# AMSER Case of the Month September 2025

## An inpatient 76-year-old male with worsening mental status and fever

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# Patient Presentation

- A 76-year-old male with a past medical history of stage IV B-cell lymphoma, deceased-donor kidney transplant (27 years prior), Crohn's disease, chronic Foley catheter placement (last exchanged 2 months prior to admission), and type 2 diabetes mellitus presented to the ED with altered mental status.
- The patient was found to have hyponatremia, with a sodium level of 108, and was admitted for aggressive fluid management to improve sodium levels to ~134. However, despite electrolyte correction, the patient began to re-experience altered mental status and developed a new fever mid-admission.

# Patient on Physical examination

Vital signs:

- 99.6 °F, HR 99, RR 23, BP 111/46, SpO2 95%

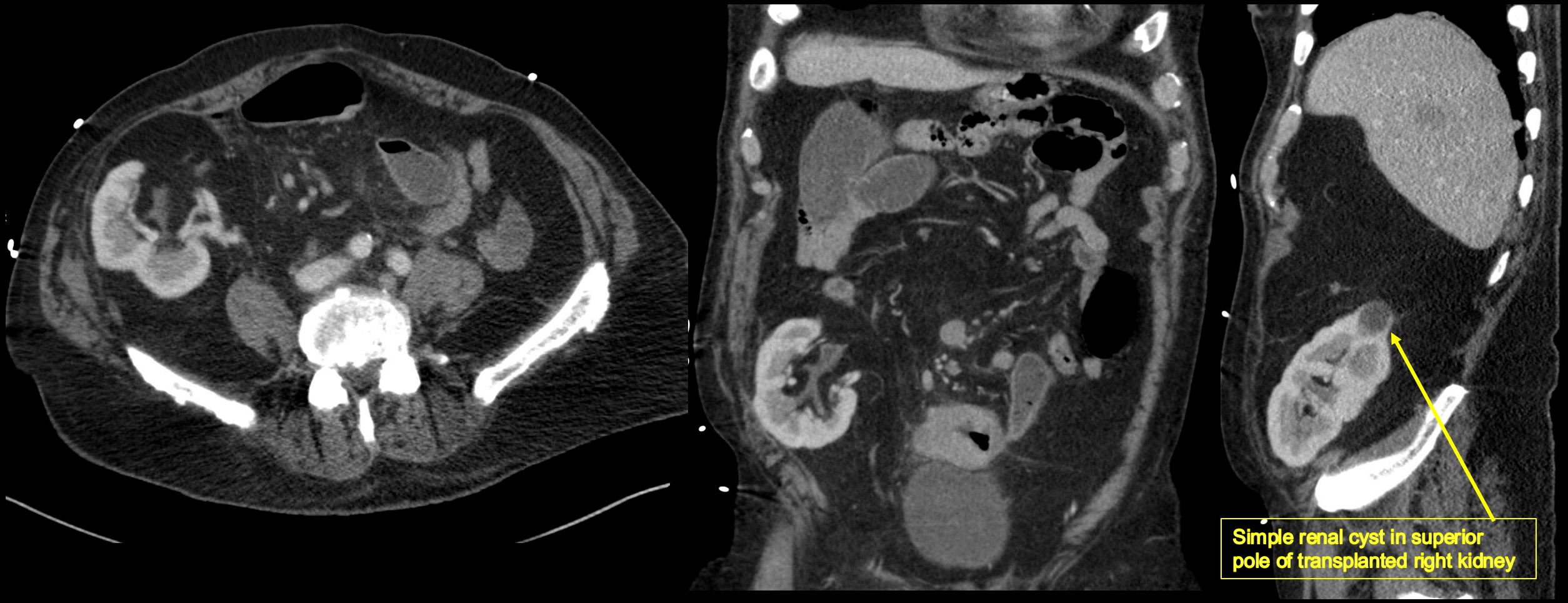
Pertinent physical exam findings:

- Altered mental status, but not in acute distress
- Coarse bilateral crackles with poor air entry
- Abdominal distension
- Bilateral edema

# Pertinent Labs

- Hgb: 7.2
- WBC: 22,000
- Sodium: 134
- Glucose: 150
- BUN/CR ratio: 52/1.8
- BUN: 32
- Cr: 1.52 (baseline: ~1.05)
- Urinalysis: Indicative of an infectious etiology

# Prior imaging from an outside institution 14 days prior (labeled):




CT Abdomen and Pelvis W/ IV contrast performed at an outside institution (labeled) with axial, coronal, and sagittal views, respectively demonstrating a right lower quadrant transplanted kidney with no prominent abnormalities.

