

ACUTE INFLAMMATORY KIDNEY LESIONS: CURRENT AND PARTICULAR ASPECTS IN COMPUTED TOMOGRAPHY EVALUATION

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Abstract. *Diagnosis of renal and urinary tract infections, in adults, is typically based on characteristic clinical features and abnormal laboratory values. Imaging is usually used for patients who do not respond to therapy and for those whose clinical presentation is atypical. When urinary tract infection migrates to the kidney a tubulointerstitial inflammatory reaction ensues, involving the renal pelvis and parenchyma. Complicated and uncomplicated acute pyelonephritis, pyonephrosis and xanthogranulomatous pyelonephritis, are all acute urinary tract infections for which computer tomography evaluation adds diagnostic information important for patient care.*

Keywords: urinary tract infections, diagnosis, computer tomography evaluation

Rezumat. *Diagnosticul infecțiilor renale și ale tractului urinar superior se bazează pe examenul clinic și de laborator. Imagistica este utilă la pacienții la care simptomatologia nu se ameliorează în urma tratamentului aplicat sau în cazurile atipice. Infecțiile tractului urinar superior migrează la nivelul sistemului pielocaliceal, iar de aici în parenchimul renal ducând la apariția pielonefritei, pionefrozei sau a pielonefritei xantogranulomatoase, entități în care evaluarea computer tomografică este esențială pentru diagnostic în vederea unui bilanț preterapeutic complet.*

Cuvinte-cheie: infecțiile tractului urinar, diagnostic, tomografie computerizată

Introduction

The kidney is a potential target for a variety of inflammatory conditions, which can be divided into two large categories: glomerulonephritis and interstitial nephritis. Because computer tomography plays a very limited role in patients with glomerulonephritis and noninfectious interstitial nephritis, these entities are not discussed. Causes of interstitial nephritis that are related to bacterial infection

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include acute uncomplicated and complicated pyelonephritis, and also xanthogranulomatous pyelonephritis.

Computed tomography technique. Unenhanced computer tomography is excellent for identifying urinary tract gas, calculi, hemorrhage, renal enlargement, inflammatory masses, and obstruction (14). Involved regions occasionally appear with lower attenuation related to edema; less frequently, they have pockets of higher attenuation that are thought to represent hemorrhage computer tomography in acute inflammatory kidney lesions. Postcontrast computer tomography evaluation is done at approximately 50–90 seconds after injection followed by delayed imaging if urinary tract obstruction is suspected. These parameters are designed to take advantage of the nephrographic phase in which the normal kidney is homogeneously enhanced (14).

Acute Pyelonephritis. Bacterial pyelonephritis results from ascending infection from the lower urinary tract in the vast majority of cases, typically due to gram-negative enteric pathogens (1). Common risk factors include vesico-ureteral reflux in children and stasis or obstruction in adults. Patients often present with fever, chills, flank pain, and pyuria. Pathologically, the urothelium is thickened and the kidney is focally or globally edematous. Pyelonephritis is usually multifocal, and occasionally, it may appear as a well-circumscribed mass. In patients who do not respond to initial therapy, who are diabetic, or who are immunocompromised or when complications are suspected, computer tomography is a very useful study (1, 2, 3). On contrast-enhanced computer tomography a striated nephrogram that consists of discrete rays of alternating attenuation that extend to the cortex is characteristic of acute pyelonephritis (**Figure no.1**).

If computer tomography images are obtained several hours after contrast material administration, areas of dense parenchymal staining are depicted and correspond to areas of decreased function on the immediate contrast-enhanced images (4). Computer tomography also demonstrate complications such as renal or perinephric abscess formation (**Figure no.2** and **Figure no.3**).

