electrolytes.md

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# Hyponatremia

## Resources

[EM Cases](https://emergencymedicinecases.com/episode-60-emergency-management-hyponatremia/) [MD Calc](https://www.mdcalc.com/sodium-correction-rate-hyponatremia-hypernatremia)

## Signs/symptoms

* muscular weakness
* headache
* lethargy
* confusion
* unsteady gait
* seizures, coma

## Causes

* Spurious - (pseudohypnoatremia) - lipemia (shouldn’t happen with modern labs)
* Water shifts from cells to serum (osmotic pressure) - hyperglycemia
* Can’t pee out water - heart/liver/renal failure, endocrine (SIADH, hypothyroid)
* Drinking too much water - exercise induced, psychogenic polydypsia
* Peeing out too much salt - adrenal insufficiency, diuretic use, cerebral salt wasting
* Drinking too much water and not enough salt/protein - beer potomania, “tea and toast”

## Treatment

### Mild/asymptomatic and onset greater than 48 hours

* if hypovolemic - give fluids - 3%, LR, NS, use MDCalc to calculate rate based on fluid choice
* if hypervolemic - take away fluids - furosemide
* if hyper or euvolemic - restrict free water, give salt, fix pathology
* if hypo-osmotic - give osmoles - food, salt
* if hyper-osmotic - move unwanted osmoles (hyperglycemia –> insulin)
* if endocrine problem - may need to add/remove/block hormones - corticosteroids, thyroid hormone, ddAVP
* if at risk of over-correction from spontaneous water diuresis - consider dDAVP(desmopressin)

### Severe symptoms (seizing, coma) and onset of hyponatremia within 48 hrs

* raise by 1-5mmol/L/hr until symptoms resolve or Na+ 125-130mmol/L
* hypertonic saline (3%) 1-2ml/kg/hr
* use MDCalc to find correction rate for diff. fluids

## Disposition

* Discharge: chronic AND sodium > 120 meq/l AND asymptomatic
  + this is from uptodate, I personally start to get nervous around 125 depending on chronicity
* Admit: acute OR sodium < 120 meq/l OR symptomatic

# Hyperkalemia

## Resources

[LITFL Review - ECG Examples](https://litfl.com/hyperkalaemia-ecg-library/)

## Signs/symptoms

* muscle weakness, ascending
* palpitations
* fatigue
* weakness

## Causes

* Spurious - long tourniquet time, hemolysis
* Moves out of cells - rhabdo, DKA (other acidosis), hyperkalemic periodic paralysis
* Taking too much - supplements
* Can’t pee it out - renal failure, ace-inhibitor +/- [trimethoprim](https://www.ncbi.nlm.nih.gov/pubmed/8328738), K+ sparing diuretics, adrenal insufficiency

## Treatments

* Mild - asymptomatic, no ECG changes, usually K+ < 6.0
  + treat underlying cause
  + e.g. - remove supplement/offending medication, hydration
* Severe - symptomatic, ECG changes, K+ > 6.0
  + Stabilize - Calcium Gluconate 1 gram IV
  + Dilute - IVF
  + Shift - insulin, D50, albuterol, bicarbonate
  + Remove - diuretics, dialysis, kayexelate (SPS - sodium polystyrene sulfonate), lokelma (sodium zirconium cyclosilicate)

## Disposition

* Discharge: <6 AND asymptomatic AND no ECG changes AND underlying cause is known AND problem is fixed
* Admit: >= 6 or ECG changes or underlying cause not known/not fixed

## ECG Findings

* Peaked T waves - symmetric, pointy, sometimes tall
* Prolonged intervals - everything gets spaced out, QRS is widened, QT prolonged, T wave broad based
* Junctional Bradycardia - no P waves, Rate 40-60. QRS and T look like mirror images
* Vfib/Vtach
* Sine Wave

# Hypokalemia

## Resources

[LITFL HypoK](https://litfl.com/hypokalaemia/) [Stephen Smith ECG Blog](https://hqmeded-ecg.blogspot.com/2019/05/potassium-and-magnesium-how-low-is-too.html)

## Signs/symptoms

* myalgias
* cramping, spasms
* weakness
* paralysis

## Causes

* Not taking enough - malnutrition
* Shifting - unusual (alkalosis, hyperinsulinemia, b-agonist), hypokalemic periodic paralysis
* Peeing out too much - diuretics (new thiazide), hypomagnesemia, hyperaldosteronism (cushing’s)
* Pooping/Vomiting it out - diarrhea, vomiting

## Treatments

* Repletion - oral solution, pills, IV
* 10 meq either oral or IV will increase serum concentration by 0.1 meq/l
  + i.e. if serum level is 3.0 meq/l, giving 10 meq will increase serum concentration to 3.1 meq/l
* Also check and replete magnesium if needed
* Stop potassium wasting drugs (diuretics)

## Disposition

* Discharge: if asymptomatic AND K+ > 2.5 AND no ECG changes AND able to replete at home
* Admit: if symptomatic OR K+ < 2.5 OR ECG changes OR not able to replete at home

## ECG Findings

* U waves
* T wave flattening
* Down-up T wave morphology
* ST depression
* Long QT
* Torsades