US and MDCT findings in a caudal blind ending bifid ureter with calculi

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Abstract

Herein we present a rare ureteric duplication anomaly; blind ending bifid ureter with calculi which is asymptomatic unless complicated by infection, reflux, calculi or malignancy. The diagnosis is often missed at intravenous urography (IVU) and US because the ipsilateral ureter and kidney are grossly normal. In this case the diagnosis was established with ultrasound (US) and mainly with multidetector computerized tomography (MDCT) imaging using multiplanar reformats and 3-D reconstructions which were unique to this case. MDCT scans not only revealed the exact diagnosis and anatomic relationships but also ruled out other pathologies included in the differential diagnosis as well, such as ureter and bladder diverticula.

Case Report

One of the most commonly encountered anomalies of the urinary system is ureteric duplication, however blind ending pouch in one of the limbs of the duplicated system with calculi formation is a rare occurrence with only a few cases reported so far.[1,2] This congenital anomaly often goes unnoticed because patients are either asymptomatic or complain of vague abdominal or chronic flank pain.[2,3] Also the anomaly is often missed by the radiologist because presence of a normal collecting system is assumed if uncustomized imaging modalities are used such as standard intravenous urography (IVU) or ultrasound (US).

Herein we present the IVU, US and multidetector computerized tomography (MDCT) findings in a patient with caudal blind ending bifid ureter and calculi. This case was unique in that multiplanar and 3-D CT reconstructions, rendered by MDCT imaging were the ones that revealed the exact nature of the anomaly and helped differentiation from other pathologies. Use of MDCT multiplanar reconstructions for this anomaly has not been reported so far in the literature.

A 40-year old male was referred to the radiology department with vague flank pain radiating to the left side. His pain was of low grade and chronic nature and started 7 years ago; he described his pain as an achy burning sensation. No dysuria was present but he complained of frequency. He described having prior recurrent urinary infections once or twice every year and resolving after antibiotic treatment. A medical examination back in 2003, revealed calculi on the left within the vicinity of the left ureter with no hydronephrosis therefore his symptoms were attributed to the ureteric calculi ever since. In his current admission, CBC and biochemistry revealed no anomalies. A urine analysis was performed and no microscopic hematuria or bacteruria was noted. IVU revealed a cluster of rounded calculi, measuring 6 to 10 mm, in the left pelvis nearby the ureter. Only one ureter was visible on the left side originating from the left kidney, extending to the bladder but the distal third of the ureter was somehow mildly irregular and dilated. The cranially located kidney was grossly normal in location, shape and size. No delayed function or dilatations of the calyces were detected. Also no filling defects or calculi were present in the calyces of the left kidney (Figure 1). An ultrasound exam (Toshiba SSA 774/80 Aplio ultrasound scanner) targeting the urinary system was performed with a full bladder. Adjacent to the bladder on the left side, a thin and smooth walled, oval shaped, 4.5x3 cm, cystic structure without solid soft tissue parts was detected which contained multiple dependent and mobile calculi (Figure 2). MDCT urogram without and with contrast was performed because on the sonogram both due to the adjacent bowel gas and non-dilated ureter a definite track of the ureter from the kidney to the bladder was not possible. The caudal pelvic location of the pouch adjacent to the bladder wall raised concern whether this might have been calculi within a bladder diverticula with a neck so thin and collapsed that US was unable to reveal the connection. Also an outpouching or varicose dilatation of the distal third of the ureter (pseudodiverticulosis) was a possibility which may have arisen secondary to scars caused by repetitive infections. MDCT (64 detectors-Toshiba CT scanner) revealed a bifid ureter with a blind caudal ending shaped as a pouch containing calculi in the left pelvis (Figure 3). 3-D reconstructions directed to the urinary system were of help revealing the exact anatomy of the anomaly (Figure 4). Surgery was recommended on the grounds that removal alleviated the recurrent infections and pain and also risk of developing malignancy was present. However the patient refused surgery.

