Crossing renal vessel causing ureteropelvic junction obstruction

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ABSTRACT

Ureteropelvic junction (UPJ) obstruction is caused by the presence of an aperistaltic dysplastic segment at the UPJ. Besides this intrinsic etiology, extrinsic factors, mainly crossing vessels, maybe the causative factor. The controversy regarding the functional significance of vessels crossing at the UPJ is not a new one, though this debate has been resurrected in recent years because of improved detection due to the advent of advanced imaging techniques such as multidetector row computed tomography (MDCT) and fast magnetic resonance imaging. We present a similar case where MDCT proved the crossing renal vessel to be the cause for UPJ obstruction.

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Unilateral hydronephrosis in a child or young adolescent is most likely due to ureteropelvic junction (UPJ) obstruction which in turn maybe attributable to intrinsic or extrinsic causes. An intrinsic muscular defect causing impaired peristalsis, and urine drainage is the common cause. An aberrant or accessory vascular branch leading to the lower pole of the kidney and crossing anteriorly to the UPJ or upper ureter is the most common extrinsic cause of UPJ obstruction. The surgical treatment rests on the exact etiology of UPJ obstruction. Multidetector row computed tomography (MDCT) with 3-dimensional (3D) reconstruction improves outcome in patients with UPJ obstruction by identifying crossing renal vessels (CRV) as the cause of UPJ obstruction preoperatively. Vascular UPJ obstruction presents specific clinical and imaging features within the spectrum of congenital hydronephrosis. Its intermittent nature may explain why it is detected later in life. Moreover, knowing that the patient has UPJ obstruction due to CRV is essential in choosing the appropriate surgical treatment. We report a case where 16-row MDTC angiography with 3D reconstructed images proved the CRV as the etiology of UPJ obstruction.

Case Report. A 13-year-old healthy boy presented to the hospital with intermittent left loin pain of 2 years duration. Past medical history was uneventful. Physical examination revealed fullness in the left renal angle and mild tenderness on palpation. Hematological indices were normal. Urine examination revealed 4-5 pus cells per high-power field (HPF) and 1-2 red blood cell's per HPF. Biochemical indices including urea and electrolytes were normal. Ultrasound of the abdomen revealed left mild hydronephrosis without dilatation of the ureter suggesting UPJ obstruction. The renal pelvis was bulbous. The MDCT scan was performed on a 16-detector CT scanner and 3D reconstructed images were obtained which showed an accessory left renal artery arising from the abdominal aorta and feeding the lower pole of the left kidney, coursing anterior

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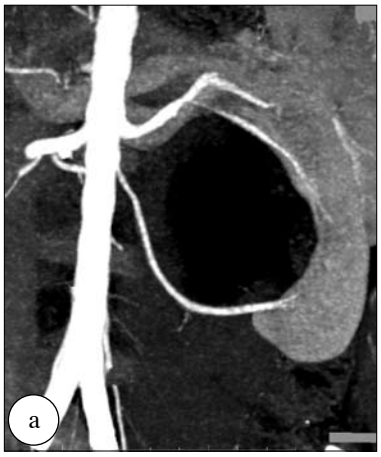

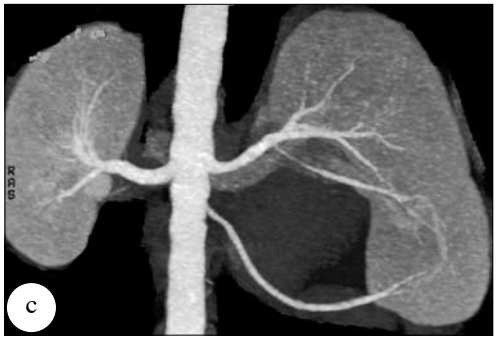

Figure 1 - Images showing an accessory of left renal artery circumventing the distended renal pelvis. **(a & b)** maximum intensity projection and **(c)** volume rendered.

and inferior to the markedly distended renal pelvis. (**Figures 1a, 1b, & 1c**). The renal vein was seen superior to the renal pelvis. (**Figure 2**). Fifteen minutes delayed axial sections revealed filling of the distended renal pelvis by excreted contrast, differentiating it from a parapelvic cyst (**Figure 3**). Based on the CT scan findings, an exploratory laparotomy was carried out and the CRV was identified to be the cause of the UPJ obstruction. An open surgical pyeloplasty was performed. He was symptom-free after the surgery.

