

## Q17 Describe the physiological consequences of positive end expiratory pressure (March 2009)

Positive end expiratory pressure – the application of positive pressure to expiration such that the airways pressure never reaches zero. Usual value applied to 5-10cmH<sub>2</sub>O. Intrinsic PEEP can occur in patients with lung disease when they fail to fully expire, resulting in 'gas trapping' within the lungs and an increase in intrathoracic pressure.

### CVS consequences

- In the healthy heart:
  - RV – reduction in preload due to positive intrathoracic pressure (ITP) reducing venous return. Increase in afterload due to increased airway pressure increasing PVR
  - LV – reduction in preload due to reduction in RV preload. Reduction in afterload due to reduction in transmural pressure (as per Laplace,  $T = P_{TM} \times r / u$ , where  $P_{TM}$  = intraventricular pressure – intrapleural pressure,  $r$  = radius and  $u$  = wall thickness). Some increase in afterload as positive ITP is also transmitted to aorta, but overall effect is a reduction in afterload, hence a reduction in cardiac output
- In the CCF heart:
  - RV – reduction in preload may push the heart to a more favourable part of the Starling curve (as myocytes no longer overstretched). PVR may improve if underinflated lungs are pushed to a more favourable part of the PVR/lung volume curve, hence afterload may decrease
  - LV – reduction in preload due to reduction in RV preload. Reduction in afterload as above reduces myocardial oxygen demand and also may push the overstretched LV to a better point on the Starling curve

### Respiratory consequences

- Increase in FRC → increases oxygen reservoir, reduces alveolar collapse and airways resistance (as airways held open by radial traction of surrounding parenchyma), improves compliance. Overall results in decreased work of breathing
- May worsen V/Q mismatching
- May increase alveolar dead space (especially alveoli in West's Zone 1)

### Renal consequences

- Reduction in cardiac output affects glomerular filtration pressure and results in an increase in ADH → fluid retention → oedema

### GIT consequences

- Increase in ITP causes venous congestion in the liver → hepatocyte dysfunction

### Haematological consequences

- Neutrophil sequestration in the compressed pulmonary vasculature