Transpl Int (2001) 14: 95–98

ORIGINAL ARTICLE

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Reconstruction of necrotic kidney graft pelvis with a vascularized small bowel patch

Received: 15 November 1999
Revised: 31 March 2000
Accepted: 15 November 2000

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Abstract Complete necrosis of the pelvis in a transplanted kidney is a rare but particularly severe complication that generally requires removal of the graft. Here, the case of a patient is reported in whom complete necrosis of the ureter and the pelvis occurred a few days after transplantation, while kidney function was excellent. After resection of all necrotic tissue, reconstruction of the pelvis was performed with a vascularized small bowel patch fixed to the renal parenchyma at the border of the intrarenal pelvis. The native ureter was then anastomosed to this reconstructed pelvis. Although the patient suffered from recurrent urinary tract infections in the early postoperative phase, he is now well, with normal kidney graft function and unimpaired urine flow through the reconstructed urinary tract, 18 months after transplantation. This report demonstrates that successful surgical reconstruction after complete necrosis of the renal pelvis in a grafted kidney can be achieved, although the long-term outcome of this graft-saving technique remains to be seen.

Keywords Pelvic necrosis · Pelvic reconstruction · Small bowel patch

Introduction

Urological complications are a relevant problem in renal transplantation; their incidence in large recent series is described between 4 and 14% [5, 9, 13, 19]. A major cause for these complications is malperfusion and subsequent necrosis of the ureter. In most cases, necrosis is limited to the distal ureter, which constitutes the region of most limited arterial perfusion. Urinary leakage within the first days and weeks after transplantation is the typical manifestation. Although percutaneous treatment may be sufficient in cases of minor leakage [2], surgical reintervention is usually required. After resection of the necrotic segment, reconstruction is mostly achieved either by re-anastomosis of the shortened ureter into the bladder or, if the remaining ureter is too short for direct uretero-neocystostomy, by an anstomosis of the transplant ureter or pelvis to the recipient's native ureter (pyeloureterostomy) [14, 16]. When the necrosis extends to the distal pelvis, reconstruction with native ureter may still be feasible if sufficient vital pelvis remains. There is no standard technique, however, for reconstruction in case of extensive necrosis of the renal pelvis. In this report we present the case of a patient who developed complete necrosis of ureter and pelvis shortly after kidney transplantation. Because of the excellent function of the kidney graft at this time, reconstruction of the pelvis was attempted by using a vascularized small-bowel patch and the ipsilateral native ureter.

Case report

A 67-year-old obese patient with terminal renal failure due to chronic glomerulonephritis received a kidney allograft at the Medizinische Hochschule Hannover. The graft was obtained from a 51-year-old donor with a creatinine of 106 μmol/l. Preservation had been performed with University of Wisconsin solution, cold ischemic time was 30 h. The graft had normal vascular and ureteral anatomy. Vascular anastomoses were performed end-to-side to

the external iliac vein and common iliac artery, respectively; a uretero-neocystostomy was performed by the modified Lich-Gregoire technique after shortening the ureter [1]. Initial immunosuppression was effected by administring oral cyclosporine (aimed trough levels: 150 ng/ml), 2 × 1 g/day mycophenolate mofetil, and tapered steroids. The graft showed initial nonfunction, but routine ultrasound and color-coded Doppler-ultrasonographic examinations revealed no pathological results, and normal arterial and venous blood flow patterns. A biopsy performed on the 7th postoperative day showed no evidence of rejection.

On the 10th postoperative day, diuresis started and the patient developed pain. Ultrasound showed fluid collection around the kidney, and a urinary leak was demonstrated by scintigraphy. During reoperation, necrosis of the ureter and the distal pelvis was found, while the kidney appeared completely normal without evidence of malperfusion. The necrotic ureter and the distal part of the renal pelvis were resected, and after division and proximal ligation of the native ureter, an end-to-end pyelo-ureterostomy was performed after insertion of a 7-F double pigtail catheter. For optimal decompression of the bladder, a suprapubic catheter was inserted.

