

Preventable Urological Complications Post Kidney Transplant with Modified Lich-Gregoir Technique for Ureteroneocystostomy

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Abstract

Aim: Various ureteroneocystostomy techniques for kidney transplant have been described with Lich-Gregoir (LG) being widely employed. However, even with multiple modifications on this technique, urine leakage and ureteric stenosis remain as most common complications. This study aims to evaluate urological complications by using our modified LG technique after kidney transplant.

Method: From 26th January 2010 to 30th May 2014, 206 consecutive kidney transplants were performed at our institute. 124 were deceased-donor and 69 were live-donor kidney transplants; 13 patients received a small tumour excised kidney graft. All transplants except one were done by conventional open surgery. The modification involves an additional stitch placed at proximal part of bladder muscular incision with peri ureteric tissue at the entrance of ureter to bladder. Urological complications were defined as urine leakage or ureteral stricture. The patients were followed-up from 12 to 64 months.

Results: There was no urine leakage in this cohort. One case of ipsilateral dual-kidney transplant developed distal ureteral stricture secondary to a lymphocele that was treated by laparoscopic fenestration. Subsequently, surgical reconstruction of urinary tract was required and success. Seven cases had mild to moderate hydronephrosis identified on CDU; 4 were due to a lymphocele; 3 were secondary to urinary tract stones. Four patients had renal pelvis prominence on CDU, which was spontaneously resolved with satisfactory renal function.

Conclusion: From this study, it is demonstrated that urine leakage can be prevented and ureteric stricture may be minimised by using this modified LG technique. The ureter was always shortened in an adequate length and a ureteric stent was inserted. This modification is simple and reproducible by placing additional two stitches, which secure the potential gap at the entrance of ureter to the bladder.

Keywords: Post kidney transplant; Lich-Gregoir technique; Ureteroneocystostomy

Introduction

Kidney transplant is the preferred treatment for patients with end-stage renal disease (ESRD). There are about 70,000 kidney transplants in the world every year. With the advancement and refinement in surgical techniques over the decades, urological complications especially urine leakage and ureteric stenosis after kidney transplant have reduced tremendously. However, it could be still devastating if it occurs, leading to prolonged hospital stay, and even mortality [1-4].

There are various techniques employed for ureteroneocystostomy in kidney transplantation. Extravesical ureteroneocystostomy has been in favour in comparison with intravesical ureteroneocystostomy in recent systematic reviews [5,6]. Also, systematic review and meta-analysis have supported the placement of ureteric stent for ureteroneocystostomy. In the extravesical approach, Lich-Gregoir (LG) technique has become widely employed due to its advantages of use of a shorter ureter, minimal bladder dissection, and less complications. Nevertheless, LG technique still has a risk of urine leakage in 1.6% and ureteric stricture in 1.9% [5].

The aim of this study is to evaluate a modification of Lich-Gregoir technique in the cohort of 206 consecutive kidney transplants in our institute.

Materials and Methods

The approval of study was obtained from the hospital quality improvement committee and human research ethics committee. Retrospective review of the medical records of patients who had kidney transplants from 26th January 2010 to 30th May 2014 was conducted and data collection was recorded on the designed spreading sheet.

Two hundred and six kidney transplants were performed during study period. There were 136 males and 70 females. The age was from 3 to 81 years old with average 49.94 years old. Of 206 recipients, 124 were deceased-donor (DD) kidney transplants, 69 were live-donor (LD) kidney transplants and 13 patients received kidney transplant by using a small tumor excised kidney graft [7]. Laparoscopic or retroperitoneoscopic donor nephrectomy was routinely performed for live kidney donors [8]. The majority of patients had their first kidney transplant, whereas 33, 4 and 1 patients received second, third and fourth transplant respectively. In addition, there were 9 recipients who had dual kidney transplantation (Table 1).

All kidney transplants were performed by conventional open surgery except one kidney transplant was done laparoscopically via the extraperitoneal approach [9]. The ureteroneocystostomy was performed using our modified Lich-Gregoir technique. Briefly, the bladder is distended by running 150 ml of methylene blue stained normal saline into the bladder. The bladder muscular layer is incised 3 cm in length at lateral-posterior part of the bladder. The proximal two thirds of the muscular incision is incomplete leaving a very thin layer of muscle with

