Chronic Renal failure : Stages, Symptoms, and Treatment

Chronic renal failure is a progressive and irreversible loss of renal function in which the body fails to maintain metabolic, fluid and electrolyte balance.

Deterioration ranges from those at risk, mild, moderate and unto severe kidney failure.

Initially, it is asymptomatic but with time, Loss of the excretory, metabolic and endocrine functions of the kidney leads to the development of the clinical symptoms and signs of renal failure, which are referred to as uremia.

Is associated with azotemia.

In Chronic Renal Failure, there is almost 80% loss of nephrons thus it is referred to as an end-stage renal disease.

Causes of chronic renal failure

Chronic renal failure is caused by systemic diseases such as;

- Diabetes mellitus (the leading cause).
- Severe hypertension (systemic, glomerular and portal)
- Chronic glomerulonephritis and pyelonephritis.
- Hereditary lesions e.g. polycystic disease of the kidney.
- Autoimmune diseases e.g. SLE.
- Gout
- Toxic agents e.g. lead and mercury.
- Vascular diseases e.g. RVT.

Pathophysiology of Chronic Renal Failure

Following the deterioration and loss of nephrons, the sum total of the renal function progressively reduces too especially if the underlying systemic disease e.g. Diabetes mellitus is not well controlled.

Consequently, the GFR falls as serum creatinine clearance reduces too along with continued accumulation of nitrogenous wastes.

The remaining nephrons hypertrophy as they are required to filter a large load of solutes. Nevertheless, the kidney continues losing its ability to concentrate urine adequately. In an attempt to continue excreting solutes, a large volume of dilute urine is passed making the patient susceptible to fluid depletion.

On the other hand, the tubules gradually lose the ability to reabsorb electrolytes; this initially leads to “salt-wasting” in which urine contains large amounts of sodium, enhancing polyuria further.

As the number of functioning nephrons keeps declining further along with GFR, the body is unable to rid itself of water, salts, and nitrogenous wastes. By the time the GFR is less than 20ml/min, the body is severely uremia intoxicated. Uremia has far-reaching effects on all body systems.

Signs and symptoms

Electrolyte imbalances

- Initially hyponatremia and later hypernatremia with hypertension and CHF.
- Hyperkalemia associated with cardiac dysrhythmias.
- Hypocalcemia due to reduced tubular reabsorption of calcium and reduced activation of vit.D by the kidney.
- Hyperphosphatemia due to reduced secretion of phoshorus.this causes increased secretion of parathyroid hormone to facilitate phosphate excretion and increase calcium resorption from the bones.

NB: hypocalcaemia triggers osteomalacia and osteosclerosis.

Hematological changes

- Anemia (normochromic and normocytic) with fatigue, cold intolerance, dyspnoea and air hunger following impaired erythropoietin production.
- Thrombocytopenia associated with bleeding tendencies.

GIT changes

"Uremic fetor" i.e. ammonia odor in the breath (a urine-like odor on the breath of persons with **uremia**.)

- Nausea and vomiting, anorexia and hiccups due to elevated serum nitrogenous wastes.
- Complains of metallic taste
- Weight loss (cachexia) secondary to increased protein catabolism.
- GIT bleeding probably due to stress and uremic ulcers along with thrombocytopenia defect.
- Stomatitis, gingivitis, and parotitis following poor oral hygiene and ammonia formation from the salivary area.
- Diarrhea and constipation
- Thirst due to hypernatremia and hyperglycemia.

Dermatological & musculoskeletal manifestations

- Pallor
- Dry and itchy skin secondary to dehydration and atrophy of sweat glands.
- Osteodystrophy i.e. osteomalacia and osteoporosis.
- Bone demineralization following hyperparathyroidism.
- Bone (joint) pains a sign of osteoporosis.
- The skin develops a grayish tinge secondary to anemia.
- The skin develops a yellowish tone due to the accumulation of carotenoids or urochrome pigments.