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Discussion

This rare anomaly is asymptomatic unless complicated with a male/female ratio of 3/1 and a familial occurrence especially in twins and sisters.[3] Complications related to the blind ending limb often cause the patients to seek medical help which are reflux, infection and calculus formation and compressive symptoms in the adjacent ureter and kidney causing flank pain, dysuria, fever and hematuria.[4] Therefore the condition is diagnosed much later in life especially in the third or the fourth decades.[2,3] Uroepithelial tumor development is also a possibility therefore family member with the same vague symptoms no matter how old should be screened for the same anomaly as well.[5]

Blind ending ureteral duplications most likely develop from the malunion of the metanephric blastema with the prematurely divided ureteric bud.[5,6] The bifid ureter may be short (below the pelvic inlet) as in our case which is more common or may be long. A cap of nephrogenic tissue may be present representing the remnant of the metanephric blastema with or without continuous connection, which may blush in contrast examinations. Nephrogenic caps are more common with the long ureters. The bifid ureters may join and enter as a single unit to the bladder as in our case or may open to the bladder at ectopic locations separately.[4]

Diagnosis is established in most of the cases using IVU or retrograde pyelogram. The diagnosis is often missed especially if IVU is used because unless a nephrogenic cap or a

uretero-ureteric reflux is present, the bifid blind ending ureter is not opacified. Retrograde urography is recommended as a diagnostic tool in such a case however the procedure is interventional in nature. A cystoscopy and ureteric negotiation of the catheter are needed to opacify the system in a retrograde fashion. In case of US scans, the examined kidney will appear grossly normal if the ipsilateral kidney and the collecting system including the bifid blind ending branch are not dilated or if calculi are not present. Overlying bowel gas shadowing is also a problem in US. MDCT imaging without and with contrast directed at the urinary system is most valuable in this situation. Multiformatted images and 3-D reconstruction of the urinary system not only reveal the anatomy of the urinary system but also help to exclude the other possible etiologies that may be included in the differential diagnosis such as a urinary diverticula, a post hemi-nephrectomy stump or an acquired diverticula of the ureter.[4] CT diagnosis was available only in a few of the cases[7] and demonstration of the anomaly using MDCT multiplanar reformation and 3-D reconstructions is unique to this case.

There are approximately 200 case reports so far published regarding blind ending bifid ureters[8] but those with calculi is even much rarer. For instance, only 5 cases were reported in the Japanese literature among the 77 case reports of blind ending bifid ureters.[5] Vesicoureteral reflux, poor peristaltism and stasis in the blind ending branch and recurrent infections predispose to calculi formation.[2] Reports commonly emphasize that resection of the blind ending branch or removal of stones alleviate the patient's symptoms and development of malignancy in the blind ending branch is always a possibility therefore open or laparoscopic surgical removal should be considered in the management of this anomaly[2,4-8]In conclusion, this case emphasizes the superiority of a CT urogram over an IVU when a caudal ending bifid ureter is concerned. Multiplanar imaging and 3-D reconstructions reveal further anatomic and functional detail, anatomic relationships and establish the exact diagnosis whereas with IVU alone the diagnosis is often missed.

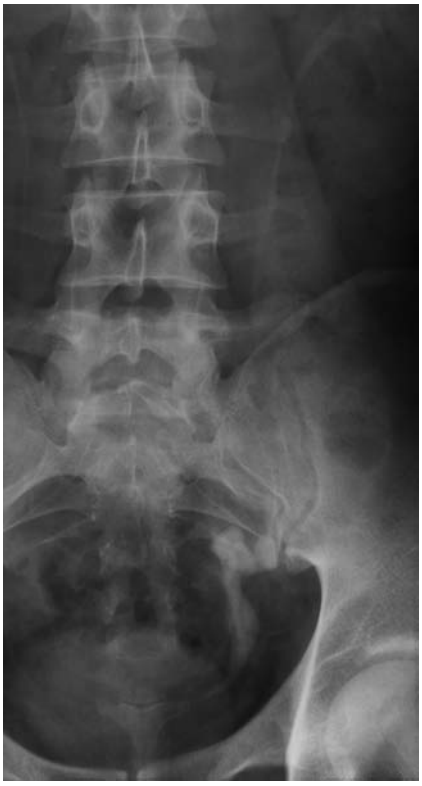

Figure 1. In this intravenous urography image, obtained 5 min after contrast injection, the ureter is opacified extending from the normal calyces and pelvis of the cranially located kidney to the bladder. In the pelvic inlet at the distal third of the ureter, adjacent to the bladder on the left, the cluster of calculi is visualized. The distal third of the left ureter beyond this point is mildly irregular and somehow dilated.

