The importance of gray scale and color Doppler ultrasonography in the diagnosis of spontaneous renal pelvis rupture: case report

Spontan renal pelvis yırtılması tanısında gri skala ve renkli Doppler ultrasonografünün önemi: olgu sunumu

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Abstract
Peripelvic extravasation associated with spontaneous rupture of renal pelvis is a rare occurrence, caused mostly by the obstruction due to calculus. However, the presence of renal anomalies increases the risk of rupture. Urinary extravasation leads to flank pain and may cause acute abdominal symptoms. Especially, the displacement of viscera by extravasated urine and the presence of gastrointestinal symptoms arising through intestinal reflex stimulation renders diagnosis more difficult. Ultrasonography, intravenous urography and computed tomography are the most efficient diagnostic tools in the diagnosis of pelvic renal rupture. In the present study, pre- and post-treatment radiological imaging findings of a case with renal pelvis rupture due to right ureter stone and the use of gray scale and color Doppler ultrasonography in the diagnosis has been discussed.

Key words: Pelvis; renal; rupture; spontaneous; ultrasonography.

Case report

A 38-year-old female patient was referred to radiology clinic for intravenous urography (IVU) and USG investigation with the complaint of right flank pain. The left psoas muscle was well-seen on the abdominal radiography, but the mid-portion and superior margin of the right psoas muscle was not visualized (Fig. 1a). Plain abdominal radiography and IVU showed opacities consistent with calculi at the diameter of approximately 5 mm, located in middle part calyx of right kidney and 1/3 section of right ureter. There were dilatations in proximal ureter secondary to right ureter stone, enlargement in right renal pelvis and grade 2-3 ectasia in caliceal
system. In addition, extravasated opaque substance collection was observed in peripelic and perirenal area on the film obtained after 7 min (Fig. 1b-c). In USG examination, in addition to IVU findings, a defect (rupture) at the diameter of 4.5 mm and a urinoma at the size of 2x1 cm in peripelvic area were observed (Fig. 2a, b). In color Doppler examination, when a slight compression was made on the side of the urinoma, jet effect the site of rupture to renal pelvis was observed (Fig. 2c). One day later, double J catheter was inserted in to right collecting system with diagnosis of pelvic rupture and subsequently abdominal computed tomography (CT) scanning was performed. Widespread free fluid areas in perirenal and retroperitoneal area were observed in CT examination (Fig. 3a). A few hours after the insertion of catheter, symptoms resolved markedly and in the control CT taken next day, it was observed that fluid was considerably resorbed with minimal fluid left around renal pelvis (Fig. 3b). General condition of the patient improved substantially and creatinine values and the amount of diuresis were normal. Patient was discharged in good clinical condition.

**Figure 1**
Radiographic images of spontaneous rupture of renal pelvis. (a) The left psoas muscle margin (black arrows) is normal and smooth; the right psoas muscle midportion and superior margin is not seen (red arrows). (b, c) In intravenous urography taken at 15th and 45th min, extravasation which increasingly grows larger in peripelvic and perirenal area is observed (orange arrow: renal stone, yellow arrow: ureteric stone, brown arrows: loss of the psoas muscle border, black arrows: left psoas muscle, green arrow: renal pelvis, red arrow: extravasated contrast material, blue arrow: dilated ureter).

**Figure 2**
Spontaneous rupture of renal pelvis in USG. (a, b) A defect at the size of 4.5 mm (arrows) in renal pelvis is observed. (c) In color Doppler investigation, color flow to renal pelvis is observed associated with compression by urinoma (arrows: renal pelvis rupture).
Discussion

Urine extravasation of kidney origin frequently occurs due to trauma. In addition, stones that cause urinary obstruction and increase intraluminal pressure, pelvic masses, pregnancy, retroperitoneal fibrosis, congenital anomalies, malignant diseases, and vesicoureteral reflux may also give rise to rupture.\[^{8-10}\] Its clinical presentation ranges from mild flank pain to acute abdominal symptoms.

