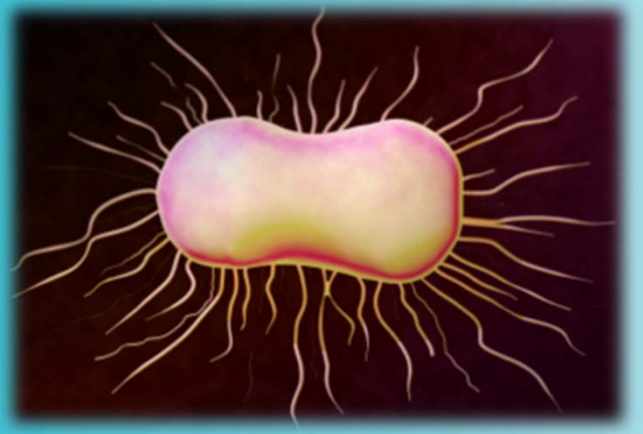
Canadian Undergraduate Urology Curriculum (CanUUC):

URINARY TRACT INFECTIONS



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Objectives

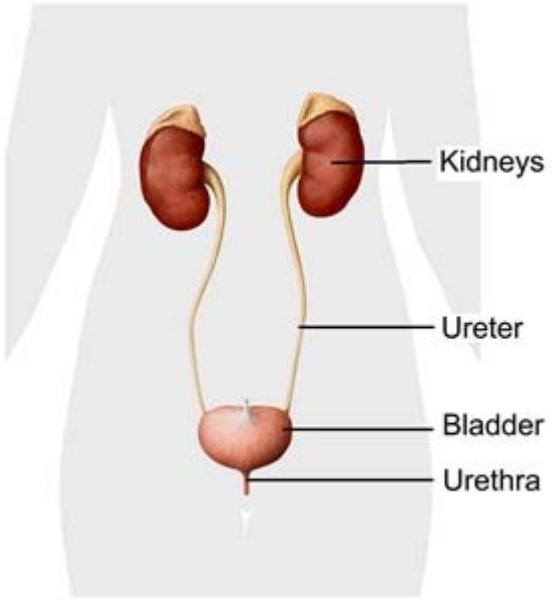
1. Describe the **signs and symptoms** of bacterial cystitis and pyelonephritis.
2. List the reasons to treat **asymptomatic bacteriuria**.
3. List the **common bacteria** causing urinary tract infections.
4. List the common **antibiotics** used to treat urinary tract infections.
5. Outline the **investigations and treatment** of bacterial cystitis and urinary tract infections.
6. Describe treatment options available for patients with **recurrent bacterial cystitis**.
7. Recognize the importance of an early diagnosis and emergent treatment of **obstructed urinary tract infections**.

Urinary tract infections (UTIs)

Infection and inflammation at some level of the urinary tract:

- **Urethra: Urethritis**
- **Bladder: Cystitis**
- **Kidneys +/- ureters: Pyelonephritis**

Location of infection is usually determined based on signs/symptoms



Urinary tract infections (UTIs)

Diagnosis can be supported with positive urine cultures

Most symptomatic episode should be documented with cultures

Other definitions

Complicated cystitis: Presence of at least one aggravating factors

- Male gender
- Functional/anatomic abnormality of urinary tract
- Pregnancy
- Diabetes
- Immunosuppression
- Urinary tract instrumentation / indwelling catheters or stents
- Hospital-acquired infections
- Stones
- Unusual organisms
- Persistent/recurrent infections
- Others...

Other definitions

Persistent UTI: Persistence of symptoms and positive cultures with same bacteria despite culture-adjusted antibiotic treatment

Recurrent UTI: Recurrence of symptomatic UTIs and positive cultures with asymptomatic periods between episodes

Asymptomatic bacteriuria: Presence of bacteria in urine without symptoms or signs of UTI

Pyuria: Presence of white blood cells in urine

- Maybe be present in UTI, but is not specific for UTI

Bacterial Cystitis: Signs & Symptoms

SYMPTOMS:

- Frequency
- Urgency
- Dysuria
- Hematuria - microscopic or gross
- Pain - suprapubic or urethral

SIGNS:

- Suprapubic tenderness

Pyelonephritis: Signs & Symptoms

SYMPTOMS

- Flank pain
- General malaise
- Chills, sweats, rigors
- Nausea & vomiting
- Confusion / decreased level of consciousness (if severe / sepsis)
- Fever
- Abdominal tenderness
- Costovertebral angle tenderness
- Tachycardia
- Hypotension
- Unwell, flushed, diaphoretic, toxic (if severe / sepsis)

May also be associated with **symptoms of bacterial cystitis**

SIGNS

Classic triad: Fever, flank pain, positive urine cultures

Asymptomatic Bacteriuria: When to Treat?

