

Understanding Atherosclerosis

By Jorge Plutzky, MD

What is Atherosclerosis?

Atherosclerosis is the build-up of cholesterol deposits (plaque) in arteries that carry oxygen to the heart, the brain and elsewhere. This process, which underlies most heart attacks and strokes, can be seen as a response to vessel wall injury – from cardiovascular risk factors like high blood pressure, smoking, and diabetes. Atherosclerosis arises over decades: the heart attack later in life may well have its origins from much earlier arterial changes.

From injury to heart attack: What happens?

Initially, damage occurs to the endothelium, cells lining the artery wall. Bad cholesterol – LDL - can accumulate in the artery, inciting inflammation much like what happens after a skinned knee. White blood cells, called into the artery to deal with the injury, ingest LDL and other material, fostering plaque formation.

Previously atherosclerotic plaque was thought to build up until the blood supply was cut off. Although chronic blockages can contribute to coronary heart disease and exertional symptoms like chest pain (angina) or leg pain with walking (claudication), we now realize that most heart attacks happen when plaque ruptures, allowing an arterial blood clot to cut off the blood supply, depriving oxygen to the tissue supplied by the artery, potentially resulting in a heart attack. Similar processes can cause stroke.

How can one tell if they are at risk?

Work with your doctor to know your numbers: lipid profile (levels of bad LDL cholesterol, good HDL cholesterol and triglycerides), blood pressure, some measure of your fitness (weight, waist circumference, body mass index), even your glucose

values. These numbers help define your risk of future heart attack, stroke and diabetes. Ideally, LDL should be less than 100 mg/dl and blood pressure around 120/80 mm Hg, although not everyone should take drug therapy to achieve these. Many other factors can contribute to atherosclerosis. One of the worst offenders is smoking. A family history of early heart disease is another factor to consider.

Are risk patterns changing in the United States?

Yes. The increased use of preventive therapies like cholesterol-lowering medications has improved some problems. But great concern exists over how the epidemic of obesity and type 2 diabetes in increasingly younger individuals will drive cardiovascular risk. Type 2 diabetes, which also arises over years, brings many associated cardiovascular risk factors: central obesity (excess fat around the waist), higher triglycerides, decreased HDL, hypertension and increased markers of inflammation (like C-reactive protein). Those with diabetes may have the same risk of a heart attack as a heart attack survivor. Most guidelines suggest aggressive cardiovascular treatment for those with diabetes regardless of their cardiac history.

What's the best way to control risk factors?

Heading off atherosclerosis involves many approaches. Lifestyle changes – healthier eating, increased activity, improved weight - can decrease risk for diabetes and cardiovascular disease. Given how early diabetes and heart disease can begin, these issues are relevant for families, and the habits children form. For others, drug therapy is also needed. The evidence is very strong that reducing LDL with a statin can bring major reduction in the risk of first or recurrent heart attack. Statins also may favorably alter inflammation. Research is focusing on raising levels of HDL - the good cholesterol thought to

move excess cholesterol away from arteries. Aspirin and its inhibition of blood clot-promoting platelets can also be important. High blood pressure and blood sugars should also be controlled.

What if I am getting chest pains when I exert myself?

Exertional chest discomfort that comes from a lack of oxygen to heart muscle is basically an issue of supply and demand. As heart muscle demand increases, arterial blockages can limit supply. Doctors can manage these issues by altering this supply-demand relationship - decreasing demand with medications that lower blood pressure and heart rate. Some patients require an increased supply, by stenting blockages or performing coronary bypass surgery. Importantly, these procedures do not change why the blockages occurred; improving this brings us back to better lifestyle and drug therapy. If you are having chest discomfort, it is critical to see your doctor. Major new therapies and diagnostic tools, like advanced imaging techniques, are available but not if you don't get seen and evaluated.

What's your advice on living a healthier lifestyle?

Eat right and be more active in doing things you enjoy. Even small improvements can have a big impact on the risk of diabetes and cardiovascular disease. Simple dietary changes - avoiding trans fats, excessive simple carbohydrates, avoiding calorie dense foods, limiting portion size - can move you quickly in the right direction. Know your numbers and work with your doctor to make those numbers, and your health, better.

Dr. Plutzky is a cardiologist at Brigham and Women's Hospital, where he directs the Vascular Disease Prevention Program, and is a faculty member of Harvard Medical School.

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