Lab Values Associated with Cognition

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Before we do that...

First and foremost, we are not physicians. Do not overstep bounds.

However, we are healthcare professionals.

Knowing how medical conditions affect cognition and behavior is part of working in a healthcare environment.

We will start with a few clinical scenarios- keep these in mind as we review broad lab categories that are relevant to cognition and neuropsychological evaluations.

Scenario 1:

You are asked to evaluate an 80-year-old individual with altered mental status who is newly admitted to an inpatient medical unit. As a neuropsychologist, what labs would you look at as part of your assessment?

Scenario 2:

You are seeing a patient with hypothyroidism and Celiac disease for evaluation of cognitive difficulties. TSH was elevated. What other labs, if any, would you want to look at as part of your assessment?

Scenario 3:

You are seeing a patient referred by neurology as part of a new dementia workup. A1c was WNL. What other labs, if any, would you want to look at as part of your assessment?

Overview

Electrolyte Labs

Non-electrolyte Labs

Other Lab Values (Kidney, Liver, Glucose, Hemoglobin A1c)

Vitamin Lab Values

Neurologic Effects of Vitamin Absorption Conditions

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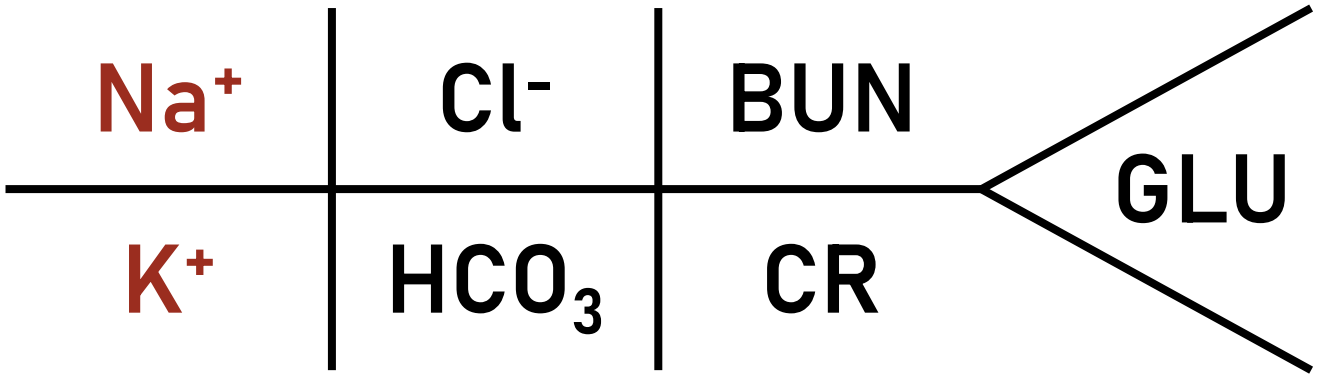
Electrolytes

Sodium

Potassium

ELECTROLYTES

- Chemically, these are substances that become ions in solution and acquire the capacity to conduct electricity
- Balance of the electrolytes in our bodies is essential for normal function of our cells and our organs
- Common ones: sodium, potassium



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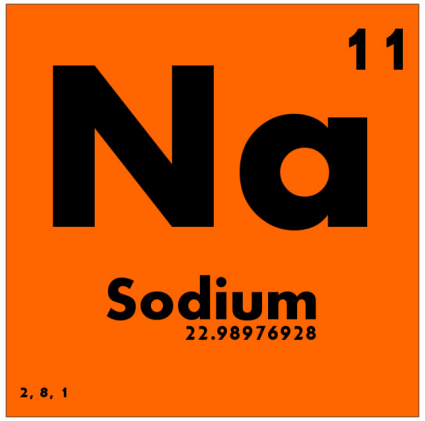
Sodium



- Important for cell function
- Balance between dietary sodium intake and renal secretion
- Medications that affect sodium levels:
  - Increase: Anabolic steroids, corticosteroids, antibiotics, cough medicines, laxatives, oral contraceptives
  - Decrease: ACE inhibitors, diuretics, heparin, NSAIDS, tricyclic antidepressants

Too little sodium = hyponatremia

Possible causes: congestive heart failure, water intoxication

The most common electrolyte disorder

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Acute: delirium

Start to see symptoms <125
weakness

Sodium levels <115

confusion, lethargy

Stupor and coma

Chronic: lethargy, disorientation, other cognitive changes

*

Sodium

- Too much sodium=hypernatremia
  - Possible causes: dehydration (not drinking enough fluids, vomiting/diarrhea), kidney disease
  - Chronic hypernatremia better tolerated than chronic hyponatremia
  - BUT can still result in cognitive difficulties

Serum Sodium and Cognition in Older Community-Dwelling Men

Kristen L. Nowak,[1] Kristine Yaffe,[2] Eric S. Orwoll,[3] Joachim H. Ix,[4,5] Zhiying You,[1] Elizabeth Barrett-Connor,[6] Andrew R. Hoffman,[7] and Michel Chonchol[1]

Clin J Am Soc Nephrol 13: 366–374, 2018.

- **Aimed to examine relationship between lower normal serum sodium levels/ mild hyponatremia and cognition (3MS and Trails B) in *community dwelling older men***
- **Participants were 5,435 men over age of 65**
- **Mean age of 74; mean serum sodium level of 141 ± 3**

Results:

- **Serum sodium between 126 and 140 (mild hyponatremia/normal) associated with both increased rates of cognitive impairment and cognitive decline at follow-up (4.6 years later).**
  - **Hyponatremia defined as < 136**
- **Highlights potential importance of even mild decrease in sodium for cognition for older adults**

