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# Preoperative Pulmonary Evaluation

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# preoperative evaluation

- decrease surgical morbidity
- minimize expensive delays and cancellations on the day of surgery

# Pulmonary Complication

- Atelectasis
- Infection
- Bronchospasm
- Prolongation of mechanical ventilation

# Risk factors

- **Patient related:**
  - **Chronic lung disease**
  - **Smoking**
  - **Obesity**  
(BMI>27.5kg/m<sup>2</sup>)
  - **Age > 70 years**
  - **General Health status**
- **Procedure related**
  - **Surgical site**
  - **Duration of surgery**
  - **Anesthesia type**
  - **Type of neuromuscular blockade**

# Pulmonary disease

- History of reactive airway **Asthma**
- Frequency, reversible of symptoms, interval, last attack, history of steroid used
- Optimize good condition before elective surgery
- Typical findings on PFTs are a reduction in the ratio of the forced expiratory volume in 1 second (FEV1) to forced vital capacity (FVC)—with a ratio below 0.7 being indicative of airflow obstruction.

# Pulmonary disease

- If results are normal but a diagnosis of asthma is still strongly suspected, a methacholine challenge test or a trial of bronchodilator therapy should be performed.
- Patients with mild well-controlled asthma have no greater perioperative risk than do individuals without asthma.

- **Arterial blood gases** are not necessary unless the patient is having a severe acute exacerbation.
- Patients taking oral corticosteroids should have their blood **glucose** checked.
- **Chest radiography** is needed only if an infection or pneumothorax is suspected.
- Bronchodilators, corticosteroids (inhaled and oral), and any antibiotics must be continued on the day of surgery.
- $\beta$ -adrenergic agonists are a useful prophylactic intervention to lower the risk of bronchospasm after induction of anesthesia.
- This therapy can be supplemented with prednisone (20 -60 mg daily for 3-5 days) in any newly diagnosed or poorly controlled asthmatic patient (**stress dose**)



# Chronic Obstructive Pulmonary Disease

- Once a patient has evidence of airway obstruction on spirometry (FEV1/FVC ratio  $< 0.7$ ),
- mild FEV1 airflow limitation is at or greater than 80% of predicted,
- *moderate* limitation is FEV1 between 50% and 79% of predicted,
- *severe* limitation is FEV1 between 30% and 49% of predicted,
- and *very severe* limitation is FEV1 is less than 30% of predicted.
- A COPD exacerbation is defined as “*an acute worsening of respiratory symptoms that result in additional therapy*”

- The preoperative evaluation of patients with COPD is similar to that of patients with asthma, with an additional emphasis on signs of recent infection (e.g., changes in sputum amount or color).
- In general, PFTs are not useful for estimating perioperative risk in patients with COPD, with the exception of individuals undergoing lung resection surgery
- A chest radiograph is useful only if infection or bullous disease is suspected.

- Smoking cessation should be encouraged for any ongoing smokers (see section on “Smokers and Second- Hand Smoke Exposure”).
- Additionally, consideration can be given to preoperative inspiratory muscle training and physiotherapy in high-risk patients, and discussion about the potential respiratory benefits of neuraxial anesthesia or analgesia (see section on “Postoperative Pulmonary Complications”).
- Inhalers and other long-term medications for COPD should be continued on the day of surgery, and individuals on chronic corticosteroid treatment may need “stress dose steroids”

# Restrictive Pulmonary Disorders

Restrictive lung disease is characterized by a reduced total lung capacity

Pulmonary causes include idiopathic interstitial pneumonia, prior lung resection, pulmonary fibrosis, and interstitial lung disease secondary to connective tissue disease.

Extrapulmonary causes include chest wall limitations (e.g., kyphoscoliosis, obesity, ankylosing spondylitis), muscle dysfunction (e.g., muscular dystrophies, myasthenia gravis, diaphragm paralysis), and pleural disease (e.g., mesothelioma, effusion, pneumothorax).

- Chest radiograph and PFTs can help establish the diagnosis.
- Typically, the FEV1 and the FVC are reduced proportionally such that the FEV1/FVC ratio is normal (i.e.,  $> 0.7$ ).
- Preoperative PFTs can also help assess for acute or progressive worsening of known restrictive lung disease; however, routine testing is not necessary in the absence of clinical suspicion.
- These patients are also at risk of pulmonary hypertension that may not be recognized because of overlapping symptoms with restrictive lung disease. Thus, echocardiography may also be indicated to investigate causes of worsening symptoms in a patient with known restrictive lung disease.

