

AMSER Case of the Month

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62-year-old Female Presenting with Weakness

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Patient Presentation

- **History of Present Illness:** A 62-year-old female presented to the emergency department with weakness, heat intolerance and back pain, with acute hypotension occurring during ED visit.
- **Medical History:** Hypothyroidism
- **Surgical History:** Bilateral breast reductions
- **Social History:** Few alcoholic drinks on weekends. No tobacco or illicit drug use.
- **Physical Exam:** Afebrile, tachycardic, hypotensive with systolic of 80, right costovertebral tenderness

Pertinent Studies

- **Comprehensive Metabolic Panel:** Potassium of 3.0, BUN of 41, creatinine of 1.87
- **Complete Blood Count:** Leukocytosis of 33.7 with neutrophilic predominance, otherwise within normal limits.
- **Urinalysis:** Proteinuria, hematuria, leukocytes, and bacteriuria
- **Urine Culture:** *E. coli*
- **Blood Culture:** *E. coli*
- **Imaging:** CTA with contrast ordered for acute hypotension showed enlarged, hypodense right kidney. Otherwise, no acute findings.

What Imaging Should We Order?

Select the applicable ACR Appropriateness Criteria

Variant 3: Suspected or confirmed sepsis. Acute abdominal pain. Initial imaging.

| Procedure | Appropriateness Category | Relative Radiation Level |
|---|-----------------------------------|--------------------------|
| CT abdomen and pelvis with IV contrast | Usually Appropriate | ⊗⊗⊗ |
| US abdomen | May Be Appropriate | ○ |
| CT abdomen and pelvis without IV contrast | May Be Appropriate (Disagreement) | ⊗⊗⊗ |
| Radiography abdomen | Usually Not Appropriate | ⊗ |
| Fluoroscopy contrast enema | Usually Not Appropriate | ⊗⊗⊗ |
| Fluoroscopy upper GI series with small bowel follow-through | Usually Not Appropriate | ⊗⊗⊗ |
| MRI abdomen and pelvis without and with IV contrast | Usually Not Appropriate | ○ |
| MRI abdomen and pelvis without IV contrast | Usually Not Appropriate | ○ |
| Nuclear medicine scan gallbladder | Usually Not Appropriate | ⊗⊗ |
| CT abdomen and pelvis without and with IV contrast | Usually Not Appropriate | ⊗⊗⊗⊗ |
| FDG-PET/CT skull base to mid-thigh | Usually Not Appropriate | ⊗⊗⊗⊗ |
| WBC scan abdomen and pelvis | Usually Not Appropriate | ⊗⊗⊗⊗ |