In most patients, asymptomatic bacteriuria should **not** be treated

Absolute indications to treat:

- Pregnancy
- Before urological procedures

Relative Indications to treat:

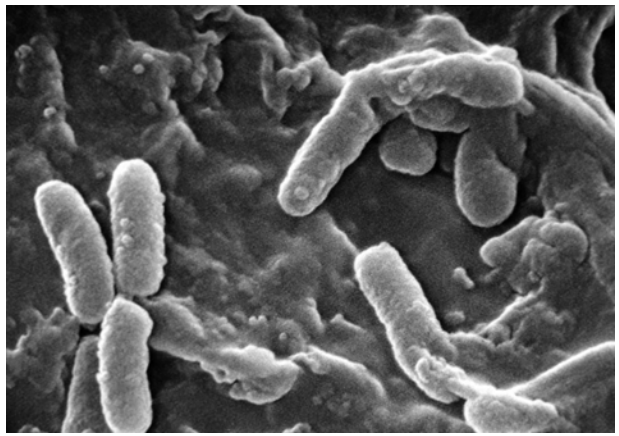
- Before surgical procedures with implant material
- Immunosuppressed state
- Atypical micro-organisms

Uncomplicated Cystitis: Common uropathogens

- **Escherichia coli**
  - By far the most common; 75-90% of cases
- **Staphylococcus saprophyticus**
- **Klebsiella species**
- **Proteus species**
- **Enterococcus faecalis**

Complicated Cystitis: Common uropathogens

- **Escherichia coli**
  - Most common; 35% of cases
- **Pseudomonas species**
- **Enterococcus faecalis**
- **Staphylococcus saprophyticus**
- **Klebsiella species**
- **Proteus species**



UTI Antibiotics: Common agents

- **Trimethoprim/sulfamethoxazole**
- **Nitrofurantoin**
- **Fosfomycin**

} **3 first-line antibiotics for uncomplicated cystitis**

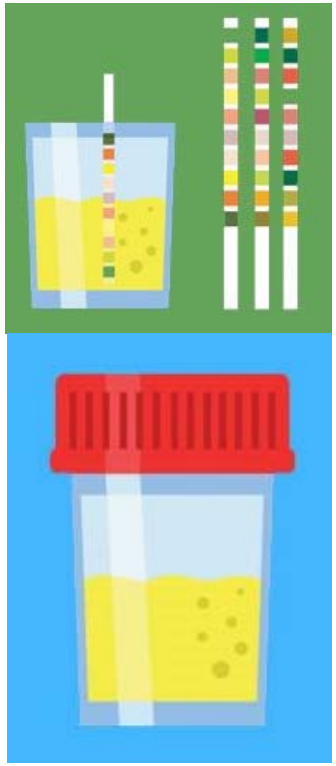
- **Fluoroquinolones**
  - Ciprofloxacin, levofloxacin
- **Penicillins/aminopenicillins**
  - Amoxicillin, ampicillin
- **Cephalosporins**
  - Cephalexin, cefadroxil, ceftriaxone
- **Aminoglycosides**
  - Gentamicin, tobramycin

Uncomplicated Cystitis: Investigations

- **Microscopic urinalysis**
  - Can help make diagnosis
  - Pyuria (WBCs)
    - Sensitivity: 80-95%
    - Specificity: 50-75%
  - Hematuria (RBCs)
    - Sensitivity: 40-60%
  - Bacteriuria
    - Sensitivity: 40-70%
    - Specificity: 85-95%

