Transpl Int (1994) 7: 253–257

ORIGINAL ARTICLE

H. Keller
G. Nöldge
H. Wilms
G. Kirste

Incidence, diagnosis, and treatment of ureteric stenosis in 1298 renal transplant patients

Received: 9 July 1993
Received after revision: 4 November 1993
Accepted: 26 November 1993

H. Keller (✉) · H. Wilms · G. Kirste
Chirurgische Universitätsklinik Freiburg, Abteilung Allgemeine Chirurgie mit Poliklinik, Sektion Transplantationschirurgie, Hugstetter Strasse 55, D-79106 Freiburg, Germany
Fax: 07 61-27 89 70

G. Nöldge
Radiologische Universitätsklinik Freiburg, Abteilung Röntgendiagnostik, Hugstetter Strasse 55, D-79106 Freiburg, Germany

Abstract Of 1130 patients who had undergone a total of 1298 kidney transplantations, 40 developed a stenosis of the ureter (3.1 %). In all of the transplants, the anastomosis between the ureter and the urinary bladder was established as extravesical ureteroneocystostomy. Up until 1984, in cases where an obstruction in the urinary tract was suspected, the diagnosis was made by an i. v. pyelogram or by nuclear scans of the transplant. Thereafter, in 28 patients, in cases of sonographically suspected stenosis of the ureter, the diagnosis was established by means of a simplified Whitaker test. Nearly one-half of the stenoses of the ureter developed within the first 3 months after transplantation. In five patients (12.5 %) the stenosis developed significantly later, 3–10 years after kidney transplantation. Seventy percent of the stenoses were localized in the distal third of the ureter. About 75 % of the surgically explored stenoses could be corrected by resection and reimplantation of the ureter. During the postoperative follow-up, restenosis occurred in three patients. At present, 62 % of all patients whose ureteric stenoses were corrected have well-functioning kidney transplants.

Key words Ureteric stenosis · Kidney transplantation, ureteric stenosis · Stenosis, ureter

Introduction

Ureteric stenoses and urinary fistulae are the most common surgical complications after kidney transplantation. The urinary fistulae develop within the 1st days after surgery and can be easily diagnosed in most cases. Ureteric stenoses can occur even years after kidney transplantation, but can also be a reason for malfunction during the 1st days. In the case of rapid deterioration of function, it is necessary to differentiate between ureteric obstruction or stenosis and organ rejection [3, 4, 6, 10]. Ultrasonography is the method of choice for detecting dilatation of the pelvis of the kidney. Dilatation of the pelvis could be a result of denervation or a sign of distal obstruction (Fig. 1 a, b). Only the Whitaker test gives information about pressure in the renal pelvis and the ureter of the kidney [15]. The grade of the stenosis and its exact anatomical location can be demonstrated by administration of contrast medium via the percutaneous transcatheteral approach to the pelvis of the kidney. It is the aim of this publication to demonstrate the simplicity of this diagnostic procedure and to list the results of consecutive therapy for ureteric stenoses in 1298 cases of kidney transplantations that were carried out between January 1976 and December 1992.

Patients and methods

Between January 1976 and December 1992, 1298 consecutive renal transplantations were performed on 1130 patients. The average age was 39.5 years (range 2–71 years). The ratio male/female was 1.6:1. There were 1105 first transplants, 173 second transplants, 18 third transplants, and 2 fourth transplants. The anastomosis between the ureter and the urinary bladder was done using Woodruff et al.'s extravesical technique [16] with 5/0 chromium catgut. This anastomosis was sheathed by the musculature of the urinary bladder over a

