Fluid and Electrolytes: Balance and Disturbances

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Body Fluids

- Factors that influence body fluid
- 60% of our body is fluid (water and electrolytes.

ICF vs. ECF

- Intracellular space (fluid in the cells) and Extracellular space (fluid outside a cell)
- 2/3rds located in ICF and is usually in skeletal mass.
- 1/3rd located in ECF.

ICF vs. ECF

- ECF further divided
  - Intravascular-contains plasma
  - Interstitial-fluid that surrounds the cell
  - Transcellular
- Shifting of fluid
  - Normal
- Third spacing

Third Spacing

- Manifestations
  - ↓Urine output

  Other s/s
  - ↑Heart rate
  - ↓BP, ↓CVP, edema
  - ↑Body weight
- Imbalances in I/O

Electrolytes

- Active chemicals in body fluids
  - Cations (+ charge)
    - Na^{+}, K^{+}, Ca^{++}, Mg^{+}, H^{+}
  - Anions (- charge)
    - Cl^{-}, HCO_3, Phos.

Regulation of Fluid

- Osmosis and Osmolality
- Diffusion
- Filtration
- Sodium-Potassium Pump

Routes of Gains & Losses

- Kidneys
- Skin
- Lungs
- Gastrointestinal Tract

Sodium

- Major electrolyte in ECF
- Normal: 134-145 mEq/L
- ECF levels effect ICF levels:
  - ↓ serum Na^+ = dilute ECF
    - H2O drawn into cells
  - ↑ serum Na^+ = concentrated ECF
    - H2O pulled out of cells
- Na^+ into cell → K^+ moves out of cell

Function of Sodium

- Controls H_2O distribution
- Determine ECF concentration
- Determine ECF volume
- Electrochemical state for proper muscle & nerve function

Serum sodium level decreases (water excess)

Serum sodium level increases (water deficit)

Serum osmolality falls to less than 280 mOsm/kg

Serum osmolality rises to more than 300 mOsm/kg

Thirst diminishes, leading to decreased water intake

Thirst increases , leading to Increased water intake

Antidiuretic hormone (ADH) release is suppressed

ADH release increases

Renal water excretion increases

Renal water excretion diminishes

Serum osmolality normalizes

Hyponatremia

- Sodium < 134 mEq/L
- Causes—See Pathophysiology slide #27
  - “N”
  - “O”
  - “N”
  - “A”

Hyponatremia-Causes
(NO Na+)

- “N”a+ excretion increase w/renal problems, NG suction, vomiting, diuretics, sweating, diarrhea, decreased secretion of aldosterone (DI)
- “O”verload of fluid (CHF, RF, hypotonic fluids infusion
- “N”a+ intake low (low salt diet, NPO)
- “A”ntidiuretic hormone oversecretion (SIADH)

S/S Hyponatremia

- S/S depend on the cause, magnitude and speed at which the deficit occurs.
  - Pathophysiology Slide #28
  - “S” “A” “L” “T”
  - “L” “O” “S” “S”

Hyponatremia-Signs/Symptoms "SALT LOSS"

- "S"eizures & Stupor
- "A"bdominal cramping, attitude changes (confusion)
- "L"ethargic
- "T"endon reflexes diminished, trouble concentrating (confused)
- "L"oss of urine & appetite
- "O"rthostatic hypotension, overactive bowel sounds
- "S"hallow respirations (happens late due to skeletal muscle weakness
- "S"pasms of muscles

Hyponatremia: Lab Data

- Serum Na^+ < 134 mEq/L
- Serum osmolality < 275 mOsm/kg
- Urinary Na^+ < 20 mEq/L
- Urine specific gravity < 1.010

Medical Treatment for Hyponatremia

- Na replacement by mouth, IV, or NGT
- Replacement depends on the rate lost
  - Can use LR, NS
  - When replacing Na, watch for signs of fluid overload or pulmonary edema
- Rule of thumb: serum Na must not be increased > 12 mEq/L in 24 hours.

