Lower Ureteral Obstruction and Leakage in the First Month Following Renal Transplantation

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Abstract

Background: Transplantation has revolutionized treatment of end- stage renal disease (ESRD) by proving more cost effective than hemodialysis, with a lower morbidity and improved quality of life.

Objective: To evaluate the development of these complications in the first month postoperatively and correlate their development to the type of donation whether related or unrelated.

Methods: Fifty (50) patients aged (15-62) years, with a mean age (34.46 ± 12.4 SD) years with (ESRD), who underwent renal transplantation from September 2000 to October 2002, were followed-up for one month postoperatively clinically and by assessment of renal function tests, sonographic and Doppler examinations. Ureteral obstruction was considered in those patients who had allograft dysfunction, ultrasonic evidence of peritransplant collection, moderate-severe dilatation of upper urinary tract of transplanted kidney and postoperative ipsilateral or bilateral leg edema. Ureteral leakage was considered in those patients who had persistent drainage of urine with or without allograft dysfunction. Two patients were excluded from the follow-up due to death in the first 24-hour postoperatively.

Results: Six (6) patients (12.5% of cases) developed ureteral obstruction due to peri-ureteral fluid collection. In five patients the collection decreased and upper urinary tract dilatation improved gradually, as shown by ultrasound, on watchful waiting. One patient had surgical evacuation of a large hematoma. Four (4) patients (8.3% of cases) developed ureteral leakage. The leakage stopped in one patient after keeping the urethral catheter for a longer period. Three patients had surgical exploration due to persistent urinary leakage. Redo implantation of allograft ureter was done in two cases.

Development of ureteral complications was compared with the type of donation (related or unrelated). The comparison was not statistically significant.

Conclusions: The development of ureteral complications in not related to the type of donation. Extravesical ureteral anastamosis with the use of a stent is less likely to be associated with postoperative ureteral complications.

Key words: Renal transplantation, Extravesical ureteroneocystostomy

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Introduction:

Renal transplantation has become the procedure of choice and the most cost-effective strategy for the management of patients with end-stage renal disease (ESRD) [1]. Indeed, one year graft survival rates are reported to be 80% for mismatched cadaveric renal grafts, 90% for non-identical living related grafts and 95% for human lymphocyte antigen – identical grafts [2].Contraindications to renal transplantation are decreasing nowadays and most of them are relative rather than absolute. Transplanted kidneys may be taken from cadaver donors, living unrelated donors (LURDs), or living related donors (LRDs). Live donor renal transplantation has many advantages including greater graft and patient survival, shorter waiting periods, improved HLA-matching, and less cold ischemia [3]. The rate of complications following kidney transplantation has decreased due to improvements in surgical and diagnostic techniques, as well as to the greater safety of the immunosuppressive regimen.

Table (1) summarizes classification of the main complications according to their occurrence in the postoperative period. Because the clinical presentation of surgical and non-surgical complications may be quite similar, diagnostic evaluation to differentiate technical problems from allograft rejection or drug-induced toxicity is best achieved by full clinical assessment and the (Gold Triad) of Doppler ultrasound examination, measurement of cyclosporine concentration and renal biopsy [4, 5].

The two major types of urologic problems after renal transplantation are urinary leakage and obstruction [6]. Obstruction most commonly occurs within 3 months of surgery. The majority of cases result from technical error. Distal ischemia is the most common cause of distal stricture formation. This compromised blood supply can be due to problems in operative technique, or high dose immunosuppression [7]. Upon removal of the donor kidney and ureter, the donor ureter is dependent on the renal artery as its sole source of blood. The ureteral length of transplanted kidney is kept as short as possible to reduce the risk of ischemia and subsequent necrosis or fibrosis of the distal segment. Two surgical errors may compromise this supply. The first involves stripping the ureter of its adventitia and connective tissue, leading to ischemia and necrosis of the distal ureter. The second error involves compromise of the ureteral branch of the renal artery by dissecting too high into the renal hilum