Over the following days, renal function was good with rapid decrease in creatinine levels. Three days later, however, large volumes of urine appeared in the wound drainage, indicating urinary leakage. Reoperation was performed, and rupture of the ureteral anastomosis with complete necrosis of the pelvis was found. After resecting the necrotic extrarenal part of the pelvis, the intrarenal part of the pelvis remained; it was partially necrotic at the resection line, but appeared vital more proximally. Since the kidney itself appeared completely normal and well perfused with normal urine production, it was decided to attempt a reconstruction of the urinary tract in order to save the kidney.

The peritoneum medially to the transplanted kidney was opened and a 10 cm segment of proximal jejunum (with its vascular pedicle left intact) was excluded from the intestinal passage. The small bowel segment was then opened longitudinally at its antimesenteric side, thereby creating a vascularized small bowel patch. This patch was washed extensively with physiologic saline and was then moved towards the transplanted kidney with its vascular pedicle positioned behind the sigmoid colon. The size of the jejunal patch was diminished by concentric resection so that a well perfused oval patch of about 5 × 3 cm remained. After placement of a nephrostomy catheter into the pyelon, the jejunal patch was sutured to the renal parenchyma surrounding the pelvis with its partially necrotic remnant tissue using 4–0 PDS and single stitches. Finally, the native ureter was anstomosed to this new pelvis at its distal edge with the medial half of the ureteral opening being sutured to the small bowel patch and the lateral half to the kidney parenchyma (Fig. 1). A 7-F pigtail catheter was again used for stenting of the ureter, the suprapubic catheter in the bladder was left in place. A scheduled second-look operation performed on the following day showed normal conditions.

Postoperative kidney function was close to normal with 80–100% of the urine draining though the nephrostomy catheter for the following 2 weeks. Evaluations by scintigraphy 8 days after reconstruction showed no evidence of a urinary leak, and application of contrast medium via nephrostomy demonstrated an open passage through the native ureter into the bladder. The nephrostomy catheter was removed, and the patient passed her urine normally via the suprapubic cathter.

Three weeks after the last operation, urine output suddenly stopped, and a urinary leak with fluid collection around the kidney graft was seen. Upon reoperation a small, punched-out perforation of the native ureter about 3 mm distal to its anastomosis was the only pathologic finding, the reconstructed neo-pelvis showing good perfusion; the cause of this perforation remained unclear. The perforation was closed by a single suture, and a nephrostomy was again inserted into the pelvis intraoperatively under ultrasonographic control. Through the nephrostomy, cloudy fluid could be aspirated and was washed out from the pelvis; injection of methylene blue solution showed no further evidence of leakage. *Enterococcus faecalis* could be grown from urine, and the patient received vancomycin intravenously for 3 weeks.

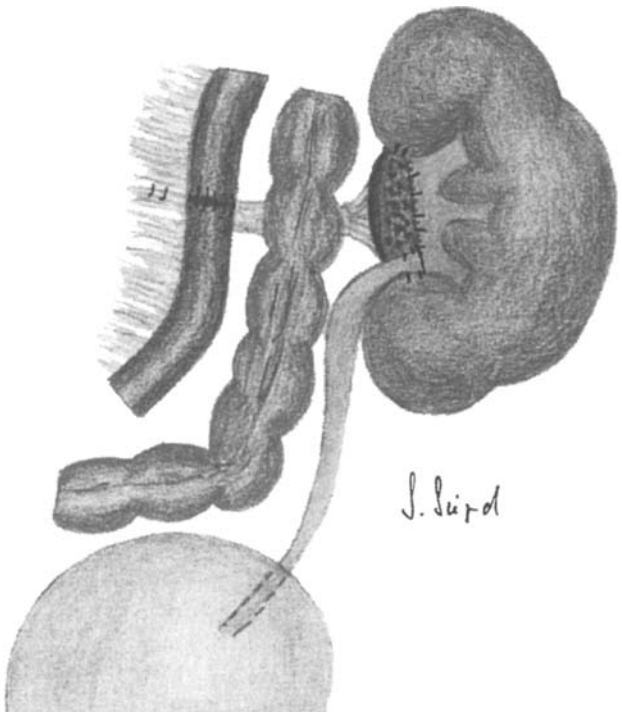

Fig. 1 Scheme of surgical reconstruction applied after complete necrosis of the renal pelvis. The extrarenal portion of the pelvis was resected completely, while the intrarenal parts of the pelvis (partially necrotic) were left in situ. A small bowel patch (with its vascular pedicle behind the sigmoid colon) was then sutured to the renal parenchyma surrounding the renal pelvis. Finally, the native ureter was anastomosed to the distal part of the newly created pelvis at the junction between small bowel and kidney parenchyma

After this operation, creatinine decreased to 100 μmol/l over the next 3 days. Because of the bacterial infection, the double pigtail catheter was removed via cystoscopy 2 weeks later. A urogram performed through the nephrostomy after further 7 days indicated a slightly dilated pelvis, but open passage throuh the ureter (Fig. 2), and the nephrostomy was removed. The suprapubic catheter was taken out one week later, and the patient was discharged home.

