Perioperative Management of the Patient with Severe Lung Disease

Chronic Obstructive Pulmonary Disease
Pulmonary Hypertension

Peter Slinger MD, FRCPC
(No Disclosures)

COPD Preoperative Assessment

- 60 y.o. Female
- Laparotomy for Bowel Obstruction
- Empysema, FEV1 27%
- Prev. colectomy for diverticulitis
- Rx: Puffers, occas. steroids
- Do You Need a Chest X-ray?

- Bullae

- Dynamic Hyperinflation
- CO2 Retention

Peter Slinger, MD
**COPD Ventilation-Perfusion Matching**

**Air**

**High FiO2**


---

**Effects of Hypercapnia**

- Central Nervous System: cerebral blood flow, level of consciousness
- Autonomic Nervous System
- Cardiovascular System
- Respiratory System, Pulmonary Vasoconstriction

**CO2 is Good For You**

---

**Arterial Blood Gases**

16 yr. male, grain aspiration

<table>
<thead>
<tr>
<th>pH</th>
<th>pCO2</th>
<th>pO2</th>
<th>HCO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.5</td>
<td>500</td>
<td>84</td>
<td>30</td>
</tr>
<tr>
<td>6.9</td>
<td>300</td>
<td>400</td>
<td>29</td>
</tr>
</tbody>
</table>


---

**COPD patients in Ac. Resp. Failure**

ABGs air vs. 100% Oxygen

<table>
<thead>
<tr>
<th></th>
<th>Air</th>
<th>100% O2</th>
</tr>
</thead>
<tbody>
<tr>
<td>PaCO2 (mm Hg)</td>
<td>65 +/- 3</td>
<td>88 +/- 5</td>
</tr>
<tr>
<td>PaO2 (mm Hg)</td>
<td>38 +/- 2</td>
<td>225 +/- 23</td>
</tr>
<tr>
<td>Min Vent (l/min)</td>
<td>10.2 +/- 0.5</td>
<td>9.5 +/- 0.7</td>
</tr>
</tbody>
</table>

Milo-Emilia J, Aubler M. Anes Analg 1980
**COPD, Laparotomy Bowel Obstruction**

- Rapid Sequence Induction
- Propofol 80 mg., Fent. 100 ug, Roc. 50 mg.
- Easy Intubation, SpO2 100%, PetCO2 30mmHg
- Pulse 80
- BP 120/60
- Air Entry Equal Bilat.
- Diagnosis?

---

**Expiratory Flow Limitation In COPD**

**Dynamic Hyperinflation**

---

**The Lazarus Syndrome:**

Spontaneous Return of Circulation after Cessation of Cardiopulmonary Resuscitation

Rembrandt van Rijn 1606-1669


---

**Decreasing Dynamic Hyperinflation**

- Bronchodilators
- Prolong Expiratory Time
- Add PEEP

---

**Paradoxical Responses to PEEP in Patients with COPD during Controlled Ventilation**

COPD Preoperative Assessment

- 60 y.o. Female
- Laparotomy for Bowel Obstruction
- Emphysema, FEV1 27%
- Prev. colectomy for diverticulitis
- Rx Puffers, occas. steroids
- Should you do a Thoracic Epidural?

Greatest Hospital Costs from Complications after Surgery?

- A) Cardiac/Vascular
- B) Thromboembolic
- C) Respiratory
- D) Wound Infection


Hospital Costs Associated with Surgical Complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>Incidence %</th>
<th>Increase LOS d</th>
<th>Median Cost $K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac/Vascular</td>
<td>1</td>
<td>0</td>
<td>7.7</td>
</tr>
<tr>
<td>Thromboembolic</td>
<td>1</td>
<td>15</td>
<td>18.3</td>
</tr>
<tr>
<td>Respiratory</td>
<td>3.4</td>
<td>14</td>
<td>52.5</td>
</tr>
<tr>
<td>Wound Infection</td>
<td>6.9</td>
<td>4</td>
<td>1.4</td>
</tr>
</tbody>
</table>


Incidence and Mortality of Postoperative Pulmonary Complications (PPC)

<table>
<thead>
<tr>
<th>Type of Surgery</th>
<th>Incidence %</th>
<th>In-Hosp. Death with PPC%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac</td>
<td>40</td>
<td>0</td>
</tr>
<tr>
<td>Thoracic</td>
<td>31</td>
<td>18</td>
</tr>
<tr>
<td>Abdominal</td>
<td>7</td>
<td>35</td>
</tr>
<tr>
<td>Orthopedic</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>15</td>
</tr>
</tbody>
</table>

n= > 2400, Major Surgery

Perioperative Management of the Patient with Severe Lung Disease

- Chronic Obstructive Pulmonary Disease
- Pulmonary Hypertension

Pulmonary Hypertension

- 54 y.o. Female
- Open Wedge Resection of Recurrent Left Upper Lobe Metastasis
- VATS resection LUL lesion 1yr. prev., no problem GA
- Post-op. DVTs
- Colectomy for Ca. 3yr. prev.
### Pulmonary Hypertension