[8]. Trauma to the renal artery during donor nephrectomy, as caused by excessive traction on the renal vessels during removal or damage from the perfusion cannula can cause distal ureteral ischemia [9]. Uretero-vesical implantation may be done by either intravesical antireflux (Pollitano-Leadbetter) technique or extravesical (Lich-Gregoir) technique. A modified technique of each may be used. The technique of ureteral reimplantation into the recipient bladder has been shown to have an impact on the incidence of ureteral obstruction [10, 11]. The extravesical technique requires a shorter donor ureter, and the use of a stent postoperatively prevents ureteral kinking. Extrinsic compression of the ureter may lead to obstruction, and this may be caused by lymphocele, pelvic hematoma, pelvic abscess, or lymphoproliferative disease/ tumor. Intrinsic obstruction of ureter may be caused by edema, calculi, blood clot, or tumor [9].Urinary leakage usually present within three weeks of the transplant, most commonly at the uretero-vesical junction, subsequent to distal ureteric ischemia and necrosis. Urinary leaks also occur from the calyces, thought to be consequent to excessive dissection of polar renal arteries during transplantation [12].

The diagnosis of ureteral obstruction in a renal transplant recipient is usually made during evaluation of azotemia in an otherwise asymptomatic patient. The denervated graft does not allow the obstruction to cause pain for the recipient. Mild hydronephrosis is quite common in allografts without obstruction. It is generally minimal in early graft obstruction, and is seldom as dramatic in the renal allograft as in the acutely obstructed native kidney. Doppler ultrasound and renal scan are used in many centers for the initial diagnostic evaluation of poorly functioning grafts. Ultrasound is the most useful diagnostic tool when lymphocele is suspected as a cause of obstruction. Computed Tomography (CT) scanning and Magnetic Resonance Imaging (MRI) will likely show the cause of obstruction if calculi or extrinsic compression are involved. The most definitive diagnostic tool is percutaneous nephrostomy tube placement with antegrade nephrostogram. This method is invasive, but allows visualization and confirmation of stenosis or the site of ureteral leakage. Allowing the graft to drain via the nephrostomy tube is also therapeutic, and subsequent improvement in function will further confirm the diagnosis [9]. Treatment of ureteral obstruction consists of either endourological techniques or open surgery. Table (2) summarizes management of ureteral obstruction in renal allograft. Open surgery is generally reserved for the few cases in which endourological techniques do not work. An example of this is immediate obstruction, especially in the presence of extravasation. This is most likely due to distal ureteral ischemia with necrosis, and open repair / reconstruction is required. Causes of extrinsic compression such as hematoma or lymphocele, may be managed by open or percutaneous techniques. A hematoma may be evacuated by an open procedure, and a lymphocele may be marsupialized into the peritoneal cavity [13]. The treatment of choice for small leaks in the immediate postoperative period is short-term urinary diversion with nephrostomy or ureteral stenting for one to two weeks. Surgical repair is reserved for small leaks which fail conservative therapy, and leaks which are initially large or associated with complete disruption of the ureteroneocystostomy [5].

Recent data in rodent models of experimental hydronephrosis demonstrate similar pathobiologic events in both the obstructed kidney and an allograft undergoing the chronic rejection process .To this end, investigation needs to be conducted to assess whether partial, unrecognized ureteral obstruction in an allograft hastens the development of chronic rejection. This would further underscore the importance of ureteral obstruction as a cause for not only acute azotemia in an allograft, but also chronic deterioration in renal transplant function [9].

Methods

This is a prospective study conducted from September 2000 to October 2002 (26 months). Fifty (50) patients were evaluated. Those patients underwent renal transplantation in the renal transplantation unit of Surgical Specialties Hospital-Baghdad. All the recipients had received their transplanted kidneys from living donors (LDs).

Transplanted kidneys were taken from living unrelated donors (LURDs), in twenty one (21) patients (42% of cases) while twenty nine (29) patients (58% of cases) received their transplanted kidneys from living related donors (LRDs). Recipients and their potential donors were tissue-typed. Direct matching between the serum of recipient and lymphocytes of the donor was negative.

