Management of Urine Leak Following Renal Transplantation: An Evidence-Based Approach

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Abstract
Renal transplantation [RT] is associated with a significant rate of surgical complications which contribute to patient morbidity and can result in graft loss. Urological complications occur in 9% of RT and account for a significant proportion of surgical problems. They are thought to be related to the quality of the ureterovesical anastomosis and that of the donor ureter. Urological problems can occur in the early postoperative period [most often comprising of urinary leaks and ureteric obstruction/compression] or occur late [mainly comprising of ureterovesical anastomosis stenosis or vesicoureteric reflux]. From a clinical perspective, an elevated drain output in the early postoperative phase should alert to the possibility of a surgical complication [including haematoma, lymphocele or urinary fistula]. Biochemical analysis of the drain fluid is vital to confirm the diagnosis of urinary fistula. Imaging studies including ultrasonography, computed tomography and cystography can be helpful in diagnosis although the gold standard diagnostic test is a nephrostomy and antegrade pyeloureterogram if the graft is hydronephrotic. About two thirds of patients can be successfully treated with maximal decompression [catheter/drain/nephrostomy with or without stenting]. However, failures of this approach or large volume leaks require open exploration and reconstruction.

Keywords: Renal Transplantation; Complication; Urinary Fistula;
slowly falling haemoglobin with evidence of delayed graft function [the drain output may not be elevated if the drain is blocked with clots]. Imaging can be helpful in confirming the diagnosis of bleeding. A Doppler USS would show an echogenic collection although it is worth noting that USS may miss a haematoma[10]. A CT with angiogram phase is more useful but carries a small risk of contrast nephropathy [11]. In an unstable patient with suspicion of bleeding post RT, urgent surgical exploration is warranted as delaying this to obtain imaging may result in poor patient outcome. In cases of diagnostic doubt, imaging plays an important role.

Lymphoceles

This is lymph collection around the transplanted kidney and incidence has been reported between 1-15% [12]. Lymphoceles are thought to arise due to injury to lymphatic channels around the recipient iliac vessels during dissection or in the graft kidney hilum [13, 14]. Lymphoceles typically present the second week following RT with ongoing elevated drain output with biochemistry of the drain fluid being similar to serum i.e. comparable level of potassium and creatinine. The use of routine post-operative USS has led to an increased detection of asymptomatic lymphoceles which do not generally require intervention [15]. However, large lymphoceles can cause complications such as ureteric compression leading to delayed graft function.

Interventions for lymphoceles include prolonged percutaneous drainage [which can carry a recurrence rate of up to 50%] or surgery [16]. Surgical techniques traditionally comprised open drainage with creation of a large internal window to allow intraperitoneal drainage. Laparoscopic fenestration for lymphoceles is now accepted as a safe alternative to open surgery if no contraindications to this minimally invasive approach exist [17, 18].

Urinary Leak

Urinomas complicate 2-6% of renal transplants [19]. They usually present in the early postoperative period with clinical features including high drain output, reduced urine output, prolonged wound leakage or delayed graft function. The diagnosis of urine leak is confirmed by biochemical analysis of drain fluid which will have a high creatinine and potassium level compared to a concurrent serum sample. USS usually shows an anechoic collection without septation[20].

Urinary Leak Post-Transplant – Clinical, Biochemical and Radiological Features

Urine leaks occur most commonly within the first 2 weeks post-surgery [21]. A blocked urethral catheter can be the causative factor as it leads to high intravesical pressures in presence of a newly formed ureteroneocystostomy - this should be promptly identified [by flushing the catheter] as it is an easily corrected cause of urinary fistula. The commonest urine leak site is the ureteroneocystostomy[22]. Routine prophylactic ureteric stenting reduces the risk of urological complications following RT. A Cochrane systematic review of 7 RCT [over 1100 patients] found a 76% reduction in the rate of urological complications in stented patients [the stented group was however associated with a higher UTI rate] [23].

Other potential sites for urine leaks include the transplant ureter, the renal pelvicalyceal system or the bladder itself [19]. Urine leaks generally arise as a result of technical failure [which manifests clinically within the first 24-48h post operatively] or due to ureteric ischaemia/necrosis [here clinical presentation is delayed and typically happens 1-2 weeks postop][6, 24]. Ureteric ischaemia can be caused by long ureteric length or devascularisation of the peri-ureteric tissue during back benching. Ligation of a lower pole vessel can also contribute to ureteric ischaemia[24]. Therefore, from a technical perspective, prevention of ureteric ischaemia involves using a shorter length of ureter, avoiding stripping the ureter and preserving lower polar vessels. Rarely, urine leaks can arise proximally in the transplanted ureter due to perforation during intraoperative placement of a ureteric stent. Another uncommon cause is calyceal leak which could be due to local ischaemia following polar artery ligation [25].

