Myeloperoxidase

Know your risk™ *of a heart attack.*

inflammation

What is myeloperoxidase?

Myeloperoxidase, or MPO, is an enzyme that is released by white blood cells called macrophages that measures your body's response to damaged artery walls that have become thin, cracked, and ultimately unstable due to cholesterol accumulation and inflammation.

Why check my MPO levels?

When the walls of your arteries become damaged, cholesterol can enter and build up. Your body tries to remove the cholesterol by sending in immune cells. These cells wrongly think the cholesterol particles are bacteria or viruses that have invaded the body, and try to kill them by releasing MPO which acts like bleach. Instead of killing the cholesterol, MPO damages the cholesterol and contributes to the formation of foam cells, a name for cholesterol-filled immune cells. Instead of removing the cholesterol, these foam cells get stuck in the artery wall and contribute to chronic inflammation. Over time, the artery wall gets filled with plaque - a mixture of cholesterol, immune cells and foam cells - which goes relatively unnoticed until it is too late.

Just as lava in a volcano becomes hot and bursts open through the surface of the earth, plaque buildup inside the artery wall can become inflamed and burst through the wall of the artery to where the blood flows. When the plaque ruptures into the blood, the body responds to this injury by forming a clot. If the clot causes a complete blockage of blood flow, this can cause a heart attack.

Whether you have traditional risk factors for heart or vascular disease, such as abnormal cholesterol levels or high blood pressure, or known heart disease, the MPO test can help your medical provider find out if you have inflammation in your arteries that can add to your risk for a heart attack.

When should the MPO test be performed?

The MPO test can be performed at the same time your medical provider runs other tests, such as a cholesterol test, to determine if you are at increased risk for a heart attack.

How should I prepare for the MPO test?

The MPO test does not require any special preparation. You do not need to be fasting, and can be taking medications.

What can I do to help lower my MPO levels?

There are a number of things you can do to lower your overall risk of heart disease, as well as lowering your MPO levels.

- It is important to maintain a healthy blood pressure because high blood pressure may damage the vessel wall and begin plaque formation.
- A heart-healthy diet is also recommended, as research has shown that weight loss helps decrease inflammation.
- If you are a smoker, the importance of stopping smoking to decrease the chance of plaque rupture and clot formation is even more urgent.
- There are prescription and non-prescription medicines your medical provider can give you that reduce MPO levels.

Your medical provider will work with you to develop a treatment plan that is right for you to help reduce your risk of a heart attack. This may include imaging testing, such as CIMT or coronary artery calcium scoring.

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RELATIVE RISK

MPO (pmol/L)

<470 Low
470 - 539 Moderate
≥540 High

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Lp-PLA$_2$

Know your risk™ *for a heart attack or stroke.*

inflammation

What is the Lp-PLA$_2$ Test?

The Lp-PLA$_2$ Test measures the amount of Lp-PLA$_2$ in the bloodstream. Lp-PLA$_2$ is an enzyme that can assess the amount of inflammation in your arteries due to a build-up of cholesterol.

Why should I get the Lp-PLA$_2$ Test?

The Lp-PLA$_2$ Test can help assess your risk for heart disease or stroke. When LDL cholesterol (the carrier of "bad" cholesterol) gets into your artery wall, the body tries to get rid of it by making Lp-PLA$_2$. Unfortunately, the actions of Lp-PLA$_2$ contribute to increased inflammation and increased cholesterol accumulation in the artery wall, forming what is called plaque. Inflammation can also make the cap covering the plaque thinner, which makes it more likely to rupture. The body responds to the rupture by forming a blood clot, which can block the flow of blood. If the blood flowing to the heart is blocked, it may cause a heart attack, while blocked blood flow to the brain may cause a stroke.

In short, the Lp-PLA$_2$ Test can help your medical provider better understand the health of your arteries and determine if you are actively growing plaque that is at risk for rupturing and developing a heart attack or stroke.

Traditionally, the risk of having a stroke is associated with many factors including high blood pressure. Although high blood pressure is known to increase stroke risk, having high blood pressure and a high Lp-PLA$_2$ Test result can put you at a much higher risk for stroke. But, it's important to remember that even if your blood pressure is controlled, a high Lp-PLA$_2$ Test result alone still puts you at risk for a stroke.

