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ORIGINAL ARTICLE

Raja Khauli

Modified extravesical ureteral reimplantation and routine stenting in kidney transplantation

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R. Khauli
Division of Urology,
American University of Beirut Medical Center, 850 Third Avenue,
18th Floor, New York, NY 10022, USA
E-mail: rkhauli@aub.edu.lb
Tel.: + 1-9611-744464

Abstract In the past, extravesical ureteroneocystostomy has been technically modified several times, with varying results. In this study, we evaluate our experience with modified extravesical re-implantation and routine stenting. From January 1988 to September 2001, 411 consecutive renal transplantations (220 LRD/LUD, 191 CAD) were performed at our institutions. Of 220 kidneys utilized for living related transplantation, 39 were retrieved laparoscopically and 181 were retrieved by open nephrectomy. The ureteroneocystostomy performed was a modified Lich–Gregoir re-implantation with routine stenting, using the upper transplant ureter. A double ureter was encountered in 11 patients and was managed with a conjoint ureteral ostium-to-mucosa anastomosis, using two stents. In two patients with graft ureteropelvic junction (UPJ) stenosis, a double ipsilateral drainage was performed, applying modified extravesical reimplantation with concomitant ureteroneocystostomy. There were no ureteral leaks. Five (1.22%) patients developed temporary ureterovesical junction (UVJ) obstruction/edema following stent removal, which necessitated re-stenting for 4–6 weeks. Two patients (0.49%) developed delayed stenosis and were successfully treated with retrograde balloon dilatation.(One at the UPJ of a pediatric kidney, and one at UVJ). All patients with functioning grafts in this series are currently stent-free. We conclude that the modified extravesical reimplantation with routine stenting is an effective and safe technique in renal transplantation, associated with almost no complications.

Keywords Renal transplantation · Extravesical ureteroneocystostomy · Ureteral stent · Ureteral complications · Laparoscopic nephrectomy

Abbreviations *UPJ* ureteropelvic junction · *UVJ* ureterovesical junction

Introduction

Intravesical [7, 12] and extravesical ureteroneocystostomy [1, 5, 6] are the two principle approaches for re-establishing urinary tract continuity in renal transplantation. Extravesical reimplantation is associated with several advantages, most importantly, rapidity and ease of construction. The extravesical approach was first described by Lich et al. [8] and Gregoir [2] for the correction of vesicoureteral reflux, and initially utilized in clinical transplantation by MacKinnon et al. [9]. The technique was later modified by Konnak et al. [5, 6] and applied routinely in renal transplantation. Our preferred technique of extravesical ureteral re-implantation with routine stenting has been described elsewhere [3, 4], and is similar to that described by Konnak et al. [5, 6], with few modifications. The two major modifications introduced in our technique were the exclusive utility of the upper ureter which is the healthiest ureteral segment, and the use of routine ureteral stenting, yielding a consistent operation that can be effectively applied in most transplantations with a minimal risk of urological complications. Here we report on our updated experience in 411 consecutive transplants.

Materials and methods

Surgical technique

A more detailed description of the technique is reported elsewhere [3, 4]. The bladder is pre-filled with dilute antibiotic solution at the beginning of the procedure, and the foley is clamped. A 3 cm incision is made in the posterolateral aspect of the bladder by retracting of the bladder medially. Blunt and sharp dissection is used to develop the plane between the muscularis and the mucosa, taking care not to enter the bladder, and the two sides of the detrusor are retracted using stay sutures of 3–0 chromic catgut, allowing the mucosa to bulge out. An ellipse of mucosa is excised from the distal apex. The ureter is prepared with an incision at the anticipated anastomotic site, which is planned in the upper ureter, since it has the most consistent blood supply, dependent on the lower pole arterial branches of the renal artery. Access to this upper portion of the ureter is obtained by sharply dividing its lateral fibrous attachment to the lower pole, obtaining 1–2 cm of extra length, and allowing for discard of the mid ureter. A 4.8 French pediatric Double-J stent is passed over its guide wire into the renal pelvis, and the lower end of the stent is entered into the mucosal opening in the bladder.

