Cardiac anesthesia and intensive care

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Cardiac anesthesia

Anesthesia and intensive care

Cardiac anesthesia

Cardiac intensive care

Cardiac procedures - anesthesia

- Cardiac surgical procedures:
  - coronaries, valves, septal defects
  - aorta
  - pericardial diseases (fluid, tumor)
  - transplant
  - congenital diseases
- Anesthesia – intensive therapy:
  - Patient safety
  - Ensure the conditions for surgical procedure

Preoperative assessment

- Assessment of patient's state
  - Age, gender
  - Anamnesis: previous operations, diseases, smoking, infections
  - Medications
  - Examinations: chest X-ray, abdominal US, respiratory function test, echo, carotid US, laboratory parameters
  - Possible inflammatory focuses: OL, Gynec, Urol, Dent
- Evaluate the risk of procedure

Preoperative assessment

- Risk – benefit evaluation (mortality and morbidity connetcted to procedure)
- Inform the patient

- Score systems:
  - Euroscore
  - Parsonnet score
  - Cleveland Clinic score
  - French score
  - Pons score

EUROSCORE

Score	Expected mortality
0-2 low risk	0,8%
3-5 middle risk	3%
6 - high risk	11,2%

EuroScore has the highest predictive value for mortality

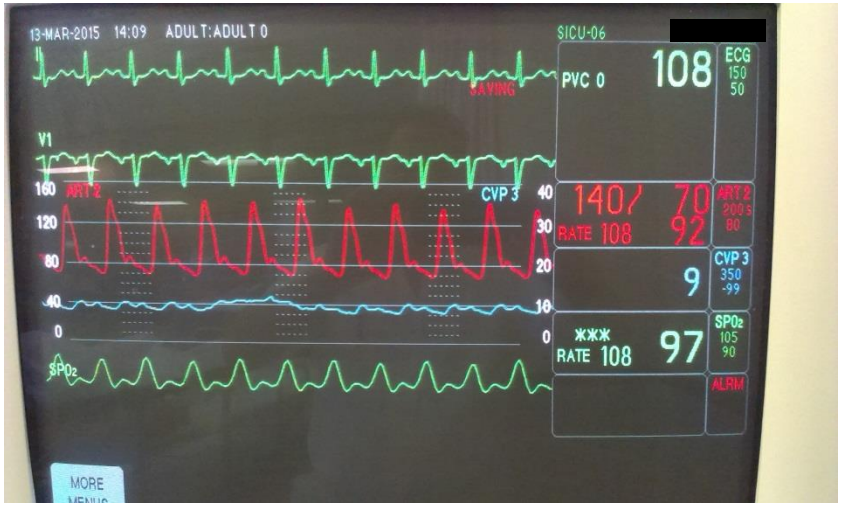
Factor	Score
Age 60-65	1
66-70	2
71-75	3
76-80	4
80<	5
Female gender	1
COPD	1
Extracard arteriopathy	2
Neurological dysfunction	2
Previous cardiac surgery	3
Creatinine > 200 µmol/l	2
Active endocarditis	3
Critical perioperative state	3
Unstable angina	2
EF 30-50%	1
EF< 30%	3
Recent myocardial infarct	2
Pulmonary pressure > 60mmHg	2
Emergency operation	2
Other than isolated CABG	2
Surgery on thoracic aorta	3
Post-infarct septal rupture	4

Anesthesia

- Patient's state – possibly complications
  - Monitoring
  - Induction of anesthesia
  - Transfusion, bleeding
  - Other complications

