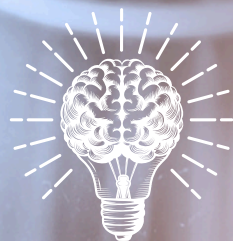
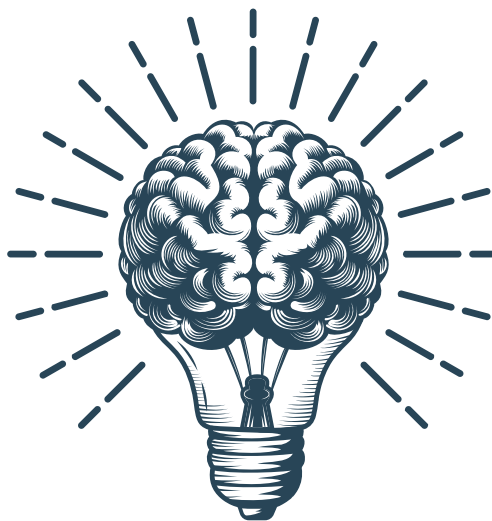


Labs Flash Cards





Shine brightly.

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CBC (Complete Blood Count) - what to watch out for:



Conditions like anemia, infection, and other disorders -
watch for agranulocytosis, leukopenia, infection, and
anemia



Anemia can cause:



Fatigue, which can be mistaken for depression



Antipsychotics and anticonvulsants can cause:



Neutropenia (an absolute neutrophil count [ANC] of < 1,500)



Depakote (divalproex) and Tegretol (carbamazepine) can
cause:



Thrombocytopenia (platelets <150,000)



Depakote and Tegretol lab draws:



Recommend baseline platelets at 2 weeks and then ever six months or annually (more vigilant with elderly or bleeding disorder)



Tegretol (carbamazepine) can cause (rarely):



Leukopenia, occurs within 1 month (less than 4,500 cells per microliter [$4.5 \times 10^9/L$])



Agranulocytosis is an:



ANC < 500 - potentially fatal, clozapine and carbamazepine both cause neutropenia and agranulocytosis



Lithium may increase:



White blood cell count (leukocytosis). This elevation is generally harmless and does not correlate with the dose. Also, lithium might be used to counteract neutropenia



CMP (Comprehensive Metabolic Panel) measures:



Glucose, calcium, and electrolytes



CMP provides important information about:



Heart, kidney, and muscle function. It can also give information about blood sugar levels, blood protein levels, and your acid/base balance



TSH (thyroid stimulating hormone)



This test is used to diagnose thyroid disorders, especially an underactive or overactive thyroid



Lipid Panel



This measures cholesterol levels in the blood, both the good (HDL) and the bad (LDL) cholesterol, as well as triglycerides. It is crucial for assessing the risk of heart disease



HbA1C (Hemoglobin A1C)



This test measures the average blood sugar over the past 2-3 months. It is a critical test for diagnosing and monitoring diabetes



UA (Urinalysis)



This test checks different components of urine and is used to diagnose kidney diseases, urinary tract infections, and other conditions



Utox (Urine Drug Screen)



This screens for various drugs in the urine. It is used to monitor patients for potential substance abuse or to ensure compliance with certain medications



HcG (Human Chorionic Gonadotropin)



For females, this is a pregnancy test. It measures HcG, a hormone produced during pregnancy



Normal Laboratory Values for Sodium



Nausea and vomiting; Headache; Short-term memory loss or confusion; Fatigue or lethargy; Muscle weakness, spasms, or cramps; Seizures; Decreased consciousness or coma; Unsteady gait or falls



Symptoms of Hypernatremia (High Sodium Levels)



Extreme thirst; Dry mouth and mucous membranes;
Decreased urination or dark yellow urine; Fatigue or
lethargy; Irritability or restlessness; Muscle twitching or
spasms; Confusion or altered mental status; Seizures; Coma



Selective Serotonin Reuptake Inhibitors (SSRIs) and Trileptal (oxcarbazepine) have been associated with:



The development of hyponatremia, particularly in elderly patients



SSRIs and Hyponatremia:



SSRIs can lead to hyponatremia due to a mechanism involving the Syndrome of Inappropriate Antidiuretic Hormone Secretion (SIADH). SIADH results in excessive water retention, diluting the concentration of sodium in the bloodstream. Elderly patients are particularly susceptible to this side effect (presents with symptoms like dizziness, fatigue, or muscle cramping)



Trileptal (oxcarbazepine) and Hyponatremia:



