Spontaneous rupture of the ureter secondary to urolithiasis and extravasation of calyceal fornix due to acute urinary bladder distension: four cases report

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Spontaneous rupture of the ureter is defined as a nontraumatic leakage of the urine from the ureter. This type of rupture is rarely encountered and predominantly consequent to calculus disease. Occasionally the rupture of upper ureter or renal pelvis may be confused with a physiologic phenomenon of the fornical rupture with urine extravasation. Fornical extravasation is also mainly due to ureteral stone. In contrast to ureteral rupture, fornical extravasation is more commonly seen and the symptom is always mild. Conservative management is the principle of treatment. A clear distinction between these two conditions becomes very important since both course and treatment are different. We present 3 cases of spontaneous rupture of the ureter with calculus disease and a case of fornical extravasation unusually due to acute urinary bladder distension. Difference between these two conditions is discussed.

Key words: Forniceal rupture; Genitourinary system, calculi

CASE REPORT

Case 1
A 64-year-old woman was admitted due to left lower quadrant cramping pain for several days. She had mild fever. The complete blood count and urinary analysis were within normal limit. There was no history of trauma. Plain film of abdomen showed a 6 × 4 mm calcified nodule at left paraspinal region of L2-L3 (Fig. 1a). Abdominal sonography revealed left upper ureteral stone causing obstructive uropathy with perirenal space fluid collection. CT scan discovered left upper third ureteral stone with contrast material extravasation and a non-opacified ureter (Fig. 1b, 1c). Left upper ureteral stone with rupture of the ureter was impressed. Percutaneous nephrostomy (PCN) with
perirenal fluid drainage was done, and the patient recovered apparently.

**Case 2**

A 59-year-old man came to our ER due to lower abdominal pain. Fever, rebounding pain and elevated white blood cell count up to 25190/ul were noted. Under the impression of acute appendicitis, appendectomy was performed. Three days later, the symptom and sign improved, but mild fever and epigastric pain were still present. The patient was discharged according to his own will, and was requested to follow up at the out patient clinic. Unfortunately, he was readmitted to the ER with fever and diffuse abdominal pain one week later. The white blood cell count elevated to 50000/ul. Abdominal radiography showed a lesion with air-fluid level over right upper quadrant of abdomen and gas in the right collecting system (Fig 2a). Emergent CT scan was performed and revealed right upper ureteral stone with gas accumulation in renal pelvis and retroperitoneal space. Air-fluid level was also noted (Fig. 2b, 2c). Under the impression of right upper third ureteral stone with rupture of the collecting system and retroperitoneal abscess formation, CT-guided drainages were performed on the next day. One of the drains was for the retroperitoneal abscess and the other was for nephrostomy (Fig. 2d). Followed-up excretory urography one month later revealed a $5 \times 8$ mm right upper third ureteral stone with healing of the ruptured collecting system (Fig. 2e, 2f).

**Case 3**

A 54-year-old man presented with left flank pain, nausea and hematuria. Knocking pain was noted on physical examination. White blood cell count was 6870/ul. He denied any traumatic history. The symptom was aggravated despite of conservative

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**Figure 1.**

a. Plain film of abdomen shows a calcified nodule (arrow) measuring $6 \times 4$ mm at left paraspinal region of L2-L3 with relative blurring of ipsilateral psoas muscle shadow. b. Precontrast CT scan reveals a left upper ureteral stone (arrow) with fluid collection in left perirenal and pararenal spaces (arrow heads). c. Postcontrast CT scan, secretory phase of both kidneys, demonstrates leakage of excreted contrast medium (arrow) with a non-opacified ureter (arrow head).
Figure 2. a. Plain abdominal radiography shows air-fluid level (arrows) over right upper quadrant of abdomen, and gas in the collecting system (arrow heads). b. Postcontrast CT scan reveals gas in the collecting system (arrows), and air-fluid level (arrow heads) in the retroperitoneal space. c. The image taken more 6 cm lower reveals right upper ureteral stone (arrow head) with retroperitoneal gas formation (arrows). d. CT-guided PCN with prone position demonstrates 2 drains respectively in renal pelvis (black arrow head) and retroperitoneal space (white arrow head). The contrast medium retention of the previous CT study (arrow) is noted. e. One month later, plain film of the excretory urography shows 2 calcified nodules at right paraspinal region of L3 (arrows). f. Postcontrast film shows contrast medium in the right collecting system obstructed by the ureteral stone.
treatment. The excretory urography showed a radiopaque nodule sized 2.5 mm near left ureterovesical junction (Fig. 3a). Contrast material extravasated into left renal fossa without visualization of left ureter (Fig. 3b). However the patient refused any further management and was discharged. We believe that there was a left lower ureteral stone causing rupture of upper ureter.

Case 4

A 73-year-old woman visited our ER with fever and left lower quadrant pain for 3-4 days. Abdominal sonography showed a common bile duct stone with dilatation of bilateral intrahepatic ducts. She was admitted with suspicious cholangitis. Laboratory data including complete blood count and urinalysis were unremarkable. No ureteral or renal stone could be found in the plain film of abdomen. The fever was remitted after antibiotics treatment, but left lower quadrant pain was still noted 5 days later. Abdominal CT scan revealed marked distension of urinary bladder (Fig. 4a) with contrast medium extravasation into left perirenal and pararenal spaces (Fig. 4b, 4c). The left ureter was opacified. She received Foley’s catheterization. CT-guided PCN was arranged on the next day. To our surprise, the fluid obviously decreased in amount in the CT scan (Fig. 4d). We think this was a typical presentation of forniceal tear with extravasation. Therefore, the PCN was not done. The patient recovered uneventfully without any specific treatment and was discharged one week later.

