LifeExtension® BOOK EXCERPT

BLOOD TESTING That Can Save Your Life

BY MICHAEL OZNER, MD

In his new book, HEART ATTACK PROOF, cardiologist and researcher, Michael Ozner, MD, presents a proven program to help you avoid the devastation of heart disease. One critical component of his unique protocol is the use of specific blood tests to help you and your physician clearly assess your risk for heart attacks. From these tests, you can move yourself into the safety zone by incorporating lifestyle changes, high-level nutrients, and when necessary, pharmaceuticals to make yourself virtually heart attack proof. In this excerpt, Dr. Ozner explains why a blood test that utilizes an expanded cardiovascular risk profile can save your life.

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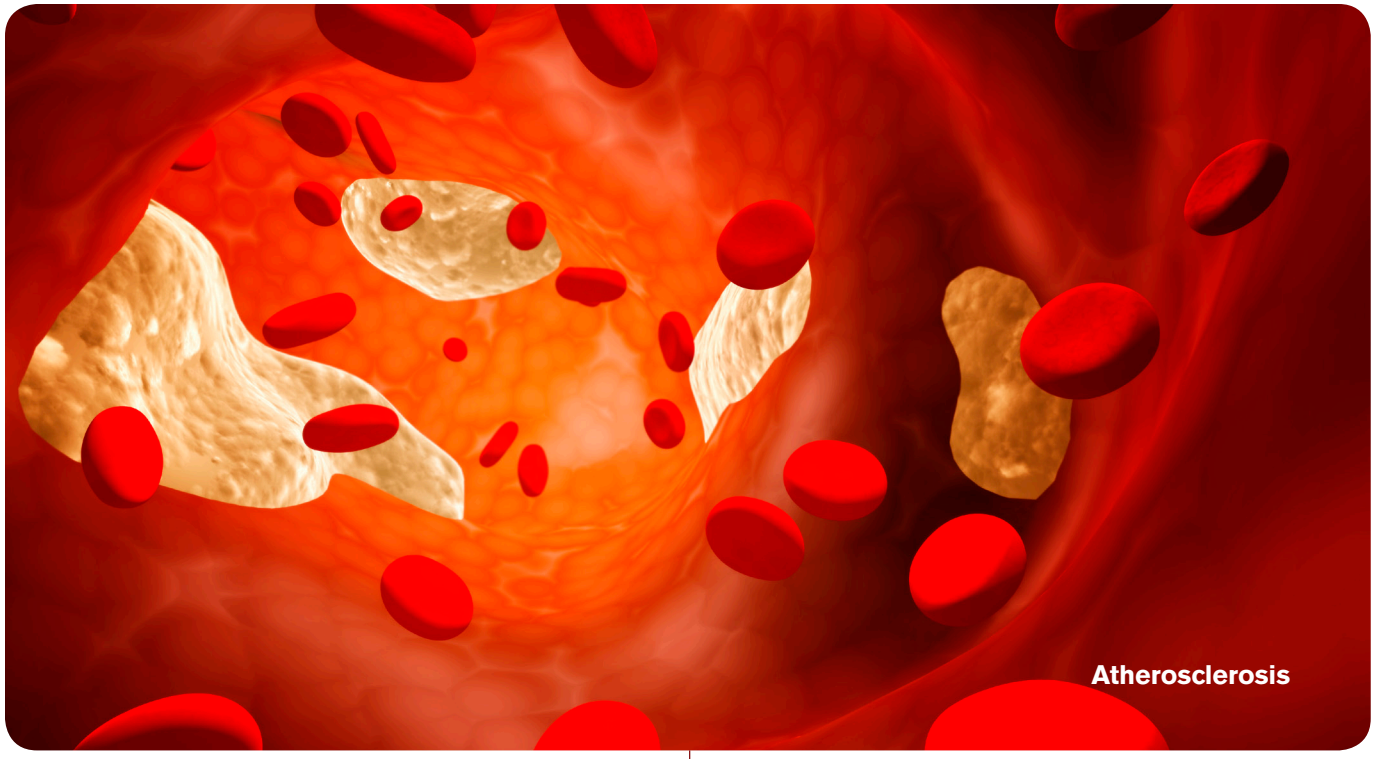


