Non-tumoral Disease Involvement of the Perirenal Space: Evaluation with Computed Tomography

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Fifteen patients with non-tumoral, retroperitoneal disease involving the perirenal spaces were evaluated using abdominal computed tomography (CT). The disease entity included urinomas (2 patients), blunt abdominal traumas (2 patients), abscesses due to ureteral stones (1 patient) and renal stones (1 patient), abscess formation status post extracorporeal shock wave lithotripsy (ESWL) (1 patient), hematoma after ESWL (1 patient), ureteral catheter-induced traumas (2 patients), pyelonephritis (1 patient), and pancreatitis (4 patients). All patients were evaluated with non-enhanced CT and 11 patients were studied using intravenous contrast enhancement. One patient had a perirenal urinoma and one had a hematoma that extended down to the inferior cone of the perirenal space. One patient had a urinoma that extended down through the inferior cone to the pelvic cavity. One patient had a urinoma and one patient had a hematoma that passed the midline anterior to the great vessels. We concluded that retroperitoneal disease can involve the perirenal spaces and CT is a good imaging tool to evaluate the extent of the disease.

Key words: Disease, retroperitoneal space; Computed tomography (CT)

The anatomy of the perirenal spaces can delineate the extent of the disease process [1-7]. Many retroperitoneal conditions can involve the perirenal spaces, for example, urinomas [1,2], traumatic events [1, 3, 5, 7, 8], infections [9] and pancreatitis [10-13]. We present 15 patients to identify the disease processes in the perirenal spaces and their extent using CT.

Patients and Methods

Fifteen patients (5 males and 10 females) aged 26 to 76 years (mean age, 52.3 years) received abdominal CT examination due to various causes, including urinoma due to the ureteral obstruction (2 patients), blunt abdominal trauma (2 patients), abscess formation due to renal stones (1 patient) or ureteral stones (1 patient), abscess formation status post (s/p) extracorporeal shock-wave lithotripsy (ESWL) (1 patient), hematoma s/p ESWL (1 patient), catheter-induced ureteral trauma (2 patients), pyelonephritis (1 patient) and acute pancreatitis (4 patients). The patients were scanned in a helical CT scanner (CT Prospeed; General Electric Medical Systems, Milwaukee, WI). The CT scans were obtained with slice thickness of 1 cm and slice interval of 1 cm from the diaphragm to the pubic symphysis in all the patients. All the patients received non-enhanced CT study and 11 patients received contrast-enhanced study using intravenous infusion of 100 ml of contrast medium (meglumine iothalamate.)
USP 60%). All the patients were evaluated for the involvement of the perirenal spaces and the extent of their conditions. The diagnoses were proven using clinical history, and results from laboratory examinations and cultures.

RESULTS

For the four patients with traumatic events (blunt abdominal trauma (1 patient), s/p ESWL (1 patient) and catheter-induced ureteral trauma (2 patients)) (Fig. 1 and 2), their lesions were located in the perirenal spaces and were managed with conservative treatment. One patient had perirenal hematoma induced by ESWL that extended beyond the midline to the contralateral side anterior to the great vessels (Fig. 1). One patient had a perirenal hematoma that extended down to the inferior cone of the perirenal space. He was treated using percutaneous drainage (Fig. 3). Two patients had urinomas (Fig. 4 and 5) that extended to long distances: one extended downward to the inverted cone of the perirenal space at the level of the iliac wing (Fig. 4) and the other extended beyond the inverted cone to the pelvic cavity and crossed the midline to the contralateral side (Fig. 5). These two patients were treated successfully using percutaneous drainage.

Figure 1. Perirenal hematoma formation 15 hours after ESWL to the proximal ureteral stone. a. Pre-contrast-enhanced CT shows the left perirenal hyperdense lesion (black arrow) posterior to the anteriorly displaced left kidney (open arrow). The left proximal ureteral stone is also noted (white arrow). b. Contrast-enhanced CT revealed the hematoma (black arrow) hypodense relative to the mildly enhanced left kidney (open arrow), which is less enhanced than the right kidney (white arrow), indicating the impaired function of left kidney. c. The perirenal hematoma extends beyond the midline (arrow) anterior to the bifurcation of the inferior vena cava and abdominal aorta at the level of L4.

Figure 2. Non-enhanced CT immediately post-bilateral retrograde pyelographies showed leakage of the contrast medium (arrow) to the left perirenal space, abutting the left psoas muscle.
Two patients with abscesses due to the urolithiasis that were limited to the kidney and the perirenal space were treated either using percutaneous drainage (1 patient) or using surgical intervention (1 patient). One patient had abscess formation s/p ESWL that not only involved the perirenal spaces but also extended to the iliopsoas compartment and was managed first using percutaneous drainage and later using surgical intervention (Fig. 6). The patients with pyelonephritis (1 patient) and acute pancreatitis (4 patients; Fig. 7) had perirenal space involvement and were managed successfully using conservative treatment.

