Patient presents with symptoms of pyelonephritis:
- Fever > 100.4°F
- CVA tenderness
- Shaking chills/rigors
- New onset of delirium
- Dysuria
- Urinary urgency and/or frequency
- Suprapubic or flank pain

Note: See OSUWMC Urinary Tract Infection in Adult Patients: Diagnosis and Management guideline.

Positive urinalysis?

Indications for observation / admission?
- Inability to take PO fluids or medications
- Significant dehydration
- Uncertainty about the diagnosis
- Severe illness (high fevers: ≥ 100.4°F; abnormal vital signs: HR > 90 bpm, BP <120/80 mmHg, RR > 20 breath per minute)
- High likelihood of non-compliance with outpatient therapy
- Poor access to resources
- Immunosuppression

Consider alternative diagnosis:
- Tube-ovarian abscess
- Nephrolithiasis
- Appendicitis
- Pancreatitis
- Perforated viscus
- Tubal pregnancy
- Pelvic inflammatory disease
- Lower lobe pneumonia

Discharge to home
- Collect urine culture (prior to antibiotics)
- Give first dose of antibiotics
  - See Table 1 for recommended empiric antibiotics
- Follow up on cultures and sensitivities

UNCOMPPLICATED Pyelonephritis
- Begin antibiotic regimen
  - See Table 1 for recommended empiric antibiotics
- Imaging generally not indicated*
- Transition to oral therapy as soon as tolerated
- Follow up on cultures and sensitivities and de-escalate therapy as appropriate

CDU / Observation
- Collect urine culture prior to antibiotics
- Check CBC and Chem 6, if not done
- Supportive care as indicated (IV fluids, antipyretics; consider early removal of urinary catheters, ureteral stents, etc.)

Admit to hospital

Complicating factors?
- Renal transplantation
- Obstruction
- Nephrolithiasis
- Anatomic abnormality
- Neurogenic bladder
- Pregnancy
- Indwelling urinary catheter
- Failed outpatient therapy
- Healthcare-associated infection
- Recent instrumentation (ureteral stent, cystoscopy)
- Concomitant bacteremia

COMPPLICATED Pyelonephritis
- Obtain blood cultures
- Begin antibiotic regimen (See Table 2 for recommended empiric antibiotics)
- Consider imaging for suspected infection*
  - CT with and without contrast
  - In patients who are not able to receive IV contrast for CT (allergy or compromised renal function) MRI kidneys may be considered with diffusion-weighted imaging (MRI is not good at detecting renal stones & gas).
- Pregnant patients: MRI would be the preferred modality for evaluation of complications of pyelonephritis in this situation.
- Consultation based on results as appropriate (Infectious Diseases, Urology)
- Follow up on cultures and sensitivities and de-escalate therapy as appropriate
- Consider longer duration of therapy (at least 14 days)

*Note: See ACR Appropriateness Criteria® for Acute Pyelonephritis

NOTE: This guideline does not apply to chronic or recurrent pyelonephritis.
Table 1. Empiric Antibiotics Recommended for UNCOMPLICATED Pyelonephritis

- Due to increasing prevalence of resistance in *E. coli*, TMP/SMX, ciprofloxacin, and ampicillin are generally not recommended for therapy, but may be an option when susceptibilities are known.
- First-generation cephalosporins can be used based on OSUWMC’s current antibiogram.
- Cephalosporins are ineffective for the treatment of *Enterococcus*.
- Doses are for patients with normal renal function.
  - Modified doses may be required in renal insufficiency.

<table>
<thead>
<tr>
<th>Medication*</th>
<th>Dose</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cephalexin</td>
<td>500-1000 mg Q6-8 hrs. X 10-14 days (Oral)</td>
<td>• One-time dose of ceftriaxone is required in addition per IDSA dosing.</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>1 g every 24 hrs. (IV or IM) X 7 days</td>
<td>• In pregnancy, ceftriaxone is an appropriate empiric therapy unless the patient has other risk factors for, or history of, multi-drug resistant pathogens.</td>
</tr>
<tr>
<td>Cefdinir</td>
<td>300 mg Q12 hrs. X 7 days (Oral)</td>
<td>• One-time dose of ceftriaxone is required in addition per IDSA dosing.</td>
</tr>
<tr>
<td>Cefazolin</td>
<td>1 g Q8 hrs. X 7 days (IV)</td>
<td></td>
</tr>
<tr>
<td>Levofloxacin</td>
<td>750 mg Q24 hrs. X 7 days (IV or Oral)</td>
<td>• Caution in patients who are elderly or who have history of multiple urinary tract infections due to increased resistance.</td>
</tr>
</tbody>
</table>
  - Should be reserved for use in patients that are penicillin allergic.

*Listed in order of preference

Table 2. Empiric Antibiotics Recommended for COMPLICATED Pyelonephritis

- Cephalosporins are ineffective for the treatment of *Enterococcus*.
- Doses are for patients with normal renal function. Modified doses may be required in renal insufficiency.
- Initial treatment should be modified based upon the results of urine culture and sensitivity.
- Extended spectrum beta-lactamase organisms (ESBL) risk factors: history of ESBL infection, nursing home resident, and/or exposure to multiple antibiotics. If ESBL risk factors are present, consider treatment with a carbapenem agent.

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dose</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piperacillin / tazobactam (preferred)</td>
<td>4.5 g Q8 hrs. X 14 days (IV)</td>
<td>• β-lactamase inhibitor (tazobactam) may provide broader coverage for some Gram-negative enterics.</td>
</tr>
</tbody>
</table>
  - Recommended if ampicillin-susceptible *Enterococcus or Pseudomonas* suspected. |
| Cefepime   | 1 g Q12 hrs. X 14 days (IV) | • Use for non-severe penicillin allergy. |
References


Order Sets

- OSU IP GU: Admission Urology (aka pyelonephritis)
- OSU IP ED: CDU/OBS Pyelonephritis

Quality Measures

For ICU and Non-ICU patients:
- Percent of patients with CT imaging
- Appropriate antibiotics ordered based on urine or blood work

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Guideline Reviewed by:
- Radiology Quality & Safety Committee
- Antibiotic Stewardship Program

Guideline Approved


Disclaimer: Clinical practice guidelines and algorithms at The Ohio State University Wexner Medical Center (OSUWMC) are standards that are intended to provide general guidance to clinicians. Patient choice and clinician judgment must remain central to the selection of diagnostic tests and therapy. OSUWMC’s guidelines and algorithms are reviewed periodically for consistency with new evidence; however, new developments may not be represented.