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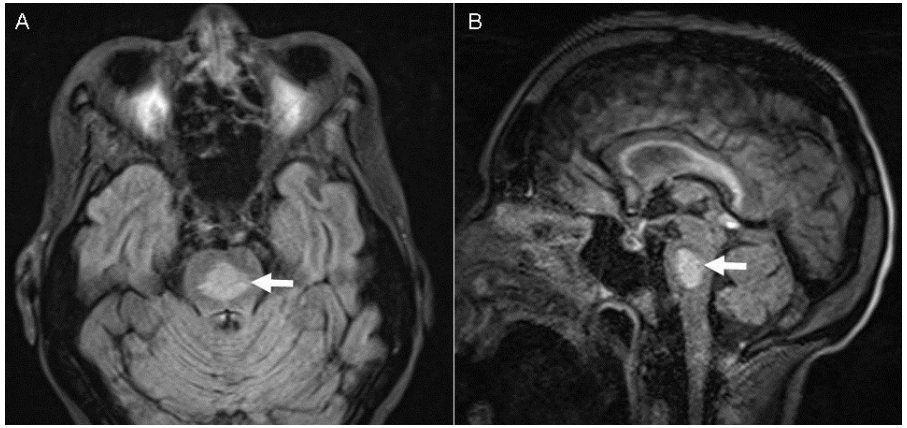
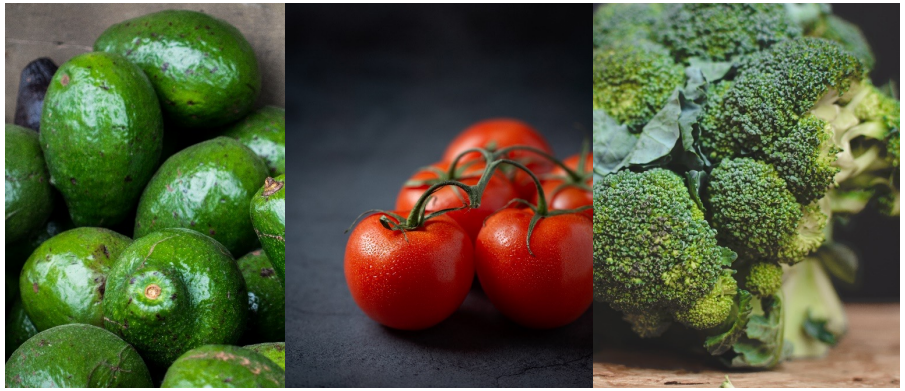
Sodium



- Extremes can be fatal
- Stabilization of sodium levels → normalization of cognitive function (unless there are other etiologies)
- Too rapid stabilization → central pontine myelinolysis
    - Spastic quadriparesis
    - Pseudobulbar palsy
    - Respiratory paralysis
    - MS changes
    - Locked-in syndrome
    - Death

Potassium



- **Potassium** is important for:
  - Regulation of fluid balance and heartbeat
  - Muscle and nerve function
  - “body needs potassium for your cells, muscles and nerves to function correctly” (Cleveland Clinic)
- Largely comes from diet
  - Found in a wide variety of foods (e.g., legumes, soybeans, potatoes, fruits, vegetables, poultry, fish, milk, yogurt)
- Kidneys remove excess potassium from body
- Factors that can affect potassium levels include:
  - Diarrhea, vomiting, excessive sweating
  - Kidney disease, eating disorders, alcohol use disorder
  - Medications
    - Antibiotics, histamines and lithium can increase
    - Laxatives, insulin and diuretics can decrease
- Potassium can also lessen effects of sodium and reduce blood pressure

Potassium

- Normal range of serum potassium levels (3.5-5.0 mEq/L)
  Too little = hypokalemia (severe hypokalemia: < 2.5-3.0 mEq/L)
  Too much = hyperkalemia

- Severe hypo/hyperkalemia can be associated with life threatening cardiac arrhythmias
- Hypokalemia is common electrolyte disturbance
  - Increased risk in hospitalized patients
  - Symptoms tend to be associated with level and duration of potassium change

Mild Hypokalemia	Severe Hypokalemia
constipation	muscle twitches and cramps
heart palpitations	severe muscle weakness, leading to paralysis
fatigue	low blood pressure,
muscle weakness and spasms	lightheadedness
tingling/numbness	abnormal heart rhythms

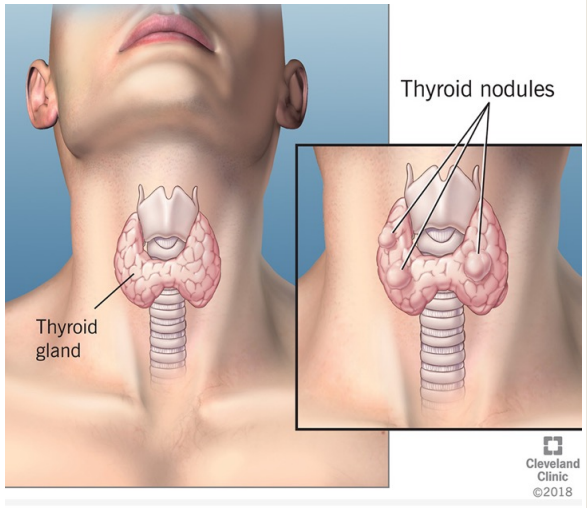
- Hyperkalemia is often asymptomatic in healthy individuals because kidneys eliminate excess potassium in urine; Individuals with kidney disease and diabetes at higher risk

Non-electrolyte Labs

Thyroid Function

Complete Blood Count

Thyroid Function



3 thyroid hormones:

1. **Thyroid stimulating hormone (TSH)**
2. **Thyroxine (T4)**
3. **Triiodothyronine (T3)**

