Coronary Blood Flow

What You Must Know

1. Coronary blood flow is approximately 250 mL/min and proceeds from the epicardium to the endocardium.
2. The heart is perfused entirely by the right and left coronary arteries.
3. Most of the venous return from the heart is through the coronary sinus, which opens directly into the right atrium.
4. A small amount of myocardial venous drainage empties directly into the cardiac chambers through the Thebesian veins.
5. During systole, myocardial contraction produces sufficient pressure to prevent perfusion. Therefore, the majority of perfusion occurs during diastole (70 – 80%).
   a. Coronary Perfusion Pressure = Diastolic Pressure – LVEDP
6. The myocardium has a very high degree of oxygen extraction (65%).
7. Myocardial oxygen demand is the most important factor determining coronary blood flow.

The coronary arteries originate from the aorta, just distal to the aortic valve. Coronary blood flow (CBF) proceeds from the epicardium to the endocardium. As a result, subendocardium receives a smaller amount of blood flow while being subjected to the highest pressures. This makes the subendocardium the most vulnerable area for ischemia. Venous return from the myocardium enters the posterior right atrium through the coronary sinus. A small amount or myocardial venous drainage empties directly into the cardiac chambers through the Thebesian veins. The drainage of the Thebesian veins contributes to the normal physiologic shunt.

During systole, the force of myocardial contraction in the left ventricle prevents myocardial perfusion. As a result, about 70 – 80% of left ventricular perfusion occurs during diastole. Coronary perfusion pressure (CPP) is calculated as:

\[ \text{CPP} = \text{Diastolic Pressure} - \text{Left Ventricular End Diastolic Pressure} \]

The myocardium has a high degree of oxygen extraction and the oxygen saturation in the coronary sinus is only about 35%. The myocardium has little ability to further extract oxygen during low-flow states.

The coronary arteries receive both sympathetic and parasympathetic innervation. However, the major determinant of coronary blood flow is myocardial oxygen consumption and coronary blood flow is tightly coupled to myocardial oxygen demand. At rest, coronary blood flow is approximately 250 mL/min in the adult or about 5% of cardiac output.

Additional Reading:

Barash, PG, Cullen, BF, Stoelting, RK, Cahalan, MK, Stock, MC, and Ortega, R. Clinical Anesthesia. Philadelphia: Lippincott Williams & Wilkins, 2013:244