

TREATMENT BULLETIN

A comprehensive guide to health and well-being for people living with HIV/AIDS

March 2012



UNDERSTANDING YOUR BLOODWORK: AN IMPORTANT FACTOR IN MAINTAINING GOOD HEALTH

Toronto People With AIDS Foundation

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Disclaimer: The Treatment Resources Program at the Toronto People With AIDS Foundation provides information and resources to empower people living with HIV/AIDS to be proactive around their health by working in partnership with their health care providers. We do not recommend or promote any treatment in particular. We strongly urge those interested in any specific treatment to consult a wide range of resources, including a qualified medical and/or complementary therapy practitioner who has experience in working with HIV+ individuals.

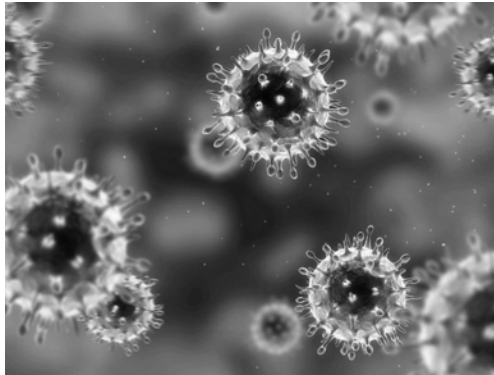
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Understanding your blood work is an important aspect of your health. It can help you to have a better grasp on the status of your physical health and help you to make informed decisions about your health care, such as starting HIV treatment, other medications, or making dietary and lifestyle changes.

This bulletin will provide you with an overview of some basic tests that your doctor may perform and what they mean. They are not intended to help you to self-diagnose but rather to help you to gain a better understanding of what your lab values tell you about your health. Note that the values listed for each test are approximate. Different labs may have slightly different “normal” ranges for each test and so it is important, when looking at your own test results, to look at the reference range for the lab that your doctor uses. Reference ranges are always provided on the test results.

HIV & IMMUNE SYSTEM RELATED TESTS



These are probably the numbers you will see the most and will become very familiar with. These values will tell you how much HIV you have in your blood and how healthy your immune system is.

CD4 Absolute refers to the number of CD4 cells in one cubic millimeter of blood and is one of the numbers that is used to monitor progress and determine when to start treatment. Your CD4 cells are an important part of your immune system, helping to lead the immune response against infection, and are the ones that are primarily targeted by the HIV virus. You will often see it expressed as a decimal number – E.g. 0.325 rather than 325. Normal values are usually between 500 and 1600. The number does tend to fluctuate and may change with stress, fatigue, time of day, etc. A value below 200 indicates that the immune system has undergone significant damage and doctors are now starting treatment when CD4 counts are below 350.

CD8 Absolute. CD8 cells are also part of the immune system and kill cancer cells and cells that are infected with a virus. Normal CD8 cell counts are between 150 and

1000. CD8 cells numbers will generally increase over time in HIV+ individuals but on their own are not used in monitoring HIV disease progression.

CD4% and CD8% refers to what percentage of your lymphocytes are CD4 or CD8 cells. This number is more stable (since CD4 and CD8 count cell numbers can be affected by numerous factors) and may be a better indicator of HIV disease progression. Normal percentages range between 30%-60% for CD4 and 15-40% for CD8 cells, depending on the lab. A CD4% of less than 14% is used in defining when HIV disease has progressed to AIDS.

CD4/CD8 Ratio This number is found by dividing your CD4 number by your CD8 number. A normal value can range from 1.0-3.0, meaning that there are at least 1-3 CD4 cells for every CD8 cell. In HIV, this number is often much lower as the CD4 count decreases and the CD8 count increases.

Viral Load tests the amount of HIV virus in your blood. It is reported as the number of copies in a milliliter of blood (copies/mL). When the amount of virus is less than 40 copies/mL it is considered undetectable, meaning that there are less copies present than the test is able to detect. This does not mean that the virus has been eliminated from your body, but rather that the virus is not replicating and under control through the use of anti-retroviral medication.