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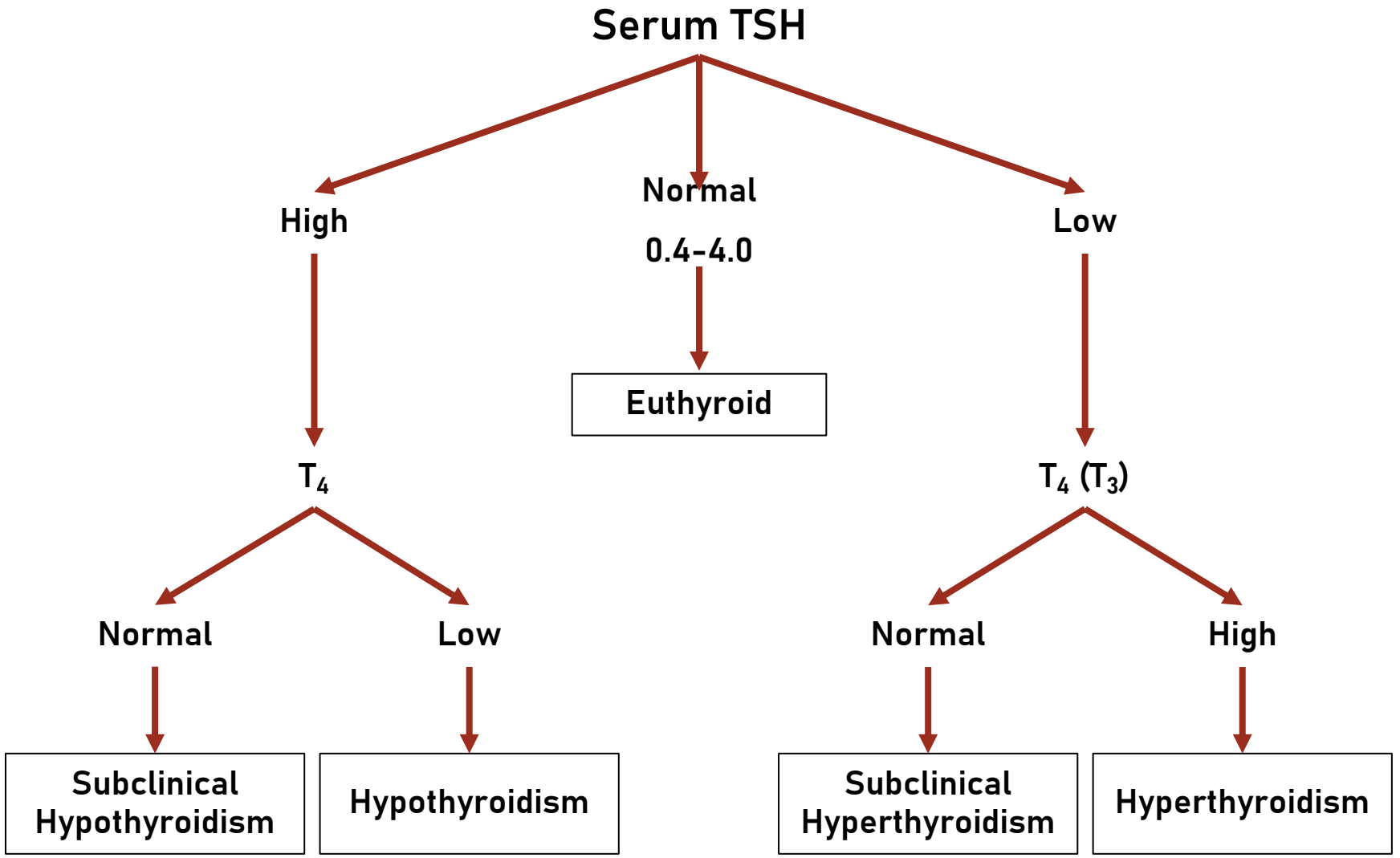
Serum TSH
High
Normal
0.4-4.0
Low
Euthyroid
T_4
T_4 (T_3)
Normal
Low
Normal
High
Subclinical Hypothyroidism
Hypothyroidism
Subclinical Hyperthyroidism
Hyperthyroidism

Hypothyroidism

- Psychomotor slowing, apathy, depression

- When profound: “myxedema madness” with deficits in attention, memory, paranoia, hallucinations
  - MRI: no specific changes
  - EEG: diminished amplitude
  - SPECT: global hypoperfusion that reverses after normalization of thyroid function
  - Cognitive problems can be present and can persist

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Hyperthyroidism

Associated symptoms	
Anxiety	Restlessness
Irritability	Emotional lability
Distractibility	Poor attention
Impaired memory	Difficulty with calculations

THYROID FUNCTION AND DEMENTIA RISK

- Epidemiological studies suggest both hypothyroidism and hyperthyroidism may increase risk for dementia but mechanisms are unclear
  - **Framingham Study:** high and low TSH in women, but not men, associated with increased risk of developing AD (Tan et al., 2008)
    - Mean age 71, follow-up average time 12.7 years
  - **Thyroid Epidemiology, Audit, and Research Study** (TEARS; Vadiveloo et al., 2011)— 12,115 euthyroid and subclinical hyperthyroid
    - Mean age 66, followed for 5.6 years
    - Participants with TSH levels < 0.4 mIU/L at baseline had a 2-fold increased risk of dementia
  - **Danish Nationwide Register study** compared patients with hypothyroidism to euthyroid individuals (Thvilum et al., 2021), mean age 56; median follow-up 6.2 years
    - Hypothyroidism associated with increased risk of dementia
    - Association influenced by comorbidities and age
    - Every 6 months of elevated TSH increased risk of dementia by 12%

NON-ELECTROLYTE LABS

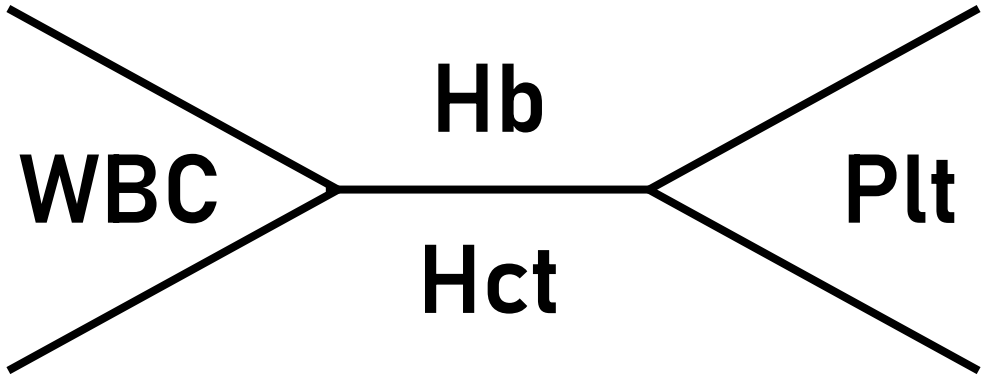
Review of Complete Blood Count (CBC)

1 **Hemogoblin**

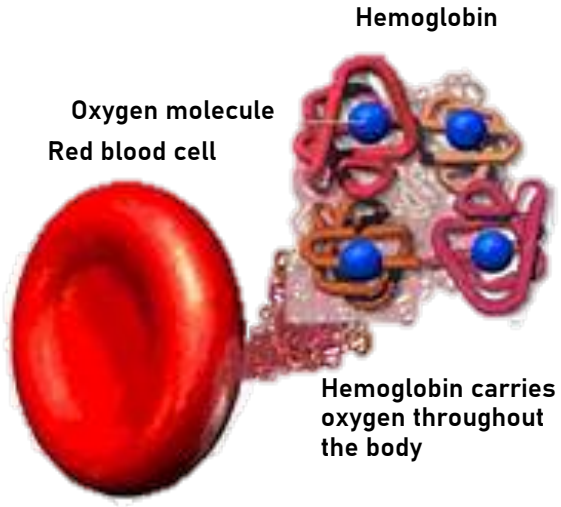
2 **Anemia and Cognition**

Complete Blood Count (CBC)

- Provides information on 3 types of blood cells
  - White Blood Cells (WBC; fight infection)
  - Red Blood Cells (RBC; carry oxygen throughout body)
    - Hemoglobin (Hb; oxygen-carrying protein)
    - Hematocrit (Hct; proportion of red blood cells to the plasma in blood)
  - Platelets (Plt; help with blood clotting)
- Helpful for detection of anemia, polycythemia, infection, and inflammatory state that can present with altered mental status



Hemoglobin (Hb)