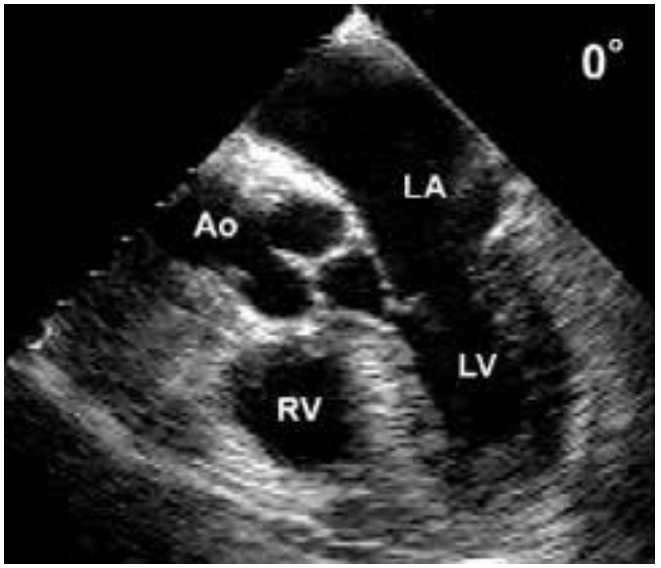
Anesthesia - Monitoring

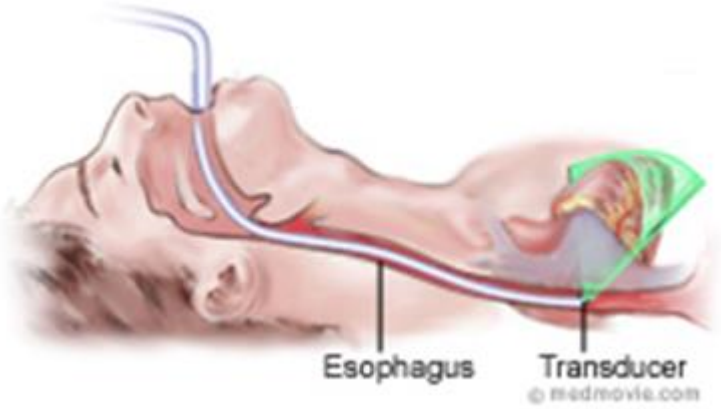
- Basic monitoring:
  - ECG,
  - Invasive BP,
  - CVP (central venous line),
  - SpO_2,
  - Urine output
  - Temperature
  - (+ large-bore periferal venous line)

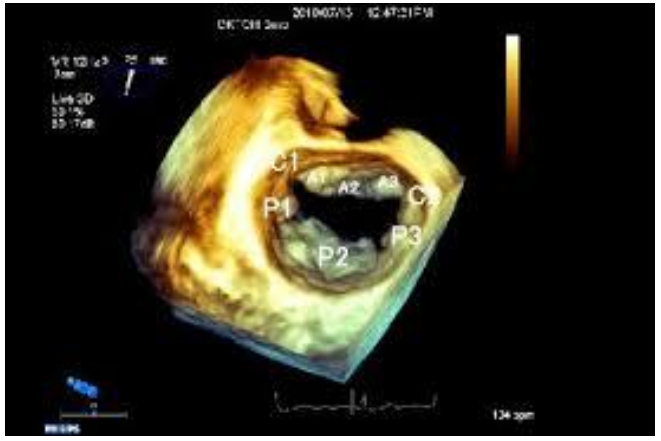


- Transoesophageal echocardiography (TOE or TEE)
- Invasive haemodynamic monitor:
  - Swan-Ganz catheter
  - PiCCO (Pulse Conture Cardiac Output)
- **N**ear **I**nfra**R**ed **S**pectroscopy, **BiS**pectral index

