

Pyelonephritis - acute - Management

Scenario: Diagnosis of acute pyelonephritis

How do I diagnose acute pyelonephritis?

- Acute pyelonephritis is diagnosed in a person with a proven urinary tract infection who has loin pain and/or fever. There are no clinical features or routine investigations that conclusively distinguish acute pyelonephritis from cystitis.
- **Suspect acute pyelonephritis in people with loin pain and/or fever.**
- **Dipstick test the urine for leucocyte esterase and nitrite for evidence of a urinary tract infection (UTI).** For further information, see [Dipstick testing](#).
- If both dipstick tests are negative, a UTI is unlikely.
- If the leucocyte esterase test alone is positive, a UTI is moderately likely.
- If the nitrite test is positive, with or without a positive leucocyte esterase test, a UTI is highly likely.
- **Consider and exclude other causes of loin pain and/or fever** (particularly if both dipstick tests are negative) including:
 - Pelvic inflammatory disease.
 - Appendicitis.
 - Renal calculi.
- **Send a midstream (or catheter) specimen of urine** for culture and sensitivity.
- **A final diagnosis of acute pyelonephritis is made in people with loin pain and/or fever if:**
 - A UTI is confirmed by culturing a urinary pathogen from the urine, *and*
 - Other causes for symptoms have been excluded.

Dipstick testing

Urinary nitrite and leucocyte esterase

- People with acute pyelonephritis have increased numbers of white blood cells and bacteria in their urine.
- Nitrite is produced by most urinary pathogens in contact with urine. A positive nitrite test is strongly suggestive of a urinary tract infection (UTI). A negative result occurs when:

- No pathogens are present.
- Pathogens are present, but were not in contact with urine long enough to produce detectable levels of nitrite.
- Pathogens that do not produce nitrite are present.
 - Leucocyte esterase is present in white blood cells.
- A positive leucocyte esterase test occurs when sufficiently high levels of white blood cells are present in urine, as a response to either infection or contamination.
- A negative leucocyte esterase test occurs either because there is no infection present or because infection is present but the numbers of white blood cells are insufficient to produce a positive result.

Interpretation of urine dipstick tests in people with urinary tract symptoms

- Nitrite positive, and leucocyte esterase positive or negative — over 90% will have a UTI.
- Nitrite negative and leucocyte positive — 50% will have a UTI.
- Nitrite negative and leucocyte negative — 5% will have a UTI.

[[Ramakrishnan and Scheid, 2005](#); [COMPASS, 2007](#)]

Basis for recommendation

Dipstick tests for nitrite and leucocyte esterase

- Experts recommend urinary dipstick tests to detect nitrite and leucocyte esterase to help distinguish people with acute pyelonephritis from those with similar symptoms and signs who do not have a UTI [[SIGN, 2006](#); [COMPASS, 2007](#)].
- Although dipstick tests are not highly sensitive and specific, they help support decisions to start immediate treatment for pyelonephritis or investigate for other causes of symptoms and signs.

Microbiological examination of urine for all people with suspected pyelonephritis

- Experts recommend sending a midstream or catheter specimen of urine for all people with suspected acute pyelonephritis to [[SIGN, 2006](#); [HPA and Association of Medical Microbiologists, 2008](#)] to:
 - Confirm the diagnosis.
 - Guide an appropriate change of treatment if the infection is not sensitive to empirical antibiotics.

Clinical features suggestive of infection localized to the upper urinary tract

- In the absence of more sensitive clinical features or practical clinical tests, experts recommend diagnosing acute pyelonephritis based on evidence of a UTI in a person with loin pain or a temperature over 38°C [[Tomson, 2003](#)].

Pyelonephritis - acute - Management

Scenario: Pyelonephritis - acute

When should I arrange admission for a person with acute pyelonephritis?