Protein in red blood cells that carries oxygen from lungs to the organs and tissues and transports carbon dioxide back to your lungs

- Levels vary according to sex and age
  - Women < men
  - Decreases with age

Normal Results

Normal results for adults vary, but in general are:

- Male: 13.8 to 17.2 grams per deciliter (g/dL) or 138 to 172 grams per liter (g/L)
- Female: 12.1 to 15.1 g/dL or 121 to 151 g/L

Normal results for children vary, but in general are:

- Newborn: 14 to 24 g/dL or 140 to 240 g/L
- Infant: 9.5 to 13 g/dL or 95 to 130 g/L

- Higher than normal hemoglobin has several potential causes
  - Time of day (8am > 8pm)
  - Living at high altitude
  - Dehydration
  - Polycythemia vera (blood disorder)
  - Smoking
  - Lung diseases such as COPD, emphysema or pulmonary fibrosis

https://ufhealth.org/hemoglobin

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Anemia

- Lower than normal hemoglobin means low red blood cell count= anemia
- RBCs contain hemoglobin, a protein that carries O2 throughout the body
  - Iron is needed for the body to make hemoglobin
  - Vitamin B12 and folate are needed to make RBC
- Anemia can have many causes:
  - body makes too few RBCs
  - body destroys too many RBCs
  - body loses too many RBCs

Types of Anemia

- Mean corpuscular volume (MCV)- average size of RBCs
- Microcytic Anemia - smaller than average RBC, often seen in iron-deficient anemia
- Normocytic Anemia – normal sized RBC but too few.
    - could be due to low production or significant blood loss.
- Macrocytic Anemia - larger than average RBC size, but not enough hemoglobin overall
    - changes in DNA synthesis during production of RBCs (megaloblastic)
    - Low vitamin B12 or folate (megaloblastic)
    - Alcohol (non-megaloblastic)

Anemia & Cognition

- Associated with poorer global cognitive function, but this association may be specific to measures of processing speed and executive function and not to memory
    - regardless of type of anemia (e.g., macro versus microcytic)

Anemia & Cognition

- Mixed evidence that it contributes to neurodegeneration
  - High concentrations of iron can lead to oxidative stress and inflammation
  - Disruption of iron homeostasis can accelerate progression of neurodegeneration
  - High concentrations of minerals, including iron, present in amyloid plaques and neurofibrillary tangles
- Possibly related to inadequate cerebral oxygenation, which in turn may lead to impaired cerebral perfusion and cerebral function (i.e., vascular mechanisms). As blood flow becomes inadequate, can lead to impaired cerebral function and ischemia.
  - Can also lead to cardiac arrhythmias

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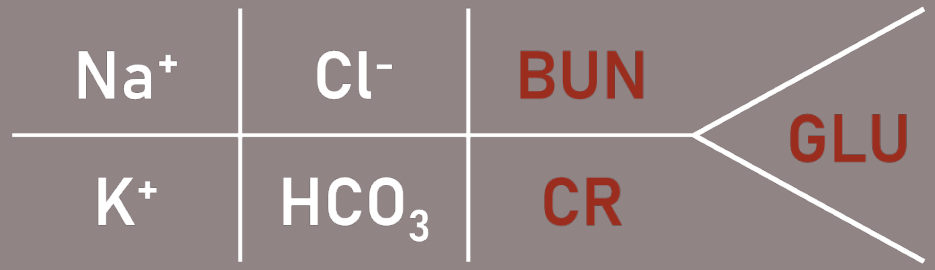
Other Lab Values



Renal Function

Liver Function

Glucose

Hemoglobin A1C

RENAL FUNCTION

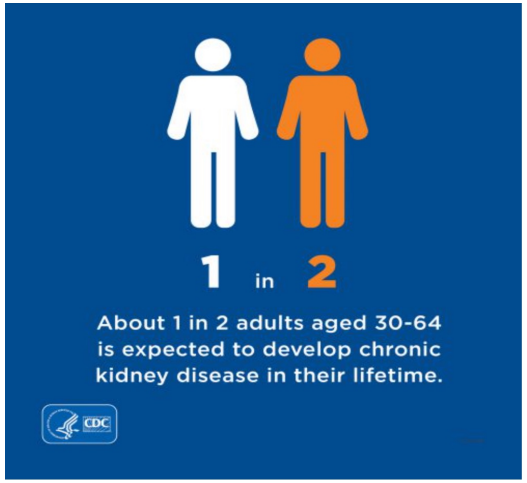
- Kidneys clean blood of toxins/transform waste into urine
- As kidney function deteriorates (due to disease or injury), uremia can develop
- Uremia: Increased urea/other nitrogenous waste compounds in the blood that are normally eliminated by kidneys
- Uremia can cause fluid accumulation, hormone and electrolyte imbalance
- Decreased renal function can be associated with:
  - Hyponatremia
  - Hyperkalemia
  - Hypermagnesemia
  - Hypocalcemia
  - Metabolic acidosis
  - Accumulation of poorly dialyzable drugs

Renal labs	Purpose
Blood Urea Nitrogen (BUN) In adults, normal range is 10-20 mg/dL	Measures the urea nitrogen in blood due to the breakdown of protein from consumed foods and body metabolism. It is normally removed from blood by the kidneys. Rises when kidney function declines (can also be elevated in dehydration) Can also be affected by level of protein intake.
Creatanine (CR) Normal range varies by age and sex	Measures the waste product in blood from muscle activity; normally removed from blood by kidneys. Level rises when kidney function slows down. Can be affected by muscle mass and protein intake

Neurologic Effects of Renal Dysfunction

- Drowsiness, fatigue, apathy
- Poor concentration and memory
- Irritability
- Tremor, fasciculations
- Mild headache
- Mental status changes
- Later/more severe: delirium, hallucinations, coma, seizures

- Most pronounced with rapid development of uremia → uremic encephalopathy can result in delirium
- Chronic kidney disease (CKD) may cause more subtle changes that can be seen on NP testing, especially processing speed and attention



Liver Function Tests (LFTs)

Albumin, Globulin, and Total Protein: Albumin is most abundant protein produced by liver; low in liver damage/disease but can be reduced for other reasons as well

Enzymes present in the liver (increase with liver damage/disease):

Alkaline Phosphatase (ALP): Found in liver and bones; important for breaking down proteins. Elevated ALP may indicate liver damage/disease or bone disease.

Alanine aminotransferase (ALT): helps convert proteins into energy for liver cells.

Aspartate aminotransferase (AST): helps metabolize amino acids; elevated rates could indicate liver damage/disease or muscle damage.