- 54 y.o. Female
- COPD, Hypertension
- Diabetes, oral meds
- Obstructive Sleep Apnea
- Morbid Obese, BMI 53

### 54 Female, Obese, Wedge Resection LU Lobe

- FEV1 65%, DLCO 78%
- ECG Normal
- Exercise tolerance SOB 1 flight
- Labs Normal
- Trans-thoracic echo: Normal LV & Right Ventricle, RVSP 32mmHg
- Anesthetic Management

### Preoperative Assessment

- 54 y.o. Female
- VATS resection LUL lesion
- Colectomy for Ca. 3yr. prev.
- COPD, hypertension
- Diabetes, oral meds
- Obstructive Sleep Apnea
- Morbid Obese, BMI 53

### Trans-Thoracic Echocardiography

- 2012: Difficult study, Mild hypertrophy RV, RVSP calculated 55mmHg
- 2013 (1 week preop.) Difficult study, Normal LV/RV, RVSP calculated 32mmHg
- 2013 (1 week postop.) Difficult study, Mild hypertrophy RV, RVSP calculated 58mmHg
54 Female, Obese, Wedge Resection LU Lobe

- FEV1 65%, DLCO 78%
- ECG Normal
- Exercise tolerance SOB 1 flight
- Labs Normal
- Trans-thoracic echo: Normal LV RVSP 55mmHg
- Change Management?

Pulmonary Hypertension Classifications
(Eur Heart J 2009; 30: 2493-537)

- Pulmonary Arterial: Idiopathic, Drug/Toxin induced, Portal Hypertension, Connective Tissue Diseases, Veno-occlusive Disease
- Left Heart Disease, Systolic Dysfunction, Diastolic Dysfunction, Valvular Disease
- Lung Disease: CPOD, Interstitial lung Dis., Sleep Apnea, Central hypoventilation, Altitude
- Chronic Thromboembolic Pulmonary Hypertension
- Uncertain Etiologies: Sarcoidosis, Glycogen Storage Disease, Fibrosing mediastinitis

Hosseinian L, JCVA 2014, 28: 1076-86

The Right Heart is Not Smart

Severe Pulmonary Hypertension Complicates Postoperative Outcome of Non-Cardiac Surgery

- 9600 Preop. Echos, n= 62 RVSP >70 mmHg
- 37/62 (60%) Non-Cardiac Pulm. Hypertension
- Abd. Surg 15, Ortho 14, Thoracic 4, Minor 15
- Delayed Extubation (> 24h) 20% (vs. 3%)
- Mortality 10% (vs. 0%)


Pulmonary Hypertension Anesthetic Management (as per Review Articles)

- Propofol is good
- Ketamine is bad
- Dobutamine is good
- Nitric Oxide is good
- TEE is good
- Epidurals are good
Pulmonary Hypertension

Hemodynamic collapse on induction


Desflurane, Sevoflurane, Isoflurane, in Pressure-Overload RV Hypertrophy

Baludszun G, Morel DR. Anesthesiology 2012, 117: 1051-61 (Rats)

(all signif. P<.001)

Pulmonary Hypertension Anesthetic Management

- Propofol is good
- Ketamine is bad
- Dobutamine is good
- Nitric Oxide is good
- TEE is good
- Epidurals are good

Vasoconstrictor Responses to Vasopressors


(* p<.01)

Nitric Oxide


Prostacyclin (Flolan)

Peter Slinger, MD

Perioperative Management of the Patient with Severe Lung Disease
**Tricuspid Valve**

**Pulmonic Valve**

---

**Right Ventricular Monitoring**

**Epidural Anesthesia and Right Ventricular Pressure Overload**

* RV Free Wall Strain

---

**Pulmonary Hypertension Anesthetic Management**

- Propofol is good
- Ketamine is bad
- Dobutamine is good
- Nitric Oxide is good
- TEE is good
- Epidurals are good
- Avoid Hypox./Hypercarb.

Revised:

- Hypotension is bad
- Ketamine/Etomidate OK
- Norepi/Vasopressn. good
- NO/ Epoprostenol good
- TEE is OK, CO good
- Epidurals may be OK
- Avoid Hypox./ Hypercarb.

---


Management of Pulmonary Hypertension: Physiological and Pharmacological Considerations for Anesthesiologists

Pulmonary Hypertension and Right Ventricular Dysfunction: Physiology and Perioperative Management
Strumpher J, Jacobsohn E.
Efficacy of Sildenafil in Primary Pulmonary Hypertension


Perioperative Management of the Patient with Severe Lung Disease

Chronic Obstructive Pulmonary Disease

- Bullae
- CO2 Retention
- BHI

Pulmonary Hypertension

- Right Heart vs.
- Left Heart

Peter Slinger, MD