This imaging modality was ordered by the ED physician

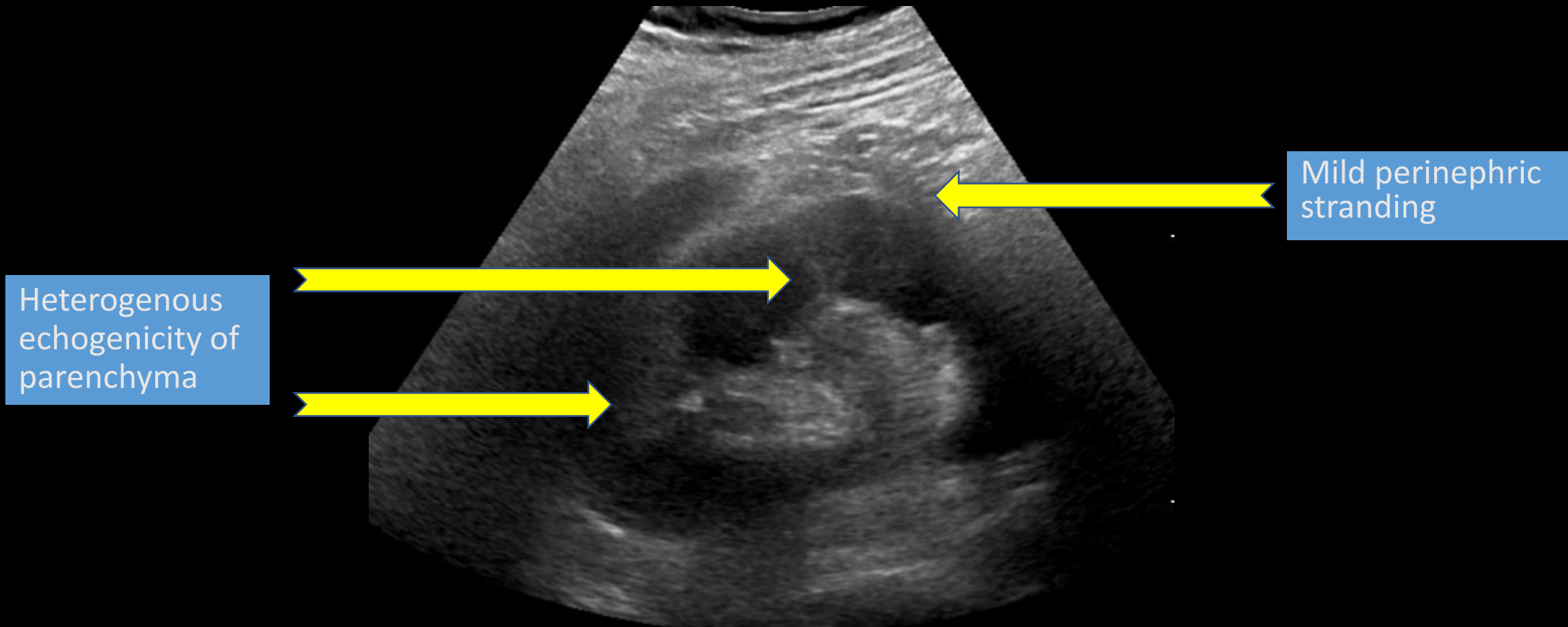


Findings (unlabeled)



Long Right Kidney Mid

Findings: (labeled)



Heterogenous echogenicity of parenchyma

Mild perinephric stranding

Long Right Kidney Mid

Interval History

- **Progress Update:** The patient was admitted for antibiotic treatment of sepsis secondary to acute pyelonephritis. After 3 days of treatment, patient showed no improvement in symptoms or physical examination.
- **Labs on day 3:** Bicarbonate of 13, BUN 82, creatinine 2.19, WBC 34.5

What Imaging Should We Order?