Hot and cold ischemia times were recorded in every transplantation procedure. The hot ischemia time was ranging between (4) minutes and (30) seconds – (14) minutes and (30) seconds, with a mean time of (8) minutes. The cold ischemia time was ranging between (60) minutes – (180) minutes, with a mean time of (91) minutes.

In (45) patients (90% of cases) the arterial anastomosis was to the external iliac artery, while in (5) patients (10% of cases) the anastomosis was to the internal iliac artery. The renal vein was anastomosed to the external iliac vein. Extravesical approach for ureteroneocystostomy was followed and a ureteral stent was used across the site of anastomosis. The

stent was removed between 5^{th} –7^{th} postoperative days.

Data Collection

Patients were followed up for one month postoperatively. The data collected included (a) Daily clinical evaluation including physical examination particularly of the abdomen and lower extremities in addition to vital signs, input, and output charts, (b) A 12-hour estimation of renal function tests. Renal allograft dysfunction was defined as a case of persistent/or progressive elevation of serum creatinine.

(c) Conventional ultrasound and color Doppler examinations were done when there was evidence of decreased urinary output, allograft dysfunction, or rejection. Postoperative ureteral leakage was considered if there was persistent drainage of urine with or without allograft dysfunction. Postoperative ureteral obstruction was considered in patients who had: (a) Allograft dysfunction. (b) Postoperative ipsilateral or bilateral leg edema. (c) Ultrasound features of moderate-severe dilatation of upper urinary tract, in addition to the presence of fluid collection around the transplanted kidney and its ureter.

Statistical analysis:

Data were arranged and tabulated in a mean (±SD), number and percentage. Association between different variables was measured by using Fisher's exact test. P value < 0.05 was considered as statistically significant.

Results:

Fifty (50) patients aged (15-62) years; with a mean age (34.46 ± 12.4 SD) years underwent renal transplantation. They were followed for one month postoperatively. They were (35) males (70% of cases) and (15) females (30% of cases). The age-group distribution of recipients is summarized in table (3).Two patients (4% of cases) died in the first 24-hour postoperatively due to cardiopulmonary complications, so they were excluded from the follow up.

Six (6) patients (12.5% of cases) developed ureteral obstruction due to fluid collection. Those patients were followed-up. In five patients the collection decreased and upper urinary tract dilatation improved gradually as shown by ultrasound on watchful waiting. One patient had surgical exploration, and an evacuation of a large hematoma (580 ml by ultrasound examination) was done.

Four (4) patients (8.3% of cases) developed ureteral leakage. Those patients were followed-up. In one patient the urethral catheter was kept for further time until the urinary leakage had stopped. Three patients had surgical exploration due to continuous leakage. The site of ureteroneocystostomy was intact in one patient who had only an evacuation of blood and fluid (proved to be urine) collection. In the second patient, partial disruption was found, thus redo implantation of allograft ureter by extravesical technique was done. In the third patient complete sloughing was detected, and redo implantation by posteriorly-based vesical flap was done. Development of early ureteral obstruction and leakage was compared with the type of donation (related or unrelated). The comparison was not statistically significant as shown in table (4).

Discussion:

Despite high graft and patient survival figures, a variety of parenchymal, vascular and urological complications can threaten the transplant in the postoperative period. Several postoperative complications of transplanted kidney, share the same pathologic features, namely cellular infiltration of the graft with resulting edema, global enlargement, and vascular compromise. Consequently, they often share similar sonographic Doppler features which can cause a diagnostic dilemma. While an awareness of the typical times of onset of complications and their clinical manifestation will usually facilitate correct diagnosis, differentiation between acute tubular necrosis (ATN), cyclosporine toxicity and acute rejection usually requires renal biopsy [4].

Ureteral obstruction and/or leakage, involving the ureterovesical anastomosis are the most common surgical complications following renal transplantation, estimated to occur in 1-30% of cases, depending on the series [14]. The most recent studies note a decline in the development of such complications to the (2-4%) range [7, 15]. Swierzewski, et al reported a (2-10%) incidence of ureteral obstruction in all renal transplant recipients [16]. The incidence of urinary leakage may be as high as (10%) and usually occurs at the ureterocystostomy site, although it can emanate from the allograft hilus [5].

