1.5 Education, divided into 8 subsections (this is a section for a community member opening our page and wanting to learn more about heart attacks).

1.5.1 Understanding heart attacks

What is a heart attack?

Heart attacks are one of the most common and serious forms of cardiovascular disease. Ischemic heart disease remains the leading cause of death worldwide, accounting for roughly 9 million deaths, about 1 in 8 deaths worldwide, per year (source). In Canada alone, 62,230 heart attack events were recorded among adults aged 20 and older in 2023-2024 (source). Importantly, 50% of heart attack deaths occur within two hours of the first signs, which is why recognizing the warning signs and seeking help urgently is so important.

A heart attack (also called a myocardial infarction) occurs when blood flow to part of the heart muscle (myocardium) is suddenly reduced or completely blocked. Without a continuous supply of oxygen-rich blood, the affected portion of the heart is injured—the longer it remains without oxygenated blood, the more severe the injury becomes. In other words, if blood flow is not restored quickly, the damage can become permanent, causing part of the heart muscle to die (infarction).

Prompt recognition and early treatment are critical because the amount of heart muscle that can be saved depends on how quickly blood flow is restored. This is why healthcare professionals often repeat: "Time is muscle." The sooner treatment begins, the greater the chance of preserving heart function and reducing long-term complications.

Extra source: https://www.heartandstroke.ca/heart-disease/conditions/heart-attack

How does the heart normally receive oxygen?

Although the heart pumps blood throughout the body, it also needs its own blood supply to function. This blood is delivered through major blood vessels called the coronary arteries, which wrap around the surface of the heart. These arteries continuously supply oxygen-rich blood and nutrients to the heart muscle, allowing it to stay alive and pump efficiently (source).

How does a coronary artery become blocked?

Over time, disease can cause a coronary artery to narrow or become blocked. Many of the factors that increase this risk are discussed in the next section.

Most heart attacks are caused by coronary artery disease. Over many years, fatty deposits called plaques, made up of cholesterol, inflammatory cells, calcium and other substances, accumulate inside the walls of coronary arteries. This process is known as atherosclerosis.

These plaques can gradually narrow the inside of the artery. Many people live with plaque buildup for years without experiencing any symptoms. Problems can occur when a plaque ruptures or when its thin surface covering is damaged or erodes. The body recognizes this damaged surface as an injury, much like a cut on the skin, and begins forming a blood clot. Sometimes this clot becomes large enough to partially or completely block the artery, preventing blood from reaching the heart muscle and triggering a heart attack.

Source: https://www.heartandstroke.ca/heart-disease/conditions/atherosclerosis

Are all heart attacks the same?

Heart attacks can be classified in several ways. One common distinction you may hear in the emergency room is STEMI versus NSTEMI, based largely on what doctors see on an electrocardiogram (ECG), a test that records the heart's electrical activity.

- STEMI (ST-elevation myocardial infarction): The ECG shows a characteristic change called ST-segment elevation, usually indicating that a coronary artery has become suddenly and severely blocked. Because a large area of heart muscle may be at immediate risk, restoring blood flow as quickly as possible is critical, most often with an urgent procedure called PCI.
- NSTEMI (non-ST-elevation myocardial infarction): There is still injury and death of heart muscle, but the ECG does not show the same ST-segment elevation. Blood flow may be severely reduced rather than completely interrupted. NSTEMI is still a heart attack and still a medical emergency, but the urgency and timing of procedures such as coronary angiography depend on the person's condition and overall risk.
    - Notably, not all NSTEMIs are caused by a new blood clot. An NSTEMI can sometimes be a secondary myocardial infarction (previously called type 2 MI), where another acute problem causes the heart's oxygen needs to exceed the available supply. This can happen, for example, with severe anemia, very low blood pressure, low oxygen levels or a sustained fast heart rhythm.

Importantly, NSTEMI does not mean a "minor" heart attack. Both STEMI and NSTEMI can cause serious and permanent heart damage.

What happens inside the heart during a heart attack?

Once blood flow is interrupted, the affected heart muscle immediately begins to suffer from oxygen deprivation. Within minutes, heart muscle cells stop functioning normally, and the affected region may contract less effectively. Oxygen deprivation can also disrupt the normal electrical properties of heart cells, increasing the risk of dangerous arrhythmias.

Irreversible heart muscle injury can begin within tens of minutes and progresses over the following hours, which is why every minute of delay can cost heart muscle. The longer blood flow remains severely reduced or blocked, the greater the amount of permanent damage. (Reimer et al., Circulation 1977, doi:10.1161/01.CIR.56.5.786).

Unlike our skin or liver tissue, heart muscle has very little ability to regenerate. Once heart muscle is lost, it is generally replaced with scar tissue rather than new healthy muscle. This scar tissue can later contribute to the development of new arrhythmias by impairing the natural electrical pathways.

Heart Attack vs. Cardiac Arrest: What's the Difference?

Although the terms are sometimes used interchangeably, a heart attack and cardiac arrest are not the same thing. A heart attack is primarily a circulation problem. Blood flow through a coronary artery is reduced or blocked, depriving part of the heart muscle of oxygen. During a heart attack, the heart usually continues to beat, and the person is often conscious. A cardiac arrest is an electrical problem. The heart's electrical system suddenly malfunctions, causing the heart to stop pumping blood effectively. The person becomes unresponsive and is not breathing normally. Cardiac arrest requires immediate CPR and use of an automated external defibrillator (AED) when available. The two conditions are connected. As mentioned, a heart attack can trigger a dangerous abnormal heart rhythm, which can lead to cardiac arrest. However, most heart attacks do not result in cardiac arrest.

Source:
https://www.heart.org/en/health-topics/heart-attack/about-heart-attacks/heart-attack-or-sudden-cardiac-arrest-how-are-they-different

Can the Heart Muscle Heal Itself after a Heart Attack?

Yes, but not by fully replacing the lost heart muscle. After a heart attack, the damaged region heals mainly by forming scar tissue. This scar helps maintain the heart's structure, but unlike healthy heart muscle, it cannot contract normally. (source)

Interestingly, the adult heart has a limited ability to generate new heart muscle cells, not enough to replace the amount lost during a heart attack. A fascinating 2009 study used carbon-14 dating, made possible by radioactive carbon released during atmospheric nuclear testing in the 1950s and 1960s, to estimate the age of human heart muscle cells (source). Researchers found that heart muscle cells are gradually replaced throughout life, but at a very slow rate. They estimated that approximately 1% are renewed each year at age 25, declining to less than 0.5% per year by age 75.

Unfortunately, this regenerative capacity is far too limited to repair the extensive damage caused by a heart attack. Depending on how much heart muscle is damaged, the heart may become less effective at pumping blood, and the risk of complications such as heart failure and abnormal heart rhythms can increase.

This is one of the reasons why prevention, early recognition and rapid treatment remain so important.