distal end of the graft was placed therein, after being adjusted and cut to the desired length. The bladder incision was sutured in two layers, while individual fixating Vicryl 3/0 sutures were placed between the bladder wall and the graft’s outer PTFE tube (figure 10). A drainage tube was placed in the Retzius space and the operation was com-
completed with closure of the incision in layers. The patient recovered easily and was taken to his ward.

Results
The patient’s immediate postoperative course was uneventful. As he already had preoperative haematocrit levels of 30%, the patient had to be transfused with two blood units. His postoperative renal function stabilised at creatinine levels of 1.6-1.8 mg/dl. The epidural catheter was removed on the second postoperative day and the drainage tube in the Retzius space on the third postoperative day. We observed urine leakage of about 150-200 cc per day from the drainage of the kidney, which immediately dropped to 30-50 cc, keeping the nephrostomy open. For this reason, the patient was discharged from the hospital on the twelfth postoperative day, in good general condition, but bearing the nephrostomy, the drainage and the Foley catheter. We maintained daily contact with his relatives, who informed us about the content of the drainage, which became null on the twentieth postoperative day, with the nephrostomy closed. On the thirtieth postoperative day, the patient underwent an antegrade nephrostomography at the hospital, which did not reveal any signs of leakage, so first the nephrostomy and the urinary catheter and, after two days, the drainage were removed (Figure 11).

The histological examination of the specimen showed the development of a high-grade urothelial carcinoma, invading the entire thickness of the ureter wall and positive local lymph nodes as well. The patient was referred to the Oncology clinic, where he underwent one platinum-based systemic chemotherapy session, with serious side effects, due to which he did not continue with subsequent cycles.

Six months after surgery, the patient maintains stable renal function and urine drainage is unproblematic. His cytological urine examination at three and six months were negative for malignancy, while the upper - lower abdomen CT at the fifth postoperative month has not so far revealed any visible disease using imaging criteria. However, the patient had to be hospitalised twice, first due to a febrile urinary tract infection, which was treated conservatively with antibiotics, and the second time due to deep vein thrombosis, for which he was set on chronic anticoagulant therapy. Due to the deterioration of his neurological and mobility problems, the patient is now permanently decu-

Figure 9. Ureterectomy preparation

Figure 10. Anastomosis of the graft in the urinary bladder

Figure 11. Postoperative nephrostomography
bitus, which we believe justifies our original choice for salvaging the kidney and avoiding extrarenal dialysis, although it seems to be risky for the oncological result.

**Discussion**

Upper urinary tract tumors are the second most common urothelial tumours, after those of the urinary bladder, but, unlike those, in over 60% of cases, they appear invasive at diagnosis, with relatively poor prognosis. Radical nephroureterectomy remains the treatment of choice; however, with the advancement of technology, more conservative operations, aimed at salvaging the kidney, appear to be gaining ground. These mainly concern the endoscopic (by ureteroscope or percutaneous) removal of small tumours, mainly by using lasers or, more rarely, open segmental ureterectomy and end-to-end anastomosis or other diversions, undertaken in cases of solitary kidneys or bilateral disease, in order to maintain satisfactory renal function without the need for extrarenal dialysis. The same techniques can be applied, as a first approach, in cases of low-risk tumours (monofocal, size <1 cm, with a low-grade appearance in the urine cytology examination and/or histological examination after ureteroscopy and biopsy, without signs of invasive disease in the CT imaging study). In any case, the application of conservative surgical techniques entails an increased risk of relapse and requires close monitoring. Another drawback of these techniques appears to be the downstaging of the disease, at a rate reaching 25%, due to the inability to detect small lesions in difficult positions, despite progress in endourology equipment.

Although the situation seems straightforward as regards low-risk tumours or patients with a normally functional other kidney, it is always a challenge to manage the disease in patients with a solitary kidney. In these cases, it is clear that besides the imaging, endoscopic or histological features of the disease, factors such as age, general condition, and even the possibility of easy access to dialysis units and, finally, the patient’s wishes, must be taken into account. Especially in cases of extensive invasive tumours, where routine endoscopic procedures are not possible, the urologist is often called to adopt novel therapeutic modalities to achieve the desired result. In a patient with an extensive pelvic tumour in a solitary kidney, Williams et al. applied a combination of preoperative chemotherapy and percutaneous elect rotomy, using a resectoscope. Rocco et al. managed a pelvic tumour extending in the middle and lower calyx by ligating the renal artery branches that perfuse the middle and lower third of the kidney, electrotomy of the tumour and ureterocalicostomy. Holmang et al. attempted to manage pelvic or ureter tumours in patients with solitary kidney (by ureteroscope or percutaneous) removal of small tumours, mainly represented by Desgrandchamps et al., who, in 1995, published the first cases of ureter replacement using synthetic pyelo-cystic bypass grafts (detour), p.55-62.
indications to benign diseases\textsuperscript{15,16}. The method began to be applied successfully in increasingly more centres, dramatically improving the quality of life of hundreds of patients, who were condemned to living with permanent percutaneous nephrostomies\textsuperscript{17,18,3,19}. The variant implementation of the method in the case of our patient provided us, in a not very technically demanding way, with the advantage of solving the oncological and urine diversion problems at the same time. The patient tolerated the surgery well and his immediate postoperative course presented no major complications. Six months later, the patient lives without the need for extrarenal dialysis and without visible signs of disease relapse. It is undoubtedly necessary to apply the technique to a larger number of patients with longer follow-up times in order to answer questions about the graft’s behaviour over time and in specific situations, such as chemotherapy, or the possibility of endoscopic examination of the pyelocalyx system through the graft.

