External Ureteroneocystostomy and Ureteroureterostomy in Renal Transplantation

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Reported are 204 primary external ureteroneocystostomies and 16 primary ureteroureterostomies in a series of 220 consecutive renal transplants. A total of 12 (5%) complications occurred; however, only seven (3%) required major operative repair, whereas five (2%) were minor and were repaired by cystoscopic or transvesical procedures. There was no mortality and no allograft loss from these complications, which tend to occur late and be amenable to prompt repair. Since the complications of external ureteroneocystostomy differ from those of the internal ureteroneocystostomy, a discussion of their treatment is provided. A review of literature shows that the external repair is growing in popularity because of its good results. The good results are attributable to the use of a short length of ureter, to the use of a continuous monofilament suture that produces an anastomosis less likely to leak, and to the need of a very small cystostomy.

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WE BECAME DISSATISFIED with our own results using the classic internal ureteroneocystostomy during the 1970s and modified our technique of urinary tract reconstruction.[1] We designed a method of implanting the ureter in the bladder dome, which had several advantages. It was technically simpler, avoided the need for a large cystotomy, allowed the use of a shorter segment of donor ureter, and could be performed rapidly. We used a nonabsorbable monofilament suture and constructed a "vascular-type" anastomosis. Although this approach was original with us, a similar approach (without continuous nonabsorbable suture) had been used previously in a series of 28 transplants.[2] We termed this procedure an external ureteroneocystostomy to contrast it with the classic transvesical internal reconstruction, and reported our experience within 88 transplants in 1979.[1] The results were exceptional but the postoperative observation period was relatively short (1–60 months). Since this earlier report, we have continued to use the external ureteroneocystostomy as originally described, and now report 220 urinary reconstructions in consecutive renal transplants. About 50% of the original series comprised patients treated at another institution by the senior members of this team. Those patients have not been followed up by us since that publication. Thus, this series includes approximately 40 implants from the previous series and 180 new implants. It is our purpose to report this larger series with longer postoperative follow-up to detail complications and treatment. We also wish to document that an earlier concern that nonabsorbable sutures would be lithogenic has not proven clinically important as yet.

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Review of the Literature

In our original review, the literature was reviewed to 1975 and showed 2091 internal ureteroneocystostomies had been reported with a complication rate of 9% (range: 0–36%) and a mortality rate of 19.6% (range: 0–100%).[1] At that time one series of 28 external ureteroneocystostomies had been reported. Since then 23 additional publications have appeared that report 7151 reconstructions (Table 1).[3–30] Of these, 2117 were external ureteroneocystostomies, whereas 4480 were internal. Thus, although the internal approach still is the most popular, there has been a remarkable increase in the use of the external reconstruction in 7 years. The lower complication rate with external ureteroneocystostomy seems to justify this trend.

According to Table 1, the best results have been with ureteroureterostomy; however, only 27 have been reported, of which 26 are from our own experience. (Institutions that did not document the type of reconstruction used and site of postoperative complications were not included in this review.)

Materials and Methods

Two hundred twenty consecutive urinary tract reconstructions performed between July 1977 and June 1985 were reviewed. A minimum of 1 year follow-up was available for all patients, the maximum follow-up was 8 years, and the mean was 4.1 years. All patients were followed up in our clinic and personally evaluated at regular intervals to monitor allograft function. Deterioration in function was evaluated by radioisotopic scans and ultrasonography. Cystograms, retrograde ureterograms, and intravenous pyelograms were performed as indicated. Abnormalities on the basis of these examinations led to therapeutic intervention in 12 of the 220 transplantations.

External ureteroneocystostomy was the procedure of choice and was used as the primary procedure in 204 transplants. However, when the bladder wall was very thin, when the position of the transplant necessitated a length of ureter greater than 10 cm, or when the donor ureter was too short to reach the bladder, a ureteroureterostomy (end to side with a continuous polypropylene suture) was performed as the primary procedure. This occurred 16 times.

