Renal/Urinary System

Study Guide (Final Exam)

Prof Study Guide Read outloud

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1. **Discuss the pathophysiology, risk factors, signs and symptoms, diagnostic tests, therapeutic procedures, diet, and nursing care for clients with:**
   - ***Acute kidney (renal) disease***
     - is the sudden cessation of kidney function that occurs when blood flow to the kidneys is significantly compromised. Manifestations occur abruptly.
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     - PHASES
       - Onset: Begins with the onset of the event, ends when oliguria develops, and lasts for hours to days.
       - Oliguria: Begins with the kidney insult; urine output is 100 to 400 mL/24 hr with or without diuretics; and lasts for 1 to 3 weeks.
       - Diuresis: Begins when the kidneys start to recover; diuresis of a large amount of fluid occurs, 1000 mL to 2000 mL per day; and can last for 2 to 6 weeks. Death can result from dehydration and imbalances in serum sodium or potassium levels
       - Recovery: Continues until kidney function is fully restored and can take up to 12 months.
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     - TYPES
       - Prerenal: Occurs as a result of volume depletion and prolonged reduction of blood flow to the kidneys, which leads

to ischemia of the nephrons. Occurs before damage to the kidney. Early intervention restoring fluid volume deficit can reverse AKI and prevent chronic kidney disease (CKD). Example is hemorrhage.
        - Intrarenal: Occurs as a result of direct damage to the kidney from lack of oxygen, indicating damage to the glomeruli, nephrons, or tubules such as chronic glomerulonephritis.
        - Postrenal: Occurs as a result of bilateral obstruction of structures leaving the kidney such as presence of renal calculi
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    - RISK FACTORS
    - Prerenal acute kidney injury
        - Kidney vascular obstruction
        - Shock
        - Decreased cardiac output causing decreased kidney profusion
        - Sepsis
        - Hypovolemia
        - Peripheral vascular resistance
        - Use of aspirin, ibuprofen, or NSAIDs
        - Liver failure
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    - Intrarenal acute kidney injury
        - Physical injury: trauma
        - Hypoxic injury: renal artery or vein stenosis or thrombosis
        - Chemical injury: acute nephrotoxins (antibiotics, contrast dye, heavy metals, blood transfusion reaction, alcohol, cocaine)
        - Immunologic injury: infection, vasculitis, acute glomerulonephritis
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    - Postrenal acute kidney injury
        - Stone, tumor, bladder atony
        - Prostate hyperplasia, urethral stricture
        - Spinal cord disease or injury
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    - EXPECTED FINDINGS

        - In most cases, the findings of AKI are related to waste buildup and decreased urine output. However, almost every body system can be affected.
        - CARDIOVASCULAR: Hypertension, fluid overload (dependent and generalized edema), dysrhythmia (hyperkalemia)
        - RESPIRATORY: Crackles, decreased oxygenation, shortness of breath
        - RENAL: Scant to normal or excessive urine output, depending on the phase; possible hematuria
        - NEUROLOGIC: Lethargy, muscle twitching, seizures
        - INTEGUMENTARY: Dry skin and mucous membranes The nurse should also monitor for findings associated with the underlying cause.
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    - LABORATORY TESTS
        - Blood creatinine gradually increases 1 to 2 mg/dL every 24 to 48 hr, or 1 to 6 mg/dL in 1 week or less.
        - Blood urea nitrogen (BUN) can increase to 80 to 100 mg/dL within 1 week.
        - Urine specific gravity varies in postrenal type; can be elevated up to 1.030 in prerenal type or diluted as low as 1.000 in intrarenal type.
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        - Electrolytes: Sodium can be decreased (prerenal azotemia) or increased (intrarenal azotemia); hyperkalemia, hyperphosphatemia, hypocalcemia.
        - Hematocrit: decreased
        - Urinalysis: presence of sediment (RBC, casts)
        - ABG: metabolic acidosis
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    - DIAGNOSTIC PROCEDURES
        - Kidney biopsy is performed when the cause of AKI is uncertain and manifestations continue.
        - This can also be performed to detect immunological disease or determine kidney dysfunction reversibility and need for dialysis therapy.

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- Imaging procedures
    - X-ray of the pelvis, or kidneys, urethra, and bladder (KUB) to detect calculi and hydronephrosis and to determine size of kidneys
    - Ultrasound to detect an obstruction in the urinary tract
    - CT scan without contrast dye or MRI to detect anatomical changes, tumors, or other obstruction; patency of ureters; kidney perfusion
    - Nuclear medicine tests (cystography, retrograde pyelography)
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- NURSING CARE
    - Identify and assist with correcting the underlying cause.
    - Monitor central venous pressure (CVP) and for hypotension and tachycardia.
    - Monitor fluid intake and output strictly.
    - Review laboratory values (BUN, creatinine, electrolytes, hematocrit).
    - Avoid using nephrotoxic medications. If necessary, give these medications sparingly and decrease the medication dosage.
    - Monitor for edema and manifestations of heart failure or pulmonary edema.
    - Restrict fluid intake as prescribed.
    - Monitor for flank pain, nausea, and vomiting (nephrolithiasis).
    - Monitor for ECG dysrhythmias and changes (tall T waves).
    - Monitor daily weights.
    - Monitor for changes in urination stream or difficulty starting the stream of urine.
    - Monitor the urine for blood or particles.
    - Treat fever or infection promptly to prevent increase in the client's metabolic rate.
    - Provide skin care to prevent injury (bathe with cool water, reposition frequently, provide adequate moisture).