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CHARACTERISTICS	NUMBER
SEX	
MALE	136
FEMALE	70
AGE	
MEAN	49.94
RANGE	3 - 81
DONOR	
DECEASED DONOR (DD)	124
LIVING DONOR (LV)	69
DUAL KIDNEY TRANSPLANT	6 including 1 Dual Paediatric kidneys
TUMOUR EXCISED KIDNEY	13
POSITION OF TRANSPLANT	
RIGHT ILIAC FOSSA	152
LEFT ILIAC FOSSA	45
SURGICAL TECHNIQUE	
OPEN	205
LAPAROSCOPIC	1
COLD ISCHAEMIC TIME (MIN)	
• SINGLE KIDNEY TRANSPLANT	434.17
• RANGE	40 - 1764
• DUAL KIDNEY TRANSPLANT	Left: 810.4 Right: 832
URETERONEOCYSTOSTOMY TIME (MEAN) (MINUTES)	19.7
• RANGE	8 - 45
LENGTH OF STAY (DAYS), MEAN	4-64 (8.1)
	8.1
FOLLOW-UP (MONTHS)	12 - 64

Table 1: Demographics kidney transplant recipients and characteristics of kidney transplant.

the bladder mucosa while the distal one third of the muscular layer is completely incised and the mucosa is seen bulge out like an “eye-ball”. This part of bladder mucosa is incised open for ureter-bladder anastomosis (Figure 1). The ureter is trimmed in adequate shorter length and spatulated about 1.2 cm in length for anastomosis. A ureteric stent was routinely inserted in this cohort. The anastomosis is commenced at the proximal and distal corner using 5/0 PDS Polydioxanone (PDS) suture (Ethicon) (Figure 2). One side anastomosis was continued from distal corner to proximal corner by running 5/0 PDS suture of the bladder mucosa layer to the ureter whole layer, whereas another side anastomosis is continued from proximal corner to the distal corner by running the 5/0 PDS suture in the same fashion (Figure 3). Then the muscular layer is approximated using 3/0 Vicryl suture (Ethicon) in interrupted fashion (Figure 4) and the ureter is tunneled underneath of the muscular layer, but not squeezed tight. An additional stitch was placed at the proximal part of bladder muscular incision with peri-ureteric tissue on each side (Figure 4). A wound drain is routinely placed before the wound closure. The ureteric stent is removed by flexible cystoscopy between four and six weeks after transplant.

The record for cold ischemic time was available for 151 patients. The average cold ischaemic time was 417.86 minutes (from 40 to 1764 minutes). The average cold ischaemic time for dual-kidney transplant was calculated separately where the left and right transplanted kidneys was 810.4 and 832 minutes respectively. Ureteroneocystostomy anastomotic time was recorded in 22 patients. It ranged from 8 minutes to 45 minutes with an average of 19.7 minutes (Table 1).

The immunosuppression is triple regimen with Steroids, Mycophenolate mofetil and Calcineurin inhibitors. The majority of recipients had Basiliximab induction therapy in our cohort. There was no delayed graft function (DGF) in live donor kidney transplant. There

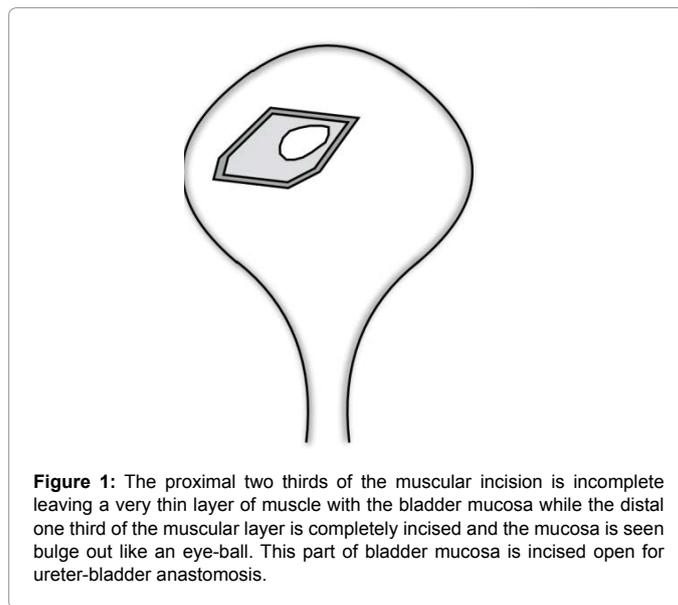


Figure 1: The proximal two thirds of the muscular incision is incomplete leaving a very thin layer of muscle with the bladder mucosa while the distal one third of the muscular layer is completely incised and the mucosa is seen bulge out like an eye-ball. This part of bladder mucosa is incised open for ureter-bladder anastomosis.

