1. Genitourinary System, Part 2 Urinary System

Genitourinary System, Part 2
Urinary System

Basic Human Pathology II, 2008

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2. Urinary System

Urinary System

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3. **Urinary System**

**Urinary System**

- **Normal Functions**
  - **Upper urinary tract**
    - Kidneys (functional unit - Nephron)
      - Ultrafiltration of blood (remove waste products of the body’s metabolic processes in the form of urine)
      - Maintenance of water and electrolyte homeostasis
      - When impaired
        » Partial or total renal failure
  - **Lower urinary tract**
    - Pelvicalyceal systems - urine collection
    - Ureters - transportation of urine
    - Bladder and urethra - storage and voiding of urine

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4. **Urinary System, Part 2**

**Urinary System, Part 2**

- **Diseases of renal tubules & interstitium**
  - Pyelonephritis
    - Acute
    - Chronic
    - Tuberculous
  - Acute tubular necrosis
  - Interstitial nephritis
    - Acute (Drug induced)
    - Analgesic
    - Radiation
  - Metabolic abnormalities
- **Renal transplantation**
- **Kidney Tumors**
  - Benign
  - Malignant
    - Renal adenocarcinoma
    - Wilms’s tumor (nephroblastoma)
- **Diseases of the Lower UT**
  - Infection
  - Obstruction
  - Urinary calculi
  - Tumors of the Lower UT
    - Transitional cell carcinoma
    - Non-transitional cell carcinoma
  - Congenital Diseases of the Kidney and Lower UT
    - Alport’s syndrome
    - Adult Polycystic Disease of the Kidney
    - Simple renal cysts
    - Developmental abnormalities

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5. Disease of Renal Tubules and Interstitium

Disease of Renal Tubules and Interstitium

- Accounts for large numbers of renal failure cases
  - Main causes:
    - Infections
    - Ischemia
    - Toxic and metabolic disorders
- Acute pyelonephritis
  - Most important and common type of tubulointerstitial inflammation
  - Signs / symptoms of lower urinary tract infection (UTI)
    - Fever, rigors, and pain in the back
  - Diagnosis by examination of urine culture
    - Usually E. coli

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6. Pathways of Renal Infection

Pathways of Renal Infection

- Acute pyelonephritis - cont’d
  - Caused by bacterial infection
  - Organisms enter kidney by one of 2 routes
    - Ascending infection from lower urinary tract
      - Most common
      - Predisposing factors:
        - Pregnancy, diabetes, stasis of urine, enlarged prostate, malignant pelvis tumor, structural defects, reflux of urine from bladder to ureters
    - Hematogenous spread in bacteremia
      - Unusual
      - Elderly who develop pyrexia of unknown origin, often with rigors and acute renal failure

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7. Acute Pyelonephritis

Acute Pyelonephritis

• Gross examination of kidney
  - Variable numbers of small, yellowish white cortical abscesses, spherical, < 2 mm, sometimes surrounded by zone of hyperemia
  - Most often on sub-capsular surface
  - In the medulla, yellow white linear streaks that converge on the papilla
  - Pelvicalyceal mucosa may be hyperemic or covered with a fibrinopurulent exudate

8. Acute Pyelonephritis

Acute Pyelonephritis

• Histology
  - Microabscesses
  - Focal infiltration with neutrophils and occasional bacterial colonies

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9. Acute Pyelonephritis

Acute Pyelonephritis

- Untreated infection may spread --> gram negative septicemia with shock
- In severe infection:
  - Renal papillary necrosis caused by inflammatory thrombosis of vasa recta supplying the papillae
- Perinephric abscess
  - Infection spreads to perinephric fat
  - Pyonephrosis (distension of pelvi-calyeal system with pus) may be present
    - Secondary to obstruction at the pelviureteric junction or lower

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10. Disease of Renal Tubules and Interstitium

