Renal transplantation complications: Doppler evaluation
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Section: Cardiovascular
Imaging Technique: Ultrasound
Imaging Technique: Ultrasound-Colour Doppler
Case Type: Clinical Cases
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Patient: 25 years, female

Clinical History:

A 25 years old female patient submitted to a four days renal transplant was submitted to our radiology department for evaluation of graft dysfunction (sudden oliguria; serum creatinine level: 6mg/dl).

Imaging Findings:

A 25 years old female patient submitted to a four days renal transplant was submitted to our radiology department for evaluation of graft dysfunction (sudden oliguria; serum creatinine level: 6mg/dl). Her clinical course was uneventful during the follow-up period and serum creatinine levels were relatively stable (1.6–2.0 mg/dl). Ultrasound showed an echogenic heterogeneous fluid collection surrounding the renal transplant anteriorly and a large echogenic heterogeneous retroperitoneal fluid collection compatible with a haematoma. There was dilatation of the collecting system. Colour Doppler US image showed aliasing in the renal artery at the region of the retroperitoneal mass. Pulsed-wave colour Doppler US image showed a peaked systolic waveform with short acceleration time in this segment with. The velocity was 3 m/sec determined by the fluid collection compression. Intra-renal artery resistive index was increased because of the collecting system obstruction.

Discussion:

Renal transplantation has become the treatment of choice for end-stage renal disease, with improved transplantation technology and new immunosuppressive agents. Ultrasonography (US) is often the imaging method chosen for transplant evaluation early in the postoperative period, and it can be used for long-term follow-up as well. Postoperative fluid collections are common following transplantation and include hematomas, seromas, urinomas, lymphoceles, and abscesses. The appearance of peritransplant fluid collections is nonspecific, but differentiation of the fluid type may be attempted based on the radiologic appearance of the collection and the postoperative interval. Ultimately, the diagnosis can be made by using percutaneous aspiration of the fluid as needed. The appearance and complications of a fluid collection depend on its composition as well as its location. Small crescentic peritransplant fluid collections seen immediately after transplantation are most likely hematomas or seromas and should be considered a normal sequela of surgery. Size, location, and growth determine the significance of these collections. Because an increase in size may indicate the need for surgical intervention, the size of any such collections should be documented on the baseline US scan. More complex collections identified later in the postoperative period with clinical evidence of infection may represent abscesses. Urine leaks are relatively rare complications following transplantation and manifest in the early postoperative period with pain, swelling, and discharge from the wound. Leaks at the ureterovesicle anastomosis are related to surgical technique or distal ureteral necrosis. Urine leaks
elsewhere in the collecting system usually develop secondary to ischemia, with resulting necrosis of the collecting system that is either limited to a small area or involves the entire ureter. Lymphoceles usually occur 4–8 weeks after surgery and affect up to 15% of patients. The cause of these collections is likely the disruption of the normal lymphatic channels during perivascular dissection or disruption of hilar lymphatics. Most lymphoceles are discovered incidentally, are asymptomatic, and do not require therapy. Impairment of renal allograft perfusion in the early postoperative period is usually associated with acute transplant rejection. However, vascular complications such as transplant renal artery stenosis or graft venous thrombosis are rare but critical causes. For this purpose, Doppler sonography is usually the first diagnostic procedure. Colour Doppler ultrasound facilitates not only a global assessment of the intrarenal vasculature but can also targeted to specifically examine the main renal artery and vein in renal transplant recipients. The technique can be used in the early transplant period to monitor patients with delayed graft function and is also useful in confirming the diagnosis of renal vein. The waveform of the graft intrarenal vessels (commonly the interlobar vessels) is similar to that of the native kidney and has been described as having a ‘skislope’ appearance with end diastolic flow being approximately one-third or greater of the amplitude of the peak systolic velocity. Examination of the main transplant artery may be technically difficult due to vessel tortuosity however the intrarenal branches and the main renal vein itself are normally easily visualized. Although acute cannot be differentiated from acute tubular necrosis, serial changes in the Doppler indices, in combination with clinical parameters, can aid the decision about when to biopsy the patient with delayed graft. Commonly used Doppler indices are the resistive and pulsatility index (RI, PI). Both are equally as useful although the RI is probably more commonly used. An RI <0.7 is normal, >0.9 abnormal, and between there is a large grey area. A PI <1.5 is normal, and >1.8 abnormal. The higher the RI or PI the more likely is a diagnosis of acute rejection. Renal vein thrombosis is an important cause of early graft failure. The ultrasonic features include a dilated renal vein containing thrombus, absent venous flow throughout the kidney, and reverse diastolic flow within the main artery and intrarenal vasculature. A low amplitude rounded intra-arterial waveform has also been observed in a few patients with incomplete renal vein thrombosis. Doppler ultrasound is a reliable method of diagnosis of transplant artery stenosis although the technique is operator dependant. A significant stenosis results in an increased peak systolic velocity at the site of narrowing and a dampening of the waveforms downstream in the intrarenal vessels. Turbulence, areas of reverse flow, and spectral broadening may also occur close to the area of stenosis, and give a clue as to its presence.

**Differential Diagnosis List:** retroperitoneal hematoma

**Final Diagnosis:** retroperitoneal hematoma

**References:**


Figure 1

Description: – ultrasonography showing dilatation of the renal transplant collecting system (arrow)

Origin:
Figure 2

Description: ultrasonography showing an echogenic heterogeneous fluid collection surrounding the renal transplant anteriorly (between callipers) Origin:
Figure 3

Description: ultrasonography showing the retroperitoneal fluid collection (between callipers) Origin:
Figure 4

Description: ultrasonography showing the retroperitoneal fluid collection (arrows).
**Figure 5**

Description: ultrasonography showing the relationship between the renal transplant (arrow) and the anterior fluid collection (arrowhead) Origin:
**Figure 6**

**Description:** Color Doppler showing normal intrarenal vasculature

**Origin:**
Description: Colour Doppler showing the renal artery (arrows) Origin:
Figure 8

**a**

Description: Pulsed-wave colour Doppler US image showing an increased systolic velocity at the renal artery (326.6 cm/s)

**b**

Description: Pulsed-wave colour Doppler US image showing an increased intrarenal artery resistive index (0.83)