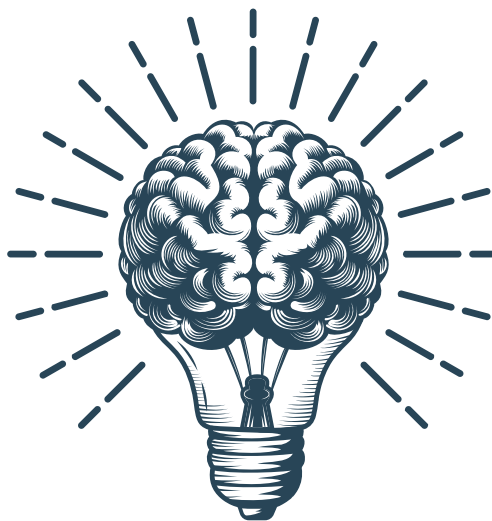


Labs Flash Cards





Shine brightly.

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



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



Anemia can cause:



Depakote and Tegretol lab draws:



Antipsychotics and anticonvulsants can cause:



Tegretol (carbamazepine) can cause (rarely):



Lithium may increase:



Agranulocytosis is an:



Thrombocytopenia (platelets <150,000)



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



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



Fatigue, which can be mistaken for depression



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



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



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



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:



Lipid Panel



CMP provides important information about:



HbA1C (Hemoglobin A1C)



TSH (thyroid stimulating hormone)



UA (Urinalysis)



HcG (Human Chorionic Gonadotropin)



Utox (Urine Drug Screen)



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



Glucose, calcium, and electrolytes



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



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



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



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



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



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



Normal Laboratory Values for Sodium



SSRIs and Hyponatremia:



Symptoms of Hypernatremia (High Sodium Levels)



Trileptal (oxcarbazepine) and Hyponatremia:



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



Serum bicarbonate (HCO_3^-):



Symptoms of High Bicarbonate Levels (Metabolic Alkalosis):



Symptoms of Low Bicarbonate Levels (Metabolic Acidosis):



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)



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



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



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



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



The development of hyponatremia, particularly in elderly patients



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



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:



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



Patients taking Topamax should be advised to:



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



BUN (Blood Urea Nitrogen) normal range:



Creatinine normal range:



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



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



- 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



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



- 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



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



- 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)



Approximately 10-20 mg/dL



- 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



- 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:



Alanine Aminotransferase (ALT) range:



One of Lithium's potential side effects is:



Aspartate Aminotransferase (AST) range:



Monitoring Schedule for BUN and Creatinine with Lithium Therapy:



Alkaline Phosphatase (ALP) range:



Albumin range:



Bilirubin 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.



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



- 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



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



- 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



- 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



- 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



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



Total Protein range:



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



Symptoms of Abnormal Liver Function: Elevated



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



Symptoms of Abnormal Liver Function: Low



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



TSH (Thyroid Stimulating Hormone) normal range:



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



- 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



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



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



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



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



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



- 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



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):



Free T4 (Thyroxine) range:



High TSH (often indicative of hypothyroidism):



Free T3 (Triiodothyronine) range:



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:



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



Symptoms of Abnormal Parathyroid Levels - Hyperparathyroidism:



Parathyroid Hormone (PTH) value 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



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



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



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



Calcium and phosphate levels in the blood



Free T4 and Free T3



Intact PTH: 10-65 pg/mL



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:



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



In hyperparathyroidism, elevated PTH levels cause:



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



Hyperparathyroidism typically leads to:



Total Cholesterol labs:



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



Symptoms of High Total Cholesterol:



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)



Calcium levels in the body



- 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



- 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



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



Hypercalcemia, an elevated level of calcium in the blood



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



- 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:



Triglycerides labs:



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



Symptoms of High Triglycerides:



Symptoms of Low HDL Cholesterol:



Dyslipidemia and Antipsychotic Medications:



HbA1c (Hemoglobin A1c) labs:



Metabolic Syndrome:



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



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



- 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



- 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



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



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



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



- 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:



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



Fasting Blood Glucose labs:



HbA1c (Hemoglobin A1c) and Antipsychotic Use:



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



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



Symptoms of Low Calcium (Hypocalcemia):



Normal Laboratory Values for Calcium:



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



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



- 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



- 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



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



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)



8.8 to 10.5 mg/dL



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):



Symptoms of High Magnesium Levels (Hypermagnesemia):



Normal Laboratory Values for Magnesium:



Normal Laboratory Values for Potassium:



Symptoms of Low Magnesium Levels (Hypomagnesemia):



Symptoms of Low Potassium (Hypokalemia):



Symptoms of High Potassium (Hyperkalemia):



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



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



3.5 to 5.0 mEq/L



1.3 - 2.1 mg/dL



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



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



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