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Post-operative Surgical Complications after Kidney Transplantation – A Nephrologist's Perspective

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ABSTRACT

The first successful kidney transplantation was performed between twins in 1954. That established kidney transplant as a key step in the treatment of end-stage kidney disease to improve the quality of life and prolong the life of patients who are fit for this procedure. However, the timely recognition, precise diagnosis, and well-timed treatment of post-operative complications are crucial in the successful management of these patients. A delay in the diagnosis or management of these complications can result in significant morbidity to the recipient leading to graft loss and mortality in spite of significant advances. Careful preoperative evaluation, proactive pre-emptive approach and careful postoperative monitoring are critical at all the stages of the transplant process: (a) donor nephrectomy, (b) bench work preparation, and (c) implantation of the allograft. Renal transplant recipients should be managed in specialised units to guarantee optimal graft survival and graft function.

Keywords: Kidney transplantation, Urinary complications, Lymphocele, Vesicoureteral reflux, Morbidity, Investigations, Complications, Diagnosis

INTRODUCTION

Post-renal transplant complications can be due to either surgical or medical issues. In some patients, it may be due to both. Safe and effective management of kidney transplant recipients commences with scrupulous pre-operative assessment and correction of risk factors. Meticulous surgical practice, strict sterile procedure and haemostasis are crucial. Nephrologists should be aware of the medical as well as surgical complications and be skilled in the prompt diagnosis of medical and surgical complications.

Early post-kidney transplant surgical complications

Surgical complications after kidney transplantation are categorized as vascular (arterial and venous thrombosis, transplant renal arterial stenosis, lymphocele, hemorrhage, graft's rupture, hematoma) and urologic (ureteral obstruction, vesicoureteral reflux, urinary fistula) **(Table1)**.

Urologic problems are the dominant surgical complication subsequently to kidney transplantation, triggering substantial morbidity and mortality. The prevalence of urologic problems after renal transplantation has reduced to 2.5% from 12.5%. The common urological problems post kidney transplantation incriminates the ureterovesical anastomosis (reflux, fistula and stenosis).

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Table 1. Early post-kidney transplant surgical complications.

Hematuria
Post-operative bleeding
Hematoma
Urinary leakage
Ureteric obstruction
Arterial thrombosis
Arterial stenosis
Lymphocele
Thrombosis of renal vein

Medical problems in post kidney transplantation

- Delayed graft function (DGF)
- Acute transplant graft rejection
- Acute tubular necrosis
- Coagulation syndromes
- Infections due to various causes

Vascular, urinary, lymphocele and post-operative bleeding are surgical complications which are carefully watched in the early course of the post-operative period in kidney transplantation.

Timely radiological assessments would go a long way in spotting vascular and urological complications. Prompt investigations and evaluations will help to reduce delayed graft function. Early radiological assessments are enlightened in **Table 2**.

Table 2. Preliminary radiological investigations [1].

Types	Causes which may exist and detection	Benefits	Drawbacks
Ultrasound	Collection of fluid around the transplanted kidney Blockage of ureter Bladder abnormalities Collections in hypodermal area Thrombosis of blood vessels Post biopsy arteriovenous fistula	Quick and simple Transportable	Dependent on ultra-sonographer. Accurate demarcations of lower areas might remain unclear.
Nuclear medicine scans	Thrombosis of blood vessels Leakage of urine Blockage of transplanted ureter Transplanted kidney core abnormal function	Not involving the instrumentations Identifies blockade, Perfusion	Takes a lot of time
Computed tomography	Collection of fluid around the area of kidney transplantation Blockage of ureter Collections of fluid	Added details available	Radioactivity introduction Might require the usage of radio contrast material
Magnetic resonance imaging	Defects in blood vessels	No instrumentations	Costly Threat of nephrogenic systemic fibrosis when estimated GFR<30 ml/min (if gadolinium is used).

Mild hydronephrosis and dilatation of the transplant collecting system on ultrasonography may be seen without the presence of an actual urinary obstruction. There is a need to have a close watch on worsening hydronephrosis that is pathological.