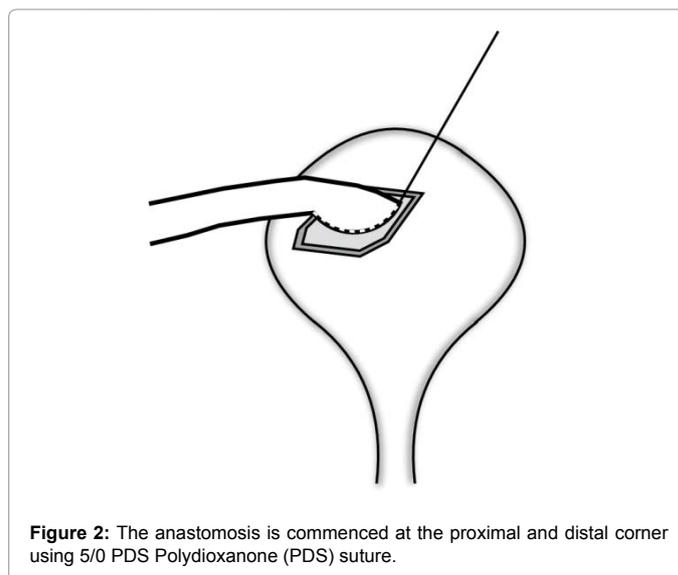


Figure 2: The anastomosis is commenced at the proximal and distal corner using 5/0 PDS Polydioxanone (PDS) suture.

were forty-eight patients experienced DGF in deceased donor kidney transplants and recovered between one and four weeks. Delayed graft function (DGF) is defined as the recipient required dialysis within seven days post kidney transplant [10].

A routine Colour Doppler Ultrasound (CDU) and renal nuclear scan (99mTc MAG3) were obtained on day one post-transplant. CDU was repeated when there was an evidence of graft function deterioration. All other images of the recipients were also reviewed during the study period to include or exclude urological complications post kidney transplant.

The CDU scans were categorized into five groups according to the time period after transplant. Baseline CDU was usually performed from post-transplant day one to day two; followed by the second group which was post-transplant day three to three months; third group which was from three months up to six months, fourth group which was from six months to twelve months and last group which was more than twelve months after transplant. All 206 recipients had baseline

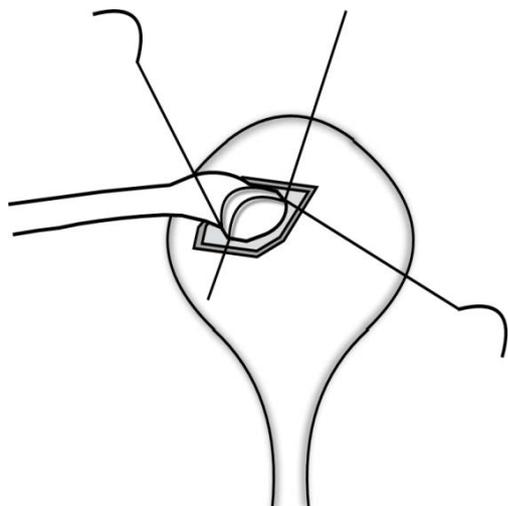


Figure 3: One side anastomosis was continued from distal corner to proximal corner by running 5/0 PDS suture of the bladder mucosa layer to the ureter whole layer, whereas another side anastomosis is continued from proximal corner to the distal corner by running the 5/0 PDS suture in the same fashion.

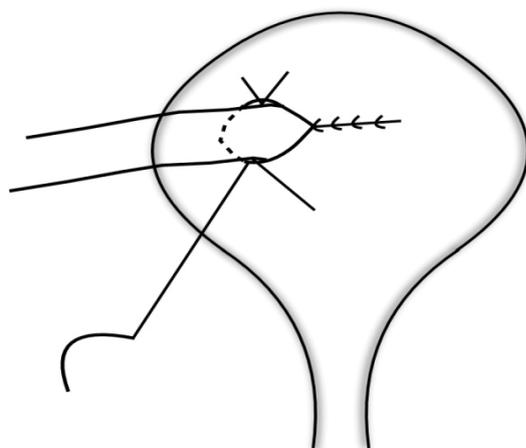


Figure 4: The muscular layer is approximated using 3/0 Vicryl suture (Ethicon) in interrupted fashion and the ureter is tunneled underneath of the muscular layer, but not squeezed tight. The additional stitch was placed at the proximal part of bladder muscular incision with peri-ureteric tissue on each side

CDU. The details of category of CDU are shown in Tables 2 and 3.

