Preoperative Pulmonary Evaluation

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No disclosures related to this lecture.
Objectives

• Identify pulmonary complications postoperatively
• Epidemiology of pulmonary patient complications
• Evaluate risk factors
• Specific patient populations
• Preoperative testing
PULMONARY COMPLICATION

• Identifiable dysfunction of the lung
• Alters the course of hospitalization and recovery period
• Negatively impacts clinical outcome
• Examples
  • Atelectasis
  • Infection (Pneumonia/Bronchitis)
  • Bronchospasm
  • Prolongation of mechanical ventilation
Incidence/Results

- More common than cardiac complications from surgery
  - Frequency 5-70%
  - Can increase hospitalization up to 2 weeks
  - Increases perioperative morbidity and mortality
- Highest risk surgeries are cardiac and upper abdominal procedures (10-20%)
  - Incidence 1-2% in minor procedures
Predictors for Complications

- Age > 60
- Pre-existing lung disease
- Smoking
- Previous spirometric change (FEV1 < 1L)
- Duration of anesthesia (> 3H)
- Head and neck surgeries, chest, upper abdomen & use of NG tube perioperatively
Risk Models

• There are no validated risk models specific to pulmonary complications
• There are GUIDELINES
  • American College of Chest Physicians
  • Pneumology & Anesthesiology, Pain and Intensive Care Medicine of the Escola Paulista de Medicina

HISTORY AND PHYSICIAL is CRUCIAL
Surgery-Related Factors

- Surgery not involving opening of a body cavity (risk lower)
- Laparoscopic approach may minimize risk but does not eliminate
- CARDIAC
  - Temporary or perennial phrenic nerve injury
  - ARDS after cardiopulmonary bypass
    - Risk is low at < 2% but mortality is high > 50%
    - Highest risk if pump time > 150 minutes
- UPPER ABDOMEN
- SPINE SURGERY
Anesthesia-Related Factors

• Anesthesia time > 3 hours is an independent risk for postoperative pulmonary complications
• GENERAL ANESTHESIA
  • Can worsen post operative hypoxemia with residual NMB
  • Suppresses cough and gag reflex leading to aspiration
  • Exposure to anesthetic can change gas exchange and temporary immunosuppression due to reduced production of surfactant and slow muco-ciliary clearance
  • Supine body position contributes to V/Q mismatch
• SPINAL/EPIDURAL ANESTHESIA
  • Preserved oxygenation and CO2 elimination EXCEPT in morbidly obese patients (abdominal muscles cause a reduction in up to 25% FEV1 and FVC
  • May decrease need for post operative opioids
Anesthesia on Respiratory Physiology

- Lung Parenchyma
- Airways
- Ventilation Control
- Pulmonary Circulation
- Gas Exchange
- Immune Function
Patient-Related Factors

- Age
  - Increased with each decade after age 60
- Ability to perform daily/instrumental activities
- Smoking status (greatest > 20pyh)
- Obesity (BMI > 40kg/m2)
- Malnutrition with hypoalbuminemia (albumen < 3.5g/L)
- Preexisting conditions
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Chronic Obstructive Pulmonary Disease (COPD)

- Airway management can increase inflammation even in stable patients.
- Chronic colonization can be associated with temporary immunosuppression induced by surgical procedure and increased work of breathing.
- Risk is proportional to impairment of FEV1.
- Those with concomitant pulmonary hypertension or home oxygen use have worse prognosis.
Restrictive Lung Disease

- Not as clear of a risk as with obstructive lung disease
- Inflammatory process can promote ARDS
- In scoliosis surgeries, there is a reported 60% decrease in function during corrective surgeries often delaying extubation
Obstructive Sleep Apnea (OSA)

• Common in up to 22% of adults undergoing surgery and up to 70% of them do not have a diagnosis before SURGERY
• Look for risk factors

<table>
<thead>
<tr>
<th>Risk Factor</th>
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<tr>
<td>Obesity</td>
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<tr>
<td>Age &gt; 50</td>
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<tr>
<td>Neck Circumference</td>
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<td>Acromgaly</td>
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<td>Macroglossia</td>
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<td>Retrognathia</td>
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<td>Polycystic ovarian Syndrome</td>
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<td>Postmenopausal status</td>
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<td>Tracheomalacia</td>
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<td>Down Syndrome</td>
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<td>Achondroplasia</td>
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<td>Tonsillar hypertrophy</td>
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PREOPERATIVE TESTING

Role for additional medical tests in pulmonary risk evaluation
Preoperative patient

In most cases medical history and physical examination will be sufficient to determine the pulmonary risk.

* blood tests, chest x-ray and pulmonary function should only be ordered when the results actually involve changing the strategy planned for initial evaluation
Pulmonary Medical Therapies

- Medicine evaluation for compliance
- Perioperative medical changes may require caution (i.e. beta blockers)
- Tobacco cessation
  - Most studies recommend 8 weeks of smoking abstinence to be optimal
  - Those who have quit 6+ months prior have rate of post op pulmonary complications similar to nonsmokers
- Mucus clearing devices and therapies
Blood Tests

- BUN > 21 and serum albumin < 3.5g/dL
- Predictors of pneumonia and acute respiratory failure in post operative non-cardiac surgery
- Creatinine > 1.5 g/dL
  - Higher perioperative pulmonary, infectious, cardiac and hemorrhagic complications
- Arterial blood gas
  - > 45 mmHg indicates high risk

Reference 44
Chest X-Ray

- 23% of preoperative x-rays yielded abnormal results of which changed medical management in 0.1-3% of cases
- Subset of patients that may benefit more
  - Patients with cardiopulmonary disease
  - Age > 40 having major/medium surgeries particularly if thoracic or upper abdominal (i.e. AAA surgery)

Reference 46
Spirometry/Pulmonary Function

- Beneficial to subset of patients
  - Known chronic lung disease
  - Smokers
  - Exposures to inhalants long enough to cause structural lung injury
  - Chronic respiratory symptoms or findings on PE or Imaging
  - Bariatric surgery patients
  - Scoliosis/kyphoscoliosis or NMD undergoing general anesthesia

There is no FEV1 prohibitive limit for anesthesia.
Echocardiogram/EKG

- Helpful in patients with known pulmonary arterial hypertension
- > 77mm RAP had higher perioperative morbidity and mortality independent of surgery type
6 MINUTE WALK

• Would not be performed routinely unless symptoms or impaired functional status
  • < 399m was predictive of higher surgical postop complications
• Inability to raise heart rate with simple exercise may predict 79% of pulmonary complications
• Cardiopulmonary exercise testing (CPET) is not routinely used for surgical stratification but is used more clinically for disease prognosis OR for specific preoperative eval for lung resection surgery
Examples of a Functional Capacity of More Than 4 METs

- Climbing one flight of stairs
- Mowing the lawn
- Gardening
- Golfing without a cart
- Doubles tennis
- Swimming
- Riding a bike
- Square dancing
- Jogging
Summary

• Evaluation of the preoperative patient with pulmonary disease involves careful history and physical examination
• Identification of patient risk factors is important for prevention of postoperative pulmonary complications
References


QUESTIONS

IF AT FIRST YOU DON’T SUCCEED QUIT, QUIT AGAIN.