When should the Lp-PLA$_2$ Test be performed?

The Lp-PLA$_2$ Test can be performed at the same time your medical provider runs other tests, such as a cholesterol test, to determine if you are at increased risk for heart disease or stroke. The Lp-PLA$_2$ Test is recommended if you have two or more risk factors for heart disease, such as high cholesterol or obesity.

How should I prepare for the Lp-PLA$_2$ Test?

The Lp-PLA$_2$ Test does not require any special preparation. You do not need to be fasting, and can be taking medications.

What can I do to help lower my Lp-PLA$_2$ levels?

There are a number of things you can do to lower your overall risk of heart disease, as well as lowering your Lp-PLA$_2$ levels.

- Adopting a heart-healthy diet can help to lower your Lp-PLA$_2$ levels. Eat more vegetables, fruits, and whole grain foods and reduce the amount of fatty foods you eat.
- Exercise can also help to reduce your Lp-PLA$_2$ levels.
- If you smoke, quit. It is not easy but there are programs and strategies (including over-the-counter and prescription medications) that can improve your chance of success. Talk with your medical provider to find what works best for you.
- See your dentist. Periodontal disease may elevate Lp-PLA$_2$.
- There are prescription and non-prescription medicines, as well as supplements, your medical provider can give you that reduce Lp-PLA$_2$ levels.

Your medical provider will work with you to develop a treatment plan that is right for you to help reduce your risk of heart attack and stroke.

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RELATIVE RISK
Lp-PLA$_2$ (ng/mL)

≤200 Low
>200 High

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hsCRP

Know your risk™ *for chronic inflammation.*

inflammation

What is hsCRP?

C-reactive protein (CRP) is produced by the liver when inflammation is present somewhere in your body. Traditionally, the CRP test has been used to identify risk for infection or chronic inflammatory conditions. Now, there is a newer test available called high-sensitivity CRP, or hsCRP, that measures smaller amounts of CRP in the blood.

Why should I get my hsCRP levels checked?

Most of the time, you can tell if you have inflammation. For example, if you cut your finger, you may see redness and swelling, and feel pain. This is called acute inflammation, or short-term inflammation. Other times, inflammation in your body may not be so obvious. This type of inflammation may be present for a long period of time without any symptoms. This is called chronic inflammation, or long-term inflammation.

Recently, it has been shown by researchers that chronic inflammation may occur within the arteries of the heart, where it may play a role in the development and progression of heart disease, acting as a "silent killer". Standard heart health tests, such as cholesterol tests, miss this chronic inflammation. The good news is that chronic inflammation can be monitored by measuring hsCRP levels in your blood.

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Researchers have shown that high hsCRP levels can indicate heart attack and stroke risk, even in apparently healthy individuals. High hsCRP levels are also a risk factor for people who do not have other risk factors that medical practitioners commonly look for such as high cholesterol or high blood pressure. For people who have had a heart attack, elevated hsCRP levels may indicate if they are at risk for another heart attack or an ischemic stroke.

When should my hsCRP levels be checked?

Your hsCRP level can be checked at the same time your medical provider runs other tests, such as a cholesterol test, to determine if you are at increased risk for a heart attack or stroke. You may be a good candidate for hsCRP testing if you are at moderate risk of vascular disease, or have several other risk factors such as high cholesterol or a family history of heart disease.

How should I prepare for the hsCRP test?

The hsCRP test does not require any special preparation. You do not need to be fasting, and can be taking medications. Make sure you don't have a cold, the flu or a dental infection when being checked as hsCRP levels will go up when you're sick. Instead, you should wait until you feel better before you are checked.

What can I do to help lower my hsCRP levels?

- Lifestyle changes, such as exercising more, eating more heart-healthy high fiber foods such as fruits/vegetables and whole grains or following a Mediterranean diet, can help to lower hsCRP levels.
- Quitting smoking helps reduce the amount of general inflammation in your body.
- Taking good care of your teeth can also help lower hsCRP and reduce your risk of heart disease.
- There are prescription and non-prescription medications that also can lower hsCRP.