- The skin is edematous, ecchymotic and easily bruised.

Cardiovascular and pulmonary manifestation

- Blood pressure may be increased, normal or decreased.
- Electrocardiogram changes secondary to electrolyte imbalances.
- Kussmaul breathing, periorbital edema, dyspnoea, reduced SPO2. tachypnoea, chest pain, and wheezing.
- Delayed capillary refill time
- Pericarditis following irritation of pericardial lining by uremic toxins.
- Pericardial effusion
- Pericardial tamponade
- Hyperlipidemia
- Chest crackles on auscultation
- Coughs thick, tenacious sputum
- Shortness of breath
- Reduced cough reflex
- Engorged neck veins due to increased jugular venous pressure.

Genital-urinary manifestations

- Fluid and electrolyte imbalance.
- Muscle twitching and crumps
- Fatigue and general body weakness following toxins accumulation.
- Edema
- Anuria and oliguria
- Erectile dysfunction especially if diabetes is the underlying primary disease. Etc.

Endocrine and metabolic manifestations

- Metabolic acidosis secondary to the inability of renal tubules to regenerate bicarbonate and secrete H+ ions in urine. Also due to the inability of the tubules to excrete ammonia and re-absorb sodium bicarbonate.
- Reduced excretion of phosphates and other organic acids.
- Increased renin secretion resulting in hypertension.
- The inability of the kidney to excrete insulin thus hyperglycemia results.
- Breakdown of calcium, phosphorus, and Vitamin D pathway thus renal bone disease.
- Reduced or absent erythropoietin (EPO) production.

Neurological & psychological manifestations

- Apathy and unrealistic interpretation of information.
- Activity intolerance and restlessness
- Seizures and convulsions
- Asterixis
- Depressed cognitive and thought processes
- Mental confusion
- Reduced response to stimuli.

Stages of Chronic Renal Failure

- Staging is dependent on the degree of nephron loss and glomerular filtration rate.

Stage	GFR
1	Greater than 90ml/min
2	60-89ML/MIN
3	30-59ml/min
4	15-30ML/MIN
5	Less than 15 ml/min

Patients with stages 1-3 CKD are frequently asymptomatic.

Clinical manifestations resulting from low kidney function typically appear in stages 4-5.

Diagnosis of chronic kidney disease

1. Blood chemistry
2. Urinalysis
3. Determination of creatinine clearance and GFR.
4. Renal scan to rule out renal tumors.
5. Abdominal ultrasound.
6. Urodynamics e.g IVU to explore blood supply to the kidney
7. Full haemogram to rule out anemia and thrombocytopenia.
8. Blood and urine culture where septicemia is suspected.
9. Fasting Blood Sugars and Random Blood Sugars.
10. Lipid profile
11. Coagulation screen tests.

Differential diagnoses of chronic kidney disease

- The systemic lupus erythematosus (SLE)
- Renal Artery Stenosis
- Urinary Tract Obstruction
- Granulomatosis with Polyangiitis (Wegener Granulomatosis)
- Acute Kidney Injury
- Alport Syndrome
- Antiglomerular Basement Membrane Disease
- Chronic Glomerulonephritis
- Diabetic Nephropathy
- Multiple Myeloma
- Nephrolithiasis
- Nephrosclerosis,
- Rapidly Progressive Glomerulonephritis.

Treatment of chronic kidney disease

The management aims to:

Correct or treat any reversible causes; could be pre-renal, post-renal or intra-renal causes

Monitor fluid balance (Input &Output),

Weigh the patient daily,

Monitor Blood pressure and avoid overhydration.

Restrict fluid replacement to previous day losses (500-1000mls)

Monitor renal function via serum U/Es, limit dietary potassium and do arterial blood gas analysis 4hrly.

Treat hyperkalemia through the use of sodium bicarbonate that raises blood PH thus enhancin