Edwards Clinical Education

Normal Hemodynamic Parameters and Laboratory Values

Normal hemodynamic parameters

Parameter	Equation	Normal range
Arterial Blood Pressure (BP)	Systolic (SBP) Diastolic (DBP)	90-140 mmHg 60-90 mmHg
Mean Arterial Pressure (MAP)	[SBP + (2 x DBP)]/3	70-105 mmHg
Right Atrial Pressure (RAP) Central Venous Pressure (CVP)		2-6 mmHg (CVP normal range is equivalent to RAP)
Right Ventricular Pressure (RVP)	Systolic (RVSP) Diastolic (RVDP)	15-25 mmHg 0-8 mmHg
Pulmonary Artery Pressure (PAP)	Systolic (PASP) Diastolic (PADP)	15-25 mmHg 8-15 mmHg
Mean Pulmonary Artery Pressure (MPAP)	[PASP + (2 x PADP)]/3	10-20 mmHg
Pulmonary Artery Occlusion Pressure (PAOP)		6-12 mmHg
Left Atrial Pressure (LAP)		6-12 mmHg
Cardiac Output (CO)	HR x SV/1000	4-8 L/min
Cardiac Index (CI)	CO/BSA	2.5-4 L/min/m^2
Stroke Volume (SV)	CO/HR x 1000	60-100 mL/beat
Stroke Volume Index (SVI)	CI/HR x 1000	33-47 mL/m^2/beat
Stroke Volume Variation (SVV)	100x(SVmax-SVmin)/mean (SV)	<10-15%
Systemic Vascular Resistance (SVR)	MAP-RAPx80/CO	800-1200 dynes/sec/cm^{-5}
Systemic Vascular Resistance Index (SVRI)	MAP-RAPx80/CI	1970-2390 dynes/sec/cm^{-5}/m^2
Pulmonary Vascular Resistance (PVR)	MPAP-PAOPx80/CO	100-250 dynes/sec/cm^{-5}
Pulmonary Vascular Resistance Index (PVRI)	MPAP-PAOPx80/CI	255-285 dynes/sec/cm^{-5}/m^2

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Additional hemodynamic parameters

Parameter	Equation	Normal range
Cardiac Power Index (CPI)	MAP x CI x 0.0022	0.5-0.7 W/m^2
Coronary Artery Perfusion Pressure (CPP)	Diastolic BP-PAOP	60-80 mmHg
Right Ventricular End-Diastolic Volume (RVEDV)	SV/EF	100-160 mL
Right Ventricular End-Diastolic Volume Index (RVEDVI)	RVEDV/1.7	59-94 mL/m^2
Right Ventricular End-Systolic Volume (RVESV)	EDV-SV	50-100 mL
Right Ventricular Ejection Fraction (RVEF)	SV/EDV	40-60%
Left Ventricular Stroke Work Index (LVSWI)	SVI x (MAP - PAOP) x 0.0136	50-62 g-m/m^2/beat
Right Ventricular Stroke Work Index (RVSWI)	SVI x (MPAP - RAP) x 0.0136	5-10 g-m/m^2/beat

Normal oxygenation parameters

Parameter	Equation	Normal range
Arterial Oxygen Saturation (SaO_2)		95-100%
Mixed Venous Saturation (SvO_2)		60-80%
Cerebral Tissue Oxygen Saturation (StO_2)		60-80%
Arterial Oxygen Content (CaO_2)	$(0.0138xHbxSaO_2) + (0.0031xPaO_2)$	17-20 mL/dL
Venous Oxygen Content (CvO_2)	$(0.0138xHbxSvO_2) + (0.0031xPvO_2)$	12-15 mL/dL
A- V Oxygen Content Difference [$C(a\text{-}v)O_2$]	$CaO_2 - CvO_2$	4-6 mL/dL
Oxygen Delivery (DO_2)	CaO_2 x CO x 10	950-1150 mL/min
Oxygen Delivery Index (DO_2I)	CaO_2 x CI x 10	500-600 mL/min/m^2
Oxygen Consumption (VO_2)	$C(a\text{-}v)O_2$ x CO x 10	200-250 mL/min/m^2
Oxygen Consumption Index (VO_2I)	$C(a\text{-}v)O_2$ x CI x 10	120-160 mL/min/m^2
Oxygen Extraction Ratio (O_2ER)	$[(CaO_2\text{-}CvO_2)/CaO_2]x100$	22-30%
Oxygen Extraction Index (O_2EI)	$[(SaO_2\text{-}SvO_2)/SaO_2]x100$	20-25%

Acumen HPI software parameters

- The HPI parameter displays as a value ranging from 0 to 100, with higher values indicating higher likelihood of hypotension
- The HPI value is updated every 20 seconds
- If the HPI parameter value exceeds 85, an auditory alarm will sound; if the HPI parameter exceeds 85 for two consecutive readings or reaches 100 at any time, the HPI high alert popup will appear, prompting you to review the patient hemodynamics using the HPI secondary screen

Acumen Hypotension Prediction Index (HPI) parameter

Ea$_{dyn}$
Dynamic arterial elastance
A measure of the afterload to the left ventricle by the arterial system, relative to the left ventricular elastance
The ratio of PPV : SVV

SVV | PPV*
Stroke volume variation
Pulse pressure variation
The percentage difference between minimum and maximum stroke volume (SV) or pulse pressure (PP) during a respiratory cycle

dP/dt
Systolic slope
Maximum upslope of the arterial pressure waveform from a peripheral artery

*ΔSV can be used when appropriate

Normal blood laboratory values

Test	Convention units (reference values*)	SI units
Hematocrit (Hct)	Males: 41-50% Females: 35-45%	0.41-0.50 0.35-0.45
Hemoglobin (Hgb)	Males: 13.5-17.5 g/dL Females: 12.0-15.5 g/dL	135-175 g/L 120-155 g/L
Lactate	0.93-1.65 mEq/L	0.93-1.65 mmol/L

SI Units = International Units
**Reference Values vary by regional laboratory techniques and methods.*

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