The technical aspects of external ureteroneocystostomy have been reported,[1] but a brief description follows. A 3–4-cm incision is made through the detrusor muscle in the dome of the bladder. A 1-cm incision through the bladder mucosa is made at the distal end of the detrusor incision. The ureter is spatulated and anastomosed to the bladder mucosa with a continuous suture of polypropylene. The detrusor is then reapproximated over the end of the ureter with interrupted nonabsorbable suture.

TABLE 1. *Complications of Ureteral Reconstruction in Renal Transplants (Collected Literature 1975–1986)*

	No. of Cases	No. of Complications
Internal UNC	4,480	449 (10%)
External UNC	2,117	134 (6.3%)
Pyeloureterostomy	527	47 (8.9%)
Ureteroureterostomy	27	1 (3.7%)
Total	7,151	631 (8.8%)

UNC = ureteroneocystostomy.

Results

The 12 complications observed in these 220 transplants are listed in Table 2. There were no deaths and no loss of transplants as a consequence of these complications. Note that five complications (2%) were minor, whereas only seven (3%) were major.

Nine of 12 complications were diagnosed over 1 month after transplantation, which appears to be a favorable characteristic of this technique. In general, the complications were somewhat different from those seen with internal ureteroneocystostomy.

Complication 1, the only complication using the ureteroureterostomy, was caused by a stone in the ureter distal to a ureteroureterostomy that was undiscovered by the surgeon because a catheter was not passed distally into the bladder before the anastomosis. This is a necessary step, since unsuspected obstruction does occur occasionally. The obstruction was relieved by transurethral stone extraction.

TABLE 2. *Urologic Complications in 220 Consecutive Renal Transplants*

Patient	Anastomotic Method	Onset of Postoperative Complication	Complication	Treatment
			Minor Complications: Partial Obstruction	
1	Ur–Ur	2 days	Autogenous ureterolith	Transuretheral removal of ureterolith
2	Ext UNC	46 days	Urinoma	Internal drainage (retrograde stent)
3	Ext UNC	77 days	Detrussor fibrosis	Transvesical ureteroplasty
4	Ext UNC	63 days	Small bladder stone formation	Cystoscopic forceps removal
5	Ext UNC	1 year	Large bladder stone formation	Cystoscopic forceps crushing and removal
			Major Complications: Extravasation	
6	Ext UNC	6 days	Hematoma, avulsed ureter	Revision of ureteroneocystostomy and antegrade ureteral stent
7	Ext UNC	14 days	Necrotic ureter	Ur–Ur
8	Ext UNC	33 days	Necrotic ureter	Ur–Ur
9	Ext UNC	38 days	Disruption UVJ	Revision ureteroneocystostomy
10	Ext UNC	51 days	Disruption UVJ	Ur–Ur
11	Ext UNC	110 days	Disruption UVJ	Ur–Ur contralateral anastomosis
12	Ext UNC	147 days	Disruption UVJ	Ur–Ur

Ext UNC = external ureteroneocystostomy.
Ur–Ur = ureteroureterostomy.
UVJ = ureterovesical junction.

Complication 2 was in a patient who presented 46 days after transplantation with mild dysfunction. A sonogram showed hydronephrosis and retrograde catheterization demonstrated a 1–2-cm contained urinoma, producing partial obstruction. Since the urinoma was sterile, the patient was treated with retrograde placement of a double-J Silastic® ureteral stent for 6 weeks and recovered without incident.

Complication 3 was a fibrotic reaction in the detrusor tunnel that presented as a partial obstruction 77 days after transplantation. We have only seen this complication once, but it was easily treated by a transvesical ureteroplasty.

Complications 4 and 5 were bladder stones that formed on the ends of suture which projected into the bladder. One stone was only 1–2 mm and was discovered incidently at a cystoscopic examination performed for microscopic hematuria; however, the other stone was 1.6 cm and was symptomatic. Both were removed with the cystoscopic scissors and forceps.