- **Admit people who:**
 - Are significantly dehydrated or who are unable to take oral fluids and medications.
 - Have signs of sepsis, including:
 - A temperature greater than 38°C or less than 36°C, *and*
 - Marked signs of illness (such as impaired level of consciousness, profuse sweating, rigors, pallor, significantly reduced mobility), *or*
 - Significant tachycardia, hypotension, or breathlessness.
 - Are pregnant and pyrexial.
 - Are frail, elderly residents in care homes who have recently been hospitalized or who have had recurrent urinary tract infection.
 - Fail to improve significantly within 24 hours of starting antibiotics.
- **Consider admitting people who are able to take oral fluids and medications if they are pyrexial and have a risk factor for developing a complication.** In the absence of any widely accepted admission criteria, clinical judgement on when to admit is required. A low threshold is required for people with:
 - Immunocompromise, due to immunosuppressant drug use, cancer, cancer therapies, or AIDS.
 - A foreign body within the renal tract, including renal stones and ureteric or nephrostomy catheters.

- Abnormalities of renal tract anatomy or function, including vesico–ureteric reflux and polycystic kidney disease.
- Diabetes.
- Renal impairment.
- Advanced age.
- **Manage in primary care** those people with acute pyelonephritis who are:
 - Pyrexial but have no risk factors for developing a complication from acute pyelonephritis.
 - Apyrexial, with or without risk factors for developing a complication.

Basis for recommendation

These recommendations are largely based on expert opinion and limited [evidence](#) of the risk factors for developing complications from acute pyelonephritis.

Absolute indications for hospital admission

- There is expert consensus to arrange admission for people with acute pyelonephritis who:
 - Are unable to take fluid and medications [[Neumann et al, 2008](#)].
 - Have signs of sepsis [[Neumann et al, 2008](#)].
 - Fail to improve within 24 hours of starting antibiotics in primary care [[HPA and Association of Medical Microbiologists, 2008](#)].
- A number of experts recommend arranging admission for all pregnant women with acute pyelonephritis, for at least a short observation period, because of the risk of preterm labour and maternal renal complications [[Ramakrishnan and Scheid, 2005](#)].
- Experts from the Health Protection Agency recommend treatment with ertapenem, or other carbapenem, for frail elderly residents from care homes who have been recently hospitalized or who have recurrent urinary tract infection, because they are at increased risk of having a pathogen resistant to ciprofloxacin and cephalosporins [[Livermore, Personal Communication, 2009](#)]. Treatment requires hospital admission because this antibiotic is only available in an intravenous form and no other suitable oral alternative exists.

Relative indications for hospital admission

- Although experts recommend considering admission for people with a risk factor for developing a complication from acute pyelonephritis, CKS could find no specific criteria as to when to arrange admission for those with:
 - Immunocompromise.
 - A foreign body within the renal tract.
 - Abnormalities of renal tract anatomy or function.
 - Diabetes.
 - Renal impairment.
 - Advanced age.
- Serious complications from acute pyelonephritis can develop rapidly. It is therefore recommended that there should be a low threshold for arranging admission for people with risk factors.

Treatment in primary care

- People without signs of sepsis or risk factors for developing a complication of acute pyelonephritis have a good prognosis. Experts widely recommend treatment of these people in primary care [[Ramakrishnan and Scheid, 2005](#)].
- In the absence of any trial evidence, experts agree that people who are afebrile and appear otherwise well can be considered to be at low risk for developing a serious complication from acute pyelonephritis, whether they have a risk factor or not [[Solomon, Personal Communication, 2009](#); [Wullt, Personal Communication, 2009](#)].

How do I manage a person with suspected acute pyelonephritis in primary care?

- **Arrange admission, if this is indicated.** See [Admission or treatment](#) for further information.
- **Obtain a midstream (or catheter specimen) of urine** for culture and sensitivity testing before starting empirical antibiotics.
- **Prescribe an antibiotic.**
 - For women who are not pregnant, men, and people with indwelling catheters:
 - Treat with ciprofloxacin 500 mg twice daily for 7 days.
 - Co-amoxiclav 500/125 mg three times a day for 14 days is an alternative.