Disease of Renal Tubules and Interstitium

- Chronic pyelonephritis
  - Common cause of end-stage chronic renal failure (15% of all cases)
  - Chronic interstitial inflammation associated with scarring and distortion of the pelvi-calyeal system
  - Renal-induced hypertension may develop
  - Two forms:
    - Reflux-associated
      - Reflux of urine from bladder up the ureters; childhood and manifests in young adulthood with progressive impairment of renal function
    - Obstructive
      - Recurrent episodes of infection with obstruction of the pelvi-calyeal drainage (anatomic abnormality or renal tract stone)

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11. Chronic Pyelonephritis

Chronic Pyelonephritis

- Associated with a fibrous, irregular scarring of the renal papilla, results in:
  - Depressed areas over a club-shaped distorted renal calyx
- Most common sites:
  - Renal calyces at the poles of the kidney

12. Chronic Pyelonephritis

Chronic Pyelonephritis

- Histology
  - Irregular areas of interstitial fibrosis with chronic inflammation
  - Atrophic tubules or dilated with proteinaceous eosinophilic material ("thyroidization")
  - Glomeruli show periglomerular fibrosis and many demonstrate complete hyalinization

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13. Disease of Renal Tubules and Interstitium

Disease of Renal Tubules and Interstitium

- **Tuberculous pyelonephritis**
  - Characterized by white caseous material filling the pelvicalyceal system
  - Unilateral or bilateral

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14. Tuberculous Pyelonephritis

Tuberculous Pyelonephritis

- **Initial infection renal**
  - Over months to years enlarges and ruptures into the pelvicalyceal system releasing tubercle bacilli into the lower urinary tract →
    - Tuberculous ureteritis
    - Tuberculous cystitis
    - In males, prostatitis and epididymoorchitis
  - Eventual destruction of cortex and medulla with end stage of cystic masses of partially calcified caseous material
- **This is distinct from miliary TB**
  - A fulminating lung infection spreads large numbers of tubercle bacilli to many organs including the kidney
  - Numerous, small tuberculous granulomas scattered throughout both kidneys
  - Patient usually dies before granulomas enlarge / caseate

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15. Disease of Renal Tubules and Interstitium

Disease of Renal Tubules and Interstitium

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- **Acute tubular necrosis**
  - Most common cause of acute renal failure
  - Metabolic / toxic substances cause necrosis of renal tubular epithelial cells - - ->
    - Shed but regeneration also possible if damaging stimulus corrected
  - Gross
    - Swollen and pale, especially cortical regions

16. Acute Tubular Necrosis

Acute Tubular Necrosis

- **Two main groups of causative factors**
  1. Ischemic tubular necrosis
     - Most common, patchy distribution
     - Caused by failure of renal perfusion
     - Result of:
       - Prolonged hypotension and hypovolemia in shock
       - Extensive acute blood loss
       - Clinical situations:
         - major surgery
         - severe burns
         - hemorrhage
17. **Acute Tubular Necrosis**

**Acute Tubular Necrosis**

- Two main groups of causative factors - cont’d
  2. Toxic causes
    - Uncommon; more diffuse pattern of distribution
    - Caused by direct injury to the proximal tubules
      - Endogenous products
        - Hemoglobinuria and myoglobinuria
      - Heavy metals
        - Lead, mercury
      - Organic solvents
        - Chloroform, carbon tetrachloride
      - Drugs
        - Antibiotics, NSAIDs, cyclosporin
      - Other toxins
        - Paraquat, phenol, ethylene glycol, poisonous fungi

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18. **Acute Tubular Necrosis**

**Acute Tubular Necrosis**

- Three phases
  - Oliguric phase
    - Damaging stimulus causes necrosis of renal tubular epithelium; blockage of tubules by necrotic cells --> secondary reduction in glomerular blood flow with reduced filtration (kidneys diffusely swollen); acute renal failure and oliguria
  - Polyuric phase (1-3 weeks)
    - Regeneration of renal tubular epithelium but not capable of resorption of water and electrolytes --> excess urine; removal of dead material by phagocytes
  - Recovery phase
    - Tubular cells re-establish differentiation; restoration of homeostasis

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19. Acute Tubular Necrosis

Acute Tubular Necrosis

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20. Disease of Renal Tubules and Interstitium