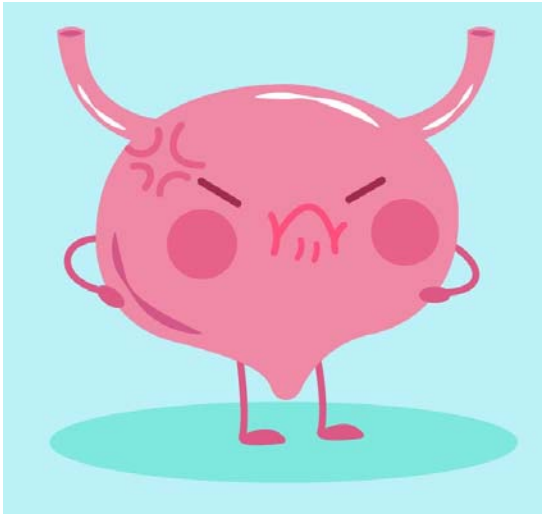
Uncomplicated Cystitis: Investigations

- **Rapid screen method (dipstick)**
  - Can help diagnosis, but low sensitivity
    - Should not replace microscopic urinalysis or culture
  - Nitrites
    - Produced by some bacteria in urine
  - Leukocyte esterase activity
    - Associated with pyuria
- **Urine culture & sensitivity**
  - Not always necessary if typical, uncomplicated presentation and positive urinalysis
  - Should obtain to identify pathogen if recurrent, persistent or atypical symptoms



Uncomplicated Cystitis: Treatment

- When possible, antibiotic treatment should be guided by **urine cultures and sensitivities** and **local resistance patterns**
- **In the absence of cultures, first-line antibiotics in Canada include:**
  - **Trimethoprim/sulfamethoxazole**
  - **Nitrofurantoin**
  - **Fosfomycin**
- **Do not perform control urine cultures if there is resolution of symptoms**



Recurrent Bacterial Cystitis: Investigations & Management

- Must document every **symptomatic** episode with **urinalysis and urine cultures**
    - Can provide patients with preemptive prescriptions for urine cultures to use during episodes
- **Counseling on increasing water intake**
    - **No** benefits from post-coital voiding, avoiding hot tubs, wiping methods, etc.
- **Evidence-based UTI prophylaxis:**
    - **Cranberry** products
    - Vaginal **estrogen** therapy
        - In post-menopausal women (vaginal atrophy associated with more UTIs)

Recurrent Bacterial Cystitis: Investigations & Management

- Consider **referral** to urology
  - May warrant imaging, cystoscopy, urodynamics
- Consider **low-dose antibiotic prophylaxis**
  - Should only be used as last resort
    - Risk of bacterial resistance
  - Intermittent, continuous, or post-coital
  - Antibiotic options (usually ½ or ¼ of regular daily dose):
    - Trimethoprim/sulfamethoxazole
    - Nitrofurantoin
    - Fosfomycin
    - Cephalexin
- Consider **preemptive antibiotic prescriptions** for patients to self-treat UTIs
  - Must document each UTI with cultures before taking antibiotics and follow up

Complicated Cystitis: Investigations & Management

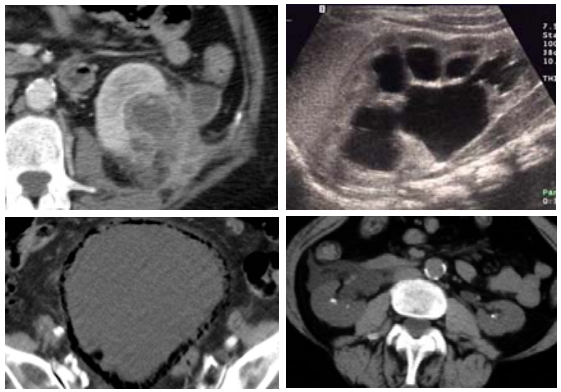
- Same as uncomplicated cystitis
- Must obtain urinalysis and **urine culture**
- Acute treatment:
  - **Fluoroquinolones** can be used as first-line, empirical treatment
    - Or based on local resistance patterns
  - Adjust treatment **based on cultures** if necessary
    - Consider TMP/SMX, amoxicillin/clavulanic acid, cefadroxil, cefixime, cephalexin
    - Avoid fosfomycin, nitrofurantoin
  - Treat for a **total of 10 to 14 days**

Pyelonephritis: Investigations & Management

- Initial management and investigations:
  - ABCs and vital signs with appropriate systemic support and monitoring
  - Bloodwork (complete blood count, creatinine, electrolytes)
  - Urine and blood cultures (before starting antibiotics, if possible)
- Antibiotics:
  - If patient has **aggravating factors or worrisome findings**, should consider **inpatient course of IV antibiotics** and monitoring, with subsequent shift to oral antibiotics
    - Hemodynamic instability
    - Patient unwell, toxic
    - High-grade fever
    - Significant anomalies on bloodwork
    - Immunosuppression
    - Unreliable patient
  - If patient is well, stable, reliable, and only has mild-to-moderate symptoms, can **consider outpatient oral antibiotics**
  - Long-term culture-adjusted antibiotic therapy often necessary (**10-14 days total**)
- Follow-up may be necessary

