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BRIEF REPORT

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Caliceal fistula in kidney transplantation

The role of magnetic resonance imaging

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Abstract Caliceal fistula is a rare complication of renal transplantation, which often raises some diagnostic problems. We report the case of a patient in which this complication occurred and in whom the diagnosis could be clearly demonstrated by using magnetic resonance imaging (MRI). On the T1-weighted images, a perirenal collection was depicted by a low signal intensity. On T2-weighted images, the collection appeared with a high signal intensity, and a linear hyperintensity was observed on the internal graft's labium at the level of the inferior pole corresponding to a caliceal fistula arising from the lower pole of the graft. In this setting, the use of MRI is compared with the other diagnostic techniques (sonography, CT scan, nephrogram, scintigraphy). MRI constitutes a progress in imaging of the renal graft by its high definition and the lack of nephrotoxicity. Its place remains, however, to be more precisely defined in the evaluation of a renal graft's complications.

Keywords Kidney transplantation · Magnetic resonance imaging · Caliceal fistula · Urologic complications

Introduction

Caliceal fistula is a rare complication of renal transplantation that can lead to graft dysfunction or loss. We report the case of a patient who developed, on postoperative day 15, a caliceal fistula of ischemic origin. The diagnosis was established by magnetic resonance imaging (MRI). The use of this diagnostic technique in this setting constitutes to our knowledge the first case described in the literature. By reviewing the literature, the utility of MRI in determining the origin of some renal graft complications is discussed.

Case report

A 49-year-old man with end-stage renal failure secondary to glomerulosclerosis was transplanted with a cadaveric right kidney. The renal graft had two arteries on an aortic patch. During the bench exploration of the graft, a collateral providing the irrigation of the lower pole of the kidney was found to have been transected. Reconstruction was performed with interrupted surgilene 7/0 stitches.

In the recipient, the graft was placed in the right iliac fossa using the external iliac vessels. Ureterovesical anastomosis was done by an extravesical ureteroneocystostomy. Ischemia lasted 36 h 43 min.

HLA-A, -B, and -DR mismatch was, respectively, 2, 1, 1. Postoperative immunosuppression consisted of triple therapy

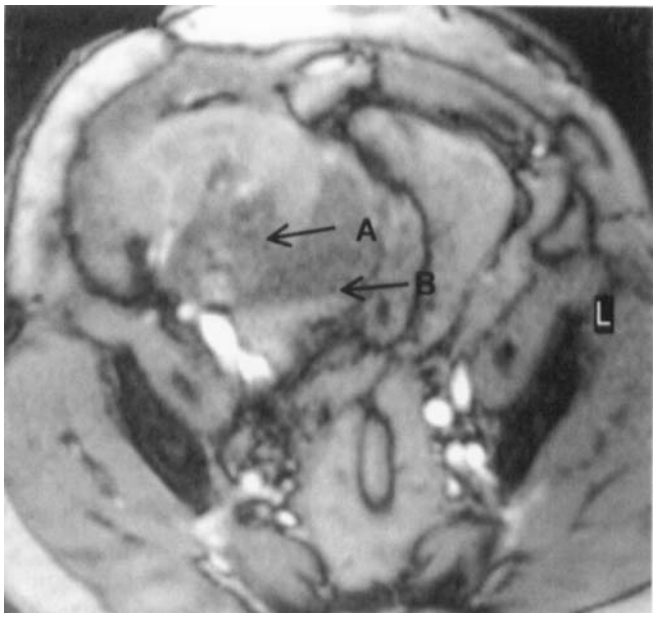

Fig. 1 T1-weighted MRI sequence: *arrow A* indicates the infarcted lower pole, whereas *arrow B* shows the perirenal collection

comprising Mycophenolate mofetil, Tacrolimus, and steroids. Low molecular weight heparin was administered for 1 week to prevent thrombosis of the vascular reconstruction. Graft function was delayed, and two sessions of hemodialysis were required.

On postoperative day 2, the wound started to ooze and there was a slight scrotal edema but no leak, and no collection could be demonstrated either by sonography or by dimercaptosuccinic acid (DMSA) scintigraphy. Urea and creatinine levels in the oozing fluid did not correspond to serum levels. Nevertheless, a bladder catheter, which had been removed on day 2, was replaced due to bladder retention and left in place from the 3rd to the 9th postoperative day. Concomitantly, oozing stopped spontaneously.

The patient was discharged on the 13th postoperative day with a creatinine level of 2.6 mg/dl. Two days later, he was readmitted with oliguria and abdominal pain; the creatinine had increased to 7.8 mg/dl.

Sonography showed a collection at the lower pole of the graft, with hydronephrosis of the renal pelvis; a bladder catheter was inserted. Cystography revealed no abnormalities.

