Fluids and Electrolytes
PNSG 2303

Chapter 58

Solutions used in the Management of Body Fluids

• Blood Plasma
  – Uses: Increase blood volume and restore plasma levels
  – Adverse Reaction: rarely nausea, chills, fever, urticaria and hypotension
  – C/P/I: Hypersensitivity to any part of solution.

• Plasma Protein Fractions (Albumin)
  – Uses: Treat hypovolemic shock
        Hypoproteinemia
  – Adverse Reaction: rarely nausea, chills, fever, urticaria and hypotension
  – C/P/I: If allergic to albumin, have severe anemia, cardiac failure. Should always be administered alone.
Solutions used in the Management of Body Fluids

• Protein Substrate (Amino Acids)
  – Uses: TPN, Wound healing, severe kidney and liver diseases
  – Adverse Reactions: Nausea, fever, flushing, decrease in phosphorous and calcium levels, Metabolic alkadosis or acidosis.
  – C/P/I: Use cautiously with renal disease, CHF, pulmonary edema and severe bleeding disorders.

Solutions used in the Management of Body Fluids

• Energy Substrates
  – Uses: Supply energy
    IV Fat emulsion: given alone or in TPN
  – Adverse Reactions: Thrombophlebitis, sepsis

  – C/P/I: Diabetic coma from high blood sugar, ICP. Fat emulsion: do not give to pt allergic to eggs.

Solutions used in the Management of Body Fluids

• Plasma Expanders (Hespan)
  – Uses: Emergency fluid volume replacement
    Prophylaxis of DVT or thromboembolism
  – Adverse reactions: Vomiting, slight increase in temperature, itching and allergic reactions.
  – C/P/I: Severe bleeding disorders, severe heart failure, renal failure, pulmonary edema.
Solutions used in the Management of Body Fluids

• Intravenous Replacement Solution
  – Uses: Hydration
    Source for electrolytes, calories and water

Solutions used in the Management of Body Fluids

  The most common adverse reaction associated with all solutions given IV is....

  Fluid Overload

Nursing Process for Solutions used in the Management of Body Fluids

• Assessment
  – VS, check site during administration
    • Extravasation or infiltration
Nursing Process for Solutions used in the Management of Body Fluids

• Nursing Diagnosis:
  – Excess Fluid Volume r/t adverse effects resulting from too rapid IV infusion.
  – Deficient Fluid Volume r/t ie: N/V, NPO....
  – Imbalanced Nutrition: Less than body requirements r/t

• Planning
  – Optimal response
  – Prevention of fluid overload
  – Correction of the fluid volume deficit
  – Improved nutrition
  – Understanding of the procedure

• Implementation
  – Make pt comfortable
  – IV solution should be at room temperature
  – Infuse at ordered rate
  – Fat solution: check breathing, HA, N/V, flushing
  – Amino Acid: ensure there is a microfilter attached.
  – Check for fluid overload.
  – Explain procedures to pt and family.
Nursing Process for Solutions used in the Management of Body Fluids

- Evaluation:
  - Was therapeutic effect achieved
  - Fluid volume deficit corrected
  - Nutrition deficit corrected
  - Pt and family demonstrate understanding.

Electrolytes

- Intracellular electrolytes:
  - Potassium
  - Magnesium
- Extracellular electrolytes:
  - Calcium
  - Sodium
- Alkalinizing Drugs
  - Bicarbonate (HCO₃⁻)
- Acidifying Drugs
Electrolytes Extracellular

**Calcium (Ca**⁺⁺)**

- Calcium salts
  - Calcium gluconate
  - Calcium carbonate

- Uses
  - Hypocalcemia
    - Parathyroid disease
  - Accidental removal parathyroid
  - Treatment and prevention of calcium deficiency, osteoporosis, osteomalacia, rickets, latent tetany, premenstrual syndrome.
  - Increase need during pregnancy
  - Those eating low calcium diet

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**Calcium**

Adverse Reactions, Contraindications, Precautions, and Interactions

- IV administration (adverse reactions)
  - Heat waves - Tingling of extremities
  - Vein irritation - Chalky taste
  - Rapid IV administration may cause bradycardia, vasodilation, and low blood pressure, dysrhythmias, and cardiac arrest.

