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Review Article

A case of high drain output after renal transplantation: Review of current evidence

Abstract

Surgical complications are not uncommon after renal transplantation. They should always be in the differential diagnosis of renal graft dysfunction. While ruling out or confirming a surgical cause of graft dysfunction, a sequential approach should be undertaken starting from clinical examination and moving on to more invasive investigations as the clinical picture becomes clearer. Biochemical assay of drain fluid is important. Causes of a collection around/near the graft include abscess, hematoma, urinoma and lymphocele. Treatment of each of them is different.

Causes of urinoma can be donor derived or surgical technique related. SPECT/CT may be needed to confirm the location of urinary leak. Treatment of the urinoma depends on its severity and location. Small and distal lesions can be treated conservatively while as larger and proximal leaks need surgical intervention. Ureteric stenting may be undertaken as a prophylaxis against urinary leak.

Lymphoceles should always be considered as a cause of perinephric collection in renal transplant. It can be differentiated from a urinoma by the concentration of creatinine in the drain fluid. The treatment may be conservative or surgical depending on the size of the lymphocele and initial response or resistance to conservative management.

Scenario: A 28-year-old CKD 5 underwent a kidney transplantation from his brother with primary function. Post-surgery, the drain is quite productive (820 mls on day 2 and 750 mls on day 3). Drain fluid biochemistry showed K of 28 mmol/L and creatinine of 16000 $\mu\text{mol/l}$. His serum creatinine on that day was 416 $\mu\text{mol/l}$ and serum K is 5.1 mmol/L.

Introduction

Surgical complications remain common causes of renal transplant dysfunction in early post transplant period. Any patient with a renal graft dysfunction should be evaluated for surgical complications including collections. Investigations should be tailored individually to each patient. Correlation of clinical examination and laboratory evaluation is fundamental for diagnosis in such cases. Biochemical assay of the drain fluid and radiological examination are essential.

Common causes of collection around transplanted kidney are hematoma, urinoma, lymphocele and abscess.

In this review, we discuss different causes of collections after a renal transplant, their diagnosis and management.

Scenario

The index patient is a renal transplant recipient day 3 post

living donor renal transplant with productive drain (820 mls on day 2 and 750 mls on day 3). Drain fluid biochemistry has showed K of 28 mmol/L and creatinine of 16000 $\mu\text{mol/l}$. His serum creatinine on that day was 416 $\mu\text{mol/l}$ and serum K is 5.1 mmol/L.

The approach to this case should be orthodox, starting with physical examination looking for any pre-renal causes of creatinine not falling as expected. The fluid charts should also be reviewed. The patient should be given fluids if they are not volume overloaded.

When evaluating delayed graft function or slowly falling creatinine in a recipient, root cause needs to be evaluated. The causes are either donor or recipient derived (ischemic injury, donor type, vascular injuries etc). Delayed graft function is traditionally defined as the use of dialysis within seven days of the transplant [1].

The second step would be to perform a scan to rule out or confirm urinary obstruction, to check perfusion and look for any collections. Serum and drain fluid should be sent simultaneously for biochemistry if needed.

The likely causes of a collection and dysfunction in early post renal transplant period are urinoma, hematoma/haemorrhage, lymphocele or abscess (Table 1). These pathologies can generally be differentiated from each other by examination of the drained fluid. While hematoma fluid will have high hemoglobin concentration, the fluid from an abscess will have high white blood cell count and a urinoma fluid would be positive for high creatinine.

Urinoma

The risk factors for urinary complications post transplant are male recipient, black recipient and U stitch technique of the ureteral anastomosis [2]. Ureteric complications are more likely after donation after cardiac death (DCD) than after living donation or donation after brain death (DBD) though donor type is not a risk factor [3]. In addition, urinary leak may be lower after ureteroureterostomy as compared to ureterocystostomy [4].

Urinary leakage makes up around 1/4th of all urological complications [5], which occur at a rate of around 3 – 6% after renal transplantation [3-5].

Urinary leak may present clinically with a picture of peritonitis if the urine is present in peritoneal cavity in case of an intraperitoneally placed kidney. More commonly, swelling around the graft or high drain output may be the only sign. In some cases, it may present as a swelling of the ipsilateral lower limb.

Causes

The major cause of urinary leak is ureteral necrosis and devascularisation during organ harvest. However, there are

other causes of urinary leak like technical failure including a poor construction of the ureterocystostomy resulting in a non-watertight anastomosis, dehiscence or polar artery ligation. Depending upon the cause, the urinary leak may present within 24 hours if secondary to technical error or after 2 weeks if secondary to necrosis [6].

Diagnosis

Biochemical – The drain fluid is six times more likely to be secondary to urine leak compared to lymphocele if the drain creatinine is 6 times higher than the plasma creatinine and the urine creatinine is not more than 3 fold drain creatinine and is 7 times higher than the plasma creatinine [7]. It is noteworthy that drained fluid from the urine leak may have creatinine nearer to plasma if creatinine clearance is low.

