

Preoperative Pulmonary Evaluation

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ACCOI

AMERICAN COLLEGE OF
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CONVENTION &
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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 PHYSICAL 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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- **Preexisting conditions**

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

Obesity	Age > 50
Neck Circumference	Acromgaly
Macroglossia	Retrognathia
Polycystic ovarian Syndrome	Postmenopausal status
Tracheomalacia	Down Syndrome
Achondroplasia	Tonsillar hypertrophy

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)

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

*FVC < 40%
OR
max pressures < 30cm
H2O
Increases risk of
extubation failure
postoperatively*

**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
 - $< 399\text{m}$ 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

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QUESTIONS

**IF AT FIRST YOU DON'T SUCCEED
QUIT, QUIT AGAIN.**

