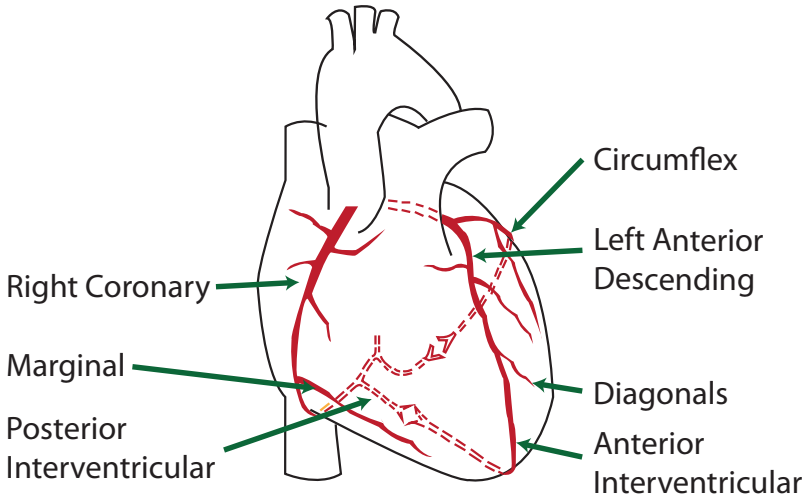
JULY 2008
QUESTION 11

Describe the adult coronary circulation (50% of marks). Describe the physiological control of the coronary circulation (50% of marks).

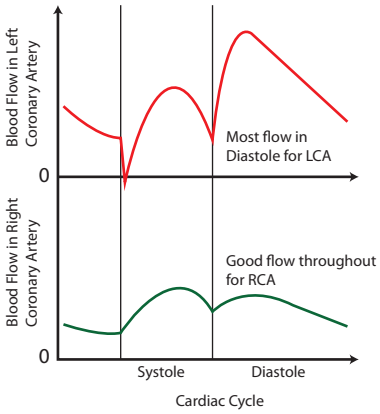


Venous system

Drains via coronary sinus

Into the right atria

30% saturation due to high extraction ratio of the heart



Coronary blood flow At rest the heart receives approximately 200-250ml per minute of blood flow which equates roughly to 5% of the total CO. Myocardial O_2 consumption is very high in the order of 8 mL O_2/min/100g of tissue which is almost 20 times that of skeletal muscle. The main determinants of myocardial oxygen demand are wall tension (30-40%), HR (15-25%), contractility (10-15%), basal metabolism (25%) and external work (10-15%). In order to achieve its high oxygen requirements the heart has two adaptations. Firstly it has a very high denisty of capillaries which enable extensive exchange opportunities. Secondly, myocardium extracts up to 75% of O_2 compared to a whole body extraction of 25%. A result of this high extraction is that blood returned via the coronary sinus and thebsian circulation has a markedly decreased PO_2. The coronary circulation has both para-sympathetic and sympathetic innervation and does demonstrate local myogenic stretch control, however it is the local metabolic control of flow that predominates especially in exercise states. This is not well understood but postulated metabolites include NO, adenosine, H^+, CO_2 and reduced O_2 tension. Mechanical aspects of the coronary blood flow are also of particular importance. Unlike most organs where driving pressure is the arterial pressure - venous pressure, in the heart the external pressure on the arteries is also considered. In this setting therefore, three pressures become important, during diastole it is the pressure at the aortic root (arterial) minus the pressure in the right artria (venous). In systole however the ventricle pressure becomes significant in a starling resistor model. It is now the pressure in the aortic root (arterial) minus the pressure in the ventricle wall (external pressure on the vessel). As a result flow will often cease in early systole in the LCA. The RCA maintains good flow due to the significantly lower ventricle wall pressures.

Christopher Andersen 2012