

Uremia: Effects on Body Systems

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What is Uremia?

- Renal failure can progress from mild to severe
- Uremia is the most severe, also known as End Stage Renal Disease (ESRD)
- The body is unable to maintain homeostasis or maintain electrolyte balance
- No wastes are excreted by the kidneys
- Renal function is $< 5\%$
- Many body systems are affected and the patient is symptomatic

Causes of Uremia

- Diabetes mellitus *
- Hypertension *
- Glomerulonephritis
- Polycystic disease
- Obstruction or infection in kidney
- Analgesic nephropathy
- * denotes most common causes of uremia

Causes of Acute Kidney Failure

- Complicated surgery, severe burns or trauma
- Renal ischemia
- Drugs, contrast dyes, or other toxins
- Heat stroke
- Multiple organ failure or sepsis
- Obstructed urine flow, nephritis or Hemolytic uremic syndrome

Genitourinary Effects

- Loss of nephrons and increased burden on those remaining nephrons
- Hypertrophy of renal tubules and possibly damage to basement membrane
- Early stage involves compensation by increased glomerular filtration rate and hyperfiltration
- Oliguria or anuria in later stages
- Albuminuria and increased creatinine and BUN in urine
- Nocturia

Effects on Musculoskeletal System

- Disordered Vitamin D metabolism causes poor absorption of dietary calcium
- Overproduction of parathyroid hormone leaches calcium from bone.
- Hypocalcemia and osteoporosis weakens bone
- Hyperuricemia seldom causes gout, but can cause pericarditis in heart muscle

Effects on Cardiovascular System

- Fluid retention leads to edema, CHF and pulmonary edema
- Hypertension is aggravated by vessel wall remodeling from renin/angiotensin effects
- Aldosterone increases vascular volume and pressure by promoting osmotic resorption of water and sodium
- Cardiac arrest risk from sudden rise in potassium
- Accelerated atherosclerosis from disordered calcium/phosphate balance causes increased risk of cardiovascular disease

Respiratory Effects

- Shortness of breath and tachypnea related to CHF or pulmonary edema
- May develop uremic fetor when urea is converted to ammonia in saliva, causing urine-like odor of the breath
- Increased respiratory rate and depth due to acidosis

Sensory Effects

- Peripheral neuropathy- usually in upper extremities, but may include restless leg syndrome
- Weakness and dizziness
- Irritability with risk of developing convulsions, and mental confusion from cerebral edema
- May notice a characteristic smell from uremia
- Hyperkalemia may cause tingling around the mouth
- Damage to retina from longstanding diabetes or HTN may cause visual deficits

Effects on Endocrine System

- Decreased estrogen due to effects of uremic toxins
- Decreased testosterone
- Increased half-life of insulin, causing it to be active for longer time, and increased risk of hypoglycemia

Gastrointestinal Effects

- Peptic Ulcer Disease is common, which should not be treated with typical antacids
- Gastroenteritis
- Anorexia
- Nausea/vomiting
- Diverticulosis

Hematologic Effects

- Anemia related to bone marrow suppression and toxic effects of aluminum
- Elevated Parathyroid hormone causes bone marrow fibrosis
- May have blood loss and induced folate deficiency from dialysis and abnormal homeostasis due to prolonged bleeding time
- Leukocyte suppression

Dermatologic Effects

- Skin color changes to increased pallor, gray, or increased pigment excreted through skin causing a sickly tan color
- Skin thicker and leathery
- Increased ecchymosis and hematoma
- Pruritis and excoriation from itching or from calcium deposits
- Uremic frost similar to sand on skin
- Dry skin and mucus membranes

Metabolic Effects

- Unable to excrete medications or waste products
- Medications and chemotherapy may cause severe toxicity problems
- Unable to maintain electrolyte balance
- Increased rate of catabolism, especially with fever, trauma, or infection

Neurological Effects

- Sleep disorders
- Impaired concentration and memory, sometimes mental confusion due to cerebral edema, and sometimes coma
- Irritabilities- hiccups, cramps, twitching, asterixis (hands flapping during uremic coma)
- Peripheral neuropathies
- Apprehension and irritability

Reproductive Effects of Uremia

- Increased risk for hypertension and severe complications during pregnancy due to extra fluids and waste products
- High risk of pre-eclampsia
- Chronic high blood pressure and waste products in mother's bloodstream can seriously affect growth and cause harm to the baby's health

How is Uremia Treated?

- By treating the illness or injury that caused acute kidney failure, it may be reversible.
- Prevent excess fluids and wastes from accumulating while the kidneys heal by limiting dietary fluids and salt, and following high-carbohydrate, low-protein and low-potassium diet
- Control diabetes or hypertension, may need to also restrict dietary potassium and phosphorous.
- Take medications as prescribed, usually cationic exchange resins to decrease hypercalcemia, and antihypertensive medications

Types of Dialysis

- Hemodialysis
- Peritoneal dialysis
- Continuous ambulatory peritoneal dialysis (CAPD)
- Continuous cycling peritoneal dialysis (CCPD)
- Kidney transplant may be needed

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