



## Anatomy of a Heart Attack

Considering that heart attacks are the #1 killer in America, it's ironic that most people don't understand the process at all. What exactly *is* a heart attack, what is hardening of the arteries, and why do they harden?

During normal circulation, the powerful left ventricle of the heart pumps oxygen-rich blood through the aorta (the body's main pipe), and throughout the rest of the body. These arteries branch again and again until they become microscopic capillaries. After the cells have extracted the food and oxygen from the blood, the nutrient poor blood finds its way back into the heart via veins, and then is pumped through the right ventricle back into the lungs to begin the process again. The heart is the only muscle that works non-stop until we die, meaning it requires its own system of arteries and capillaries to deliver the much-needed food and oxygen used to fuel its endless beating. These coronary arteries, and the smaller arteries, veins, and capillaries that fill the heart, are constantly working hard under high pressure for a person's entire life.

If blood supply is cut off from part of the heart for even a few minutes that section of heart will die, resulting in gangrene. A heart attack is exactly this, gangrene of the heart tissue. If the blockage occurs at the beginning of a coronary artery, blood supply is usually cut off from a larger section of the heart, meaning a person will usually die. If the damage occurs closer to the end of a coronary artery, it is usually less extensive and the person has a much higher chance of survival.

If a person does survive a heart attack, they never fully heal from it. The dead section of the heart stays dead and is replaced by scar tissue. It is possible for this dead section of the heart to rupture several days after the heart attack, resulting in death. Also, many people eventually die years after an extensively damaging heart attack from failure of the heart to adequately pump blood. If the damage is small but happens to short circuit the electrical circuits that trigger the heart to beat, the heart can beat so irregularly it simply quivers and the person dies a sudden death.

So what causes the obstruction of blood flow in an artery? It isn't, as many people think, gooey debris or chunks of cholesterol or other junk sitting inside the arteries. What blocks blood flow in an artery is the sudden formation of a blood clot, or thrombus. It is the same phenomenon that keeps us from bleeding to death with every



## Anatomy of a Heart Attack

cut. Blood doesn't know where it is in the body, meaning it will clot when it comes into contact with tissue it isn't supposed to. So what makes this mistake happen and how is it related to cholesterol and the hardening of the arteries?

Atherosclerosis is the gradual hardening of the arteries. When this occurs, the build-up is actually within the wall of the artery itself, not stuck to the inside. What actually coats the inside of the artery is a layer of cells, one cell thick, called the endothelium. The endothelium keeps the blood from coming into contact with any of the tissue beneath it, which would cause it to clot. To learn about a safe, painless and conclusive test to see if you have blockage, learn more about the EBT.

Cholesterol can pass through endothelium from the blood to the tissue of the arteries through diffusion. White blood cells that like to feed on cholesterol patrol this area, and if they eat enough cholesterol, they release in the process substances that cause local swelling and attract other white blood cells. Plaque is the build-up of these cholesterol-gorged white blood cells and other materials that accumulate with them. If the endothelial surface peels away, known as plaque rupture, the blood quickly clots over that area and can completely obstruct the flow of blood through that artery.

It is possible that the plaque simply grows and narrows the passageway, but never ruptures. This type, known as stable plaque, can cause pain and angina, but is much less likely to cause death than frailer plaque that can rupture at any time. In fact these flat plaques are the real killers, since the heart hasn't had time to create a backup supply of blood for the coronary arteries. If a plaque is bigger and bulkier, the body often grows and widens other coronary arteries to increase blood supply to an area being blocked by the plaque. Then, if this plaque suddenly does rupture, at least the person has a backup system already in place that may be able to save that part of the heart.

Before a heart attack, that piece of heart muscle is healthy, strong, and alive. An hour after a heart attack, some or all of that muscle is dead forever. A person with highly developed atherosclerosis can live a full normal life if a heart attack never occurs. Conversely, a person with very little atherosclerosis can have a single rupture in a bad place and suffer a major heart attack. With modern medical treatments, many of these existing plaques can be stabilized, preventing ruptures and saving millions of lives.