Q16 Discuss the factors affecting pulmonary vascular resistance (Sept 2009)

Pulmonary Vascular Resistance – resistance to flow through the pulmonary vasculature.

The factors contributing to changes in PVR include:

1. **RECRUITMENT AND DISTENTION →** PBF can adapt to large changes in CO with only small increases in PVR, due to recruitment of previously underperfused pulmonary vessels and distension of the entire pulmonary vasculature.

2. **LUNG VOLUMES →** At low lung volumes compression of the extra-alveolar vessels increases PVR; at high lung volumes the intra-veolar vessels are compressed → the least resistance is at FRC.

3. **GRAVITY AND WEST’S ZONES OF THE LUNG →**
   - In Zone 1 the PAP is just sufficient to raise blood to the apex of the lung. Any increase in alveolar pressure (e.g. PEEP) or decrease in precapillary pressure (e.g. hypotension due to haemorrhage) will cause the alveolar pressure to exceed the precapillary pressure → no flow. \( PA > Pa > Pv \)
   - In Zone 2, PAP increases because of the hydrostatic effect and now exceeds alveolar pressure. Blood flow is determined by arterial – alveolar pressure differences. \( Pa > PA > Pv \)
   - In Zone 3, venous pressure exceeds alveolar pressure. \( Pa > Pv > PA \) West’s Respiratory Physiology 9th Ed

   - **A Zone 4 is sometimes referred to where an increase in extra alveolar vessel pressures due to gravity increases resistance. Hence at the very base there is a reduction in flow compared to zone 3.**

4. **AUTONOMIC INFLUENCE →** Alpha adrenergic stimulation → vasoconstriction, beta-adrenergic stimulation → vasodilatation, cholinergic stimulation → vasodilatation

5. **METABOLIC CONTROL →** local vasodilators (NO, prostacyclin) and vasoconstrictors (serotonin, histamine, noradrenaline, hypercapnoea)

6. **HYPOXIC PULMONARY VASOCONSTRICTION →** basal NO synthesis is inhibited in the presence of low PAO2 and results in vasoconstriction

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