Why It's Important to Get Cardiovascular Blood Tests

The best way to detect metabolic abnormalities, like elevated (bad) LDL cholesterol particles or increased vascular inflammation (which may be present even if you feel well) is through a blood test. Detecting metabolic disorders is particularly important for uncovering hidden risk for heart attack, stroke, and vascular disease, thereby allowing physicians to individualize treatment programs that will lower patients' risk of disability and death from cardiovascular disease. Simply using a standard lipid or cholesterol profile (total cholesterol, [bad] LDL cholesterol, [good] HDL cholesterol, and triglycerides) uncovers 40 percent of heart attack risk, whereas an expanded cardiovascular risk profile, with tests such as LDL particle number and hs-CRP, can uncover 90 percent of heart attack risk. Performing regular blood tests is also essential for effectively monitoring already diagnosed conditions and ensuring that medical treatment and lifestyle changes are working.

The cost of comprehensive blood tests has decreased significantly over the past several years. And compared to the cost of treating heart attack, stroke, or peripheral vascular disease—that is, compared to the potential cost of not knowing what's going on in your body and only being able to treat these conditions once they strike—it's a steal!

The best time to have a comprehensive laboratory evaluation is when you are feeling well. If you wait until a heart attack (or stroke) strikes, you've waited too long. One-third of men and women do not survive their first heart attack, and those who do have to undergo expensive interventional procedures and lengthy hospital stays that can cost between $50,000 and $100,000. Long-term care can be very expensive, and the loss of your future earning potential can be significant. Prevention of atherosclerosis and heart attack or stroke is one of the most cost-effective strategies available—not to mention the nonfinancial benefits of staying healthy and productive and enjoying life.

The Genesis of a Heart Attack

Having these tests done regularly is crucially important. The next step is to understand what all the numbers mean. To do so, we first need to take a step back and look at the development and progression of cardiovascular disease, and how metabolic abnormalities can lead to a heart attack.

A heart attack occurs when the blood supply to the heart is cut off. We used to think that heart attacks were caused by the buildup of cholesterol and fat that ultimately choked off the artery causing a heart attack; we now know that the culprit is not cholesterol itself but the particles that carry it.

There are two types of these particles, characterized by the protein on their surfaces. The first type contains an apoB protein on the surface, which means they have the potential to enter the artery wall and lead to atherosclerotic plaque formation. Ninety percent of particles with apoB proteins are LDL particles. LDL particles are often referred to as "bad" particles, though they are not always bad. They play a beneficial role—they deliver cholesterol throughout the body where it is needed (cholesterol is an essential component of cell membranes, and is also necessary for the body to produce hormones such as cortisol, aldosterone, estrogen, and testosterone, as well as bile acids and vitamin D). But they also have the potential to enter the arterial wall and wreak havoc. The second type is HDL particles. These have a different protein on their surface called apoA1. HDL particles are often referred to as "good" cholesterol particles, because their job is to enter the arterial wall, remove cholesterol, and carry it to the liver for processing.

So, in short, LDL's job is to carry cholesterol to the areas of the body where it's needed, and HDL's job is to pick up excess cholesterol inside the artery wall from the places it isn't needed. All of this is necessary for proper functioning of the body. Problems arise when there is an excess number of LDL particles in the blood and these particles enter the artery wall. Once there, the particles can lead to the formation of atherosclerotic plaques, which are like pimples in the blood vessel wall. And just like pimples, these plaques can become inflamed and rupture.

The Formation of Atherosclerotic Plaques

Once inside the artery wall, cholesterol particles come into contact with something called *free radicals*. *Free radical* is the term used for any molecule with an uneven number of electrons. You may remember from chemistry class that molecules with uneven numbers of electrons don't like to stay that way. They'll do whatever they can to beg, borrow, or steal another electron so they can have an even number. This theft by free radicals is referred to as *oxidation*. When a free radical steals an electron from a cholesterol-carrying particle, the particle then becomes oxidized, and the body views it as a foreign invader. As a result, our natural defense system—inflammation—kicks in. Our immune system goes on the attack and sends white blood cells to the scene to engulf the oxidized cholesterol particles, and this leads to the formation of an atherosclerotic plaque.

