Cystallloid Infusion

- Isotonic Infusions for:
  - Low bp, vomiting, diarrhea or surgical procedures
- Hypertonic Solutions for:
  - Relieve cellular edema, cerebral edema
- Hypotonic Solutions for:
  - Hypematremia and dehydration

<table>
<thead>
<tr>
<th>Table 31.1</th>
<th>Selected Crystalloid IV Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug</td>
<td>Tonicity</td>
</tr>
<tr>
<td><em>normal saline (0.9% NaCl)</em></td>
<td>isotonic</td>
</tr>
<tr>
<td><em>hypertonic saline (4% NaCl)</em></td>
<td>hypertonic</td>
</tr>
<tr>
<td><em>hypertonic saline (2% NaCl)</em></td>
<td>hypertonic</td>
</tr>
<tr>
<td>Lactated Ringer</td>
<td>isotonic</td>
</tr>
<tr>
<td>Plasma polyglum</td>
<td>hypertonic</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OXITROSE SOLUTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5% Dextrose in water (DSW)</td>
</tr>
<tr>
<td>3% Dextrose in water saline</td>
</tr>
<tr>
<td>5% Dextrose in isotonic saline</td>
</tr>
<tr>
<td>5% Dextrose in lactated Ringer</td>
</tr>
<tr>
<td>5% Dextrose in plasma polyglum</td>
</tr>
</tbody>
</table>

*Because dextrose is metabolized quickly, the solution is sometimes considered hypotonic.*

<table>
<thead>
<tr>
<th>Table 31.2</th>
<th>Selected Colloid IV Solutions (Plasma Volume Expanders)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug</td>
<td>Tonicity</td>
</tr>
<tr>
<td>5% albumin</td>
<td>isotonic</td>
</tr>
<tr>
<td>dextran 40 in normal saline</td>
<td>isotonic</td>
</tr>
<tr>
<td>dextran 40 in DSW</td>
<td>isotonic</td>
</tr>
<tr>
<td>dextran 70 in normal saline</td>
<td>isotonic</td>
</tr>
<tr>
<td>Hespan 6% in normal saline</td>
<td>isotonic</td>
</tr>
<tr>
<td>Plasma protein fraction</td>
<td>isotonic</td>
</tr>
</tbody>
</table>

Figure 31.1 | Major fluid compartments in the body |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intracellular fluid compartment</td>
<td></td>
</tr>
<tr>
<td>40% of body weight</td>
<td></td>
</tr>
<tr>
<td>Intravascular fluid compartment</td>
<td></td>
</tr>
<tr>
<td>20% of body weight</td>
<td></td>
</tr>
<tr>
<td>Extracellular fluid compartment</td>
<td></td>
</tr>
</tbody>
</table>
Colloids

- Plasma volume expanders for
  - Hypovolemia, shock, burns, post-op
  - Can double the plasma volume in min.

Dextran

- For shocky states
- Can reduce platelet adhesiveness
- Reduce blood viscosity
- Preventing DVT and PE.

S/E
- Fluid overload: tachcardia, peripheral edema, distended neck veins dyspnea or cough

Sodium 135-145mEq/L imbalance

- Hyper-natremia
  - Hypotonic fluid and dietary Na restriction
- Hypo-natremia
  - Hypertonic solutions ^dietary Na+

Or solve the problem causing the imbalance.

Hyponatremia

- Causes:
  - To much IV fluids or hypotonic sol.
  - ^ADH secretion
  - Sodium loss: thru skin, GI tract, or Kidneys
  - Sweating and fever
  - N/V/D, GI suctioning
  - Diuretic therapy

Hyponatremia

- S/S: nausea, vomiting, anorexia, abdominal cramping
- S/S progressing: Dec LOC, confusion, lethargy, convulsions, coma, muscle twitching or tremors

**Hyernatremia:**
- Weakness, restlessness, hypertension, fluid retention
Sodium Chloride Replacement

- Na<130mEq/L : given 0.9% NaCl
- Na<115mEq/L : given 3%NaCl
- 1gm tabs available for severe low levels

Always check for S/S of fluid overload
Listen to the lungs!!!

Potassium: 3.5-5mEq/L

- Hyperkalemia causes:
  - Foods with K+
  - K+sparing diuretics
  - Kidney disease

- S/S: dysrhythmias, HB, twitching, fatigue, paresthesias, dyspnea, cramping, diarrhea

Tx of Hyperkalemia

- Reduce dietary K : bananas, citrus, dried fruits, peanut butter, broccoli, green leafy vegetables
- Stop taking: Loop, Thiazide diuretics.
- Emergency Tx: glucose, insulin,
  - Calcium gluconate or calcium-Cl
  - Sodium bicarbonate
  - Polystyrene sulfonate (Kayexalate) PO, REC, exchanges sodium for potassium in intestine, also with sorbitol=diarrhea

Hypokalemia

- Causes: loop diuretics, strenuous muscular activity, severe vomiting or diarrhea

- Be careful about giving KCL if!!:
  - Hyperkalemic states: kidney disease, acute dehydration, heat cramps, dig toxicity, AV blocks, cardiac disease or systemic acidosis

Giving KCL supplements

- Check K level first!!!
- Give with meals to reduce GI upset/plenty of water
- If renal failure/no urine output stop giving KCL. 90% of K is excreted by kidneys
- Never adm. IV push!!! Dilute and give at rate of 10mEq/hr MAX!!!
- Good IV it burns!!!!

KCL supplements contra-I

- ^K+
- Chronic renal failure
- Acidosis
- Severe dehydration
- Tissue breakdown/severe burns
- Adrenal insufficiency (aldosterone r/t)
- Administration of potassium sparing diuretics.
Figure 31.4: Acid-base imbalances.

Table 31.5: Causes of Alkalosis and Acidosis

<table>
<thead>
<tr>
<th>Causes of Alkalosis</th>
<th>Causes of Acidosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory origins</td>
<td>Respiratory origins</td>
</tr>
<tr>
<td>Lactic acidosis</td>
<td>Metabolic origins</td>
</tr>
<tr>
<td>Other metabolic</td>
<td>Other metabolic</td>
</tr>
<tr>
<td>Acidosis Tx</td>
<td>Acidosis Tx</td>
</tr>
</tbody>
</table>

**Sodium Bicarbonate (NaHCO₃)**

- **Tx of Acidosis**
- Alkalize urine: allow for excretion of acidic drugs – salicylates overdose, barbiturates
- Give Baking Soda 2-3hr before or after other meds

**Adverse Effects:** alkalosis
- Confusion, irritability, slow resp rate, vomiting.
- \(^{+} Na\), and fluid retention
- Decreased K+

**Contra-I**
- HTN, renal disease, peptic ulcer, excessive chloride loss due to GI suctioning, diarrhea, or vomiting

**Alkalosis Tx**

- Administer NaCl with KCL which increases renal excretion of bicarbonate = decreases the pH.
- Adm. Of ammonium chloride for severe alkalosis

**Ammonium Chloride**

- Hepatic conversion of ammonium chloride to urea, Cl⁻ and H⁺ = HCL
- Also acidifies the urine tx of UTI
- Promotes the excretion of alkaline drugs such as amphetamines
Ammonium Chloride

- Adverse effects:
  - CNS depression secondary to acidosis
  - Give ammonium chloride slowly.

- Contra-I; hepatic or renal impairment