The average length of hospital stay was 8.1 days, ranged from 4 to 64 days. The patients were followed-up regularly in the renal transplant clinic by renal physicians after discharge.

Follow-up period was from 12 months to 64 months. Diagnosis of ureteral obstruction was based on deterioration of kidney graft function, presence of hydronephrosis on CDU and confirmation of stenosis on pyelogram.

Results

All kidney transplantations were completed successfully using

	Number of Ultrasound Scans	Average Number of Ultrasound Scans	
DAY 1 TO DAY 2	206	1	1
DAY 3 TO 3 MONTHS	476	2.31	0-11
3 MONTHS TO 6 MONTHS	89	0.43	0-6
6 MONTHS TO 12 MONTHS	51	0.25	0-5
More than 12 Months	111	0.54	0-8

Table 2: Categories of urinary tract ultrasound

LG vs LP	Thrasher et al. (1990)	Hakim et al. (1994)	Pleass et al. (1995)	Shah et al. (1998)	Tillou et al. (2009)
Number of cases	160 vs 160	295 vs 410	150 vs 150	125 vs 125	412 vs 265
Urine Leak (%)	1.3 vs 1.3	1.4 vs 1.7	3.3 vs 5.3	1.6 vs 3.2	1.9 vs 3.4
Ureteric stenosis (%)	1.3 vs 5.6	1.0 vs 4.0	3.3 vs 5.3	0.8 vs 0	3.2 vs 4.5

Table 3: Comparative studies of LG versus LP techniques in urological complications (Urine leak and ureteric stenosis).

modified Lich-Gregoir technique for ureteroneocystostomy. Six patients died during follow up due to other medical comorbidities. There were three graft losses; two of them were due to antibody-mediated rejection and one of them was due to dehiscence of the anastomosis between a venous patch of reconstruction for multiple renal arteries and the external iliac artery. There was no occurrence of urine leakage in this cohort. There was one patient who received ipsilateral dual-kidney transplants developed distal ureteral stenosis in each of the graft with association of a lymphocele adjacent to the ureters. The lymphocele resolved completely after laparoscopic fenestration. The distal ureteral stenosis recurred following percutaneous nephrostomy, balloon dilatation of stenosis and re-insertion of a ureteric stent. The surgical urinary tract reconstruction was required. The distal ureters were excised and ureter-bladder re-anastomosis was conducted separately. There was no further complication.

Seven patients were identified with mild to moderate hydronephrosis, five by CDU and two by CT of abdomen. Of the seven patients, four patients were secondary to lymphocele. Three cases were due to ureteric calculi. Of the four lymphoceles, three resolved satisfactory following percutaneous drainage and one required open lymphocele fenestration. On follow-up CDU, the hydronephrosis was resolved without need of further intervention. In other three cases with ureteric calculi, one patient was due to crustation of ureteric stent that was seen during removal of ureteric stent in the 10th week post-transplant. The three calculi were in the mid-ureter with the largest measuring 15 mm in size. The calculi were passed spontaneously while the patient was waiting for further management. The second patient had a 12.5 mm × 13.5 mm calculus at the upper pole of kidney graft. The patient underwent extra corporeal shock wave lithotripsy (ESWL) and it was successful. The third case had three calculi from 3.5 mm to 5mm in size in the distal ureter. The cystoscopy and retrograde ureteric stent insertion was attempted but abandoned due to technical difficulty. Fortunately, the calculi were passed spontaneously while the patient was waiting for further management. The hydronephrosis was subsequently resolved on follow up US with satisfactory kidney graft

function in these 3 cases.

In addition, there were four cases of incidental discovery of renal pelvis prominence on images. All four cases had satisfactory kidney graft function and did not pursue any further investigation. The prominence of renal pelvis was spontaneously resolved on the subsequent follow up imaging.

Discussion

Our single-centre experience of 206 consecutive kidney transplants has shown that the urological complications of urine leakage can be prevented and ureteric stenosis may be minimized by using our modified Lich-Gregoir technique. In our experience, it is learnt that gentle handling kidney graft, preservation of adequate peri-ureteric tissue, ureter being shorten to a proper length are essential to prevent urological complication post kidney transplantation. Lich-Gregoir technique has been preferred due to its advantages over other techniques [11]. In the modification, one additional suture is placed at the each side of proximal part of the incised muscular layer of bladder to seal the potential gap surrounding the ureter, where the ureter enters to the bladder. Hence, the urine leakage can be ultimately prevented.