Four weeks later, a symptomatic urinary tract infection with *Pseudomonas aeruginosa* required hospital admission for one week and intravenous antibiotic treatment. After this episode, sporadic presence of *Candida lusitaniae* in urine with intermittent leukocyturia, but without any clinical signs of infection or renal dysfunction, was found but not treated. Currently, 18 months after undergoing transplantation, the patient is well, with a creatinine level of 95 μmol/l and without leukocyturia. Immunosuppression is effected by administering 2 × 50 cyclosporine (trough level: 150 ng/ml) and 7.5 mg prednisolon per day. Ultrasound indicates a slightly

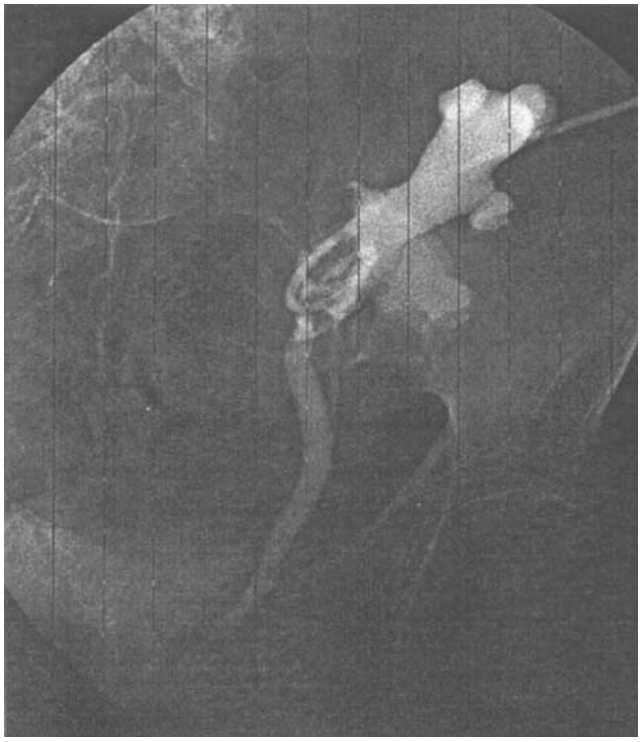

Fig. 2 Pyelography performed via the nephrostomy catheter 3 weeks after reconstruction indicating a slightly dilated pelvis but free passage of contrast medium through the native ureter into the bladder

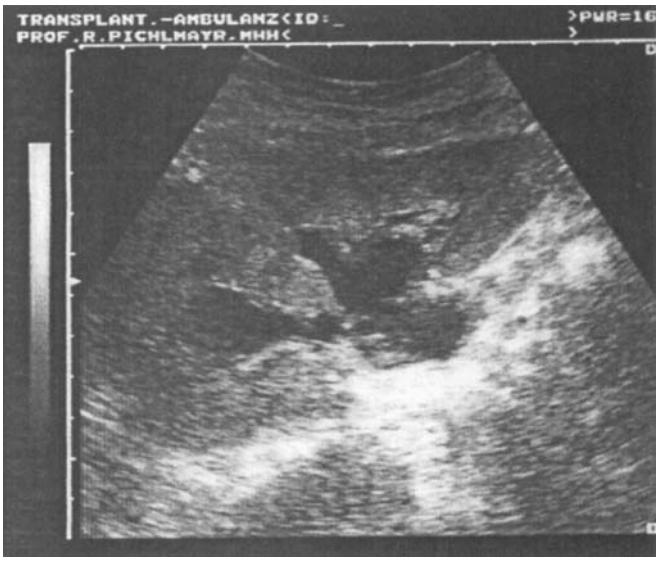

Fig. 3 Ultrasound study 5 months after reconstruction showing I° hydronephrosis

dilated pelvis (hydronephrosis I°) (Fig. 3), while the kinetic of urinary excretion as assessed by MAG-3 scintigraphy is normal.