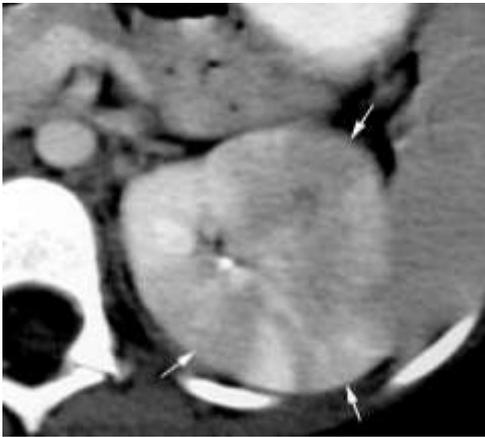


Figure no.1:
Acute bacterial pyelonephritis. CT scan shows multifocal regions of diminished enhancement that extend to the periphery of the left kidney (arrows).

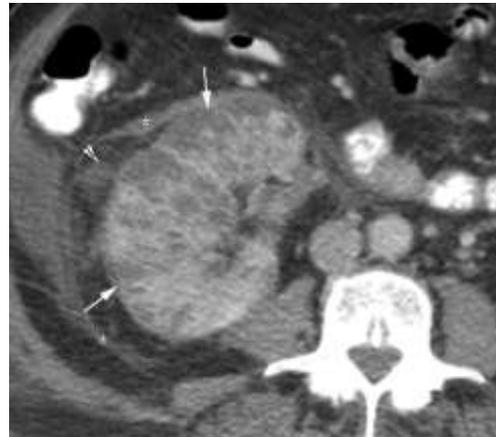


Figure no.2:
Severe acute unilateral acute pyelonephritis. CT scan shows the enlarged right kidney with decreased uptake of contrast material and multiple small low-attenuation foci from abscess (arrows); perirenal right space inflammation (arrow head); enlargement of the renal right fascias ().*



Figure no. 3a, 3b:
Severe Acute pyelonephritis with intrarenal abscess and perinephric extension. CT scan demonstrates peripheral low-attenuation lesions (arrows) that are maturing into abscess (a, b).

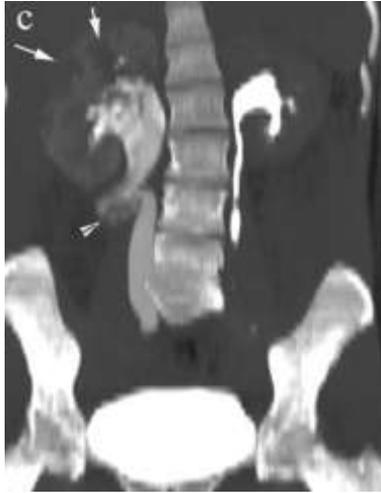


Figure no. 3c:
MIP coronal reformatation: dilatation of the right superior urinary tract- head arrow (c)

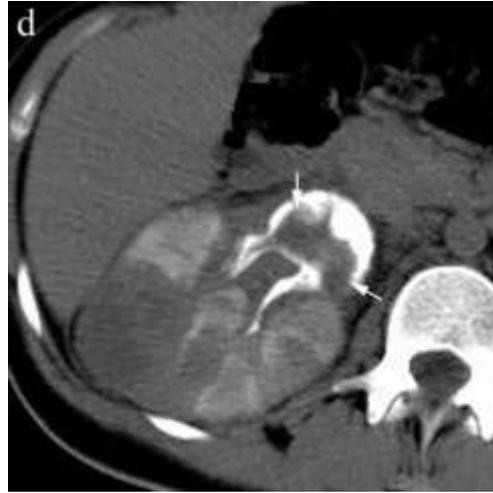


Figure no. 3d:
filling central defect into the right renal pelvis - arrow (d).

Abscess cavities may be either intra- or extra-parenchymal, and a renal abscess should be suspected when appropriate therapy does not lead to clinical response. Diabetic patients are predisposed to abscess formation (5). At computer tomography, abscesses are typically identified as round or geographic low-attenuation collections that do not enhance centrally but that may have an enhancing rim. The rims are pseudocapsules with varied wall thicknesses (**Figure no.4**) and frequent nodularity.

Extraparenchymal collections occasionally extend into adjacent structures, such as the psoas muscle.