Prior to starting treatment viral load can be as high as a million copies/mL or more. Once treatment begins viral load will continue to be monitored. Many people reach an undetectable level within weeks to months, depending on their initial viral load and treatment regimen. Medications have become so effective at reaching an undetectable viral load that a persistent viral load of over 200 copies/mL while on medication may indicate that the medication is no longer working as well and may suggest a need to change treatments.

COMPLETE BLOOD COUNT

A complete blood count, CBC for short, provides gives your doctor a measure of all of the different types of blood cells that you have, including both red and white blood cells, and platelets. Often times when things start to go wrong in the body, the first signs may show up in your blood cells and so it is a very common generalized screening tool for doctors.

Your **white blood cells** are part of your immune system, and include neutrophils, lymphocytes, monocytes, eosinophils, and basophils. Different types of infections and different conditions (e.g. certain blood cancers), will lead to specific changes in one or more of these types of cells, which can help your doctor narrow down possible causes.

Your **red blood cells** are responsible for transporting oxygen to all of the cells in your body. The oxygen is carried on a protein called hemoglobin that is part of the red blood cell. A CBC will tell you the amount of hemoglobin and red blood cells you have as well as provide information on size, since this can be affected by certain conditions such as anemia.

Platelets (also known as thrombocytes) help the blood form clots and stop bleeding. Platelets can increase or decrease with many conditions ranging from anemia and spleen enlargement to chemotherapy use and leukemia. Normal platelet counts range between 150,000 – 400,000 platelets/microliter, but the normal range may vary slightly depending on the laboratory.

BLOOD SUGAR

Your doctor will monitor your blood sugar to screen for conditions involving blood sugar abnormalities like diabetes. Often this is done as part of a regular physical but may be tested more often depending on your risk factors. Blood sugar can be tested in two ways: random and fasting.

Random Plasma Glucose: Glucose is the primary form of sugar your body uses as fuel and is the form that is measured in the blood. When tested randomly (meaning with no dietary restrictions, at any time of day), it should fall between approximately 3.6 and 7.0 mmol/L. If higher, your doctor may choose to repeat the test and have you fast.

Fasting Plasma Glucose: This test measures your blood glucose levels after you have been fasting for at least 8 hours, which includes not both not eating and drinking. This helps your doctor to get a more accurate view of the state of your blood sugar, ensuring that a recently eaten meal or drink hasn't skewed the results. Normal fasting blood glucose should be between 3.6 and 6.0 mmol/L. Values between 6.1 and 6.9 indicate that you may be prediabetic, and values of 7.0 and over are usually diagnostic for diabetes.



HbA1c, Hemoglobin A1c, or glycosylated hemoglobin, is a test that is used to measure how well blood sugar is being controlled in diabetics. Contrary to the glucose tests mentioned above, which give you a snapshot of what your blood sugar is at the moment you are having your test done, HbA1c will give you a picture of what your blood glucose has been on average over the last 2-3 months. HbA1c measures the percentage of hemoglobin that has glucose bound to it. Normal values range between 4% and 6%. In those with diabetes, HbA1c should be kept below 7% in order to successfully manage the condition.

LIPID PROFILE

Total Cholesterol is used to monitor your risk of developing heart disease. Cholesterol can be incorporated into plaques that clog your arteries and cause atherosclerosis (hardening and thickening of arteries), a major cause of heart attacks. Cholesterol values under 5.19 mmol/L are considered ideal and low risk heart disease. Values between 5.19 and 6.19 mmol/L are considered moderate risk, and 6.2 mmol/L and over is high risk for heart disease (values may vary slightly with each lab). Your doctor will likely order a full lipid profile and order the tests discussed below, which will tell them whether your high cholesterol is the result of high levels of bad or good cholesterol.

LDL-C stands for **low-density lipoprotein cholesterol** and is what you may hear referred to as your “bad” cholesterol. Lipoproteins are transport molecules that carry cholesterol around your body. LDL is the one that contributes to heart disease because it can incorporate cholesterol into atherosclerotic plaques. LDL-C is also the number that treatment decisions are often based on. Optimal levels are below 2.59 mmol/L, and risk increases as the levels increases above that value; values above 4.15 are considered high.



