

McCance: Pathophysiology, 6th Edition

Chapter 36: Alterations of Renal and Urinary Tract Function

Key Points – Print

SUMMARY REVIEW

Urinary Tract Obstruction

1. Obstruction can occur anywhere in the urinary tract, and may be anatomic or functional, including renal stones, an enlarged prostate gland, or urethral strictures. The most serious complications are hydronephrosis, hydroureter, ureterohydronephrosis, and infection caused by the accumulation of urine behind the obstruction.
2. Compensatory hypertrophy and hyperfunction of the opposite kidney compensate for loss of function of the kidney with obstructive disease.
3. Relief of obstruction is usually followed by postobstructive diuresis and may cause fluid and electrolyte imbalance.
4. Persistent obstruction of the bladder outlet leads to residual urine volumes, low bladder wall compliance, and risk for vesicoureteral reflux and infection.
5. Kidney stones are caused by supersaturation of the urine with precipitation of stone-forming substances, changes in urine pH, or urinary tract infection. Most stones are unilateral.
6. The most common kidney stone is formed from calcium oxalate and most often causes obstruction by lodging in the ureter.
7. Obstructions of the bladder are a consequence of neurogenic or anatomic alteration bladder or both.
8. A neurogenic bladder is caused by a neural lesion that interrupts innervation of the bladder.
9. Upper motor neuron lesions above the pontine micturition center result in detrusor hyperreflexia an uninhibited or reflex bladder.
10. Upper motor neuron lesions between C2 and S1 result in overactive or hyperreflexive bladder function and vesicosphincter dyssynergia (lack of coordinated neuromuscular contraction).
11. Lower motor neuron lesions result in detrusor areflexia with underactive, hypotonic, or atonic bladder function.
12. OAB syndrome is an uncontrollable or premature contraction of the bladder that results in urgency with or without incontinence, frequency, and nocturia.
13. Anatomic obstructions to urine flow include prostatic enlargement, urethral stricture, and pelvic organ prolapse in women.
14. Partial obstruction of the bladder can result in overactive bladder contractions with urgency. There is deposition of collagen in the bladder wall over time, resulting in decreased bladder wall compliance and ineffective detrusor muscle contraction.

15. Renal cell carcinoma is the most common renal neoplasm. The larger neoplasms tend to metastasize to the lung, liver, and bone.
16. Bladder tumors are commonly composed of transitional cells with a papillary appearance and a high rate of recurrence.

Urinary Tract Infection

1. UTIs are commonly caused by the retrograde movement of bacteria into the urethra and bladder. UTIs are uncomplicated when the urinary system is normal or complicated when there is a defect or abnormality.
2. Cystitis is an inflammation of the bladder commonly caused by bacteria and may be acute or chronic.
3. Painful bladder syndrome/interstitial cystitis includes nonbacterial infectious cystitis (viral, mycobacterial, chlamydial, fungal), noninfectious cystitis (i.e., radiation injury), and interstitial cystitis, which is probably related to autoimmune injury.
4. Pyelonephritis is an acute or chronic inflammation of the renal pelvis often related to ascending infection and obstructive uropathies and may cause abscess formation and scarring with an alteration in renal function.

Glomerular Disorders

1. Glomerular disorders are a group of related diseases of the glomerulus that can be caused by immune injury, toxins or drugs, vascular disorders, and other systemic diseases.
2. Acute glomerulonephritis commonly results from inflammatory damage to the glomerulus as a consequence of immune reactions including deposition of circulating immune complexes, antibodies reacting in-situ to planted antigens, and antibodies directed against the glomerular basement membrane.
3. The urine sediment may contain large amounts of protein (nephrotic sediment) or have red and white blood cells and protein (nephritic sediment).
4. Acute postinfectious glomerulonephritis is commonly associated with immune complex deposition in the glomerulus or forming in situ.
5. Lupus nephritis is caused by the formation of autoantibodies against dsDNA and nucleosomes in the glomerulus, causing inflammation and injury.
6. IgA nephropathy is the binding of abnormal IgA to mesangial cells in the glomerulus resulting in injury and mesangial proliferation.
7. RPGN is associated with injury that results in the proliferation of glomerular capillary endothelial cells and a rapid loss of renal function.
8. Mesangial proliferative glomerulonephritis involves deposits of immune complexes in the mesangium with mesangial proliferation leading to nephritic syndrome.

9. Membranous nephropathy is complement-mediated glomerular injury with increased glomerular permeability and glomerulosclerosis.
10. Membranoproliferative glomerulonephritis involves mesangial cell proliferation, complement deposition, and crescent formation.
11. Chronic glomerulonephritis is related to a variety of diseases that cause deterioration of the glomerulus and a progressive loss of renal function over a period of months to years.
12. Nephrotic syndrome is the excretion of at least 3.5 g protein (primarily albumin) in the urine per day primarily because of glomerular injury with increased capillary permeability and loss of membrane negative charge. The principal signs are hypoproteinuria, hyperlipidemia, and edema. The liver cannot produce enough protein to adequately compensate for urinary loss.

Acute Kidney Injury

1. AKI is the sudden decline in kidney function with decreased glomerular filtration and an increase in serum creatinine and BUN.
2. AKI is considered in three categories as prerenal, intrarenal, or postrenal and is usually accompanied by oliguria with elevated plasma BUN and plasma creatinine levels.
3. Prerenal acute renal failure is caused by decreased renal perfusion with a decreased GFR, ischemia, and tubular necrosis.
4. Intrarenal acute renal failure is associated with several systemic diseases but is commonly related to ATN.
5. Postrenal acute renal failure is associated with diseases that obstruct the flow of urine from the kidneys.

Chronic Kidney Disease

1. Chronic kidney disease is a progressive loss of renal function. Plasma creatinine levels gradually become elevated as GFR declines, sodium is lost in the urine, potassium is retained, acidosis develops, calcium metabolism and phosphate metabolism are altered, and erythropoietin production is diminished. All organ systems are affected by CRF.
2. Symptomatic changes usually do not become evident until renal function declines to less than 25%.
3. Glomerular hypertension, hyperfiltration, and tubulointerstitial inflammation and fibrosis contribute to the progression of chronic kidney disease. Proteinuria and angiotensin II promote the pathologic changes of chronic renal injury.
4. Uremic syndrome is a proinflammatory state with the accumulation of solutes; toxins; and alterations in fluid, electrolyte and acid-base balance that result from chronic kidney failure. All organ systems are affected and contribute to disease symptoms.