Acute Renal Failure

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Overview

- Functions of the Kidney
- Background
- Pathophysiology/Etiology
- Diagnostic Tests
- Laboratory Values
- Medical/Pharmacological Treatment
- Medical Nutrition Therapy
Functions of the Kidney

- Filtration of waste products from the blood
  - Reabsorption
    - Na, K, P, H₂O
  - Secretion
    - Waste, toxin
- Maintaining normal blood
Background

- More commonly referred to as Acute Kidney Injury (AKI)
- Inability of kidney to maintain homeostasis leading to a buildup of nitrogenous wastes and reduced urine output
  - Severe decline in glomerular filtration rate (GFR)
1. Pre-Renal

- Caused by external factors that reduce blood flow to the kidneys and decreases glomerular perfusion and filtration
  - Decreased cardiac output
  - Vasoconstriction
2. Renal (Intrinsic/Parenchymal)
- Caused by conditions that directly damage the kidney
  - Acute Glomerulonephritis
  - Acute Interstitial Nephritis
  - Acute Tubular Necrosis
  - Vascular Nephritis
- Can be caused by Pre-Renal ARF factors
- Damage to the nephrons may be reversible
3. Post-Renal

- Obstruction of the urinary tract
  - Enlarged Prostate
  - Kidney Stones
- Least common form of Acute Renal Failure
- Simplest to intervene and treat
Diagnostic Tests

- Creatinine blood test
  - 1.3mg/ml male 1.1mg/dl female
- Urinalysis
  - Urinary sediment output <0.5mL/kg/hr for >6hrs
- Creatinine Clearance test
  - Blood and urine samples
Diagnostic tests

- Renal biopsy

- Serum Electrolytes (Fractional Excretion of Sodium)
  - Distinguishes between Pre-Renal and Intrinsic ARF

\[ FE_{Na} = 100 \times \frac{(urinary \ sodium \times \ serum \ creatinine)}{(serum \ sodium \times \ urinary \ creatinine)} \]

- Imaging tests
Medical Nutrition Therapy

- **Low protein diet** dependent on patient’s needs
  - 0.5-0.6g/kg
- **Low sodium diet**
  - 500mg-1000mg
- **Low Potassium**
  - 1000mg
- **Limit the amount of fluid**
Medical/Surgical Treatments

- **Hemodialysis**
  - Wastes or uremic toxins are filtered from the blood

- **Continuous Renal Replacement Therapy (CRRT)**
  - Particularly for patients with multiple organ failure
  - Unable to tolerate hemodialysis

- **Renal Transplantation**
  - In most severe cases
Prescribed Drugs

- **Loop Diuretics** (Furosemide, Torsemide)
  - Increases excretion of water by inhibiting sodium and chloride reabsorption to manage fluid buildup
  - Does not aid in improvement of acute renal failure

- **Electrolyte Imbalances**
  - *Insulin* and *dextrose* given through IV can shift potassium from circulation into cells (severe hyperkalemia)
  - *Calcium gluconate* reduces risks of arrhythmia
  - Isotonic solutions or *sodium bicarbonate* for optimal fluid resuscitation
Mrs. J is a 26-year-old Native American who presents with a history of renal insufficiency, hypertension, and type 2 diabetes mellitus. Her current symptoms include anorexia, nausea and vomiting, 4 kg recent weight gain, edema, shortness of breath, pruritus, and inability to urinate. She is admitted with a diagnosis of stage 5 CKD with plans to initiate hemodialysis.

Medications: captopril, calcitriol, erythropoietin, vitamin/mineral supplement, Glucophage.

Mrs. J states that she has a very poor appetite. Her 24-hour recall is as follows: **Breakfast:** dry toast, Pepsi 12 oz. **Lunch:** 1 oz ham sandwich on bun with 1 oz American cheese, ice tea. **Dinner:** spaghetti sauce on 1 c. noodles, iced tea.

**Ht.: 5'0"; Wt.: 170 lbs.;** UBW 160–162 lbs.

Alb. 3.4 g/dL; Na 130 mEq/L; K 5.6 mEq/L; Cl 91 mEq/L; PO4 9.5 mEq/L; Mg 2.9 mEq/L; BUN 69 mg/dL; Cr 12 mg/dL; Glucose 200 mg/dL; Hgb A1c 8.9%.
- Excessive carbohydrate intake related to knowledge deficit of carbohydrate containing foods as evidenced by Hgb A1c of 8.9% and blood glucose of 200 mg/dL.

- Inadequate nutrient intake related to undesirable food choices as evidenced by 24 hour diet recall.

- Decreased protein needs related to renal dysfunction as evidenced by BUN of 69 mg/dL and creatinine of 12 mg/dL.
1. The most common form of intrinsic acute renal failure is
   - A. Acute Interstitial Nephritis
   - B. Acute Tubular Necrosis
   - C. Vascular Nephritis
   - D. Acute Glomerulonephritis
2. Which of the following diagnostic tests will determine if the ARF is pre-renal or intrinsic?

- A. Renal Biopsy
- B. Urinalysis
- C. Renal Ultrasonography
- D. Fractional Excretion of Sodium
3. Which of the following is NOT a criteria that must be met before ARF can be diagnosed?

- A. Serum creatinine rises ≥1.5-fold from the reference value, which is known or presumed to have occurred within 1 week
- B. Serum creatinine rises by ≥26 umol/L within 48 hours
- C. Urine output is <0.5 mL/kg/hr for >6 consecutive hours
- D. Urine output is <0.5 mL/kg/hr for >3 consecutive hours