        - Provide psychosocial support to the client and family. Reinforce teaching to the client and family about prescribed treatments.
        - Reinforce teaching to the client to perform coughing and deep breathing exercises, if lethargic.
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    - NUTRITION
        - Implement potassium, phosphate, sodium, and magnesium restrictions, if prescribed (depending on the stage of injury).
        - Restrict fluid intake, if prescribed.
        - High-protein diet to replace the high rate of protein breakdown due to stress from the illness. Possible total parenteral nutrition (TPN).
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    - THERAPEUTIC PROCEDURES
        - Continuous kidney replacement therapy, hemodialysis, peritoneal dialysis
- ***Chronic kidney (renal) disease***
    - Chronic kidney disease or chronic renal failure, or ESRD (End-Stage Renal Disease), exits when there is gradual loss of kidney function reaches an advanced state.
    - As much as 80% of nephrons may be severely impaired.
    - ESRD represents significant problem worldwide.
    - The number of patients diagnosed with ESRD has increased by 57% (Cooper and Gosnell, 2019).
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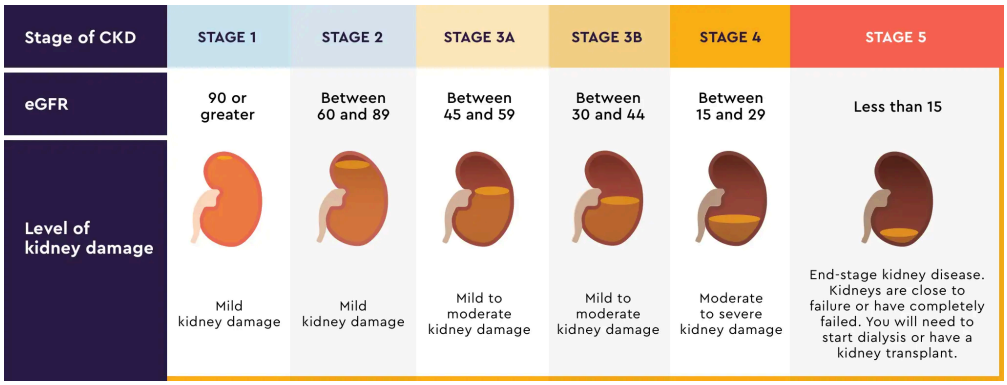
    - STAGES
    - CKD is comprised of five stages.
        - Stage 1: No manifestations
        - Stage 2: GFR decreases without manifestations
        - Stage 3: Moderate decline in GFR, can advance to end-stage kidney disease (ESKD) with complications such as infection or nephrotoxicity
        - Stage 4: Chronic manifestations of uremia
        - Stage 5: End Stage: Kidney disease requiring dialysis or kidney transplant

- 

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- RISK FACTORS
    - Acute kidney injury
    - Diabetes mellitus
    - Chronic glomerulonephritis
    - Nephrotoxic medications (gentamicin, NSAIDs) or chemicals
    - Hypertension, especially in African American clients
    - Autoimmune disorders (systemic lupus erythematosus)
    - Polycystic kidney disease
    - Pyelonephrosis
    - Renal artery stenosis
    - Recurrent severe infections
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- EXPECTED FINDINGS
    - Nausea, fatigue, lethargy, involuntary movement of legs, depression, intractable hiccups In most cases, findings of chronic kidney disease are related to fluid volume overload and include the following.
    - NEUROLOGIC: lethargy, decreased attention span, slurred speech, tremors or jerky movements, ataxia, seizures, coma
    - CARDIOVASCULAR: fluid overload (jugular distention; sacrum, ocular, or peripheral edema), hyperlipidemia, hypertension, dysrhythmias, heart failure, orthostatic hypotension, peaked T wave on ECG (hyperkalemia)
    - RESPIRATORY: uremic halitosis with deep sighing, yawning, shortness of breath, tachypnea, hyperpnea, Kussmaul respirations, crackles, pleural friction rub, frothy pink sputum

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- HEMATOLOGIC: anemia (pallor, weakness, dizziness), ecchymoses, petechiae, melena
- GASTROINTESTINAL: ulcers in mouth and throat, foul breath, blood in stools, vomiting.
- MUSCULOSKELETAL: osteodystrophy (thin fragile bones)
- RENAL: urine contains protein, blood, particles; change in the amount, color, concentration, ANURIA
- SKIN: decreased skin turgor, yellow cast to skin, dry, pruritus, urea crystal on skin (uremic frost)
- REPRODUCTIVE: erectile dysfunction
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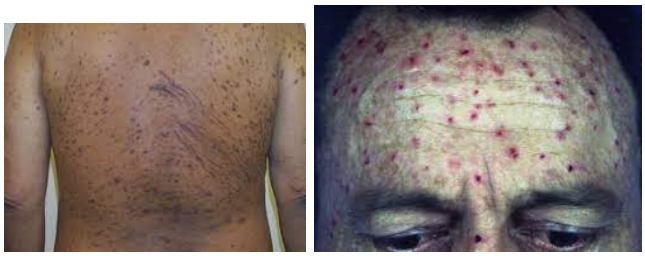
- CKD/ESRD-Associated Pruritus (Renal itch)
- 
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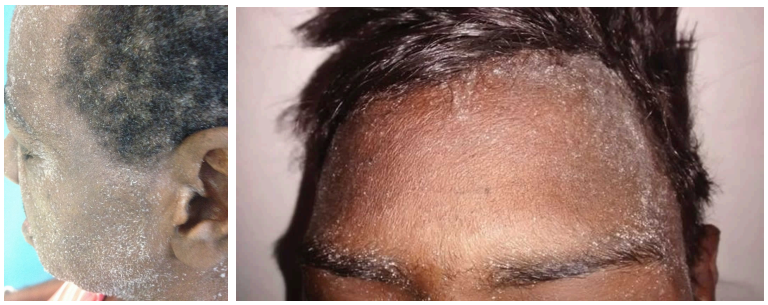
- Uremic Frost in ESRD
- 
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- LABORATORY TESTS
  - Urinalysis: Hematuria, proteinuria, and decrease in specific gravity
  - Blood creatinine: Gradual increase over months to years for CKD exceeding 4 mg/dL; can increase to 15 to 30 mg/dL