Trileptal is an antiepileptic medication that can cause hyponatremia through SIADH, similarly to SSRIs. The risk of hyponatremia is particularly high in the first few weeks of starting or titrating the drug



Serum bicarbonate (HCO_3^-):



22 to 28 mEq/L (22 to 28 mmol/L)



Symptoms of Low Bicarbonate Levels (Metabolic Acidosis):



When bicarbonate levels are lower than the normal range, it can indicate metabolic acidosis. Symptoms can include:

- Headache; Lethargy or fatigue; Confusion; Shortness of breath; Rapid breathing (tachypnea); Nausea or vomiting; Abdominal pain; Increased heart rate (tachycardia); Muscle twitching or weakness; A decrease in appetite



Symptoms of High Bicarbonate Levels (Metabolic Alkalosis):



When bicarbonate levels are higher than the normal range, it can suggest metabolic alkalosis. Symptoms can include:

- Muscle twitching or spasms; Hand tremors; Nausea or vomiting; Numbness or tingling in the face, hands, or feet; Muscle weakness; Dizziness or lightheadedness; Prolonged muscle contractions (tetany); Decreased breathing rate (hypoventilation)



Topamax (topiramate) has several potential side effects and interactions related to:



The renal system and acid-base balance:

- Metabolic Acidosis: Can impair the kidney's ability to excrete acid
 - Kidney Stones: (Nephrolithiasis) Inhibits carbonic anhydrase, an enzyme important in the reabsorption of bicarbonate and other ions in the kidney



Patients taking Topamax should be advised to:



Maintain adequate fluid intake to help decrease the risk of kidney stone formation. Regular monitoring of blood bicarbonate levels is also recommended, especially in patients on a ketogenic diet or with other risk factors for metabolic acidosis



BUN (Blood Urea Nitrogen) normal range:



Approximately 10-20 mg/dL



High BUN (BUN >20 mg/dL) can be indicative of:



- Symptoms of High BUN: Fatigue, dizziness, dry mouth, increased or decreased urination, thirst
- Dehydration; Acute or chronic kidney disease; A high-protein diet; Urinary tract obstruction; Congestive heart failure; Gastrointestinal bleeding



Low BUN (<10 mg/dL) can be due to:



- Symptoms of Low BUN: Rarely produces specific symptoms on its own, but symptoms might be related to the underlying cause
- Liver disease; A low-protein diet; Overhydration or excessive fluid intake; Pregnancy



Creatinine normal range:



- Normal Values for Men: Approximately 0.6-1.2 mg/dL
- Normal Values for Women: Approximately 0.5-1.1 mg/dL (the difference is because, on average, women have less muscle mass than men)



High Creatinine (levels above the normal range) can suggest:



- Kidney dysfunction or kidney disease
- Conditions that decrease blood flow to the kidneys, like dehydration or heart failure
- Rhabdomyolysis (a condition where muscle tissue breaks down, releasing creatinine into the bloodstream)
- Symptoms of High Creatinine: Fatigue; Breathlessness; Confusion,; Swelling or edema; Chest pain, and Reduced urine output



Low Creatinine is not common and is generally not considered harmful. It might be seen in:



- Conditions with reduced muscle mass, like muscular dystrophy
 - Conditions leading to decreased protein intake or absorption
- Symptoms of Low Creatinine: Symptoms are more related to the underlying cause than the low creatinine itself



Lithium is a mood stabilizer commonly used to treat:



- Bipolar disorder (mania)
- Considered toxic when equal to or greater than 1.5 mEq per liter



One of Lithium's potential side effects is:



Nephrotoxicity, or damage to the kidneys. As such,
monitoring kidney function while on lithium therapy is
crucial



Monitoring Schedule for BUN and Creatinine with Lithium Therapy:



- **Baseline:** Before starting lithium therapy, a baseline measure
- **After 2 Weeks:** Can detect any acute changes in kidney function and ensure that the medication is safe for the patient at the given dose
- **Yearly:** This regular check helps in monitoring any long-term effects of lithium on the kidneys and making sure they continue to function properly



Alanine Aminotransferase (ALT) range:



- Normal values: 5-35 units per liter (U/L)
 - High levels may indicate liver damage or inflammation.
- Causes can include Hepatitis; Fatty liver; Alcohol abuse;
Medications toxic to the liver, Etc.