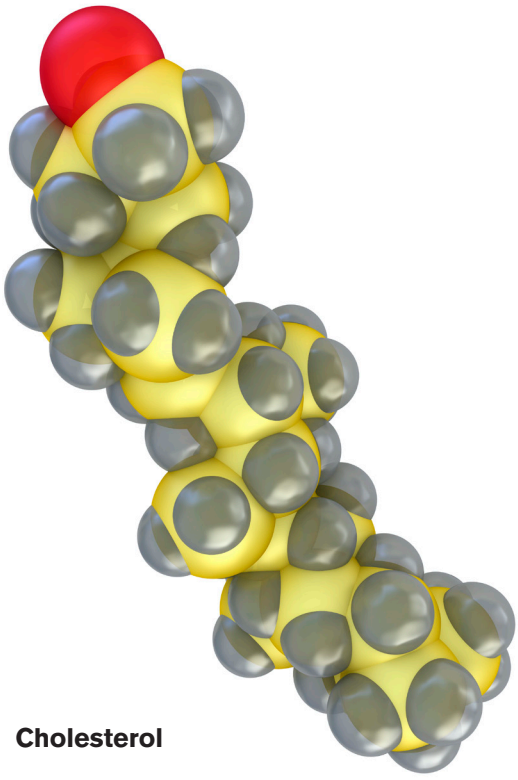
After engulfing the cholesterol particles, the white blood cells, called *macrophages*, begin to release proteinases, which are designed to break down the plaque's fibrous cap, ultimately leading the plaque to rupture. When blood comes into contact with tissue factor (a clot-promoting molecule) inside the plaque, it forms a clot at the rupture site. If that clot is large enough, it can completely block the artery, leading to a heart attack.

Reversing Heart Disease

There are a number of complex factors at work in causing a heart attack. The good news is, it's possible to not only halt the progression of atherosclerosis, but to *actually reverse it*. With the proper lifestyle and optimal medical therapy, it is possible to stabilize and even get rid of the atherosclerotic plaques that lead to heart attacks. Regression of atherosclerosis is an achievable goal.

Cholesterol

When I started my cardiology practice in 1979, a normal cholesterol level was up to 300 mg/dL! Today we know better. It is now recommended that your cholesterol level should remain under 200 mg/dL.