A MR examination was performed. A gradient-echo, T1-weighted sequence with an acquisition time of 5.45 min and a HASTE T2-weighted, on breath hold with a acquisition time of 45 s. were realised on the axial plane.

MR urographic and angiographic sequences, the last performed with three-dimensional (3D) dynamic acquisition after intravenous injection of a double dose of paramagnetic contrast medium (gadolinium 0.2 mmol/kg), useful to depict the integrity of the urinary tract and the vascular anastomosis and to evaluate the graft's function, were not obtained due to a strong sensation of claustrophobia presented by the patient and leading to a precocious interruption of the examination. On the acquired images, a perirenal collection more developed around the inferior pole of the renal graft was depicted. The collection presented a low signal intensity on the T1-weighted images and a high signal intensity on the T2-weighted images, confirming it's water component (Figs. 1, 2).

On the T2-weighted images, a linear hyperintensity was observesd on the internal graft's labium at the level of the inferior pole. This image was considered as an urinary fistula due to a necrosis of the lower pole of the kidney involving the inferior calyx.

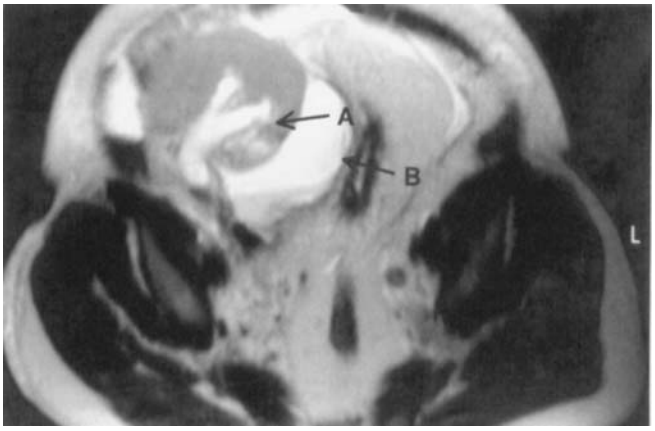

Fig. 2 T2-weighted MRI sequence depicts the water component by its high signal intensity with the infarcted lower pole (*arrow A*) and the perirenal collection (*arrow B*)

Fig. 3 Nephrostogram confirming the urinary leak arising from the lower calyx

The perirenal collection was thus interpreted as an urinoma. Further confirmation by urographic and angiographic acquisitions could not be obtained due to the patient's claustrophobia.

A percutaneous nephrostomy catheter was placed under ultrasound guidance. The nephrostogram confirmed the urinary leak emerging from the calyx located in the infarcted lower pole of the kidney (Fig. 3). An abdominal CT was also performed and showed after injection of contrast material through the nephrostomy catheter, a leak of contrast material within the collection around the graft through an opening at the level of the lower pole of the kidney.

The bladder catheter was removed 1 day after the placement of the nephrostomy catheter. A control nephrostogram, done 21 days after the insertion of the nephrostomy catheter, showed the complete healing of the urinary leak. The catheter was removed 2 days later.

The patient was discharged from the hospital 27 days after his admission with a daily diuresis of about 3 l and a serum creatinine level of 1.7 mg/dl.

Discussion

Caliceal fistula is a rare complication of renal transplantation; Gutierrez has reported 1.1% of caliceal fistulas among 543 patients [7] and van Poppel, in a large review of the literature, has reported a frequency of about 0.27%. Calciceal fistulas are frequently related to ischemic lesions of the renal parenchyma [15].

The differential diagnosis with acute tubular necrosis or rejection is often difficult and requires recourse to complementary exams [2, 20]. If there is an urinary leak through the wound, determination of urea and creatinine fluid content can lead to the diagnosis.

In the absence of urinary effusion, physical signs are those of urinary fistula: scrotal edema, suprapubic swelling, pain, fever, and deterioration of renal function [2, 10, 20]. Several complementary investigations can confirm the diagnosis, and a decision has to be taken to determine which examination should be performed first in order to confirm the diagnosis and possibly to locate precisely the origin of the leak.

Sonography is simple and noninvasive. It may be used to demonstrate the existence of a collection or a possible hydronephrosis. The exact site of the urinary leak is most often not well defined by sonography [1, 10].

Some authors suggest that scintigraphy is as good as ultrasound and should be performed first. It depicts more precisely the location of the leak [1, 4, 15].

Cystography can also be used in case of anuria following urinary leak, but this technique is often associated with a high risk of urinary tract infection and can demonstrate the origin of the fistula only in the case of a vesicoureteral leak [4].

