The first four hours after cardiac surgery

James Ramsay MD
University of California San Francisco

Disclosure

• None

The first four hours

• Early extubation
  • Analgesia
  • Cardiovascular
  • Respiratory
  • Coagulation
  • Renal
  • Endocrine

The first four hours

• Early extubation
  • Cardiovascular
  • Respiratory
  • Coagulation
  • Renal
  • Endocrine
Early Extubation

- Sedate overnight
- Within 8 hours
- Within a few hours
- On arrival to ICU
- In the operating room
- Cardiac surgery under epidural anesthesia

Pulmonary effects of cardiac surgery

- Mechanical effects on lungs/chest wall
  - Compliance decrease: 30%
  - FRC decrease: 40-50%
- Pain
- Capillary leak (CPB)
- Pulmonary edema
  - Cardiogenic
  - Noncardiogenic

Fig 1. Percentage of patients extubated in fewer than 4 hours versus age.

Higgins, 1992

Konstantakos et al; Ann Thorac Surg 2000
Strongest predictor of postoperative ventilator dependence:

preoperative cardiac failure (Higgins, 1992)

The effect of a cardiac surgical recovery area on the timing of extubation


J. Cardiothorac Vasc Anesth 1993;7:137-41

Rapid ventilator weaning

• Facilitated by anesthesiologist/intensivist at bedside
• In the absence of physician need protocol
• Rely on noninvasive monitors (SpO₂ and E'CO₂) and clinical evaluation
• “Recovery room” wean vs ICU wean
Analgesia after cardiac surgery
Chaney, 2005

- Continuous local anesthetic infiltration
- Nerve blocks (intercostal/paravertebral)
- Intravenous opioids/PCA
- Nonsteroidal antiinflammatory agents
- Alpha adrenergic agonists
- Intrathecal/epidural techniques

The first four hours

- Early extubation
- Cardiovascular
- Respiratory
- Coagulation
- Renal
- Endocrine

Decrease in ventricular function after on-pump CABG

- Good hearts:
  - Transient decrease in LVEF for 4 - 8 hours
- Bad hearts:
  - Transient decrease in LVEF for ≥ 24 hours

Mangano, 1985
Briesblatt, 1990

Briesblatt 1990

- $\text{L/min/m}^2$
- mmHg
- %

5/31/2013
**Intravascular volume**

- Capillary leak persists for up to 24 hours
- Low hematocrit and oncotic pressure
- Vascular tone may be abnormal
  - Pre-existing/acute therapy
  - Effect of CPB
- Vasodilation during rewarming

**Volume resuscitation**

- Blood products
  - Target hemoglobin
- Albumin
- Starch preparations
- Crystalloid
Effect of hydroxethyl starch on bleeding after cardiopulmonary bypass: A meta-analysis of randomized trials

Roberta J. Nasickis, PhD,† Gary R. Haynes, MD, PhD,§ and Mohlen M. Wilkes, PhD

Conclusions: Hydroxethyl starch increased blood loss, reexpansion for bleeding, and blood product transfusion after cardiopulmonary bypass. There was no evidence that these risks could be mitigated by lower molecular weight and substitution. (J Thorac Cardiovasc Surg 2012;144:223-30)

Anesthesiology, Sept 2012

Hetastarch-induced Osmotic Nephrosis

Adina S. Kamra, M.D., F.C.C.P., Marini Sunaji, M.D.
University of Nebraska Medical Center, Omaha, NE
Inotropic therapy

• Beta agonists
• Phosphodiesterase inhibitors
  • (Levosimendan)

Dobutamine after CPB
Romson JL et al Anesthesiology 1999;91:1318-28

• 100 patients received dobutamine as in DSE protocol, post CPB
• Monitored with PA catheters, TEE, ECG
Importance of rate/rhythm

• Atrial contraction contributes 15-25% of stroke volume*
• Synchronized ventricular contraction best
• If stroke volume is fixed, output is rate-dependent

*“Diastolic dysfunction”

Prevention of dysrhythmias

• Postop atrial dysrhythmias are a major source of morbidity and increased LOS
• Peak incidence is POD 2-4
• Prophylaxis with beta blockers and/or amiodarone is effective
• ?steroids

