Pulmonary Function Tests

Pulmonary function tests (PFTs)	•Categorization of different types of lung processes (restrictive versus obstructive) •Assessment of disease severity (prognosis and preoperative evaluation) •Post-treatment evaluation of lung function.

Pulmonary Function Tests (cont)

Evaluate PFT's	1. When evaluating a PFTs think: •expiratory flow • Lung volumes •Diffusion capacity •Response to bronchodilators 2. Look for all **normals everything >80%**. Most smokers have normal values. 3. Look for **restrictive disease TLC< 80%** . If TLC not known reflected in a proportional decrease in FEV1 and FVC (i.e., FEV1/FVC = 80% but FVC is< 80%). 4. If **restrictive check DLCO** for extra-thoracic or in intra-thoracic. If the decrease in DLCO is proportional to the decrease in TLC means the restriction is not due to parenchymal disease it is of extra-thoracic origin think of obesity and kyphosis. If the decrease in DLCO is disproportionately low compared to the decrease in TLC think of interstitial lung disease. 5. Look for **obstructive FEV1 and FEV1/FVC are low (<70%)**. 6. If **obstructive, check the TLC, DLCO, and reaction to beta2-agonists**: Emphysema if the TLC is high but the DLCO is low (alveolar disease); minimal-to-no response to beta2-agonist. Asthma if the DLCO is normal, or there typically is a reaction to beta2-agonist.

Pulmonary Function Tests (cont)

Obstructive Disease	**Overexpansion** of lungs – loss of recoil. **Reduction in AIRFLOW**. **FEV1/FVC Ratio is decreased (<70%).** Difficulty exhaling, narrowed airways, bronchoconstriction, mucus accumulation. **COPD [Emphysema, Chronic bronchitis], Asthma.**
Restrictive Disease	**Reduction in lung VOLUME**. Difficulty taking air in from **STIFF lung**. **Total lung capacity decreased (< 80%). ILD, scoliosis, obesity, PNA, Fibrosis, consolidation, Tumors** due to both a decreased VC and RV.

Pulmonary Function Tests

TLC (total lung capacity: VC+RV) N=80–120%	The volume of air in the lungs after maximum inspiration. **High in obstructive (>120% hyperinflation). Low in restrictive (<80%, decreased lung volume)**.
FEV1 (forced expiratory volume) N=80–120%	Total volume of air able to exhale in the first second during maximal effort. **Low (<80%) in obstructive**. Normal to slightly low (<80%) in restrictive (proportional to volume). **Bronchodilator response >12% and 200mL increased FEV1 (+asthma vs -COPD)**.
VC (vital capacity)	Volume of air expelled from the lungs during a maximum expiration. **Low in restrictive** (problem with lung dynamic, large airway is intact, so ILD).

Pulmonary Function Tests (cont)

FVC (forced vital capacity)	Total volume of air able to exhale for the total duration of the test during maximal effort. **Low restrictive** (**decreased expansion** from fibrosis, tumor/cancer, consolidation, heart failure with pulmonary edema, thick pleura, effusion, cardiomegaly, chest wall issues, muscle weakness).
FEV1/FVC Ratio N=80%	Percentage of the FVC expired in one second (do the volumes, flow out of lung as expected). **Low (<70%) in obstructive diseases (COPD or asthma)**. Normal/high (>70%) in restrictive diseases (ILD, sarcoidosis, asbestosis, CHF, MSK, neuromuscular diseases + morbid obesity).
FRC (functional residual capacity)	Volume of air in the lungs after a normal expiration (increase indicates hyperinflation).

Pulmonary Function Tests (cont)

RV (residual volume) N=75–120%	Volume of air in the lungs at maximal expiration. **High in obstructive (dead space air, increase indicates air trapping)**. Low in restrictive.
TV (tidal volume)	Volume of air breathed in a and out of the lungs during quiet breathing.

Pulmonary Function Tests (cont)

DLCO (gas exchange) N=75–120%	Lung diffusion testing (ability of the body to absorb carbon monoxide from a single breath) is used to determine how well oxygen passes from the alveolar space (alveolar membrane permeability) of the lungs into the blood. **Low in ILD, pulmonary vascular diseases**, anemia, emphysema (loss of alveolar-capillary units). Normal in chronic bronchitis, asthma (bronchoconstriction, but NO alveolar disease. **Increased in problems that increase effective blood flow to the functional lung**, such as heart failure, disease alveolar hemorrhage, pulmonary infarction, and idiopathic pulmonary hemosiderosis (IPH).
DLCO/VA	**PERFUSION** Diffusing capacity corrected for alveolar volume/Hct-adjusted.