        - BUN: Gradual increase with elevated blood creatinine over months to years for CKD; can increase 10 to 20 times the creatinine finding
        - Blood electrolytes: Decreased sodium (dilutional) and calcium; increased potassium, phosphorus, and magnesium
        - CBC: Decreased hemoglobin and hematocrit from anemia secondary to the loss of erythropoietin in CKD
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    - DIAGNOSTIC PROCEDURES
        - Cystoscopy
        - Retrograde pyelography
        - Kidney biopsy Imaging procedures Radiologic procedures to detect disease processes, obstruction, and arterial defects
        - Ultrasound
        - Kidneys, ureter, and bladder (KUB)
        - Computerized tomography (CT)
        - Magnetic resonance imaging (MRI) without contrast dye
        - Aortorenal angiography
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    - NURSING CARE
        - Report and monitor irregular findings.
        - URINARY ELIMINATION PATTERNS: amount, color, odor, and consistency.
        - VITAL SIGNS: blood pressure can be increased or decreased.
        - WEIGHT: 1 kg (2.2 lb) daily weight increase is approximately 1 L of fluid retained.
        - Monitor vascular access or peritoneal dialysis insertion site.
        - Obtain a detailed medication and herb history to determine the client's risk for continued kidney injury.
        - Control protein intake based on the client's stage of CKD and type of dialysis prescribed.
        - Restrict dietary sodium, potassium, phosphorous, and magnesium (animal products, nuts).
        - Restrict intake of fluids (based on urinary output). Provide a diet that is high in carbohydrates and moderate in fat.
        - Monitor for weight gain trends.

        - Adhere to meticulous cleaning of areas on skin not intact and access sites to control infections.
        - Balance the client's activity and rest.
        - Prepare the client for hemodialysis, peritoneal dialysis, and hemofiltration if indicated.
        - Provide skin care in order to increase comfort and prevent breakdown.
        - Protect the client from injury.
        - Provide emotional support to the client and family.
        - Encourage the client to ask questions and discuss fears.
        - Administer medications as prescribed.
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    - MEDICATIONS
        - Digoxin: a cardiac glycoside that increases contractility of the myocardium and promotes cardiac output
        - Monitor digoxin laboratory levels and expect dosages to be reduced due to slow excretion of the medication with CKD.
        - Monitor carefully for manifestations of digoxin toxicity (nausea, vomiting, anorexia, visual changes). Monitor potassium level.
        - Administer digoxin after dialysis.
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    - MEDICATIONS
        - Sodium polystyrene: increases elimination of potassium
        - Restrict sodium intake. Sodium polystyrene contains sodium and can cause fluid retention and hypertension, a complication of CKD.
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    - MEDICATIONS
        - Epoetin alfa: stimulates production of red blood cells; given for anemia
        - Ferrous sulfate: an iron supplement to prevent severe iron deficiency Calcium carbonate
        - Taken with meals to bind phosphate in food and stop phosphate absorption.

        - Take 2 hr before or after other medications.
        - Can cause constipation, so clients can require a stool softener.
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    - MEDICATIONS
        - Furosemide or bumetanide: loop-diuretics administered to excrete excess fluids
        - Avoid administering to a client who has end-stage kidney disease.
        - Clients can also receive thiazide diuretics, potassium-sparing diuretics, and osmotic diuretics.
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    - THERAPEUTIC PROCEDURES
        - Peritoneal dialysis
        - Hemodialysis
        - Kidney transplantation
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    - CLIENT EDUCATION
        - Monitor the daily intake of carbohydrates, proteins, sodium, and potassium.
        - Monitor fluid intake according to prescribed fluid restriction.
        - Avoid antacids containing magnesium.
        - Take rest periods from activity.
        - Follow instructions for home or outpatient peritoneal dialysis or hemodialysis.
        - Measure blood pressure and weight at home.
        - Ask questions and discuss fears.
        - Diet, exercise, and take medication as prescribed.
        - Notify the provider of skin breakdown.
        - CARE AFTER DISCHARGE
        - Nephrology services is indicated if receiving outpatient dialysis.
        - Consider joining a community support group relating to the disease.
        - Consult nutritional services for dietary needs.

        - Take part in a smoking-cessation support group and counseling if needed.
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    - COMPLICATIONS
        - Potential complications include electrolyte imbalance, dysrhythmias, fluid overload, hypertension, metabolic acidosis, secondary infection, and uremia.
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- ***UTI***
    - A urinary tract infection (UTI) refers to any portion of the lower urinary tract (ureters, bladder, urethra, prostate).
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    - UTIs include the following.
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        - Cystitis
        - Urethritis
        - Prostatitis
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    - An upper UTI refers to conditions such as pyelonephritis (inflammation of the kidney pelvis).
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    - UTIs are often caused by Escherichia coli. Other organisms include enterobacteriaceae micro-organisms (klebsiella, proteus), pseudomonas, and Staphylococcus saprophyticus.
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    - Untreated UTIs can lead to pyelonephritis and urosepsis, which can result in septic shock and death.
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    - **RISK FACTORS**
        - Alkaline urine promotes bacterial growth.
        - Indwelling urinary catheters (significant source of infection in clients who are hospitalized)
        - Stool incontinence. Bladder distention
        - Urinary conditions (anomalies, stasis, calculi, residual urine)
        - Possible genetic links

- Disease (diabetes mellitus)
- Female sex
- Short urethra predisposes females to UTIs
- Close proximity of the urethra to the rectum
- Decreased estrogen in aging females promotes atrophy of the urethral opening toward the rectum (increases the risk of urosepsis in females).
- Sexual intercourse
- Frequent use of feminine hygiene sprays, tampons, sanitary napkins, and spermicidal jellies
- Pregnancy
- Poorly-fitted diaphragm
- Hormonal influences within the vaginal flora
- Synthetic underwear and pantyhose
- Wet bathing suits
- Frequent submersion into baths or hot tubs Older adult clients
- Increased risk of bacteremia, sepsis, and shock
- Bladder prolapse in females
- Inability to empty bladder (neurogenic bladder) as a result of a stroke or Parkinson's disease
- Fecal incontinence with poor perineal hygiene
- Hypoestrogenism in females affecting the mucosa of the vagina and urethra, causing bacteria to adhere to the mucosal surface
- Renal complications increase due to decreased number of functioning nephrons and fluid intake