# Obesity

Independent risk factor for pulmonary complications particularly atelectasis

Risk of hypoventilation, hypercapnea

Hypoxia

Obstructive Sleep Apnea (OSA)

## Interventions

Upright positioning

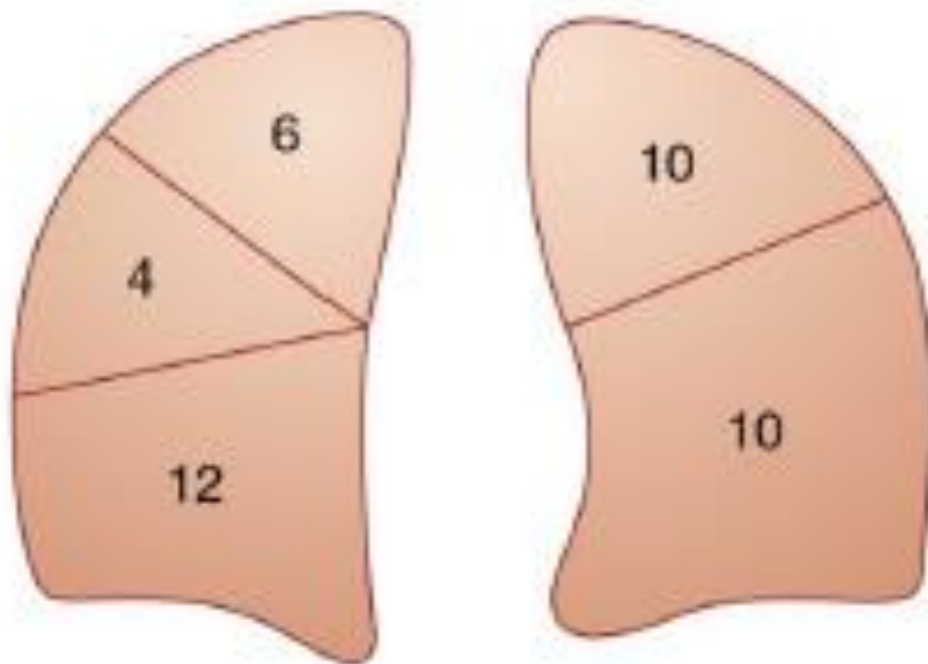
Oxygen used sparingly

CPAP, BiPAP, Incentive spirometry

- Of these the most valid single test for post-thoracotomy respiratory complications is the predicted postoperative FEV 1 (ppoFEV 1 %)

## Lung segments

Total subsegments = 42



Example: Right lower lobectomy  
Postoperative FEV<sub>1</sub> decrease = 12/42 (29%)

$$\text{postoperative FEV}_1 = 70\% \times (1 - 29/100) = 50\%.$$



# Lung Parenchymal Function

## gas exchange

- Arterial blood gas data such as PaO<sub>2</sub> less than 60 mm Hg or PaCO<sub>2</sub> greater than 45 mm Hg have been used as cutoff values for pulmonary resection
- The most useful test : diffusing capacity for carbon monoxide (DLCO).

- The DLCO correlates with the total functioning surface area of the alveolar-capillary interface.
- This simple noninvasive test, which is included with spirometry and plethysmography by most pulmonary function laboratories, is a useful predictor of perioperative **mortality** but not long-term **survival**.
- A ppoDLCO less than 40% predicted correlates with both increased respiratory and cardiac complications and is, to a large degree, independent of the FEV<sub>1</sub>.

The "three-legged" stool of prethoracotomy  
respiratory assessment

Respiratory  
mechanics

$FEV_1^*$   
(ppo > 40%)

MVV, RV/TLC,  
FVC

Cardiopulmonary  
reserve

$Vo_2max^*$   
( > 15 mL/kg/min)

Stair climb > two flights,  
6 min walk,  
Exercise  $SpO_2 < 4\%$

Lung parenchymal  
function

$DLco^*$   
(ppo > 40%)

$PaO_2 > 60$   
 $Paco_2 < 45$

## Postthoracotomy anesthetic management:

Predicted postoperative FEV<sub>1</sub> (ppoFEV<sub>1</sub>%)

>40%

Extubate in operating room if:  
patient AWaC  
(alert, warm, and comfortable)

30%–40%

Consider extubation based on:  
Exercise tolerance  
DLCO  
V̇/Q̇ scan  
Associated diseases

<30%

Staged weaning from mech. ventilation  
Consider extubation if >20% plus:  
Thoracic epidural analgesia

# Pulmonary disease

- History of reactive airway Asthma
- Frequency, reversible of symptoms, interval, last attack, history of steroid used
- Optimize good condition before elective surgery
- COPD: new onset of bronchospasm, dyspnea and reduced exercise tolerance should be indicated to delay elective surgery
- Recent URI is controversial , elective surgery should be delayed several weeks