Aspartate Aminotransferase (AST) range:



- Normal values: 5-40 U/L
- Elevated levels can also suggest liver damage or inflammation. It is found in other organs besides the liver, so it is typically viewed in relation to ALT levels



Alkaline Phosphatase (ALP) range:



- Normal values: 44-147 U/L
- High levels might indicate liver disease or a blockage of the bile ducts. It can also be elevated in bone diseases



Bilirubin range:



- Normal values: Total bilirubin: 0.1-1.2 milligrams per deciliter (mg/dL)
- High bilirubin can lead to jaundice, causing yellowing of the skin and eyes. It can indicate various conditions like hepatitis, bile duct blockage, or hemolytic anemia



Albumin range:



- Normal values: 3.5-5.5 grams per deciliter (g/dL)
- Low levels can suggest liver disease or malnutrition



Total Protein range:



- Normal values: 6.3-7.9 g/dL
- Abnormal levels can be seen in Liver disease; Kidney disease; or Other conditions



Symptoms of Abnormal Liver Function: Elevated



Jaundice (yellowing of skin and eyes); Dark urine; Pale stool or bloody/tar-colored stool; Swelling in the legs and ankles; Chronic fatigue; Nausea or vomiting; Abdominal pain or discomfort, especially in the area around your liver; Easy bruising or abnormal bleeding; Itchy skin; Loss of appetite



Symptoms of Abnormal Liver Function: Low



Swelling in the legs, ankles, or abdomen; Muscle wasting;
Thinning hair; Brittle nails; Fatigue



Depakote (valproic acid) is an anticonvulsant and mood stabilizer primarily used to treat seizures and bipolar disorder. Depakote can cause:



- Hepatotoxicity, which is why it is essential to monitor liver function
- Liver Function Tests (LFTs) should be drawn at baseline, 2 weeks after initiation or dose adjustment, and then periodically, preferably yearly
- Concurrent alcohol consumption can increase the risk of hepatotoxicity with Depakote



Cymbalta (duloxetine) is an antidepressant that affects serotonin and norepinephrine. Cymbalta can cause:



A modest increase in ALT in a small percentage of people (around 1%). It is crucial to monitor for signs and symptoms of liver damage, such as jaundice



MAOIs (monoamine oxidase inhibitors) like Phenezine are an older class of antidepressants. Phenezine has been linked to cases of:



Liver injury. Though the mechanism is not well understood, liver failure can occur, making it crucial to monitor patients on this medication for signs of liver dysfunction



Statins are primarily used to lower cholesterol. They can cause elevations in:



- Liver enzymes, particularly ALT
- The elevation is typically modest and reversible upon discontinuation or dose reduction
- While earlier practices involved routine monitoring of LFTs in statin users, current guidelines emphasize symptom-based monitoring due to the low risk of severe liver injury



TSH (Thyroid Stimulating Hormone) normal range:



Approximately 0.5-5.0 mIU/L, but these values can vary depending on the laboratory that analyzes the sample



Low TSH (often indicative of hyperthyroidism):



Weight loss despite increased appetite; Rapid or irregular heartbeat; Nervousness or anxiety; Irritability; Tremor (usually a fine trembling in the hands and fingers); Sweating; Changes in menstrual patterns; Increased sensitivity to heat; More frequent bowel movements; An enlarged thyroid gland (goiter; at the base of the neck); Fatigue; Difficulty sleeping; Skin thinning; Fine, brittle hair



High TSH (often indicative of hypothyroidism):



Fatigue; Increased sensitivity to cold; Constipation; Dry skin; Weight gain; Puffy face; Hoarseness; Muscle weakness; Elevated blood cholesterol levels; Muscle aches, tenderness, and stiffness; Pain, stiffness, or swelling in your joints; Heavier than normal or irregular menstrual periods; Thinning hair; Slowed heart rate; Depression; Impaired memory



It is important to note that while TSH is a primary marker for thyroid function, comprehensive evaluation often involves looking at other thyroid hormones like:



Free T4 and Free T3



Free T4 (Thyroxine) range:



Normal Values: The reference range can vary based on the lab, but typically it falls between 0.8-2.8 ng/dL. Low Levels = Hypothyroidism; High Levels = Hyperthyroidism



Free T3 (Triiodothyronine) range:



Normal Values: Reference ranges can vary based on the lab, but typically it falls between 2.3-4.2 pg/mL. Low Levels = Hypothyroidism; High Levels = Hyperthyroidism



The parathyroid glands are responsible for producing parathyroid hormone (PTH), which plays a key role in regulating:



Calcium and phosphate levels in the blood



Parathyroid Hormone (PTH) value range:



Intact PTH: 10-65 pg/mL



Symptoms of Abnormal Parathyroid Levels - Hyperparathyroidism:



Hyperparathyroidism (High PTH Levels): Primary cause:
Overactivity of one or more of the parathyroid glands.