The anastomosis of the ureter-to-bladder mucosa is performed with two running 5–0 chromic catgut- or 5–0 PDS sutures from either side over the indwelling Double–J stent. The bladder muscle is closed over the ureter with interrupted 3–0 chromic catgut sutures. In cases of double ureters, the ureterneocystostomy is performed utilizing the same technique (a single tunnel) with a conjoint ureter-to-mucosa anastomosis, using two stents. The ureters are spatulated and joined together in the medial edge to make the common ostium using a running 5–0 chromic suture. The ureteral catheter is left in-dwelling for 5–30 days and occasionally longer, if deemed necessary, based on the appearance and viability of the ureter at the time of transplantation. In the majority of cases (95%), the ureteral stent was removed 5–8 days following transplantation, just prior to discharge, or on the first follow up visit to the clinic. In cases of technical difficulty in the construction of the extravesical tunnel, secondary to thin bladder musculature or prior surgeries on the bladder, the foley catheter and the ureteral stent are left longer (stent 15–30 days, foley 7–14 days). No retroperitoneal drains were used in any cases. The ureteral catheter is removed in the clinic following discharge, by means of flexible or rigid cystoscopy under local anesthesia. Patients received only a single dose of intravenous antibiotics at the time of surgery (Tobramycin 80mg, Ampicillin 1000mg, and Oxacillin 1000mg). Antibiotic suppression with low dose Trimethoprim-Sulfamethoxazole and Nystatin was maintained for 3–6 months postoperatively.

Patient data

From January 1988 to September 2001, 411 consecutive renal transplantations (220 LRD/LUD, 191 CAD) were performed at our institutions, utilizing the modified extravesical re-implantation technique. Of the 220 LRD/LUD, 181 kidneys were retrieved by means of open nephrectomy, and 39 kidneys were retrieved laparoscopically. In 11 of 411 transplantations, a double ureter was encountered, and the ureterneocystostomy was done with a conjoint ostium and single tunnel with two stents left indwelling. Two patients had a graft ureteropelvic junction (UPJ) stenosis noted preoperatively and intraoperatively, and a double ipsilateral ureteral drainage was performed using the extravesical re-implant and a concomitant uerteropyelostomy (native ureter end-to-side to the graft renal pelvis) with two stents. Follow up time ranged from 1–139 months.

Results

There were no ureteral- or bladder leaks in this series. Five patients (1.22%) developed temporary ureterovesical junction. (UVJ) obstruction/edema following stent removal, necessitating re-stenting for 4–8 weeks. Two patients (0.49%) developed delayed stenosis and were successfully treated with retrograde balloon dilatation (one at UPJ in a pediatric kidney, and one UVJ stenosis. There were three cases of primary non-function (recipients of CAD kidneys). Febrile urinary tract infections and/or graft pyelonephritis were observed in four patients in the initial 6 months of transplantation (0.97%), and were successfully treated with parenteral antibiotics. One patient had systemic candidiasis and was treated successfully with antifungal therapy and stent removal. No urologic complications were observed with laparoscopically retrieved kidneys. Furthermore, there were no graft losses secondary to urological complications in this series. All patients with functioning grafts are currently stent-free.

Discussion

The vulnerability of the graft ureter in renal transplantation makes this organ a source of serious complications that are potentially fatal. However, these complications can be prevented almost totally by paying utmost attention to operative techniques of procurement and transplantation. The initial potential insult is a harvesting injury, skeletonizing or inadvertently stretching the ureter, resulting in attenuated blood supply and thereby threatening its viability [3, 4, 7]. Any trivial mishandling of the ureter may jeopardize the tiny periureteral arterial branches, threatening the anastomosis. Unfortunately, it is not always possible to ensure consistent and proper organ retrieval by the donor team, or to discern intraoperatively whether a ureter will develop ischemic necrosis or stricture. Thus, the transplant surgeon must utilize a consistent and reproducible operative technique for ureteral reimplantation that is associated with minimal incidence of complications, especially of urinary leakage.