LFT Components	Hepatitis Pattern	Cirrhosis Pattern
Total Protein	Normal	↓
Albumin	Normal	↓
Globulin	Normal	↑
A/G ratio	>1	<1
(ALP)	Elevated 1-2 times normal	Elevated 1-2 times normal
ALT	Values increased into the thousands	ALT, AST are increased
AST	Values increased into the thousands; but ALT is > than AST	Never greater than 300 IU AST is always > than ALT

table adapted from (c) 2006, Kanchan Ganda, M.D.

https://www.mayoclinic.org/tests-procedures/liver-function-tests/about/pac-20394595

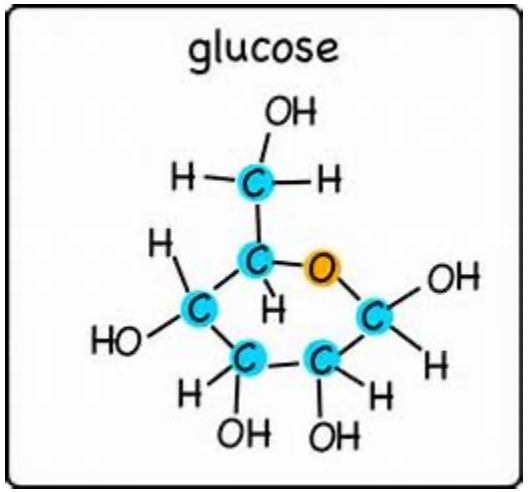
Liver Disease & Cognition

- Hepatic encephalopathy (HE): brain dysfunction caused by liver disease
- Over 40% of patients with cirrhosis with develop HE

West Haven Criteria for grading extent of HE

Grade	Criteria
1	Trivial lack of awareness Euphoria or anxiety Shortened attention span Impairment of addition or subtraction
2	Lethargy or apathy Minimal disorientation of time or place Subtle personality changes Inappropriate behavior Lethargy or apathy
3	Somnolence to semi-stupor but responsive to verbal stimuli Confusion Gross disorientation
4	Coma

Glucose



- Critical values
  - <50 and >400 mg/dL
- Effected by:
  - Time of day
  - Recently eating
  - Caffeine
  - Pregnancy
  - Stress (trauma, general anesthesia, infection, burns, MI)
  - Medications
    - Increase: tricyclic antidepressants, corticosteroids, estrogens, lithium
    - Decrease: acetaminophen, alcohol, MAOIs, propranolol

GLUCOSE

- Individuals with diabetes mellitus type I or II
  - Hypoglycemia can affect cognitive or motor function
  - Moderate to severe hyperglycemia
  - Consistently associated with cognitive impairment

- Individuals without diabetes
  - Less clear the effects of hypoglycemia
  - Seem to tolerate mild hyperglycemia pretty well

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Hemoglobin A1c

- Provides an average of your blood sugar control over the past 2 to 3 months
    - If your glucose levels have been high over recent weeks, your hemoglobin A1c test will be higher
- Hemoglobin is found in red blood cells, which carry oxygen throughout your body
    - When diabetes is not controlled (meaning that your blood sugar is too high), sugar builds up in blood and combines with hemoglobin, becoming "glycated"

Hemoglobin A1c

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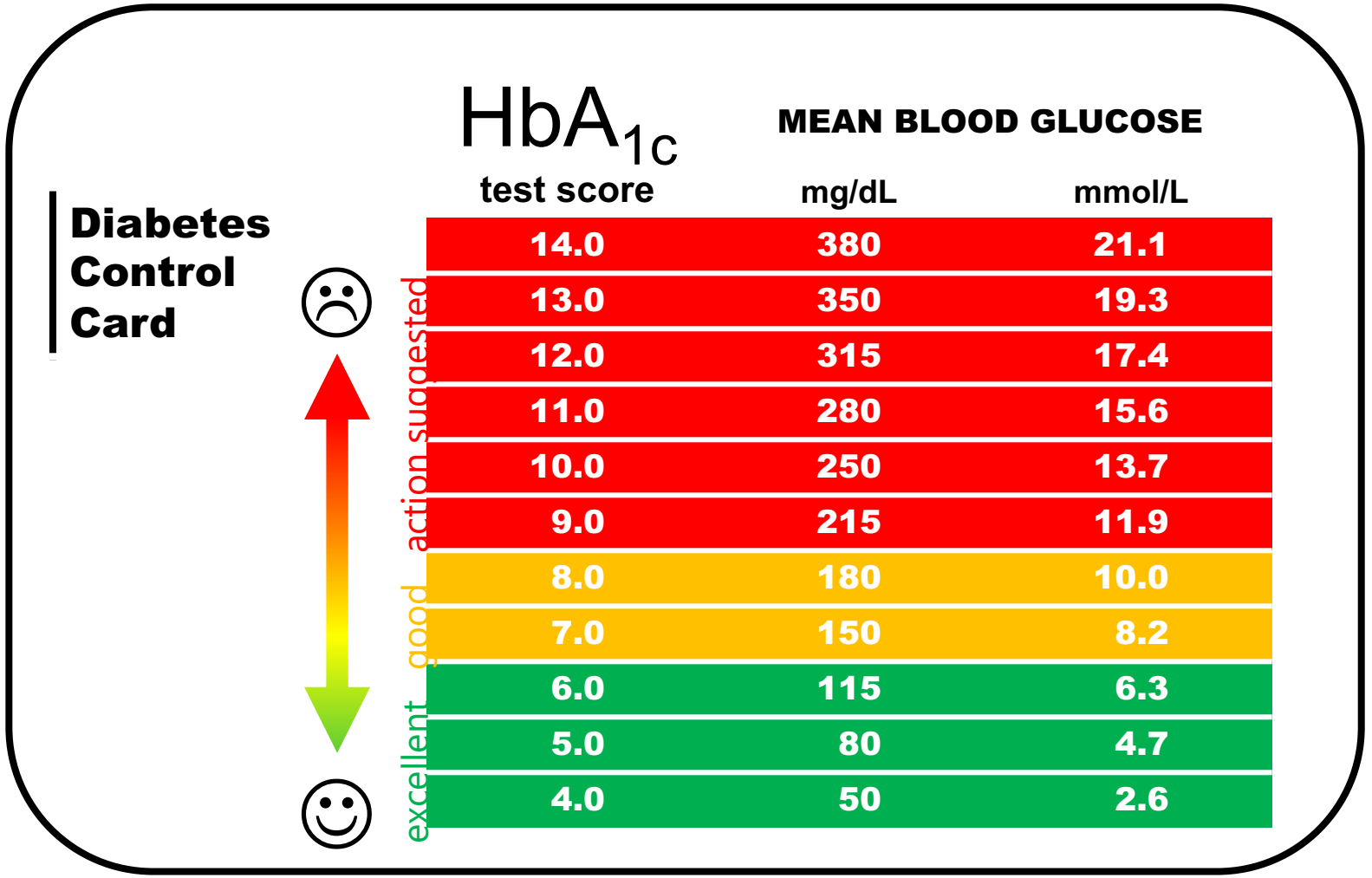
- No DM, the normal range for the hemoglobin A1c test is between 4% and 5.6%
- Levels between 5.7% and 6.4% = increased risk of diabetes
- Levels of 6.5% or higher indicate diabetes
- Because studies have repeatedly shown that out-of-control diabetes results in complications from the disease, the goal for people WITH diabetes is a hemoglobin A1c less than 7%
    - The higher the hemoglobin A1c, the higher the risks of developing complications related to diabetes