**Conclusion**
The management of extensive invasive drainage system tumours in patients with solitary kidney is a specialised situation that requires taking into consideration factors such as age, general condition and the patient’s consent for radical operations that would lead to permanent extrarenal dialysis in the already known oncological data of the disease. Using an individualised approach to each case, it appears that the modified use of synthetic pyelo-cystic bypass grafts (Detours) for replacing the affected ureter at the same time is a safe solution for patients with low life expectancy, which prolongs their disease-free survival period, maintaining renal function at least on a par with preoperative levels. This first successful attempt in an oncology case opens up prospects for its more widespread use, as in the management of extensive, iatrogenic or not, drainage system lesions, until now treated with nephrectomy or permanent nephrostomy or complex operations involving the intestinal tract and/or autotransplantation and ambivalent results. The application of the method in a larger number of patients with a longer follow-up time will lead to safer conclusions regarding the method’s indications, limits and results.

**Conflicts of interest**
The authors declared no conflicts of interest.

### Περίληψη

**Εισαγωγή:** Η χρήση υποδόριου μοσχεύματος πυελοκυστικής παράκαμψης (detour) έχει περιγραφεί, ως ελάχιστα επεμβατική μέθοδος αντιμετώπισης εκτεταμένων ουρητηρικών βλάβων, συνήθως ογκολογικής, μετακινητικής ή ιατρογενούς αιτιολογίας. Παρουσιάζεται η πρώτη περίπτωση χρήσης του συγκεκριμένου μοσχεύματος σε ανοικτή επέμβαση, για αντικατάσταση ουρητήρα.

**Υλικό & Μέθοδος:** Ασθενής 81 ετών, λειτουργικός μονόνεφρος ΑΡ, προσήλθε με εικόνα αποφρακτικής ανουρίας. Αντιμετώπισε την παρουσία όγκου του άνω τριτημορίου του ΑΡ ουρητήρα, σε έκταση που δεν επέτρεπε συντηρητική τύπου επέμβαση. Με δεδομένη την αυξημένη νοσηρότητα και την ανησυχία του ασθενούς για την ακολούθηση υποδόριου μοσχεύματος, εκτελέστηκε εκτεταμένη ουρητηρική επιχείρηση με τοποθέτηση καθετήρα pig tail και κατά τη διερεύνηση που ακολούθησε, διαπιστώθηκε η παρουσία όγκου του άνω τριτημορίου του ΑΡ ουρητήρα, σε έκταση που δεν επέτρεπε συντηρητική τύπου επέμβαση. Με δεδομένη την αυξημένη νοσηρότητα και την άρνηση του ασθενούς να καταλήξει σε μόνιμη εξωνεφρική κατάσταση, εκτελέστηκε εκτεταμένη αντικατάσταση του ουρητήρα από συνθετικό μόσχευμα detour, που αναστομώθηκε στα δύο άκρα του με την πύελο και την αναστολή νεφροστομίας κατά τη διάρκεια της επιχείρησης, για αποκλεισμό αλλότριου όγκου και τοποθετήθηκε προφυλακτική νεφροστομία.

**Αποτελέσματα:** Ο ασθενής εξήλθε την 12η μετεγχειρητική ημέρα σε καλή γενική κατάσταση. Την 30η μετεγχειρητική ημέρα και αφού προηγήθηκε νεφροστομογραφία για αποκλεισμό συμπτωμάτων διαφυγής, αφαιρέθηκαν η νεφροστομία και η παροχέτευση. Ακολούθησε επιτυχημένη χημειοθεραπεία, οπότε ο ασθενής είναι απεικονισμένος σε οριακή διαφυγή και ασθενεία.

**Συμπεράσματα:** Το σχεδιασμένο για υποδόρια χρήση συνθετικό μόσχευμα πυελοκυστικής παράκαμψης (detour), μπορεί να χρησιμοποιηθεί με ασφάλεια σε ανοικτές επεμβάσεις, σε αυστηρά επιλεγμένους ασθενείς.
References