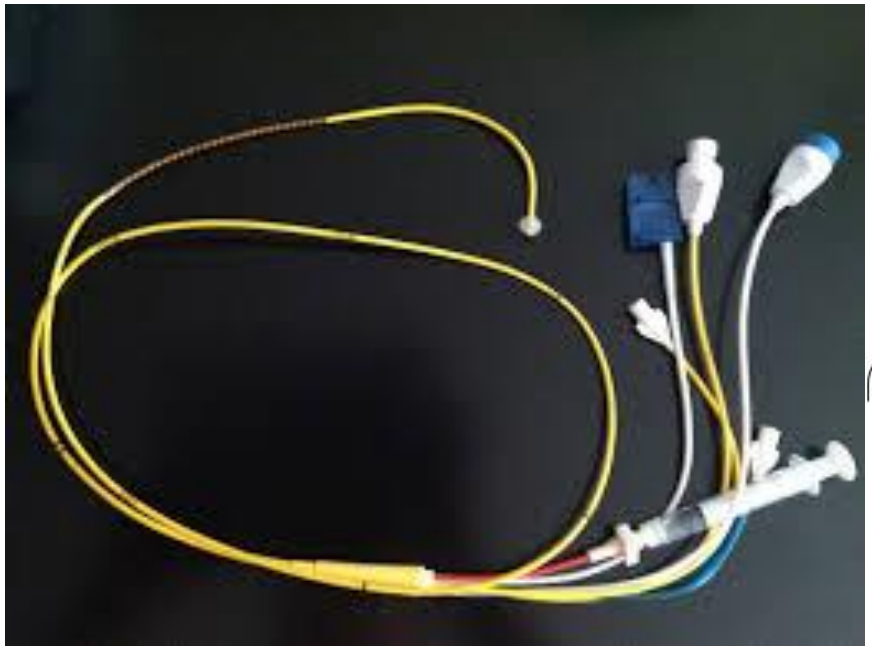
Transoesophageal echocardiography

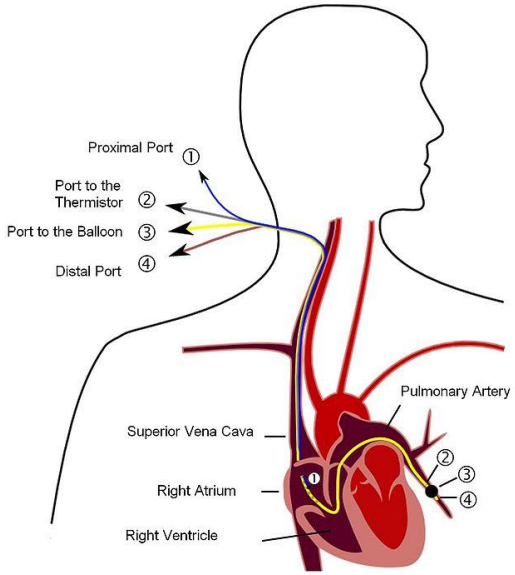


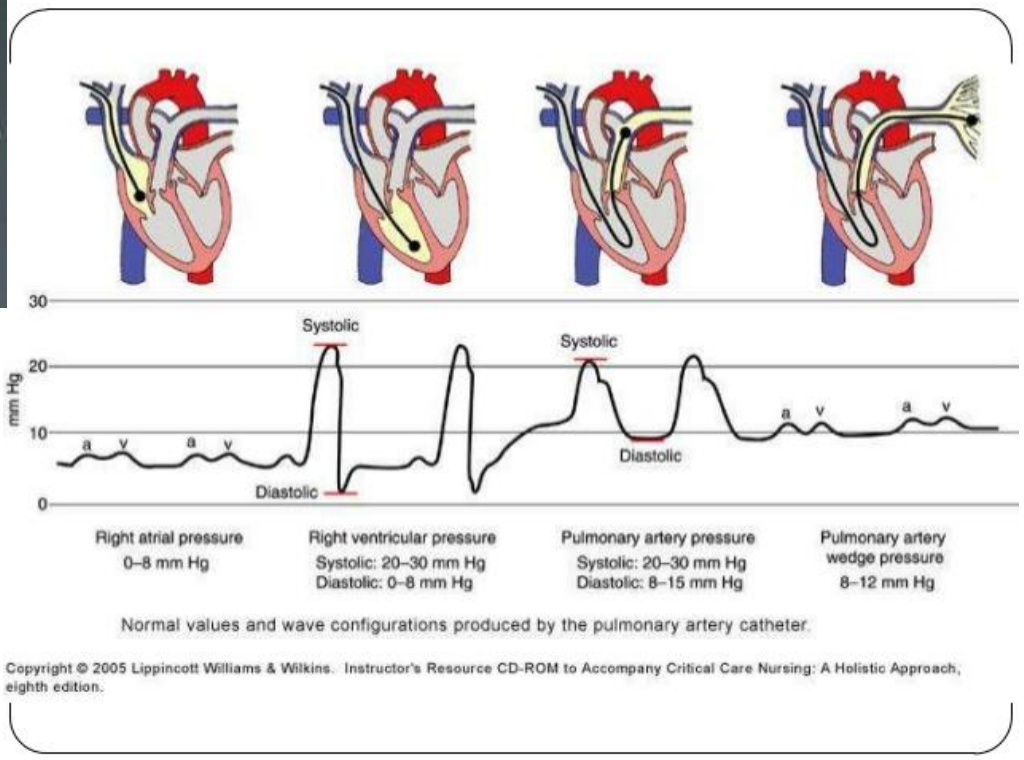




Swan-Ganz catheter



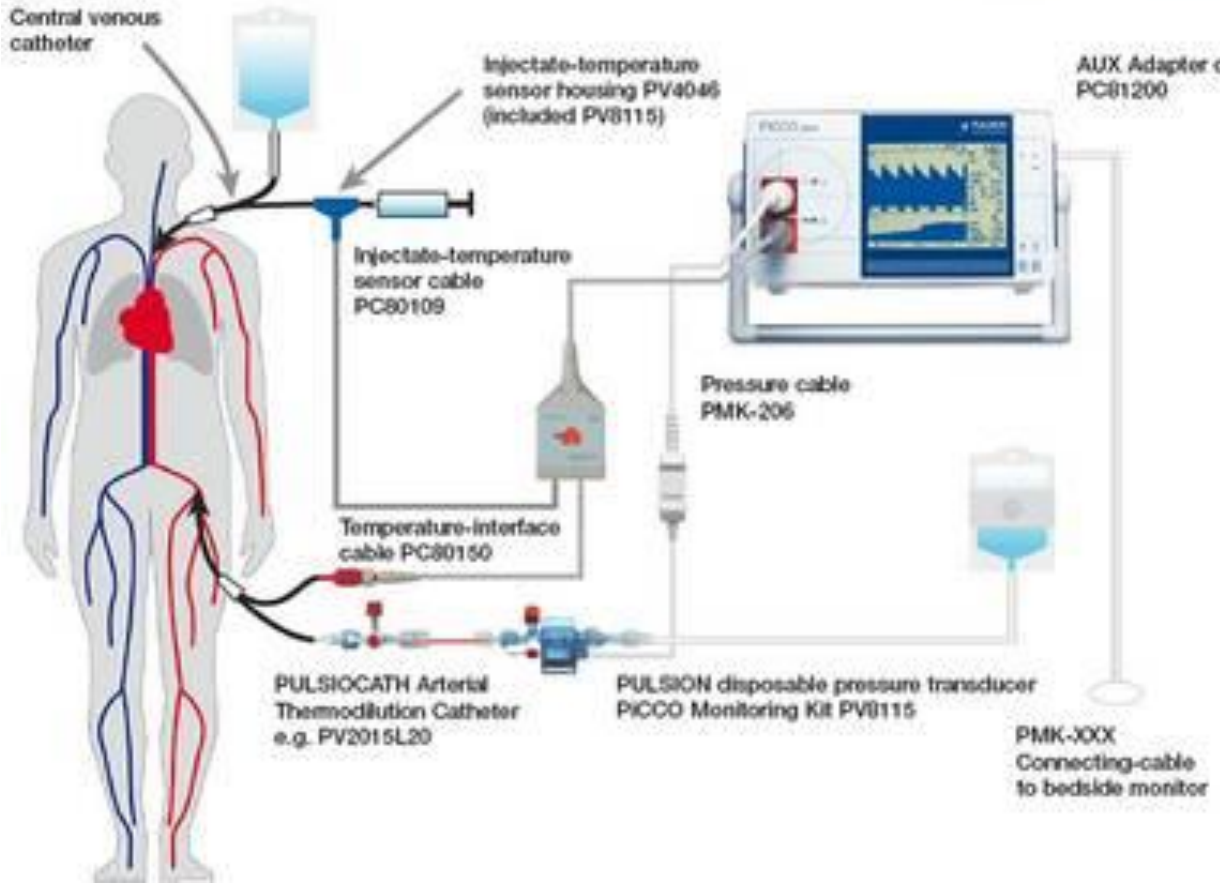




Catheter in the pulmonary artery via right heart

- Pressures : pulmonary art pressure, pulm capillary wedge press.
- Thermodilution measurement: cardiac output, vascular resistance (SVR)

PiCCO



Spec. arterial catheter + central venous line (transpulmonary technic):