After kidney transplantation, there could be vascular [1-5] or urologic [6,7] complications. Surgical problems have an occurrence of 5-10% and continue to be an important source of graft loss. They usually present early after transplantation.

VASCULAR COMPLICATIONS

Renal vein thrombosis

Renal vein thrombosis happens in the first postoperative week in 0.3%-6.1% of kidney recipients [8]. Abruptly loss of urine output, the presence of blood in the urine and ache in the graft site are observed. Potential threats are the technique of transplantation surgery, hyper coagulopathy, and severe volume depletion and right donor kidney, compression of the renal vein by a localised collection of blood or collection of lymphatic fluid. With short right renal vein, venous thrombosis is an added risk [9].

Renal artery stenosis

In less than 1% of renal transplant recipient's arterial thrombosis (TRAS) may be a cause of graft loss [8,10] though has been reported as high as 23% [11,12]. It can present as worsening renal function, flash pulmonary edema and the rapid start of uncontrollable blood pressure [13]. Several recipients show no symptoms with transplant renal artery stenosis (TRAS). Using regular duplex assessment (grey scale as well as Doppler), TRAS is seen in 2.4% of symptomatic and 12.4% in asymptomatic recipients [14]. TRAS most frequently happens in the anastomotic area at 3 to 24 months, though it may occur in the post or pre-anastomotic sites as well. In patients with end-to-end anastomosis, TRAS is more likely to happen.

Urological problems cause noteworthy graft injury and death. The incidence of urologic complications varies from 2.5% to 30% [15-20]. Among them, the ureteral leakage manifestations may be minor or major. Usually, a substantial decrease in output happens with an increase in drainage. The incidence of urine leakage identified about 1% and 4.3%. The frequency of lymphatic fluid collection ranges from 0.6% to 18.1%. After introducing check ultrasonograms for regular inspection of the renal graft, the pickup rate may be excessive around 50%. Blood clots can be spotted and cured swiftly [21].

Differential diagnosis of post-kidney transplant fluid collection in this given scenario:

- Hematoma/Bleeding
- Lymphocele
- Peri-renal abscesses
- Urinoma due to urine leak

Work-up and dealing with acute transplant kidney injury post-transplantation and transplant ureteral dilemmas are shown in **Figure 1**.