Radiological – Ultrasonography helps in identifying a collection around or near the renal graft. However, it may be difficult to differentiate urinoma from other collections. Usually, urinoma is a well-defined simple collection without internal echoes while as abscesses and hematomas are hyperechoic with septations. A urinoma may show septations if it is secondarily infected or blood contaminated.

In some cases diagnosis may still be unclear. Scintigraphic^{99mTc-DTPA}renography may play an important role in such cases especially if the volume of urine leak is large. The pattern of photopenia and its course over time may differentiate urine leak from lymphocele, hematoma and abscess. The initial photopenic region which becomes hotter than the background is very likely secondary to a urine leak as compared to other causes [8].

Scintigraphy is more sensitive than ultrasonography in the diagnosis of urinoma. AyşegülDirlik et al reported five patients who underwent imaging related to collection around the graft. Ultrasound diagnosed urinary leak in one patient out of four

Table 1: clinical presentation and treatment of different post-transplant perinephric collections

Cause of collection	Aetiology	Presentation	Drain fluid	Radiology	Treatment
Urinoma	necrosis	High drain output	High creatinine	US to confirm collection	Conservative or surgical depending on the clinical scenario
	Devascularisation	Swelling around the graft			
	Technical failure	Swelling in the ipsilateral leg		Scintigraphy	
	Dehiscence				
Lymphocele	Dissection of lymphatics at the time of procurement	Mostly asymptomatic	Drain fluid Creatinine level match serum creatinine level	US to confirm collection (mostly inferior to the lower pole)	Percutaneous drainage
	Lymphatics damage at the time of surgery		Pacovsky nomogram	Scintigraphy (presence of a rim)	sclerosis
	cellular rejection, use of mTOR inhibitors,				Deroofing
Hematoma	Anastomosis leak	Hypovolemia	High Hb	US – usually crescentic echogenic if acute; hypoechoic if old/ resolving	Usually conservative
	Post biopsy	Ecchymosis			May need exploration if compressing
		Fall in Hb			
Abscess	Secondary infection of a collection	Systemic symptoms	High WBCs	US – hyper echoic with septations	Urgent drainage in most cases
		inflammatory markers - high			antibiotics

Hb – Haemoglobin, mTOR – Mammalian target of rapamycin, US=ultrasonography, WBC – white blood cells.

while as scintigraphy detected all the four cases of urinary leak in addition to one false positive [9].

Even after confirming that the collection is secondary to a urine leak, the exact location of the leak may still be undetected. Accompanying SPECT/CT may be very useful in evaluating the anatomy of the urine leak [10], (Figure A-C).

Treatment

Stenting: ureteral stenting is used routinely after renal transplantation. The contribution of stents in preventing urine leaks is controversial.

In this prospective randomized study [11], with a total of 194 renal transplant patients, 97 were randomized to have a double pigtail stent inserted and another 97 patients were without a stent. 6 patients in the no-stent group had urinary leak while only one patient in the stent group developed a urinary leak, hence favouring stenting.

In another randomized trial, 280 renal transplant recipients were randomized to either a no-routine stent group or a routine stent group. In the no-routine stent group patients

were not stented except for an intra-operative event based on surgeon's opinion. There was no difference between the groups in an intention to treat analysis [12].

The approach to the management of urinary leak is either conservative or surgical. The surgical exploration is undertaken if the urine leak is large and/or proximal and if the conservative management has failed previously.

Conservative management includes urinary diversion and is usually considered in small distal urine leak. Urine is diverted by placing a Foley's catheter and a percutaneous nephrostomy tube. If the urinomas are large, they should be drained surgically. The nephrostomy may help determining the anatomy of urinary leak. The tubes are removed once leak resolves. Nephrostography should be performed regularly as surveillance for the urine leak and to check closure.

In one study the documented closure rate was 87% with infection related complications occurring in 17% and one case of stricture [13]. Balloon dilation or endoureterotomy may be considered for short, low-grade strictures, but open reconstruction is associated with higher success rates.

Nearly 60% of patients can be successfully managed with a pelvic drain and urinary decompression (nephrostomy tube, ureteral stent, and indwelling bladder catheter). Proximal, large-volume, or leaks that persist despite urinary diversion, require open repair [14].

Surgical treatment: Surgical management includes drainage of urinomas, resection of devitalized ureter if needed and ureteral reimplantation. The residual ureter may be short in which case a bladder flap may be needed. In some cases a cutaneous ureterostomy with omental interposition is undertaken.

Patients, who develop transplant ureteral fistulae, can be treated endourologically [15].

Lymphocele

Another cause of high drain output after renal transplantation is a lymphocele which is a collection of lymphatic fluid around the kidney. It is a hard fibrous cavity without epithelial lining containing lymph [16].

Before ultrasound, the incidence of lymphocele ranged between 0.6 – 18% increasing to around 33% with the use of ultrasound [17,18].

The causes of lymphocele are not very well known. The disturbances in lymph flow of the transplanted kidney or the recipient secondary to dissection of lymphatics at the time of procurement or at the time of surgery respectively has been suggested as a cause for the development of lymphocele. Adult dominant polycystic kidney disease (ADPKD) as the background disease, cellular rejection, use of mTOR inhibitors, diuretics and high dose steroids are some of the other suggested causes [19].

