AORTIC CROSS CLAMPING

What are the physiological changes observed during aortic clamping (30%)
What therapeutic interventions can be undertaken to minimize these effects (20%)
What are the physiological changes does unclamping of the aorta cause? (30%)
What therapeutic interventions can be taken to minimize the effects of unclamping? (20%)

OUTLINE (5 Mins)

Physiological changes: Cross clamping
- Haemodynamic: BP, HR, SVR, PAP, Pre-load, Afterload
- Metabolic

Interventions:
- Pre-load and after load manipulation
- Renal protection
- Others

Physiological changes: Cross unclamping
- Haemodynamic: BP, HR, SVR, PAP, Pre-load, Afterload
- Metabolic

Interventions
Answer (10 Mins)

Physiological Changes: Complex and depends on many factors
- Level of cross-clamp
- Extent of CAD and myocardial function
- Degree of periaortic collateralization
- Blood volume and distribution
- Activation of the sympathetic nervous system
- Anaesthetic agents and techniques

Haemodynamic Changes:
- ↑Central venous pressure
- ↑Pulmonary occlusion pressure
- ↑Left ventricular wall tension
- ↑Segmental wall motion abnormalities
- ↓Ejection fraction
- ↓Cardiac output
- ↑Arterial blood pressure
- ↑Coronary blood flow
- ↓Renal blood flow
Metabolic Changes:
- No blood flow to the lower part of the body
  - $\downarrow$ Total body oxygen consumption
– ↓Total body oxygen extraction
– ↑Mixed venous oxygen saturation
– ↓Total body carbon dioxide production
– Metabolic acidosis

• ↑Epinephrine and norepinephrine
• Respiratory alkalosis

**Therapeutic Interventions:**

- Afterload reduction
  – Sodium nitroprusside
  – Inhalational anesthetics
  – Amrinone
  – Shunts
  – Aorta-to-femoral bypass

- Preload reduction
  – Nitroglycerin
  – Controlled phlebotomy
  – Atrial-to-femoral bypass

- Renal protection
  – Fluid administration
  – Distal aortic perfusion techniques
  – Mannitol
  – Drugs to augment renal perfusion (Fenoldopam)
• Other changes
  – Hypothermia
  – ↓ Minute ventilation
  – Sodium bicarbonate

**AORTIC UNCLAMPING: Physiological changes**
Haemodynamic

- ↓Myocardial contractility
- ↑Pulmonary artery pressure
- ↓Central venous pressure
- ↓Venous return
- ↓Cardiac output
- ↓Arterial blood pressure

Metabolic:

Re-perfusion:

- ↑Total-body oxygen consumption
- ↓Mixed venous oxygen saturation

- ↑Prostaglandins
• ↑Activated complement
• ↑Myocardial-depressant factors

• ↓Temperature
• ↑Lactate
• Metabolic acidosis

THERAPEUTIC INTERVENTIONS:

• ↓Inhaled anesthetics
• ↓Vasodilators

• ↑Fluid administration
• ↑Vasoconstrictor drugs
• Reapply cross-clamp for severe hypotension

• Consider mannitol
• Consider sodium bicarbonate