Medical Treatment for Hyponatremia

Water gain:

- Restrict H20 safer than giving Na (800ml/ 24hr)
- Hypertonic solution 3%-5% NaCL
- Edema only-restrict Na
- Edema and Na- restrict both
- Loop Diuretics

Nursing Interventions

- Identify pt. at risk
  - Monitor labs, I&O, daily weight
- Review medications
- GI manifestations
- Monitor for S/S of hyponatremia
- Monitor for neurological changes
- Oral hygiene

SIADH

- Syndrome of Inappropriate Anti-Diuretic Hormone
- Body secretes too much antidiuretic hormone (ADH)
- Disturbs fluid and electrolyte balance
- Major cause of low sodium levels

SIADH

What happens:

- ADH increases the permeability of the renal tubules
- Increased permeability of renal tubules increases water retention and extracellular fluid volume
- Leads to:
  - Reduced plasma osmolality
  - Dilutional hyponatremia
  - Dimished aldosterone secretion
  - Elevated GFR
- Increased sodium excretion and shifting of fluids into cells

SIADH

Can result from:

- Sustained secretion of ADH from Hypothalamus
- Production of ADH-like substance from a tumor

S/S of SIADH

- Same as Hyponatremia
- Fingerprinting
  - When the finger is pressed over a bony prominence

Lab Values of SIADH

- Low BUN and Creatinine
- Due to overhydration,
  - elevated urine sodium > 20 mEq/L
  - elevated urine specific gravity > 1.012

Treatment of SIADH

- Treat the underlying cause
- Replace sodium
  - Hypertonic solution
  - Diuretic –Lasix
- If water restriction is difficult
  - Use lithium or demeclocycline

Nursing Management of SIADH

- Monitor I/O
- Daily weight
- Monitor for Neurological symptoms
- Monitor for lithium toxicity
- Ensure adequate sodium intake
- Avoid excess water supplements
- Monitor urine specific gravity
- Monitor serum sodium

Hypernatremia

- Na^+ > 145 mEq/L
- Causes—See Pathophysiology slide #25
  - “H” “I” “G” “H”
  - “S” “A” “L” “T”

Hypernatremia-Causes ("HIGH SALT")

- **"H"ypercortisolism (Cushing's Syndrome, hyperventilation)**
- **"I"ncreased intake of sodium (oral or IV route)**
- **"G"I feeding (tube) without adequate water supplements**
- **"H"ypertonic solutions**
- "S"odium excretion decreased and corticosteroids
- "A"ldosteronism (hyper)
- "L"oss of fluids (infection, sweating, diarrhea, DI
- "T"hirst impairment

S/S Hypernatremia

- See Pathophysiology slide #26
  - “F”
  - “R”
  - “I”
  - “E”
  - “D”

Hypernatremia-Signs/ Symptoms ("No FRIED foods for you!"—too much salt)

- "F"ever, flushed skin
- "R"estless, really agitated
- "I"ncreased fluid retention
- "E"dema, extremely confused
- "D"ecreased urine output, dry mouth/skin

Hypernatremia Lab Data

- Serum Na^+ > 145 mEq/L
- Serum osmolality > 300 mOsm/L
- Urine specific gravity > 1.015

Hypernatremia Medical Treatment

- ↓ serum Na^+ level gradually
- ↓ approx. 0.5-1mEq/L/hr over 48 hrs
- Monitor for neuro changes & cerebral edema
- Hypotonic solution D5W or 0.45% NS
- Desmopressin (DDAVP)

Hypernatremia Nsg Interventions

- Identify pt at risk
- Monitor fluid loss / gain
- Neuro precautions and behavior changes
- Monitor labs
- Monitor oral Na intake
- Offer fluids
- Note medication with ↑ Na^+ content

Any Questions?

- ???????
- ?!?!?!?!
- !?!?!?!?
- !!!!!!!!!