Figure no.4:
Right renal abscess. Contrast-enhanced CT scan demonstrates a thick-walled, peripherally enhancing, low-attenuation lesion (arrows)

Emphysematous pyelonephritis is a necrotizing infection of the kidneys characterized by gas formation within or surrounding the kidneys. The majority (approximately 90%) of patients have poorly controlled diabetes (1, 2, 6). Nondiabetic patients are typically either immunocompromised or have associated



Figure no. 5:
Right emphysematous pyelonephritis. Unenhanced CT scan demonstrates emphysematous pyelonephritis, which appears as a large area of air that has completely destroyed and distorted the right kidney (arrows)

Emphysematous pyelitis is a less aggressive form of emphysematous infection of the upper urinary tract. Emphysematous pyelitis is diagnosed when gas is localized to the renal collecting system (6, 14). Emphysematous pyelitis is more common in women and is also associated with diabetes and urinary tract obstruction. Computer tomography findings are a dilated collecting system, gas bubbles or gas-fluid levels within the renal caliceal system or renal sinus, and the lack of parenchymal gas (**Figure no.6**).

urinary tract obstruction secondary to urolithiasis, neoplasm, or sloughed papilla (7, 8, 9, 10, 11, 12, 13). The most commonly identified organisms are E-coli, Klebsiella pneumonia, and Proteus mirabilis (6). Without early therapeutic intervention, the condition becomes rapidly progressive, generalizes to fulminate sepsis, and carries a high mortality rate. Computer tomography is the modality of choice for evaluating patients with emphysematous pyelonephritis (6, 7, 8, 14, 15).

Computer tomography findings include parenchymal enlargement and destruction, small bubbly or linear streaks of gas fluid collections, gas-fluid levels, and focal tissue necrosis with or without abscess (**Figure no.5**).

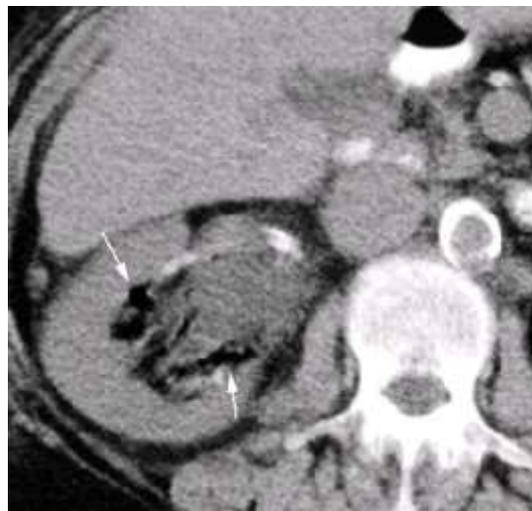


Figure no. 6:
Emphysematous right pyelitis. CT demonstrates collections of air within the central collecting systems (arrows)

Use of computer tomography allows accurate differentiation of emphysematous pyelitis from emphysematous pyelonephritis.

Pyonephrosis is an infected and obstructed collecting system, which frequently is enlarged. In the adult population, the obstruction may arise from a variety of disease processes such as calculi, tumor, complications from pyelonephritis or strictures (9, 14, 15). Early diagnosis is crucial because direct, immediate intervention is required in these patients. If pyonephrosis is left untreated, a rapid, often permanent, decline in renal function may result, and patients not uncommonly develop septic shock (10). Computer tomography evaluation be used to look for dilatation of the pelvicaliceal system, collecting system debris, fluid-fluid levels within the collecting system (**Figure no.7**).