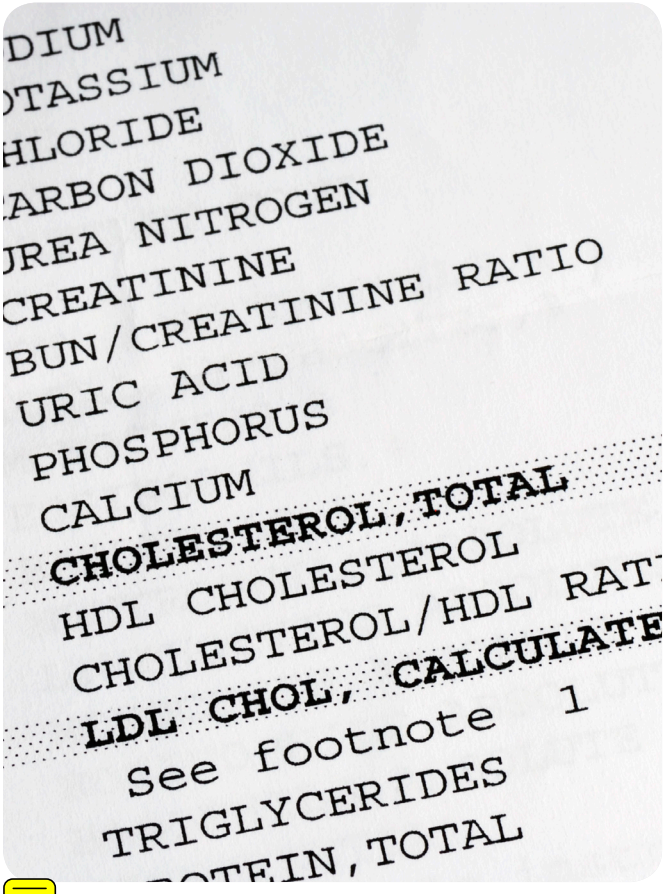


Cholesterol

And thanks to research like the Framingham Study, we know the optimal total cholesterol is actually less than 150 mg/dL. Yet the average total cholesterol for Americans is still greater than 200 mg/dL (208 mg/dL). Knowing your total cholesterol is an important part of understanding your risk for a heart attack. But it doesn't tell the whole story of what's happening inside your body. To get the rest, you need to look at several other factors—in particular, non-HDL cholesterol, LDL and HDL particle numbers, and triglycerides.

Non-HDL Cholesterol

Non-HDL cholesterol is just what it sounds like: the amount of cholesterol in your blood not contained in HDL particles. It's calculated by taking your total cholesterol and subtracting your HDL cholesterol from it—in essence, subtracting the good cholesterol from total cholesterol to give you a number that reflects the total amount of bad cholesterol contained in particles that can potentially enter the arterial wall and lead to atherosclerosis. This measurement is not the same as LDL cholesterol. Ninety percent of bad-cholesterol-carrying particles are LDL particles, but there are other particles that can potentially carry bad cholesterol, including VLDL, IDL, LP(a), and chylomicrons. So a measurement of non-HDL cholesterol turns out to be a better reflection of cardiovascular risk than measuring LDL cholesterol alone, since it checks the amount of cholesterol in *all* of the potentially bad particles. Non-HDL cholesterol is especially useful when triglyceride levels are elevated.



The following example shows how easily non-HDL can be calculated. Let's say we're looking at the following routine cholesterol panel:

Total cholesterol:	**156 mg/dL**
LDL cholesterol:	**80 mg/dL**
HDL cholesterol:	**40 mg/dL**
Triglycerides:	**180 mg/dL**

This person's non-HDL cholesterol is his or her total cholesterol (156 mg/dL) minus HDL cholesterol (40 mg/dL)—or 116 mg/dl. A normal non-HDL cholesterol is less than 130 mg/dl. However, a value of less than 100 mg/dL is advised for those men and women who are at high risk for cardiovascular disease.

Particle Number

The next important factor in heart attack prevention—possibly the most important factor—is your particle number. Decreasing the number of (bad) LDL particles in your blood and increasing the number of (good) HDL particles is key.

Remember, cholesterol is transported through the bloodstream by particles, and atherosclerotic plaques occur when LDL particles enter the artery wall, get retained, and become oxidized. You can think of the particles as cars and cholesterol molecules as passengers in the cars. Just as too many cars can cause a traffic jam, too many LDL particles can lead to a heart attack. It is the number of particles, not the amount of cholesterol in the particles, that is the problem.

Since the cholesterol content of LDL particles is variable, LDL particle number (LDL-P) is a better measure of future heart attack risk than LDL cholesterol (LDL-C). This explains how someone could have a heart attack despite having a "normal" cholesterol level; measuring cholesterol tells us the amount of cholesterol being carried but not the number of particles doing the carrying. An increased number of LDL particles, whether those particles are large or small, will increase the risk of a heart attack (studies have shown that an increased number of small particles raises heart attack risk sixfold, whereas an increased number of large particles raises risk twofold). The

likelihood of LDL particles entering the arterial wall is largely a function of LDL particles' concentration in the bloodstream; fewer LDL particles means fewer LDL particles entering the artery wall. Men and women who are overweight or obese and who have insulin resistance, metabolic syndrome, or diabetes are more likely to have an increased number of small LDL particles, while individuals with familial hyperlipidemia, a genetic disorder, have an excess number of large LDL particles. The key for both groups is to lower the number of excess LDL particles through lifestyle intervention and medication. Unfortunately, many healthcare providers do not normally measure particle number in addition to cholesterol—even though clinical studies, such as the Framingham Offspring Study, have demonstrated that LDL particle number is a superior predictor of heart attack risk than the measurement of total cholesterol or LDL cholesterol. So be informed, and discuss particle number measurement with your physician.