Complicated UTI: Investigations & Management

- In patients with suspected UTI/pyelonephritis, **should consider imaging** to rule out immediate, possibly life-threatening complications if risk factors or suggestive findings:
  - Atypical clinical presentation
  - Suboptimal response to IV antibiotics
  - Persistent fever
  - Highly elevated creatinine, unresolved with hydration
  - History of urolithiasis
  - History of urinary retention or BPH
  - Other anomalies of the urinary tract
  - Immunosuppression
- **CT scan or ultrasound** usually used; want to rule out:
  - Hydronephrosis
  - Obstructive urolithiasis ("septic stone")
  - Urinary retention
  - Abscess of the urinary tract
  - Xanthogranulomatous pyelonephritis
  - Emphysematous pyelonephritis/cystitis

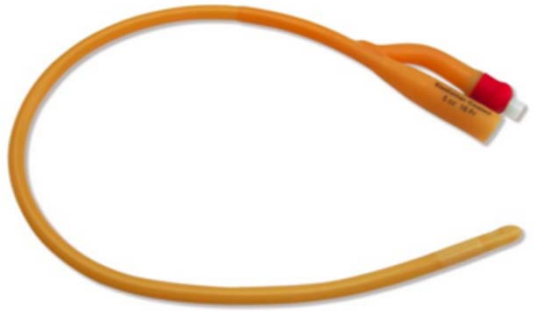


Complicated UTI: Investigations & Management

- Same initial management and investigations as pyelonephritis
- Usually requires early **intravenous antibiotics** and admission
- **Urgent** urinary drainage as indicated:
  - **Urinary catheter** (urethral or suprapubic)
    - For urinary retention, or obstruction below the bladder level (BPH, urethral stricture, etc.)
  - **Percutaneous nephrostomy / Ureteral stent**
    - Required in cases of ureteral obstruction (stones, ureteral stricture, extrinsic compression from mass, ureteropelvic junction obstruction, etc.)
  - ❖ Obstructive urinary sepsis is a urologic emergency and requires urgent, appropriate drainage
- Other surgery/intervention as indicated:
  - **Percutaneous drainage**
    - May be required for some abscesses
  - **Surgical debridement/excision at infection site**
    - May be required in refractory cases of emphysematous cystitis/pyelonephritis (rare)
- Long-term, culture-adjusted antibiotic therapy usually necessary (**10-14 days total**)

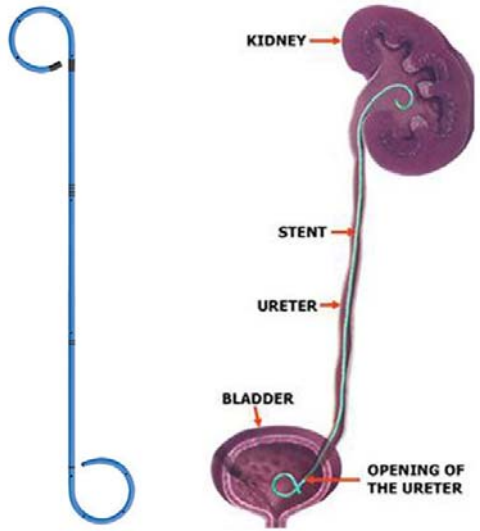
Complicated UTI: Investigations & Management

- Urinary drainage:
  - **Urinary catheter / suprapubic catheter**



Complicated UTI: Investigations & Management

- Urinary drainage:
  - **Ureteral stent (Double J stent)**



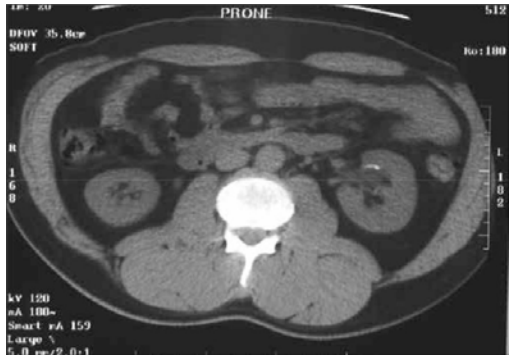
Complicated UTI: Investigations & Management

