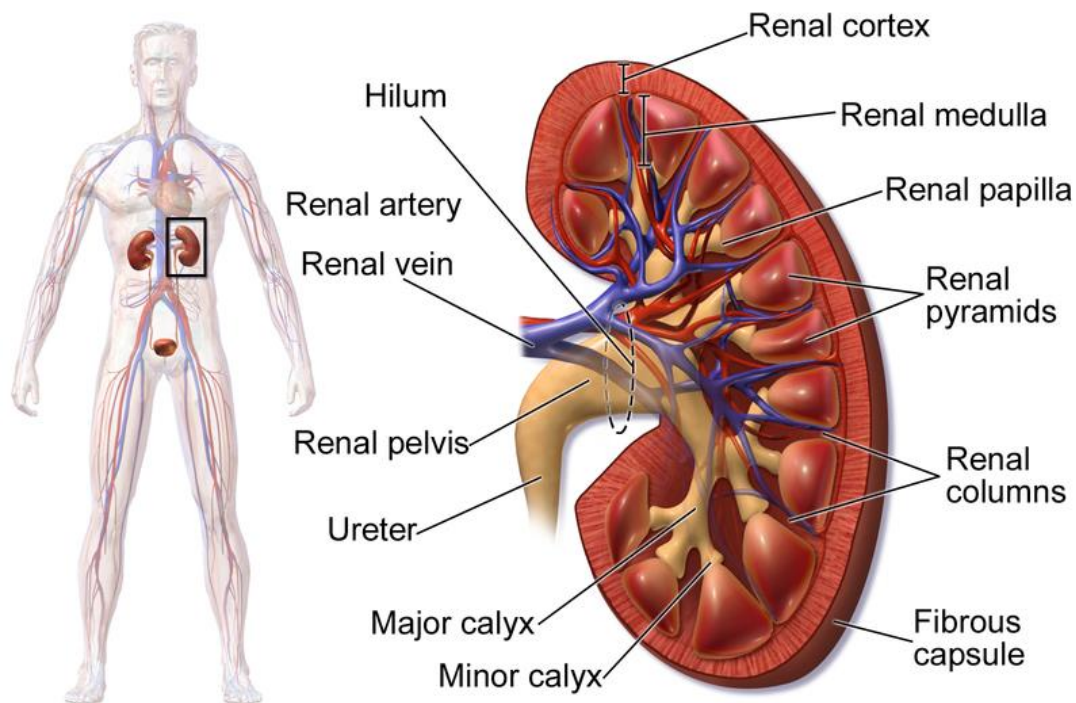


Bullet Point Nursing

Medical - Surgical / Adult Health Nursing – Nephrology system

Disclaimer: These notes are designed to provide the key points of each topic. These notes should be used with the associated lectures that expand upon each of the points. Every effort is made to ensure this content is up to date and accurate at the time of writing. No liability is assumed for the content or its relation to current standards and practices.

Anatomy and physiology nephrology review:



Kidney Anatomy

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- Kidneys are in the bilateral retroperitoneal space and enclosed in the renal capsule.
- Parenchyma includes the cortex, pyramids, and medulla.
 - Contains nephrons, which contain the glomerulus and tubules.
- Nephron pathway is Glomerulus → Bowman's capsule → PCT → Loop of Henle → DCT → Collecting duct → Bladder
- Antidiuretic hormone (ADH) increases water reabsorption in the collecting ducts.
- Aldosterone promotes sodium reabsorption and potassium excretion in the distal tubule.
- The kidneys regulate pH by reabsorbing bicarbonate or excreting hydrogen ions.
- The kidneys secrete erythropoietin stimulating red blood cell production.
- The kidneys secrete renin to regulate blood pressure through the renin-angiotensin-aldosterone system (RAAS) by controlling blood volume and systemic vascular resistance.
- The kidneys maintain regulation of fluid and electrolyte levels, and synthesize Vitamin D.
- The kidneys have a role in the excretion of a majority of medications.
 - Many medications require a dose adjustment in the event of kidney issues.

