Urinary Tract Infections (UTI)

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OBJECTIVES

1. Explain the factors contributing to upper and lower urinary tract infections (UTIs).
2. Use the nursing process as a framework for care of the patient with a lower UTI.
3. Differentiate between the various adult dysfunctional voiding patterns.
4. Develop an education plan for a patient who has mixed (stress and urge) urinary incontinence.
5. Apply the nursing process as a framework for care of the patient with UTI.

Introduction: Terminology

- **bacteriuria:** bacteria in the urine
- **interstitial cystitis:** inflammation of the bladder wall
- **micturition:** voiding or urination
- **nocturia:** awakening at night to urinate
- **urosepsis:** spread of infection from the urinary tract to the bloodstream that results in a systemic infection

Introduction

- Urinary tract infections (UTIs) are caused by pathogenic microorganisms in the urinary tract (the normal urinary tract is sterile above the urethra).
- A UTI is the second most common infection in the body.
- Most cases occur in women
- The organisms responsible for UTIs ***Escherichia coli (E. Coli)***

Classifications of UTI

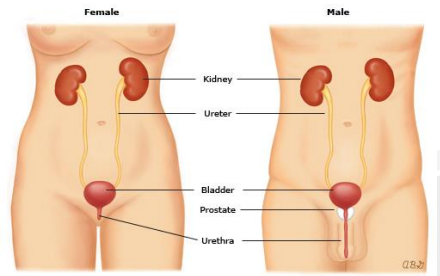
- **Lower UTI**
  - **Cystitis** (inflammation of the urinary bladder)
  - **Prostatitis** (inflammation of the prostate gland)
  - **Urethritis** (inflammation of the urethra)
- **Upper UTI**
  - **Pyelonephritis** (inflammation of the renal pelvis)
    - acute and chronic
  - **Interstitial nephritis** (inflammation of the kidney)
  - **Renal (kidney) abscess** and **perirenal abscess**

Classifications of UTI (cont…)

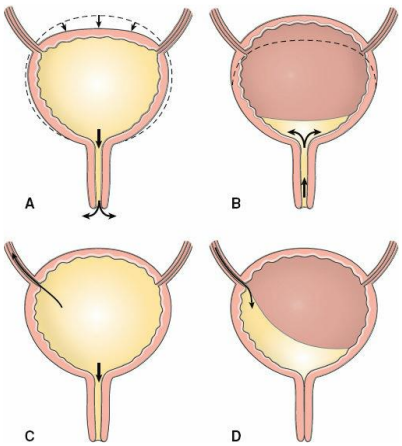
- **Uncomplicated Lower or Upper UTIs**
  - Community-acquired infection; common in young women & **not recurrent**
- **Complicated Lower or Upper UTIs**
  - Acquired in the hospital & related to catheterization (catheter-associated urinary tract infections {CAUTI}); occur in patients with ***urologic abnormalities***, ***pregnancy***, ***immunosuppression***, ***diabetes***, and ***obstructions*** and are ***recurrent***.

Factors Contributing to UTI

- **Function of glycosaminoglycan (GAG)**
- **Urethrovesical reflux:** An obstruction to free-flowing urine which is the reflux (backward flow) of urine from the urethra into the bladder
- **Ureterovesical or vesicoureteral reflux:** Refers to the backward flow of urine from the bladder into one or both ureters
- **Uropathogenic bacteria**
- **Shorter urethra in women**
- **Risk factors**



- **Urethrovesical Reflux:** With coughing and straining, bladder pressure rises, which may force urine from the bladder into the urethra. A.
  - When bladder pressure returns to normal, the urine flows back to the bladder (B), which introduces bacteria from the urethra to the bladder.
- **Ureterovesical reflux:** With failure of the ureterovesical valve, urine moves up the ureters during voiding (C) and flows into the bladder when voiding stops (D).
  - This prevents complete emptying of the bladder.
  - It also leads to urinary stasis and contamination of the ureters with bacteria-laden urine.



