RENAL ARTERY INJURY: THE CORTICAL RIM SIGN ON CT SCAN

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INTRODUCTION

The cortical rim sign has been well described in intravenous urography as a sign of renal artery occlusion. However, CT scan of the abdomen is the currently accepted investigation of choice in suspected intra-abdominal injury. In this case report, we describe a case of renal artery occlusion which showed the CT equivalent of the cortical rim sign. We also highlight the need for a high index of suspicion and an properly performed CT study.

CASE REPORT

An 8 years old boy was brought in to hospital after being hit by a motorbike while riding his bicycle. Examination revealed tenderness in the left hypochondrium. Vital signs were stable. A splenic contusion was found on unenhanced CT scan of the abdomen and he was managed conservatively.

A repeat CT scan of the abdomen was done 10 days after admission, for evaluation before discharging the patient home. This contrast enhanced CT scan (Fig.1) revealed a cortical rim nephrogram in the left kidney, with uneven distribution of contrast in the parenchyma. There was no excretion of contrast into the left collecting system. Right kidney was normal.

Duplex ultrasonography of the kidneys, which was performed on the same day, showed a marked reduction in arterial perfusion of the left kidney. Some perfusion was seen at the periphery of the cortex. There was no flow detected in the left renal artery. Left renal vein showed minimal flow.

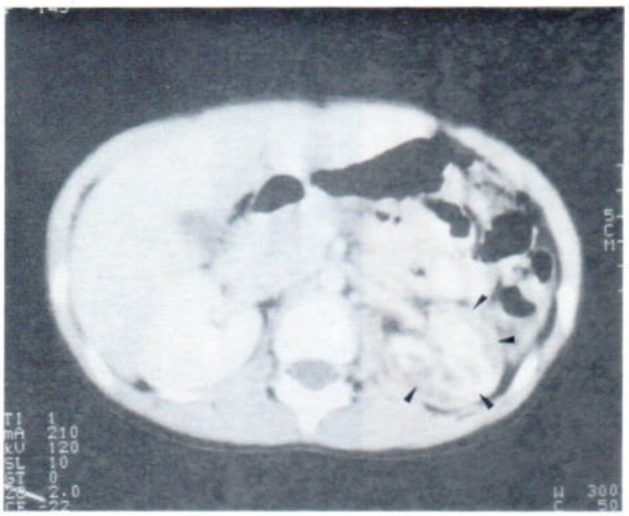

Fig. 1. CT of the abdomen at the level of the kidneys showing a cortical rim nephrogram (arrowheads) in the left kidney with uneven distribution of contrast in the parenchyma. The kidney size is normal. Marked reduction in arterial perfusion of the left kidney was seen on duplex ultrasonography (not shown)

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A flush aortogram followed by selective left renal arteriogram was performed the next day. The flush aortogram showed abrupt termination of the left renal artery 1 cm from its origin. Selective left renal angiogram revealed tapering of contrast flow at a point 1-2 cm from the origin of the artery (Fig.2). Minimal distal flow was seen. There was no excretion of contrast into the collecting system. The conclusion drawn from the investigations performed was that a traumatic dissection of the left renal artery had occurred.