Symptoms include:

- Fatigue or feeling weak; Frequent urination; Kidney stones; Bone and joint pain; Fractures; Abdominal pain due to peptic ulcers or pancreatitis; Depression or forgetfulness; Nausea and vomiting; Loss of appetite; Constipation



A hyperactive parathyroid gland, or hyperparathyroidism, results in an overproduction of parathyroid hormone (PTH).

This increased PTH level has a direct effect on:



Calcium levels in the body



In hyperparathyroidism, elevated PTH levels cause:



- Increased calcium release from bones: Stimulates osteoclast activity, breaks down bone tissue, releasing calcium into the bloodstream (osteoporosis)
- Increased calcium absorption from the intestines: Enhances the activation of vitamin D in the kidneys
- Reduced calcium excretion in the kidneys: Decreases the amount of calcium excreted in urine by promoting calcium reabsorption in the kidneys



Hyperparathyroidism typically leads to:



Hypercalcemia, an elevated level of calcium in the blood



Symptoms of Abnormal Parathyroid Levels - Hypoparathyroidism (Low PTH Levels):



Primary cause: Underactivity of the parathyroid glands

Symptoms include:

- Muscle cramps or spasms; Tingling or burning in fingertips, toes, and lips; Fatigue or feeling weak; Dry hair, brittle nails; Dry, scaly skin; Cataracts; Dental problems; Muscle aches or cramps in legs, feet, abdomen or face; Twitching or spasms of muscles (around mouth)



When the parathyroid gland is hypoactive and produces insufficient PTH, the following effects on calcium levels occur:



- Decreased Blood Calcium (Hypocalcemia): Facilitates the absorption of calcium from the gut
- Increased Phosphate Levels (Hyperphosphatemia): PTH typically decreases phosphate reabsorption in the kidneys, leading to increased phosphate excretion in the urine. In the absence or reduction of PTH, phosphate reabsorption increases, leading to elevated blood phosphate levels



Total Cholesterol labs:



- Normal: Less than 200 mg/dL
- Borderline high: 200-239 mg/dL
- High: 240 mg/dL and above



Symptoms of High Total Cholesterol:



High cholesterol typically does not cause symptoms on its own. It is usually detected through routine blood tests. However, high cholesterol increases the risk of developing atherosclerosis, which can lead to symptoms such as chest pain (angina) or heart attack



LDL (Low-Density Lipoprotein) Cholesterol - "Bad"

Cholesterol labs:



- Optimal: Less than 100 mg/dL
- Near optimal/above optimal: 100-129 mg/dL
 - Borderline high: 130-159 mg/dL
 - High: 160-189 mg/dL
 - Very high: 190 mg/dL and above



Symptoms of High LDL Cholesterol:



Similar to total cholesterol, high LDL cholesterol does not cause symptoms by itself. It is a risk factor for heart disease due to its role in atherosclerosis



HDL (High-Density Lipoprotein) Cholesterol - "Good" Cholesterol labs:



- Low (risk factor for heart disease): Less than 40 mg/dL for men and less than 50 mg/dL for women
 - Average: 40-59 mg/dL
- High (considered protective against heart disease): 60 mg/dL and above



Symptoms of Low HDL Cholesterol:



No direct symptoms, but a low HDL level is associated with a higher risk of heart disease



Triglycerides labs:



- Normal: Less than 150 mg/dL
- Borderline high: 150-199 mg/dL
 - High: 200-499 mg/dL
- Very high: 500 mg/dL and above



Symptoms of High Triglycerides:



- Severe elevations can lead to acute pancreatitis
- Xanthomas (fatty deposits under the skin) and xanthelasmas (fatty deposits on the eyelids) can occur in chronic cases



Dyslipidemia and Antipsychotic Medications:



Many antipsychotic medications, especially the second-generation or atypical antipsychotics, have been associated with metabolic side effects, including dyslipidemia. This can increase the risk of cardiovascular disease and other health issues



Metabolic Syndrome:



Metabolic syndrome is a cluster of conditions that occur together, increasing the risk of heart disease, stroke, and type 2 diabetes (three or more of these conditions typically qualifies a person as having metabolic syndrome):

- Large waist circumference; Hyperlipidemia; Low HDL cholesterol; Hypertension (HTN): at or above 130/85 mmHg; Glucose intolerance



