

51. Chronic Renal Failure

Etiology

- Five stages of renal dysfunction leading to end-stage disease:
 - Impaired renal function: 40–80% kidney function; asymptomatic
 - Chronic renal insufficiency: 25–50% kidney function, asymptomatic but shortened stature and increased PTH with normal serum Ca^{++} and Ph^{3-}
 - Chronic renal failure: <30% kidney function; symptoms include anemia, hypertension, lethargy, acidosis, and renal osteodystrophy
 - End-stage renal disease: <10% kidney function; dialysis essential
- Obstructive uropathy is most common etiology (50% of cases in children)

Differential Dx

- Obstructive uropathy
 - Reflux nephropathy
 - Posterior urethral valves
 - Prune-belly syndrome
 - UPJ obstruction
 - Urethral atresia
- Cystic disease
- Renal hypo/dysplasia
- Hereditary nephritis
- Cystinosis
- Focal segmental glomerulosclerosis
- Membranous proliferative glomerulonephritis

Epidemiology

- 1.5–3.0 children per million develop end-stage renal disease; kidneys can compensate until $\text{GFR} < 15 \text{ mL/min per } 1.73 \text{ m}^2$

Signs/Symptoms

- Specific signs/symptoms in children
 - Growth failure
 - Bone deformities
 - Abnormal tooth development
 - Unexplained dehydration, salt craving
 - Normochromic anemia
- Other signs/symptoms
 - Hypertension
 - Edema
 - Nocturia, polyuria
 - Lethargy, reduced exercise tolerance
 - Itching
 - Nausea, vomiting
 - Peripheral neuropathy
 - Encephalopathy

Diagnosis

- Metabolic abnormalities include:
 - Increased BUN and protein intolerance, causing anorexia and malnutrition
 - Decreased phosphorus excretion, causing transient hyperphosphatemia and hypocalcemia
 - Decreased production of 1,25-dihydroxycholecalciferol by the kidneys, leading to hypocalcemia, stimulation of parathyroid hormone secretion, and resultant calcium and phosphorus resorption from bone; this results in renal osteodystrophy
 - Decreased H^+ excretion due to decreased ammonia production by the kidney
 - Decreased sodium excretion, resulting in hypertension
 - Hyperkalemia due to decreased potassium excretion
 - Anemia due to decreased erythropoietin production

Treatment

- The goal of treatment is to prevent further loss of renal function and avoid associated complications
- Diet modification to provide adequate caloric intake but no more than 0.5–1.5g/kg/day of protein
- Calcium carbonate (calcium supplement and phosphate binder) and 1,25-dihydroxycholecalciferol to manage renal osteodystrophy
- Iron supplement and erythropoietin for anemia
- Sodium restriction and ACE inhibitor to control HTN
- Sodium bicarbonate or citrate supplement to correct metabolic acidosis
- Correction of metabolic abnormalities, ensure adequate dietary intake, and growth hormone supplementation to manage growth failure
- Dialysis
- Renal transplant

Prognosis/Clinical Course

- Complications include metabolic acidosis; growth retardation; renal osteodystrophy; confusion, apathy, lethargy, and pericarditis due to uremia; seizures secondary to hypertension or electrolyte abnormalities; GI bleeding from platelet dysfunction
- Dialysis
 - Indications include renal function <10%, lethargy, or poor functioning
 - Most successful in children >15 kg
 - Options for renal replacement therapy include hemodialysis, peritoneal dialysis, or renal transplant
- Successful allograft transplantation offers a superior physical and psychosocial outcome