Routes of infection:

- **The transurethral route: Up the urethra: ascending infection**
  - most common route
  - Bacteria (fecal contamination) colonize the periurethral area and subsequently enter the bladder by urethra.
  - In women, the short urethra offers little resistance to the movement of uropathogenic bacteria.
  - Sexual intercourse forces the bacteria from the urethra into the bladder.
- **Through the blood stream (hematogenous spread).**
- **By means of a fistula from the intestine (direct extension)**

Risk factors:

- Inability or failure to empty the bladder completely
- Obstructed urinary flow (e.g., Calculi (stones) in the ureters or kidneys; Bladder tumors)
- Decrease natural host defense or immunosuppression
- Instrumentation of the urinary tract (e.g., catheterization, cystoscopic procedures)
- Inflammation or abrasion of the urethral mucosa
- Contributing conditions : DM, pregnancy, neurological disorders, gout, incomplete emptying of the bladder and urinary stasis

Lower Urinary tract infections

- Pathophysiology: for infection to occur
  1. bacteria must gain access to the bladder,
  2. attach to and colonize the epithelium of the urinary tract to avoid being washed out with voiding,
  3. evade host defense mechanisms, and initiate inflammation
- **Most UTI's results from**
  1. fecal organism
  2. Reflux: Urethrovesical reflux (backward flow of urine from the urethra into the bladder

Clinical manifestations:

- about half patient with Bacteriuria have no symptoms.
- **Uncomplicated UTI:**
  1. pain and burning on urination,
  2. Urinary frequency (voiding more than every 3 hours),
  3. Urgency, Nocturia, Incontinence,
  4. Suprapubic or pelvic pain,
  5. Hematuria & back pain may presented
- **Complicated UTI:** manifestations may range from ***asymptomatic*** bacteriuria to a gram-negative sepsis with shock

Assessment and Diagnostic Findings

- **Urine culture:** remains the ***gold standard*** in documenting a UTI and can Identify the specific organism present
- **Colony count:** greater than 100,000 CFU/mL of urine on a clean catch midstream or catheterized specimen is a major criterion for infection
- **Cellular studies:** microscopic ***hematuria*** (RBC's in urine), ***Pyuria*** (WBC's in urine).
- A CT scan may detect pyelonephritis or abscesses.
- Ultrasonography and kidney scans are extremely sensitive for detecting obstruction, abscesses, tumors, and cysts.

Medical Management

1. **Acute Pharmacologic Therapy**
   - Antibacterial agent, Single dose administration, short-course (3-7 day) regimens therapeutic course used in treating uncomplicated lower UTI.
2. **Long-Term Pharmacologic Therapy**
   - If infection reoccurs within 2 weeks after completing antimicrobial therapy, another short course of full-dose antimicrobial therapy, followed by a regular bedtime dose of an antimicrobial agent be prescribed
   - If there is no recurrence, medication may taken every other night for 6-7 months

Patient Education

- **Preventing Recurrent Urinary Tract Infections**

1. **Hygiene** (shower rather than bathe tube)
2. **Fluid intake:** Drink liberal amounts of fluids daily to flush out bacteria. Avoid coffee, tea, colas, alcohol that are urinary tract irritants.
3. **Voiding Habits:** void every 2-3 hours, void immediately after sexual intercourse
4. **Therapy:** take medication exactly as prescribed, if recurrence take long term treatment

Upper Urinary Tract Infections (UTI)

1. **Acute Pyelonephritis** is a bacterial infection of the renal pelvis, tubules, and interstitial tissue of one or both kidneys.

- Causes involve either the upward spread of bacteria from the bladder or spread from systemic sources reaching the kidney via the bloodstream.
- ***Pathophysiology:***
  - Ascending of bacteria from the urethra, then to bladder to reach the kidney
  - Ureterovesical reflux
  - Urinary tract obstruction, bladder tumor, strictures, benign prostatic hyperplasia, and urinary stones
  - Usually these pt has enlarged kidneys with interstitial infiltration of inflammatory cells which may lead to destruction and atrophy of the kidney.