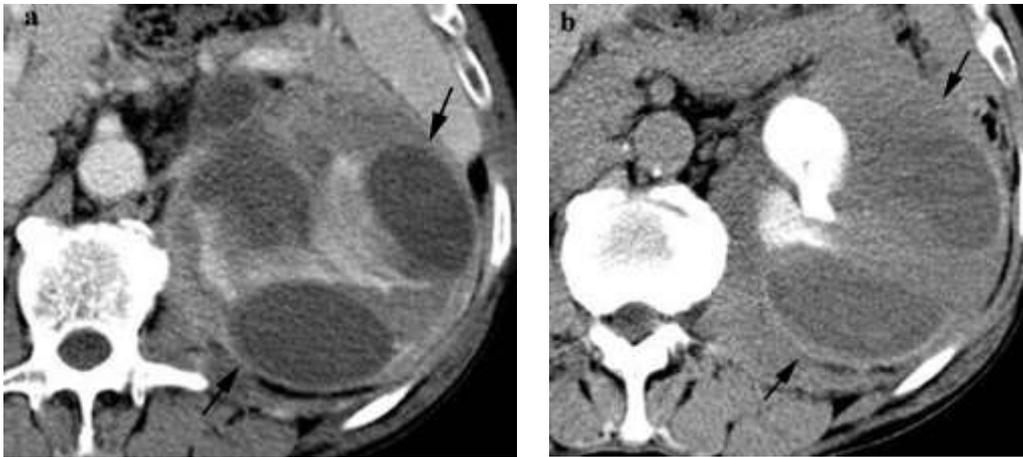


Figure no.7a, 7b:

Pyonephrosis. Enhanced helical CT scan shows a diffusely enlarged left kidney with the parenchyma replaced by multiple hypoattenuating, representing dilated calices or abscesses (arrows) (a, b).

Xanthogranulomatous Pyelonephritis is a chronic renal inflammatory disease that arises from an abnormal host response to bacterial infection (most often *Escherichia coli* or *Proteus mirabilis*) and results in parenchymal destruction and replacement with lipid-laden macrophages (10, 11, 12). There is variable involvement of the perinephric space and beyond (11).

Typical patient with xanthogranulomatous pyelonephritis is a middle-aged woman who presents with recurrent fever and flank pain (11, 13). Obstruction from renal calculus disease is present in up to 70% of cases (11, 14, 15). Xanthogranulomatous pyelonephritis can simulate an infiltrative neoplasm. Computer tomography combination of a nonfunctioning enlarged kidney, a central calculus within a contracted renal pelvis, expansion of the calices, and

inflammatory changes in the perinephric fat is strongly suggestive of xanthogranulomatous pyelonephritis (**Figure no.8**).

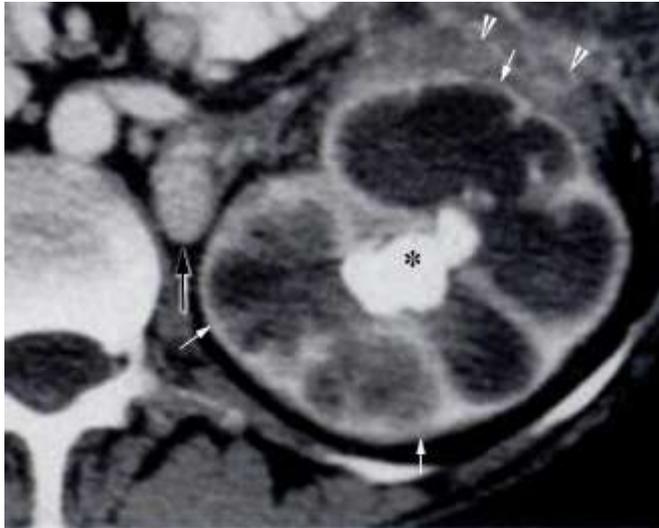


Figure no.8:
Xanthogranulomatous pyelonephritis. Contrast-enhanced CT scan demonstrates left renal pelvis calculi (), with distention of the left collecting system (arrows) and extension of the inflammation into the perirenal space (arrowhead); enlarged lymphadenopathy (black arrow).*

Conclusions

Assessment of severe renal inflammatory disease can be a difficult diagnostic problem.

Computer tomography is an important tool in the diagnosis and management of patients with inflammatory kidney lesions. Computer tomography is recommended if there is: 1. persistence of symptoms despite antibiotic therapy; 2. predisposing conditions, such as urinary tract obstruction, debilitating disease, history or immune incompetence; 3. suspicion of a renal or flank mass on another radio-imaging method (urography or ultrasound evaluation) or physical examination.

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