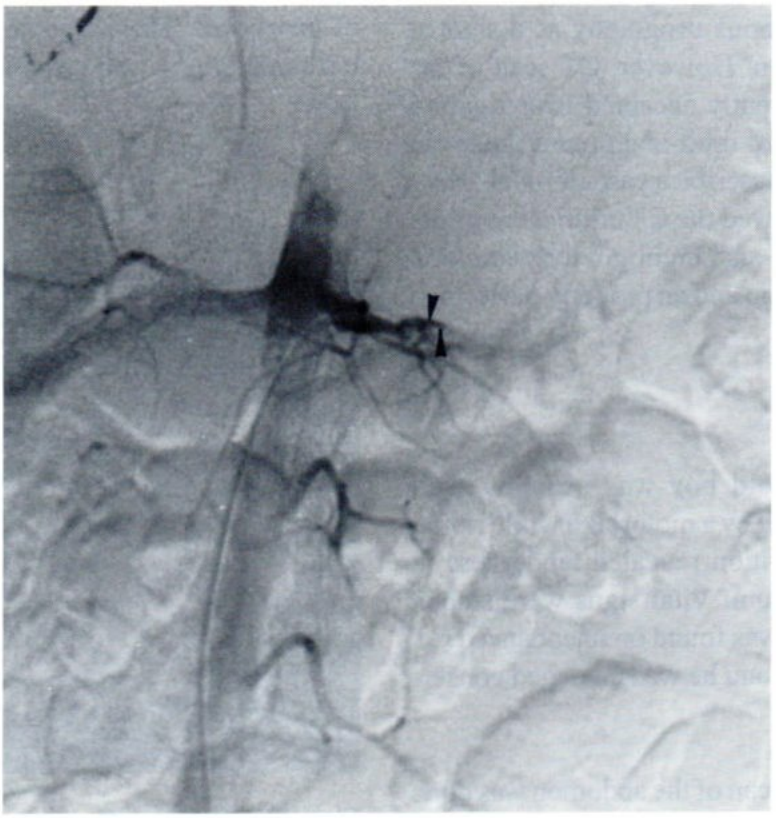

Fig. 2. Tapering of contrast flow (arrowheads) 1-2 cm from the origin of the left renal artery shown on selective angiography.

DISCUSSION

Recognition of renal arterial injuries caused by blunt trauma has become much more common in the past two decades, through the use of intravenous urography, arteriography and more recently contrast enhanced CT scanning. CT is probably the imaging modality of choice in the assessment of blunt abdominal trauma. Traumatic renal artery occlusion is rapidly detected by CT scanning and is based on several findings[1]:

i) lack of contrast enhancement by intravenous contrast
ii) non-opacification of the pelvicalyceal system
iii) cortical rim sign
iiii) medullary enhancement in a spoke-wheel appearance
iiiii) direct visualization of the thrombosed renal artery (rare).

The cortical rim sign occurs when there is a thin rim of perfused cortical tissue surrounding an area of lower attenuation, which is the nonperfused, nonfunctioning central renal parenchyma.[2] This sign reflects perfusion of the preserved outer rim of cortex by collateral vessels in the presence of renal artery occlusion.[3] The renal collateral circulation is supplied via renal capsular vessels, peripelvic vessels and periureteric vessels.[4]

To prevent the rapid loss of function that results from renal pedicle injuries, early diagnosis and revascularization are required. In the case described above, the initial CT scan was done without contrast enhancement and therefore the renal artery occlusion was not diagnosed immediately. Another point to note is that the patient did not have haematuria, and thus did not arouse any suspicion of such an injury. In a study of 41 patients with renal pedicle injuries, Cass et al[5] reported no haematuria or only microscopic haematuria in 56%. Smith et al[1] found only microscopic haematuria in more than half of their 7 patients with renal pedicle injuries. These findings indicate that if radiological diagnostic studies were reserved for patients with gross haematuria only, the diagnosis would be delayed in more than half of patients with renal pedicle injuries.

Once the diagnosis of renal pedicle injuries is made, the next consideration is whether to attempt revascularization. Clark et al[6] recommended attempted revascularization in all cases of bilateral renal arterial injury, but reserved revascularization attempts to patients with unilateral renal artery occlusion in the presence of (i) good contralateral function; (ii) young patient in a stable condition; (iii) a prompt diagnosis; and (iv) availability of an experienced surgeon. In his review of 50 attempts at renal artery reconstruction in 45 patients with blunt renal arterial trauma, no case of attempted repair was successful if performed after 18 hours of trauma. The 12 documented successful renal artery reconstructions were performed 3 to 18 hours after injury occurred.

If arterial repair is not performed or is not successful, immediate nephrectomy is not required, although the patient's blood pressure must be carefully followed.[6] Hypertension may necessitate later surgery. In most cases, the kidney will atrophy without producing hypertension, and in a small percentage, function may return.

In the case described above, diagnosis was delayed and therefore revascularization was not attempted. A 99m-Tc DMSA study of the kidneys done two months after injury showed that the left kidney only contributed 3% of the total renal function. A contrast enhanced CT scan of the abdomen done at approximately the same time showed atrophy of the left kidney. It appears that the prognosis for recovery of left renal function is quite poor.

CONCLUSION

The cortical rim sign is a well-recognized indicator of renal artery occlusion. It appears to be equally well demonstrated by computed tomography as it is by intravenous urography. This case illustrates the value of the cortical rim sign in diagnosing renal arterial injuries when patients with suspected intra-abdominal trauma are evaluated by urgent CT scan. The need for a high index of suspicion and adequate CT study is also highlighted.

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