- Oral administration
  - GI disturbance

- Contraindicated with patients taking digitalis, atenolol, and verapamil.

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Electrolytes Extracellular

**Magnesium (Mg**⁺⁺**)**

- Action
  - Transmission of nerve impulse
  - Reactivity of many enzyme reaction such as carbohydrate metabolism

- Use of Magnesium Sulfate (MgSO₄)
  - Replacement therapy of hypomagnesemia
  - Often added to TPN
  - Prevention and control of seizures in PIH (pregnancy induced hypertension)
    - Eclampsia
    - Pre-eclampsia
Magnesium
Adverse Reactions, Contraindications, Precautions, and Interactions

- **Adverse reactions (rare)**
  - Flushing - Sweating
  - Hypotension - Depressed reflexes
  - Muscle weakness - Circulatory collapse

- **Contraindications**
  - Heart block
  - Myocardial damage

- **Precautions**
  - Pregnancy - Renal impairment
  - Myocardial disease

- **Interaction**
  - Neuromuscular blocking agents
  - Increased CN depression with narcotics, hypnotics, alcohol, antidepressants, barbiturates

Electrolytes Intracellular
Potassium (K+)
Actions and Uses

- **Actions**
  - Transmission of nerve impulses
  - Contraction of smooth, cardiac, and skeletal muscles
  - Other physiologic processes

- **Potassium**
  - Available as potassium chloride and potassium gluconate and measured in milliequivalents (mEq)
  - Used for the treatment of hypokalemia
    - Diuretics, N/V, Diarrhea

Potassium
Adverse Reaction, Contraindication, Precautions, and Interaction

- **Adverse Reaction**
  - N/V - Diarrhea
  - Phlebitis - Extravasation

- **Contraindication/Precautions**
  - Those at risk for hyperkalemia

- **Interactions**
  - ACE inhibitors
  - Digitalis
  - Potassium sparing diuretics
  - Salt substitutes
**Electrolytes Intracellular**

**Sodium (Na⁺)**

**Actions and Use**

- Sodium is essential for the maintenance of normal heart action and in the regulation of osmotic pressure in body cells.

- Administered for hyponatremia

  Sodium as Sodium Chloride (NaCl) may be given in the IV

  - 0.9% NaCl = normal saline (NS)
  - 0.45% NaCl = half normal saline (1/2 NS)
  - Sodium can also be combined with dextrose 5%

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**Sodium**

**Adverse Reactions, Contraindications, Precautions, and Interactions**

- **Adverse reaction**
  - Related to overdose
  - N/V

- **Contraindication**
  - Hypernatremia
  - Fluid retention
  - Precaution with surgical patient, circulatory insufficiency, hypoproteinemia, urinary tract obstruction, CHF, edema, pregnancy, and renal impairment

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**Electrolytes**

**Combined Electrolyte Solution**

- Available in oral and IV solutions
- IV solutions contain various electrolytes and dextrose
Electrolytes
Examples of Combined Electrolyte IV Solutions
• Dextrose 5% with 0.9% NaCl
• Lactated Ringer’s injection
• Plasma-Lyte
• 10% travert (equal parts fructose and dextrose)

Electrolytes
Oral Electrolyte Solution
• Oral electrolytes contain carbohydrates and various electrolytes
• Oral electrolyte solutions are often used to replace lost electrolytes, carbohydrates, and fluids lost with severe vomiting and diarrhea
  – Rehydralyte
  – Pedialyte