DISCUSSION

Rupture of the ureter may be spontaneous or post-traumatic. Spontaneous rupture of the ureter is a rare entity. The description of “spontaneous” in some papers should be applied in the following conditions: no external trauma, no previous surgery on adjacent structures, no recent ureteric instrumentation and excluding external compression during the excretory urography [1, 2]. With these criteria, spontaneous rupture usually results from ureteral calculus [5, 7]. The mechanism can be explained as either pressure necrosis around the ureteral wall due to stone impaction or a tear of the ureter during passage of the stone [2, 3]. In addition, ureteral tumor, ureteral infection, colonic and duodenal diseases were also reported to be responsible for the problem [4]. Most of these patients with perforation of the ureter are much more unwell with a high temperature, leukocytosis and severe pain. Periureteral abscess is not uncommon in these cases. Ureteral rupture complicated with retroperitoneal abscess and sepsis can result in death [2]. Symptoms of ureteral rupture may mimic acute abdomen. Incorrect diagnosis such as appendicitis (case 2) or diverticulitis is frequently reported [5]. Treatment usually includes incision or drainage of the retroperitoneal space and removal of the ureteral calculus if possible [2, 3].

On the other hand, there are many cases of forniceal rupture reported. Sudden obstruction of a ureter will increase the pressure of the collecting
system. The elevated pressure can be temporarily relieved with dilatation of the collecting system. If there is insufficient relief of the pressure, urine may escape through the collecting system by tearing the renal fornix [6, 7]. Like spontaneous rupture of the ureter, fornical extravasation is also secondary to ureteral calculi in most cases [10, 11]. Less common causes including tumor, pregnancy, enlarged lymph nodes, ruptured renal cysts, post irradiation scars, retroperitoneal fibrosis and enlarged prostate gland have been reported [6]. Forniceal rupture is thought to be a safety valve for alleviation of the increased intrapelvic pressure in an acute obstructive uropathy. It has been classified into 4 categories: pyelosinus, pyelolymphatic, pyelovenous and pyelotubular backflow [2, 8]. How often fornical extravasation is seen during the excretory urography may depend on the dose of contrast medium used. In one study of Bernadino and McClennan, fornical extravasation occurred during the excretory urography in 8.1% of patients with acute ureteral obstruction if 75ml bolus of contrast medium used, and in 24.4% of patients with 140ml contrast medium used [9]. Forniceal extravasation also tends to happen with the use of compression technique during urography. In contrast to true rupture of the ureter, most patients with fornical extravasation show mild presentations, such as flank pain, nausea and vomiting. Rare complication of retroperitoneal abscess should be kept in mind. Some papers also postulated that extravasation may cause the retroperitoneal fibrosis and ureteropelvic junction obstruction [9, 10]. The treatment is always conservative, i.e. analgesics and observation. Antibiotics are used in chronic state to prevent...

Figure 4. a. Precontrast CT scan demonstrates marked distension of urinary bladder. b. Postcontrast CT scan revealed fluid collection in left perirenal and pararenal spaces (arrow heads). c. The image taken 5 hours later shows extravasation of contrast medium into left perirenal and pararenal spaces (arrow heads). d. CT scan 1 day later, small amount of residual extravasated fluid (arrow heads) is seen. A CBD stone is also noted (arrow).
infection. Open drainage is not necessary. However, if pain persists or infection is encountered, drainage is indicated [6].

There is some confusion between the backflow extravasation and true rupture of the ureter or renal pelvis in the medical literature. Some cases reported as spontaneous rupture of renal pelvis or ureter actually presented spontaneous extravasation of the fornix, while some cases reported as backflow extravasation characteristically showed rupture of the renal pelvis or the ureter [8]. Differentiation between these two conditions may be made by some observations. The presence of contrast material around the calyx highly suggests the fornical rupture [8, 11]. Non-visualisation of the ureter on the affected side usually indicates rupture of the ureter or renal pelvis [8]. If the radiological picture remains unchanged for a long period of time, it always points to the possibility of the ureteral rupture, while in cases of the fornical rupture, contrast extravasation usually disappears in 24-48 hrs after the onset of an attack [8, 11]. Furthermore, most patients with actual rupture of ureter are more unwell with a high temperature and leukocytosis than those with backflow extravasation [8].

In three cases with true rupture of the collecting system we presented here (case 1, 2, 3), two had non-visualized ureter on the affected side (case 1, 3). Two cases showed symptoms subsided after the PCN and drainage, except the third case refused further management. In the second case of ureteral rupture, the patient was initially diagnosed as appendicitis. Therefore when we deal with patients with acute abdomen, ureteral rupture should be kept in mind. The fourth case is of interest in that the fornical extravasation was unusually caused by acute urinary bladder distension. The extravasated fluid markedly decreased after decompression is the character of backflow extravasation.

REFERENCES

因為尿路結石造成自發性輸尿管破裂以及由於急性膀胱膨脹形成腎盂穹窿尿液外漬：四病例報告

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自發性輸尿管破裂是很少發生的，而且被認為是尿液非受傷性地從輸尿管漏出，它通常是因為結石造成輸尿管的阻塞，症狀比較嚴重，治療需要引流或者手術。真正的上輸尿管或腎盂破裂可能和腎盂穹窿尿液外漬的生理現象混淆。腎盂穹窿外漬也常導致於輸尿管結石，相對於輸尿管破裂，腎盂穹窿外漬較常看到而且症狀較輕微，保守性的處理是治療的原則。因為過程和治療方式不同，區別這兩種情況顯得非常重要。我們報告三個因為結石造成罕見的自發性輸尿管破裂以及一個不尋常地由於急性膀胱膨脹造成腎盂穹窿外漬的病例，並且討論這兩種情況的不同。

關鍵詞：腎盂穹窿外漬；泌尿系統結石