It is important for you to work together with your medical provider to come up with a plan that is right for you.

RELATIVE RISK

hsCRP (mg/L)

<1.0 Low
1.0-3.0 Moderate
>3.0 High

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Urinary Microalbumin

Know your risk™ *for endothelial dysfunction.*

inflammation

What do my kidneys do?

Your kidneys have an important role in keeping you alive and well. Their main function is to get rid of waste and extra water from your body. This is done by the endothelium, or the thin layer of cells that line the blood vessels in the kidney, which act like a coffee filter. The kidney endothelium filters your blood to get rid of waste by making urine. Your kidneys also do other important things, such as help control your blood pressure.

What is urinary microalbumin?

Albumin is a protein that is normally found in your blood and not normally found in your urine. The urinary microalbumin test is able to measure very small amounts (micro-) of albumin that can leak into the urine.

What causes increased urinary microalbumin?

If albumin is in the urine, even in small amounts, then you may have kidney damage. You can think of kidney damage as a ripped coffee filter which allows coffee grounds into your coffee. This damage may be caused by high blood pressure or high blood sugar levels, both of which can cause damage to the endothelium of the kidney. Albumin can sneak through this damage in the endothelium and end up in the urine, where it can be measured.

Why should I get my urinary microalbumin levels checked?

If your medical provider finds out that albumin is leaking into your urine, this may be a sign that there is damage to other tissues in your body including your arteries. The things that are damaging the endothelium in your kidneys, such as having high blood pressure or high blood sugar, are probably also damaging the endothelium in your arteries. When the endothelium in the arteries becomes damaged, cholesterol can accumulate there, setting off a chain of events that may result in the development of plaque. Increased levels of urinary microalbumin may also identify the presence of diabetes or heart disease.

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When should my urinary microalbumin levels be checked?

Your urinary microalbumin levels should be checked at the same time your medical provider runs other tests, such as a cholesterol test. If your level is high, your medical provider may want to repeat the test. High urinary microalbumin levels may be seen in pregnancy, following exercise, or in people with high blood sugar levels, fever or urinary tract infections.

How should I prepare for the urinary microalbumin test?

The urinary microalbumin test does not require any special preparation. You do not need to be fasting, and can be taking medications. It is best if you have the urinary microalbumin test done in the morning.

What can I do to help lower my urinary microalbumin levels?

Two major factors that contribute to high urinary microalbumin levels are high blood pressure and high blood sugar levels. Therefore, it is important that you work with your medical provider to develop a plan to lower these.

- Lifestyle changes, including increasing the amount of fruits, vegetables, and whole grain products and reducing the amount of salty or sugary foods you eat may help to reduce your blood pressure and blood sugar.
- Exercising regularly can also help you regulate your blood pressure and blood sugar.
- There are medications which your medical provider can prescribe if lifestyle changes are not working well enough for you.

Talk with your medical provider to develop a plan that works the best for you.

RELATIVE RISK

Urinary Microalbumin/Creatinine (mg/g)

	Women	Men
Low	<7.5	<3.9
High	≥7.5	≥3.9

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Oxidized LDL

Know your risk™ *for metabolic syndrome.*

inflammation

Metabolic syndrome consists of various risk factors that increase your chance of developing diabetes or vascular disease. Metabolic syndrome is characterized by having at least 3 of the following risk factors: a large waistline, high triglyceride levels, low HDL cholesterol (the "good" cholesterol) levels, high blood pressure or high blood glucose levels. In the US, approximately 34% of adults meet the criteria for metabolic syndrome. Even more alarming is the increasing presence of metabolic syndrome in children due to obesity.

Unfortunately, by the time metabolic syndrome is diagnosed, your blood vessels and heart are already damaged. Researchers have recently found that measuring oxidized LDL can predict your risk of developing metabolic syndrome.

What is oxidized LDL?

