

Q8 Describe the factors that affect the output of the right ventricle (March 2011)

Like the left ventricle, the output of the right ventricle depends on heart rate and stroke volume ($CO = HR \times SV$).

HR is dependent on cardiac pacemaker cell function.

SV, like in the LV, will be dependent on preload, afterload and contractility.

- PRELOAD
 - The end diastolic volume, which depends on intravascular volume status, ventricular relaxation, ventricular chamber compliance, heart rate, passive and active atrial characteristics, LV filling, and pericardial constraint
 - Preload of the ventricles also depends on the functionality of the tricuspid valve (ie, a stenosed valve will lead to a reduction in preload)

- AFTERLOAD
 - The pressure against which the RV has to empty at the end of diastole. The main factors governing this are:
 - Pulmonary valve functionality – stenosis will increase afterload
 - Pulmonary artery pressure PAP, or pulmonary vascular resistance PVR. Normally PAP is 25/10mmHg. Factors affecting PVR:
 - At higher vascular pressures, the vessels compensate by recruiting closed capillaries or distending open capillaries such that the pressure falls
 - PVR increases at high and low lung volumes (because vessels are held open by the radial traction of the surrounding lung parenchyma; at very low volumes many capillaries collapse, and at high volumes they are compressed by the expanded lung tissue)
 - PVR increases with alveolar hypoxia (hypoxic pulmonary vasoconstriction)

- CONTRACTILITY
 - Will depend on the functionality of the RV myocytes and levels of intracellular calcium available to participate in excitation-contraction coupling

The right ventricle pumps the same stroke volume as the left ventricle (because they are arranged in series) but with $\approx 25\%$ of the stroke work because of the low resistance of the pulmonary vasculature. Therefore, by virtue of the Laplace relationship, the right ventricle is more thin walled and compliant. Hence it is very sensitive to changes in RV preload and afterload.

Other factors affecting RV output include:

- HEART RHYTHM → as with the LV, arrhythmia may affect RV filling through loss of the atrial kick
- SYNCHRONY OF VENTRICULAR CONTRACTION → RV dyssynchrony refers to the concept of suboptimal coordination of RV mechanical function.
- VENTRICULAR INTERDEPENDENCE → refers to the concept that size, shape and compliance of the LV may affect those factors in the RV through direct mechanical interaction. Ventricular interdependence is most apparent with changes in loading conditions such as respiration or sudden postural change