Disease of Renal Tubules and Interstitium

- Interstitial nephritis
  - Inflammation of the interstitium associated with tubular atrophy or damage
  - Many causes
    - Main one is exposure to drug, esp. certain antibiotics and analgesics
    - Others include physical agents such as irradiation
  1. Drug-induced acute form
    - Thought to be an immune reaction to the drug; usually recovery if drug is withdrawn
    - Occurs 2-3 weeks after exposure – fever, hematuria, proteinuria, elevated blood urea
    - Edema of the interstitium; tubules may have necrosis or degeneration

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21. Interstitial Nephritis

Interstitial Nephritis

2. Analgesic nephropathy
   • Administration of especially acetaminophen and NSAIDs; if long term → renal tubular failure with polyuria, metabolic acidosis → chronic renal failure
   • Also associated with renal papillary necrosis
   • Increased risk of carcinoma of the urothelium

3. Radiation nephritis
   • Following cancer treatment when kidneys are in the field of radiation
   • Hyalinization of the glomeruli and small vessels → ischemic tubular atrophy and interstitial fibrosis

22. Disease of Renal Tubules and Interstitium

Disease of Renal Tubules and Interstitium

• Metabolic abnormalities that may cause secondary tubular damage
  - Urate nephropathy
    • In a few patients with hyperuricemia
    • Precipitation of urate crystals in renal collecting ducts → tubular damage, inflammation → scarring
  - Nephrocalcinosis
    • Caused by persistent hypercalcemia or hyperphosphatemia; calcification in renal parenchyma esp. tubular bm → tubule damage → fibrosis
    • Failure of tubular function → polyuria
  - Myeloma
    • Cubes of secreted Bence-Jones protein precipitate in the tubules → physical obstruction of tubules
    • May also get amyloid formation in glomeruli
    • If hypercalcemia (bone destruction) then superimposed nephrocalcinosis

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23. Renal Transplantation

Renal Transplantation

- Treatment of end-stage renal failure
- Possible complications
  - Thrombosis of the surgical vascular anastomosis → ischemia in the graft
  - Transplant rejection
  - Recurrence of disease in the transplanted kidney
- Four patterns of rejection
  1. Hyperacute
  2. Acute
  3. Accelerated acute
  4. Chronic

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24. Renal Transplantation

Renal Transplantation

- Patterns of rejection
  1. Hyperacute
     - Very soon after organ is perfused by host’s blood due to pre-formed host antibodies reacting instantly with antigens in the graft
     - e.g. historically blood group incompatibility but now very rare since pretesting of recipients’ blood to rule out antibodies to donor’s lymphocytes
     - Widespread intravascular thrombosis in small vessels with focal necrosis and neutrophil infiltration

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Renal Transplantation

- **Patterns of rejection – cont’d**
  2. **Acute**
     - Occurs within a week of the graft insertion or after cessation of immunosuppressive therapy
     - Progresses rapidly
     - Mediated by both humoral and cell-mediated mechanisms
     - Treatment of the cell-mediated portion reversed by reinstituting immunosuppressive therapy but humoral damage typically permanent
  3. **Accelerated acute**
     - Can occur in a patient with previous unsuccessful graft so already sensitized to donor antigens

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Renal Transplantation

- **Patterns of rejection – cont’d**
  4. **Chronic**
     - Occurs slowly and progressively over some months
     - It is a result of slow breakdown of the host’s tolerance to the graft due to inadequate immune suppression
     - Intimal fibrosis in arteries in the graft - - -> ischemic damage to the parenchyma

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27. Renal Transplantation Rejection

Renal Transplantation Rejection

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28. Tumors of the Kidney

Tumors of the Kidney

• **Introduction**
  - **Benign tumors**
    - Commonly seen as an incidental finding with little clinical significance
    - Incidental findings *post mortem* or after imaging
  - **Malignant tumors**
    - Wilms’ tumor (nephoblastoma)
      - Almost exclusively in children
    - Main tumors in adults
      - Renal adenocarcinoma
      - Metastatic tumors - uncommon