Historically, Murray et al. in 1954 successfully implanted the ureter by using Leadbetter-Politano (LP) technique during kidney transplantation between identical twins [12]. LP technique requires one cystostomy to access the interior of the bladder and a second cystostomy to create a new ureteric orifice [13,14]. This technique is more laborious and has a higher incidence of haematuria [15-17]. Since then, various studies have reported their experience with different ureteroneocystostomy techniques and its associated urological complications. De Campos Freire et al. [18] were the first to utilize extravesical ureteroneocystostomy technique in kidney transplantation following the technique described by Lich and Gregoir (hence, Lich-Gregoir technique) for the treatment of vesical-ureteral reflux (VUR) in paediatric population [19]. In the series of 88 patients, the results were commendable with complication rates of 7.6% urine leakage and 2.5% of ureteral stenosis [18]. Subsequently, Taguchi and colleagues [20] in 1971 trialed a new extravesical ureteroneocystostomy technique (U-stitch technique) where a U-stitch is used at the distal part of the ureter to anchor it to the anterior bladder wall. The antireflux procedure is performed similarly to LG by imbricating the seromuscular layer over the ureter; it differs from LG technique where it lacks a mucosa to mucosa anastomosis. It has been noted to be superior in operative times but unfortunately it had a higher incidence of haematuria [21,22]. U-stitch technique has also been modified by others. Shanfield used only one stitch but MacKinnon preferred two stitches at the distal part of ureter [23,24]. Finally, the full-thickness technique is reported, in which the ureter is anastomosed to the full thickness of the bladder wall without a tunnel. By using this technique, the urine leakage was 1.1% and ureteric stricture was 2.5% in a series of 327 kidney transplants [25].

LG technique has become the technique of option in most centres to reestablish urinary tract continuity in kidney transplantation owing to its simplicity and lower complications rates.

Nevertheless, various modifications have been attempted to further improve urological complication as it remains as one of the most common complications after kidney transplantation with urine leakage ranging from 0.8% to 9.3%; ureteral obstruction from 1% to 8.3% [21,26,27]. Haberal et al. [28] described a Corner-saving technique as a modification to LG with a result of 2.4% of urological complication (1 urine leakage and 1 ureteral stenosis) in a small study population of 82 cases. Khauli emphasized employment of a ureteric stent and using

upper ureter in his modification [29]. Our modification aimed to seal the potential gap surrounding the ureter, at the entrance of ureter to the bladder by additional stitch at each side of ureter with bladder muscular layer. This will provide water-tight anastomosis and avoid ureteral obstruction owing to over approximation of bladder muscular layer. In this cohort, there was no urine leakage and no ureteral obstruction resulting from ureteroneocystostomy. One case with dual kidney transplant developed distal ureteral stenosis secondary to ischemic fibrosis.

The effect of vesicoureteral reflux on long-term kidney graft survival is controversial [3]. Vesicoureteral reflux (VUR) was reported in a wide range from 2% to 86%, depending on the definition, the utility of voiding cystourethrography and the timing of the investigation [30-32]. The VUR was not observed as a problem in our cohort by using our modified LG technique. Renal pelvis prominence observed incidentally in our cohort may be due to ureteral oedema that has resolved over time spontaneously. It is understood that the urological complication is multifactorial. Gentle handling the kidney graft and preservation of sufficient peri-ureteric tissue are essential. The most modifiable factor is surgical technique. This modification actually seals the entrance of ureter to the bladder better to prevent the urine leakage, while the ureter is not overly approximated to avoid ureteral stricture.

We routinely use ureteral stent in our practice as it is supported by literature review with less urological complications when compared with no placement of ureteral stent [6]. It is understood that placement of a ureteric stent does predispose some problems such as infection and potential cru station of stent if it is left forgotten. There was a case of urinary tract calculi that was acquired secondary to stent cru station after 10 weeks post kidney transplant. Therefore, early removal of ureteric stent is encouraged within 4 to 6 weeks post kidney transplant. Finally, renal transplant lithiasis is rather an uncommon event and the incidence is from 0.4% to 1% [33-36]. The modality for treating urinary tract calculi includes ESWL, Percutaneous nephrolithotomy (PCNL) and endoscopic laser lithotripsy.

Conclusion

In conclusion, our clinical experience has demonstrated that urine leakage may be preventable and ureteral stenosis can be minimized by using our modified LG technique for ureteroneocystostomy. Our study has the limitation as a retrospective study. However, it is essential by using meticulous surgical technique and gentle handling the kidney graft during kidney procurement, back table preparation and kidney transplantation. Preservation of "golden triangle" and periureteric tissue should be always emphasized. The ureter is preferred to be shorter but not to predispose tension on the anastomosis.

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