Clinical Manifestations of Acute Pyelonephritis

- **Chills & fever;** Leukocytosis; Bacteriuria.
- Low back pain, **flank pain**, nausea & vomiting,
- Headache, malaise, & painful urination are common findings.
- Physical examination: pain & tenderness in the area of the **costovertebral angle;** UTI symptoms (dysuria, frequency & urgency, pyuria, hematuria, nocturia)
- **Assessment and Diagnostic Findings:** US, CT scan to locate any obstruction, urine culture and sensitivity may performed

Medical Management

- patient usually treated as outpatient if they are not dehydrated, not experiencing nausea or vomiting and not showing S/S of sepsis.
- For outpatient, a 2-weeks course of antibiotic is recommended , 6 weeks therapy may needed if relapse is seen, follow up urine culture is done 2 weeks after completion of antibiotic therapy
- Commonly cephalosporins, levoflaxin, ciproflaxin, amoxicillin.
- Hydration with oral or parenteral fluids is essential in all patients with UTIs when there is adequate kidney function. Hydration helps facilitate “flushing” of the urinary tract and reduces pain and discomfort.

Nursing Process: The Care of the Patient with a UTI—Assessment

- Symptoms may include pain and burning upon urination; frequency; nocturia; incontinence; suprapubic, pelvic, or back pain; hematuria; and change in urine or urinary pattern
- About half are asymptomatic
- Assess voiding patterns, association of symptoms with sexual intercourse, contraceptive practices, and personal hygiene
- Assessment of urine, urinalysis, and urine cultures
- Other diagnostic tests

Nursing Process

- **Nursing Diagnoses**
  - Acute pain
  - Deficient knowledge
- Collaborative Problems/Potential Complications
  - Sepsis (urosepsis)
  - Acute kidney injury and/or chronic kidney disease

Planning and Goals

- Major goals for the patient may include relief of pain and discomfort,
- Increased knowledge of preventive measures and treatment modalities,
- Absence of complications.

Nursing Interventions

- **Relieving Pain**
  - Antimicrobial, Antispasmodic, Analgesic
  - application of heat to the perineum help relieve pain and spasm.
  - drink liberal amounts of fluids to promote renal blood flow and to flush the bacteria from the urinary tract.
  - Urinary tract irritants (e.g., coffee, tea, citrus, spices, colas, alcohol) should be avoided.
  - Frequent voiding (every 2 to 3 hours) is encouraged to empty the bladder completely, to lower urine bacterial counts, reduce urinary stasis, and prevent reinfection
  - Patient education

Nursing Interventions

- Monitoring & Managing Potential Complications
  - CAUTIs should be avoided

Upper UTI

2. **Chronic Pyelonephritis:** Repeated bouts of acute pyelonephritis may lead to chronic pyelonephritis.

- **Clinical manifestations:** usually no symptoms of infection, S/S may include fatigue, headache, poor appetite, polyuria, excessive thirst, and weight loss.
- Persistent and recurring infection may produce progressive scarring of the kidney, resulting in chronic kidney disease
- **Assessment & Diagnostic Findings:** IV urogram and measurements of creatinine clearance, blood urea nitrogen, and creatinine levels

Complications of chronic pyelonephritis

- end-stage kidney disease; Hypertension; formation of kidney stones
- **Medical management:** Antibiotics depends on U/C, careful monitoring of renal function is important while giving medication due to the alteration of kidney function
- **Nursing Management:** Monitor I &O, encourage fluid (3-4 L/day) unless contraindicated, Assess Temp. every 4 hrs, administer antibiotic as prescribed, Teach the pt the preventive measures of UTI.

