A refresher on basic coronary anatomy

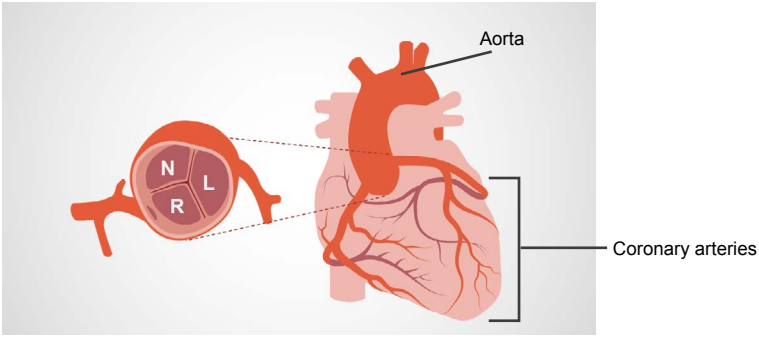
Let's start by refreshing our memories about basic coronary anatomy.

The majority of people have both a left and right coronary artery. Of course, keep in mind that variations and congenital abnormalities are possible.

The coronary arteries originate from the aortic root, just above the level of the aortic valve in the sinuses of Valsalva. Ordinarily, the left coronary artery (LCA) arises from the left coronary sinus of Valsalva, and the right coronary artery (RCA) arises from the right coronary sinus of Valsalva. There is no coronary artery associated with the third sinus of Valsalva which is, therefore, often referred to as the non-coronary sinus.

The cusps of a normal aortic valve are named similarly—according to the coronary artery that is associated with them. You may have already come across this when studying the aortic valve in more detail or during an imaging or echo course.

In the image featured next, you can see a picture of the coronary arteries arising from the aorta and their respective courses. Obviously, there is some variation in their courses between individual subjects.



L = Left coronary sinus of Valsalva
R= Right coronary sinus of Valsalva
N = Non-coronary sinus

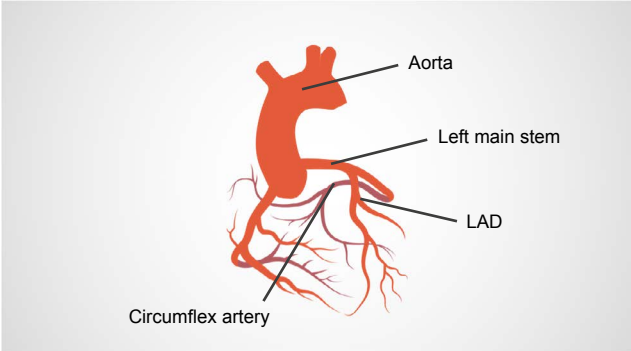
The coronary arteries are situated on the surface of the heart (i.e., epicardially) and are located directly under the pericardium. These are the arteries we are studying on a coronary angiogram.

Left coronary artery

We will discuss the LCA first. From the aorta, it originates as a vessel known as the left main stem.

The left main stem bifurcates (i.e., divides) to form the left anterior descending (LAD) artery, which is sometimes referred to as the left interventricular artery. It runs in the interventricular sulcus between the left and right ventricles on the anterior surface of the heart.

The circumflex artery is the other branch off the left main stem. It goes around the heart in the atrioventricular groove.

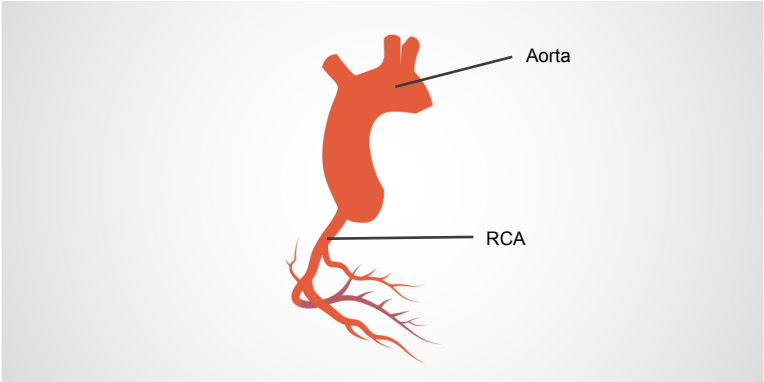


Left coronary artery

Right coronary artery

The RCA is a separate vessel from the left coronary artery. It takes a different course entirely and predominantly supplies the right ventricle, but often it also supplies the sinus and atrioventricular (AV) node.