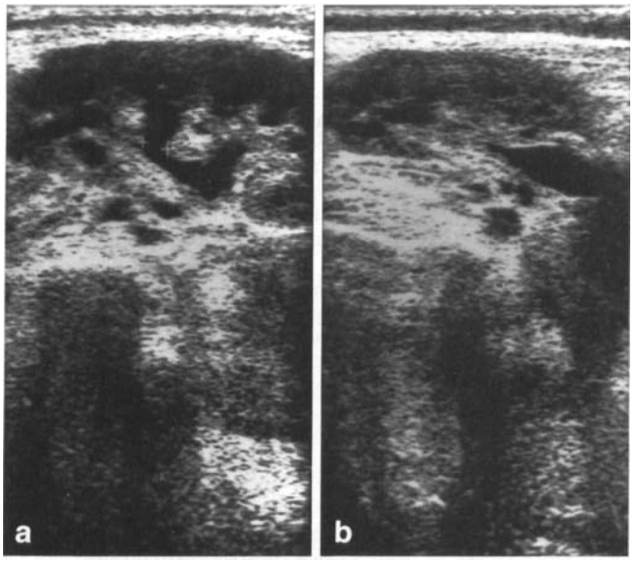

Fig. 1 **a** Longitudinal ultrasound scan of the renal transplant with moderate dilatation of the calcyceal system; **b** ultrasonography of the renal transplant with dilatation of the proximal ureter

length of 2–3 cm as an antireflux plasty. A drain was placed at the ceiling of the urinary bladder; this was withdrawn on the 4th postoperative day.

The immunosuppressive therapy administered during the 1st years consisted of prednisolone and azathioprine. Since 1984, triple therapy with prednisolone, azathioprine and cyclosporin has been given. During the first 4 postoperative weeks, all kidney transplants were evaluated by ultrasound at short intervals. After discharge, when there was a malfunction of the kidney transplant, the first diagnostic step was to use ultrasound to prove or exclude an obstruction. If ureteric stenosis was suspected, additional diagnostic steps were necessary. Between 1976 and 1984, i. v. pyelography and nuclear scanning were performed. Later, ureteric stenoses were proved and visualized exclusively by the modified and simplified Whitaker test. The dilated pelvis of the kidney transplant was punctured using a percutaneous and transrenal approach. An F-4 pigtail catheter was placed in the pelvis of the kidney. Using the original Whitaker test, the pelvis is flushed with a constant flow of 10 cc/min of 0.9 % sodium chloride solution or contrast medium. While flushing, the pressure is measured and monitored. Unlike the original method, we performed a simplified Whitaker test. After puncturing the pelvis of the kidney, 20–30 cc of 30 % ultravist was slowly injected freehand via the pigtail catheter for visualization of the ureteric stenosis (Fig. 2 a, b). The pressure in the pelvis of the kidney was measured in cm H_2O with a vertical plastic tube that was connected to the catheter. If the pressure was elevated, the pigtail catheter was kept in place for decompression of the renal pelvis until the stenosis was corrected (Fig. 3).

Results

An ureteric obstruction developed after 40 of the 1298 kidney transplantations (3.1 %; Fig. 4). Of these, 36 (90 %) were first, 3 were second, and 1 was a third transplant. In 18 cases (45 %), the ureteric stenosis was visualized within the first 3 months after kidney transplantation, and in 8 cases (17.5 %), in the first 4 postoperative weeks. In 30 cases (75 %), the stenosis was diagnosed within the period of 1–12 months after surgery and in 5 cases (12.5 %) 1–3 years after kidney transplantation. In another 5 cases (12.5 %) the stenosis was diagnosed between the 3rd and the 10th year after surgery. In 9 patients (22.5 %) i. v. pyelography and in 3 patients (7.5 %) a nuclear scan of the kidney were performed before 1984;

Fig. 2 a, b Ultrasound-guided puncture of the upper calyceal group and antegrade pyelography:
a dilatation of the calyceal system;
b approximately 5-cm stenosis of the prevesical ureter causing hydronephrosis. Contrast fluid entering the bladder