Changing from the Leadbetter-Politano technique to a stented extravesical for the ureterovesical anastomosis has been a major factor in reducing the incidence of urological complications [17]. In Leungwattanakij S. et al the comparative results of the ureteral complications of the extravesical technique were significantly less than the modified Leadbetter-Politano technique (4.49% vs 10.75%), (P value < 0.05) [18]. In Kumar et al the overall ureteral complications were reduced from (8.5%) in non-stented recipients to (0.22%) in stented recipients for 4 weeks [13]. The use of double J stent across the ureterovesical anastomosis appears to decrease the incidence of urological complications after renal transplantation without increasing the incidence of postoperative urinary tract infection [19, 20].However Burmeister D. et al reported a higher rate of postoperative urinary tract infection [21].

In this study: Early postoperative ureteral obstruction was reported in (6) patients (12.5% of cases) and ureteral leakage was reported in (4) patients (8.3% of cases). Five out of six patients, who developed ureteral obstruction, responded to watchful waiting when peri-ureteral fluid collection decreased and upper urinary tract dilatation improved gradually as shown by ultrasound examination. The patient who had surgical exploration was found to have a large hematoma which was secondary to therapeutic doses of parenteral heparin due to the development of postoperative deep vein thrombosis. One patient had a complete sloughing at the site of ureteroneocystostomy. Posteriorly-based vesical flap was used for reconstruction. Complete necrosis of the ureter following renal transplantation is uncommon and reconstruction may be difficult. Using the bladder via Boari-flap or direct pyelovesicostomy is an effective technique with minimal morbidity [22]. The development of ureteral obstruction or leakage was compared with the type of donation whether related or unrelated. The comparison was not statistically significant.

The patients in this study need to be followed for longer period to evaluate the development of late ureteral complications along the ureteroneocystostomy site.

Conclusions:

Ureteral complications following renal transplantation are important because they may present in a similar way to other postoperative complications, mainly acute rejection and because their incidence can be reduced or even prevented. This study could not correlate the development of such complications to the type of donation.

(Table-1) Renal Allograft Complications

Complications	*Immediate (< 1 week)*	*Early (1-4 weeks)*	*Late (> 1 month)*
Parenchymal	Acute Tubular Necrosis Rejection: Hyperacute Accelerated acute	Acute rejection	Acute rejection Chronic rejection Cyclosporine toxicity Disease recurrence Infection
Vascular	Renal vein thrombosis Renal artery thrombosis	Renal vein thrombosis	Renal artery stenosis
Urologic	Ureteral edema	Urinary fistulae, Urinoma	Ureteral strictures
Fluid collections	Hematoma, Abscess	Urinoma	Lymphocele
Neoplastic			Skin malignancies Lymphomas
Iatrogenic	Post biopsy haemorrhage Renal AV fistula Pseudo aneurysm		

(Table -2)
Management of Ureteral Obstruction in Renal Allograft

Endourological Approach	*Open Surgery*
Nephrostomy drainage.	Repeat ureteroneocystostomy.
Percutaneous endopyelotomy.	Ureteropyelostomy with use of native ureter.
Indwelling ureteral stent placement.	Vesicopyelostomy.
Incisional ureterotomy.	Ileal interposition.
Transluminal ureteral dilation.	Ureterocalicostomy.
	Vesicocalicostomy.

Table (3)

*Age-Group Distribution of Recipients **

Age (Years)	*no. of patients*
10-19	5 (10%)
20-29	15 (30%)
30-39	12 (24%)
40-49	11 (22%)
50-59	6 (12%)
60-69	1 (2%)

*** : Total no. of recipients = 50**

Table (4)
Comparison between Developments of Ureteral Complications and the Type of Donation

*Complication **	*Related donor (n=29)*	*Unrelated donor (n=19)*	*Total no. (n=48)*
Present	4	2	6 (12.5%)
Absent	25	17	42 (87.5%)
Present	3	1	4 (8.3%)
Absent	26	18	44 (91.6%)

*** : P value not significant**

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