Understanding Your Lab Work (Blood Tests)

In order for you and your health care provider to know how best to fight your HIV infection, you will need to have some blood tests on a regular basis. Generally your health care provider will order a routine set of blood tests every three or four months (although it may be more or less frequent depending on how far your HIV disease has progressed and what medicines you’re taking). This will help you closely monitor your health and any possible damage that HIV or the drugs you’re taking might cause.

Here are the tests you will need:
- **CD4 Cell Count**
- **Viral Load Count**
- **Chem-Screen (CS) Test**
- **Complete Blood Count (CBC)**

**CD4 Cell Count**
A CD4 cell is a type of lymphocyte, which is a type of white blood cell. About 15 to 40 percent of your white blood cells are lymphocytes. These cells protect you from viral infections; help other cells fight bacterial and fungal infections; produce antibodies; fight cancers; and coordinate the activities of other cells in the immune system.

CD4 cells are the prime target of HIV, which can cause the number of these cells to decrease over time. Too few CD4 cells means that the immune system will no longer function like it is supposed to.

The two main types of lymphocytes are B-cells and T-cells. B-cells are created and mature in your bone marrow, while T-cells are created in bone marrow, but mature in your thymus gland. B-cells produce antibodies, which help the body destroy abnormal cells and infective organisms, such as bacteria, viruses, and fungi.

T-cells are divided into three groups:

- Helper T-Cells (also called T4 or CD4+ cells) help other cells destroy infective organisms.
- Suppressor T-Cells (also called T8 or CD8+ cells) suppress the activity of other lymphocytes so
they don’t destroy normal tissue.

- Killer T-Cells (also called cytotoxic T lymphocytes, or CTLs, and are another kind of T8 or CD8+ cell) recognize and destroy abnormal or infected cells.

Knowing how many CD4 cells you have, can tell you how healthy your immune system is and how well it is holding up in the fight against HIV. Your CD4 cell count will also be helpful in figuring out when to start antiretroviral (ARV) therapy and whether or not you should start taking medications to prevent AIDS-related infections.

You will usually find your CD-cell counts and percent ages listed under “Lymph Subset” or “CD-cell Panel” in your blood lab reports.

Here’s what a CD4 test looks like:

CD3+ Absolute Count
This represents the total number of T lymphocytes, a type of white blood cell that matures in the thymus gland. These include the CD4 and CD8 cells.

CD3 Percentage
The total T lymphocyte count (including CD4 and CD8 cells) as a percentage of total lymphocytes, which are white blood cells that mature and reside in the lymphoid organs of the body.

CD4 Cell Count
The number of CD4 cells per cubic millimeter of blood. As HIV disease progresses, the CD4 cells fall from a normal count of 500-1500 down to as low as zero. When the CD4-cell count goes below 200, there is an increased risk of opportunistic infections, and when the CD4-cell count drops below 50, the risk rises dramatically.

CD4 Percentage
The CD4 count as a percentage of total lymphocytes, which are white blood cells that mature and reside in the lymphoid organs of the body. The CD4 percentage is sometimes a more reliable measurement than the CD4 count because it tends to vary less between measurements.

CD8 Cell Count
The number of CD8 cells per cubic millimeter of blood. Even though most test results refer to these as Suppressor cells, the count actually includes both Suppressor and Killer T-cells (see definitions above). The CD8 cell count is usually elevated in people infected by HIV, but since little is known as to why this is, the test result is rarely used in making treatment decisions.

CD8 Percentage
The CD8 count as a percentage of total lymphocytes, which are white blood cells that mature and reside in the lymphoid organs of the body. The CD8 percentage is sometimes a more reliable measurement than the CD8 count because it tends to vary less between measurements.

CD-Cell Ratio
The CD4 count divided by the CD8 count. Since the CD4 count is usually lower than normal in people living with HIV, and the CD8 count is usually higher, the ratio is usually much lower than normal. A normal ratio is usually between 0.9 and 6.0. Like the CD8 cell count, nobody really knows what this low number means. However, most experts agree that once antiretroviral treatment is started, an increase in the CD-cell ratio (i.e. a rising CD4 count and a falling CD8 count) is a sign that treatment is working.

Viral Load Count
A test known as a viral load count, a viral burden count, or an HIV RNA count, measures the amount of HIV in a drop of blood. If only a small amount of virus is present (say, less than 50-200 copies depending on the test), then the test cannot detect the virus. This is what is meant when a viral load count comes back with a result of “undetectable.” It doesn’t mean that there is no virus present, but that the amount is so low that the test cannot measure it. As HIV disease progresses, the viral load count tends to rise, so that someone who starts with a very low viral load count (say 5,000 copies of virus per drop) may rise to a very high viral load count (say, several hundred thousand or even more than a million copies of virus per drop of blood). While it is sometimes used to determine if antiretroviral therapy should be started—HIV-positive patients with higher viral loads may progress quickly to AIDS without antiretroviral treatment—viral load is most often employed while a person is on therapy to make sure that the medications are working correctly. When using HIV medications, the ultimate goal is to make the viral load go undetectable. If your viral load becomes detectable or continues increasing while you’re on treatment, it may be necessary to switch your regimen to control the virus and to protect your CD4 cells and health.