LAB VALUES OTHER ORGANS

Diabetes Control Card (replication)



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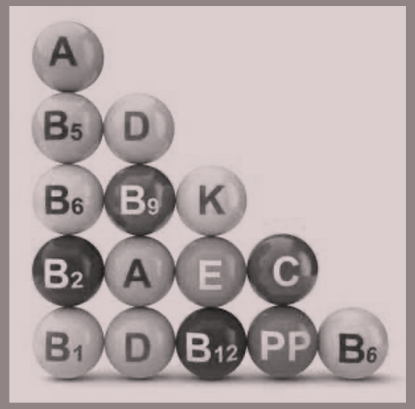
Hemoglobin A1c

- People with diseases affecting hemoglobin, such as anemia, may get abnormal results with this test
- Other abnormalities that can affect the results of the hemoglobin A1c include supplements such as vitamins C and E and high cholesterol levels
- Kidney disease and liver disease may also affect the result of the hemoglobin A1c test

Vitamin Lab Values



Vitamin B12

Folic Acid

Niacin

Vitamin D

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Vitamin B12

- Serum B12 levels <200 pg/ml
- Substances that can decrease include alcohol, anticonvulsants, and oral contraceptives
- Megaloblastic anemia
  - Fracture and hemolyze
  - Can take 6-18 months before anemia develops
- Can see cognitive symptoms in normal or borderline levels in the elderly OR in those with abnormal plasma vitamin B12 binding antibodies

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Causes of Vitamin B12 deficiency: pernicious anemia

- Pernicious anemia
  - Condition occurs when body's immune system attacks cells in stomach that produce substance called intrinsic factor
  - Without this substance, B-12 can't be absorbed in the intestines, which is needed to make red blood cells
- Treatment usually 1000 micrograms of B12 IM for 10 days, then weekly for a month, then monthly

Other causes of Vitamin B12 deficiency

Low levels of stomach acid

- Gastric acid separates ingested B12 from binding proteins
- Medications for GERD such as proton-pump inhibitors, can lower B12 levels.

Diet

- B12 found mainly in meat, eggs and milk
- Some foods (e.g., cereals) fortified with B12

Gastric Surgeries

- Removal of portions of stomach or intestines can reduce amount of intrinsic factor produces and amount of space available for B12 to be absorbed

Digestive Diseases

- Diseases that affect the digestive system, such as Crohn's Disease and Celiac's Disease
- Can interfere with absorption of B12

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Low Vitamin B12:

Should I care?

- Low vitamin B12 and folic acid increase risk of hyperhomocystinemia
  - Can be associated with renal disease
  - Can increase risk of blood clots
  - Could contribute to migraine headaches and epilepsy
  - Can decrease integrity of the blood-brain barrier
- Neurologic effects

Low Vitamin B12: Neurologic Effects

- Psychomotor slowness *
- Confusion
- Memory difficulties
- Depression
- Peripheral neuropathy
- Superficial sensory impairment
- Burning paresthesia
- Vision problems





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Low Vitamin B12: Neurologic Effects

- Can cause demyelinating myelopathy of the posterior and lateral columns
  - Impaired vibratory sense, limb weakness, spasticity, increased muscle stretch reflexes, extensor plantar responses

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Folic Acid/Folate (Vitamin B9)

- Deficiency mimics vitamin B12 deficiency including cognitive problems
- Serum folate of 3ng/ml or less is abnormally low and most symptoms reverse after administration of 1mg/day or more

Niacin (Vitamin B3)