Of greater concern in recent years is the vulnerability of the ureter to harvesting insult during laparoscopic donor nephrectomy. The urological complications with transplantation performed from laparoscopically retrieved donor kidneys have been reported to be as high as 8–10%, and the majority are due to ureteral necrosis secondary to over-dissection of the ureter, or ischemic damage from over-retraction by the laparoscopic instruments [10, 11]. The high incidence of ureteral complications persisted even after considerable experience with laparoscopic kidney retrieval [10]. This clearly represents a significantly greater risk for urological complications, compared to live donor transplantations using kidneys retrieved with the open surgical approach, where the urological complications are typically < 3% [4]. Thus, the widened application of laparoscopic donor nephrectomy underscores the need for a safe and versatile technique for ureteral reimplantation that can obviate or lessen the urological complications occurring as a result of laparoscopic retrieval. We have not noted any urological complications among the thirty-nine transplantations performed with laparoscopic donor kidneys in this series, which attests the reliance and reproducibility of the modified reimplantation technique and routine stenting.

We believe that the use of ureteral catheters to drain the upper tract is especially useful in the setting of renal transplantation, where the ureteral blood supply is particularly endangered. In this setting, the indwelling ureteral catheter achieves several objectives; 1. It prevents the increased intraluminal pressure and ureteral distension during diuresis, which threatens the ureteral wall-vascularity and predisposes to ischemia. 2. It allows the construction of a water-tight ureterovesical anastomosis, without the risk of obstruction, especially during the early post operative period, where the risk of ureterovesical edema is at its highest. 3. In cases of oligoanuria, the presence of a ureteral catheter abolishes the possibility of technical problems from being included in the differential diagnosis.

The major advantages of the technique described above are related to the following; 1. dependence on the upper portion of the transplant ureter, where the blood supply is invariably preserved, via branches from the lower pole renal circulation [4]. We mobilize the upper ureter to allow it to reach the posterolateral bladder wall, discarding the middle ureter, which has a more endangered blood supply. 2. Utility of the shortest possible distance between the posterolateral bladder wall and the renal allograft. This is an inherent characteristic of the extravesical reimplantation technique, that should be planned allowing the use of the upper-most ureteral segment while maintaining a good tunnel length. 3. Use of routine ureteral stenting. As mentioned above, the use of an indwelling ureteral catheter abolishes the risk of increased intraluminal pressure and distension secondary to distal obstruction, anatomic or functional, such as the postoperative anastomotic edema. This results in a diminished circulation to the ureteral tip by compression of the longitudinal vessels running along the adventitial wall, and predisposes to necrosis and leakage. The use of routine stenting, which could simply be regarded as an insurance, may not be needed in every case, but it confers significant protection in a finite percentage of cases.

It may be argued that the prolonged presence of indwelling stents and foley catheters may predispose to urinary tract infections, particularly fungal colonization in the setting of wide spectrum antibiotic therapy. We have not observed any adverse effects of routine stenting in our series, nor were there any patient morbidities related to infections. We speculate that prompt catheter- and stent removal in the majority of our patients obviated problems related to reflux or colonization due to the presence of the ureteral stent. Furthermore, the use of a single dose of wide-spectrum antibiotic therapy at the time of transplantation may have lessened the possibility of fungal colonization in this population.

In conclusion, we associate extravesical reimplantation with routine stenting with a very low rate of minor complications (1.2%), and with virtually no major complications, such as ureteral- or bladder leaks. The technique is versatile and lends itself to minor modifications, necessary, for example, when dealing with ureteral duplication or graft UPJ obstructions. Also, it seems to be effective in laparoscopically retrieved kidneys, where the ureter is at increased risk of necrosis. Most importantly, there were no graft losses that could be attributable to urological complications in our series. This compares favorably to other large series, and thus has stood the test of time. We believe that this technique is the most consistent in yielding good drainage of renal allografts with the minimal possible urological complications.

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