From a clinical perspective, an elevated drain output [with high creatinine compared to serum] is the hallmark of a urinary fistula post RT. This may also be accompanied by a reduced urine output, wound fluid leakage and delayed graft function. Imaging with USS can show an anechoic collection but would not be diagnostic of a urinoma [this requires knowledge of the fluid biochemistry]. In addition, large urinomas can ureteric compression leading to graft hydrourephrosis which is easily detected on ultrasonography [20]. CT scan with contrast [needs delayed phase imaging] may show the site of the urine leak, however there are risks to contrast nephropathy associated with CT imaging in this setting especially in the presence of delayed graft function[26]. A cystogram can show the presence of a bladder injury or leak from the ureteroneocystotomy[27]. Nephrostomy and antegrade ureteropyelogram [see Figure 1] is
considered the gold standard imaging to identify the source of leak but generally requires the present of a hydronephrotic graft [28, 29]. Table 1 summarises the key radiological investigations in diagnosing urine leak.

<table>
<thead>
<tr>
<th>Imaging modality</th>
<th>Utility and pitfalls</th>
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</thead>
<tbody>
<tr>
<td>Ultrasound</td>
<td>• Cheap and easy access</td>
</tr>
<tr>
<td></td>
<td>• Urinoma appears as anechoic peri-graft collection</td>
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<tr>
<td></td>
<td>• Not diagnostic for urinoma and does not show leak site</td>
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<tr>
<td>Computed tomography</td>
<td>• Can diagnose urine leak and potentially site (on delayed phase)</td>
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<tr>
<td></td>
<td>• Risk of contrast nephropathy</td>
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<tr>
<td>Cystogram</td>
<td>• Can show urine leak at ureterovesical anastomosis/ bladder</td>
</tr>
<tr>
<td>Nephrostomy and antegrade study</td>
<td>• Excellent visualisation of site and degree of leak</td>
</tr>
<tr>
<td></td>
<td>• Requires a hydronephrotic graft to perform</td>
</tr>
<tr>
<td></td>
<td>• Invasive procedure with risk of graft injury</td>
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</tbody>
</table>

### Table 1: Radiological investigations for suspected urine leak post renal transplant

Management of Urine Leak

Figure 2 summarises the treatment for urine leaks. The principles of management include initial maximal decompression of the urinary system which is achieved by placement of urethral catheter together with a nephrostomy or ureteric stent [30]. The drain is left in situ to control the urinary fistula. For patients who have not responded to this approach or those with extensive extravasation, surgical exploration is required to reimplant the transplant ureter[31].

In the absence of hydronephrosis in patients with ureteric stents in situ, simple conservative management with prolonged drainage with catheter/drain may be successful but retrograde change of the stent may be required [6, 29]. When hydronephrosis is associated with a small urine leak, percutaneous nephrostomy [PCN] placement allows diversion of urine away from the leak site and healing to occur. PCN is a safe and effective procedure for the treatment of ureteric obstruction / urinary fistula post-transplant[32]. In a large retrospective series of 100 RT from a European centre, 2.9% developed urinary fistulae within 72h of RT and 55% of those were managed with nephrostomy drainage [the remaining 45% had open surgery]. Nephrostomy placement [with or without stenting] resulted in a 62.5% resolution of the fistula [33].

Open exploration remains the treatment of choice for patients who have failed management with maximal decompression, those with large volume extravasation or proximal fistulae [6, 19]. For large volume extravasation presenting within the first 24h postop due to technical failure of the ureterovesical anastomosis, open re-anastomosis should be performed over a ureteric stent [if this was not previously sited]. For patients with ureteric necrosis presenting later, resection of the necrotic part and reimplantation is required. If the length of the remaining ureter is short, reconstruction using a Boari flap or use of the native ureter should be considered [34].

### Conclusion

Urinary fistula should be borne in mind in the presence of an elevated drain output in the early post-operative RT period. Biochemical analysis of the drain fluid is vital to confirm the diagnosis. About two thirds of patients can be successfully treated with maximal decompression [catheter/drain/nephrostomy with or without stenting]. However, failures of this approach or large volume leaks require open exploration and reconstruction.
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Figure 2: Flowchart for management of urine leak post renal transplant

References