- Thermodilution measurement – volumes, cardiac output, SVR, others

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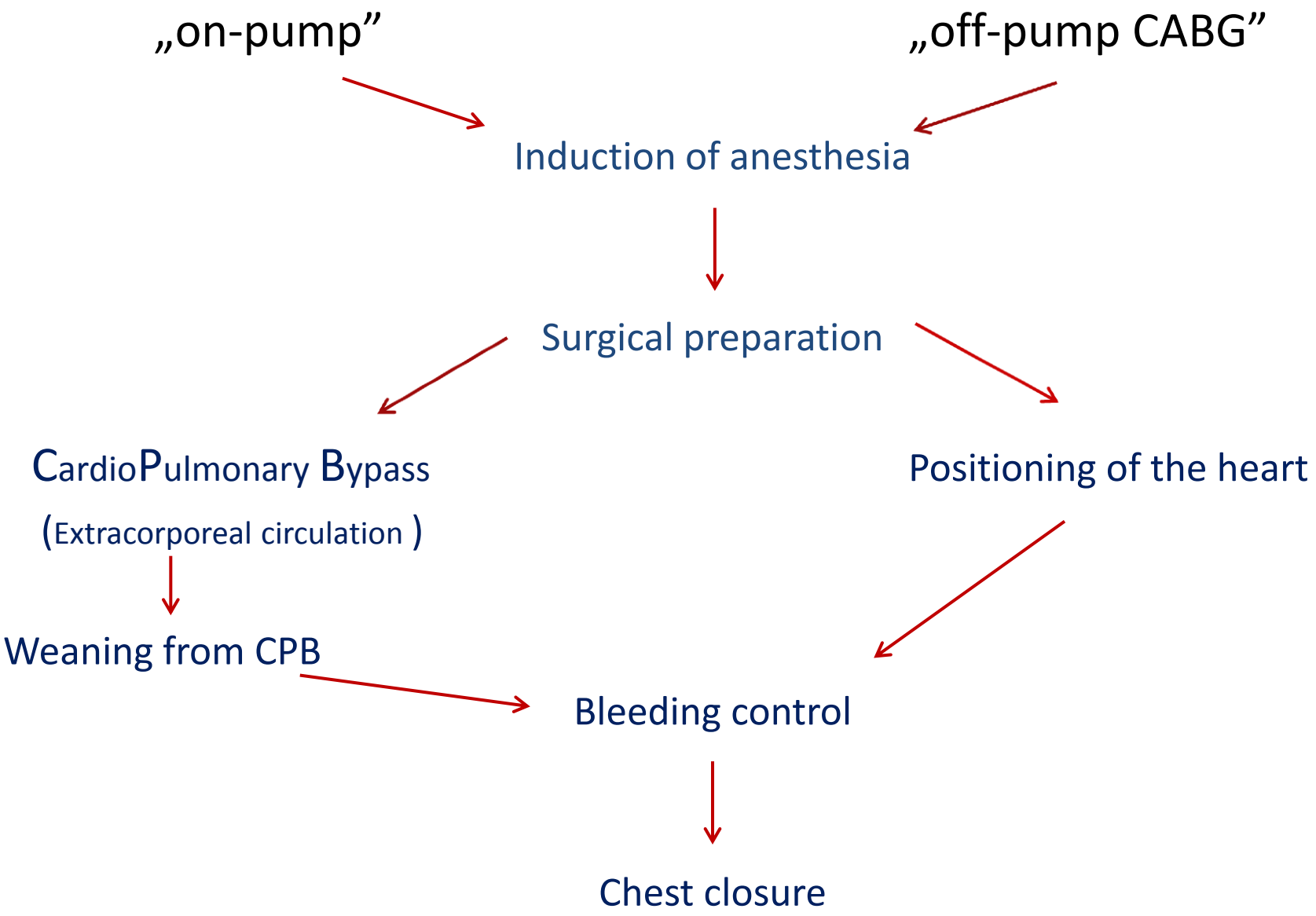
- Continuous cardiac output, SVR, others

Procedure


„on-pump”
„off-pump CABG”
Induction of anesthesia
Surgical preparation
CardioPulmonary Bypass
(Extracorporeal circulation)
Positioning of the heart
Weaning from CPB
Bleeding control
Chest closure

Anesthesia – induction, maintenance

The goal is the hemodynamic stability!!!

- Premedication: benzodiazepins
- Induction:
  - benzodiazepine, propofol, thiopental, etomidate
  - Fentanyl, sufentanyl
  - Pancuronium, rocuronium, pipecuronium, …
  - Antibiotic profilaxis
- Maintenance:
  - Propofol infusion – TIVA
  - Inhalation agents: sevoflurane, desflurane,
  - Glucose 40% + insulin – normoglycaemia
  - I.v. fluid

  } Both usable during CPB

- Mild hypotension - bleeding control

Anesthesia – cardiopulmonary bypass

- Continuous or pulsatile flow - Countered cardiac output

- Prime (fluid in the CPB machine)
- Cardioplegic solution

} Haemodilution

↓

- Activation of thrombocytes
- Heparine (300 IU/kg)

→ Coagulopathy

- Activation of inflammatory system
- Activation of complement cascade

} Systemic Inflammatory Response Syndrome (SIRS)

↓

„Normal" laboratory-parameter changes (WBC, CRP, PCT) after procedure

Anesthesia – weaning from CPB

To rebuild the patient's normal circulation

- Normalisation of metabolic state
- Normalisation of bodytemperature
- Normalisation of heart rhythm – defibrillation, pacemaker

- Gradual loading - heart takes over the pump function – pump stops

- Loading of reservoir content
  - Blood pressure control
  - Right and left ventricle function

Anesthesia – postbypass period

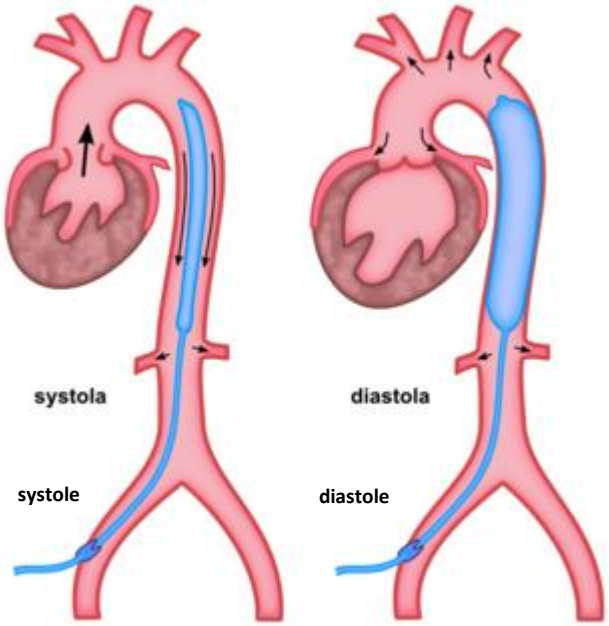
Haemodynamic stability, bleeding control