Prophylactic oral amiodarone for the prevention of arrhythmias that begin early after revascularization, valve replacement, or repair: PAPABEAR: A randomized controlled trial

(December 28, 2005)
Mechanical ventilation

- Positive pressure ventilation helps the failing heart
- Withdrawal may precipitate acute heart failure

McGregor, 1979

McGare, 1979

Lemaire et al, 1988
The first four hours

- Early extubation
- Cardiovascular
- Respiratory
- Coagulation
- Renal
- Endocrine

“Normal” chest tube output

- 100–200 ml in first hour
- Decreasing trend

Coagulation

- Heparin “rebound” (check ACT in the ICU)
- Hypothermia inhibits enzymes
- Platelet function is impaired
- Don’t forget fibrinogen
- Transfusion Algorithm
- “POC” Thromboelastography
- Novo 7 and factor concentrates

The first four hours

- Early extubation
- Cardiovascular
- Respiratory
- Coagulation
- Renal
- Endocrine
Renal dysfunction after myocardial revascularization: risk factors, adverse outcomes, and hospital resource utilization

Mora Mangano C, Diamondstone LS, Ramsay JG et al


Mora Mangano et al 1998

- 2222 patients studied 1991-1993
- 24 diverse health care settings
- Prospective data collection (no intervention)
- Pre and Post op Serum creatinine
- In-hospital outcome and resource utilization

Definitions (Mora Mangano 1998)

- Renal dysfunction:
  - postoperative creatinine ≥ 2.0 mg/dl
  - increase in creatinine of ≥ 0.7 mg/dl
- Renal failure:
  - dialysis

Incidence of renal dysfunction/failure (Mora Mangano 1998)

- Dysfunction: 7.7%
- Failure: 1.4%
Preoperative risk factors
Mora Mangano 1998

- Age 70-79: 1.6 (1.1-2.3)
- Age 80-95: 3.5 (1.9-6.3)
- CHF (NYHA 3,4): 1.8 (1.3-2.6)
- Previous CABG: 1.8 (1.2-2.7)
- Creat 1.4-2.0: 2.3 (1.6-3.4)
- Type 1 diabetes: 1.8 (1.1-3.0)
- Glucose >300: 3.7 (1.7-7.8)

Intra/postop risk factors
Mora Mangano 1998

- CPB > 3 hours: 2.8 (1.9-7.2)
- Low output state:
  - severe: 4.5 (2.9-7.2)
  - moderate: 3.1 (1.9-4.9)
  - Mild: 4.3 (2.2-8.5)

Outcome
Mora Mangano 1998

- ICU LOS
  - Renal dysfunction: 2 X LOS
  - Renal failure: 5 X LOS
- Prognosis:
  - Mortality:
    - No failure/dysfn: 0.9 %
    - Dysfunction: 27.0 %
    - Failure: 63.0 %

Kidney “magic”

- “low dose” dopamine
- Fenoldopam
- Nesiritide
- Bicarbonate
The first four hours

- Early extubation
- Cardiovascular
- Respiratory
- Coagulation
- Renal
- Endocrine

Intensive insulin therapy in critically ill patients

N Engl J Med 345;001:1359-67

Intensive Insulin therapy
Van den Berghe et al NEJM 2001

- 1548 mechanically ventilated patients
- Surgical ICU; 63% post cardiac surgery
- 13% diabetics
- Randomized to:
  - Blood sugar 80 – 110 mg/dl
  - Blood sugar 180 – 200 mg/dl

<table>
<thead>
<tr>
<th>Blood Glucose</th>
<th>80 - 110</th>
<th>180 – 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality in ICU</td>
<td>4.6%</td>
<td>8.0%</td>
</tr>
<tr>
<td>Mortality in ICU with ICU ≥ 5 days</td>
<td>10.6%</td>
<td>20.2%</td>
</tr>
<tr>
<td>Sepsis</td>
<td>4.2%</td>
<td>7.8%</td>
</tr>
</tbody>
</table>
The first four hours

- Early extubation
- Analgesia
- Cardiovascular
- Respiratory
- Coagulation
- Renal
- Endocrine

**Hypoglycemia**

6.8% vs 0.5%

- OR: persistently above 180 mg/dl: infusion
- ICU: insulin infusion to keep < 180 mg/dl
- ICU > 3 days: insulin infusion to keep < 150 mg/dl