Nephrostogram provides a lot of information regarding the diagnosis and location of the leak [10, 15, 20, 21, 23]. Moreover associated with the placement of a catheter, it already constitutes a possible therapeutic intervention. This has been illustrated in our case study by complete healing of the urinary leak.

The use of MRI in identifying the origin of renal graft complications is still under development. Several pioneering studies using corticomedullary differentiation (CMD) to differentiate acute rejection (AR) with acute tubular necrosis (ATN) found that MRI lacked specificity and was thus inappropriate to evaluate the precise etiology of renal graft dysfunction [8, 11]. However, most of these studies did not use contrast material or had other serious technical drawbacks such as the lack of fast imaging techniques or surface coils.

More recently, by using dynamic contrast-enhanced MRI and because of the progress in imaging resolution, MRI offers a new approach to the diagnosis of renal graft complication as well as to the assessment of living donors [5, 6, 12, 13, 16, 22].

By using gadolinium-diethylenetriamine pentaacetic acid (DTPA)-enhanced MRI, Raj and Klaus showed that AR, ATN, immunosuppressive drug nephrotoxicity, and normally functioning renal allograft have a distinct pattern in picking up and elimination of contrast and that they can be differentiated by MRI [16, 22].

Sonography and MRI are noninvasive techniques. Compared with sonography, MRI has a superior resolution, multiplanar capability, and lack of operator dependence. Compared with CT scan, MRI does not use nephrotoxic contrast material which can be deleterious in patients with renal failure and in renal transplant patients [5, 12, 13].

MRI has general potential to increase the characterization of abnormalities detected with sonography and to provide specific diagnosis in cases of complex abnormalities of renal allografts such as posttransplantation lymphoproliferative disorder (PTLD) [3, 13]. PTLD appears to have a relatively characteristic appearance in MR images. Normal MR images found in cases of suspected mass at sonography may obviate biopsy [13].

The evaluation of living potential renal transplant donors requires accurate depiction of renal anatomy: vasculature, urinary tract, and morphology. The radiologic evaluation of the living donor has usually included conventional angiography and excretory urography. By combining MR angiography, MR urography, and MR nephrography into one noninvasive MR examination, the same information may be obtained as with conventional studies, but with improved patient convenience, less potential morbidity, and substantial cost savings [12].

MRI has also been found useful in a case of torsion of an intraperitoneal renal transplant [25]. The only limitation of MRI is its accessibility, which is still not always compatible with the diagnostic and therapeutic time limits.

About 0.5% of patients experience claustrophobia during MRI [18]. This drawback can be reduced by simple and clear information given prior to the examination and by the use of open-magnet equipment [24].

In our case, the diagnosis was established by MRI, despite the patient having severe claustrophobia, and was largely confirmed by the other techniques.

CT scan is more easily available and can be performed with or without the injection of contrast material. It can also be used as a guide for the placement of a nephrostomy catheter [7, 23].

The infarction of the lower pole can result from the transection of a collateral of the main renal artery at the time of organ procurement [1, 9, 23]. Besides technical reasons, infarction can also be encountered in hyperacute rejection or in a recipient with a hypercoagulable state such as protein C, protein S, or antithrombin III deficiency or emboli in the small intraparenchymal ves-

sels. Stenosis, intimal dissection, or pseudoaneurysm of the renal artery have also been reported [4].

In our case, the renal graft had two arteries on an aortic patch. A collateral of one of the arteries had been transected at the time of renal procurement and was repaired. Immediate and total recoloration of the graft was observed after clamp removal. Low molecular weight heparin was administered for 1 week. But despite this prophylactic regimen, infarction occurred after thrombosis of the repaired collateral artery.

The placement of a nephrostomy catheter can be the sole treatment of a caliceal fistula [2, 10, 14, 15, 17, 19]. If a surgical revision is required, the use of a nephrostomy catheter avoids the progression of the renal graft dysfunction and the risk associated with a poorly functioning graft [10, 19, 23].

In our case, the nephrostomy catheter, which had been left in place for 23 days, was sufficient to treat the urinary leak. Most authors recommend keeping it in for at least 4–5 weeks [1, 17, 19, 23]. Healing can be followed by nephrostogram.

If the flow of the leak is more important, partial nephrectomy has been recommended. Closure of transected area of the kidney can be achieved by using the greater omentum, the peritoneum or the dura-mater [7, 15, 21].

Conclusion

Sonography and scintigraphy remain the most largely used imaging diagnostic techniques with which to depict the urinary complications after renal transplantation. However, due to recent progress in imaging and use of nonnephrotoxic contrast material, MRI offers a new approach in the diagnosis of these complications after renal transplantation. Using MRI, the definition of a caliceal fistula can be accurately shown.

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