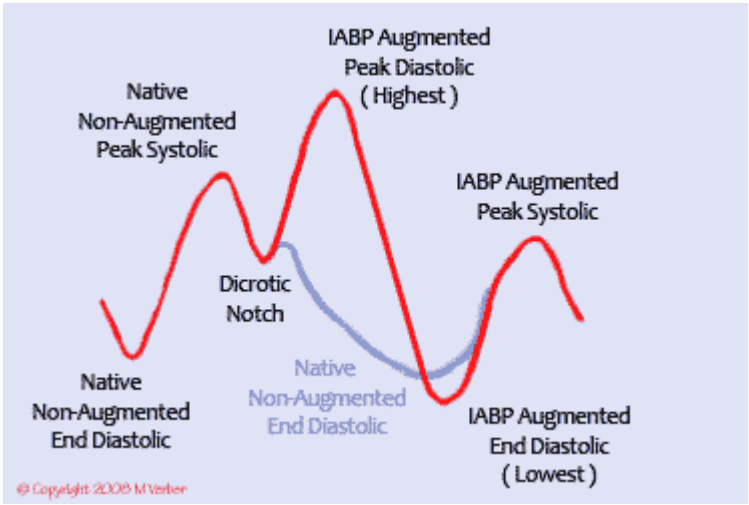
- Inotrope, vasoconstrictor
  - Low systemic vascular resistance after CPB, protamine effect
    - Vasoconstrictor: noradrenalin, phenylephrine, epinephrine
  - Left or/and right heart failure
    - Inotrope: dobutamine, milrinone, levosimendan
    - Mechanical support: IABP, ECMO

Invasive hemodynamic monitoring, TEE

Anesthesia – Mechanical circulatory support

- IntraAortic Balloon Pump
  - makes „extra” pulse wave toward coronaries and brain
  - Improves the coronary and brain circulation

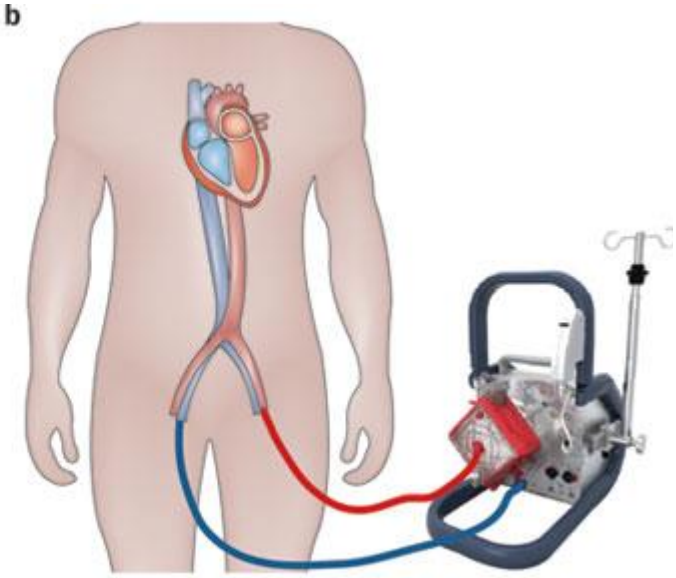


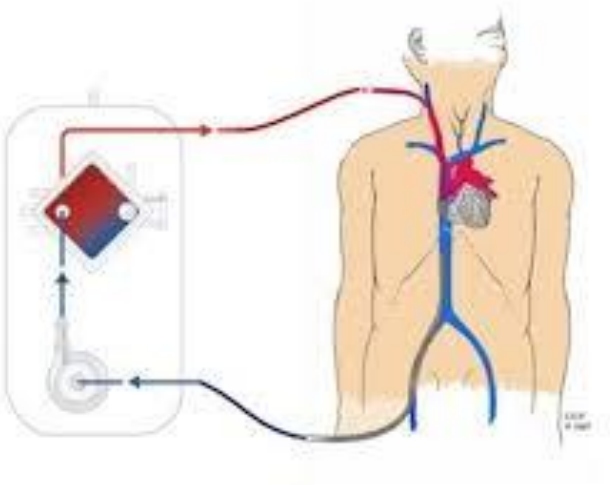


- Contraindications:
  - Severe aortic valve insufficientia
  - Aortic dissection
  - Severe aortoiliac occlusive disease