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29. Tumors of the Kidney

Tumors of the Kidney

• Benign tumors
  – Renal adenomas
    • Derived from renal tubular epithelium
    • Histology very similar to carcinomas, so arbitrary 3 cm size cut-off
  – Renal oncocytomas
    • Large cells filled with eosinophilic cytoplasm filled with mitochondria; variant of adenoma
  – Angiomyolipomas
    • Smooth muscle, fat, and large blood vessels; associated with tuberous sclerosis
  – Renal fibromas
    • Very common; small (3-10 mm), in the medulla; may be hamartomas; no functional significance

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30. Tumors of the Kidney

Tumors of the Kidney

❖ Renal adenocarcinoma
  – 90% of primary malignant renal tumors in adults
  – Derived from tubular epithelium
  – Majority occur as sporadic events
    • Advances in molecular classification occurring that will aid the understanding of the etiology
  – Usually after the age of 50 years; > men
  – Often arise at the poles, especially upper
  – Symptoms
    • Hematuria, flank pain, palpable mass

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31. Renal Adenocarcinoma

Renal Adenocarcinoma

- Gross
  - Rounded, yellow cut face with hemorrhage and necrosis

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32. Renal Adenocarcinoma

Renal Adenocarcinoma

- Histology
  - Most common pattern is polygonal ‘clear cell’

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33. Renal Adenocarcinoma

Renal Adenocarcinoma

Characteristically large tumors grow as a solid core along the main renal vein, even entering the inferior vena cava.

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34. Renal Adenocarcinoma

Renal Adenocarcinoma

- Often associated with:
  - Paraneoplastic syndromes
  - Hypercalcemia
  - Hypertension
  - Polycythemia
  - Cushing’s syndrome
- Spreads by local expansion and blood-borne metastasis (lung, bone, brain, liver)
- Prognosis depends on stage
  - If confined to renal capsule - 70% 10-year survival
  - If metastasis present - very poor prognosis

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35. Tumors of the Kidney

Tumors of the Kidney

- Wilm’s tumor (nephroblastoma)
  - Derived from primitive metanephros
    - At least 3 different genes involved
  - Predominantly seen in young children
    - Peak incidence between 1-4 years old
  - Abdominal palpable, often huge mass
  - Less frequently hematuria

- Treatment
  - Combination of radiation and intensive chemotherapy

- Prognosis
  - Related to spread of tumor at diagnosis; anaplasia is poor sign
  - Proper treatment has yielded a high cure rate

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36. Wilm’s Tumor

Wilm’s Tumor

- Gross
  - Rounded, replace large area of kidney
  - Solid, fleshy, white with frequent areas of necrosis

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37. Wilm’s Tumor

Wilm’s Tumor

- **Histology**
  - Small cells resembling metanephric blastema, immature looking glomerular structures, epithelial tubules, spindled cell stroma with striated muscle

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38. Urinary System

Urinary System

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39. Urinary System

Urinary System

- Normal Functions
  - Upper urinary tract
    - Kidneys (functional unit - Neophron)
      - Ultrafiltration of blood (remove waste products of the body’s metabolic processes in the form of urine)
      - Maintenance of water and electrolyte homeostasis
      - When impaired
        - Partial or total renal failure
  - Lower urinary tract
    - Pelvicalyceal systems - urine collection
    - Ureters - transportation of urine
    - Bladder and urethra - storage and voiding of urine

40. Diseases of the Lower Urinary Tract

Diseases of the Lower Urinary Tract

- Introduction
  - Extends from calyces in the kidney to the distal end of the urethra
  - Transmits urine from the kidney to the exterior with the bladder acting as a reservoir
  - Lined by urothelium (transitional cell epithelium) which can resist the osmotic stresses of contact with urine
  - Five main groups of disorders
    - Infection, obstruction, urinary calculi, tumors, and congenital diseases
41. Diseases of the Lower Urinary Tract

