Intra-Aortic Balloon Pumping

**Description:**
- The intra-aortic balloon is a volume displacement device that is inserted into the femoral artery either by cutdown or by introducer and positioned in the aorta 1 - 2 cm distal to the subclavian artery.
- With the patient’s EKG or arterial pressure wave as a signal, the pump is timed to inflate and deflate (usually with helium as the gas) in synchrony with the cardiac cycle, inflating during diastole, deflating in systole.

**Effects of the Balloon:**

1. **Inflated during Diastole**
   - Rapid inflation is set to occur at the beginning of diastole, when 75 - 90% of coronary artery perfusion occurs.
   - By raising root pressure early in diastole, balloon inflation increases coronary artery perfusion & myocardial O₂ supply.
   - Balloon inflation also increases perfusion pressure below the balloon, thus increasing forward flow, peripheral perfusion, and peripheral blood pressure.
   - The increase in early diastolic pressure is called “diastolic augmentation.”
   - Diastole begins with the closure of the aortic valve, which creates the dicrotic notch on the arterial wave. The dicrotic notch is the best marker for timing balloon inflation.

2. **Deflated during Systole**
   - Rapid deflation is set to occur at the end of diastole, during isovolumetric contraction (all cardiac valves are closed).
   - Deflation reduces end-diastolic pressure in the aortic root.
   - When the aortic valve opens at the beginning of systole, the left ventricle sees less pressure against which to eject.
   - Decreased end-diastolic pressure reduces ventricular afterload, heart work, and myocardial O₂ demand, resulting in improved:
     - Stroke volume
     - Cardiac output
     - Blood pressure
     - O₂ delivery to tissue.
   - The end of diastole and the beginning of systole is marked by the beginning of the upslope of the arterial wave.