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Nephrology assessment and diagnostics:

- Volume / Fluid assessment
 - Skin turgor, edema, JVD, BP, I/O, mucous membranes, lung sounds
 - Normal urine output in adults is 0.5-1 ml/kg/hr.
- Nephrology labs:
 - Urine Specific Gravity: Normal range: 1.005–1.030.
 - Serum Creatinine: Normal range: 0.6–1.2 mg/dL.
 - Blood Urea Nitrogen (BUN): Normal range: 10–20 mg/dL.
 - Serum Sodium (Na⁺): Normal range: 135–145 mmol/L.
 - Serum Osmolality: Normal range: 275-295 mOsm/kg.
 - Glomerular filtration rate (GFR) Normal range: 90-120 ml per minute.
 - Best assessed via creatinine clearance test
- Urinalysis:
 - Instruct the patient to wash perinium, to ideally collect midstream, from the first urine of the day.
 - Cloudy or reddish urine may indicate infection or hematuria.
 - Proteinuria is a sign of glomerular dysfunction.
 - Nitrites and leukocyte esterase are indicators of a UTI.
- Renal Ultrasound:
 - Used to evaluate kidney size, structure, and detect abnormalities like hydronephrosis, cysts, or tumors.
- KUB (Kidney, Ureter, Bladder) X-ray: Used for kidney stones, obstructions, or abnormalities.

Nephrology Notes:

- Hemodialysis (HD):
 - Filters waste products, excess fluid, and electrolytes from the blood.
 - AEIOU indications for urgent dialysis (in addition to CKD):
 - A: Acidosis, E: Electrolyte imbalance, I: Ingestion or intoxication, O: Overload of fluid, U: Uremia.
 - Access Types:
 - Arteriovenous (AV) Fistula: Created by connecting an artery to a vein; preferred for long-term use due to lower infection and clotting risks.
 - AV Graft: A synthetic tube used when a fistula isn't feasible; higher risk of complications than a fistula.
 - Central Venous Catheter (CVC): Temporary access placed in a large vein (e.g., jugular or femoral); high risk of infection and thrombosis.
 - Check for a thrill (palpable vibration) and bruit (audible whooshing sound).
 - Avoid taking blood pressures in the arm with AV fistula or graft.
 - Most medications are withheld before dialysis to avoid removal by dialysis.
 - Antihypertensives are withheld to avoid hypotension during dialysis.
- Peritoneal Dialysis (PD):
 - Uses the peritoneum as a natural filter. The dialysis solution is infused into the abdominal cavity, where it absorbs waste products and excess fluid, then is drained.

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- Continuous Renal Replacement Therapy (CRRT):
 - A slower, continuous dialysis process typically performed in critically ill patients in an ICU. It removes waste, fluids, and solutes slower than traditional hemodialysis.
- Kidney transplant is indicated for patients with end-stage renal disease (ESRD)
 - Short-Term issues: Graft rejection, infection, and delayed graft function.
 - Long-Term issues: Increased risk of infections, malignancies, and medication-related complications (e.g., diabetes, hypertension, or osteoporosis due to immunosuppressants)
- Some patients with kidney disease require dietary modifications, such as limiting protein, sodium, potassium, and phosphorus to reduce kidney workload and prevent complications.
- In older adults, GFR typically declines with age. This leads to elevated creatinine levels and a reduced ability to concentrate urine, increasing the risk of dehydration.
- Common nephrotoxic drugs include NSAIDs, aminoglycosides, and contrast dyes.

Pathophysiology and Nursing Practice:

- **Acute Kidney Injury (AKI)**
 - Patho: AKI is a sudden decline in kidney function, typically defined as a decrease in glomerular filtration rate (GFR) over a short period (hours to days).
 - Prerenal (due to decreased perfusion)
 - Intrarenal (due to damage to the kidneys' structures)
 - Postrenal (due to obstruction in the urinary tract)
 - Presentation: Oliguria or anuria, edema, fatigue, confusion, nausea/vomiting, SOA.
 - Diagnosed based on presentation and renal labs
 - Management: Monitor I/O, fluids, renal labs, and electrolytes
 - Prerenal AKI: Fluid resuscitation and correcting the underlying cause
 - Intrinsic AKI: Addressing the underlying cause
 - Postrenal AKI: Relieving the obstruction
 - Disease progresses through oliguric phase, diuretic phase, and recovery.
- **Chronic Kidney Disease (CKD)**
 - Patho: CKD is a progressive and irreversible decline in kidney function due to chronic damage to the nephrons.
 - It is classified into five stages based on the glomerular filtration rate.
 - Common causes include DM, HTN, AKI, and PKD.
 - Presentation: Early stages may be asymptomatic. Symptoms include fatigue, anemia, hypertension, edema, pruritus, and electrolyte imbalances.
 - Diagnosed by GFR $< 90 \text{ mL/min/1.73m}^2$ for at least 3 months.
 - Management: Slow progression by treating any underlying DM, HTN, and smoking.
 - Treated with kidney transplant and dialysis.
 - Facilitate medication, fluids and diet restrictions, and dialysis compliance.
 - Monitor for complications such as anemia and fluid / electrolyte imbalance (hyperkalemia, hypermagnesemia, hyperphosphatemia, hypocalcemia).
- **Pyelonephritis**
 - Patho: Pyelonephritis is an upper urinary tract infection involving the renal pelvis and kidney parenchyma.