Electrolytes Alkalinizing
Bicarbonate (HCO₃⁻)
Actions and Use
• IV Bicarbonate (NaHCO₃)
• Metabolic acidosis
  – Shock
  – Diabetic acidosis
  – Renal disease
  – Cardiac arrest
  – Severe diarrhea
  – Extracorporeal circulation of blood
• Oral Bicarbonate
  – Gastric and urinary alkalinizer
  – Antacid
**Bicarbonate**
Adverse Reactions, Contraindication, Precautions, and Interactions

- PO may produce nausea and vomiting
- Excessive doses of IV NaHCO$_3$ or prolong use of oral NaHCO$_3$ may cause systemic alkalosis
  - Use cautiously
    - CHF
    - Renal impairment
    - Glucocorticoid therapy
    - Pregnancy
- Is contraindicated with
  - Patients losing chloride by prolonged NG suctioning or vomiting
  - Hypocalcemia,
  - Renal failure
  - Severe abdominal pain from unknown cause
  - Those on sodium restricted diet

**Bicarbonate (Cont.)**
Adverse Reactions, Contraindication, Precautions, and Interactions (Cont.)

- Do not give Bicarbonate within two hours of enteric coated ASA
- Interacts with the following drugs
  - Ketoconazole
  - Quinidine
  - Flecainide
  - Sympathomimetics
  - Fluroquinolones (CIPRO)
  - Lithium
  - Methotrexate
  - Chlorproamide
  - Salicylates
  - Tetracyclines

**Acidifying Drug**

- Ammonium Chloride is used to lower PH
  - Metabolizes into urea, than hydrochloric acid, than into hydrogen ions that increase the acidity of the blood
  - Adverse reactions and interactions
    - Metabolic acidosis
    - Use with spironolactone can increase systemic acidosis
The Patient Receiving Electrolytes

Nursing Process

Assessment

• Preadministration assessment
  – Assess for S/S of electrolyte imbalances
  – Review recent laboratory and diagnostic test
  – Vital signs

• Ongoing assessment
  – Lab value
  – VS
  – Changes in patient condition r/t therapy
  – Know signs and symptoms of hypo and hyper

Assessment

• Bicarbonate
  – Monitor pH and blood gases
  – V/S
  – Monitor for extravasation

• Calcium
  – Monitor V/S
  – Monitor for signs of Hypercalcemia
Trouseau’s Sign

Muscle spasms of the hand and wrist resulting from pressure applied to nerves and vessels of the upper arm. Characteristic of hypocalcemia and latent tetany.

Chvostek’s sign

A spasm of the facial muscles (twitching of the nose or lips) following a tap of the facial nerve just below the temple or 2 cm anterior to the ear lobe), seen in tetany and hypocalcemia.

Assessment

• Potassium
  – Blood pressure should be monitored every 4 hours
  – Assess for irregular heart rhythm
  – Signs of hyperkalemia
  – IV site for extravasation
  – I & O
• Magnesium
  – V/S every 5-10 minutes during IV infusion
  – Signs of hypermagnesemia
Nursing Diagnosis

- Imbalanced Nutrition r/t...
- Risk of Injury r/t...
- Disturbed thought process r/t...
- Risk for Decreased Cardiac output r/t...

Planning

Is based on achieving the optimal response to therapy, compliance with prescribed therapeutic regimen, and an understanding of the drug regimen and adverse drug effects

Implementation

- Promoting an optimal response to therapy
- Electrolyte imbalance may potentially occur
  - Nasogastric suction
  - Severe vomiting and diarrhea of several days

Electrolyte administration
- Parental usually expressed in mEq
- Oral usually expressed in mg
  Exception can be K+
Total Parental Nutrition

TPN is used to prevent nitrogen and weight loss or to treat a negative nitrogen balance.

Total Parental Nutrition

- Oral, gastrostomy, or jejunostomy routes cannot be used.
- GI absorption of proteins is impaired by obstruction
- Inflammatory disease or antineoplastic therapy prevents normal GI function
- Bowel rest is needed

Nursing Alert

Hyperglycemia is the most common metabolic complication

Rebound hypoglycemic reaction from sudden withdrawal of TPN