Diseases of the Lower Urinary Tract

- **Infection**
  - Predisposed by obstruction and stasis
    - Diabetes mellitus also
  - Usually due to Gram-negative coliform bacilli
    - (e.g., E. coli and Proteus)
  - Women are particularly prone to ascending infections
    - Short urethra likely the reason
  - Men infections
    - Usually associated with structural abnormalities of the lower urinary tract and stasis due to obstruction
  - Usually localized to urethra and bladder

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42. Pathways of Renal Infection

Pathways of Renal Infection

- **Ascending**
  - More common
  - Due to combination of:
    - Bladder infection
    - Vesicoureteral reflux
    - Intrarenal reflux
- **Hematogenous infection from bacteremia**
  - Less common

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43. Infection of the Lower Urinary Tract

Infection of the Lower Urinary Tract

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44. Infection

Infection

- Acute bacterial urethritis and cystitis → ascending ureteritis and pyelitis (inflammation of the renal pelvis and calyces) → organism in renal parenchyma → acute pyelonephritis with abscess formation (medulla and cortex)
- Complications
  - Acute and chronic pyelonephritis
  - Pyonephrosis
    - Distention of the pelvicalyceal system with pus usually due to infection superimposed on obstruction
  - Papillary necrosis
    - Severe infection in diabetics, obstruction without infection, infection with or without obstruction, analgesic abuse, sickle cell disease

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45. Diseases of the Lower Urinary Tract

Diseases of the Lower Urinary Tract

- **Obstruction**
  - Obstruction of drainage of urine from the kidney causes hydrenephrosis
  - May occur at any place in the urinary tract
    - Renal pelvis
      - Calculi, tumors
    - Pelviureteric junction
      - Stricture, calculi, extrinsic compression, idiopathic
    - Ureter
      - Calculi, extrinsic compression (pregnancy, tumor, retroperitoneal fibrosis)
    - Bladder base
      - Tumor, calculi
    - Urethra
      - Prostatic hyperplasia or carcinoma compression, urethral valves, urethral stricture

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46. Obstruction

Obstruction

- In the **urethra** - - - - > bladder dilatation and secondary hypertrophy of wall muscle - - > predisposes outpouching of the bladder mucosa (diverticula)
- In the **ureter** - - - - > dilation of ureter (megoureter) with progressive dilation of the renal pelvicalyceal system (i.e., hydrenephrosis)
  - Fluid entering collecting ducts cannot empty into renal pelvis and there is intrarenal resorption of fluid
    - If obstruction relieved then renal function returns to normal
    - If obstruction persists - - - - > atrophy of renal tubules, glomerular hyalination, and fibrosis - - - - > end stage with parenchyma severely atrophic and renal function permanently impaired

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47. Hydronephrosis

Hydronephrosis

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Early: dilation of renal pelvis (P) Later: severe loss of parenchyma with dilated pelvicalyceal system

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48. Obstruction

Obstruction

- **End stage hydronephrosis**
  - *Unilateral* obstruction of a ureter
  - Renal function maintained by non-obstructed kidney
- **Bilateral** obstruction
  - e.g. bladder base or retroperitoneal tissues
  - Renal failure develops before severe atrophy of both kidneys occurs
- Also predisposes to infection and stone formation

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Disease of the Lower Urinary Tract

Diseases of the Lower Urinary Tract

- **Urinary Calculi**
  - **Introduction**
    - May form anywhere in the lower urinary tract (urolithiasis); > men
    - Most common sites are pelvicalyceal system and bladder
    - Two main predisposing factors:
      - Increased concentration of solute in urine
        - Increased metabolite or low fluid throughput
      - Reduced solubility of solute in urine
        - Due to abnormal pH

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Urinary Calculi

- **Introduction - cont’d**
  - Clinical predisposing factors:
    - Low fluid intake
    - Urine stasis
    - Persistent UTI
    - Primary metabolic disturbances
  - Most common type (80%)
    - Composed of calcium oxalate or calcium phosphate or both
    - 50% of this type are associated with idiopathic hypercalciuria
    - Only 10% caused by hypercalcemia