Anesthesia – Mechanical circulatory support

- ExtraCorporeal Membrane Oxygenation (ExtraCorporeal Life Support)
  - Similar to CPB used during operation
  - Veno-Arterial ECMO





Anesthesia – postbypass period

Haemodynamic stability, bleeding control

- Fliud management
  - I.v. fliuds, transfusion

- Transfusion
  - Pocked red blood cell, FFP, Tct
  - Factor concentrates (Prothombin Complex Concentrate, Fibrinogen Concentrate, Activated factor VII concentrate)
- Protamine (1:1 Heparine)

Point of Care tests
(Blood gas, Activated Clotting Time, Thrombelastography)
Laboratory tests

- Tranexamic acid – continuous infusion from start of the procedure

Postoperative Intensive Care

Patient usually is not wakened and extubated in the operating theatre

- Tasks on ICU:
  - To ensure hemodynamic stability
  - Bleeding control
  - Weaning from mechanical ventilation
  - Pain management
  - Physiotherapy

Postoperative Intensive Care

- To ensure hemodynamic stability:
  - Monitoring
  - Fluid therapy
  - Metabolic stability
  - Reduction of catecholamine dose

- Bleeding control
  - Hourly check – severe > 100 -200ml/h (bodyweight!)
  - Medical therapy (as above)
  - Surgery - reoperation

