

## Normal Values and Estimated Risk Thresholds

**Remember Risk Thresholds are estimates & will vary for different procedures and will evolve as perioperative care evolves eg change in surgical technique and so are NOT fixed**

Variable and Units	Normal Value							Abnormal/Associated with risk (approximates for risk)
VO <sub>2</sub> peak (ml/kg/min) Cycle ergometry Nb treadmill approx. 10% higher than cycle ergometer	Age	20-29	30-39	40-49	50-59	60-69	>70	<ul style="list-style-type: none"> <li>&lt; 15ml/kg/min associated with increased perioperative risk</li> <li>&lt; 10 ml/kg/min very high risk</li> </ul>
		yrs	yrs	yrs	yrs	yrs	yrs	
	M	42.0	30.8	28.0	26.1	22.9	21	
F	30.8	22.2	20.1	18	16.6	16		
AT (ml/kg/min)	<ul style="list-style-type: none"> <li>15-25ml/kg/min</li> <li>Patients normal range 40-60%</li> <li>Normal range 40-80% of VO<sub>2</sub>peak</li> </ul>							<ul style="list-style-type: none"> <li>&lt; 9-10 associated with increased perioperative risk</li> </ul>
VO <sub>2</sub> /WR (ml/min/watt)	<ul style="list-style-type: none"> <li>10 ml/min/watt</li> <li>Normal range 9-12</li> </ul>							<ul style="list-style-type: none"> <li>&lt;9 abnormal (only linear portion of slope)</li> <li>↓ Gradient suggests impaired dynamic ventricular function</li> <li>Abrupt change in gdnt suggests sudden impaired CO – ischaemia/arrhythmia/aortic stenosis/HOCUM</li> </ul>
Peak HR (bpm)	<ul style="list-style-type: none"> <li>220-age</li> <li>Normal is 90% of predicted +/- 15bpm</li> </ul>							<ul style="list-style-type: none"> <li>Note standard deviation 20-30</li> </ul>
Peak Oxygen Pulse (ml/bt)	<ul style="list-style-type: none"> <li>VO<sub>2</sub> = (SVxHR)(AV O<sub>2</sub> extraction ratio)</li> <li>O<sub>2</sub> pulse = VO<sub>2</sub>/HR = SV(O<sub>2</sub>extraction ratio)</li> <li>Normal &gt; 80% of predicted approx:                             <ul style="list-style-type: none"> <li>Males: 15-20</li> <li>Females: 10-15</li> </ul> </li> </ul>							<ul style="list-style-type: none"> <li>Peak O<sub>2</sub> pulse reduced in heart failure and deconditioning</li> <li>&lt; 80% predicted value is abnormal</li> <li>Early flattening of O<sub>2</sub> Pulse with ↑ HR suggests acute SV limitation – ischaemia, arrhythmia, heart failure</li> </ul>
Breathing Reserve (ml/L or % of MVV)	<ul style="list-style-type: none"> <li>25-30% of MVV</li> <li>estimate MVV from FEV1X40</li> </ul>							<ul style="list-style-type: none"> <li>&lt; 15% of MVV = ventilatory limitation – limiting resp disease</li> </ul>
VE/VCO <sub>2</sub> at AT or Minimum VE/VCO <sub>2</sub>	<ul style="list-style-type: none"> <li>23-34</li> <li>Increases with age to max 32</li> </ul>							<ul style="list-style-type: none"> <li>&gt; 34 abnormal &amp; associated with ↑ perioperative risk (heart failure/respiratory disease)</li> </ul>
VE/VCO <sub>2</sub> slope	<ul style="list-style-type: none"> <li>25 in young</li> <li>Increases with age to max 32</li> <li>Gradient – exc kinetic phase &amp; above RCP</li> </ul>							<ul style="list-style-type: none"> <li>&gt; 35 associated with V/Q mismatch – heart failure, pulmonary hypertenstion, respiratory disease</li> <li>↑perioperative risk in thoracics &gt; 35</li> </ul>
Resp Rate (bpm)	<ul style="list-style-type: none"> <li>8-12 rest</li> </ul>							
Rest ETO <sub>2</sub> (mmHg)	<ul style="list-style-type: none"> <li>90-110 mmHg, Increases above AT</li> </ul>							
Rest ETCO <sub>2</sub> (mmHg)	<ul style="list-style-type: none"> <li>35-42 mmHg,</li> <li>Decreases above AT</li> </ul>							<ul style="list-style-type: none"> <li>Low resting values in acute hyperventilation, heart failure and LV</li> </ul>
Rest RER	<ul style="list-style-type: none"> <li>0.7-1.0</li> </ul>							<ul style="list-style-type: none"> <li>&lt; 0.7 ? calibration. &gt; 1.0 ? hyperventilation</li> </ul>
Peak RER	<ul style="list-style-type: none"> <li>&gt; 1.15</li> </ul>							<ul style="list-style-type: none"> <li>&gt; 1.15 suggests physiologically maximal effort</li> </ul>

