# **Protecting the Lungs**

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Disclosures:

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# 58 y.o. Male, Chronic Gallstone Pancreatitis, Open Cholecystectomy



100 pack/year smoker Dyspnea > 1 block WHY dyspneic? Rule-out Cardiac etiol: ECG, TTEcho, Myocardial perfusion stress assess

 Rule-in Respiratory etiology

# Protecting the Lungs: From Who/What?



- The Patient him/herself
- The Perioperative Experience (Surgeon)
- The Anesthesiologist

### **Preoperative Assessment**



 History: Cough , Sputum, Exercise Tol. (Infection) Auscultation (Bronchospasm) Lab tests: CXR Spirometry ABG







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 Forced Expiratory volume (FEV1%) mild 80=50% mod. 50-35% severe < 35%FEV1/FVC ratio < 0.7= obstruction Post-bronchodilator **FEV1%** increase >10% =a/w reactivity

### **Preoperative Assessment**



 History: cough , sputum, exercise Tol. (Infection) Auscultation (Bronchospasm) Lab tests: CXR Spirometry **Arterial Blood Gas** 



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#### Helping Surgical Patients Quit Smoking Warner DO, Anesth Analg 2005; 101: 481-7

### **Surgical Benefits:**

- Decrease ST changes intraop.: 2 days
- Decrease wound complic's: <u>></u>4wk.
- ◆ Decrease Resp. Complications : Cardiac: ≥8 wk. Thoracic: anytime

Abstinence @ 1yr:
After ACB: 55%
Angioplasty : 25%
Angiography: 14%

# **Preoperative Physiotherapy**

 Particularly in patients with excessive secretions

No proven superior modality

 Proven decrease in pulmonary complications in COPD

Warner DO, Anesthesiology 2000, 92: 1467

# Protecting the Lungs: From Who/What?



 The Patient him/herself

 The Perioperative Experience (Surgeon) Atelectasis Analgesia

 The Anesthesiologist

# Atelectasis





#### Intra-op.

#### **Recovery Room**

# Pulmonary Atelectasis

Duggan M, Kavanagh B. Anesthesiology 2005, 102: 838-54



### **Pulmonary Atelectasis**

#### Duggan M, Kavanagh B. Anesthesiology 2005, 102: 838-54



#### Atelectasis

## Atelectasis Causes Lung Injury in Non-Atelectatic Lung Regions

Tschudia S, et al. AJRCCM 2006: 174: 279-89

#### Non-Dependent







- Rat lung injury model
- Lg. Vol. Vent.
- Distal airway injury all regions
- Alveolar injury more severe in nondependent, nonatelectatic regions

### CPAP Treatment of Post-op. Hypoxemia Squadrone V, et al. JAMA 2005, 293: 589-95

### Patients:

- ♦ n= 209
- Major Abd. Surg.
- PaO2/FiO2<300</li>
   post-op. in
   Rec.Room
- FiO2 0.5 by mask or CPAP until PaO2/FiO2 stable
   >300 (19-28h)

### Results:

- CPAP decreased sepsis (p= .03)
- Decreased
- pneumonia (p= .02)
- Decreased reintubation (p< .01)</li>

The Comparative Effects of Analgesia on Pulmonary Outcomes : Meta-Analysis

Ballantyne JC, et al. Anesth Analg 1998, 86: 598

- <u>Atelectasis</u> decreased: Epidural opioid/LA vs. Systemic opioid
- <u>Pulmonary Infections</u> decreased Epidural opioid/LA vs. Systemic opioid
- Pain VAS movement (not PFTs) correlate with outcome

Epidural Anaesthesia and Analgesia and Outcome of Major Surgery (MASTER) n =888, random., ASA >/=3, Abd./Esoph. Surg., 225/ 447 Epidural > 72h.

Mortality Epidural vs. IV: ns.
Cardiac/Renal/GI/ Sepsis: ns.
Resp. Fail. Epid. vs. IV: 23% vs. 30% (.02)
Analgesia: Epid. vs. IV @ rest n.s., with cough <.001</li>

Rigg JRA, et al. Lancet 359: 1276-82, 2002

# Protecting the Lungs: From Who/What?



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- The Anesthesiologist: Lung Injury

# Extravascular Lung Water after Pneumonectomy in Sheep



Kuzkov V, et al. Crit Care Med 35: 1550-9, 2007

# Principles of Lung-Protective Ventilation:

Mimic normal spontaneous ventilation
FiO2 as low as safe
Tidal volumes 4-6 ml/kg
Frequent recruitment maneuvers
Vary position / vary tidal volume
PEEP to maintain FRC

Fan E, et al. JAMA. 2005; 294:2889-96

### Low Tidal Vol. + PEEP Prevents Alveolar Coagulation in Patients Without Lung Injury



Choi G, et al. Anesthesiology 2006; 105: 689-95

#### Transfusion-Related Acute Lung Injury Bux J, Sachs U. Br J Haem 136: 788-99, 2007



Normal Circulating Neutrophil





#### Normal Neutrophil

#### Deformed Neutrophil









#### Primed Neutrophil



Human Leukocyte Antigen



Human Neutrophil Antigen

"One Hit"









"One Hit"

### Damaged Pulmonary Capillary ICAM



#### Cytokine Release

"Two Hit"



"One Hit"

# Protecting the Lungs: From Who/What?



The Patient: **Smoking Cessation** Physiotherapy The Perioperative **Experience:** Atelectais Analgesia Anesthesiologist: Ventilation TRALI