- **EXPECTED FINDINGS**
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    - Lower back or lower abdominal discomfort and tenderness over the bladder area
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    - Nausea
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    - Urinary frequency and urgency
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    - Dysuria, bladder cramping, spasms

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- Feeling of incomplete bladder emptying or retention of urine
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- Perineal itching
- Hematuria (red-tinged, smoky, coffee-colored urine)
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- Pyuria (WBCs in the urine sample)
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- Fever
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- Vomiting
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- Voiding in small amounts
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- Nocturia
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- Urethral discharge
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- Cloudy or foul-smelling urine

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- **OLDER ADULT MANIFESTATIONS**
-
    - Confusion
    -
    - Incontinence
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    - Loss of appetite
    -
    - Nocturia and dysuria
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    - Hypotension, tachycardia, tachypnea, and fever (indications of urosepsis)
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- **LAB TESTS**
    - Urinalysis and urine culture and sensitivity
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        - **EXPECTED FINDINGS**
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        - Bacteria, sediment, white blood cells (WBC), and red blood cells (RBC)
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        - Positive leukocyte esterase and nitrites (68% to 88% positive results indicates UTI)
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        - **NURSING ACTIONS**
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        - Instruct the client regarding proper technique for the collection of a clean-catch urine specimen.
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        - Collect catheterized urine specimens using sterile technique.
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    - **WBC count and differential**
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        - If urosepsis is suspected
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        - White blood cell count equal to or greater than 10,000/uL with a shift to the left, indicating an increased number of immature cells (neutrophils) in response to infection
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        - Sexually transmitted infection testing
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        - STIs can cause manifestations of a UTI.
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        - Chlamydia trachomatis, Neisseria gonorrhoeae, and herpes simplex can cause acute urethritis.
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        - Trichomoniasis or candida can cause acute vaginal infections.
    - **Diagnostics Procedures**
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        - **Imaging procedures**
            - Cystoscopy is used for complicated UTIs.

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- Cystourethroscopy detects strictures, calculi, tumors, and cystitis.
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- Computed tomography (CT) scan is used to detect pyelonephritis.
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- Ultrasonography detects cysts, tumors, calculi, and abscesses.
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- Transrectal ultrasonography is used to detect prostate and bladder conditions in males.

- **NURSING CARE**
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    - Consult with the provider regarding prescribed fluid restrictions if needed.
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    - Administer antibiotic medications as prescribed.
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    - Recommend warm sitz bath two or three times a day to provide comfort.
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    - Avoid the use of indwelling catheters if possible. This reduces the risk for infection.
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    - Clients who are pregnant require immediate and effective treatment to prevent pyelonephritis that can result in preterm labor.
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- **Medications for Urinary Tract Infections**
    - **Fluoroquinolones, nitrofurantoin, trimethoprim, or sulfonamides**
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    - **Antibiotics used to treat urinary infections by directly killing bacteria and inhibiting bacterial reproduction**
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- Penicillins and cephalosporins are administered less frequently because the medication is less effective and tolerated.
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- Nitrofurantoin is an antibacterial medication where therapeutic levels are achieved in the urine only.

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■ NURSING ACTIONS

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- If a sulfonamide is prescribed, ask the client about allergy to sulfa.

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■ NURSING ACTIONS (cont.)

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- Advise clients taking fluoroquinolones or sulfonamides that sun-sensitivity is increased and sunburn is a risk for even dark-skinned individuals. These medications can precipitate in the renal tubules, so advise client to take these medications with a full glass of water and to increase fluid intake.

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■ CLIENT EDUCATION

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- Understand the need to take all of the prescribed antibiotics even if manifestations subside.
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- Take the medication with food.
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- Monitor and report watery diarrhea that can indicate pseudomembranous colitis.

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■ **Phenazopyridine**

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- Bladder analgesic used to treat UTIs
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- CLIENT EDUCATION
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- The medication will turn urine orange.
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- Take the medication with food.
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- The medication will not treat the infection, but it will help relieve bladder discomfort, pain, burning, itching, urgency, and frequency.

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- **CLIENT EDUCATION**
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    - Drink at least 8 to 10 glasses of fluid daily.
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    - Bathe daily to promote good body hygiene.
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    - Empty bladder every 3 to 4 hr instead of waiting until the bladder is completely full.
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    - Urinate before and after intercourse.
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    - Drink cranberry juice to decrease the risk of infection.
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    - The compound in cranberries might stop certain bacteria from adhering to the mucosa of the urinary tract.
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    - Clients who have chronic cystitis should avoid cranberry juice, which irritates the bladder.
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    - Empty the bladder as soon as there is an urgency to void.
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    - Instruct female clients
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    - Wipe the perineal area from front to back.
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        - Avoid using bubble baths, and feminine products and toilet paper containing perfumes.
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        - Avoid sitting in wet bathing suits.
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        - Avoid wearing pantyhose with slacks or tight clothing.
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        - CARE AFTER DISCHARGE:
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        - Urology services can be consulted for management of long-term antibiotic therapy for chronic UTIs.
    - **COMPLICATIONS**
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        - Urethral obstruction, pyelonephritis, chronic kidney disease, urosepsis, septic shock, and death
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- ***End Stage Renal Disease***
    - Dialysis or transplant is required to maintain life.
    - Often gradual progression.
    - Anuria – less than 100 mL of urine per day.
    - Azotemia
    - Anemia
    - Elevated BUN and creatinine
    - Patient may report – lethargy, confusion, edema, pruritis.
    - FLUID VOLUME EXCESS
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- ***Glomerulonephritis***
    - Immunologic kidney disorder that can start in the kidneys (genetic basis and immune-inducing inflammation) or be a result of other health disorders (lupus erythematosus, diabetic nephropathy) and results in glomerular injury
    - ●This can lead to end-stage kidney disease (ESKD).
    - ●Acute glomerulonephritis often occurs following an infection.