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51. Urinary Calculi

Urinary Calculi

- Introduction - cont’d
  - 2nd most common type (15%)
    - Composed of magnesium, ammonium, and calcium phosphates (struvite)
    - Associated with lower UTI
      » Result of urea-splitting organisms (pH permanently > 7.0)
  - Uric acid stones (5%)
    - Predisposed by hyperuricemia (e.g., gout)
    - 50% do not have hyperuricemia (persistent acid urine?)
  - Cystine stones rare (< 1%)
    - Heritable tubular transport defects causing cystinuria

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52. Urinary Calculi

Urinary Calculi

- Different morphologic appearance of stones at different sites
  - Pelvicalyceal system
    - Often multiple, small “gravel” appearance (arrow)
    - Large, branching staghorn (S) calculi occasionally form (accretion of calcium salts)
    - Predisposes to:
      - Persistent pelvicalyceal infection
      - Pyonephrosis and perinephric abscess
      - Squamous metaplasia of the urothelium (squamous cell carcinoma may arise)

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53. Urinary Calculi

Urinary Calculi

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Staghorn calculi in the pelvicalyceal system

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54. Urinary Calculi

Urinary Calculi

- Different morphologic appearance of stones at different sites - cont’d
  - Ureter
    - Most developed in the renal pelvis and passed down the urinary tract
    - Often intense loin pain (ureteric colic)
  - Bladder
    - Stones are spherical, laminated and may be large
    - Due to stasis and chronic infection
    - Can cause squamous metaplasia and subsequent carcinoma

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55. Tumors of the Lower Urinary Tract

Tumors of the Lower Urinary Tract

- Transitional cell carcinoma
  - Arise from transitional cell epithelium
  - Most common tumor of the urinary collecting system (calyces, pelvis, ureter, bladder)
  - Often multifocal
  - Mainly caused by environmental agents excreted in high concentration in the urine (aniline dye, cigarettes, cyclophosphamide)
    - Field change takes place in all of the urothelium so that multiple tumors are common
  - Most common in men but fairly common in women
  - Most common sign and symptom:
    - Hematuria

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56. Transitional Cell Carcinoma of the Bladder

Transitional Cell Carcinoma of the Bladder

- Majority of TCCa’s arise in the bladder
- Have a papillary growth pattern with a fronded, cauliflower appearance
- High grade tumors tend to be solid, ulcerations rather than papillary

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57. Morphologic Patterns of Bladder Cancer

Morphologic Patterns of Bladder Cancer

- Papilloma – papillary carcinoma
- Invasive papillary carcinoma
- Flat noninvasive carcinoma
- Flat invasive carcinoma

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58. Transitional Cell Carcinoma of the Bladder

Transitional Cell Carcinoma of the Bladder

- Histology
  - Varies from bland to cytologically abnormal but all are considered carcinomas
  - Grades I to IV on basis of cellular and nuclear pleomorphism and mitoses
    - Grade relates to biological behavior
  - Transition from low grade to high grade over time can occur

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59. Transitional Cell Carcinoma of the Bladder

Transitional Cell Carcinoma of the Bladder

- **Histology**
  - ~80% non-invasive, low-grade papillary
  - ~20% invasive, moderate- to high-grade, with a mixed solitary and papillary growth pattern

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60. Transitional Cell Carcinoma of the Bladder

Transitional Cell Carcinoma of the Bladder

- **Histology - cont’d**
  - Carcinoma-in-situ
    - Flat, red lesion with marked cytological atypia in the absence of invasion but can develop into high-grade, solid invasive carcinoma

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61. Transitional Cell Carcinoma of the Bladder

Transitional Cell Carcinoma of the Bladder

- Spread by local, vascular, and lymphatic routes
- Staging
  - In-situ
  - Papillary, non-invasive
  - Superficially invasive
  - Deeply invasive
  - Metastatic
- Renal pelvis, ureter, urethra – transitional cell ca
  - Histology similar to TCCa of the bladder

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62. Transitional Cell Carcinoma of the Renal Pelvis

Transitional Cell Carcinoma of the Renal Pelvis

Papillary tumor fills the renal pelvis with dilation of the renal calyces caused by obstruction