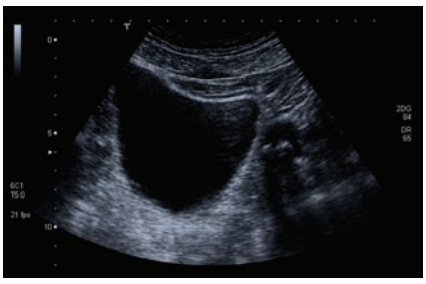

Figure 2. In the ultrasound scan, on the left side of the bladder the cystic pouch with shadowing calculi is seen.

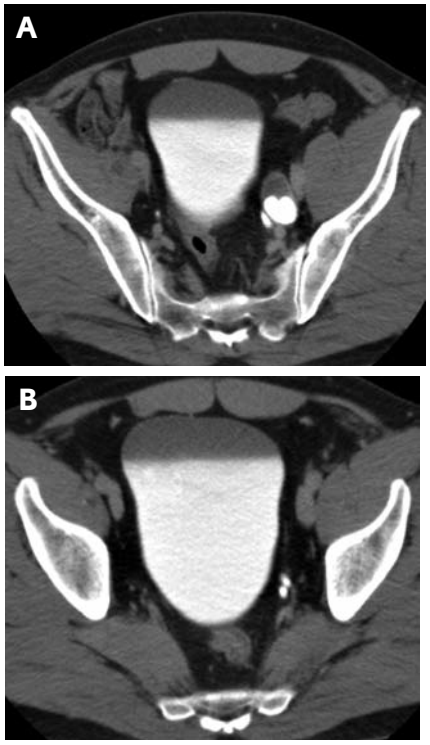

Figure 3. A) In this axial computed tomography image, the pouch containing the calculi adjacent to the bladder is present. B) In the more caudal image, presence of opacified double ureters is noted.

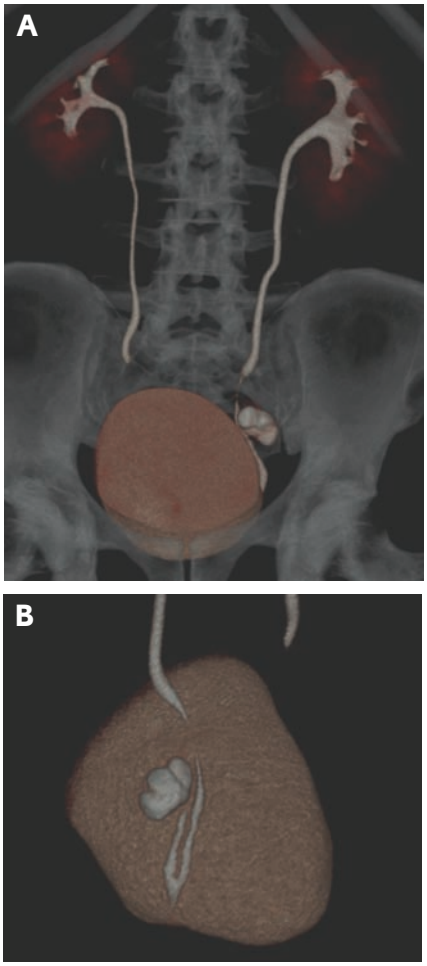

Figure 4. A) 3-D reconstructions clearly depicted the anomaly, the pouch and the bifid ureter are located adjacent to the bladder; B) the bifid ureter joining the main ureter is much clearly demonstrated when the images are rotated to the posterior oblique view.

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