

JULY 2007  
QUESTION 1

Explain how oxygen supply is maintained to the tissues in chronic anaemia

Definition: Anaemia is a decrease in circulating red blood cells due to increased destruction, blood loss or reduced production.

WHO Hb levels      Men < 130 g/L      Women < 120 g/L  
Chronic > 3 months

Compensation:      Kidney 90% (and liver 10%) sense decreased tissue oxygenation  
release EPO which increases RBC production

Oxygen supply :      Oxygen delivery  
Oxygen extraction

Oxygen delivery:      Equation       $DO_2 = CO(\text{Sats} \times \text{Hb} \times 1.34 + \text{dissolved } O_2)$   
Normal      1000ml (20ml per 100ml)

Compensation:      When the Hb is decreased the other factors will generally increase.

Cardiac output = HR x SV

HR is variable (increased demand vrs output benefit)

SV determined by preload, afterload and contractility

Improvements in CO are driven by SV

Increased circulating volume and venous return increase preload

Decreased blood viscosity (due to decreased Hb) improves afterload

Contractility is generally increased (except in IHD) via sympathetic outflow

Saturations are usually not significantly changed due O<sub>2</sub>-Hb curve shift

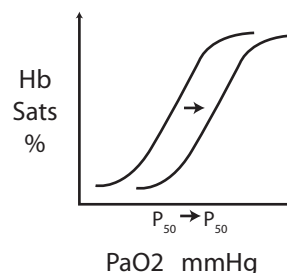
Dissolved O<sub>2</sub> is minor and unchanged - Henry's law

Oxygen extraction:      % O<sub>2</sub> removed at tissues

Equation       $100(1 - \text{MV } O_2 \text{ content} / \text{Arterial } O_2 \text{ content})$

Determined by Hb-O<sub>2</sub> curve,

Right shift increases extraction at the tissues, loading at lungs min affected (flat curve)



Compensation:      Increased levels of 2,3 DPG are the main adaptation

Other adaptations:      Cardiac output is redistributed towards the brain/heart over the splanchnic