- For pregnant women who do *not* require admission:
- Treat with cefalexin 500 mg twice daily for 10 to 14 days.
- **Treat pain and fever** with paracetamol.
- **Maintain full hydration** — advise sufficient fluid intake to ensure frequent passage of pale-coloured urine.
- **Review 24 hours after starting treatment** and arrange admission if there is any clinical deterioration or the person does not respond to treatment.
- **Review culture and sensitivity results** when they become available, and change the antibiotic if indicated.
- **Consider referral for investigation of an underlying abnormality of the renal tract, for:**
 - Men, following their first episode of acute pyelonephritis.
 - Women, following two or more episodes of acute pyelonephritis.
 - All people with a urinary tract infection caused by *Proteus* species.

Basis for recommendation

Antibiotics

- These recommendations conform with Health Protection Agency (HPA) advice [[HPA and Association of Medical Microbiologists, 2008](#)].
- The HPA recommend ciprofloxacin and co-amoxiclav for the empirical treatment of acute pyelonephritis. This is based on the need to cover the broad spectrum of pathogens that cause acute pyelonephritis, and their excellent kidney penetration. Cefalexin has a reduced spectrum of activity, but is considered to have a better safety profile in pregnant women.
- Although ciprofloxacin, cefalexin, and co-amoxiclav are associated with an increased risk of *Clostridium difficile*, methicillin-resistant *Staphylococcus aureus* (MRSA), and other antibiotic-resistant infections, this has to be balanced against the risk of treatment failure and consequent serious complications with the use of narrower spectrum antibiotics.

Treatment of pain and fever

- Paracetamol is recommended by experts, based on the extrapolation of the effectiveness of paracetamol in the treatment of pain and fever in other conditions [[COMPASS, 2007](#)].
- Nonsteroidal anti-inflammatory drugs are generally not recommended by experts, because they are thought to increase the risk of renal impairment in people with acute pyelonephritis [[COMPASS, 2007](#)].

Maintenance of full hydration

- This is recommended by experts to maintain a high urine output [[COMPASS, 2007](#)], which is believed to help resolve acute pyelonephritis by mechanically flushing the bacteria from the kidney.

Referral for investigation of an underlying risk factor

- Experts recommend investigating people with acute pyelonephritis, especially men, because [[Zandi-Nejad and Brown, 2001](#)]:
 - Men with acute pyelonephritis are more likely to have an underlying abnormality of renal function or anatomy.
 - People with recurrent acute pyelonephritis are more likely to have an underlying abnormality of renal function or anatomy.
 - *Proteus* species is much more common in people with renal calculi.

Prescriptions

For information on contraindications, cautions, drug interactions, and adverse effects, see the electronic Medicines Compendium (eMC) (<http://emc.medicines.org.uk>), or the British National Formulary (BNF) (www.bnf.org).

First-line antibiotics: ciprofloxacin or co-amoxiclav

Age from 16 years onwards

Co-amoxiclav tablets: 500/125mg three times a day

Co-amoxiclav 500mg/125mg tablets
Take one tablet three times a day for 14 days.
Supply 42 tablets.

Age: from 16 years onwards
NHS cost: £12.60
Licensed use: yes

Age from 18 years onwards

Ciprofloxacin tablets: 500mg twice a day for 7 days

Ciprofloxacin 500mg tablets
Take one tablet twice a day for 7 days.
Supply 14 tablets.

Age: from 18 years onwards
NHS cost: £0.86
Licensed use: yes

First-line antibiotic if pregnant: cefalexin

Age from 16 years onwards

Cefalexin tablets: 500mg twice a day for 10 days

Cefalexin 500mg tablets
Take one tablet twice a day for 10 days.
Supply 20 tablets.

Age: from 16 years onwards
NHS cost: £2.71
Licensed use: yes

Cefalexin tablets: 500mg twice a day for 14 days

Cefalexin 500mg tablets
Take one tablet twice a day for 14 days.
Supply 28 tablets.

Age: from 16 years onwards
NHS cost: £3.61
Licensed use: yes

Analgesia use when required

Age from 16 years onwards

Paracetamol tablets: 1g up to four times a day

Paracetamol 500mg tablets
Take two tablets every 4 to 6 hours when required for pain relief. Maximum of 8 tablets in 24 hours.
Supply 50 tablets.

Age: from 16 years onwards
NHS cost: £0.78
OTC cost: £1.38
Licensed use: yes