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The Biological Basis and Risk Factors for Coronary Heart Disease.

Coronary heart disease is a blanket term which describes all types of heart disease caused by blockage of the arteries that supply blood to the heart. Lack of sufficient blood is associated with a lack of oxygen, also called ischemia. Hence coronary heart disease is also called ischemic heart disease. Angina, heart attack and heart failure and are all clinical forms of coronary heart disease.1

Overall, coronary heart disease is *the* leading cause of death in the Western world.2 In the UK, heart attacks are responsible for around 150,000 deaths every year and cost the NHS approximately £719 million per year. Almost half of all heart attack sufferers die within 20 days of the attack.3

The heart of the problem

The heart is a vital organ, pumping blood which carries essential oxygen and nutrients all around the body. As a powerfully active muscle, the heart needs a ready and plentiful supply of oxygen and nutrients itself; however these are *not* extracted from the blood that flows through it. Instead, the heart has its own specific blood supply – the coronary arteries. There are two major coronary arteries – the right and left. The volume of blood which flows to the heart is largely determined by the width of these vessels and is not so dependent on the power at which the blood is pumped through them. Unlike other organs which can use the oxygen within veins if needed, the heart is completely reliant on the coronary arteries' supply. Hence their ability to expand and supply more blood when required is essential.4-6

Coronary heart disease develops when various materials build up within the walls of the coronary arteries causing a narrowing of the vessels and potentially leading to complete blockage. The obstruction of blood flow to the heart which results from this build up within the coronary arteries can cause a range of cardiac problems. When the blood flow to the heart is only temporarily interrupted, usually during exercise and times of exertion when the heart muscle requires more oxygen, the condition is known as angina. A person with angina will experience short attacks of chest pain which usually clear up with rest. Ultimately, insufficient blood flow can result in actual physical damage to the heart tissue. In severe cases, where blood flow is completely blocked, the portion of the heart affected may die from lack of oxygen– this is termed myocardial infarction,

commonly known as a heart attack. Symptoms of heart attack include prolonged and severe chest pain, weakness and shortness of breath. In rare cases, patients with coronary heart disease experience heart failure. This is a broad condition which describes any symptoms showing that a patient's heart is not performing as it should. 4-6

Why do coronary arteries become blocked?

In healthy arteries, the walls are smooth and blood flows easily. The process leading to the development of coronary heart disease begins with the development of 'fatty streaks'. These are yellow patches which appear within the wall of the coronary artery. The streaks are made up of a special type of cell called foam cells, which are rich in fats, plus smooth muscle cells. Over time, streaks can turn into plaques. Plaques, also known as atheroma, are fatty lumps which form within the lining of the arteries. There are various different kinds of plaques. Some are made up of a soft inner core of cholesterol covered by a thin firm outer layer. Others are completely solid and composed of smooth muscle cells and various other strong materials. Calcium may also build up on a plaque making the problem worse.4,7

What is the blockage like?

Plaques cause several problems to coronary blood flow. Firstly, a plaque itself can be big enough to narrow the artery and reduce the space available for blood to flow through it. Secondly, as blood is thrust against the side of the plaque with each heart beat, the outer shell of the plaque may crack open exposing the cholesterol core. When the cholesterol core is exposed, blood clotting is triggered within the artery. Clots reduce the blood flow even more. This whole process can happen repeatedly causing the artery to become narrower and narrower and eventually leading to complete blockage.4,7

Overall, the process of plaque formation and associated thickening, loss of elasticity and narrowing of the artery walls is known as atherosclerosis. Atherosclerosis is *the* major cause of coronary heart disease however, it is also present to some degree in almost every adult male in Western societies. What causes atherosclerosis to occur is complex and uncertain and there is much still to learn. Current thinking is that atherosclerosis results from some kind of 'response to injury' where initial non-specific injury to the lining of the artery wall triggers the whole process to start up.4,7,8