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Hello and welcome to the Health Hits podcast.

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Today we'll be learning about heart attack, how the heart works and some of the pioneers of modern medical techniques, including an inspiring guitarist.

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So the heart.

There are so many terms that fly about when we talk about heart disease. Heart attack, myocardial infarction, angina, heart failure, cardiac arrest, coronary, coronary artery disease, angiogram, angioplasty, STEMI, non-STEMI.

Today we are going to try and unpick these terms and talk about what exactly happens during a heart attack.

As we've covered in the blood pressure episode, our heart contracts or beats, pumping blood around the body through the arteries.

The main artery that leaves the left side of the heart and carries blood to the body and the brain is called the aorta.

At the very start of the aorta, just as the blood leaves the heart, there are 3 branches that divert some of this blood flow back over the surface of the heart called coronary arteries. It is important that the heart itself gets a supply of oxygen rich blood, because the walls of the heart are made of muscle and they require the oxygen to work and pump, like any muscle in the body.

What happens during a heart attack, is that one of these coronary arteries becomes blocked and no blood can flow past the obstruction. You can think of it like a river that suddenly has a dam placed across it. The flow downstream of the blockage dries up AND the heart muscle finds it is no longer being supplied with blood and oxygen.

This heart muscle, also known as myocardium (which is literally heart muscle in Latin), will start to die downstream of the blockage.

The medical term for heart attack is myocardial infarction. And because it involves blockage of a coronary artery in America it is also often called coronary thrombosis or coronary for short.

The blockage most commonly occurs when an already narrowed coronary artery gets further damaged and a tear on the inside of this narrowed area leads to a blood clot forming. This blood clot is what causes the total blockage of the artery. The artery will have become narrowed previously due to the effect of aging, smoking, diabetes, high cholesterol and various other factors. I've researched and written a 10 thousand word thesis on THIS process, known as atherosclerosis, but fortunately we don't the time for me to bore you with it.

When a blockage occurs and the downstream heart muscle starts to fail and die we feel it commonly as a tightness or pressure over the front of the chest. The pain can also be felt in the left arm and up into the jaw due to the overlap of nerves that supply all these areas and our brains inability to exactly pinpoint the source.

Shortness of breath, sweating, feeling sick and just a general sense that something is going terribly wrong can also occur.

A large American research study published last year suggests that up to 45% of heart attacks can occur without symptoms, which they call silent myocardial infarctions. But these likely only cause minor damage anyway.

If the coronary arteries are simply narrowed but not completely blocked you can often provoke these symptoms. During exertion or exercise our heart has to beat harder and faster to keep up with the extra demand for blood from our arm and leg muscles. This pain is usually short lived and settles when we rest, and it is known by another Latin word, angina.

The difference between this and a heart attack is that the pain continues or worsens, despite rest.

If you experience these symptoms it is a very good idea to seek medical help immediately. There is a phrase in medicine “minutes means myocardium”. In other words, the longer you wait before treating the heart attack, the more muscle is damaged beyond repair.

I have added a link to an excellent NHS advice page on what to do if you experience chest pain and you can find it on the twitter and facebook pages @HealthHitsPod or the resources section of the website HealthHits.info.

A diagnosis of heart attack can be made using the presenting symptoms, but also from changes on an ECG. ECG or electrocardiogram monitors the electrical movement through the heart and since electricity only moves through working heart muscle, changes to the normal ECG pattern can be used to make the diagnosis.

ST elevation myocardial infarction or STEMI, refers to changes of a particular part of the ECG pattern which occurs in heart attack.

But depending on which part of the heart muscle is affected by the blockage you may not see any changes on an ECG at all, but instead you can rely on a blood test that specifically looks for a protein released into the blood by dying heart muscle. A blood test positive heart attack with a normal ECG is referred to as a non ST elevation MI or Non-STEMI.

A heart attack caused by a blockage of the very end of a coronary artery may not damage much heart muscle at all and may not really lead to any long term problems.

A blockage of the very start of an artery may cause so much damage that the heart just stops, or goes into a dangerous rhythm and then stops. This is called a cardiac arrest – ie, the heart stops pumping. A massive heart attack could cause cardiac arrest, but there are lots of other causes including disease, drugs, infection, blood loss, hypothermia.

A heart attack somewhere between these two extremes might cause longer term problems. If parts of the heart muscle die, they don't repair like other muscles, instead they scar. Scarred areas of heart do not contribute to the pumping action and as a result you may get an insufficient heart pump which is known as heart failure.

We know from studying mummies that even the Ancient Egyptians 4 thousand years ago suffered from heart attacks but it is only in about the last 70 years or so that medicine has been able to do anything to help.

Doctors had been aware for some time of the process of narrowing of the coronary arteries, but it was only in 1976 that research in London proved that it was blood clots that caused the sudden complete blockage which lead to the heart attacks.

Knowing that, doctors were then able to inject patients with drugs that actually broke down the clots and improved blood flow downstream of the blockage.

This was incredibly successful but these “clot-busting” drugs were not specific to the heart and would often result in bleeding from other parts of the body, sometimes catastrophically.

So doctors looked for other ways.

In 1953 a Swedish doctor called Sven Seldinger had invented a technique to get lines into veins and arteries. It involves passing a small needle into a blood vessel, much like having a blood test. He then passed a thin wire through the needle and was then able to completely remove the needle. The tract from outside the body into the blood vessel was maintained by this flexible wire. An interventional cardiologist once told me that the sizes of the wires used in the Seldinger technique are based on the widths of steel guitar strings, because Seldinger was a keen guitarist and that's what he had to hand. I can't find any evidence in the literature up but I would love the maverick element of this story to be true.

So then in the 1970s a German doctor Andreas Gruentzig build on this technique to pass a catheter or tube over the flexible wire, into the artery of the leg and then up to the start of the aorta and into the coronary arteries.

Gruentzig was a radiologist or imaging doctor, and injection of a dye that shows up on Xray could nicely demonstrate where any narrowings were. This is called angiogram.

He used a balloon at the end of this tube which, when inflated, opened up the narrowed coronary artery. Moving from looking with angiogram to treating with the balloon was called angioplasty.

This was initially used to treat angina symptoms but by the 1990s it was being used to unblock arteries during heart attack too. Various types of stent or meshwork tubes were then introduced to keep these arteries from narrowing again too quickly.

This process is called percutaneous coronary intervention or PCI and is the gold standard of treatment for heart attack. It only carries a small amount of risk, and is more effective the sooner it is done. Beyond several hours it may not be effective as the heart muscle will have been starved of blood for too long and restoring blood flow will be unlikely to reverse the damage.

Drugs that prevent further clots like aspirin, clopidogrel or Ticagrelor are often used afterwards.

Stopping smoking, reducing weight, increasing exercise are all recommended, in a sensible graded way after a heart attack.

Medications reducing blood pressure and cholesterol are often given as we know these can contribute to the atherosclerosis or narrowing of the arteries.

Clearly after a heart attack we should do all we can to prevent a further one, but what would be even better would be to maintain a healthy lifestyle, not smoke or drink too much, watch our weight and actually reduce our risk of developing a heart attack in the first place.

So that hopefully covers heart attack. There are extra resources available on facebook and twitter, just search for @HealthHitsPod or come to the resources library on the site [HealthHits.info](http://HealthHits.info).

You can use facebook or the site to ask questions or suggest topics for future episodes, and all the episodes are available on iTunes or Stitcher. Google Play podcasts are not available in the UK yet but no doubt they will be coming soon.

Thank you so much for listening and please join me again for another episode of Health Hits.