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# What Imaging Should We Order?

# Select the applicable ACR Appropriateness Criteria

**Variant 5:** **Suspected acute pyelonephritis. History of pelvic renal transplant with native kidneys in situ and no other complications (eg, no history of pyelonephritis, diabetes, history of stones or renal obstruction, prior renal surgery, advanced age, vesicoureteral reflux, lack of response to therapy, or pregnancy). Initial imaging.**

| Procedure | Appropriateness Category | Relative Radiation Level |
|---|---|---|
| US duplex Doppler kidney transplant | Usually Appropriate | O |
| CT abdomen and pelvis with IV contrast | Usually Appropriate | ☢☢☢ |
| MRI abdomen and pelvis without and with IV contrast | May Be Appropriate | O |
| MRI abdomen and pelvis without IV contrast | May Be Appropriate | O |
| CT abdomen and pelvis without IV contrast | May Be Appropriate | ☢☢☢ |
| CT abdomen and pelvis without and with IV contrast | May Be Appropriate | ☢☢☢☢ |
| US abdomen | Usually Not Appropriate | O |
| US color Doppler kidneys and bladder retroperitoneal | Usually Not Appropriate | O |
| Fluoroscopy voiding cystourethrography | Usually Not Appropriate | ☢☢ |
| Radiography abdomen and pelvis | Usually Not Appropriate | ☢☢ |
| Fluoroscopy antegrade pyelography | Usually Not Appropriate | ☢☢☢ |
| Radiography intravenous urography | Usually Not Appropriate | ☢☢☢ |
| MRI abdomen without and with IV contrast | Usually Not Appropriate | O |
| MRI abdomen without IV contrast | Usually Not Appropriate | O |
| MRI pelvis without and with IV contrast | Usually Not Appropriate | O |
| MRI pelvis without IV contrast | Usually Not Appropriate | O |
| MRU without and with IV contrast | Usually Not Appropriate | O |
| MRU without IV contrast | Usually Not Appropriate | O |
| CT abdomen with IV contrast | Usually Not Appropriate | ☢☢☢ |
| CT abdomen without IV contrast | Usually Not Appropriate | ☢☢☢ |
| DMSA renal scan | Usually Not Appropriate | ☢☢☢ |
| CT abdomen without and with IV contrast | Usually Not Appropriate | ☢☢☢☢ |
| CTU without and with IV contrast | Usually Not Appropriate | ☢☢☢☢ |

This imaging modality was ordered by the IP physician

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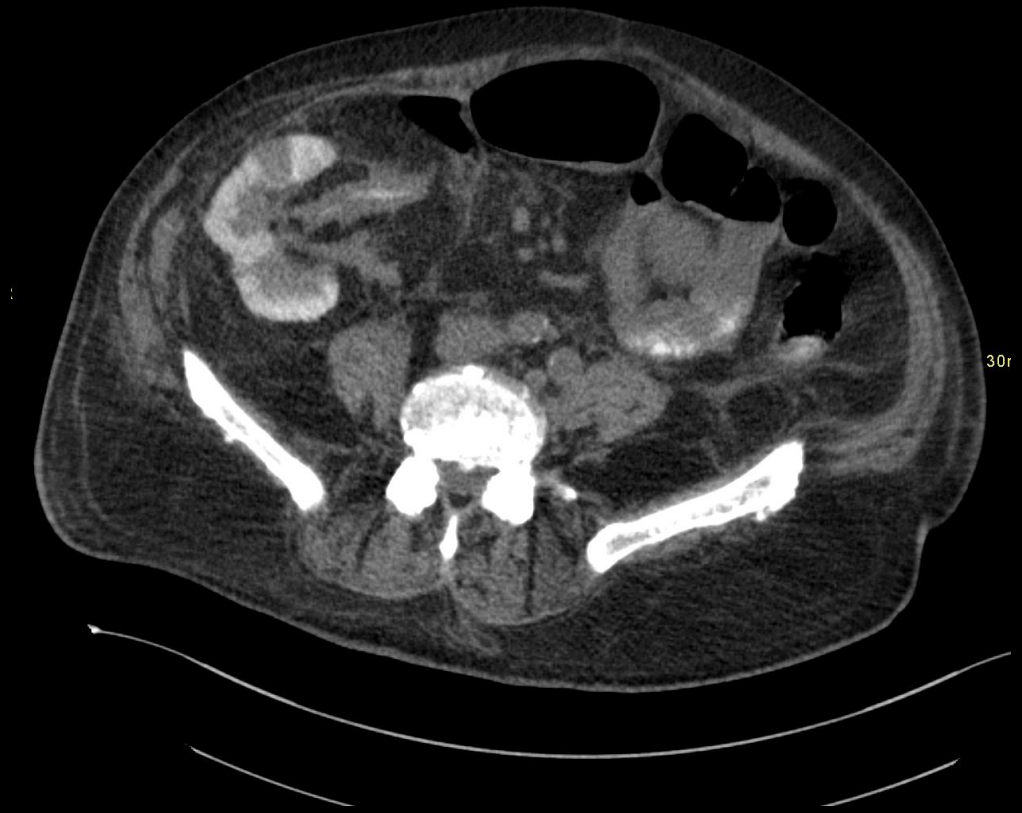
# Current non-contrast imaging obtained (unlabeled):