Complication 6 was secondary to a hematoma at the ureteral tip, which incompletely avulsed the anastomosis apart. The anastomosis was taken down, the small hematoma cleared, and the ureter reimplanted at a nearby site. Recovery was prompt.

Complications 7 and 8 apparently resulted from inadequate blood supply to the distal ureter since a 1–2-cm segment was clearly necrotic at the time of re-exploration. We have tried to keep the ureter as short as possible to avoid this problem and perform a ureteroureterostomy primarily if the position of the kidney requires a ureter of longer than 10 cm. Apparently this practice does not eliminate this complication.

Complications 9–12 are, so far as we know, unique to this type of implant. Each appeared to be a complete avulsion of the ureter from the bladder with the end of the ureter lying within a urinoma membrane that had ruptured to produce extravasation. This could be caused by the ureter being too short and mechanically pulled from the bladder. Alternatively, it could represent late presentation of ischemic necrosis of the ureter tip. However, in each case, the distal end of the ureter appeared normal. The ureter was reanastomosed to the autogenous ureter in three patients and to the bladder in one patient.

In the seven patients with major complications (complications 6–12, Table 2), there were six in whom the urine appeared clear and there were no signs of infection. In all of these patients the wounds were closed without drainage after reconstruction and after appropriate wound lavage and debridement. All wounds healed per primum. In one patient the urinoma was infected and the wound was closed around a suction drain without an attempt at repair. After the fistula matured and the urine sterilized, the patient was reoperated on through a midline incision and the transplant ureter was anastomosed to the contralateral autogenous ureter. This patient and his allograft have remained well for over 5 years.

Discussion

A number of lessons have been learned from this experience. A total complication rate of 5% compares favorably with other results published during the past 7 years and is 50% less than the collected experience with the internal ureteroneocystostomy (Table 1). This is sufficient explanation for the increased use of the external ureteroneocystostomy without considering that five of the 12 complications were relatively minor. Thus, the major urologic complication rate in this series was only 3%. Further, there were no deaths nor transplant losses from the complications. The treatment of these complications required some innovation. We do not know of previous reports of transvesical ureteroplasty, ureteroureterostomy using the contralateral ureter, nor internal stenting for a small sterile urinoma being used in these clinical settings.

That most complications occurred over 1 month after the transplant is advantageous since by that time the patient has recovered from the initial transplant operation, the uremic state, and is receiving reduced doses of immunosuppressive drugs.

The two bladder stones were of interest. That they both occurred about the exposed tips of nonabsorbable suture is in accordance with our unpublished canine experiments. Those experiments demonstrated that the polypropylene continuous suture rapidly became covered with urothelium and produced less inflammation than did absorbable material. It would appear that in these instances of stone formation, a tag left from a suture knot worked into the lumen of the bladder. These protruding ends could not be covered with urothelium, and concretions occurred on them as would be expected. This should be preventable. No stones have appeared that produced obstruction. The mean follow-up period of 4.1 years without serious stone disease should be sufficient to justify the continued use of nonabsorbable suture.

The technical details of the external ureteroneocystostomy were outlined in our 1979 publication,[1] but it seems appropriate to emphasize the importance of the use of a monofilament "low-drag" suture fo perform a "vascular-type" anastomosis. This produces a watertight anastomosis with minimal inflammatory reaction and obviates the need for stents or drains. This is almost certainly responsible for the good results obtained with the external ureteroureterostomy. A case can be made for more common use of the ureteroureterostomy as a primary procedure but we continue to use it as a second choice since it is a ready alternative for complications with the ureteroneocystostomy.

Summary and Conclusions

The external ureteroneocystostomy is a reliable method of reconstitution of urinary drainage in renal allografts, with few complications (5%). Our complications generally occurred late and were all successfully treated.

Ureteroureterostomy yields comparable results but is probably best used when ureteroneocystostomy cannot be done or has failed, since it provides a ready alternative procedure.

Use of nonabsorbable sutures in the urinary tract has not proven to be lithogenic except when ligated suture tags were left in the bladder lumen.

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