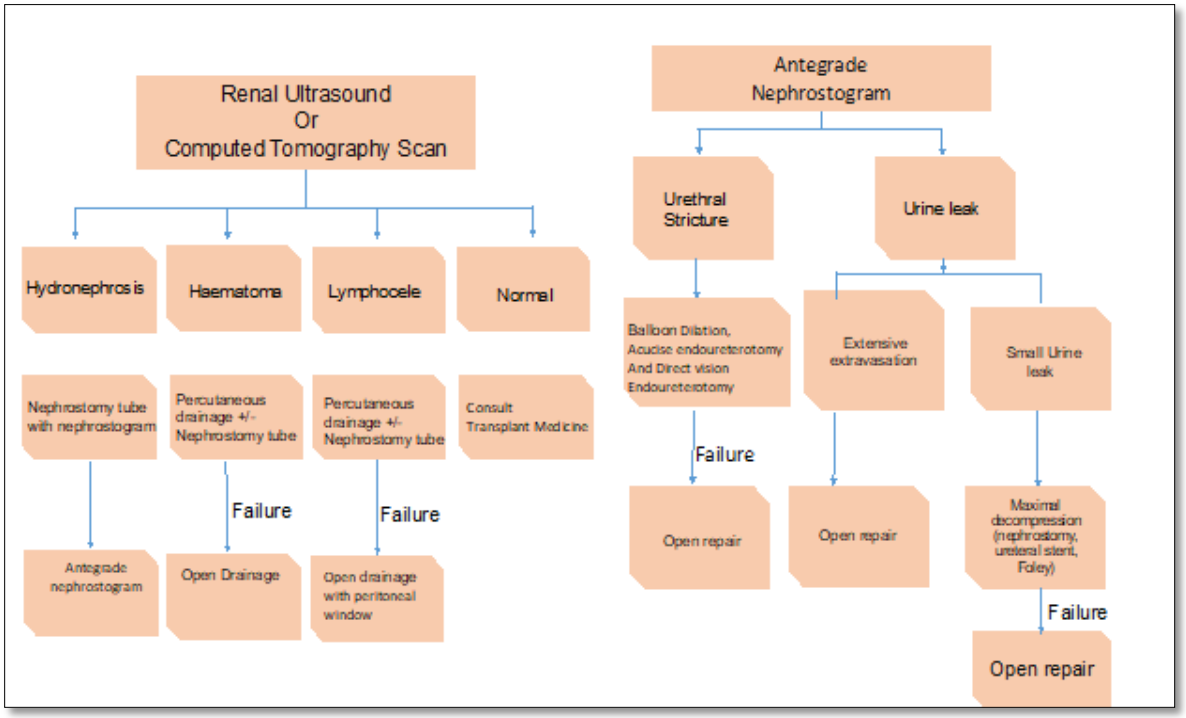

Figure 1. Post kidney transplant - Urological scrutiny [22].

Hematoma/hemorrhage

Hematoma presents as bloodstained leakage of blood associated with tachycardia, hypotension and drop in hemoglobin. Sometimes clots may block the drain. The urgent scan is vital and may be followed by immediate re-exploration if there is any doubt.

Lymphocele

Even large lymphocele could be asymptomatic if it is far from hilum and is not squeezing the ureter. Reduced urine output and DGF can be caused by lymphocele if ureter is blocked. Intervention is not indicated if there is no graft dysfunction and no hydronephrosis [23,24]. Biochemical studies can aid in diagnosis. Elevated creatinine and potassium values in drained or aspirated fluid would give an answer.

Perinephric abscesses

Gram stain and culture and sensitivity should be sent to the lab to discover the organisms as abscesses may be a complication of hematoma, urinoma and lymphocele.

Urinoma

With the use of the double-J ureteric stent, urine leak is less common. Urine leak may be instant or late. It can present as increased drainage, DGF or leaking from the wound.

CASE SCENARIO

Recipient age: 28 years, CKD stage 5, Pre-emptive kidney transplantation

Donor: Brother

Post-operative drainage: Day 2:820 ml and Day 3:750 ml. Subsequent **Table 3** shows the laboratory values of fluid and serum.

Table 3. Analysis of drain fluid and serum.

Biochemistry	Drainage fluid	Serum
Creatinine	16000 µmol/L	416 µmol/L
Potassium	28 mmol/L	K 5.1 mmol/L

Biochemical studies of fluid and serum together can assist in diagnosis. High creatinine and potassium levels in the drained or aspirated fluid indicate urinoma. Therefore, this patient has a urine leak. Biochemical analysis of the drainage fluid will display high creatinine and potassium levels on drainage or removed fluid equated with a simultaneous serum. If the drained fluid biochemistry is similar to serum sample, it means that the liquid is either seroma or lymphocele.

METHODOLOGY TO DIAGNOSE AND RESOLVE THE PROBLEMS

Urologic complications are common in post kidney transplantation, equated with vascular difficulties. Maximum urologic issues happen in the first two weeks. Anastomotic leaks are common [25]. Leaks are occurring instantly typically due to technical problems [24]. After one week, it may be caused by ureteral necrosis. Catheter blocks must be excluded [20,26]. Suture dehiscence, caliceal leak, ureteric kinking, ureteric ischemia and bladder perforation are to be considered [27,28]. If a polar artery is tied off, it may cause a localized infarction. This may lead to a caliceal leak [29].

DISTINCTIVE FEATURES

Disproportionate drain fluid (volume and biochemistry) throughout the initial postoperative days reduced urine through the catheter, impaired graft function and pain over the graft are scrutinised. The timing of the removal of the double-J stent may give a clue to urine leakage [30,31]. It could present with an insidious start. Urinoma is typically anechoic, lacking septations and happening in less than two weeks of post kidney transplantation surgery. **Table 4** assesses the clinical issues and management specificities according to the mechanism of urine leak.

