**The Cardiac Cycle**

The cardiac cycle is the sequence of events that occur in the heart from the beginning of one heartbeat to the beginning of the next. It consists of a coordinated series of contractions and relaxations of the heart chambers that ensure the continuous flow of blood throughout the body. The cardiac cycle can be divided into three main phases: atrial systole, ventricular systole, and diastole.

1. Atrial Systole

Atrial systole is the first phase of the cardiac cycle. During this phase, the atria contract, pushing blood into the ventricles. This contraction is triggered by an electrical impulse from the sinoatrial (SA) node, often referred to as the heart's natural pacemaker. The increased pressure in the atria forces the atrioventricular (AV) valves (the mitral and tricuspid valves) to open, allowing blood to flow from the atria into the ventricles.

2. Ventricular Systole

Ventricular systole is the second phase and can be further divided into two stages: contraction and ejection.

• Contraction: At the start of ventricular systole, the ventricles begin to contract with all valves closed. This causes the pressure within the ventricles to rise sharply without any change in blood volume.

• Ejection: Once the pressure in the ventricles exceeds the pressure in the arteries, the semilunar valves (the aortic and pulmonary valves) open. Blood is then ejected from the right ventricle into the pulmonary artery and from the left ventricle into the aorta. This phase ends when the ventricles begin to relax and the pressure within them falls below the pressure in the arteries, causing the semilunar valves to close.

3. Diastole

Diastole is the final phase, involving the relaxation of the heart chambers, and it too can be subdivided into two stages: relaxation and filling.

• Relaxation: Following ventricular ejection, the ventricles relax, causing the pressure within them to drop. During this brief period, all heart valves are closed, and no blood enters or leaves the ventricles.

• Filling: As the ventricles continue to relax, the pressure within them drops below the pressure in the atria. This causes the AV valves to open, allowing blood to flow passively from the atria into the ventricles. This passive filling is followed by the atrial systole, which tops off the ventricular volume with any remaining blood from the atria, completing the cycle.

Pressure and Volume Changes

Throughout the cardiac cycle, there are significant changes in the pressures and volumes within the heart chambers. During systole, the contraction of the heart muscles leads to increased pressure and ejection of blood. During diastole, the relaxation of the heart muscles allows the chambers to refill with blood.

Understanding the cardiac cycle is crucial for comprehending how the heart functions as a pump to maintain efficient circulation, delivering oxygen and nutrients to tissues while removing waste products.

This cycle, repeating approximately 70-75 times per minute in a healthy adult at rest, ensures the continuous and efficient flow of blood throughout the body, adapting to the varying demands of different physiological conditions.