- ●Chronic glomerulonephritis develops over a period of 20 to 30 years.
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- RISK FACTORS
- Recent infection particularly of the skin or upper respiratory tract
- ●Recent travel or other possible exposure to bacteria, viruses, fungi or parasites
- ●Presence of systemic diseases (systemic lupus erythematosus, Goodpasture syndrome- a group of acute illnesses that affects the lungs and kidneys)
- ●Recent surgery or illness
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- EXPECTED FINDINGS
- ● Anorexia
- ●Nausea
- ●Dysuria
- ●Flank pain
- ●Puffiness around the eyes or visual disturbances
- ●Oliguria
- ●Fatigue
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- EXPECTED FINDINGS (cont.)
- ●Hypertension
- ●Difficulty breathing
- ●Crackles
- ●S3 heart sound
- ●Generalized edema
- ●Reddish-brown, smoky-colored, or cola-colored urine
- ●Older adult clients likely to have the less common manifestations related to circulatory overload, which can be confused with congestive heart failure
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- LABORATORY TESTS
- ●Urinalysis shows red blood cells and protein.
- ●Glomerular filtration rate is decreased.

- ●Blood, skin or throat cultures (if indicated).
- ●24-hr urine collection for protein assay (increased in acute glomerulonephritis and decreased in chronic glomerulonephritis).
- ●Blood urea nitrogen and creatinine are increased.
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- LABORATORY TESTS (cont.)
- ●Antistreptolysin O titers are increased after group A beta hemolytic streptococcus infection.
- ●C3 complement levels decreased.
- ●Cryoglobulins present.
- ●Anti-nuclear antibody (ANA) presence.
- ●Altered electrolytes: Hyperkalemia, hyperphosphatemia, hypocalcemia.
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- DIAGNOSTIC PROCEDURES
- Kidney biopsy will diagnose the condition, determine prognosis, and guide treatment.
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- NURSING CARE
- ●Coordinate care to conserve client energy.
- ●Consult with provider to determine if fluid restriction is needed.
- ●Administer antibiotics as prescribed.
- ●Reinforce teaching about relaxation exercises to decrease stress.
- ●Monitor blood pressure.
- ●Monitor respiratory status.
- ●Monitor fluid and electrolytes.
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- Medications for Glumerulonephritis
- Antibiotics:
- Penicillin, erythromycin, or azithromycin is prescribed for glomerulonephritis infection due to streptococcal infection.
- Antihypertensives:
- To control hypertension

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- CLIENT EDUCATION
- Complete full course of antibiotics.
- Monitor weight daily and report increases to provider.
- Adhere to dietary and fluid restrictions.
- Perform basic infection control practices, such as hand hygiene.
- CARE AFTER DISCHARGE
- ● Consider home care services for continued dialysis or plasmapheresis if needed. Follow up with the provider as directed.
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- ***Renal calculi/urolithiasis***
  - Urolithiasis (Renal Calculi)
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  - Formation of calculi in the urinary tract
  - Urolithiasis develops from minerals that have precipitated out of solution and adhere, forming stones that vary in size and shape.
  - The majority of calculi are composed of calcium phosphate or calcium oxalate, but they can contain other substances (uric acid, struvite, cystine).
  - Untreated, may lead to hydronephrosis
  - Patient frequently experiences severe pain
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  - Risk Factors:
  - ●Cause is unknown
  - ●Increased incidence in males

- ●Genetic predisposition
- ●Urinary tract lining that is damaged
- ●Urine flow that is decreased, concentrated, and contains particles (calcium)
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- Risk Factors:
- ●Metabolic defects
- Increased intestinal absorption or decreased renal excretion of calcium
- Increased oxalate production (genetic) or inability to metabolize oxalate from foods (black tea, spinach, beets, Swiss chard, chocolate, and peanuts)
- Increased production or decreased clearance of purines (contributing to increased uric-acid levels)
- ●High alkalinity or acidity of urine
- ●Urinary stasis, urinary retention, immobilization, and dehydration
- ●Decreased fluid intake or increased incidence of dehydration among older adult clients
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- Expected Findings
- ●Severe pain (renal colic)
- Pain intensifies as the calculus moves through the ureter.
- Flank pain suggests calculi are located in the kidney or ureter.

- Flank pain that radiates to the abdomen, scrotum, testes, or vulva suggests calculi in the ureter or bladder.
- ●Urinary frequency or dysuria (calculi in the bladder)
- ●Fever
- ●Diaphoresis
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- Expected Findings
- ●Pallor
- ●Nausea/vomiting
- ●Tachycardia, tachypnea, increased blood pressure (pain), or decreased blood pressure (shock)
- ●Oliguria/anuria occurs with calculi that obstruct urinary flow. Urinary tract obstruction is a medical emergency and needs to be treated to preserve kidney function.
- ●Hematuria (rusty or smoky-looking urine)
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- Laboratory Tests:
- Urinalysis
- ●Altered odor of the urine and increased urine turbidity if infection is present
- ●Increased RBCs, WBCs, and bacteria (presence of infection)
- ●Crystals noted on microscopic exam
- ●Abnormal blood calcium, phosphate, and uric-acid levels in the presence of metabolic disorders/defects