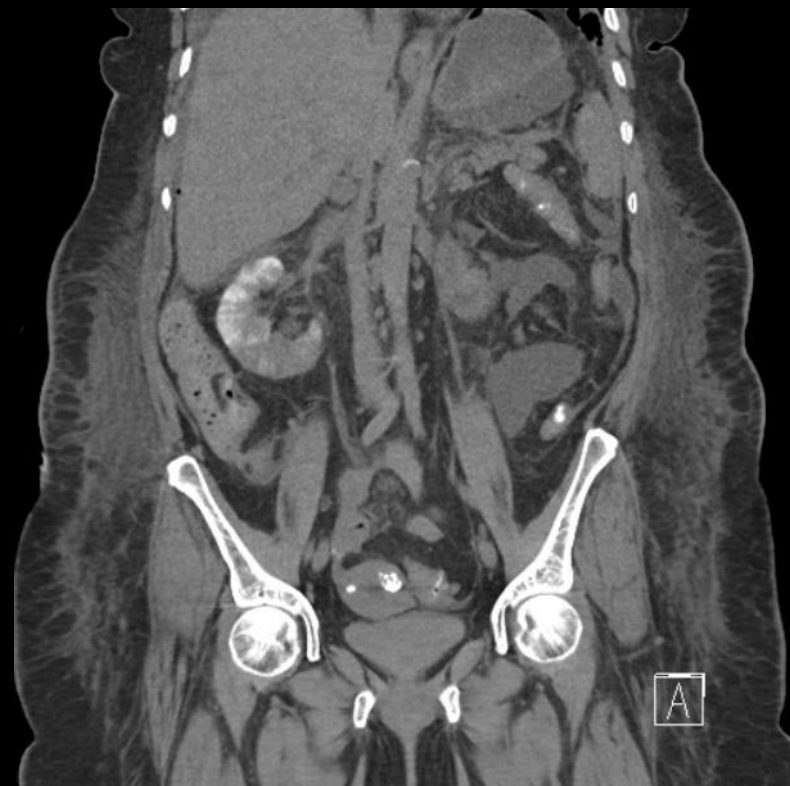
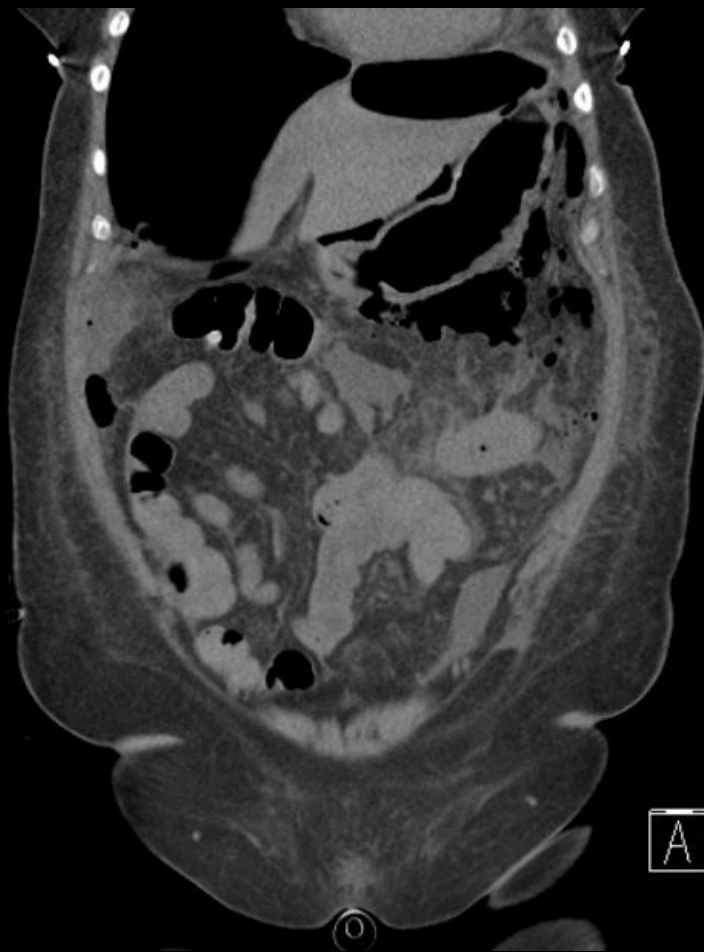
Select the applicable ACR Appropriateness Criteria

Variants 2: Suspected acute pyelonephritis. Complicated patient (eg, recurrent pyelonephritis, diabetes, immune compromise, advanced age, vesicoureteral reflux, or lack of response to initial therapy). Initial imaging.

