THE ABC OF A CBC (COMPLETE BLOOD COUNT)

Your guide to understanding how to interpret a Complete Blood Count

By Daniel Schepers

If you've ever wanted to better understand how to read and interpret a complete blood count panel, this guide will help you understand:

- What's included in a CBC
- What the different markers mean
- And why it's important that you know how to interpret them!

Let's start with that last one.

A doctor often sees a lot of patients in a day so a lot can be missed. It's human nature and it happens. Therefore understanding what these markers mean will help you better communicate with your GP and advocate for yourself.

So let's get started.

What is a CBC (Complete Blood Count)?

A Complete Blood Count often abbreviated as CBC provides us with insight into the composition of red blood cells, white blood cells and platelets. A CBC can therefore be useful when patients feel tired or are suffering from infections. Since white blood cells are a topic on their own, I will share more about it later on. CBCs are valuable and one of the most used lab tests in the world.

How to read a CBC?

On a typical CBC you can find different lab values. You can find the amount of red and white blood cells, how much hemoglobin is in your red blood cells, the average size of your red blood cells, how many different family members of white blood cells you have and more.

You see! It isn't hard at all!

You just need to recognize their difficult scientific and dull names! Here we go:

Erythrocytes

Erythrocytes are just a fancy way of saying 'red blood cells'. Red blood cells can become 3-4 months old. If you are working out, red blood cells, because of the pressure, get damaged when they are squeezed into the tiniest blood vessels and live on average a month shorter. We make about 17 million red blood cells per second, but under stress, this production can go up to 119 million red blood cells per second!

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Red blood cell (RBC) count

The Red Blood Cell count is a measure of how many blood cells are present in your blood. If your RBC is low, this can be considered a form of anemia. For example, this can be caused by a lack of:

- Iron
- Vitamin B12
- Folate (vitamin B9)
- Zinc
- Copper
- Vitamin A

Hemoglobin (Hb or Hgb)

The protein hemoglobin carries oxygen. You can find hemoglobin in the red blood cell. At the core of this protein is an iron atom. If you are low on iron for a while, this can cause low hemoglobin values. This is often the cause of iron deficient anemia or microcytic anemia. What happens to the average size of the red blood cell is that it can shrink. Some people might experience anemia symptoms already when Hb gets close to the border of the reference ranges. This is why it is recommended to have hemoglobin concentrations in the middle of the reference range.

Mean Corpuscular Value (MCV)

This is a fancy word/abbreviation of the average size of the red blood cells. It's really that simple. Like I said: a low Hb causes the red blood cells to shrink. This results in a lower MCV. Typical reference ranges for the MCV are between the 80 and 100 fL (Femtoliters). The optimal reference range is between 80 and 90 fL.

Can the MCV also get too high?

Yes! This is called 'macrocytic anemia'. It causes the same type of symptoms as any other anemia, but in this case, the cause is often a deficiency in vitamin B12, folate or vitamin B6.

But what if you have macrocytic anemia and microcytic anemia at the same time? This can lead to a normal average and a perfect-looking MCV. In some cases, this can mean that anemia gets missed. This is why I always recommend measuring iron, vitamin B12, folate and vitamin B6 besides Hb and MCV as well.

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Hematocrit (Hct)

This test measures the amount of space (volume) red blood cells take up in the blood. The value is given as a percentage of red blood cells in a volume of blood. For example, a hematocrit of 38 means that 38% of the blood's volume is made of red blood cells.

A low Hct is also often an indication of anemia. This can also be caused by a lack of the nutrients you need to build red blood cells (see the list of nutrients above). Asthma, COPD and sleep apnea can cause hematocrit to rise. It is the body's attempt to try to get more oxygen to the cells of the body.

Thrombocytes or Platelet Count (Plt)

Platelets (thrombocytes) are the smallest type of blood cell. They are important in blood clotting. When bleeding occurs, the platelets swell, clump together, and form a sticky plug that helps stop the bleeding. If there are too few platelets, uncontrolled bleeding may be a problem. If there are too many platelets, a blood clot can form in a blood vessel. It's usually a good idea to have platelets in the upper half of the reference range.
Stress can lead to an elevation in platelets. Why? You could think of it as a way to prepare the body for injuries. With stress, the body is anticipating a physical attack. But it makes the blood also thicker and can contribute to the hardening of the arteries (atherosclerosis). Reducing unnecessary stress and stressful thinking patterns is good for cardiovascular health!

Mean Platelet Volume (MPV)

Mean platelet volume measures the average amount (volume) of platelets. MPV is used along with platelet count to diagnose some diseases. If the platelet count is normal, the MPV can still be too high or too low.