HbA1c (Hemoglobin A1c) labs:



- Normal Range: Generally, for non-diabetic individuals, the HbA1c level is less than 5.7%
- Pre-diabetes Range: 5.7% to 6.4%
- Diabetes Range: 6.5% or higher on two separate tests



Symptoms of Abnormal HbA1c Levels:



High HbA1c Levels (Note: HbA1c does not typically cause symptoms; instead, it reflects long-term glucose exposure. The symptoms above are more indicative of prolonged high blood sugar):

- Frequent urination; Increased thirst; Fatigue; Blurred vision; Slow healing sores; Frequent infections



Fasting Blood Glucose labs:



- Normal Range: 70 to 100 mg/dL
- Pre-diabetes Range: 100 to 125 mg/dL
- Diabetes Range: 126 mg/dL or higher on two separate tests



Symptoms of Abnormal Fasting Blood Glucose Levels - Low Blood Glucose (Hypoglycemia):



Shaking; Sweating; Rapid heartbeat; Blurred vision;
Dizziness or lightheadedness; Sudden moodiness or
behavior changes; Hunger; Fatigue or tiredness; Headache;
Difficulty sleeping; Tingling or numbness in the lips,
tongue, or cheeks; Unconsciousness or seizures (in severe
cases)



Symptoms of Abnormal Fasting Blood Glucose Levels - High Blood Glucose (Hyperglycemia):



Frequent urination; Increased thirst; Dry mouth and skin;
Fatigue; Blurred vision; Slow-healing wounds; Weight loss
(even though you might be eating more); Nausea



HbA1c (Hemoglobin A1c) and Antipsychotic Use:



- Atypical antipsychotics, particularly olanzapine (Zyprexa), clozapine (Clozaril), and risperidone (Risperdal), have been linked to an increased risk of type 2 diabetes
- These drugs can increase HbA1c levels, indicating worse glucose control. Elevated HbA1c reflects chronic hyperglycemia



Given the potential for antipsychotic medications to impact metabolic parameters, what should be monitored:



1. Baseline metabolic monitoring (including weight, lipid panel, fasting blood glucose, and HbA1c) before initiating treatment
2. Regular monitoring throughout treatment
3. Lifestyle interventions
4. If metabolic abnormalities are detected, consideration might be given to switching to a different antipsychotic



Normal Laboratory Values for Calcium:



8.8 to 10.5 mg/dL



Symptoms of Low Calcium (Hypocalcemia):



Numbness or tingling in the fingers and around the mouth;
Muscle cramps, especially in the hands and feet; Muscle spasms (facial twitching or tetany); Fatigue or weakness;
Dry skin; Brittle nails; Seizures (in severe cases);
Arrhythmias or changes in heart rate; Depression or mood changes; Confusion



Symptoms of High Calcium (Hypercalcemia):



Fatigue or weakness; Nausea or vomiting; Constipation;
Excessive thirst (polydipsia); Frequent urination (polyuria);
Bone pain or tenderness; Kidney stones; Abdominal pain;
Confusion or difficulty thinking; Depression or mood
changes; Arrhythmias or changes in heart rate; High blood
pressure



Normal Laboratory Values for Magnesium:



1.3 - 2.1 mg/dL



Symptoms of Low Magnesium Levels (Hypomagnesemia):



Muscle tremors or twitching; Muscle weakness; Fatigue;
Nausea or vomiting; Loss of appetite; Numbness or
tingling; Abnormal heart rhythms; Personality changes or
confusion; Seizures



Symptoms of High Magnesium Levels (Hypermagnesemia):



Nausea or vomiting; Muscle weakness; Low blood pressure (hypotension); Urinary retention; Difficulty breathing or respiratory depression; Irregular heartbeat or cardiac arrest; Drowsiness or lethargy; Decreased reflexes; Flushing or feeling warm



Normal Laboratory Values for Potassium:



3.5 to 5.0 mEq/L



Symptoms of Low Potassium (Hypokalemia):



Fatigue or weakness; Muscle cramps or weakness;
Constipation; Irregular heart rhythm or palpitations;
Numbness or tingling; Frequent urination or excessive
thirst; Low blood pressure; Respiratory distress or
difficulty breathing



Symptoms of High Potassium (Hyperkalemia):



Irregular heart rhythm or palpitations; Slow heart rate (bradycardia); Muscle weakness or paralysis; Numbness or tingling; Fatigue or weakness; Breathing difficulties; Nausea or vomiting