Urolithiasis & Nephrolithiasis (Renal stone)

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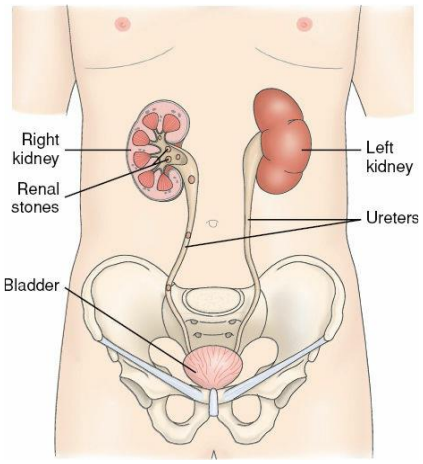
Urolithiasis & Nephrolithiasis

- Refer to stones (calculi) in the urinary tract & kidney
- **Occur in the 30 to 50 years old & Affect men twice as women**
- Stones develop in one or both kidneys & yearly episodes increasing
  - **Urolithiasis:** formation of urinary calculi in the ureters.
  - **Nephrolithiasis:** formation of kidney calculi in the renal parenchyma.
- Stones found anywhere kidney/bladder & vary in size from minute granular deposits, called **sand** or **gravel**, to bladder stones as large as an **orange**.



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Pathophysiology

- Stones are formed in the urinary tract when urinary concentrations of substances such as calcium oxalate, calcium phosphate, and uric acid increase (supersaturation) this depends on the amount of the **substance**, **ionic strength**, & **pH** of the urine.
- ***Certain factors cause formation of stones:***
  - Infection; urinary stasis; Immobility
  - increased calcium concentrations in the blood & urine promote formation of stones (80% of all kidney stones are calcium based)

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Pathophysiology

- Causes of **hypercalcemia** (high serum calcium) & **hypercalciuria** (high urine calcium) may include the following:
  - Hyperparathyroidism
  - Renal tubular acidosis
  - Cancers (e.g., leukemia, multiple myeloma)
  - Dehydration
  - Excessive intake of milk and alkali & vitamin D
  - Myeloproliferative diseases such as polycythemia vera.

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Pathophysiology

- **Uric acid stones** (5% to 10% of all stones)
  - patients with gout or myeloproliferative disorders.
  - Foods high in purine (shellfish, anchovies, asparagus, mushrooms, and organ meats) are avoided, and other proteins may be limited.
- **Struvite stones** (15% of urinary calculi and form in alkaline, ammonia-rich urine (recurrent UTIs)

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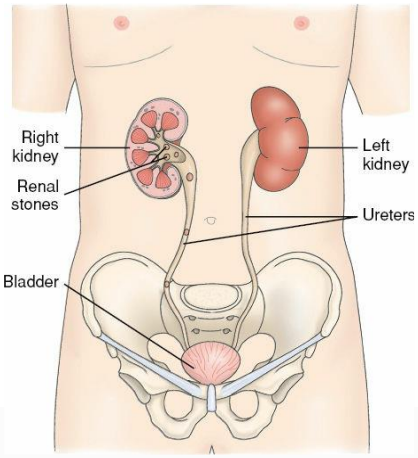
Clinical Manifestations

- S & S of stones in the urinary system depend on the presence of
  - **obstruction**, **infection**, and **edema**.
- When stones block the flow of urine, obstruction develops, producing an increase in **hydrostatic pressure** and distending the renal pelvis and proximal ureter.
- **Infection** (pyelonephritis and UTI with chills, fever, and frequency) can be a contributing factor with **struvite stones**.