Fig. 3 Percutaneous nephrostomy with an F-5 pigtail catheter

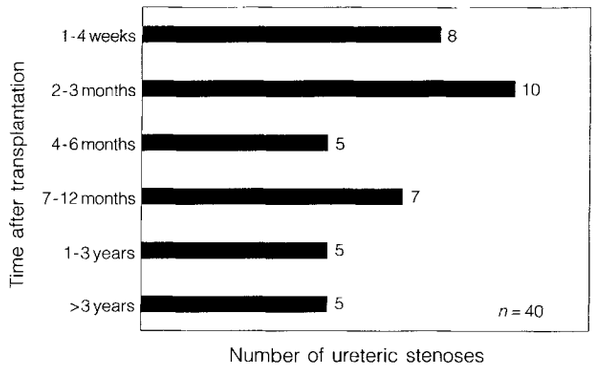

Fig. 4 Time of diagnosis of ureteric stenoses

in 28 patients (70 %) the simplified Whitaker test was the method of choice.

The Whitaker tests for all 27 patients showed elevated values. The pressure measurements ranged between 25 and 110 cm H_2O, with an average of 83.3 cm (normal value < 15 cm H_2O).

Evaluation of the radiographs and the intraoperative findings showed the stenoses to be localized in the distal third of the ureter in approximately 70 % of the cases (Table 1). In four patients (10 %) the stenoses were found in the middle third of the ureter and in one patient in the proximal third of the transplanted ureter. In five patients (12.5 %), a full-length ureteric stenosis could be seen. In one patient an exact localization of the stenosis could not be determined.

All 40 patients with proven stenosis of the ureter underwent corrective surgery (Table 2). In 32 patients (80 %) the stenotic segment of the ureter was resected and the ureter reimplanted. In 6 patients (15 %) a pyelocystostomy was done, and in 2 patients (5 %) a ureteroureterostomy with the original ureter of the right or left kidney was performed. All of the new ureteric anastomoses were splinted with a vesicorenal double-J catheter that usually remained in place for 4 weeks.

In the early postoperative period, the renal function of all patients who had undergone corrective surgery was monitored by checking serum creatinine levels. The preoperative mean serum creatinine level was 3.69 ± 1.85 mg/dl. Within 4 weeks after revisional surgery, this had decreased to 2.19 ± 1.44 mg/dl. The serum creatinine values of all 40 patients before and after surgical correction of the ureteric obstruction are shown in Fig. 5.

One patient developed a recurrent ureteric stenosis after removal of the splint. In two patients, a restenosis occurred within 4 months after the first postoperative correction. All three restenoses were successfully treated by surgical revision. In two cases, a renewed implantation of the ureter was necessary, in one case a pyelocystostomy had to be done.

Of the 40 patients with proven ureteric stenoses, 25 (62.5 %) had well-functioning transplants. The follow-up period was 1–16 years. Fifteen patients (37.5 %) experienced rejection of the kidney transplant. In 7 of these patients the rejection occurred in the 1st year after transplantation, and in 8 just after the end of the 1st postoperative year.