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- Presentation: Fever, chills, flank pain, CVA tenderness, nausea/vomiting, UTI s/s.
- Diagnosed by lab work (WBC, UA, urine culture).
- Management: Antibiotics (usually fluoroquinolones), fluids, pain management.
- **Nephrolithiasis (Renal calculi)**
 - Patho: Crystals aggregate, forming stones. The most common types are calcium oxalate, uric acid, struvite, and cystine stones. Stones may obstruct urine flow, leading to pain and possible kidney damage.
 - Presentation: Severe, colicky flank pain, n/v, hematuria, dysuria, urgency.
 - Diagnosed by non-contrast abd/pelvis CT. Backup option is renal US or KUB.
 - Management: Pain management, ambulation, and increased hydration.
 - Stones ≤5 mm – Typically do not require intervention.
 - Stones >5 and ≤10 mm – Alpha blocker (usually tamsulosin)
 - Stones >10 mm and/or in the proximal ureter – These patients usually require urology intervention.
 - Interventions include cystoscopy, lithotripsy, or lithotomy.
 - Stones may obstruct urine flow, leading to pain and possible kidney damage.
 - Ensure urine straining for collecting stones in the excreted urine.
 - Educate patient on dietary risk factors such as protein, calcium, purines, alkali.
- **Glomerulonephritis**
 - Patho: Inflammation and damage of the glomeruli, impairing their ability to filter blood properly.
 - Presentation: Oliguria, fatigue, hypertension, and cola colored urine.
 - Diagnosed by UA, labs, and confirmed by kidney biopsy.
 - Management: Antibiotics and supportive care.
 - Can be caused by infections, autoimmune diseases (i.e. lupus), or other conditions.
 - Can lead to chronic kidney disease (CKD).
- **Nephrotic syndrome**
 - Patho: Damage to the glomerular filtration barrier, which leads to abnormal permeability and excessive loss of proteins in the urine.
 - Presentation: Proteinuria, foamy urine, periorbital and peripheral edema, hypoalbuminemia, hyperlipidemia, and hypercoagulability.
 - Diagnosed by proteinuria (24-hour urine, normal is under 150mg/day. Over 3.5 g/day is diagnostic.) and kidney biopsy.
 - Management: Treat underlying causes (diabetic nephropathy, lupus).
 - Dietary modifications: Low-sodium, moderate-protein diet to manage edema and protein loss.
 - Medications: ACE inhibitors or ARBs, diuretics, statins, anticoagulants
- **Diabetic Nephropathy / Diabetic Kidney Disease**
 - Patho: Chronic hyperglycemia leading to damage of the glomeruli and renal microvasculature.
 - Presentation: Asymptomatic, progresses to include proteinuria, albuminuria, HTN, and edema.
 - Diagnosed by elevated BUN and creatinine, decreased GFR, elevated Hgb A1C, albuminuria (30-300+ mg/day).

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- Management: Address underlying DM, HTN, and HLD. Recommend low protein and low salt diet.
- Leading cause of chronic kidney disease (CKD) and end-stage renal disease (ESRD).
- **Polycystic Kidney Disease (PKD)**
 - Patho: A genetic disorder with growth of multiple fluid-filled cysts in the kidneys, leading to progressive enlargement and loss of kidney function.
 - Autosomal dominant PKD (Adult polycystic disease)
 - Autosomal recessive PKD (infantile polycystic disease)
 - The cysts interfere with normal kidney structure and function, causing hypertension, kidney failure, and other complications.
 - Presentation: Flank or abdominal pain, hematuria, hypertension, Recurrent UTI
 - Diagnosed by renal ultrasound.
 - Management: Control BP (ACEI/ARB), low sodium diet, treat UTIs, and increase fluid intake (unless contraindicated).

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