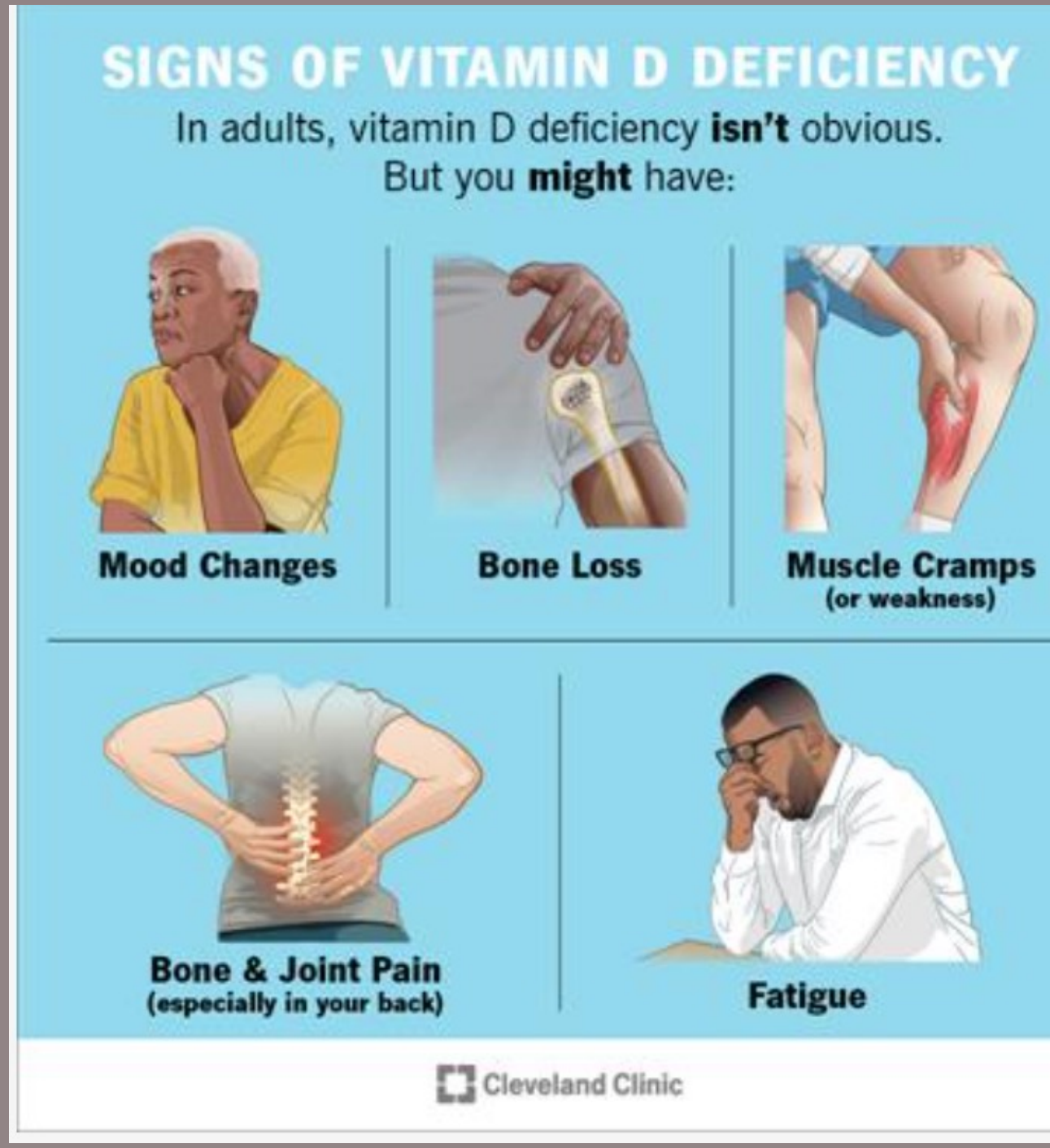
optimal level 0.5 to 8.45 ug/ml

- Important for metabolism of macronutrients (carbohydrates, protein, and fat)
- Deficit results from chronic dietary neglect (e.g., chronic and severe alcohol use) or malabsorption conditions, but is rare in the US
- Results in pellagra, which includes the 3 D's: dementia, dermatitis, diarrhea
    - Psychomotor slowing, memory impairment, poor concentration, anxiety, depression, irritability, lability, headache, insomnia
    - Dementia and delirium may occur as pellagra advances
    - Dermatitis is sunburn-like changes on skin typically exposed to sun (brown discoloration and lesions)

Vitamin D

- Promotes calcium absorption, bone growth, immune function, and reduction of inflammation.
- Obtained through:
  - sun exposure on your skin
  - food
  - nutritional supplements
- Chronic and/or severe Vitamin D deficiency can lead to hypocalcemia (low calcium levels in blood), which can lead to secondary hyperparathyroidism (overactive parathyroid glands attempting to regulate blood calcium levels)
- < 30 is considered deficient
- Approx. 35% of US adults have Vitamin D deficiency

Vitamin D


SIGNS OF VITAMIN D DEFICIENCY
In adults, vitamin D deficiency isn't obvious.
But you might have:
Mood Changes
Bone Loss
Muscle Cramps
(or weakness)
Bone & Joint Pain
(especially in your back)
Fatigue
Cleveland Clinic

Vitamin D in the news

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JULY 28, 2022 VOL. 387 NO. 4

Supplemental Vitamin D and Incident Fractures in Midlife and Older Adults

Meryl S. LeBoff, M.D., Sharon H. Chou, M.D., Kristin A. Ratliff, B.A., Nancy R. Cook, Sc.D., Bharti Khurana, M.D., Eunjung Kim, M.S., Peggy M. Cawthon, Ph.D., M.P.H., Douglas C. Bauer, M.D., Dennis Black, Ph.D., J. Chris Gallagher, M.D., I-Min Lee, M.B., B.S., Sc.D., Julie E. Buring, Sc.D., and JoAnn E. Manson, M.D., Dr.P.H.

The Seattle Times

The Seattle Times

Wellness

Is it time to stop taking vitamin D?

Aug. 22, 2022 at 6:00 am | *Updated Aug. 24, 2022 at 8:44 am*

Findings from the VITAL study:

Supplemental Vitamin D3 did not result in lower risk of fractures relative to placebo in individuals over the age of 50

- >25K participants followed for 5 years
- 2000 IU per day of D3 vs placebo
- No difference, even in the 20% of participants also taking calcium supplements (Vitamin D is essential for calcium absorption)

Vitamin D and Cognition

Reduced Vitamin D and Risk for dementia

- Meta-analysis of nearly 19,000 adults found severe Vitamin D deficiency (< 10) was associated with 54% increase in risk of dementia (Sommer et al., 2017)
- Updated meta-analysis published in 2019 found Vitamin D deficiency (<20) associated with increased risk of dementia and AD; risk increased with severe Vitamin D deficiency compared to moderate deficiency (Chai et al., 2019)

However, results not consistent

- Longitudinal assessment of cognition over 20 years did not differ according to baseline Vitamin D level in a sample of individuals (Schneider et al., 2018)
  - > 13000 participants; Mean age at baseline = 57 years
  - NP assessment at 3 timepoints (delayed word recall test , the digit symbol substitution test, and the word fluency test)

Improved cognitive performance with Vitamin D supplementation in individuals with MCI and AD

- Vitamin D supplementation over 1 year period in patients diagnosed with AD and MCI resulted in improved cognitive function compared to those who received placebo (Jia et al., 2019; Yang et al., 2020)

Neurologic Effects of Vitamin Absorption Conditions

Celiac Disease (CD)

CD & Vitamin B's

CD & Thyroid

CD & Neurologic Manifestations

Gluten Ataxia

Celiac Disease (CD)

- Autoimmune disorder
  - Intestinal inflammation in response to gluten
    - High-molecular-weight seed storage protein commonly found in grass-related grains (wheat, barley, rye)
    - Nourish seeds during flowering and germination
    - Allows wheat to form dough bread, cereals, pastas
  - Malabsorption, diarrhea, weight loss
  - Global prevalence of 1%, mostly European/Caucasian populations
    - 4.5% among first degree relatives
- Gluten Free Diet (GFD) is the treatment
  - Associated with increased total cholesterol, HDLs
  - Low fiber

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Celiac Disease & Vitamin B's

- GFD is also associated with nutritional deficits
  - Deficiencies in certain minerals (calcium, iron, magnesium, zinc) and vitamins (B12, D, folate)
- Low vitamin B12 and folic acid increase risk of hyperhomocystinemia
  - Can be associated with renal disease
  - Can increase risk of blood clots
  - Could contribute to migraine headaches and epilepsy
  - Can decrease integrity of the blood-brain barrier

*

Celiac Disease & Thyroid

- Hypothyroidism reported in 2-13% of CD patients (3-4 fold higher risk than in general population)
- Conflicting results about increased risk of hyperthyroidism
- Unclear if a GFD normalizes hypothyroidism
- Suspicion for CD should be raised in patients with hypothyroidism who are med compliant but not responding to treatment
    - CD can cause malabsorption of levothyroxine