Oxidized LDL is LDL cholesterol (the "bad" cholesterol) that has been modified by oxidation. Oxidized LDL triggers inflammation leading to the formation of plaque in the arteries, also known as atherosclerosis. Oxidized LDL may also play a role in increasing the amount of triglycerides the body produces, as well as increasing the amount of fat deposited by the body. In turn, fat tissue can enhance the oxidation of LDL, creating a vicious cycle.

Why should I get my oxidized LDL levels tested?

Researchers have found that individuals with high levels of oxidized LDL are 4x more likely to develop metabolic syndrome up to five years following testing. In particular, increased oxidized LDL levels were associated with abdominal obesity and high triglyceride levels, as well as high blood glucose.

The oxidized LDL test can also help your medical provider decide if you may be at a higher risk for heart attack or heart disease than by looking at traditional risk factors alone. Oxidized LDL may be twice as good at helping your medical provider know your risk for heart disease as any one of the traditional risk factors.

When should I get tested for oxidized LDL?

Your oxidized LDL levels should be tested when you get your standard cholesterol test. Your medical provider may order oxidized LDL if you are at low or intermediate risk of metabolic syndrome or cardiovascular disease due to lifestyle risks.

How should I prepare for the oxidized LDL test?

There are no preparations necessary. The oxidized LDL test does not require you to fast, and you can continue to take your medications.

What can I do to help lower my oxidized LDL levels?

- Lifestyle changes are the best option to help lower your oxidized LDL levels.
- If you smoke, ask your medical provider to help you quit. It is not easy but there are programs and strategies (including over-the-counter and prescription medications) that can improve your chance of success.
- Adjust your diet to include foods low in saturated fat and those with zero trans-fat. Fruits and vegetables are also great options as they contain anti-oxidants.
- Talk with your medical provider about over-the-counter supplements containing anti-oxidants.
- Increase your amount of physical activity as approved by your medical provider.

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RELATIVE RISK
OxLDL (U/L)

<60 Low
60-69 Moderate
≥70 High

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F_2-Isoprostanes

Know your risk™ *for oxidative stress.*

inflammation

Why is lifestyle so important?

Eating right and getting enough exercise are important factors for your health today as well as in the future. Bad habits, such as bypassing a home-cooked meal to grab fast food or spending your days on the couch watching TV rather than taking a 20 minute walk, can contribute to the onset of various chronic diseases such as diabetes, heart disease, and cancer.

Poor lifestyle choices not only contribute to how you feel mentally but how your body functions physically. As part of everyday life, our bodies produce some potentially harmful molecules called free radicals. These free radicals cause damage to parts of the cells in your body, such as DNA and lipids, by a process called oxidation. Most of the time, your body is able to combat damage to its tissues through the use of antioxidants. However, lifestyle choices may increase the amount of oxidation in the body and overwhelm its antioxidant capabilities. This creates a state of imbalance often referred to as oxidative stress which, in turn, increases the likelihood of tissue damage and the potential for chronic disease.

One chronic disease which has been associated with oxidative stress is atherosclerosis, the build-up of plaque in the arteries. Atherosclerosis can lead to heart disease, heart attacks or strokes. Therefore, knowing how much oxidative stress your body is under can help you keep your heart and entire vascular system healthy. Your physician now has the ability to assess the amount of oxidation in your body by using a non-invasive urine test to measure your F_2-Isoprostanes (F_2-IsoPs) levels.

What are F_2-IsoPs?

F_2-IsoPs are compounds formed from arachidonic acid. Arachidonic acid is required by your body to make muscles and for basic functioning. Your body can make arachidonic acid on its own, or can get it from the foods you eat, such as red meat or egg yolks. As with many things, having too much or too little arachidonic acid can be harmful to the body. Having too much arachidonic acid can increase the production of F_2-IsoPs which can damage the body's tissues and therefore contributes to the onset of chronic disease.

Why check my F_2-IsoPs?

F_2-IsoPs can cause blood vessels to constrict, which may raise your blood pressure, and promote blood clotting resulting in a heart attack or stroke. In support of this, F_2-IsoPs may be elevated at the earliest stages of plaque development in your arteries. Research has shown that people with high levels of F_2-IsoPs are 30x more likely to develop heart disease[1].

