Weak heart: perioperative management

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No conflict of interest!
INTRODUCTION

• HF is a major risk factor in perioperative care and is found in 2.5% to 10% of non-cardiac surgery patients

• Incidence of MACE with HF
  • 2 to 8% in non-cardiac surgery
  • ≥ 20% in cardiac surgery
  • in open vascular surgery
    • 18% with isolated diastolic dysfunction
    • 23% with asymptomatic systolic dysfunction
    • 49% with CHF

(Poldermans D, et al. EJA 2010;27:92-137
Meta-analysis global Group in chronic heart failure. EHJ 2012;33:1750-7
Outcomes in Heart Failure Patients After Major Noncardiac Surgery

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(Jacc 2004;1446-53)

Emergent surgery

Elective surgery

Urgent surgery
More specifically, cardiac complications can arise in patients with documented or asymptomatic ischaemic heart disease (IHD), left ventricular (LV) dysfunction, valvular heart disease (VHD), and arrhythmias, who undergo surgical procedures that are associated with prolonged haemodynamic and cardiac stress. In the case of peri-

(Kristensen SD, et al. EHJ 2014;35:2383-431)
INTRODUCTION

• RV dysfunction?
• Increased mortality in cardiac surgery, non-cardiac surgery and ICU
• Present in 40% of postcardiotomy cardiogenic shocks
• Lack of guidelines on perioperative management of patient with RV function

(Denault AY, et al. Current Opin Anaesthesiol 2013;26:71-81
PREOPERATIVE VISITE

- Assess surgical and patient risk
- Identify preexisting LV or RV dysfunction or preexisting anomalies of pulmonary vasculature
  - Clinical signs of ventricular dysfunction
  - ECG, Chest X Ray, TTE, coronary angiogram
  - Laboratory (Troponin, NT-BNP, Creat)
  - Diagnosis of underlying cardiac disease
  - Diagnosis of underlying end-organ dysfunction
- Maintain preoperative HF and PHT therapy except diuretics
- Individualized premedication

(Kristensen SD, et al. EHJ 2014;35:2383-431
PERIOPERATIVE LV DYSFUNCTION
PERIOPERATIVE LVF PREVENTION

• Identification of high-risk patient
• Prevention of worsening of LV function
  • Avoid drug-induced myocardial depression
  • Optimize LV preload and contractility
  • Reduce afterload
  • Avoid tachy- brady-arrhythmias
  • Prevent hypoperfusion of major organs
  • Avoid liver- and nephrotoxic drugs
  • Avoid overdose of agents

Cardiac complications associated with goal-directed therapy in high-risk surgical patients: a meta-analysis

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- Metaanalysis on 22 RCT; 2229 patients
- Benefit more pronounced in patients receiving fluid and inotrope therapy to achieve a supranormal DO2 with the use of minimally invasive CO monitoring
MONITORING

- Standard ASA monitoring
- Invasive monitoring adapted to the extent of surgery
  - Arterial and multilumen central catheters
  - TEE mandatory except in case of absolute CI
  - PAC: no convincing evidence
  - Non invasive CO monitoring: might be beneficial; lack of large randomized studies
ANAESTHESIA

- Induction agents with the least haemodynamic effect
- Most volatile and intravenous agents reduce preload, afterload and contractility
- Induction agent in increasing order of negative inotropic action: etomidate, midazolam, propofol, ketamine, thiopental
- Opioids have no known adverse effects on LV function
- Reduction of the dose
- Slow-down the rate of drug administration
- Neuraxial technique: slow introduction of blockade
PERIOPERATIVE MANAGEMENT

• Identification of LV failure and underlying cardiac disease for prompt and aggressive management (TEE)

• Search for reversible condition: myocardial ischemia, infarction, acute valvular dysfunction, LVOTO, septic shock, post cardiotomy LCOS

• Golden hours for HF management

PERIOPERATIVE MANAGEMENT

• Maximize oxygenation and ventilation
• Correct acid-base and electrolytes abnormalities
• Optimization of preload, afterload and contractility, ideally under TEE monitoring
• Control HR and rhythm
## POSITIVE INOTROPIC AGENTS