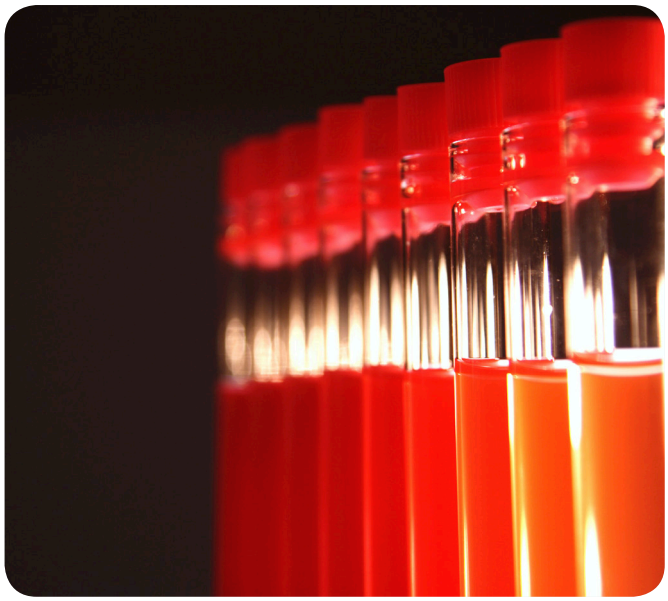
Triglycerides

The final factor to consider is triglycerides. Triglycerides are a type of fat that, if elevated, can increase cardiovascular risk by increasing the number of small dense LDL particles and decreasing the number of HDL particles. Elevated triglycerides can also lead to pancreatitis (inflammation of the pancreas).

The Optimal Lipid Profile

The chart below lists the recommended and optimal values for a standard lipid profile, including particle number (for apoB and LDL-P). To become Heart Attack Proof, you want your numbers to be as close to optimal as possible.

	Recommended	Optimal
Total cholesterol	< 200 mg/dL	< 150 mg/dL
LDL cholesterol	< 100 mg/dL	< 70 mg/dL
HDL cholesterol	> 40 mg/dL (for men) > 50 mg/dL (for women)	> 40 mg/dL (for men) > 50 mg/dL (for women)
Non-HDL cholesterol	< 130 mg/dL	< 100 mg/dL
Triglycerides	< 150 mg/dL	< 100 mg/dL
LDL-P	< 1000 nmol/L	< 700 nmol/L
apoB	< 90 mg/dL	< 60 mg/dL



Building a Brick House

In order to have an atherosclerotic plaque, you must have atherogenic (mainly LDL) particles. Inflammation, oxidative stress, high blood pressure, diabetes, and other factors may all contribute to plaque development—but without sufficient LDL particles, you don't develop an atherosclerotic plaque. Not enough LDL particles—no atherosclerotic plaque.

Many physicians believe that LDL cholesterol needs to be lowered to optimal levels (less than 70 mg/dl) only if you are at very high risk for coronary heart disease, or you actually have coronary heart disease or have suffered a heart attack. That line of reasoning has never made sense to me. Why wait until you've had a heart attack to lower your LDL cholesterol to optimal levels? Remember, half the men and women who suffer a heart attack have no prior warning, and many don't survive their first event. Why not be proactive and lower your total cholesterol, LDL cholesterol, non-HDL cholesterol, and LDL particle number to levels that slams the door shut on the possibility of a heart attack?

Inflammation

As you now know, inflammation is involved in all stages of coronary artery disease, from the formation of plaque in the artery wall, to the plaque's progression and rupture, to the clot that blocks blood flow to the heart muscle. The more pronounced your body's inflammatory response, the more likely your plaques

are to form, rupture, and lead to heart attacks or strokes. Chronic inflammation may also inhibit the release of nitric oxide, the chemical responsible for the dilation of blood vessels, which leads to narrowed arteries, decreased blood flow, and increased blood pressure—all of which make it easier for clots to block the flow of blood.