CT Abdomen and Pelvis WO/ IV contrast performed at our institution (14 days after prior imaging) with axial, coronal, and sagittal views, respectively.

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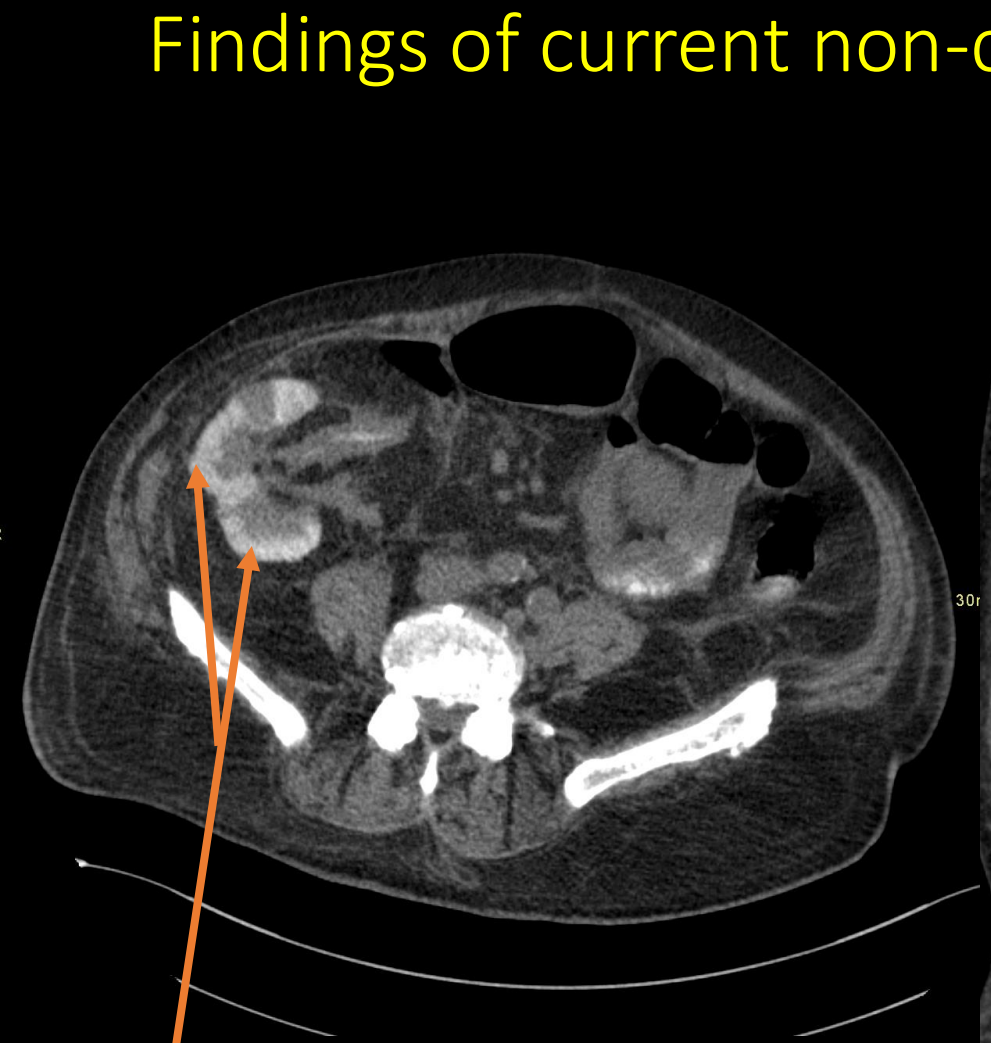
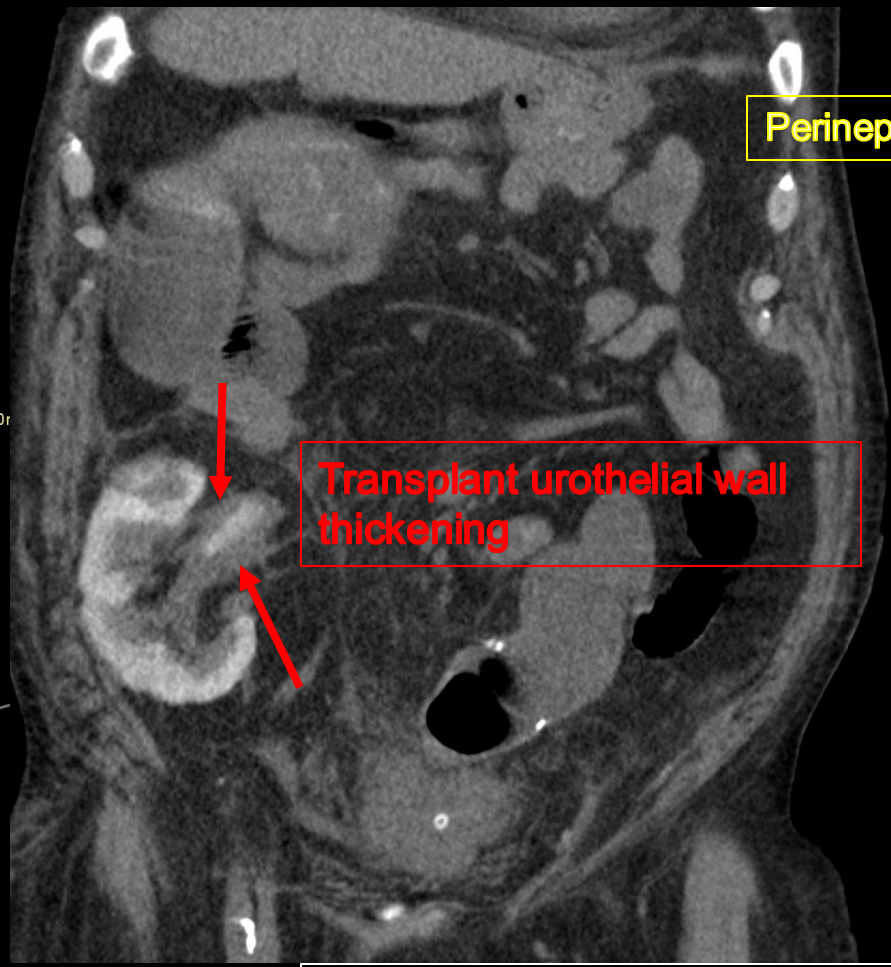
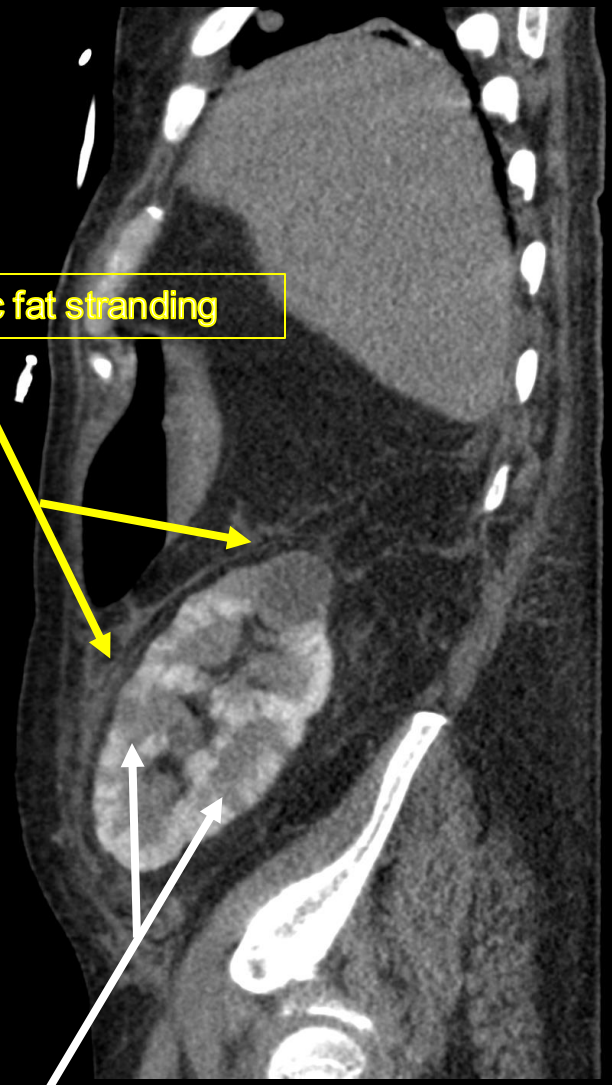
# Findings of current non-contrast CT study (labeled):