Table 4. Clinical presentation and treatment specificities according to the mechanism of urine leak [32].

Cause of Leak	Urine Leak Site	Timing After Kidney Transplant	Clinical and Imaging Feature Specificities	Treatment
Technical Failure	Either ureterovesical or pyeloureteral anastomosis	First 24 h after surgery	Increased fluid drainage, decreased urine output; ultrasonography showing echoic collection	Re-anastomosis as soon as possible (additional suture)
Obstruction	Either bladder leak or anastomosis site leak	Early or later in the postoperative period	Decreased urine output; pain over the graft; collection with hydronephrosis	Conservative treatment first (percutaneous nephrostomy + double J stent)
Polar artery ligation	Caliceal leak	First week after kidney transplant	Decreased urine output; ultrasonography showing echoic collection; Doppler ultrasonography showing segmental renal infarction	Conservative treatment is performed first; if not effective, then perform partial nephrectomy
Necrosis	Ureteral	2 weeks after kidney transplant	Decreased urine output; ultrasonography showing echoic collection	Resection of necrotic ureter part + re-implantation
Dehiscence	Bladder	Early in the post-operative period	Decreased urine output; ultrasonography showing echoic collection	Replacing the catheter; If not resorbed leak, then perform bladder repair

Few radiological investigations and managements like CT scan, antegrade DJ stent insertion and nephrostogram are shown in **Figures 2-5**.

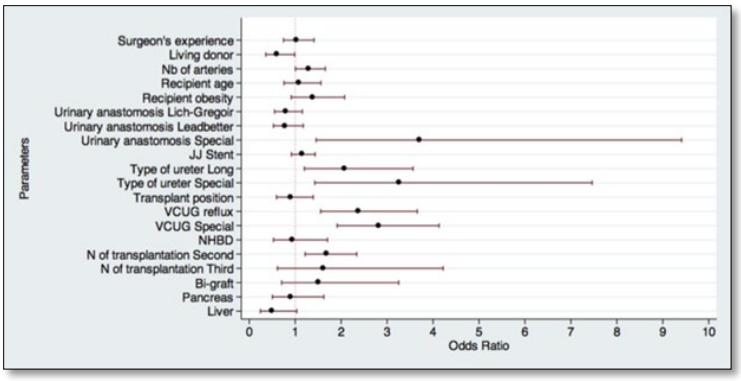

Figure 2. Odds ratio of risk factors for urinary complications of renal transplantation [33].

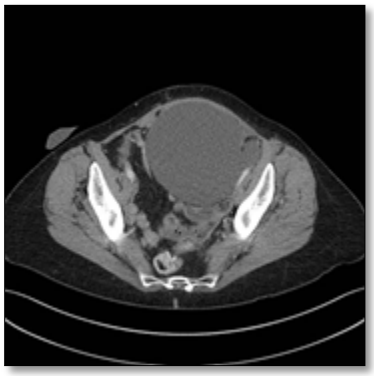

Figure 3. Urinoma.

Figure 4. Right antegrade DJ stent.

Figure 5. Nephrostogram.

Avoidance of post-operative complications:

1. Ureteric ischemia is avoided by unnecessary dissection around donor ureter
2. Shorter ureter usage lessens ureteric ischemia.
3. Routine usage of the ureteric stent at the time of ureterovesical anastomosis is recommended though there is an association with a higher possibility of urinary tract infections in transplanted kidneys [34].

Conservative approach is justifiable if there is no hydronephrosis. If the patient did not have a double J stent, retrograde insertion of the stent is never an option in postoperative transplant period.

PERCUTANEOUS MANAGEMENT

When there is a small leak with hydronephrosis, ureteral fistula can be treated with percutaneous nephrostomy. If there is a delay in surgery for managing more significant leaks, the collections should be drained to reduce the risk of infection [24,35-37]. Complete decompression with percutaneous nephrostomy and double J stent placement is crucial. Surgical exploration is indicated when conservative management fails.

