

# Diagnostic Imaging Pathways - Loin Pain (Acute Pyelonephritis)

## Population Covered By The Guidance

This pathway provides guidance for imaging adult patients with acute loin pain suspected to be due to acute pyelonephritis.

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## Quick User Guide

Move the mouse cursor over the **PINK** text boxes inside the flow chart to bring up a pop up box with salient points.

Clicking on the **PINK** text box will bring up the full text.

The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

### SYMBOL



### RRL

None

### EFFECTIVE DOSE RANGE

0



Minimal

< 1 millisieverts



Low

1-5 mSv



Medium

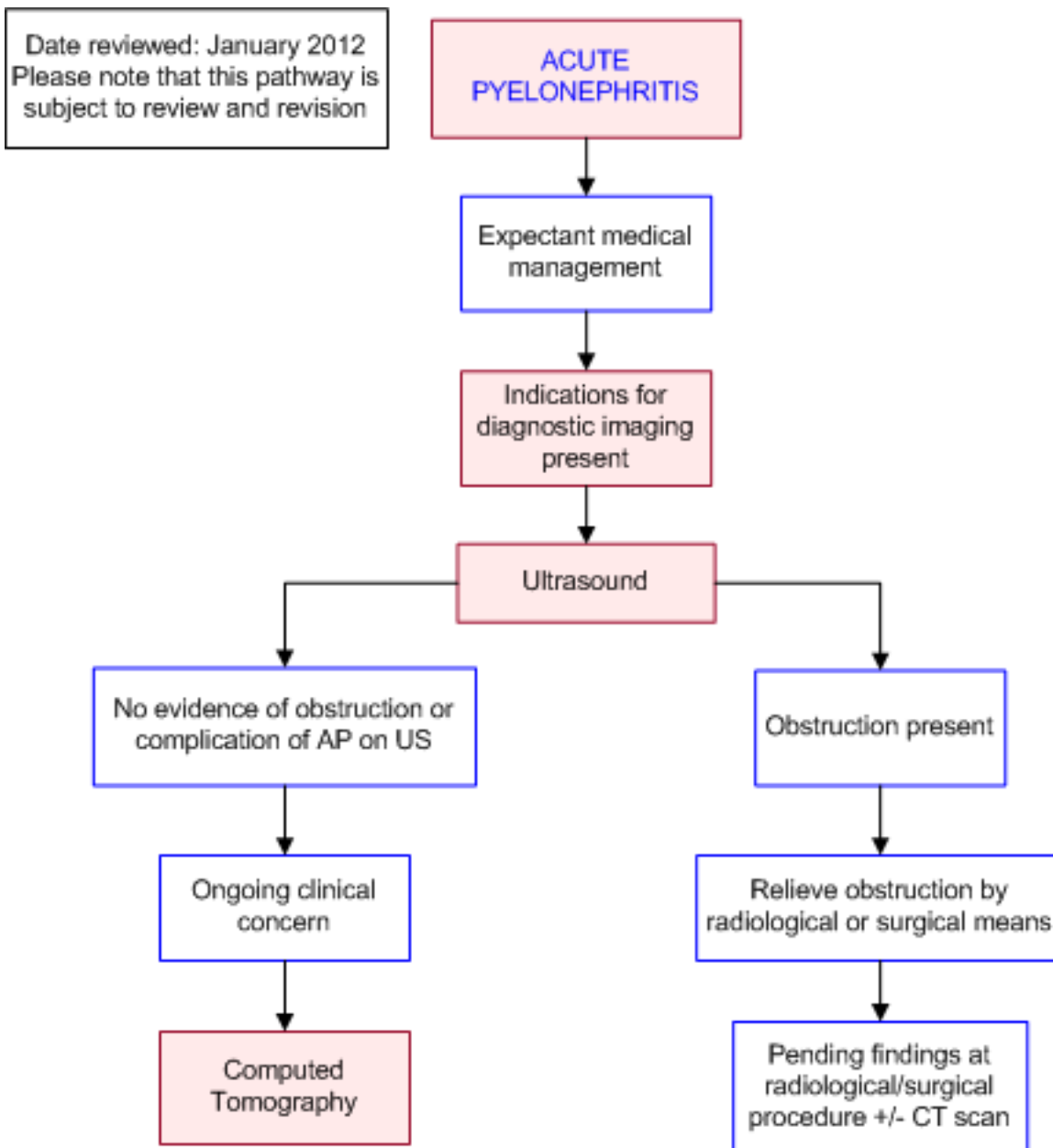
5-10 mSv



High

>10 mSv

## Pathway Diagram



## Image Gallery

*Note: These images open in a new page*

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### Acute Pyelonephritis

Image 1 (Computed Tomography): Contrast enhanced CT in the cortical phase shows wedge shaped low attenuation lesion in an enlarged right kidney.