The RCA commonly gives rise to the posterior interventricular artery or posterior descending artery (PDA). We will cover this anatomy in more detail when we review the coronary arteries, in turn, so don't worry too much about it at this stage.

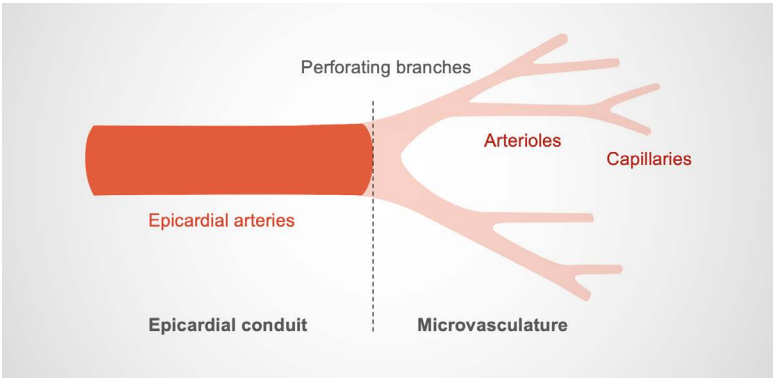


The coronary microcirculation

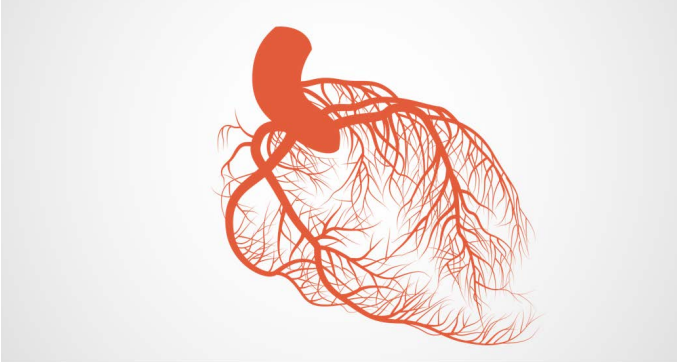
The coronary arteries perforate deep into the myocardium towards the endocardium where they branch into a large network of perforating arteries, arterioles, and capillaries. This huge vascular bed is often known as the coronary microcirculation.

The microcirculation cannot be appreciated on a coronary angiogram as these vessels tend to be less than 300 μm in diameter, so they are below the spatial image resolution of a coronary angiogram.

Broadly speaking, the main epicardial arteries are referred to as epicardial conduits. The rest of the small vessels, particularly those that are less than 300 μm in diameter, are known as the microvasculature.



The next figure illustrates just how extensive this microvasculature network is. On a coronary angiogram, the epicardial coronary vessels and their main branches are only just a small part of the entire coronary circulation. Although they are very important, it is sensible to start thinking of these epicardial vessels as just tubes or conduits to allow blood to reach the microcirculation from the aorta.



Coronary microcirculation

Why is microcirculation so important?

The microvascular component of coronary circulation is extremely important, as it makes up the greatest proportion of myocardial blood supply. In fact, vasodilator stress agents such as adenosine (used for myocardial perfusion scans in nuclear medicine and cardiac magnetic resonance imaging) predominantly affect the microcirculation, not the epicardial vessels.

In addition, the microvasculature is pivotal when it comes to determining the functional importance of a lesion using measurements such as fractional flow reserve (FFR) following an invasive pressure wire assessment.

Finally, one cannot understand the concept of acute no-reflow or slow flow without considering coronary microcirculation. This phenomenon is sometimes seen following a percutaneous coronary intervention (PCI), and it can happen with any PCI case, although is more prevalent in acute coronary syndrome cases where there is an increased burden of intracoronary thrombosis. We will dive into this concept in more detail next using a real case.