

ELECTROLYTES

Sodium (Na) - This is the major extracellular cation in the body. It is said that where sodium goes, so goes water. The normal Na level is 135-145 mEq/L. Sodium is also responsible for nerve conduction. This is why there are neurological symptoms when sodium disturbances are present in our patient.

Potassium (K) - Potassium is the major intracellular cation. This is why blood serum levels are so low. The normal range is 3.5-5.5 mEq/L. Potassium is responsible for maintaining membrane potential and nerve conduction.

Chloride (Cl) - Chloride isn't one of the major electrolytes that we think about. However, it is responsible for several important biochemical functions. The GABA receptor operates by allowing Cl into the neuron resulting in hyperpolarization. Chloride is also an integral player in acid-base balance. The normal Cl range is 95-105 mEq/L.

Carbon dioxide (CO₂) – Carbon dioxide is listed here because it is included in a normal electrolyte panel aka chem. 7 or basic metabolic profile (BMP). This value tells us about acid-base balance. The normal range is 21-34 mEq/L.

Glucose – Glucose is the body's primary energy source. Normal glucose levels are 70-110 mg/dL. Elevated levels may indicate the patient has diabetes. Low levels may be associated with coma.

Calcium – There are two primary forms of calcium in the body, total and ionized calcium. Ionized or free calcium is the portion of the total calcium that isn't bound to proteins (the majority of calcium in the blood is bound to albumin). It is freely available to interact in biochemical reactions in the body. High calcium levels can be associated with parathyroid disease and bone cancer. Low levels may be due to pancreatitis, hypoparathyroidism, or renal failure

COAGULATION PROFILE

There are several different tests to assess bleeding disorders. We will only cover the most common here.

PTT (partial thromboplastin time) - measures the effectiveness of heparin therapy and the intrinsic and final common coagulation pathway. The normal is 21-35 sec.

PT (prothrombin time) - measures Coumadin therapy and the extrinsic coagulation pathway. **INR** international normalized ratio is associated with the prothrombin time in that it standardizes the results of the PT. Prothrombin is reacted with tissue factor and the INR compensates for the differences in various tissue factors from different labs. The normal PT is 12-15 sec. The normal INR is 0.8-1.4.

Bleeding Time - is literally the time one bleeds after being cut. A small standardized incision is made in the arm and wiped with a filter paper every 30 sec. until it stops bleeding. The normal time is 3-7 minutes.

Thrombin Time - is a test used to assess heparin therapy and fibrinogen activity. The normal time is 11-15sec. It is prolonged by heparin and fibrin degradation products.

Platelets - the cells in the blood that plug the holes in the vasculature. Normal platelet count is 140,000-450,000/ml. Platelets live for about a week. They are irreversibly inactivated by aspirin.

Fibrinogen (Factor I) - is an indicator of inflammation and tissue damage. Low levels may be associated with DIC. The normal value is 160-450 mg/dL.

LABWORK FOR DISSEMINATED INTRAVASCULAR COAGULATION

Platelet and fibrinogen tests should be performed every 2 hr. FDP or fibrin degradation products (sometimes referred to as fibrin split products) can also give us information about what is going on in this disease process. Normal FDP is less than 10 mcg/ml. Widespread fibrinolysis leads to increased degradation products. The D dimer is a measure of fibrin degradation products. The PT, PTT, & D-dimer can assist the diagnosis and help guide the treatment of DIC

RENAL FUNCTION STUDIES

BUN - blood urea nitrogen. It is a measure of the waste products of protein metabolism. Normal is 7-20 mg/dL.

Creatinine - is the waste product of creatine phosphate or phosphocreatine, an energy source in muscle. The normal level is 0.6-1.2 mg/dL.

Estimated Creatinine Clearance - is a useful formula to estimate glomerular filtration rate. The norm is based on the Crockcroft-Gault formula. The normal value is greater than or equal to 90 ml/min.

ENDOCRINE FUNCTION STUDIES

T3 (triiodothyronin) - is one of the major thyroid hormones. T4 is converted to T3 in the body and T3 is primarily what inhibits TSH production. The normal level is 0.8-1.1 ug/dL.

T4 (thyroxine) - is the thyroid hormone that is produced to the greatest extent in the thyroid gland. It is converted to T3 in the tissues. The normal level is 5-13 ug/dL

TSH (thyroid stimulating hormone) - is a predictor of thyroid function. The thyroid gland operates off of a negative feedback mechanism. High levels of T3 and T4 inhibit the production of TSH and low levels cause an increase in the production and release of TSH. The normal value is 0.4-5.0 mIU/L.

LIVER FUNCTION STUDIES

ALT (SGPT or ALAT) - alanine aminotransferase is a protein that is produced in the liver. Very high levels indicate liver damage. Normal levels are 5-40 U/L.

AST (SGOT or ASAT) - aspartate aminotransferase is a protein that is released in response to liver damage. It is also found in RBCs, brain tissue, skeletal and cardiac muscle. Normal levels are 5-45 U/L.

ALP - alkaline phosphatase is a test that can indicate that the bile ducts of the liver are blocked. It is also found in significant levels in the bone. Therefore elevated levels may be due to disorders of the bone. Normal levels are 20-70 U/L.

Bilirubin - the byproduct of heme destruction. It has a yellowish color. This is the compound responsible for the yellow color of bile and jaundice. Bilirubin can be conjugated or free unconjugated. The normal level of total bilirubin is 0.2-1.4 mg/dL.

GGT - gamma-glutamyl transpeptidase, like ALP, can test for liver and bile duct injury. GGT is not elevated in bone disease. However, it is commonly elevated in alcoholics. The normal level is 0-51 IU/L.

Morgan GE, Mikhail MS, Murray MJ. Clinical Anesthesiology. 4th ed. New York, NY: McGraw-Hill; 2006: 662-689.

American Association for Clinical Chemistry. Lab Tests Online. [Online] August 20, 2008 <<http://www.labtestsonline.org/>>.