Main urinary complications and surgical management

Ureteric leak: At the time of re-implantation, one must make sure that ureter is well perfused. If there is not enough length of a well-perfused transplanted ureter, then the native ureter rather than the urinary bladder is used for anastomosis. By using the ipsilateral native ureter, ureteropyelostomy is the right decision. Cystopyelostomy repairs necrotic ureter [38-42].

Bladder leak: In meaningful leaks, bladder-mending surgery is suggested. This should be followed by extended bladder drainage, a minimum of two weeks.

Calyceal leak: Calyceal leakage can be caused by segmental transplanted graft infarction by ligature of a polar artery. If conservative action does not work, then partial nephrectomy can be used earlier to rescue the allograft in a rather rare situation. The location of the leak and the grade should be evaluated at the earliest.

Vesicoureteral reflux: Vesicoureteral reflux after kidney transplantation is not very uncommon. The occurrence may be as high as 50%-86% [22,43]. This may be due to surgical practice. To lessen the risk of ureteral stricture several surgeons support a patulous ureteroneocystostomy procedure rather than a tunneled implantation of the ureter. Open reconstruction desirable for high-grade VUR.

Surgical procedures [44]

Urological complications range from 5-10%. Unlike native ureters that derive their blood supply from renal arteries, aorta, iliac arteries and vesicle arteries, the transplanted ureter depends solely on the blood supplied by the branches of the renal artery that traverse through peri-ureteric tissues. To preserve transplant ureter's blood supply, one must be careful to protect the "golden triangle" **(Figure 6)**. Hitching of a mobilised bladder **(Figure 7)** and Boari flap **(Figure 8)** are surgical procedures. Use of ileum as a neo-ureter, in the absence of native ureter, is an option in rare instances (past two-sided nephroureterectomy). A small anastomotic leak can be cured with resection and re-implantation of distal ureter.

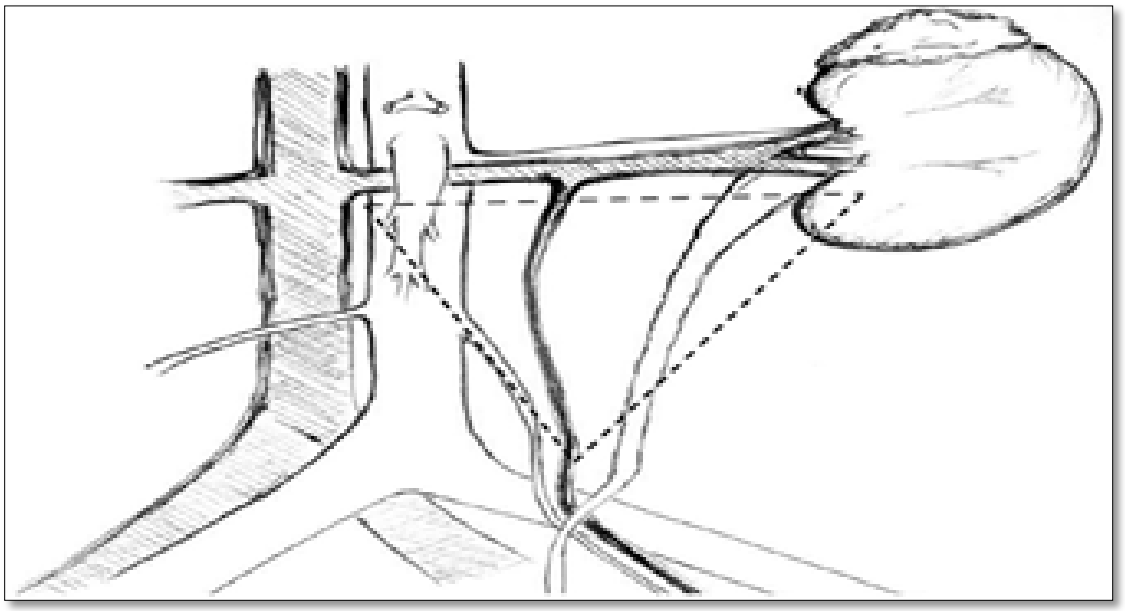

Figure 6. The golden triangle.

