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.

Date reviewed: September 2018
Date of next review: September 2021
Published: March 2019

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.

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>RRL</th>
<th>EFFECTIVE DOSE RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Minimal</td>
<td>&lt; 1 millisieverts</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>1-5 mSv</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>5-10 mSv</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>&gt;10 mSv</td>
</tr>
</tbody>
</table>

Pathway Diagram
Acute Pyelonephritis

Image Gallery

Note: These images open in a new page

1

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
- The role of imaging is:
  - To assess for complications or obstruction
  - To assess for underlying predisposing abnormalities
  - Investigate for alternative diagnoses if diagnosis is in doubt
- Ultrasound is commonly the initial imaging modality of choice in suspected acute pyelonephritis because it avoids ionising radiation and IV contrast, but it is less sensitive for complications
- CT 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
- 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
- The majority of cases of pyelonephritis are diagnosed clinically, with appropriate confirmatory evidence from laboratory and microbiological tests, although urine cultures may be negative in as many as 30-76%
- Imaging is not required for diagnosis in uncomplicated pyelonephritis

Imaging Indications in Acute Pyelonephritis

- Routine imaging is not advocated in uncomplicated acute pyelonephritis (90% of cases). However it can be challenging to identify which patients will require intervention without performing imaging studies
  - Studies have found structural abnormalities to be more frequent in patients who were febrile and/or haemodynamically unstable, or have prolonged fever >72h, however in other studies, patients with and without abscesses and structural abnormalities could not be clinically differentiated
  - For this reason, some guidelines suggest all patients should undergo imaging with ultrasound
- The role of imaging is to assess for complications or obstruction, underlying predisposing abnormalities

Some features increase the likelihood of relevant abnormalities on imaging:

- Failure to respond to treatment
  - Initial treatment with suitable antibiotics for 72h is usually appropriate
- Abnormal renal function
- Urolithiasis
- Immunocompromised patients or diabetes mellitus
  - Poorly controlled diabetes increases the risk of emphysematous pyelonephritis, which requires surgical intervention and can be challenging to detect on ultrasound
- Patients with known anatomical abnormalities

Other indications for imaging include:
Recurrent presentations
Single kidney or transplanted kidney
If obstruction of the collecting system is suspected, investigation is required to prevent destruction of the renal parenchyma and irreversible loss of renal function
When the diagnosis is in doubt

Ultrasound

- In the adult, hydronephrosis or 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, echoes and septations secondary to gas forming bacteria or debris may be seen
  - Compared to CT, ultrasound is 78-85% sensitive for hydronephrosis; the sensitivity is higher with larger stones
  - However, ultrasound is significantly less sensitive than CT for demonstrating parenchymal change and abscesses, including gas-forming infections
- 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
- The main advantage of ultrasound is that it avoids ionising radiation, which is especially important as pyelonephritis occurs frequently in younger women
- Disadvantages:
  - Less sensitive than CT
  - Operator dependent

Computed Tomography (CT)

- Contrast-enhanced CT is the most accurate modality for identifying pyelonephritis and its complications
- Several studies have shown that ultrasonography may miss subtle changes of acute pyelonephritis or underestimate its severity, therefore, if persistent clinical suspicion remains following an unremarkable ultrasound, CT is indicated
- Some guidelines recommend CT as the initial investigation of choice
- 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
- The main disadvantage of contrast-enhanced CT is the significant radiation exposure

Low Dose Non-Contrast CT

- Sensitivity of 93-97% and specificity of 86-97% for urolithiasis compared to standard dose CT
- However, contrast-enhanced CT has higher sensitivity for parenchymal changes in acute pyelonephritis
References

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


Information for Consumers

<table>
<thead>
<tr>
<th>Information from this website</th>
<th>Information from the Royal Australian and New Zealand College of Radiologists’ website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiation Risks of X-rays and Scans</td>
<td>Computed Tomography (CT)</td>
</tr>
<tr>
<td>Computed Tomography (CT)</td>
<td>Iodine-Containing Contrast Medium</td>
</tr>
<tr>
<td>Ultrasound</td>
<td>Radiation Risk of Medical Imaging During Pregnancy</td>
</tr>
<tr>
<td></td>
<td>Radiation Risk of Medical Imaging for Adults and Children</td>
</tr>
<tr>
<td></td>
<td>Ultrasound</td>
</tr>
<tr>
<td></td>
<td>Nephrostomy</td>
</tr>
</tbody>
</table>

Copyright

© Copyright 2015, Department of Health Western Australia. All Rights Reserved. This web site and its content has been prepared by The Department of Health, Western Australia. The information contained on this web site is protected by copyright.

Legal Notice

Please remember that this leaflet is intended as general information only. It is not definitive and The Department of Health, Western Australia can not accept any legal liability arising from its use. The information is kept as up to date and accurate as possible, but please be warned that it is always subject to change.
File Formats

Some documents for download on this website are in a Portable Document Format (PDF). To read these files you might need to download Adobe Acrobat Reader.