Discussion

Urinary leakage in the first 2 weeks after kidney transplantation is frequently due to malperfusion of the ureter and/or the pelvis of the graft. The ureter of a transplanted kidney receives its blood supply exclusively through the renal vessels. Central, as well as peripheral arteial perfusion problems, therefore, carry a high risk of distal or complete necrosis of the transplant ureter [6, 17]. The risk of ureteral necrosis appears to be increased in the presence of multiple arteries [12]. Additional risk factors for necrosis of the ureter and the pelvis are extensive dissection or denudation of these structures during harvesting or during final preparation of the graft [15]. Long ischemic times [4] and rejection episodes [7] with subsequent disturbances in ureteral microcirculation may also play a role in the development of ureteral necrosis. In our case, the only obvious risk factor present was a prolonged ischemic time. However, the actual cause of necrosis of the ureter *and* the pelvis of the graft remains obscure.

Because of the severe shortage of donor organs, best use of each available organ is mandatory, even if advanced surgical techniques are necessary. This applies not only to liver transplantation, where split liver techniques facilitate implantation of two patients with one donor liver, but also for kidney transplantation, where average waiting times (in Eurotransplant) for patients with the blood groups 0 and A are around 4–5 years. Every implanted graft must, if ever possible, be preserved, since a second transplant might be several years away and might carry an increased immunological risk due to the patient's pre-sensitization by the first graft. On the other hand, however, the potential complications associated with the attempt to save the graft, e.g., the risk of bleeding or infection due to complex surgical reconstruction, have to be considered individually in each case. In our patient, complete necrosis of the renal pelvis combined with an otherwise well-functioning kidney graft seemed to justify an attempt at surgical reconstruction.

While there is a broad range of reports about methods for reconstructive surgery for distal or complete ureteral necrosis [3, 8, 14, 16], this is, to our knowledge, the first report of successful reconstruction for complete necrosis of the renal pelvis in a transplanted kidney. Vascularized small bowel was chosen for reconstruction because it represents a well perfused tissue with a mucosal surface that has been successfully used for urinary drainage in the non-transplant as well as in the transplant setting, mostly as ileal pouch [11], but sometimes also as an interposition for grafts [10, 18]. A vesiculoplasty was not used in this case because of the small size of the bladder in this previously anuric patient. In

order to mimic the physiological situation as closely as possible, the widely open renal pelvis was "closed" by a jejunal patch with its mucosal surface replacing the extrarenal part of the pelvis. For urinary drainage into the bladder, the native ureter was then anastomosed to the "neo-pelvis" at the junction of renal parenchyma and the small bowel patch. Eighteen months after the operation, the functional result of this reconstruction is good with normal passage of the urine from the kidney through the "neo-pelvis" and the native ureter into the bladder.

Although the use of a transurethral catheter in addition to the double-J catheter and transcutaneous catheter was probably not necessary, it was used to achieve optimal decompression. Moreover, the scheduled second-look operation perfomed on the subsequent day might have been omitted. In the latter course, the patient developed several episodes of (asymptomatic) urinary tract infection, but all could be well management by adequate antibiotic or antimycotic treatment. Nevertheless, the risk of recurrent infection is a major concern in the further course of the patient. Currently, moderate hydronephrosis is seen on ultrasound, and the creatinine is stable at normal values. Whether the situation will remain stable, or whether recurrent infections will cause deterioration of graft function in the long-term is unclear. So far, however, the reconstruction has obviously been successful with a good quality of life for the patient. Therefore, this technique should be considered as a graft-saving procedure in similar cases.

Acknowledgements The authors would like to thank Priv.-Doz. Dr. G. Berding, Abteilung Nuklearmedizin, Dr. M. Hiss, Abteilung Nephrologie, and Prof. Dr. Ch. Stief, Klinik für Urologie, Medizinische Hochschule Hannover, for their contribution to the clinical care of the patient and for providing the ultrasound and urography images; and Mrs. S. Siegismund for her excellent graphical work in depicting the operative procedure.

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