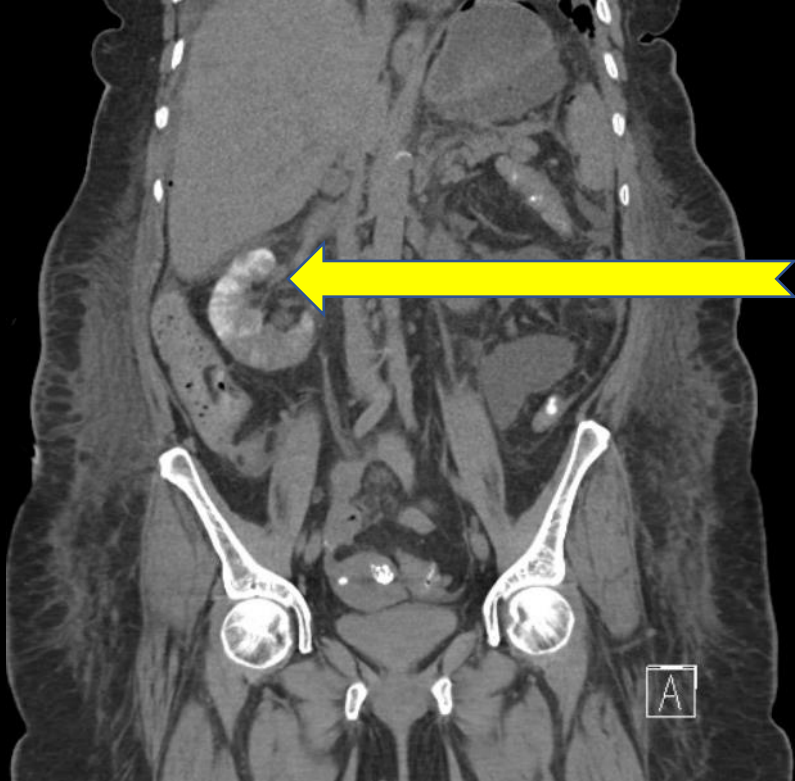
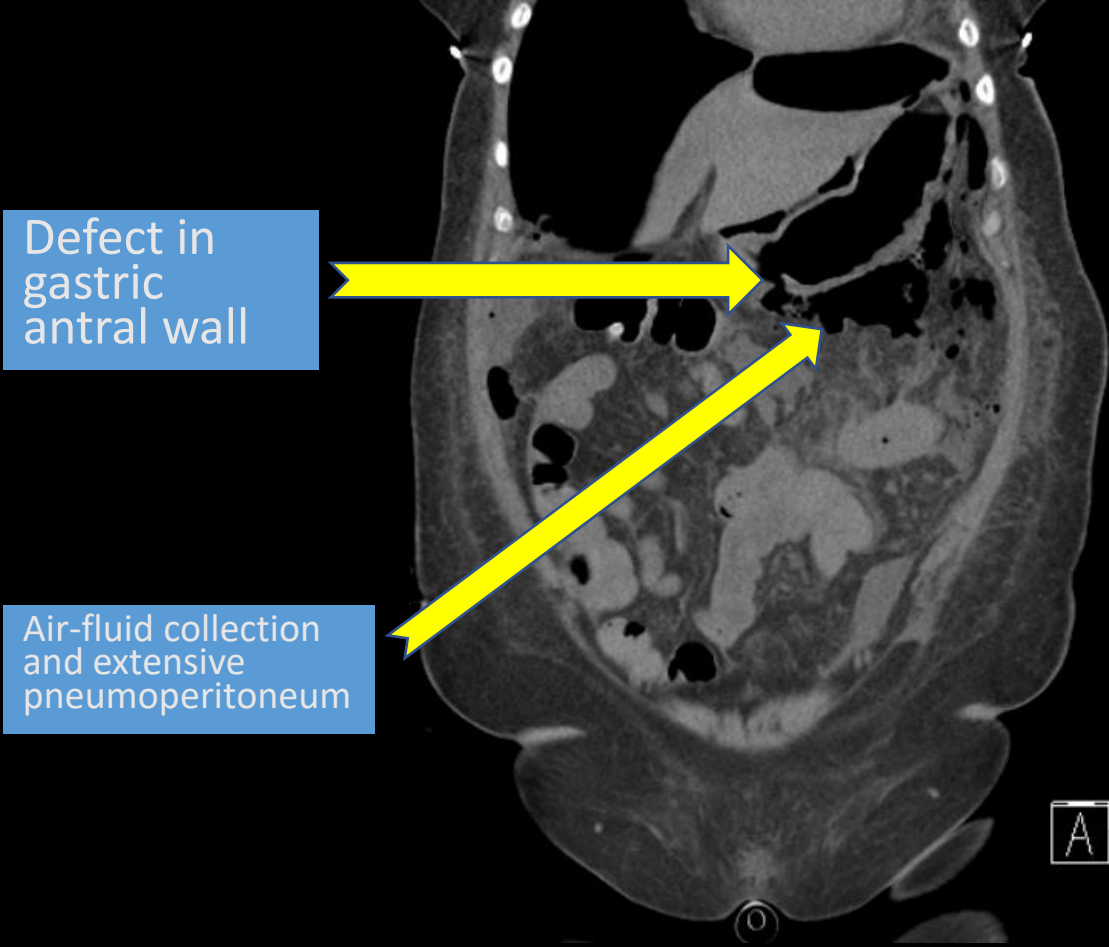
| Procedure | Appropriateness Category | Relative Radiation Level |
|--|-----------------------------------|--------------------------|
| CT abdomen and pelvis with IV contrast | Usually Appropriate | ⊕⊕⊕ |
| US abdomen | May Be Appropriate | ○ |
| US color Doppler kidneys and bladder retroperitoneal | May Be Appropriate | ○ |
| MRI abdomen and pelvis without and with IV contrast | May Be Appropriate | ○ |
| MRI abdomen and pelvis without IV contrast | May Be Appropriate | ○ |
| CT abdomen and pelvis without IV contrast | May Be Appropriate | ⊕⊕⊕ |
| CT abdomen with IV contrast | May Be Appropriate (Disagreement) | ⊕⊕⊕ |
| CT abdomen and pelvis without and with IV contrast | May Be Appropriate (Disagreement) | ⊕⊕⊕⊕ |
| 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 | ○ |
| MRI abdomen without IV contrast | Usually Not Appropriate | ○ |
| MRU without and with IV contrast | Usually Not Appropriate | ○ |
| MRU without 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 inpatient hospitalist