What is clear is that any inflammatory state that becomes chronic, even on a low-grade level, is hazardous to your health, and doing your best to reduce the cause of the inflammation is important to protecting your heart—and your life.

Testing for Inflammation

The two most commonly used biomarkers of vascular inflammation are hs-CRP and Lp-PLA2. There are many clinical trials around the world showing that hs-CRP is a better independent predictor of heart attack and stroke than LpPLA2, however LpPLA2 is a more specific biomarker of vascular inflammation than hs-CRP: it's more likely to be related to vascular inflammation as opposed to general inflammation such as arthritis. Nevertheless, the two blood tests are complementary, since both together are more predictive of a potential cardiovascular event than either test alone. In fact, elevated LpPLA2 tells us that the risk of stroke is increased fivefold, whereas elevated LpPLA2 and hs-CRP tells us that the risk is increased elevenfold!

The chart below lists the recommended and optimal values for both hs-CRP and Lp-PLA2.

	Recommended	Optimal
hs-CRP	< 2.0 mg/L	< 1.0 mg/L
Lp-PLA2	< 200 ng/mL	< 200 ng/mL

Omega-3 and Vitamin D

For now, suffice it to say that both omega 3 and vitamin D are essential for optimal cardiovascular health. Fortunately, omega-3 and vitamin D can be measured with a blood test, and replacement therapy is advised for those who are deficient.

	High risk	Intermediate risk	Optimal
HS-Omega-3 Index (%)	< 4%	4–8%	> 8%
25-hydroxy-vitamin D (ng/ml)	< 15	15–29	> 30

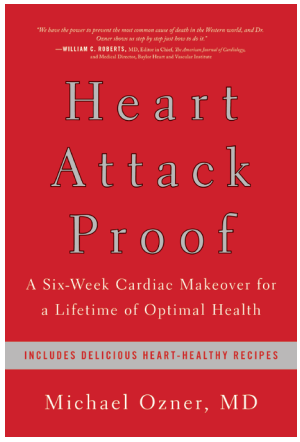
For easy reference, I've included the most important test results, and their optimal results, below.

The Optimal Blood Test Profile	
LIPIDS	
Total cholesterol	< 150 mg/dL
LDL cholesterol	< 70 mg/dL
HDL cholesterol	> 40 mg/dL (men); > 50mg/dL (women)
Non-HDL cholesterol	< 100 mg/dL
Triglycerides	< 100 mg/dL
LDL-P	< 700 nmol/L
apoB	< 60 mg/dL
LP(a) mass	< 30 mg/dL
INFLAMMATION BIOMARKERS	
hs-CRP	< 1.0
Lp-PLA2	< 200
OTHER	
Blood pressure	< 120/80
Fasting blood sugar	< 100 mg/dL
HbA1c	< 5.7%
Hs-Omega-3-index	> 8.0%
25-hydroxyvitamin D	> 30

Now that you know what all these tests mean and why you need them, your assignment this week is to assess your own results. Is your LDL cholesterol too high? Do you have too many LDL particles? Do you need to boost your HDL cholesterol levels? How much vascular inflammation do you have? Do you tend to have high blood glucose? Is your blood pressure in the optimal range? Make sure to talk to your doctor about any abnormal lab values. ●

About the Author

Michael Ozner, MD, FACC, FAHA, is one of America's leading advocates for heart disease prevention. Dr. Ozner is a board-certified cardiologist, a Fellow of both the American College of Cardiology and the American Heart Association, Medical Director of Wellness and Prevention at Baptist Health South Florida, and a well-known regional and national speaker in the field of preventative cardiology. He is symposium director for "Cardiovascular Disease Prevention," an annual international meeting dedicated to the treatment and prevention of heart attack and stroke. He was the recipient of the 2008 American Heart Association Humanitarian Award and was elected one of the "Top Cardiologists in America" by the Consumer Council of America. Dr. Ozner is also the author of *The Miami Mediterranean Diet* and *The Great American Heart Hoax*.



If you have any questions on the scientific content of this article, please call a Life Extension® Health Advisor at 1-866-864-3027.

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