Renal Diseases

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Renal pathology

- Glomerulus
- Tubules
- Interstitial
- Renal Lithiasis
- Renal failure

Glomerular Disorders

Glomerulonephritis

- An overactive immune system may attack the kidney, causing inflammation and some damage.
- Presence of blood, protein and cast in the urine
- Acute> chronic> nephrotic syndrome > renal failure

Glomerular Disorders

Acute Glomerulonephritis

- Damage to glomerular membrane
- Typical urinalysis findings
  - Proteinuria, oliguria, hematuria and dysmorphic RBCs
  - Varied casts - RBC, WBC, hyaline and granular
  - Increased BUN
- Group A streptococcus infection

Glomerular Disorders

Chronic Glomerulonephritis

- Gradually worsening symptoms
  - fatigue, anemia, hypertension, edema and oliguria
- Typical UA findings
  - hematuria, massive proteinuria, glucosuria, dysmorphic RBCs and presence of varieties of casts including broad cast
- Marked↓GFR with ↑BUN and creatinine

Glomerular Disorders

Nephrotic Syndrome

- Damage to the kidneys causes them to spill large amounts of protein into the urine
- Laboratory findings:
  - Urine dip stick: 3+ protein
  - 24 hour urine collection protein >3.5 g/day
  - Hematuria ,lipiduria, fatty casts and waxy casts, RTE casts

Nephrotic Syndrome

- Oval fat bodies, fat droplets
  - Maltese cross formation with polarized light microscopy
- Increased permeability of the glomerular membrane
  - leads to damage to the shield of negativity
  - Podocytes that produce less tightly connected barrier

Associated diseases with nephrotic syndrome

- Minimal change disease
- Focal segmental glomerulosclerosis (FSGS)
- Membranous glomerulonephritis
- Diabetic nephropathy
  - Diabetes mellitus I/II
- Amyloidosis
- Lupus nephritis
  - Can manifest with nephritic or nephrotic symptoms

Tubules

- Acquired (most common)
  - Acute Tubular Necrosis
- Hereditary/Metabolic
  - Fanconi Syndrome
  - Renal Glycosuria
  - Diabetes insipidus

Tubular disorders

Acute Tubular Necrosis

- Disorder associated with damage to the renal tubules caused by ischemia or toxic agents
- Urinalysis results
  - Presence of large amount of hemoglobin and myoglobin
  - Proteinuria
  - Renal tubular epithelial cells
  - Casts may be present
    - Hyaline, granular, waxy, broad and RTE

Fanconi Syndrome

- Disorder associated with tubular dysfunction
- Failure of tubular reabsorption in the proximal convoluted tubule
- Urinalysis findings are glucose and may be mild protein in the urine
- Inherited disorder in association with cystinosis and Hartnup disease

Renal Glycosuria

- Inherited disorder
- Presence of glucose in the urine when blood glucose level reaches the maximum tubular reabsorption capacity
- Increased urine glucose with normal blood glucose

Interstitial

- Cystitis (UTI)
- Pyelonephritis
  - Acute and chronic
- Acute interstitial nephritis

Acute pyelonephritis

- It’s a result of assessing movement of bacteria from a lower UTI into the renal tubule and interestitium.
- Patients symptoms:
  - urinary frequency ,burning on urination and lower back pain.
- The ascending movement of bacteria from the bladder interfere with the downward flow of urine.

Acute pyelonephritis

- Incomplete emptying of the bladder during urination
- Urinalysis results:
  - numerous WBC and bacteria with mild proteinuria and hematuria
- Presence of WBC cast signifies infection within the tubules.

Lower UTI/Cystitis

- The most common symptoms associated with lower UTI include dysuria or acute pain, frequent urination, urgency, and incontinence.
- Occasionally hematuria, cloudy urine, or foul-smelling urine.
- Bacteria.

Acute interstitial nephritis

- It’s an inflammation of the renal interstitial followed by inflammation of the renal tubules.
- Reaction to medications
- Urinalysis results:
  - hematuria, protein urea , numerous WBCs and WBC cast without bacteria.
  - Hansel stain for presence of eosinophil

Renal Lithiasis

- 75% calcium oxalate or phosphate
- Others
  - Magnesium ammonium phosphate (struvite)
  - Uric acid
  - Cystine
- Microscopic hematuria most common lab finding
  - Crystals often not present

Renal failure

- Decreased GFR, oliguria, edema, azotemia, electrolyte imbalances

- Acute (common, often reversible)
  - Numerous causes
    - Prerenal (decreased blood flow), Renal, and Postrenal (impaired outflow)
- Chronic (irreversible)
  - Hypertension
  - Diabetes mellitus
  - Glomerulonephritis

Metabolic disorders

- Most findings are due to overflow into urine
- Amino acids (AA)
  - Phenylalanine-Tyrosine (P-T)
  - Tryptophan
  - Cystine
  - Branched-chain
- Porphyrins
- Mucopolysaccharides
- Purines
- Carbohydrates

Phenylalanine-Tyrosine Disorders

Phenylketonuria (PKU)

- Most common AA metabolic disorder
  - 1 per 10-20,000 babies
- Phenylalanine hydroxylase defect
  - Tyrosine cannot be formed
  - Buildup of phenylpyruvic acid
- Urine – Ferric chloride test
  - Blue-green

Other P-T disorders

- Tyrosyluria
  - Excess tyrosine (and degradation products)
- Melanuria
  - Excess melanin production
  - Associated with melanoma
- Alkaptonuria
  - Defect in homogentisic acid oxidation
  - Black-stained diapers

Cystine

- Cystinuria
  - Inherited defect in renal tubular absorption of cystine
- Cystinosis
  - Systemic accumulation of cystine crystals
  - Not inherited defect of renal tubules
- Homocystinuria
  - Excess homocystine due to defect in methionine metabolism

Branched-chain

- Maple syrup urine disease
  - Accumulation of amino acid degradation products
  - Defects in leucine, isoleucine, and valine metabolism
  - Odorous urine
- Organic acidemias
  - Numerous subtypes
  - Accumulation of organic acid produced further down in the AA metabolic pathway

Others

- Porphyrinuria
  - Defective heme synthesis (porphyria)
  - Numerous subtypes
- Mucopolysaccharidoses
  - Numerous subtypes
    - Hunter and Hurler syndrome
      - Most severe
    - Sanfilippo syndrome
      - Less severe

Others

- Purines
  - Lesch-Nyhan disease
    - Systemic uric acid accumulation
    - Self-mutilation
- Carbohydrates
  - Melituria (increased sugar)
    - Galactosuria
    - Lactosuria, fructosuria, pentosuria

Thank you!