HDL-C, or high-density lipoprotein cholesterol, is your “good” cholesterol and is protective against heart disease. It keeps cholesterol from depositing in your arteries and transports it back to the liver to either be eliminated from the body or re-used. Ideally, HDL should be above 1.0 mmol/L in men and above

1.3 mmol/L in women. Those with levels below these numbers are at increased risk for heart disease. In general, lower HDL levels are seen in HIV+ individuals.

Triglycerides are a type of fat that provide energy to the body. After a meal they are transported to be stored for later use via the blood. The test needs to be performed when fasting so that levels measured are not the result of a recently eaten meal but reflect true levels. Elevated triglycerides in the blood increase your risk for heart disease. A desirable triglyceride level is below 1.7 mmol/L. Levels above 2.3 mmol/L are considered to be high.

Triglyceride levels can be a concern in people living with HIV/AIDS. HIV itself, as well as some of antiretroviral medications (particularly protease inhibitor regimens, and especially those using ritonavir) are known to increase triglyceride levels. Elevated blood lipids, such as cholesterol and triglycerides, can also occur as part of a condition called lipodystrophy, which affects body fat distribution.

Note: *Lipid profiles are generally done when fasting, usually anywhere between 8 and 12 hours. If the test occurs when not fasting, only HDL-C and total cholesterol can be used for heart disease risk assessment.*

LIVER TESTS

Liver tests help your doctor to detect liver damage and diagnose liver disease. There are many other tests that your doctor can use to monitor your liver such as alkaline phosphatase (ALP), lactate dehydrogenase (LDH), bilirubin, and albumin, but we will focus on two of the most important and commonly ordered tests.

AST (aspartate aminotransferase) and **ALT (alanine aminotransferase)** are liver enzymes used in the detection of liver damage and are usually ordered together. Elevated AST can also result from injury to other tissues such as the heart, but ALT is more specific to the liver. Both tests, however, provide useful information and are often included in routine liver screening as part of your physical.

Low levels of these enzymes are usually found in the blood, but when the liver (or other tissue containing these enzymes) is injured higher amounts are released. If your AST and/or ALT are irregular, your doctor will compare the results with other tests, including those mentioned above, to determine whether your liver or another organ has been injured, and the cause.

KIDNEY TESTS

Creatinine is a waste product that is formed when your muscles break down creatine, a substance needed to produce energy for muscle contraction. Creatinine is almost exclusively eliminated by your kidneys and so is a good measure of how well your kidneys are functioning. Men will have slightly higher levels than women because they have a higher muscle mass. Normal creatinine levels range from 60-115 $\mu\text{mol/L}$ (though some labs have reference ranges that start at 50 and go as high as 127 $\mu\text{mol/L}$). When creatinine levels increase above the normal this suggests that kidney function has been affected, since the kidney is not able to effectively eliminate creatinine from the blood.

Urea, like creatinine, is used to monitor kidney function and both are often ordered together during routine screening tests used in physical exams. It is a waste product that is formed when protein breaks down (as part of normal processes in the body) and is eliminated by the kidneys. It can be used both in diagnosis and in monitoring patients with existing kidney disease, as well as to assess how they are responding to treatment. As with creatinine, when kidney function is impaired, levels of urea rise in the blood since the kidney is not able to filter it out. Normal levels of urea range from 2.5-8 mmol/L (with values slightly varying between labs).

eGFR stands for **estimated glomerular filtration rate** and is another test which measures kidney function. Glomeruli are tiny filters in the kidneys that filter out waste products from our blood, while keeping in important substances we don't want our bodies to lose. eGFR is a calculation that uses your creatinine levels to figure out how much blood your kidneys are filtering per minute and takes into account factors such as age, gender, and race. Actually measuring GFR is a complicated procedure and so an estimated value is calculated instead. eGFR is a good early detector of kidney damage and part of routine screening when creatinine is ordered. Values of over 90 ml/minute are considered normal and as values decrease, so does the degree of kidney damage. An eGFR of less than 15 ml/minute indicates kidney failure.

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The Toronto People With AIDS Foundation exists to promote the health and well-being of all people living with HIV/AIDS by providing accessible, direct, and practical support services.

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