**DISCUSSION**

The perirenal space is an inverted cone of
tissue delineated by the anterior and posterior renal fasciae [1]. The lateral extent of the perirenal space is limited by the lateroconal fascia formed by fusion of the anterior and posterior renal fasciae. The superior extent of the perirenal space is open to the bare area of the liver and to the mediastinum [1,2]. Two perirenal hematomas after ESWL (Fig. 1), and one perirenal urinoma (Fig. 5) communicate with the contralateral side below the level of the superior mesenteric artery that supports results of a previous report that narrow channels are present between the perirenal spaces anterior to the aorta and inferior vena cava at the level of the lower lumbar vertebrae [3,4]. However, other report showed that the interlobular septa acts as a

**Figure 5.** Right perirenal urinoma and bilateral obstructive uropathies due to bladder carcinoma. Only non-enhanced CT is obtained due to the patient’s impaired renal function. **a.** Urine in the right perirenal space extends across the midline (black arrow) anterior to the inferior vena cava and aorta at the L3-4 disc level. Urine is also noted in right posterior pararenal space (white arrow). Bilateral hydronephroses are also noted. **b.** Right perirenal urine extends through the midline (black arrow) anterior to the inferior vena cava and abdominal aorta at the L4-5 disc level and to the right posterior pararenal space (white arrow). **c.** At the mid-pelvis level, urine extends to the infrarenal space (white arrow) through the inferior cone of right perirenal space medial to the right external iliac vessel. Urine is also noted in the presacral space (open white arrow). Bilateral hydroureters (small white arrows) are present due to the invasive bladder carcinoma (small black arrow).

**Figure 6.** Left renal and ureteral stones progressing to abscess formation involving the left kidney, perirenal space and iliopsoas compartment after many times of ESWL. Post-contrast-enhanced CT reveals destruction and deformity of the whole left kidney with a huge thick-walled abscess formation involving the left kidney, perirenal space and psoas muscle. Interior foamy air and thick pus was noted with retroaortic extension. Arrow indicates stone in the destructed left kidney.

**Figure 7.** Acute pancreatitis with fluid extension along the transverse mesocolon (open arrow) and to bilateral perirenal spaces (arrows).
barrier to the spread of disease from the perirenal space to the central retroperitoneum or vice versa [5].

The lower aspect of the inverted cone of the perirenal space is closed at the level of the iliac wing [6], as supported by the examination results of our patients with the traumatic perirenal hematoma (Fig. 3) and the urinoma (Fig. 4). This has been shown to be due to the inferior fusion of the leaves of the anterior and posterior fasciae that act as a barrier to disease extension down to the pelvic cavity. However, some have suggested that the inferior cone of the perirenal space opens toward the iliac fossa [4]. This was also seen in our other patient with perirenal urinoma (Fig. 5). Therefore, the results of our study showed that the inferior aspect of the inverted cone of the perirenal space was closed at or opened toward the iliac fossa.

The post ESWL perirenal changes included the increased perirenal soft tissue stranding and the thickening of the Gerota's fascia [7], hematoma [8] and abscess formation [9], and are related to the shock waves and the decreased elasticity of the kidney associated with a relatively thin parenchymal wall. The widespread extension of the abscess status post ESWL involving the kidney, the perirenal space and the iliopsoas compartment may be due to the combined effect of chronic infection induced by the urolithiasis and the acute effect of the shock wave (Fig. 6).

The perirenal hematoma may be due to a traumatic event, especially to the flank region or post ESWL. The hematoma revealed hyperdensity on non-contrast-enhanced CT in the acute phase (Fig. 1) and became hypodense and even fluid dense during the chronic stage (Fig. 3). The hematoma may cross the midline anterior to the greater vessels [3,4] (Fig. 1) or extend to the inferior aspect of the inverted cone of the perirenal space [6] (Fig. 3).

Pancreatitis can also involve the perirenal spaces, but that is rare [12]. The protective effect of the Gerota's fasciae acts as a barrier between the pararenal and perirenal spaces. The proteolytic exudates of the pancreatitis may destroy the Gerota's fascia and accumulate in the perirenal spaces [10,11] or the fluid may leak into the perirenal spaces by diapedesis through the renal fascia [12, 13] (Fig. 7).

In conclusion, many diseases (of renal or extrarenal origins) can involve the perirenal spaces. Recognition of the anatomy of the perirenal spaces is important and it, along with CT demonstration, can explain the extent and the spread of the disease.

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病人患有後腹腔之非腫瘤疾病，以腹部電腦斷層掃描術 電腦斷層 評估其侵犯腎周圍間隙之情形。疾病之種類包括尿性囊腫二例，腹部撞挫傷二例，輸尿管及腎結石引起之膿腫各一例，體外震波碎石術 后造成之腫瘤一例， 輸尿管導管引起之輸尿管傷害二例，腎盂腎炎一例及潰爛炎四例。所有病患皆接受靜脈注射造影前之電腦斷層，其中 位同時也接受注射造影後之電腦斷層。於疾病侵犯範圍方面，一例之腎周圍間隙尿性囊腫及一例血腫延伸至腎周圍間隙周圍之下緣，一例之尿性囊腫則通過周圍下緣到達骨盆之例，一例之尿性囊腫及一例之血腫於大血管前方通過中線。結論為後腹腔疾病可侵犯腎周圍間隙，電腦斷層為一評估疾病侵犯及延伸範圍的良好工具。

關鍵詞：疾病，後腹腔，電腦斷層