When should my F_2-IsoPs levels be checked?

Your F_2-IsoPs levels can be checked at the same time your medical provider runs other tests, such as a cholesterol test, to determine if you are at increased risk for developing vascular disease.

How should I prepare for the F_2-IsoPs test?

The F_2-IsoPs test does not require any special preparation. You do not need to be fasting, and can be taking medications.

What can I do to help lower my F_2-IsoPs levels?

Because F_2-IsoPs are known as "lifestyle" markers, their levels are affected by lifestyle choices you make, such as what you eat and how much you exercise. Therefore, you can make changes in your daily life which can lower your F_2-IsoPs to safe levels.

- Reducing the amount of red meat and increasing the amount of fruit and vegetables you eat can help lower your F_2-IsoPs levels. Adding one fish meal a week as part of a low-fat diet may also lower F_2-IsoPs levels.
- Your F_2-IsoP levels may also be lowered by increasing the amount you exercise.
- If you smoke, you should consider stopping as smoking also increases F_2-IsoPs levels.

1. Schwedhelm E et al. Urinary 8-iso-prostaglandin F_2a as a risk marker in patients with coronary heart disease: A matched case-control study. *Circulation*. 2004; 109: 843-848.

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RELATIVE RISK

F_2-IsoPs (ng/mg)

<0.86 Low	≥0.86 High

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ADMA/SDMA

Know your risk™ *for endothelial dysfunction.*

endothelial dysfunction

What is the endothelium and why is it important?

The endothelium is a thin layer of cells lining the inside of your blood vessels. These cells are in constant contact with the blood supply and, therefore, play an integral role in immunity, blood clotting and maintenance of blood pressure. When your endothelium is damaged, it may signify that you are at increased risk of having cardiovascular disease or renal failure.

What are ADMA and SDMA?

ADMA (asymmetric dimethylarginine) and SDMA (symmetric dimethylarginine) are compounds made in your body as proteins are degraded, or broken down. ADMA and SDMA reduce your body's ability to produce nitric oxide, a molecule that helps maintain a healthy endothelium. Therefore, elevated levels of ADMA and SDMA may identify reduced nitric oxide production and endothelial dysfunction, or damage.

What causes increased ADMA/SDMA levels?

Your ADMA and SDMA levels may increase if you have a poor diet/lifestyle, elevated LDL cholesterol, high blood sugar, high blood pressure, or if you are a smoker. These are all risk factors that can damage the delicate endothelial cells that protect your vasculature.

Why should I check my ADMA/SDMA levels?

You should check your ADMA/SDMA levels to determine if you have a healthy endothelium.

- ADMA can tell you if your risk factors may be contributing to endothelial damage and increasing your likelihood for cardiovascular disease.
- SDMA can tell you if your risk factors may be contributing to an increased likelihood for kidney damage or, in some cases, kidney failure.

The ADMA/SDMA test determines if you have a healthy vessel wall.

When should my ADMA/SDMA levels be checked?

Your ADMA and SDMA levels should be checked if you have a poor diet/lifestyle, elevated LDL cholesterol, high blood sugar, high blood pressure, or if you are a smoker.

How do I prepare for the ADMA/SDMA test?

It is recommended, but not required, that you fast overnight before your sample is collected.

What can I do to lower my ADMA/SDMA levels?

Focusing on the health of your endothelium may help to lower ADMA and SDMA levels. This may be accomplished through:

- Lifestyle changes, including a balanced diet that is low in fat and incorporates more fruits and vegetables. You should limit your intake of sweet and salty foods.
- Maintaining an active lifestyle with regular exercise, maintaining a healthy weight, lowering blood pressure and decreasing blood LDL cholesterol levels.
- Medications your provider may prescribe to achieve a healthy blood pressure or normalize blood cholesterol and blood sugar levels.

It is important that you talk with your medical provider to develop a plan that works for you.

RELATIVE RISK	ADMA (ng/mL)	REFERENCE RANGE	SDMA (ng/mL)
	<100 Low		73 - 135 Low
	100 - 123 Moderate		>135 High
	> 123 High		

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