

## Hemodynamic Parameters

Parameter	Calculation	Normal Value	Definition
Mean Arterial Pressure (MAP)	$\frac{SBP + (DBP \times 2)}{3}$ DBP + 1/3 pulse pressure	70-105 mmHg	
CVP		0-8 mmHg	Reflects filling pressure of RV and mean pressure of systemic veins (i.e., venous return)
PAP		<u>15-25 mmHg</u> 6-12 mmHg	Reflects RV afterload LV preload
Mean PA pressure	$\frac{PAS + (PAD \times 2)}{3}$	9-16 mmHg	
PCWP		5-12 mmHg	Reflects filling pressure of LV if no obstruction exists between catheter balloon tip and LV (i.e., mitral stenosis)
Stroke volume	$\frac{CO \times 1000}{HR}$	60-135 ml/beat	Volume of blood ejected from the ventricle per beat

Parameter	Calculation	Normal Value	Definition
Cardiac Output (CO)	Stroke volume x HR	4-8 L/min	Blood ejected from the heart into systemic circulation per minute
Cardiac Index (CI)	CO/BSA SVI x HR	2.5 - 4.0 L/min	CO adjusted for body size
Pulmonary Vascular Resistance (PVR)	$\frac{(PAM-PCWP) \times 80}{CO}$	155-255 dyn/sec/cm-5	Resistance to RV ejection offered by pulmonary pressure. Reflects RV afterload.
Systemic Vascular Resistance (SVR)	$\frac{(MAP - CVP) \times 80}{CO}$	800-1200 dyn/sec/cm-5	Resistance to LV ejection offered by aortic pressure. Reflects LV afterload.
Right Ventricular Stroke Work	SVI x (MPAP-CVP) x 0.0136	range: 7-12 g.M/m <sup>2</sup>	Force generated by the ventricle x volume ejected from the ventricle: How well the ventricles are contracting.
Left Ventricular Stroke Work	SVI x (MAP-PAOP) x 0.0136	range: 43-61 g.M/m <sup>2</sup>	

	CVP	PA	PCWP
Causes of ↓ pressure	Hypovolemia Venodilation ↓ venous return	Hypovolemia Venodilation ↓ venous return	Hypovolemia Venodilation ↓ venous return
Causes of ↑ pressure	Hypervolemia Impedance to RA emptying: <ul style="list-style-type: none"> <li>• Tricuspid stenosis</li> <li>• RV failure</li> <li>• Pulmonic stenosis</li> <li>• Pulmonary HTN</li> <li>• Mitral stenosis</li> <li>• LV failure</li> <li>• Aortic stenosis</li> <li>• Pericardial tamponade</li> <li>• ↑SVR, systemic HTN</li> </ul> ↑ intrathoracic pressure <ul style="list-style-type: none"> <li>• PEEP</li> <li>• Tension pneumo</li> </ul>	Hypervolemia Hypoxic pulmonary vasoconstriction Impedance to pulmonary blood flow: <ul style="list-style-type: none"> <li>• Interstitial pulmonary edema</li> <li>• Mitral stenosis / regurg</li> <li>• LV failure</li> <li>• Aortic stenosis</li> <li>• Pericardial tamponade</li> <li>• ↑SVR, systemic HTN</li> </ul> ↑ Intrathoracic pressure <ul style="list-style-type: none"> <li>• PEEP</li> <li>• Tension pneumo</li> </ul>	Hypervolemia Impedance to LA emptying: <ul style="list-style-type: none"> <li>• Mitral stenosis / regurg</li> <li>• LV failure</li> <li>• Aortic stenosis</li> <li>• Pericardial tamponade</li> <li>• Systemic HTN, ↑SVR</li> </ul> ↑ Intrathoracic pressure <ul style="list-style-type: none"> <li>• PEEP</li> <li>• Tension pneumo</li> </ul>