Figure 2 - Oblique coronal reconstructed image showing left renal vein superior to the bulbous renal pelvis.

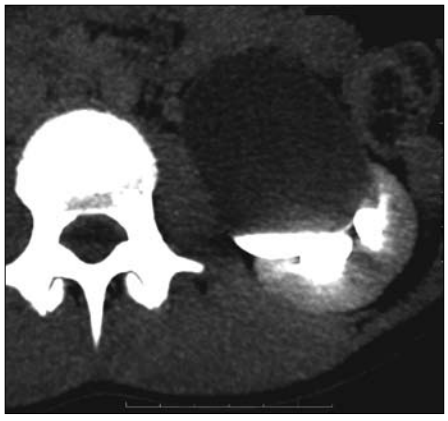

Figure 3 - Delayed axial image through the left renal pelvis showing pooling of excreted contrast in the distended pelvis.

Discussion. Congenital UPJ obstruction is most likely secondary to abnormal musculature that prevents relaxation and filling of the ureter. In patients with UPJ obstruction, the percentage of those with crossing vessels has been estimated to be as high as 79%.[1] Crossing vessels are usually located anterior to the UPJ whereas posteriorly crossing vessels are less commonly found.[1] These CRV have been defined by different authors as "anomalous", "aberrant", or "crossing". Since such vessels often run from the anterior to the UPJ, such definitions are etiologically inadequate and therefore, in reality, it would be more appropriate to speak of a "vascular bar" rather than congenital vascular anomaly.[2] Besides, the CRV causing UPJ obstruction, portosystemic collaterals have also been shown to cause similar effect.[3] Due to these reasons, UPJ obstruction remains an enigma in terms of both diagnosis and therapy.[4]

Identification of a crossing vessel preoperatively is of utmost significance as it changes the surgical

management. Endoscopic treatment of UPJ obstruction has a success rate that approaches 90%. These results drop to 40% in the presence of crossing vessels. Unrecognized crossing vessels can also result in significant hemorrhage during endopyelotomy. Therefore, accurate preoperative imaging is crucial for appropriate treatment planning.[5] Ureteropelvic junction obstruction presents with recurrent renal colic and hydronephrosis. Different imaging modalities like ultrasound, intravenous pyelography, color Doppler ultrasound and renography have been described in literature.[6] Multiphasic helical CT scan accurately delineate the spatial anatomy of the renal and perirenal area.[7] The fast T2 weighted magnetic resonance imaging allows a noninvasive preoperative assessment of crossing vessels at the UPJ, but is limited by the high cost and the low sensitivity (80%).[8]

Helical CT angiography with 3D reconstructed images provides valuable preoperative information in patients with UPJ obstruction scheduled for surgical intervention.[9] Khaira et al[5] reported a sensitivity of 91% and specificity of 100% and positive predictive value of 100% with the helical computed tomography with 3D reconstructions for the identification of crossing vessels in UPJ obstruction. El-Nahas et al[7] evaluated the role of multiphasic helical computed tomography in planning surgical treatment for UPJ obstruction and showed a sensitivity of 97% in detecting crossing vessels. Rouviere et al[10] compared helical CT angiography with intra-arterial angiography and found CT angiography to be 100% sensitive for detecting crossing vessels when digital subtraction angiography (DSA) was used as the standard of reference and they concluded that renal helical CT seems suitable to replace intra-arterial DSA in the preoperative assessment of crossing arteries in kidneys with UPJ obstruction. Quillin et al[1] in 1996 used helical CT angiography for identification of crossing vessels at the UPJ and found that laparoscopy and open surgery findings were in agreement with helical CT angiograms in all patients.

Multidetector row CT with 3D reconstructions and advanced reconstruction algorithms like volume rendering techniques and maximum intensity projections can accurately delineate the vascular anatomy of the kidney and is an accurate predictor of the presence of crossing vessels in UPJ obstruction, which may have a profound impact on the surgical treatment and outcome.

We recommend that the presence of a crossing vessel be routinely determined preoperatively in cases of UPJ obstruction by MDCT angiography, because it may influence the choice of treatment modality and thereby, the clinical outcome.

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