Findings (unlabeled)



Findings: (labeled)



Final Dx:

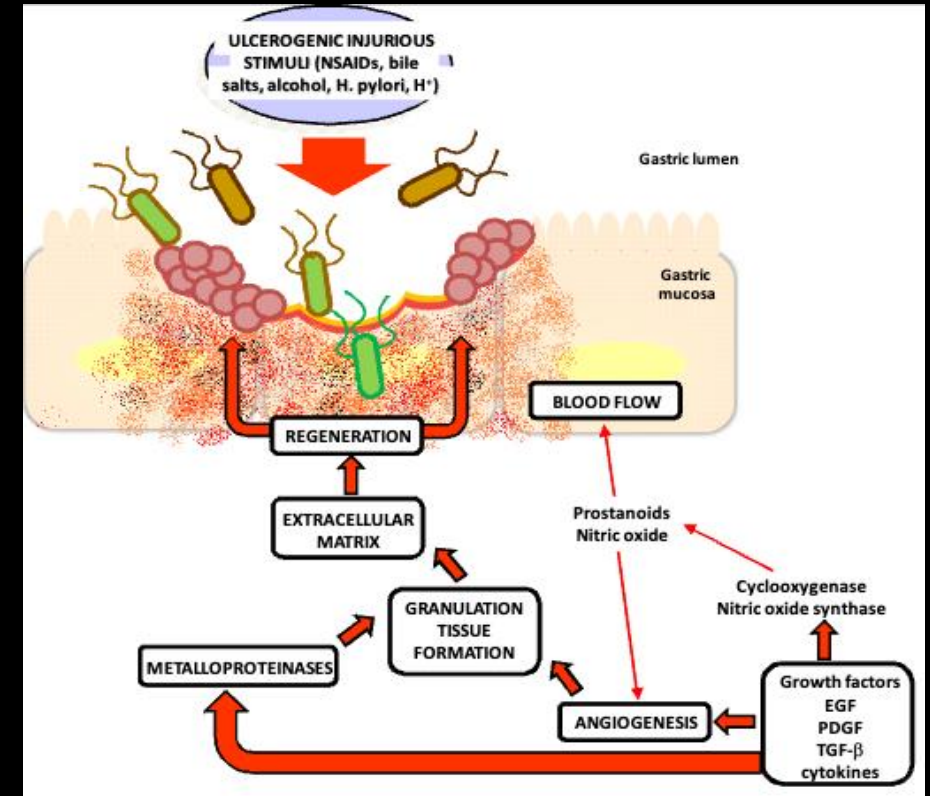
Pyelonephritis and Incidental Perforated Gastric
Antral Ulcer

Case Discussion: Imaging in Pyelonephritis

- Grayscale US is not sensitive for diagnosing uncomplicated pyelonephritis and is often normal. However, sometimes regions of altered echotexture may be evident.
- Acute pyelonephritis may present with a striated nephrogram on CT imaging with contrast
- Initially, the striated appearance is due to decreased enhancement in areas with increased parenchymal pressures
- Delayed imaging, however, will show increased enhancement in these areas when compared to normal tissue due to hyper-concentration of contrast in the setting of tubular stasis
- Differentials for unilateral striated nephrograms include pyelonephritis, acute tubular necrosis, ureteral obstruction, renal vein thrombosis, and ischemia
- Persistence of striated nephrogram after 24 hours may occur in patients with renal dysfunction secondary to the above etiologies due to obstructive patterns and tubular stasis
- Although imaging is not necessary to diagnose pyelonephritis, lack of improvement after 72 hours of appropriate treatment warrants imaging to assess for complications such as hydronephrosis or abscess
- In this case, the lack of clinical improvement was due to the incidentally found gastric perforation