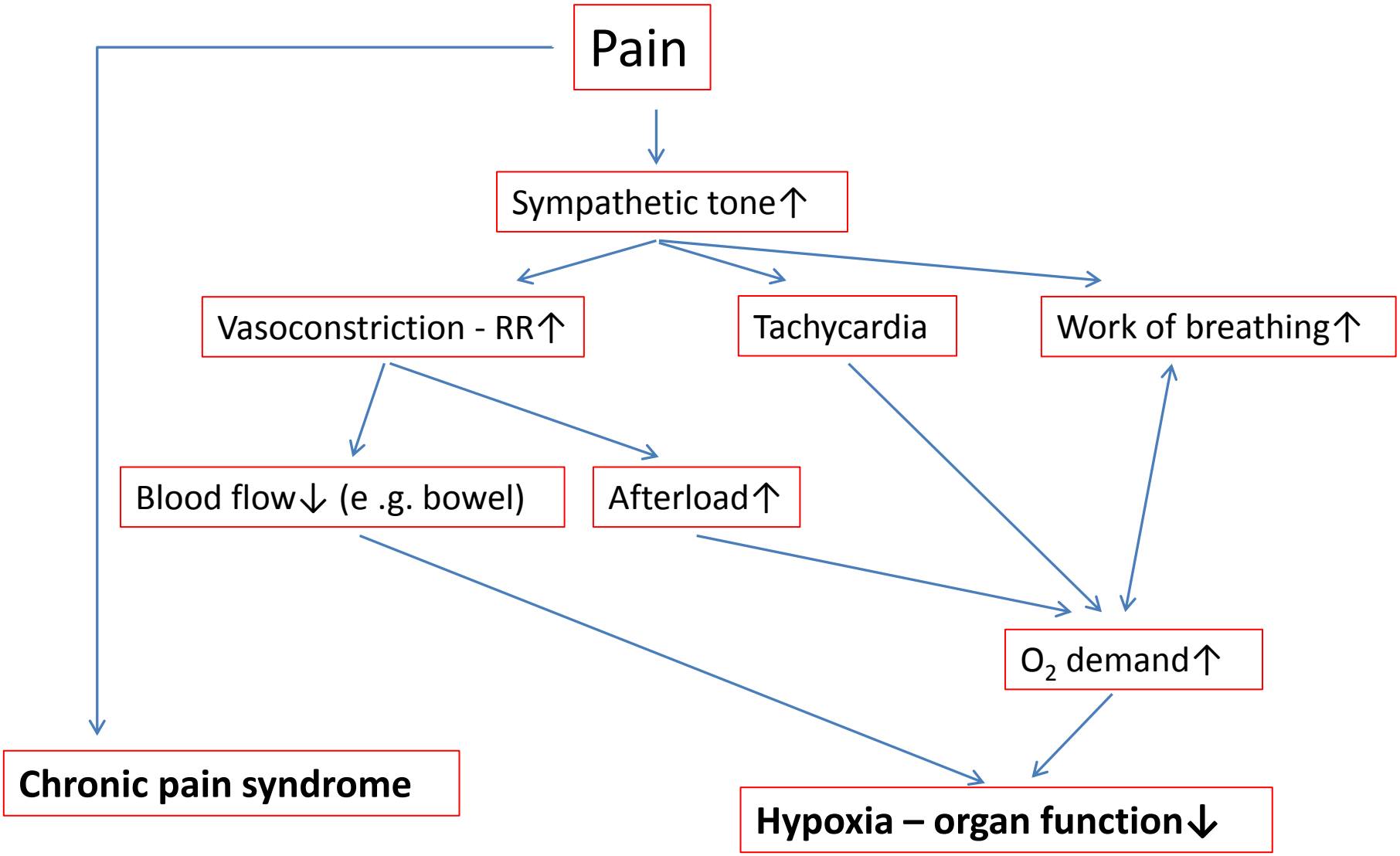
Postoperative Intensive Care

- Weaning from ventilator:
  - Stable hemodynamic state
  - Normal blood gas parameters and temperature
  - Adequate muscle force
  - Minimal pain

extubation

O_2 supplementation (face mask, nasal)

Postoperative Intensive Care

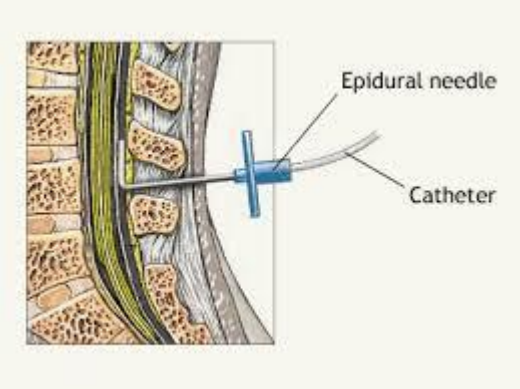


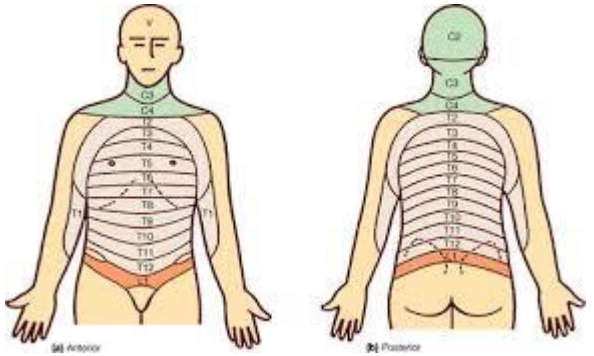
Postoperative Intensive Care

- Pain management
  - Opioids: morphine, sufentanyl
    - Nausea – dehydrobensperidol, ondansetron
    - Drowsiness
  - NSAIDs: diclofenac, Ibuprophen,…
    - Kidney function ?
    - Bleeding ?
  - Paracetamol
  - Tramadol
    - nausea
- Traditional method: i.v. opioid base and NSAID and/or paracetamol
- Multimodal therapy – without opioids

Postoperative Intensive Care

- Pain management
  - I.V.:
    - Continuous infusion
    - I.V. infusion
    - Patient Controlled Analgesia – special pump
  - Per os
  - Epidural catheter (sympathic tone↓ ↔ local effect, antithrombotic th?)



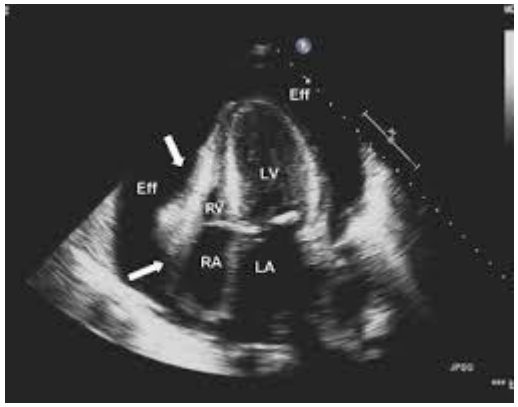


Postoperative Intensive Care

Fast track: there are not fixed, accepted definition: extubation within 8 hours – decrease the ICU and hospital lenght of stay – decrease the costs

- Pateint selection: good condition, not complicated procedure (adult, elective surgery, etc.)
- Drugs: to know how you administer
- Safe management: extubation and ICU discharge critiria

Postoperative Intensive Care - Complications



- Bleeding
- Pericardial tamponade – hemodynamic instability, RR↓, Urine output↓, CVP↑ - operation
- Kidney function↓ - diuretics, Hemodialysis
- Breathing problems – phrenic nerve injury – physiotherapy, stimulation
- Atrial fibrillation (40% after cardiac surgery) – ions, ß-blocker, amiodarone