MCH and MCHC

You will find these values often grouped together under the MCV. Again: difficult names but an easy explanation!

- MCH stands for Mean Corpuscular Hemoglobin. It is the average amount of hemoglobin inside the red blood cell.
- MCHC stands for Mean Corpuscular Hemoglobin Concentration. It is the average concentration of hemoglobin.

Although these numbers are often on a panel, they aren't used often, or at least where I come from, but they can provide extra insight into understanding anemia.

Next time you get your results from the doctor, ask them to print or email you your results! Take a look and have fun understanding your lab results. See if you can spot what lab values are in the optimal range... or which values were missed by the doctor!

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White Blood Cells Explained

What do you need to have healthy white blood cells? What type of white blood cells can you find on your lab reports? And what do these types actually do? These are all questions you will find the answers to next!

Right now in my country (The Netherlands) a lot of people have the flu and/or COVID. Almost 60 percent of the Dutch people are vitamin D deficient in the winter. Why? Because the sun doesn't rise high enough in the sky for enough UVB light radiated from the sun to pass the ozone layer.

60%!!!

We need vitamin D to produce white blood cells. Almost all white blood cells do have vitamin D receptors suggesting we need vitamin D to make the white blood cells do their job as well. Below are nutrients to support your white blood cells:

- Vitamin D: We estimate that vitamin D activates 1 up to 5% of our genes. That is a lot! To give you some perspective: we share about 98% of our genes with pigs. Most of those genes are related to the immune system and how we regulate inflammation.
- Zinc: Zinc influences the production of white blood cells. For example, zinc is needed to produce and mature white blood cells. Zinc is also needed for the functioning of white blood cells (click here to read an article)
- Vitamin A: Also this vitamin is needed for the production of white blood cells. A lack of vitamin A can also cause other problems like dry skin and hair, night blindness, irregular patches on the white of the eyes and/or Xerophthalmia (a severe dryness of the eye).
- B vitamins: A deficiency in B12 can lead to a low white blood cell count and so does a folate deficiency. Vitamin B6 plays a role in the function and composition of T cells and a deficiency in this vitamin impairs lymphocyte function as well (if you like to dive deep, you can take a look at this study and this study).

What type of white blood cells can you find on your lab results?

The white blood cells are called 'leukocytes'. You can find them often on your lab reports. They can also be called WBC (which is the abbreviation of White Blood Cells). High numbers of white blood cells are often seen with starting infections. A low white blood cell count can be caused by a simmering longer-lasting infection.

Often the reference range of WBC is between 4000 and 10000 cells per microliter. It is my personal experience that an immune system at rest is often around 6000 cells per microliter.

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There are different types of white blood cells. When the doctor orders a 'White Blood Cell Differential' you will find a breakdown of the following white blood cells:

- Neutrophils: When the body is attacked by an invader, neutrophils are the first type of white blood cells that attack. With an immune system at rest, these are the type of white blood cells that are the most abundant. Personally, I like to see neutrophils making up around 70% of white blood cells. If for example you see that the percentage of neutrophils is around 50%, this might indicate that some of your neutrophils have died during a war against an infection.

Neutrophils are like 3-dimensional packman's and can eat microbes. This is called phagocytosis.

- Lymphocytes: There are 2 groups of lymphocytes: T lymphocytes (or T cells) and B lymphocytes (or B cells). T cells are made when young lymphocytes travel to the thymus gland. T cells control your body's immune system response and directly attack and kill infected cells and tumor cells.

When young lymphocytes enter lymph nodes, they get a different kind of training and they will develop into B cells. B cells make antibodies. Antibodies are proteins that target viruses, bacteria and other foreign invaders.

Lymphocytes often increase with infections and lower for the same reason as neutrophils when infections last longer.

- Monocytes: These types of white blood cells act more like firefighters. When they hear an alarm they come to the rescue. Monocytes are types of white blood cells that can help defend when invaders penetrate tissues. They also help remove damaged tissue. They can differentiate into 2 types: macrophages (which can eat microbes, just like neutrophils) and dendritic cells (which release proteins called cytokines that notify other white blood cells to come to the site of the infection and destroy the invader).
- Eosinophils: Eosinophils are a type of white blood cells that are more present in the gut. Elevations of eosinophils can mean your body is fighting an infection or an allergic reaction. They also help fight fungal infections and parasites and worms. Having a strong immune system is therefore important for gut health.
- Basophils: These types of white blood cells help fight parasitic infections as well. Unlike eosinophils, basophils are found in many tissues throughout your body. Basophils also release histamine when the body is exposed to an allergen.

And there you have it! I hope the next time you look at your personal lab values you are able to understand them better!