- ●Decreased pH: uric acid, cystine stones
- ●Increased pH: calcium or struvite stones
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- Diagnostic Procedures:
- Radiology examination
- X-ray of kidney, ureters, bladder (KUB), or intravenous pyelogram (IVP) is used to confirm the presence and location of calculi. IVP is contraindicated if there is a urinary obstruction.
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- Diagnostic Procedures:
- CT or MRI of the abdomen and pelvis
- A CT (noncontrast helical scan) or MRI is used to identify cystine or uric-acid calculi, which cannot be seen on standard x-rays.
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- Diagnostic Procedures:
- Renal ultrasound or cystoscopy
- These can confirm the diagnosis.
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- Nursing Care:
- ●Report laboratory and diagnostic findings to the provider.
- ●Provide preoperative and postoperative care as indicated.
- ●Administer prescribed medications.
- ●Strain all urine to check for passage of the calculus and save the calculus for laboratory analysis.
- ●Encourage increased oral intake to 3 L/day unless contraindicated.
- ●Encourage the use of hot baths and moist heat to promote comfort.
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- Nursing Care:
- ●Assist with the administration of IV fluids as prescribed.
- ●Encourage ambulation to promote passage of the calculus.
- ●Some clients can pass stones less than 5 mm without any interventions. Monitor the client closely during this period.
- MONITOR
- ●Pain status
- ●Intake and output
- ●Urinary pH
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- Medications:
- Analgesics
- Opioids
- ●Morphine sulfate can be used in the first 24 to 36 hr with the acute onset of calculi. It can be administered IV or IM.
- ●Opioid agents are used to treat moderate to severe pain. Activation of these receptors produces analgesia, respiratory depression, euphoria, sedation, and decreased GI motility.
- ●Use cautiously with clients who have asthma or emphysema due to the risk of respiratory depression.
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- Medications:
- Opioids
- ●NURSING ACTIONS
- ◯Check the client frequently.
- ◯Watch for evidence of respiratory depression, especially in older adult clients. If respirations are 12/min or less, stop the medication and notify the provider immediately.
- ◯Monitor vital signs for hypotension and decreased respirations.
- ◯Monitor level of sedation (drowsiness, level of consciousness).
- ●CLIENT EDUCATION:
- Drink plenty of fluids to prevent constipation.
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- NSAIDs
- ●Ketorolac is used to treat mild to moderate pain, fever, and inflammation.
- ●There is a risk for decreased renal function and perfusion.
- ●NURSING ACTIONS:
- Observe for indications of bleeding.
- ●CLIENT EDUCATION
- Watch for bleeding (dark stools, blood in stools).
- Notify the provider if abdominal pain occurs, which can be due to gastric ulceration.
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- Spasmolytic medications
- Oxybutynin alleviates pain by decreasing bladder spasms that can result due to renal calculi.
- NURSING ACTIONS
- ●Check for history of glaucoma, as this medication increases intraocular pressure.
- ●Monitor for dizziness and tachycardia.
- ●Monitor for urinary retention.
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- Spasmolytic medications
- Oxybutynin

- CLIENT EDUCATION
- ●Report palpitations and problems with voiding or constipation.
- ●Dizziness and dry mouth are common with the medication.
- ●Suck on hard candies to alleviate dry mouth.
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- Antibiotics
- Gentamicin and cephalexin are used to treat UTIs.
- NURSING ACTIONS
- ●Administer medication with food to decrease GI distress.
- ●Monitor for nephrotoxicity and ototoxicity for clients taking gentamicin.
- CLIENT EDUCATION
- ●Urine can have foul odor related to the antibiotic.
- ●Report loose stools related to the medication.
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- Therapeutic procedures:
- Extracorporeal shock wave lithotripsy (ESWL)
- ●Uses sound, laser, or shock-wave energies to break calculi into fragments ●Requires moderate (conscious) sedation and ECG monitoring during the procedure
- NURSING ACTIONS
- ●Preprocedure
- Assist with obtaining informed consent for treatment.
- Position the client in a flat position.

- Assist with the application of a topical anesthetic over stone site 45 min prior to procedure.
- Monitor for gross hematuria and strain urine following the procedure.
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- Therapeutic procedures:
- Extracorporeal shock wave lithotripsy (ESWL)
- ●Postprocedure
- Strain all urine.
- Monitor site.
- CLIENT EDUCATION
- ●Bruising is normal at the site where waves are applied.
- ●There will be hematuria post-procedure.
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- Surgical Interventions
- Stenting is the placement of a small tube in the ureter during a ureteroscopy to dilate the ureter and allow passage of a calculus. An indwelling urinary catheter can be used to facilitate the passage of calculus.
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- Surgical Interventions
- Percutaneous ureterolithotomy/ nephrolithotomy is the insertion of an ultrasonic or laser lithotripter into the ureter or kidney to grasp and extract the calculus using a basket and forceps.
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- Surgical Interventions
- Open surgery uses a surgical incision to remove the calculus. This surgery is used for large or impacted calculi (staghorn calculi) or for calculi not removed by other approaches.
- ●Ureterolithotomy: into the ureter
- ●Pyelolithotomy: into the kidney pelvis
- ●Nephrolithotomy: into the kidney
- CARE AFTER DISCHARGE:
- Nutritional services can be consulted for dietary modifications concerning foods related to calculi formation.
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- Client Education
- Adhere to the diet and medications in the treatment for prevention of renal calculi.
- Calcium phosphate

- ●Limit intake of food high in animal protein (reduction of protein intake decreases calcium precipitation).
- ●Limit sodium intake.
- ●Reduced calcium intake (dairy products) is individualized.
- Medications
- ●Thiazide diuretics (hydrochlorothiazide) are used to increase calcium reabsorption.
- ●Orthophosphates are used to decrease urine saturation of calcium oxalate.
- ●Sodium cellulose phosphate is used to reduce the intestinal absorption of calcium.
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- Client Education
- Adhere to the diet and medications in the treatment for prevention of renal calculi.
- Calcium oxalate
- ●Avoid oxalate sources: spinach, black tea, rhubarb, cocoa, beets, pecans, strawberries, peanuts, okra, chocolate, wheat germ, lime peel, and Swiss chard.
- ●Limit sodium intake.
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- Client Education

- Adhere to the diet and medications in the treatment for prevention of renal calculi.
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- Client Education
- Adhere to the diet and medications in the treatment for prevention of renal calculi.
- Struvite (magnesium ammonium phosphate)
- Avoid high-phosphate foods: dairy products, red and organ meats, and whole grains.
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- Client Education
- Adhere to the diet and medications in the treatment for prevention of renal calculi.
- Uric acid (urate)
- ●Decrease intake of purine sources: organ meats, poultry, fish, gravies, red wine, and sardines.
- ●Lemon or orange juice can be consumed to alkalinize the urine.
- Medications
- ●Allopurinol is used to prevent the formation of uric acid.
- ●Potassium or sodium citrate or sodium bicarbonate is used to alkalinize the urine.

