INTRAVENOUS FLUIDS

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Types of IV fluids

- Crystalloids
- Colloids
Crystalloids are aqueous solutions of low molecular weight ions, with or without glucose. They are often considered as the initial resuscitation fluid in patients with hemorrhagic and septic shock, in burn patients, in patients with head injury (to maintain cerebral perfusion pressure), and in patients undergoing plasmapheresis and hepatic resection.

Solutions are chosen according to the type of fluid loss being replaced:

- For losses primarily involving water, replacement is hypotonic solutions also known as maintenance type solutions like: Dextrose solution 5%
- If losses involve both water and electrolytes replacement is with isotonic electrolytes solutions or replacement type solutions like: ringer’s lactate
Examples of crystalloid solutions are:

- Normal saline
- Dextrose solution 5%
- Lactated Ringer’s solution
- Others
Normal saline or sodium chloride 0.9% is a mixture of sodium chloride in water that is slightly hypertonic and contains more chloride than ECF, when given in large volumes, it produces hyperchloremic metabolic acidosis because of its high chloride content and lack of bicarbonate.

In addition, chloride-rich crystalloids such as normal saline may contribute to perioperative acute kidney injury. Therefore, we prefer balanced salt solutions for most intraoperative uses.

Normal saline is the preferred solution for
1. hypochloremic metabolic alkalosis
2. diluting packed red blood cells prior to transfusion
Five percent dextrose in water (D5W)

It is a hypotonic, isosmotic solution that doesn't contain electrolytes.

Dextrose solution is equivalent to administering water that's why:

1. It is used for replacement of pure water deficits.
2. As a maintenance fluid for patients on sodium restriction (hypernatremia).
3. It prevents the catabolic state (hypoglycemia and ketosis) that follows prolonged fasting.

***More concentrated dextrose solutions (10%, 20%, and 50%) are available but their use is limited to the management of diabetic patients and patients of hypoglycemia.
Ringer's lactate solution or (Hartmann's solution), is a mixture of sodium chloride, sodium lactate, potassium chloride, and calcium chloride in water.

Uses of ringer lactate:
1. It is used for replacing fluids and electrolytes in those who have low blood volume or low blood pressure.
2. It may also be used to treat metabolic acidosis in cases other than those caused by lactic acidosis.
3. And to wash the eye following a chemical burn.
Other types of solutions:

- **Plasmalyte**: is a family of balanced crystalloid solutions with multiple different formulations available.
- It closely mimics human plasma in content of electrolytes, osmolality and pH that’s why it is a replacement type solution.
- **Hypertonic 3% saline** is employed in therapy of severe symptomatic hyponatremia.
colloids

Are those containing high mw substances that exert an oncotic pressure

indications for colloids include

1. fluid resuscitation in patients with severe intravascular fluid deficits (eg, hemorrhagic shock) prior to the arrival of blood for transfusion

2. fluid resuscitation in the presence of severe hypoalbuminemia or conditions associated with large protein losses such as burns.

(Replacing an intravascular volume deficit with crystalloids generally requires three to four times the volume needed when using colloids, this justifies their indication for the use where more than 3–4 liters of crystalloid solution has been injected)
The 2 categories of colloids are

1. Natural (human albumin)
2. Artificial (gelatins, dextrans and hydroxyethyl starches)
• **Albumin**:
  - Half life = 1.6 hours in plasma
  - Stays in intravascular space
  - 5% solution isotonic 10% and 25% hypertonic
  - Expands volume 5x in 30 minutes and its effect lasts 1-2 days
    Side effects:
    1. Volume overload
    2. Fever ?? Pyrogens in albumin
    3. Defects in hemostasis
• Synthetic colloids include gelatins and dextrose starches

• **Dextran**
  • High molecular weight polysaccharide (40000 > coagulation effect than dextran 70000 )
  • 10% solution in NS or D5W
  • SE: anaphylaxis, coagulopathy, renal failure
  • is used as a volume expander but also reduces blood viscosity, von Willebrand factor antigen, platelet adhesion, and red blood cell aggregation, that’s why it is used by microsurgeons to improve microcirculatory flow and decrease risk of microthrombus formation
- **hydroxyethyl starch (the best colloid)**

- is highly effective as a plasma expander and is less expensive than albumin. Allergic reactions are rare, but anaphylactic reactions have been reported.

- Hetastarch can decrease von Willebrand factor antigen levels, may prolong the prothrombin time, and has been associated with hemorrhagic complications. It is potentially nephrotoxic.
Differences between colloids and crystalloids

1. Colloids are more expensive than crystalloids
2. Colloids have higher molecular weight
3. Half life of crystalloids is between 15 to 20 minutes while colloids last 2-3hrs
4. Colloids act as plasma expanders