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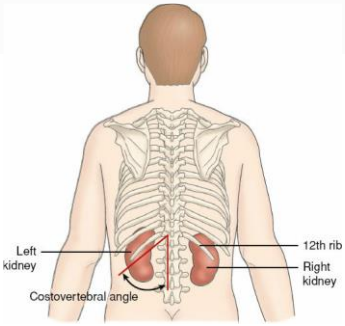
Clinical Manifestations

Pain is the key symptom



- Excruciating pain and discomfort.
- **Stones in the renal pelvis:**
  - Intense, deep pain in the **costovertebral region**.
  - radiates anteriorly and downward toward the bladder in the female and toward the testes in the male.
  - Hematuria & pyuria
  - **Renal Colic** (Sudden acute pain, with tenderness over the costovertebral area, N & V
- **Stones lodged in the ureter (ureteral obstruction)** cause acute, excruciating, colicky, wavelike pain that radiates down the **thigh and to the genitalia**.
  - desire to void (frequency), but little urine is passed, contains blood because of the abrasive action of the stone (Hematuria) & Acute pain. This group of symptoms is called **ureteral colic**.

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Assessment and Diagnostic Findings

- Ultrasound shows stones. Non-contrast CT scan
- Blood chemistries and a 24-hour urine test for measurement of calcium, uric acid, creatinine, sodium, pH, and total volume.
- X- ray of kidneys, ureters, and bladder (KUB) shows most renal stones.
- A **urinalysis** can assess for hematuria, the presence of WBC, crystal fragments, or all three, if the client has a urinary tract infection or possibly a renal stone, with accompanying signs/symptoms of UTI.

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Medical Management

- The immediate treatment is to relieve the pain
  - Opioid analgesic
  - Nonsteroidal anti-inflammatory drugs (NSAIDs)
- Hot baths or moist heat to the flank area helpful.
- Fluids are encouraged at least eight 8-ounce glasses of water daily or IV fluids to keep the urine dilute.
- A urine output exceeding 2 L (2000/ml)/day is advisable.
- Restrict calcium in their diet.
- Uric Acid Stones (low-purine diet); A low-protein diet is prescribed,

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Preventing Kidney Stones

- Avoid protein intake to decrease urinary excretion of calcium and uric acid.
- Limit sodium intake to 3–4 g/day. Table salt and high-sodium foods should be reduced.
- Avoid intake of oxalate-containing foods (e.g., spinach, strawberries, rhubarb, tea, peanuts, wheat bran).
- Drink fluids every 1–2 hours during the day. Drink two glasses of water at bedtime and an additional glass at each nighttime
- Avoid activities that cause excessive sweating and dehydration.
- Encourage ambulation

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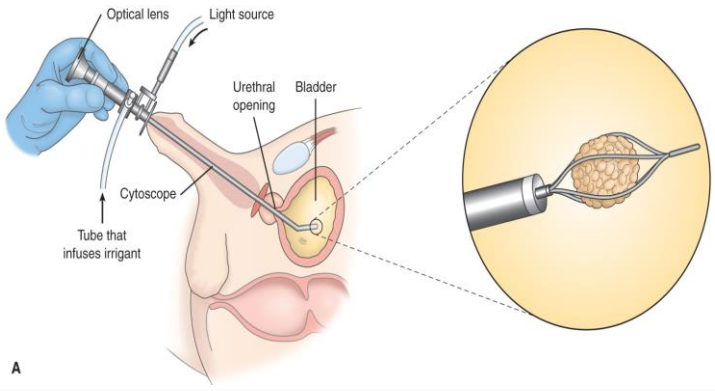
Interventional Procedures: Ureteroscopy

- Used for removing small stones located in the ureter close to the bladder, a ureteroscope is inserted into the ureter to visualize the stone. The stone is then fragmented or captured and removed.



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Extracorporeal shock wave lithotripsy (ESWL)

- patient is able to pass stones 0.5 to 1 cm in diameter.
- Stones larger than 1 cm in diameter must be removed or fragmented (broken up by lithotripsy) so that they can be removed or passed spontaneously.
- **ESWL:** Used for most symptomatic, nonpassable upper urinary stones.
- Electromagnetically generated shock waves are focused over the area of the kidney stone.
- The high-energy dry shock waves pass through the skin and fragment the stone.