- Urinary drainage:
  - **Percutaneous nephrostomy**

Complicated UTI: Additional investigations

Other factors that **may warrant further long-term investigations** (diagnostic imaging, endoscopy, urodynamics):

- Recurrent pyelonephritis
- Gross/microscopic hematuria **after** UTI
- Pneumaturia/fecaluria
- Obstructive lower urinary tract symptoms
  - Low urinary flow, high post-void residual volume
- History of urolithiasis (bladder or kidney)
- History of urinary tract surgery or trauma
- History of abdominopelvic malignancy
- Immunosuppression
- Urea-splitting bacteria on urine culture

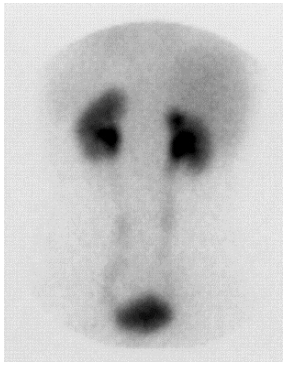


Complicated UTI: Additional investigations

- **Diagnostic imaging**:
  - **Kidney-Ureter-Bladder (KUB) radiography**
    - Low-cost; asses for stones and gas
  - **Intravenous pyelogram (IVP)**
    - Radiography with IV contrast injection; better visualization of urinary tract
  - **Voiding cystourethrogram (VCUG)**
    - Images of voiding patient with contrast-filled bladder
    - Assess for vesicoureteral reflux or posterior urethral valve

Complicated UTI: Additional investigations

- **Diagnostic imaging**:
  - **Ultrasound**
    - Excellent to assess hydronephrosis or post-void residual volume
  - **Magnetic resonance imaging (MRI)**
    - Little benefit over CT; no radiations
  - **Nuclear medicine / Renal scintigraphy**
    - Evaluate renal function
    - Assess for renal scarring
    - Dynamic studies can help diagnose urinary tract obstruction (e.g. MAG3 Lasix renogram)

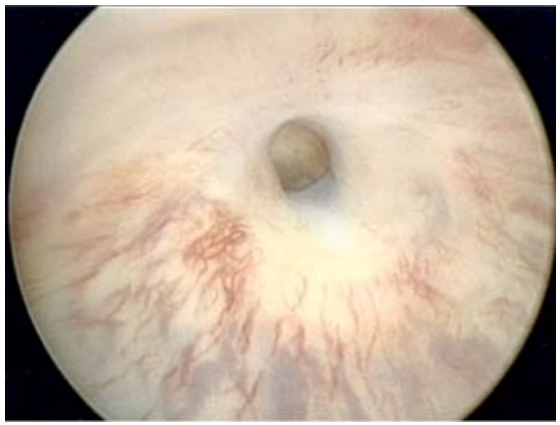


Complicated UTI: Additional investigations

- **Endoscopy:**
  - **Urethrocystoscopy**
    - Endoscopy of the **lower urinary tract**
    - Assessment of the **urethra**
      - Obstructive benign prostatic hyperplasia (BPH)
      - Urethral stricture
      - Urethral diverticulum
    - Assessment of the **bladder**
      - Bladder stone
      - Bladder diverticulum
      - Vesical fistula
  - **Ureterorenoscopy**
    - Endoscopy of the **upper urinary tract**
    - Assessment of the **ureters**
      - Ureteral stricture
      - Ureteral stone
    - Assessment of the **kidneys**
      - Renal stone
      - Fungus ball
      - Sloughed renal papilla

Complicated UTI: Additional investigations

- **Endoscopy:**



Urethroscopy
Urethral stricture

Cystoscopy
Bladder stones

Ureteroscopy
Ureteral stone

Complicated UTI: Additional investigations

- **Urodynamics:**
  - Dynamic study of the transport, storage, and evacuation of urine in the lower urinary tract
  - Measurements of pressure, volume, and flow across the urinary tract
    - Can also measure electromyography activity
    - Uses pressure sensors, urinary catheters, etc.
  - Diagnostic and prognostic adjunct
  - Can help diagnose or suggest:
    - Bladder hypocontractility
    - Detrusor sphincter dyssynergia
    - Bladder outlet obstruction