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Cheatography

PFT ACNP Student Cheat Sheet

by xkissmekatex (kissmekate) via cheatography.com/33594/cs/10488/

PFTs for Specific Lung Diseases

Interstitial Lung Disease Restrictive

- •Normal to increased FEV/FVC.
- •Straight or slightly convex expiratory flow-volume loop tracing.
- •Proportional decrease in all lung volumes.
- •**DLCO is reduced** (due to thickening of the alveolar capillary interface) and is the 1st pulmonary parameter to change with disease progression

Asthma Obstructive

- •PFTs may be normal if no active disease.
- •Decreased expiratory flow.
- •Concave expiratory flow-volume loop tracing.
- •**Significant response to beta2-agonist**.
- •Normal or increased TLC (due to hyperinflation) and normal or reduced VC.
- •**DLCO is normal**.

Emphysema Obstructive

- •Decreased expiratory flow volume
- •Concave expiratory flow-volume loop tracing.
- •**Minimal response to beta2-agonist**:< 12% improvement or < 200mL improvement in FEV1 or FVC.
- •**Increased TLC, reduced VC=hyperinflation with trapped air**.
- •**DLCO is decreased** (destruction of alveolar capillary interface--suggests emphysema) but early on maybe normal spirometry and lung volume

PFTs for Specific Lung Diseases (cont)

Chronic Bronchitis Obstructive

- •Decreased expiratory flow volume
- •Concave expiratory flow-volume loop tracing.
- •**Minimal response to beta2-agonist**:< 12% improvement or < 200mL improvement in FEV1 or FVC.
- •Normal or only slight increase in TLC = normal or slightly reduced VC.
- •DLCO is normal to slightly decreased, but it is not as low as in patients with emphysema.
- •DLCO is to differentiate emphysema from chronic bronchitis and asthma.

Most cases of COPD have mixed physiology with components of both chronic bronchitis and emphysema.

FEV

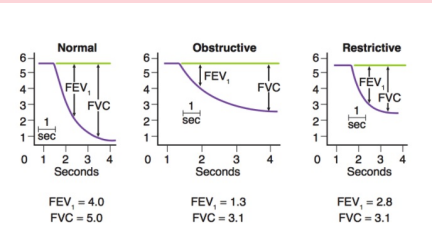
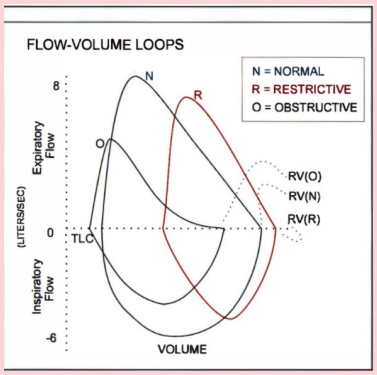


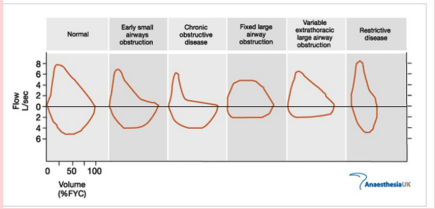
Figure 9-2. Forced Expiratory Volumes

Flow Volume Loops



The relationship between airflow rates compared with lung volumes.

Flow Loop



Test to Order

Smoker: age 40+	Spirometry with bronchodilator q3-4yrs
Hx COPD	•Spirometry with bronchodilator q 1-2 yrs •Also DLCO and if FEV1 < 50% check blood gases •Static lung volumes, looking for increased RV
Asthma: diagnosis	•Spirometry with challenge/ bronchodilator q1yr •**Daily peak flows** •Written plan in place
Allergic Rhinitis	Correlates w/Asthma so baseline for reactive airways with spirometry with methacholine challenge and bronchodilator
Exertional Dyspnea	Spirometry with dilators & methacholine, DLCO, Pox, Exercise Testing
Chest Tightness	Spirometry with methacholine and bronchodilators
Chronic Cough	Spirometry with methacholine, bronchodilators, and inspiratory flow loop
CAD (smoker and HF)	Spirometry with bronchodilator
Recurrent PNA or Bronchitis	Spirometry with methacholine and bronchodilators

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Test to Order (cont)

Neuromuscular Disease	Spirometry with methacholine and bronchodilators, DLco testing, maximal respiratory pressures
Occupational exposures	Spirometry

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