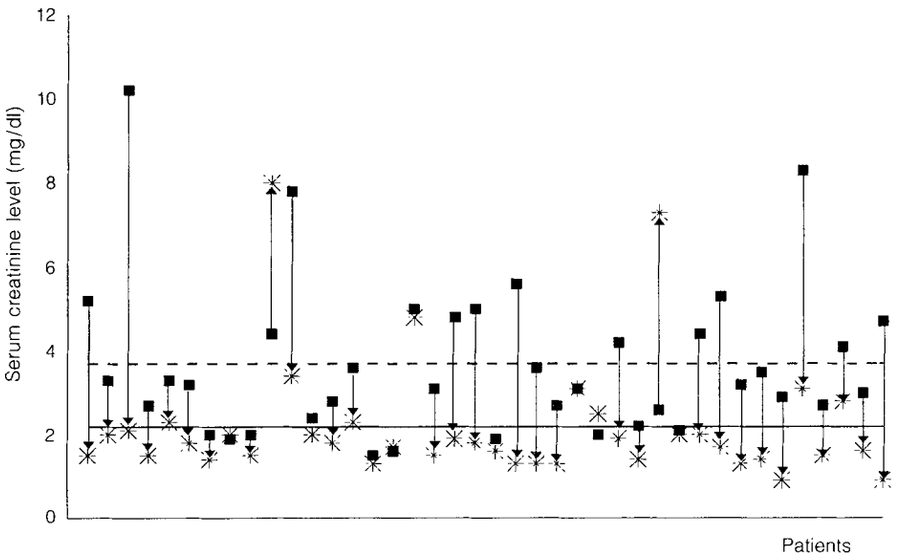

Fig. 5 Serum creatinine values before (■) and after (*) surgical correction of ureteric stenoses

Table 1 Site of ureteric stenoses

Location	*n*	%
Distal third	29	72.5
Middle third	4	10.0
Proximal third	1	2.5
Full length	5	12.5
Not known	1	2.5

Table 2 Management of ureteric stenoses

Corrective operation	*n*	%
Ureteric reimplantation	32	80
Pyelocystostomy	6	15
Ureteroureterostomy	2	5

Discussion

In addition to urinary fistula, obstruction of the ureter is the most common surgical complication after kidney transplantation. It has been reported that in large series of cases, ranging from 600 to 1000 kidney transplantations, the incidence of urological complications is between 14 % and 15.2 %, with the incidence of ureteric obstruction between 3.2 % and 5.2 % [2, 7, 12]. Technical errors during organ procurement are mainly responsible for ureteric stenoses. Since the blood supply to the ureter is guaranteed only by the transplanted kidney, excessive preparation of the ureter during explantation of the organ with a lower perfusion at the distal part must be avoided. Seventy percent of the ureteric stenoses observed in the present study were localized in the distal third of the ureter.

There are various techniques for ureterovesical anastomosis. Compared to the technique of Politano and Leadbetter [13], the extravesical technique of Woodruff et al. [16] is safe and easy to perform. Our rate of 4.8 % for urinary fistulae was in the same range as those reported by Jaskowski et al. [2] and Mundy et al. [12].

The cause of stenoses in the middle and proximal thirds of the ureter is most often a cicatrized stricture that occurs when the ureter of the kidney transplant is too long. Torsion of the ureter or compression by the deferent duct or the round ligament is a very rare cause.

Patients who had to undergo retransplantation had no increased risk of ureteric stenosis. Only one-half of the patients developed a stenosis within the first 3 months after kidney transplantation, but stenosis can also develop some years after surgery and is probably due to rejection. In one of the patients we followed-up, ureteric stenosis occurred 10 years after kidney transplantation.

Ultrasound alone is not sufficient to establish the presence of a ureteric stenosis. A dilation of the pelvis of the kidney with a dilation of the ureter greater than 1 cm in diameter is a sure sign that there is a stenosis. Proof can be obtained by administering a contrast medium via a percutaneously placed catheter in the pelvis of the kidney. Slight dilation of the renal pelvis and of the ureter is quite common in the early postoperative period due to denervation. The exact diagnostic procedure for establishing ureteric stenosis is the sonographically guided puncture of the dilated pelvis of the kidney with continuous application of contrast medium to visualize the stenosis. This can also be achieved by evaluating the pressure in the renal pelvis [8, 14]. In our experience, the original Whitaker test is not necessary, as it is time-consuming and the equipment is more extensive. The i. v. pyelography and the nuclear scanning of the transplanted kidney that used to be done are less adequate diagnostic tools for establishing exact proof of a ureteric stenosis [9, 11]. The biggest advantage of the simplified Whitaker method is the immediate decompression of the dilated renal pelvis, which is effective as a temporary measure until surgery has been performed. Surgical correction of a ureteric stenosis can be done immediately or 1–2 days after the presence of the stenosis has been established. No complications of the modified and simplified Whitaker test were experienced in our patient group. In one case, we refrained from doing the test because of the existence of a double pelvis of the kidney.