Case Discussion: Pathophysiology of Peptic Ulcer Disease

- Caused by damaging stimuli to gastric mucosa that outweigh protective factors cause ulceration
 - Damaging stimuli may include NSAIDs, tobacco, alcohol, and H. pylori infection
 - Protective factors include mucinous barrier, prostaglandins, blood flow and cell regeneration
- Lifetime prevalence of PUD estimated to be 5-10%
- Ulcers may perforate
 - Full thickness injury of gastric or bowel wall with leakage of contents



Reference 2

Case Discussion: Presentation and Prognosis of Ulcer Perforation

Presentation

- **Symptoms:** Sudden, diffuse abdominal pain
- **Physical Exam:** Fever, tachycardia, hypotension, generalized abdominal tenderness with rigidity
- **Labs:** Neutrophilic leukocytosis, lactic acidosis
- **Imaging findings:** CT abdomen pelvis with IV contrast for confirmation, upright abdominal X-ray if too unstable for CT
 - CT: pneumoperitoneum, loss of gastric or bowel wall integrity, fat stranding
 - X-Ray: free intraperitoneal air
- **Prognosis:** Estimated 30 day mortality of 24%
 - Prognostic factors: delayed diagnosis, age, comorbidities, American Society of Anesthesiologists (ASA) score, Boey score

Prognosis

- **Mortality:** estimated 30-day rate of 24%
- **Prognostic factors:** delayed diagnosis, age, American Society of Anesthesiologists (ASA) score, Boey score (shown below)

| Risk factors | Points |
|--|--------|
| Time from perforation to admission >24 hours. | 1 |
| Pre-op SBP <100 mmHg. | 1 |
| Any one or more systemic illness : heart disease, liver disease, renal disease, DM | 1 |
| Mortality : Score 0 = 0%, 1 = 10%, 2 = 45.5%, 3 = 100% | |

Reference 5

Case Discussion: Treatment of Ulcer Perforation

Treatment

- NPO diet for bowel rest
- Two large bore IV's for resuscitation due to risk for rapid development of hypotension and shock
- Type and cross blood for possible transfusions
- Proton pump inhibitors may facilitate healing and bleeding cessation
 - Efficacy not fully established
- Broad spectrum antibiotics due to risk for resulting sepsis, especially in patients meeting SIRS criteria
 - Sepsis accounts for up to 50% of all mortality in these patients
- Definitive management with early, emergent surgical repair

References:

1. Saunders HS, Dyer RB, Shifrin RY, Scharling ES, Bechtold RE, Zagoria RJ. The CT nephrogram: implications for evaluation of urinary tract disease. *RadioGraphics*. 1995;15(5):1069-1085. doi:<https://doi.org/10.1148/radiographics.15.5.7501851>
2. Fornai M, Antonioli L, Colucci R, Tuccori M, Blandizzi C. Pathophysiology of Gastric ulcer Development and healing: molecular mechanisms and novel therapeutic options. In: *InTech eBooks*. ; 2011. doi:10.5772/17640
3. Stern E, Sugumar K, Journey JD. *StatPearls Publishing* . Treasure Island, FL: StatPearls Publishing; 2022. Peptic ulcer perforated; p. 7
4. Unver M, Fırat Ö, Ünalp ÖV, Uğuz A, Gümüş T, Sezer TÖ, Öztürk Ş, Yoldaş T, Ersin S, Güler A. Prognostic factors in peptic ulcer perforations: a retrospective 14-year study. *Int Surg*. 2015 May;100(5):942-8. doi: 10.9738/INTSURG-D-14-00187.1. PMID: 26011220; PMCID: PMC4452989.
5. Nichakankitti N, Athigakunagorn J. The accuracy of prognostic scoring systems for post-operative morbidity and mortality in patients with perforated peptic ulcer. *International Surgery Journal*. January 2016:286-290. doi:10.18203/2349-2902.isj20160244