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63. Tumors of the Lower Urinary Tract

Tumors of the Lower Urinary Tract

- Non-transitional-cell carcinoma of the bladder
  - Uncommon (~ 15% of all tumors)
  - Squamous cell carcinoma
    - Most often in bladder and renal pelvis
    - Derived from metaplastic epithelium secondary to chronic irritation from calculus
    - Chronic inflammation
      - From bacterial infection or
      - Schistosomiasis (common cause in endemic areas)
  - Adenocarcinoma
    - Dome region of bladder (from persistent glandular tissue)
    - Can spread along remnant tract to umbilicus
  - Also, mixed (transitional cell and adenocarcinoma), undifferentiated carcinomas, and spindle cell carcinomas

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64. Congenital Diseases of the Kidney and Lower Urinary Tract

Congenital Diseases of the Kidney and Lower Urinary Tract

- Developmental
  - Common clinical problem often found in association with other congenital abnormalities
    - Bilateral renal agenesis
    - Failure of differentiation (renal dysplasia)
    - Abnormal anatomic development
    - Abnormalities of renal tubular support
    - Developmental abnormalities of structural elements

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65. Congenital Diseases of the Kidney and Lower Urinary Tract

Congenital Diseases of the Kidney and Lower Urinary Tract

- **Alport’s syndrome**
  - Usually X-linked dominant transmission condition
  - Characterized by progressive nephritis leading to renal failure in the second decade (nephritic syndrome)
  - Sensorineural hearing loss and eye diseases (e.g., lens dislocation and cataracts)

66. Alport’s Syndrome

Alport’s Syndrome

- **Main defect in kidney:**
  - Irregular glomerular basement membrane which shows focal splitting of the lamina densa
- **Due to defective type IV collagen**
  - Constituent of basal lamina in:
  - Glomeruli
  - Lens
  - Organ of Corti

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67. Congenital Diseases of the Kidney and Lower Urinary Tract

Congenital Diseases of the Kidney and Lower Urinary Tract

- Adult polycystic disease
  - Autosomal dominant
  - Manifestation in adult life
    - Two genes identified
      - One on chromosome 4q2
      - Other on chromosome 16
    - Kidneys greatly enlarged, bilaterally, with partial parenchyma replacement by cysts
    - Cysts progressively enlarge over a number of years but remain asymptomatic until number and size become so great that abdominal mass is observed.

68. Adult Polycystic Disease of the Kidney

Adult Polycystic Disease of the Kidney

- Gross
  - Large numbers of cysts with hemorrhage into them
- Cysts cause slowly progressive impairment of renal function -> chronic renal failure and hypertension
- Cysts may also develop in liver, lung, pancreas

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69. Congenital Diseases of the Kidney and Lower Urinary Tract

Congenital Diseases of the Kidney and Lower Urinary Tract

- Simple renal cysts
  - Most common form of renal cystic disease
  - Not congenital - acquired
    - Incidence increases with age
  - Contain clear, watery fluid
    - Have a smooth lining
  - Single or multiple
    - Size no greater than 5-6 cm
  - No effect on renal function

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70. Congenital Diseases of the Kidney and Lower Urinary Tract

Congenital Diseases of the Kidney and Lower Urinary Tract

- Developmental abnormalities of the lower UT
  - Ureterocele
    - Cyst of the lower ureter at its passage through the bladder wall; 90% unilateral
    - Causes obstruction of the ureter
  - Persistant urachus
  - Exstrophy of the bladder
    - Failure of closure of bladder
      - Lining exposed recurrent infections develop
      - Metaplasia of transitional cell epithelium predisposes to adenocarcinoma
  - Posterior urethral valves
    - Folds of lining mucosa in the urethra -> obstruction
      - -> hydrourephrosis, > male

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71. Congenital Diseases of the Kidney and Lower Urinary Tract

Congenital Diseases of the Kidney and Lower Urinary Tract

- Developmental abnormalities - cont’d
  - Ureteric defects
    - Bifid or double ureters