To correct stenosis in the distal part of the ureter, resection of the stenotic segment with consecutive reimplantation of the ureter is the method of choice. In cases of stenoses in the middle and/or proximal parts of the ureter, pyelocystostomy or a ureteroureterostomy can be done. A vesico-renal double-J-pigtail catheter should always be placed during correction. Balloon dilatation or placement of stents in the stenosed segment of the ureter, which has been recommended by other groups [1, 5], was not performed by our team.

We believe that good results after surgically corrected ureteric stenoses can only be demonstrated when diagnostic procedures are carefully performed and when correction is made early. The fact that there were no complications and that there was no operative mortality associated with this surgical revision shows that this is an excellent procedure.

References

1. Berger RE, Ansell JS, Tremorn JA, Herz JH, Ratheezi LC, Marchioro TL (1980) The use of self-retained ureteral stents in the management of urologic complications in renal transplant recipients. J Urol 124: 781–782
2. Jaskowski A, Jones RM, Murie JA, Morris PJ (1987) Urological complications in 600 consecutive renal transplants. Br J Surg 74: 922–925
3. Lee JKT, Baron RL, Meison GL, McClennan BL, Weyman PJ (1981) Can real-time ultrasonography replace B-scanning in the diagnosis of renal obstruction? Radiology 139: 161–165
4. Letourneau JG, Day DL, Feinberg SB (1987) Ultrasound and computed tomographic evaluation of renal transplantation. Radiol Clin North Am 25: 267–279
5. Liebermann RP, Glass NR, Crummy AB, Sollinger HW, Belzer FO (1982) Nonoperative percutaneous management of urinary fistulas and strictures in renal transplantation. Surg Gynecol Obstet 155: 667–672
6. Looser CM, Terrier F, Scheidegger JR, Frey FJ, Gertsch P, Lerut J, Revel D (1988) Radiologische Diagnostik der Frühkomplikationen nach Nierentransplantation. Radiologe 28: 549–559
7. Loughlin KR, Tilney NL, Richie JP (1984) Urologic complications in 718 renal transplant patients. Surgery 95: 297–302
8. Lupton EW, Richards D, Testa HJ, Gilpin SA, Gosling JA, Barnard RJ (1985) A comparison of diuresis renography, the Whitaker test and renal pelvic morphology in idiopathic hydronephrosis. Br J Urol 57: 119–123
9. MacGregor RJ, Konnak JW, Thrall JH, Campbell DA, Koff SA (1983) Diuretic radionuclide urography in the diagnosis of suspected ureteral obstruction following renal transplantation. J Urol 129: 708–710
10. Meier J, Otto R, Binswanger U (1981) Die Sonographie bei Funktionseinschränkung von Nierentransplantaten. Fortschr Röntgenstr 134: 142–147
11. Meller ST, Eckstein HB (1981) Renal scintigraphy: quantitative assessment of upper urinary tract dilatation in children. J Pediatric Surg 16: 126–133
12. Mundy AR, Podesta ML, Bewick M, Rudge CJ, Ellis G (1981) The urological complications of 1000 renal transplants. Br J Urol 53: 397–402
13. Politano VA, Leadbetter WF (1958) An operative technique for the correction of vesicoureteric reflux. J Urol 79: 932–941
14. Ryan PC, Maher K, Hurley GD, Fitzpatrick JM (1989) The Whitaker test: experimental analysis in a canine model of partial ureteric obstruction. J Urol 141: 387–390
15. Whitaker RH (1973) Methods of assessing an obstruction in dilated ureters. Br J Urol 45: 15–22
16. Woodruff MFA, Robson JS, Nolan B, McDonald MK (1969) Renal transplantation in man. Lancet I: 6–12