Kootenai Health

Fluids and Electrolytes

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A Heart for Excellence

We Will Cover:

- normal and abnormal fluid requirements
- distribution of water and electrolytes in the body
- causes of fluid shifts
- treatment of fluid derangements

Desert Island Scenario

What is required to survive
1 to 4 weeks on the island?

- Water
- Sodium
- Potassium

Water:

- 4cc/kg/hr for first 10 kg
- 2cc/kg/hr for next 10 kg
- 1cc/kg/hr for every kilogram above 20 kilograms

Sodium:

- 1 meq/kg/day

Potassium:

- 1/2 meq/kg/day

What is the requirement for a 70 kg person then?

- 110 cc/hr (approx. 2.6 liter/24 hours)
- 70 meq sodium
- 35 meq potassium

What IV solutions are available?

- D5W
- D5 1/4 NS
- D5 1/2 NS
- NS
- D5 NS
- Ringer's Lactate

ALL COME WITH 0, 10, 20, 30 or 40 meq KCl/liter

So what solution do we write for this 70 kg person?

- D5 1/4 NS with 20 meq KCl/liter at 110 cc/hr!

We have assumed that this person is euvolemic, eunatremic and eukalemic and is healthy.

- What if the person is sick?
- Can we treat every patient the same way as this?

NO!!! They may have altered fluid requirements.

What can affect fluid status?

Where The Person Started At:

- Are they euvolemic, hypovolemic or hypervolemic?

Do you expect the person to move towards hypo or hypervolemia?

- In other words, do you expect some medical conditions to cause decreased or increased fluid requirements?

Hypovolemia or Shock Review and Definitions

- 10% volume loss

Oliguria

- 20% volume loss

Postural Hypotension

- 30% volume loss

Supine Hypotension

- 40% volume loss

Death!

Causes of Volume Loss:

- Bleeding

"Third Spacing":

- Sepsis
- anaphylaxis (this causes vasodilation too)
- Injury-think surgery-can cause a huge injury-several liter intravascular volume loss (not blood but fluid!)

Hypervolemia - Causes:

- "pump failure":- CHF, MI
- Renal failure
- Iatrogenic-too much fluid given
- Resolution of third spacing-most common cause of CHF on surgical floor
  - We won't address treatment of these problems today except fluid restriction is required

What are the volumes of bodily fluids?

- Rule of 2/3   1/3
- We are 2/3 water
- 2/3 of fluid is intracellular,
  1/3 is extracellular
- 2/3 of extracellular water is interstitial, 1/3 is intravascular

What is the sodium and potassium concentration of intracellular and extracellular water?

- Intracellular: Sodium 5 meq/dl, potassium 140 meq/dl
- Extracellular (remember this includes intravascular!): Sodium 140 meq/dl, potassium 5 meq/dl

Pop Quiz

So if healthy patient receives 1 liter of crystalloid (ie normal saline or Ringer's lactate) **how many cc's stay intravascular?**

- 333 cc's!

A healthy patient looses 2 liters of blood at surgery and is hypotensive.

How much crystalloid does this patient require if not given blood (not including maintenance fluids)?

- 6 liters

A healthy patient has an elective, uneventful 4 hour major abdominal surgery with no blood loss.

How much crystalloid does this patient require?

- 4-5 liters

What fluid and amount should we write for a healthy 70 kg patient who just had an elective, 1 hour small bowel resection?

- D5 1/2NS plus 20 meq KCl/l at 150 cc/hr
- D5 1/4NS plus 20 meq KCL/l at 110 cc/hr plus Ringer's or NS at 40 cc/hr

Conclusions

- Each patient has to be treated according to their present and expected fluid and electrolyte requirements.

Constantly Reassess

- How do we do this?

- Watch for the signs of 10, 20 or 30% intravascular loss; oliguria, postural hypotension, supine hypotension.

- Remember death is a late sign.

- Watch for abnormal fluid and electrolyte requirements.
  - The classic scenario is the patient who does not mobilize their third space

Questions?