## Teaching Points

- Imaging in uncomplicated acute pyelonephritis is usually not indicated. However, in clinical practice

it is common to perform an ultrasound early in the course of the disease

- Ultrasound is the initial imaging modality of choice in suspected acute pyelonephritis
- Computed Tomography is an alternative more sensitive investigation in suspected acute pyelonephritis

## Acute Pyelonephritis

- Acute pyelonephritis is due to bacterial or fungal infection that causes tubulo-interstitial inflammation of the renal parenchyma [1](#)
- The diagnosis is suggested by the typical features of urinary frequency/dysuria, flank tenderness and high grade fever accompanied by typical laboratory and microbiological findings [2](#)
- Acute pyelonephritis typically occurs as a result of ascending infection from the bladder and is due to gram-negative organisms. Haematogenous spread to the kidneys occurs less commonly (IVDU, endocarditis and skin infections) and in these cases gram positive organisms are usually present
- The majority of cases of pyelonephritis are diagnosed clinically, with appropriate confirmatory evidence from laboratory and microbiological tests. Routine imaging is not advocated in uncomplicated cases of acute pyelonephritis (90% of cases). [1](#) In practice however, the majority of patients will have an ultrasound of the renal tract early in the course of their presentation

## Computed Tomography (CT)

- Patients who have no evidence of obstruction on ultrasound, but clinically are not improving should be considered for a CT scan. [5,6,7,8](#) This is especially the case for patients with 'high risk' features described above
- CT is superior in the detection of acute pyelonephritis or its complications. Several studies have shown that ultrasonography may miss subtle changes of acute pyelonephritis or underestimate its severity. [5,6,7](#) Therefore if persistent clinical suspicion remains following an unremarkable ultrasound, CT is indicated
- Pre and post contrast CT should be undertaken, based on the patients renal function
  - The un-enhanced CT scan can detect calculi, gas formation, haemorrhage, parenchymal calcifications, obstruction, renal enlargement and inflammatory masses. In many cases however, the kidney will appear normal and contrast enhanced scans should be performed
  - Contrast enhanced scans enables different phases of excretion to be studied. Typical features of acute pyelonephritis or its complications (e.g. renal abscess, emphysematous pyelonephritis) are readily appreciated

## Diagnostic Imaging Indications in Acute Pyelonephritis

There are several indications for prompt imaging in suspected acute pyelonephritis

- When the diagnosis is uncertain/equivocal
- If obstruction of the collecting system is suspected, investigation is required to prevent destruction of the renal parenchyma and irreversible loss of renal function
- Patients who have an underlying anatomical predisposition that may predispose to complications of acute pyelonephritis (eg known congenital abnormalities)
- Patients with recurrent acute pyelonephritis
- 'High Risk' patients who are more susceptible to occult infection or complications of acute



pyelonephritis. This includes individuals with diabetes mellitus, elderly patients, patients who are immunosuppressed or on immunosuppressant therapy and renal transplant patients

- Patients who fail to respond to culture sensitive intravenous antibiotics after 72hrs of therapy

## Ultrasound

- In the adult, hydronephrosis / pyonephrosis is usually due to acute or chronic obstruction secondary to calculus, tumour, stricture or congenital anomaly with super-imposed infection
- Ultrasound is sensitive in the detection of pelvi-calyceal dilation. When pyonephrosis is present, echos and septations secondary to gas forming bacteria or debris may be seen [3,4](#)
- Further imaging may be required prior to/or following decompression via a percutaneous nephrostomy or retrograde ureteric stent placement, in order to establish the cause of obstruction. In this case a CT may be warranted

## References

References are graded from Level I to V according to the Oxford Centre for Evidence-Based Medicine, Levels of Evidence. [Download the document](#)

- [1.](#) Kawashima A, LeRoy A. **Radiologic evaluation of patients with renal infections.** Infect Dis Clin North Am. 2003;17:433-56. (Review article)
- [2.](#) Stucknell H, Buckley O, Feeney J, et al. **Imaging of acute pyelonephritis in the adult.** Eur Radiol. 2007;17:1820-8. (Review article)
- [3.](#) Vourganti S, Agarwal P, Bodner D, et al. **Ultrasonographic evaluation of renal infections.** Radio Clin North Am. 2006;44:763-75. (Review article)
- [4.](#) Kaplan D, Rosenfield A, Smith R. **Advances in the imaging of renal infection.** Infect Dis Clin North Am. 1997;11(3):681-705. (Review article)
- [5.](#) Browne R, Zwirewich, Torreggiani et al. **Imaging of urinary tract infection in the adult.** Eur Radiol. 2004;14:E168-83. (Review article)
- [6.](#) Kawashima A, Sandler C, Goldman S, et al. **CT of renal inflammatory disease.** Radiographics. 1997;17:851-66. (Review article)
- [7.](#) June C, Browning M, Smith P et al **Ultrasonography and computed tomography in severe urinary tract infection.** Arch Intern Med. 1985;145:841-5. (Level II evidence). [View the reference](#)
- [8.](#) Soulen M, Fishman E, Goldman S et al. **Bacterial renal infection: role of CT.** Radiology. 1989;171:703-7. (Level IV evidence)

## Information for Consumers

Information from this website	Information from the Royal Australian and New Zealand College of Radiologists' website
<a href="#">Radiation Risks of X-rays and Scans</a>	<a href="#">Computed Tomography (CT)</a>



[Computed Tomography \(CT\)](#)

[Ultrasound](#)

[Iodine-Containing Contrast Medium](#)

[Radiation Risk of Medical Imaging During Pregnancy](#)

[Radiation Risk of Medical Imaging for Adults and Children](#)

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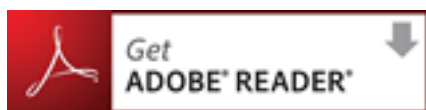
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