Pain secondary to urine extravasation may be related to chemical peritonitis or infection. In some cases, the presence of gastrointestinal symptoms arising through the displacement of some visceral organs by extravasated urine and intestinal reflex stimulation may make diagnosis more difficult. Right-sided extravasation may particularly mimic cholecystitis, appendicitis and pyelonephritis. Spontaneous rupture of renal pelvis may rarely occur during pregnancy. Although this condition is usually associated with an underlying renal disease, it is also reported in the literature that rupture may develop without any renal pathology.\[^{11}\]

In the diagnosis of renal rupture, initially radiography and serial USG and subsequently IVU and CT are most beneficial tools. The plain abdominal radiography is readily available. Plain film of the abdomen may show a loss of retroperitoneal landmark (obliteration of the ipsilateral psoas shadow or renal outline), stone, and signs of paralytic ileus. However, most of these findings are nonspecific and bowel gas may obscure these findings.\[^{12}\] If a urine leak is suspected, IVU may indicate the site and provide an estimate of the rate of leakage. Although IVU is simple and widely used, it exposes the patient to a relatively high dose of radiation, which is of special concern in children. In addition, it has to be used with caution in patients with compromised renal function; contrast medium-induced nephropathy and allergic reactions are also hazards.\[^{13}\] US can be used to confirm the diagnosis of kidney stones, hydronephrosis, the site of obstruction, and extravasated fluid; however ureteral stones may be missed due to the presence of obscuring bowel gas. US can be used in patients with an allergy to intravenous contrast, and is also useful in pregnancy, since there is no radiation to the patient or fetus. Unenhanced helical CT has been shown to be more sensitive in detecting and characterizing ureteral calculi and at least as sensitive in demonstrating the presence of obstructive uropathy.\[^{14}\] Additionally, CT may be performed rapidly, in approximately one-third the time of an IVU study, and does not require the use of intravenous contrast material. Contrast-enhanced CT with delayed images (obtained 5-20 min after contrast medium injection) shows contrast medium extravasation in the peripelvic, perinephric, or retroperitoneal spaces.\[^{3,15}\] An important consideration in choosing this modality is the significant radiation dose to the patient, compared to an IVU. This disadvantage restricts its use, especially in pregnant and pediatric patients. In this context, children and young adults will benefit most from the magnetic resonance urography advances. In obstetric patients, T2-weighted sequences might provide sufficient

![Computed tomography images of spontaneous rupture of renal pelvis. (a) In abdominal CT taken immediately after the insertion of double-J catheter, widespread free fluid areas are observed in perirenal area (black arrows: free fluid areas, white arrow: renal pelvis), (b) In abdominal CT taken one day after the insertion of Double-J catheter, minimal free fluid area is observed around pelvis (yellow arrows: minimal fluid around pelvis).](image)
information and thus eliminate the need for the use of contrast material and ionized radiation. In our case, above-mentioned findings of spontaneous renal pelvis rupture were present. However, it was remarkable in our case that USG demonstrated the location and size of rupture in renal pelvis and that in color Doppler examination, colored flow from the site of rupture was visible.

Urinomas at small size can be spontaneously resorbed without any need for drainage. At present, conservative treatment of spontaneous renal pelvis rupture by ureteral stent is successfully carried out. Double J catheter or percutaneous nephrostomy are urinary diversion methods to be used especially in the presence of small rupture. Surgical treatment is performed especially in cases diagnosed late and/or with large urinomas or those with concurrent pathologies that should be corrected surgically.

In conclusion, spontaneous pelvis rupture is a rare cause of acute flank pain and imaging methods, primarily IVU and CT are diagnostic. However, grey scale and color Doppler USG examination may give useful information about the location and wideness of rupture, and extravasated fluid in the selected cases like pregnancy, pediatric patients, and patients with contrast medium allergy.

Conflict of interest

No conflict of interest was declared by the authors.

References


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