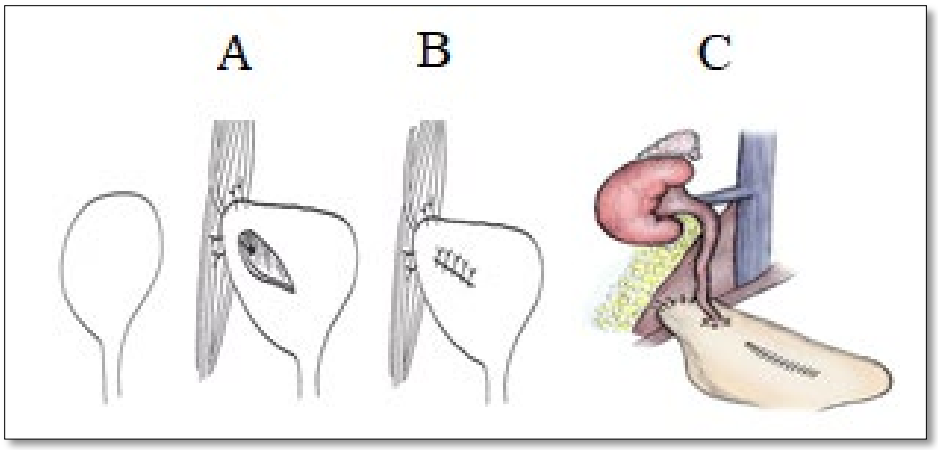

Figure 7. Psoas hitch.

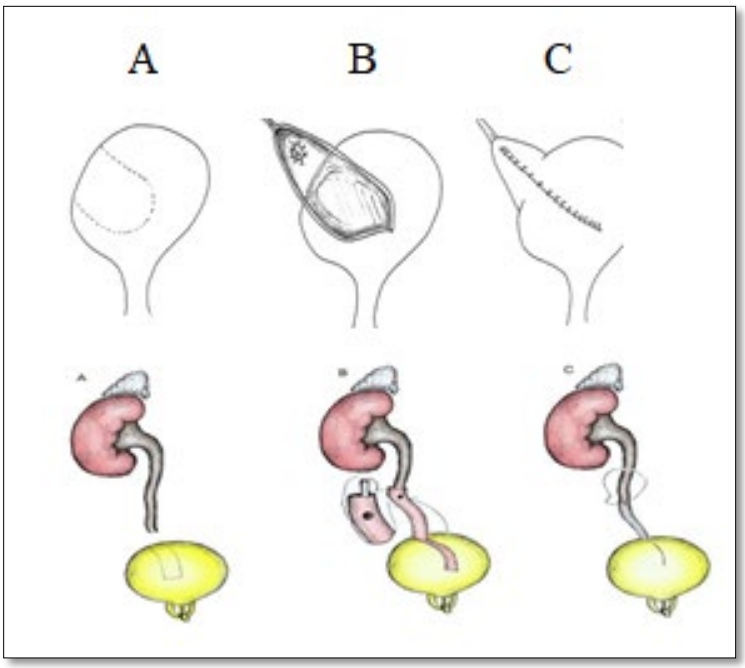

Figure 8. Boari flap.

CONCLUSION

Urine leak, ureteric necrosis, VUR and obstruction are common urological hurdles. Post-transplant urine leak management is vital. Biochemical scrutiny of emptied fluid is the necessary choice of investigation and must be matched with the sample of serum. Historically these difficulties have been handled by extensive restoration. Now conservative action or by percutaneous drainage ought to be pondered as the first choice of treatment in recipients with minor urine leaks. But in the absence of any response to conservative action or if the leak is ominously huge, then surgical exploration must be executed. Surgical handling varies on leak cause, anastomosis style, and perfusion of the ureter. Innovations in endourological techniques with modern-day types of equipment have been acceptable in numerous kidney recipients and done with caution.

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