<table>
<thead>
<tr>
<th>Inotropic agent</th>
<th>Dose mcg/kg</th>
<th>Dose mcg/kg/min</th>
<th>Effects</th>
<th>Adverse effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dobutamine</td>
<td>N/A</td>
<td>2.5 to 5</td>
<td>↑ ↑</td>
<td>↑/↓ BP, T, HA, N, F, Hypersensitivity, O2myoc↑</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 to 20</td>
<td>↑</td>
<td>↔ ↔ ↔ ↔ ↔ ↔</td>
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<tr>
<td>Adrenalin</td>
<td>N/A</td>
<td>0.01 to 0.05</td>
<td>↑ ↑ ↔ ↔</td>
<td>T, A, F, lactate↑</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.05 to 0.1</td>
<td>↑ ↑ ↔ ↔</td>
<td>Glyc ↑, O2myoc↑ ↑</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 0.1</td>
<td>↑ ↔ ↔ ↓</td>
<td></td>
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<tr>
<td>Milrinone</td>
<td>N/R</td>
<td>0.125 to 0.175</td>
<td>↑ ↑ ↓ ↓</td>
<td>A, T, ↓BP, O2myoc↑ ↔</td>
</tr>
<tr>
<td>Levosimendan</td>
<td>N/R</td>
<td>0.05 to 0.2</td>
<td>↑ ↑ ↔ ↓ ↓</td>
<td>T, A, HA, ↓BP, hypoK, O2myoc↔</td>
</tr>
</tbody>
</table>

(Yancy CW, et al. JACC 2013;62:e147-239
Levo and Mortality
Meta-analysis
5480 patients
45 RCT

(Landoni G, et al. CCM 2012;40:634)
PERIOPERATIVE MANAGEMENT

• If LV failure persists, mechanical assistance should be started as soon as possible
  • IABP: indications have been restricted following IABP-SHOCK II trial
  • ECLS: bridge to decision, to recovery, to LVAD or to HTPL

(Thiele H, et al. NEJM 2012;367:1287-96
RV DYSFUNCTION
PERIOPERATIVE RVF PREVENTION

• Identification of high-risk patients
• Prevent increase in PVR and RV myocardial ischaemia
  • Maintain RV preload and contractility
    • Cave volume overload
  • Minimize PVR
  • Avoid RV hypoperfusion
MONITORING

• Standard ASA monitoring
• Adaptation of monitoring to the extent of surgery
  • Arterial catheter and CVP
  • TEE: mandatory in any perioperative case of RV failure
  • PAC: severe PHT and RV failure
    • Cave arrhythmias and PA rupture
    • Validity of CO in case of TR?
• NIRS
• Continuous RVP waveform monitoring

(Rudski LG, et al. JASE 2010;23:695-713
CONTINUOUS RV WAVEFORM

(Denault AY et al. Curr Opinion Anaesth 2013:26:71-81)
RV AND ANAESTHESIA

- Ketamine, Desflurane and Nitrous Oxide increase PVR
- Propofol: conflicting findings
- Etomidate might be induction agent of choice
- Opioids have no known effects on RV Function
- Neuraxial technique
  - Cave vasodilatation

(Forrest P. Anaesth Intensive Care 2009;37:370-85
IDENTIFICATION OF RVF

- Severity of PHT is not a reflection of RV function
  - Falling PAP: PVR↓ or LAP↓ or progressive RVF
  - ↗ CO with fixed PVR -> PAP↑
PERIOPERATIVE MANAGEMENT

- Identify abnormalities of RV function
  - RAP↑, CO↓, SAP and PAP↓
  - MAP/MPAP more reliable
- Address underlying reversible problems: PE, valvulopathy, myocardial ischaemia, intracardial shunt, LV diast or syst dysfunction, tamponade, lung infection, asthma, COPD, V/P mismatch
- Maintain ventricular interaction
MAINTAIN VENTRICULAR INTERACTION

- Maximum RV developed pressure ➔ by 30% when septum inactivated

Melenovsky V, et al. EHJ 2014;35:3452-62

(courtesy of P. Wouters)

Serial interaction
+ Parallel interaction
PERIOPERATIVE MANAGEMENT

- Prevent vicious cycle of hypotension and ischemia
  - Maintain SAP while minimizing RV dilation and reducing RV afterload (inhalative)
- Maintain ratio MAP/MPAP
- Maintain SR and A-V synchrony
- Inotropic support: limited contractile mass
- Delay sternum closure
- Mechanical assist devices
CONCLUSION

• Perioperative HF
  • Result of arrhythmias or inadequate contractility, volume or pressure overload
  • Associated with worse outcome in noncardiac and cardiac surgery as well as in the ICU
  • Particular care of the RV has to be taken
  • Echocardiography is the mainstay in the perioperative assessment of biventricular function
  • Prevention, diagnosis and therapy in the perioperative setting are difficult tasks
  • The adequacy of the intraoperative management determines the late postoperative outcome
THANK YOU