- Client Education
- Adhere to the diet and medications in the treatment for prevention of renal calculi.
- Cystine
- Limit animal protein intake.
- Medications
- ●Alpha mercaptopropionyl glycine (AMPG) is used to lower urine cystine.
- ●Captopril is used to lower urine cystine.
- Complications
- Obstruction
- A calculus can block the passage of urine into the kidney, ureter, or bladder. Urinary output can be diminished or absent.
- This can predispose the client to hydroureter (enlargement of the ureter).
- NURSING ACTIONS
- ●Notify the provider immediately.
- ●Prepare the client for removal of the calculus.

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    - Complications
    - Hydronephrosis
    - Occurs when a calculus has blocked a portion of the urinary tract. The urine backs up and causes distention of the kidney.
    - This can lead to permanent kidney damage.
    - NURSING ACTIONS
    - ●Notify the provider immediately.
    - ●Prepare the client for removal of the calculus.
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- ***Urinary incontinence***
    - Refers to the loss or involuntary loss of bladder control.
    - It may range from leaking to full loss of the bladder's contents.
    - An estimated 20 million Americans are affected by urinary incontinence; 85% of that total are women.
    - Incontinence my arise as a complication of many disorders, such as UTI, loss of sphincter control, or sudden change of pressure within the abdomen.
    - It may be permanent, as with spinal cord trauma, or temporary, as with pregnancy.
    - Women with weakened structures of the pelvic floor are prone to stress incontinence.
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    - Discuss each type of incontinence with possible training exercises to decrease it.
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    - There are various types of incontinence classified according to their causes:

- Stress incontinence: Results from the pressure or stressors on the bladder sphincter by events such as sneezing or heavy lifting.
- Urge incontinence: Feelings of an urgency to void followed by incontinence. It is associated with conditions such as Parkinson's disease and Alzheimer's disease.
- Overflow incontinence: Repeated inability to fully empty the bladder results in an overly full bladder, which leaks out unexpectedly.
- Mixed incontinence: A mixture of stress and urge incontinence
- Functional incontinence: The influence of mental and physical impairments resulting in an inability to make it to the toilet in time to void.
- Total incontinence: the bladder cannot store any urine at all. It can be caused by injury to the spinal cord or by a bladder fistula.

- ***Pyelonephritis***
  - Pyelonephritis is an infection and inflammation of the kidney pelvis, calyces, and medulla.
  - The infection usually begins in the lower urinary tract with organisms ascending into the kidney pelvis.
  - ●Escherichia coli organisms are frequently the cause of acute pyelonephritis.
  - ●Repeated infections can create scarring that changes the blood flow to the kidney, glomerulus, and tubular structure.
  - ●Filtration, reabsorption, and secretion are impaired, which results in a decrease in kidney function.
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  - ●Acute pyelonephritis is an active bacterial infection that occurs most frequently in females 20 to 30 years of age and can cause the following.
  - ◯Interstitial inflammation
  - ◯Tubular cell necrosis

- ◯Abscess formation in the capsule, cortex, or medulla
- ◯Temporarily altered kidney function (this rarely progresses to chronic kidney disease)
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- ●Chronic pyelonephritis is the result of repeated infections that cause progressive inflammation and scarring.
- This can result in the thickening of the calyces and post-inflammatory fibrosis with permanent renal tissue scarring.
- It is more common with obstructions, urinary anomaly, and vesicoureteral urine reflux.
- Reflux of urine occurs at the junction where the ureter connects to the bladder
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- EXPECTED FINDINGS
- ●Chills
- ●Headache
- ●Colicky-type abdominal pain
- ●Nausea
- ●Malaise, fatigue
- ●Burning, urgency, and frequency with urination
- ●Costovertebral angle tenderness.
- ●Flank and back pain
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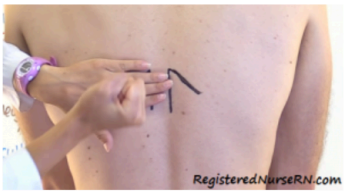

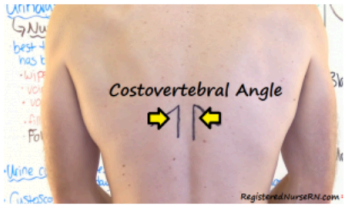

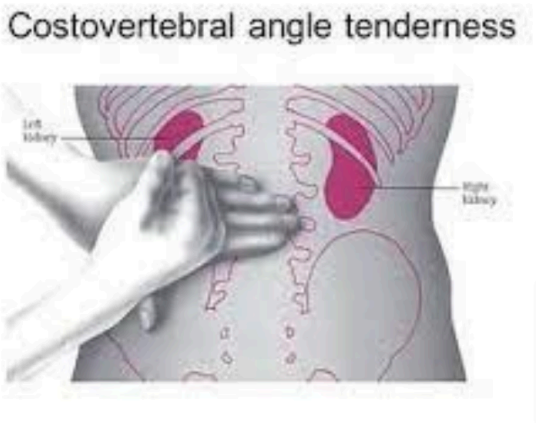

- EXPECTED FINDINGS (cont.)
- ●Nocturia
- ●Fever
- ●Tachycardia
- ●Tachypnea
- ●Hypertension
- ●Vomiting
- ●Inability to concentrate urine or conserve sodium (chronic pyelonephritis)
- ●Bacteremia without other manifestations

- LABORATORY TESTS
- ●Urinalysis and urine culture and sensitivity are the same as for a UTI
- ●WBC count and differential are the same as for a UTI.
- ●Blood cultures will be positive for the presence of bacteria if a systemic infection is present.