"Persistent nephrogram" on non-contrast scan (retention of contrast in renal transplant cortex)




Wedge-shaped hypodense areas in the parenchyma ("striated nephrogram")

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# Final Dx:

Acute pyelonephritis of
right lower quadrant transplant kidney

# Acute Pyelonephritis

- Acute pyelonephritis (APN) is a bacterial infection of the renal pelvis and parenchyma. The most common route of infection is through an ascending urinary tract infection (UTI). [1]

- There are 250,000 cases of APN reported annually in the US. [2]

- It is important to distinguish between complicated and uncomplicated pyelonephritis for appropriate patient management and disposition. Complicated cases include patients with kidney transplants, pregnant women, patients with uncontrolled diabetes, urinary anatomical abnormalities, acute or chronic kidney failure, as well as immunocompromised patients, and those with hospital-acquired bacterial infections. [1,3]

- Patients with renal transplants are at particularly increased risk of infection due to a mix of chronic immunosuppression and altered transplant anatomy. One study highlighted a 45% higher risk of transplant graft loss and death after an episode of APN. [1]

# Acute Pyelonephritis

- The most common symptoms of acute pyelonephritis are fever and flank pain. Other symptoms can include chills, nausea, vomiting, anorexia, dysuria, increased urinary frequency, and urinary urgency. [3]

- Elderly patients may present with altered mental status, fever, loss of appetite, renal failure, or damage to other organ systems. [1]

- Most patients with uncomplicated APN are managed in the outpatient setting, however there is significant morbidity and mortality (up to 20% in some studies) in severe or complicated cases. [1]

# Imaging for suspected acute pyelonephritis

- Imaging is typically not needed in uncomplicated patients with suspected pyelonephritis. However, in patients considered high-risk (i.e. poorly controlled diabetes, transplant recipients, immunocompromise, etc.), imaging may be beneficial. [4]

- A classic finding of APN on contrast-enhanced CT scan is focal, wedge-shaped hypoattenuating areas (striated nephrogram). Additionally, fat stranding and enlargement of the kidney can be seen. [1]

# Imaging for suspected acute pyelonephritis

- Non-contrast CT may be obtained as an alternative if there is concern for worsening renal function in the setting of acute kidney injury, however there are limitations in detection of parenchymal involvement and renal abscesses. [5]

- On non-contrast exams, one indication of poor kidney clearance is persistent nephrogram. It occurs after IV contrast exposure from a prior contrast bolus and refers to the persistence of contrast enhancement in the renal cortex. It can indicate impaired contrast clearance and renal function. [6]

- In our case, the patient displayed a striated cortical appearance due to wedge-shaped defects, that were visible due to the persistent nephrogram (14 days after initial contrast exposure). This helped better highlight classic imaging findings of APN that would otherwise be challenging to identify on a non-contrast exam.

# References:


1. Belyayeva M, Leslie S., Jeong J. Acute pyelonephritis. StatPearls [Internet]. StatPearls Publishing; Feb 28, 2024.
2. Medina M, Castillo-Pino E. An introduction to the epidemiology and burden of urinary tract infections. Ther Adv Urol. 2019 Jan-Dec;11:1756287219832172.
3. Sabih A, Leslie SW. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Dec 7, 2024. Complicated Urinary Tract Infections.
4. Expert Panel on Urological Imaging. Smith AD, Nikolaidis P, Khatri G, Chong ST, De Leon AD, Ganeshan D, Gore JL, Gupta RT, Kwun R, Lyshchik A, Nicola R, Purysko AS, Savage SJ, Taffel MT, Yoo DC, Delaney EW, Lockhart ME. ACR Appropriateness Criteria® Acute Pyelonephritis: 2022 Update. J Am Coll Radiol. 2022 Nov;19(11S):S224-S239.
5. Lee A, Kim HC, Hwang SI, et al. Clinical Usefulness of Unenhanced Computed Tomography in Patients with Acute Pyelonephritis. J Korean Med Sci 2018;33:e236.
6. Modi K, Padala SA, Gupta M. Contrast-Induced Nephropathy. StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; Jan 4, 2025.


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