There are actually two types of viral load tests. A viral load report—sent to your doctor after blood samples have been collected and sent to a lab—will specify which test was used. Typically, labs
use either the Amplicor polymerase chain reaction (PCR) test, or either the Quantiplex or Versant branched DNA (bDNA) tests. Just look for “PCR” or “bDNA” on your lab results, and you’ll know which one was used.

Each test uses a different technique to measure the amount of virus, but their results tell you the same thing—the amount of HIV in your blood. It’s important to use just one of these tests over time, and not switch between the two. PCR values are approximately twice those measured by bDNA (i.e., 20,000 copies using PCR is equal to 10,000 copies using bDNA).

There is no “normal” amount of HIV, since it is not normally present in the body. Your viral load lab report will list the lowest amount of virus that the particular test can detect. Most commercially available versions of viral load tests measure down to between 40 and 75 copies of virus accurately.

While taking therapy, your viral load lab report might show that HIV can no longer be detected. This is known as having an “undetectable” viral load. However, this does not mean that HIV is no longer present in your body since less than 5 percent of HIV in the body can be found in the blood. It is also important to keep in mind that even the newest versions of PCR and bDNA cannot detect very small amounts of HIV that may be present in the blood. But, in terms of figuring out how to treat HIV based on these results, the goal is simple: to keep the amount of HIV in your blood as low as possible.

Here’s what a viral load test looks like:
This is your viral load count. HIV-1 is the most common type of HIV outside of Africa (where HIV-2 is most prevalent). RNA is the virus’s genetic material, which the test looks for. PCR tells you that in this case, this is the Amplicor test. If you saw bDNA in the test name, then it would be the Quantiplex test.

Log Copies/ML
A log is a mathematical term that is difficult to explain. Scientists find that translating viral load counts into logs is an easier way to compare them, especially since the counts can sometimes be very large numbers. For those interested, a log is the number of times ten must be multiplied with itself to equal a certain number, in this case, your viral load count. For example, a viral load count of 100,000 is “log 5” because it is equal to 10 x 10 x 10 x 10 x 10. Logs are used to measure changes in viral load. For example, a reduction in viral load from 100,000 to 1,000 is a two log (or 99 percent) reduction.

Chem-Screen (CS) Test
The blood chemistry test—also known as a chem screen—measures a number of important chemicals produced by your body to help it function properly. While a chem screen won’t really tell you much about HIV or how your immune system is doing, it can help you and your doctor determine if another infection is present in the body or if you’re having any side effects to the drugs you’re taking.

A chem screen can involve many different tests, but usually measure between 6 to 24 chemicals. Some of the most important chemical levels in people living with HIV can be seen in the following example of a chem screen lab report.

Here’s what a chem-screen test looks like:
All foods take the form of sugars (glucose), fats (lipids), or proteins once inside the bloodstream. A balance of each is necessary to fulfill the body’s energy needs and to maintain
adequate fat and muscle. Glucose is simply a measure of sugars in your blood. The two major fats (lipids) in the blood are triglycerides and cholesterol. Glucose, triglyceride, and cholesterol levels are most reliably measured in the fasted state, which is in the morning before eating.

- Cholesterol can be broken down into two types: low-density lipoproteins (LDLs), known as the “bad” cholesterol, and high-density lipoproteins (HDLs), known as the “good” cholesterol. The higher the amount of HDL, the better. This form of cholesterol helps clear LDL cholesterol from the arteries and helps purge it from the body through the liver. Even if someone has a high level of LDL, a high level of HDL greatly decreases the risk of heart disease. Thus, the lower the cholesterol/HDL ratio, the better. Some combinations of therapies are known to lower HDL, and can be a sign of lipodystrophy).

- Sodium, potassium, chloride, bicarbonate, phosphate, calcium and magnesium are all “electrolytes,” the charged particles that make up salt. Electrolytes play a crucial role in the operation of cells and the electrical activity of the heart. Very often, an HIV-infected person who is experiencing a chronic illness associated with diarrhea or vomiting, or whose kidneys aren’t functioning properly, will have abnormal electrolyte levels.

- BUN (Blood Urea Nitrogen), creatinine and uric acid are all blood and urine waste products, and are primarily used to evaluate kidney function. Your kidneys excrete these waste products in your urine. Numerous drugs, including many taken by people with HIV/AIDS, affect BUN and creatinine by competing with it for excretion by the kidneys, so watch for higher than normal levels on these tests. A BUN/creatinine ratio greater than 20 can indicate kidney disease or failure.