- ●Serum creatinine and blood urea nitrogen (BUN) are elevated during acute episodes and consistently elevated with chronic infection.
- ●C-reactive protein is elevated during exacerbating inflammatory processes of the kidneys. Erythrocyte sedimentation rate (ESR) is elevated during acute or chronic inflammation.
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- DIAGNOSTIC PROCEDURES
- Imaging procedures
- ●An x-ray of the kidneys, ureters, and bladder (KUB) can demonstrate calculi or structural abnormalities.
- ●Ultrasonography is used to detect cysts, tumors, calculi, and abscesses.
- ●Gallium scan is a nuclear medicine test that uses injectable radioactive dye to visualize organs, glands, bones, and blood vessels that have infection and inflammation.
- ●Intravenous pyelogram can demonstrate calculi, structural, or vascular abnormalities.
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- NURSING CARE
- Monitor the following.
- Nutritional status
- Intake and output
- Fluid and electrolyte balance
- Temperature
- Onset, quality, duration, and severity of pain
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- NURSING CARE (cont.)
- ●Increase fluid intake to 2 L/day unless contraindicated.
- ●Administer antipyretic, such as acetaminophen, as needed for fever and opioid analgesics for pain associated with pyelonephritis.
- ●Provide emotional support.
- ●Assist with personal hygiene.
- Medications for Pyelonephritis
- Opioid analgesics (opioid agonists), morphine sulfate, and morphine: for moderate to severe pain
- Antibiotics
- ●Mild to moderate pyelonephritis treated at home for 14 days with the following
- Anti-infective: trimethoprim, sulfamethoxazole/ trimethoprim
- Quinolone antibiotic: ciprofloxacin, levofloxacin
- Medications for Pyelonephritis
- Opioid analgesics (opioid agonists), morphine sulfate, and morphine: for moderate to severe pain
- Antibiotics
- ●Severe pyelonephritis treated in the hospital for 24 to 48 hr with IV medication
- Quinolone antibiotics: ciprofloxacin
- Cephalosporin antibiotics: ceftriaxone, ceftazidime
- Aminopenicillin antibiotics: ampicillin, ampicillin/sulbactam
- Aminoglycoside antibiotics: gentamicin, tobramycin

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- CLIENT EDUCATION
- ●Maintain an adequate nutritional status.
- ●Drink at least 2 L fluids daily unless otherwise indicated by the provider.
- ●Notify the provider if acute onset of pain occurs or a fever is present.
- ●Express any fears and anxiety related to the disease.
- ●Take rest periods from activity as needed.
- CARE AFTER DISCHARGE
- ●Home care services can be indicated if needing assistance with medications or nutritional therapy.
- ●Follow up with the provider as directed.
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- ***Cystitis***
  - Etiology and Pathophysiology
  - Cystitis is an inflammation of the wall of the urinary bladder, usually caused by urethrovesical reflux, introduction of a catheter or similar instrument, or contamination from feces. The most common microorganism causing acute cystitis is E. coli. Cystitis is most common in women because of the ease of entrance of pathogens through the short urethra, even during voiding. Conflicting data exist about the role of bubble baths, clothing, and hygiene in increasing the risk of cystitis in women. Cystitis in men usually occurs secondary to another infection, such as prostatitis or epididymitis (see the Patient Teaching box).
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  - Patient Teaching
  - Cystitis

- • Teach the patient to cleanse the perineal area from front to back to prevent contamination by spread of pathogens (especially E. coli) from the rectum to the short urethra.
- • Encourage drinking 2000 mL of liquids per day unless contraindicated.
- • Instruct the patient to take all prescribed medications even though symptoms may subside quickly.
- • Remind the patient to empty the bladder as soon after intercourse as possible.
- • If UTIs are associated with intercourse, recommend cleansing the genitalia with soap and water before having sexual relations.
- • Encourage showers instead of tub baths.
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- Clinical Manifestations
- The common signs and symptoms associated with cystitis are dysuria, urinary frequency, and pyuria.
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- Assessment
- Collection of subjective data includes assessment of the lower abdomen, which may produce discomfort over the urinary bladder. Patient complaints include burning on urination, dysuria, frequency, urgency, and nocturia. The urine may be cloudy, strong-smelling, or have visible or occult hematuria. A low-grade fever may also be present.
- Collection of objective data includes a clean-catch or catheterized urinalysis with culture and sensitivity tests to aid in confirming the diagnosis and in determining the appropriate treatment.
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- Diagnostic Tests
- Microscopic inspection of the urine often reveals bacteria and hematuria. A voiding cystogram may be used to identify reflux of urine into the bladder. Diagnosis is confirmed by a clean-catch, midstream urinalysis that reveals a bacterial count greater than 100,000 organisms/mL.
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- Medical Management

- For cystitis without the complications of obstruction or other underlying pathologic conditions, medical management consists of short-term therapy (usually 3 days) with an anti-infective agent. If the treatment is effective, the patient should receive relief quickly. A repeat urinalysis 1 to 3 days after initiation of the medication confirms the effectiveness of the intervention.
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- Nursing Interventions and Patient Teaching
- Nursing interventions focus on teaching that these infections tend to recur by either reinfection or persistent infection. Encourage the patient to drink 2000 mL of caffeine-free fluid per day. Record accurate I&O. Include early detection in the teaching. Long-term prophylaxis with low doses of medication may be necessary. Encourage the patient to contact the provider when symptoms begin in order to prevent infections from becoming a complicated UTI.
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- Prognosis
- Successful treatment depends on the patient's ability to adequately flush the urinary tract and complete the course of antibiotics prescribed.
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2. Explain the **action**, **side effects**, **adverse effects**, **labs to monitor**, and **nursing considerations** for the following medications:
   a. Furosemide
   b. Prednisone
   c. Phenazopyridine HCL
   d. Bethanechol
   e. Spironolactone
   f. Bumetanide
3. Discuss the possible causes of the following:
   a. Intra-renal failure
   b. Pre-renal failure
   c. Post-renal failure
4. Differentiate stress incontinence from urge incontinence.

- ***Stress incontinence:*** *R*esults from the pressure or stressors on the bladder sphincter by events such as sneezing or heavy lifting.

- ***Urge incontinence:*** Feelings of an urgency to void followed by incontinence. It is associated with conditions such as Parkinson's disease and Alzheimer's disease.

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5. List the signs and symptoms of transplant rejection.
6. List foods not allowed in a low-sodium diet.
7. List foods high in phosphorus.
8. List foods high in potassium.