Lymphocele may develop between 2 weeks to 6 months post transplant surgery with most of them developing at 6 weeks.

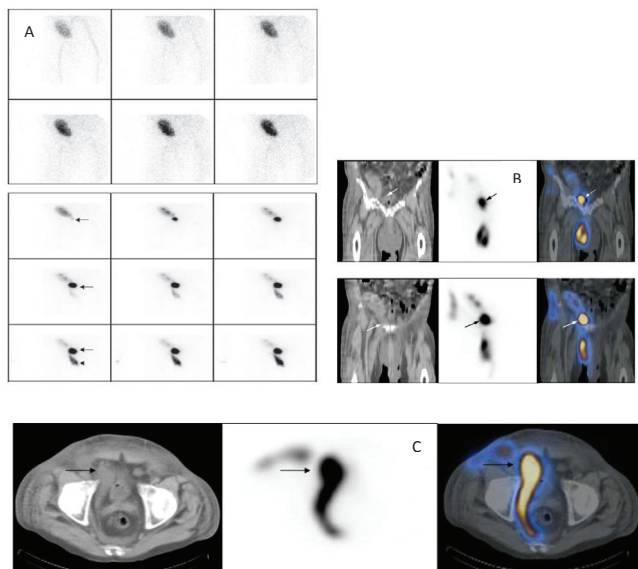


Figure 1: From an open access article(10) published with permission of unrestricted use.

(A) Renal scintigraphy performed immediately after the patient had sudden onset of scrotal swelling and anuria. Initial blood flow images (2 sec/frame) show normal renal perfusion. Here the summed flow images are shown. On subsequent 30-min functional images were obtained. Here the summed functional images demonstrate the transplant kidney showing normal perfusion and function with excretion of radiotracer into the renal collecting system and a focal collection mimicking the urinary bladder (arrows). There is a vertically oriented accumulation of radioactivity inferior to the pelvis (arrow head).

(B) Coronal images of SPECT/CT of pelvis. The images show a radiotracer accumulation demonstrating a urine leak (arrows) in the right pelvic cavity just next to the urinary bladder and in the scrotum. A Foley catheter balloon is located in the very contracted urinary bladder. More anterior coronal slice shows a urine leak (arrows) in the right pelvic cavity just below the transplanted kidney extending to the scrotum and the right abdominal wall.

(C) Axial images of SPECT/CT of pelvis. The images show a urine leak (arrows) in the right pelvic cavity next to the urinary bladder extending to the right inguinal canal and abdominal wall anteriorly and the presacral region posteriorly.

There are reports of some lymphoceles developing as late as after 3 years of transplantation [20].

Lymphoceles are mostly asymptomatic.

Diagnosis: As discussed above, the creatinine level in the fluid from lymphocele is not as high as in a urinoma and should match serum creatinine. Once it is established that the drain fluid is lymph, next question to answer is whether the lymph is recipient originated or from the transplanted kidney. CK activity, a marker of the iliac lymph, should be checked. The nomogram by Pacovsky can be used to find the contribution of renal lymph [21].

Treatment: If the lymphocele is small, it may resolve following percutaneous drainage. Bigger lymphoceles or those resistant to drainage may resolve by sclerosis with doxycycline, bleomycin, talc or fibrin glue. In some cases deroofting, either laparoscopic or open, is needed. Sclerosis may, however, cause ureteric fibrosis.

Hematoma

The hematoma can develop spontaneously, post biopsy or post surgical trauma.

The clinical presentation can be graft dysfunction as a result of hypovolemia or hydronephrosis secondary to displacement by the hematoma [22]. Clinical signs of hypovolemia may or may not be present.

Pre transplant use of anticoagulants adds to the risk of bleeding while as living donor transplant recipients and those with lower BMI carry lesser risk of bleeding [23].

The drain fluid may contain frank blood or be serosanguinous.

Hematomas are usually echogenic on US but lose echogenicity as they age. Hematomas have high-attenuated components in acute stage, but attenuation diminishes with time[22].

The hematoma can be managed conservatively if it is small but needs surgical exploration if large or compressing. There is a risk of infection and abscess formation.

Abscess

Urinoma, hematoma and other collections around a transplanted kidney can transform into an abscess. The clinical signs of sepsis may or may not be present. The drain fluid contains high number of WBCs.

Inflammatory markers may be elevated but can be so as a result of recent surgery or may be blunted because of immunosuppression.

As opposed to renal cortical abscesses, the perinephric abscesses are more likely to be due to gram negative bacteria especially Enterobacteriaceae. Rare organisms like salmonella have been reported [24].

Abscesses can have a non-specific appearance at US while as CT may differentiate them from other collections because of the gas present in an abscess [22].

Drainage would be needed in most of the cases [25,26].

Conclusion

Urinoma is not uncommon in early post transplant period and should always be in differential diagnosis of a collection around renal transplant or in recipients with high drain output. The drain fluid should be sent for biochemical assay including creatinine level and be matched with the serum creatinine. The management may be conservative or surgical depending upon the size and location of the urinary leak. Conservative management includes percutaneous drainage and should be undertaken regardless whether a surgical exploration is considered or not.

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