- Protein is needed by virtually all cells in the body to function properly. Protein is necessary to build muscle mass and is also used by the immune system to produce new cells every day. Albumin and globulin are the two types of protein that are measured by Total Protein. Albumin is the most important type of protein with respect to the needs of cells in the body. Low albumin levels can occur in people who have dietary problems—including diarrhea, nausea, or decreased appetite—and can often be corrected easily. Globulin is the protein found in antibodies produced by the immune system to fight and ward off infections. Because antibodies


are produced to fight HIV, people with the virus may have increased levels of globulin. The albumin/globulin, or A/G ratio reflects the amount of albumin in relation to the amount of globulin in the blood. Many HIV-infected patients have lower-than-normal A/G ratios considering the relatively high number of anti-HIV antibodies in the blood. This usually isn’t anything to worry about, as long as albumin levels are normal.

- Bilirubin (total and direct), alkaline phosphatase, GGT, AST (SGOT) and ALT (SGPT) are all enzymes produced by the liver. High levels of these enzymes can indicate liver damage, which can be caused by antiretroviral medications, alcohol, or hepatitis. With the exception of elevated bilirubin levels—which can cause the skin and eyes to take on a yellowish color—there are usually no symptoms of liver damage. Thus it is important to keep a watchful eye on these enzyme levels to ensure liver health.

- Amylase is a digestive enzyme produced by salivary glands and by the pancreas. A blood test for amylase is used to diagnose swelling of the pancreas (pancreatitis) and other pancreatic problems. Monitoring amylase levels is important, especially in people who are taking antiretroviral medications that can cause pancreatitis (for example, Videx/Videx EC).

- LD or LDH stands for lactate (or lactic) dehydrogenase. It is a general indicator of acute or chronic tissue damage in the body. An elevated LD level, combined with abnormal levels of other lab tests, is valuable in diagnosing liver disease, pancreatitis, some cancers, intestinal and pulmonary problems, and muscular problems.

- Iron is an important mineral that works with red blood cells to transport oxygen to all cells and tissues in the body. Low levels can be a sign of anemia and/or internal bleeding and should be followed up by a health-care provider.

Complete Blood Count (CBC) Test

One of the most important blood tests that your doctor will order for you on a regular basis is called a complete blood count (CBC). While there are many different types of cells in your blood, they can all be grouped into one of three categories: red blood cells, white blood cells, and platelets. Knowing how many of these cells you have in a blood sample provides a lot of valuable information.

*NOTE: Reference Ranges shown are for adult males. Some may vary slightly for women, children
White Blood Cells (WBC)

White blood cells, sometimes referred to as leukocytes in medical literature, are produced by the immune system to help defend the body against infection. They are formed in the bone marrow and either enter the blood or migrate to key organs, such as the spleen, lymph nodes, or gut. There are several different types of white blood cells. A high white blood cell count likely indicates that an infection is present somewhere in the body, whereas a low number might indicate that an infection or disease—such as HIV or cancer—has slowed the ability of the bone marrow to produce new WBCs.
Red Blood Cells (RBC)
Red blood cells, sometimes referred to as erythrocytes, are responsible for delivering oxygen throughout the body. There are lots of them in a single milliliter of blood—between 3.6 to 6.1 million. A low red blood cell count can indicate anemia, which can lead to fatigue. Some antiretrovirals can cause anemia, as can some AIDS-related infections and cancers.

Hemoglobin (HGB) and Hematocrit (HCT)
Both Hemoglobin & Hematocrit can help you and your doctor learn a bit more about your red blood cells. Hemoglobin is a protein used by red blood cells to distribute oxygen to other tissues and cells in the body. Hematocrit refers to the amount of your blood that is occupied by red blood cells. For men, the hematocrit should be between 40 percent and 52 percent; for women, it should be between 35 percent and 46 percent. A low hemoglobin number or hematocrit percentage are good indicators of anemia.

Mean Corpuscular Volume (MCV)
This test actually measures the size of red blood cells. Larger red blood cells may indicate anemia due to vitamin B6 or folic acid deficiency; smaller red blood cells may indicate anemia due to iron deficiency. Some antiretrovirals, like AZT (Retrovir), can cause MCV to increase without necessarily causing anemia.

Mean Corpuscular Hemoglobin (MCH) and Mean Corpuscular Hemoglobin Concentration (MCHC)
These tests measures the amount of hemoglobin in red blood cells. Both hemoglobin and hematocrit are used to calculate this number. Low levels indicate anemia.

Red Cell Distribution Width (RDW)
Red blood cells can come in different sizes. RDW looks at the range of these sizes in a blood sample. If anemia is suspected, based on other blood counts, RDW test results are often used together with MCV results to figure out what the cause of the anemia might be.

Platelets
Platelets are tiny cells produced by the bone marrow to help your blood clot in the event of a cut or scrape. A high number might be seen in people with cancer, a blood disease, or rheumatoid arthritis. A decreased platelet count is called thrombocytopenia. There are a number of possible causes of thrombocytopenia, including a disorder of the immune system that causes antibodies produced by the spleen to kill platelets (idiopathic thrombocytopenia purpura, or ITP). This can be problematic and often warrants immediate medical care. HIV treatment can help reverse thrombocytopenia, but can sometimes cause platelet levels to become too high (thrombocytosis), increasing the risk of clot clots.

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