Celiac Disease & Neurologic Manifestations

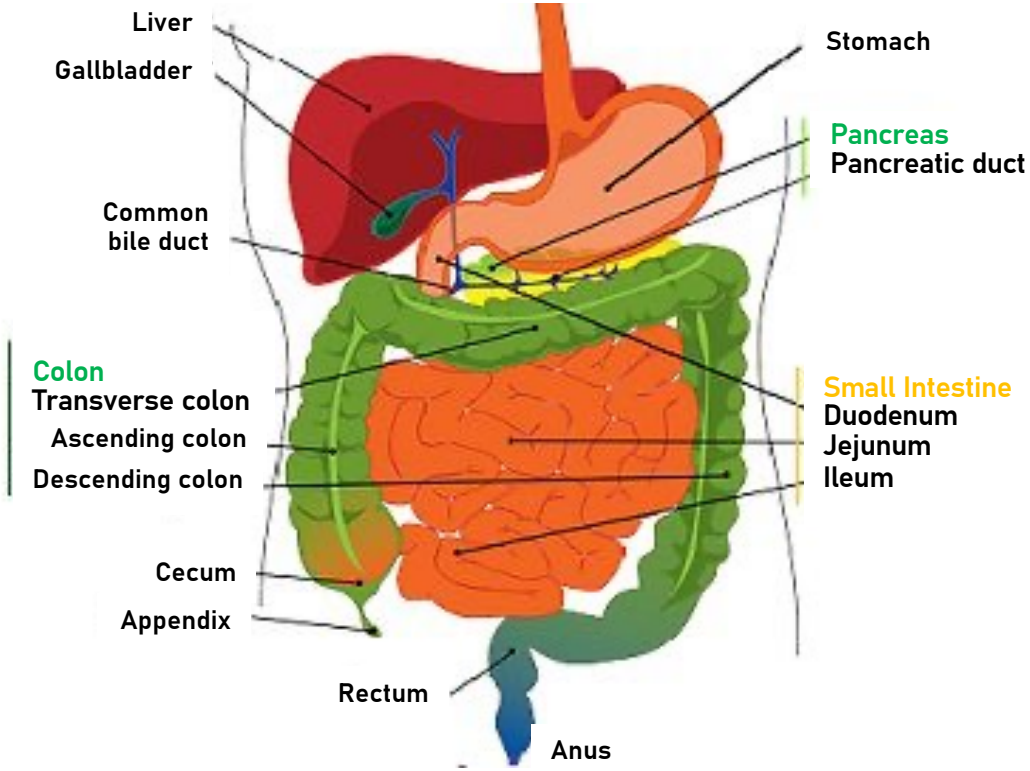
- Can appear at any time during the course of the disease and may even be the first or only symptom of CD
- Present in as many as 35% of adult patients
- Headaches (~50% of patients)
    - ~75% experience improvement with GFD
- Epilepsy
    - Prevalence of CD 2.3 higher in patients with epilepsy
    - For those with both, GFD might help, but will not lead to complete resolution of seizures
    - Triad of CD, epilepsy, cerebral calcification (CEC)
- Symptoms of depression, anxiety, irritability, ADHD, eating disorders

Gluten Ataxia

- 15% of all ataxias
- Might occur in the presence of low levels of vitamin E
- Many stabilize or improve with strict adherence to GFD, but depends on duration of ataxia prior to this
- Up to 60% have evidence on imaging of cerebellar atrophy

Inflammatory Bowel Disease

- Ulcerative colitis (UC)- basically limited to the large intestine
- Crohn's Disease (CD)- can affect any part of the digestive tract, but small intestine involved in most cases
  - Most nutrients are absorbed through the small intestine
  - Vitamin B12 malabsorption associated with higher disease activity
  - Some evidence that those with vitamin B12 malabsorption were also at higher risk for iron-deficiency anemia
  - GI hemorrhage also increases risk for iron-deficiency anemia



Inflammatory Bowel Disease

- Often treated with corticosteroids
- Many receptors in frontal cortex and hippocampus—affects memory and executive functioning
- Acute users of corticosteroids: executive functioning, recent memory, long term memory
- Chronic users of corticosteroids : recent memory

Bariatric Surgery & Nutritional Deficits

- Gastric bypass (GB)
  - Combination of restriction of the gastric capacity and reduction of functional small bowel
- Sleeve gastrectomy (SG)
  - Reduces stomach volume
- Both can be associated with reduced nutrient intake and absorption
  - Vitamin B12
  - Folate
  - Iron

So…now what?

Pearls for Neuropsychologist

- Patients with acute abnormalities in lab values resulting in encephalopathy with NO history of acute or subacute encephalopathy often demonstrate a more dramatic change in cognitive performance than those with prior history of encephalopathy.
- Lab values may return to normal before cognitive functioning does; return to baseline cognitive functioning is variable.
- Use caution when making determinations of competency or diagnostic decisions for individuals, particularly older adults, with abnormal lab values.

Back to those clinical scenarios…

What would you do in these situations?

Scenario 1:

You are asked to evaluate an 80-year-old individual with altered mental status who is newly admitted to an inpatient medical unit. As a neuropsychologist, what labs would you look at as part of your assessment?

Some possibilities: CBC, electrolytes, TSH, glucose, BUN, creatinine, LFT

Scenario 2:

You are seeing a patient with hypothyroidism and Celiac disease for evaluation of cognitive difficulties. TSH was elevated. What other labs, if any, would you want to look at as part of your assessment?

Some possibilities: TSH and BUN, creatinine, B12, B9

Scenario 3:

You are seeing a patient referred by neurology as part of a new dementia workup. A1c was WNL. What other labs, if any, would you want to look at as part of your assessment?

Some possibilities: Vitamins, electrolytes, kidney, liver, CBC, TSH

Case Examples Available through Neurology Journal Residents and Fellows Section:

Examples:

Pearls & Oy-sters: Rapidly Reversible Dementia Vitamin B_{12} Deficiency in a 29-Year-Old Woman

Akshata Huddar, Doniparthi Venkata Seshagiri, Subasree Ramakrishnan, Raghavendra Kenchaiah

Neurology Aug 2021, 97 (6) e643-e646; DOI: 10.1212/WNL.0000000000012102

Teaching NeuroImage: Reversible Symmetric Basal Ganglia Lesions in a Patient With Diabetes Undergoing Dialysis Savannah Quigley Neurology May 2022, 98 (18) 773-774; DOI: 10.1212/WNL.0000000000200594

Thank you!

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