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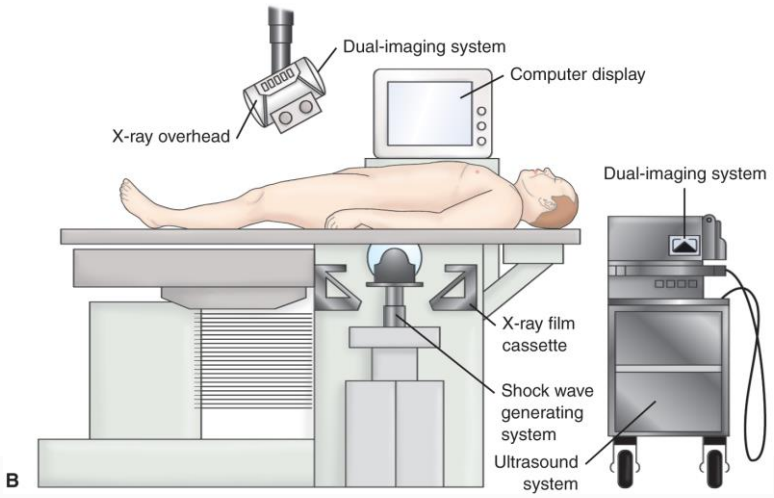
Extracorporeal shock wave lithotripsy (ESWL)

Following ESWL, the nurse should strain the patients urine for gravel or sand.



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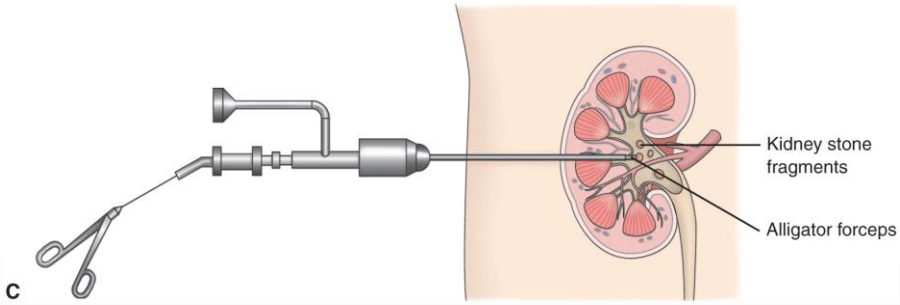
Percutaneous nephrolithotomy

- Used to treat larger stones.
- A percutaneous tract is formed, and a nephroscope is inserted through it. Then, the stone is extracted or pulverized.



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Surgical Management

- Nephrolithotomy (incision into the kidney with removal of the stone)

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The Patient With Kidney Stones

Nursing Process

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Assessment

- assessed for pain and discomfort as well as associated symptoms, such as nausea, vomiting, diarrhea, and abdominal distention.
- observing for signs and symptoms of **UTI** (chills, fever, frequency, and hesitancy)
- Observing for S & S of **obstruction** (frequent urination of small amounts, oliguria, or anuria).
- The urine is inspected for blood and is strained for stones or gravel.
- History for current episode of renal or ureteral colic.

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Nursing Diagnoses

- Acute pain related to inflammation, obstruction, and abrasion of the urinary tract
- Deficient knowledge regarding prevention of recurrence of kidney stones

- **Planning and Goals**
  - The major goals for the patient include relief of pain and discomfort,
  - prevention of recurrence of kidney stones, and absence of complications.

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Nursing Interventions

- **Relieving Pain**
  - Opioid analgesic agents (IV or intramuscular) may be prescribed and given to provide rapid relief along with an IV NSAID.
  - position of comfort
- **Monitoring and Managing Potential Complications:**
  - Increased fluid intake or (IV) to prevent dehydration to promote passage of the stone.
  - total urine output and voiding are monitored.
  - Ambulation is encouraged as a means of moving the stone through the urinary tract.
  - Monitor urine volume, bloody or cloudy urine, fever, and pain.
  - Vital signs monitored to detect early signs of infection.

Thank You

"You learn something every day if you pay attention." – Ray LeBlond