



## Hematocrit or Hemoglobin: Which One Is Better?

**Susan Leclair, PhD, CLS (NCA)**

Chancellor Professor, Department of Medical Laboratory Science  
University of Massachusetts, Dartmouth

*Please remember the opinions expressed on Patient Power are not necessarily the views of our sponsors, contributors, partners or Patient Power. Our discussions are not a substitute for seeking medical advice or care from your own doctor. That's how you'll get care that's most appropriate for you.*

### **Dr. Leclair**

Hello again. This is Susan Leclair from Patient Power. Today I'd like to spend a little bit of time not exactly on the red cells themselves but on some of the testing that we do for them. And there's a lot of, I won't call it controversy but certainly a lot of—of discussion about which tests are better, which ones should you look at, how should you handle things, that kind of stuff.

So I'd like to talk about the two most accurate tests in the clinical laboratory, one of which we no longer do, but we'll talk about that one first. The hematocrit was originally created in the 1930s by a physician by the name of Max Wintrobe, and trust me you're going to hear that name a lot because he was powerful and important in the development of hemo—of hematology.

He noticed that if you took a specimen of blood and you spun it in a centrifuge, all the red cells—which are heavy—sink to the bottom. And they would pack at the bottom of this tube. And so he said this packed cell volume—a lot of countries use that name—he called the hematocrit, and he defined it as the percentage of the total volume that was made up of red cells. So it's a percentage. It's a combination of the amount of plasma you have and the amount of red cells that you have. And you sink those red cells to the bottom, and you get a hematocrit.

And from the mid-1930s to about the mid-1970s, without a doubt it was the single most accurate test we had, and people relied on the hematocrit for tons of information. Well, what so happened in the 1970s? In the 1970, multichannel instruments came out, which gave us more tests in a shorter amount of time more consistently, so there's a lot of good reasons to switch to these multichannel instruments.

There's a problem with those multichannel instruments. They don't have a centrifuge. And if you want an answer of a complete CBC in two minutes, then I can't very well centrifuge something for five. So a different method was used in these multichannel instruments. It is not as accurate as the micro hematocrit of Max Wintrobe. Is it accurate. Yes. As often, all the time, maybe not so much.

So people turned to a second example, a second test, and that's the hemoglobin. Doesn't make any difference how big the cells, how small the cells, where the cells are. What you have is the weight of hemoglobin in a given volume of blood. And so that should be more consistent because I can measure that. I can even measure it in a relatively short span of time, and so that can come out of these multichannel instruments reasonably correct. So there should be no problem. You should take the hemoglobin or the hematocrit. They should—for the 99 percent of the people who need them—they should be equally valuable.

For people who have diseases like polycythemia or for people who have conditions that are severe anemias or have got some other problem with the marrow, maybe the hematocrit isn't quite so good because the hematocrit assumes that all your cells are going to be of the same size.

And it turns out if you have trouble making hemoglobin, your cells are going to be smaller because it takes them longer to get the amount of hemoglobin that they want. They've had a few more mitotic divisions. They tend to be smaller than they should be.

If you have trouble with your nucleus because you're missing some important part that helps to make DNA, your cells are going to be bigger because they're going to miss—miss some of these mitotic divisions, so they're going to end up being larger. Why is that important? Because large cells will pack differently than small cells. And so as a consequence, that hematocrit might not be the single most accurate test for you. Maybe the hemoglobin is.

For people whose cells are of the correct size or are all of one size, then the hematocrit is probably just as good as the hemoglobin.

But you will find your physicians periodically preferring one test over the other, and what they're trying to do is get the accurate, most precise measurement that they can of how your tissues are being oxygenated. Because, remember, why do you have hemoglobin the first place? You have it to bring oxygen to the tissues. So I need to know how much oxygen I've got, and how am I going to measure that? I can measure it by the hemoglobin. If your cells are all of similar size, I can measure it by the hematocrit and infer the hemoglobin and infer the oxygen, and that's a whole lot easier than maybe sticking a needle into your artery to get an absolute oxygen saturation level. So you can do hematocrits and hemoglobins easily, frequently. You can get an extremely legitimate answer out of both of them, but there are times when a physician is going to want to follow a hemoglobin. Someone with polycythemia is probably the best example of that.

Or they're going to want to follow the hematocrit, because that is a more consistent reflection of what's going on in somebody with certain kinds of anemias. So those two together provide a lot of information.

Now, one frequent question that's found on a lot of the listserves is how do they go together? How do the hemoglobin and the hematocrit come together to form a picture that is of value to your physician? It just so happens that one-third of the volume of a red cell is made up of hemoglobin. So if you—if any of you are math teachers, just ignore this part—if you take the raw number of the hemoglobin, let's say it's 15, and you multiply it by three, you should get the 'crit, which is

So there's something called the Rule of Three that tells you that there is reasonable progression, reasonable production, reasonable maturation of your red cells in the bone marrow if you have a ratio of one to three between your hemoglobin and your hematocrit. In a lot of the textbooks, it's called the Rule of Three, and it will hold for most situations.

It will not hold in iron deficiency, and that's important because again that's the most common anemia in the world. It will not hold for very, very severe situations of pernicious anemia. But for the vast majority of people that Rule of

Three—the easy way to remember it, hemoglobin times three equals hematocrit—gives you a good sense of whether or not you have red cell production that appears to be adequate in the bone marrow.

It doesn't substitute for a bone marrow analysis, but, you know, it's a pretty good compromise when you don't want to have one of those every day. And you can have a hemoglobin and a hematocrit done every day, and there's no big deal. So it's a really easy way to assess a little bit of what's going on in the bone marrow.

So that should help explain why physicians rely on hemoglobins, some physicians rely on the hematocrits, and some don't really care. The older physicians have a tendency to rely on the hematocrit, because they remember when it was the single most accurate test in the clinical laboratory. But other than that, there's really no difference in the type of quality of information that you get out of both of them.

So don't be concerned if all of a sudden your primary care physician is using your hematocrit, but your specialist is using the hemoglobin. They're actually looking at the same thing, and they're probably going to make decisions in essentially the same way.

I hope that explains about hemoglobins and hematocrits. I know that's a very common concern for a lot of people. And if I've confused you more than you were before, just send me a question or a complaint to [questions@patientpower.info](mailto:questions@patientpower.info). And until I see you again, remember, knowledge can be a very potent weapon.

*Please remember the opinions expressed on Patient Power are not necessarily the views of our sponsors, contributors, partners or Patient Power. Our discussions are not a substitute for seeking medical advice or care from your own doctor. That's how you'll get care that's most appropriate for you.*