

# Case Studies In Pulmonary Function

TERRENCE SHENFIELD MS, RRT-ACCS, RPFT,  
NPS, AE-C



# Recap

- **What is FVC?**

- FVC can be decreased in both obstructive lung diseases (COPD) and restrictive lung diseases (pulmonary fibrosis)

- **FEV1 and FVC Ratio**

- Used to determine if you have a restrictive process or obstructive process
- An FEV1/FVC of  $<0.7$  (70%) is diagnostic of air flow obstruction and confirms obstructive disease
- Restrictive disorders have a near-normal or higher than normal FEV1/FVC, but both the FEV1 and FVC are reduced proportionally.



# Recap

- **Reversible bronchospasm**

- In asthma with airway obstruction (FEV1/FVC ratio < 80%), repeat testing after an inhaled bronchodilator should increase the FEV1 > 200 mL or > 12% from baseline.

- **ATS/ERS FEV1% predicted**

- >70% Mild
- 60-69 Moderate
- 50-59 Moderately severe
- 35-49 Severe
- <35 Very severe



# Recap

- **Total lung capacity (TLC)**
  - Average lung capacity is about 6 liters
- **DLCO**
  - Normal DLCO: >75% of predicted, up to 140%
  - Mild: 60% to LLN (lower limit of normal)
  - Moderate: 40% to 60%
  - Severe: <40%
- **RV (Residual volume)**
  - Normal adult value is averaged at 1200ml(20-25 ml/kg)
  - Air trapping causes increased RV
- **Lung hyperinflation**
  - Total lung capacity (TLC) is >120% of the predicted value



# Case 1

- A 60-year-old man presents to his primary care provider with complaints of increasing dyspnea on exertion.
- He has a 40 pack-year history of smoking and is retired following a career as a building contractor.
- His pulmonary function testing is as follows:



Test	Pre-Bronchodilator (BD)			Post- BD	
	Actual	Predicted	% Predicted	Actual	% Change
FVC (L)	1.89	4.58	41	3.69	96
FEV <sub>1</sub> (L)	0.89	3.60	25	1.89	112
FEV <sub>1</sub> /FVC (%)	47	79			
RV (L)	5.72	2.31	248		
TLC (L)	7.51	6.41	117		
RV/TLC (%)	76	37			
DLCO corr	20.73	33.43	62		

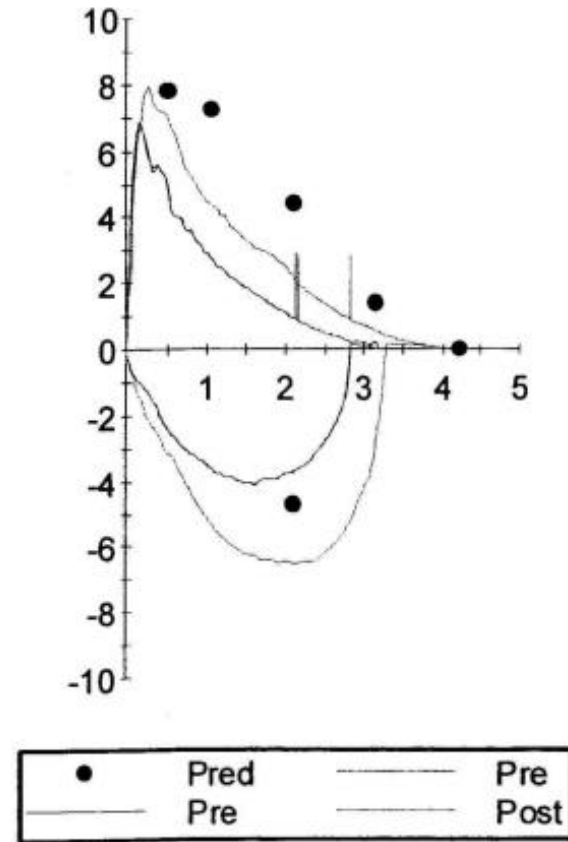
The units for DLCO are ml/min/mmHg

# *Spirometry*



# Flow Volume Loop

His flow volume loop is as follows:



# Case 1 Interpretation

- What do you think about the FVC at 41% and FEV1 at 25% of predicted values?
  - Clearly airway obstruction.
- What about the FEV1/FVC ratio being markedly reduced? What does that tell you?
  - The combination of the low FEV1, FVC and reduced FEV1/FVC ratio is consistent with a diagnosis of airflow obstruction.
- The FEV1 at 25% of predicted is classified as “what”?
  - This would be classified as “severe” airflow obstruction.
- Does the patient meet the criteria for reversible airflow obstruction?
  - Remember both the FEV1 and FVC improved by over 200 ml and 12% following administration of a bronchodilator.
- What about the RV value? What does that tell you?
  - It is indicative of air-trapping.
- The value of TLC at 117%, is this hyperinflation?
  - The total lung capacity (TLC) is somewhat elevated at 117% predicted but it is still shy of the 120% predicted level used to define hyperinflation.





## Case 2

- A 73-year-old man presents with progressive dyspnea on exertion over the past one year.
- He reports a dry cough but no wheezes, sputum production, fevers or hemoptysis.
- He is a life-long non-smoker and worked as a lawyer until retiring 3 years ago.
- He likes to hunt and fish in his leisure time.
- His pulmonary function testing is as follows:



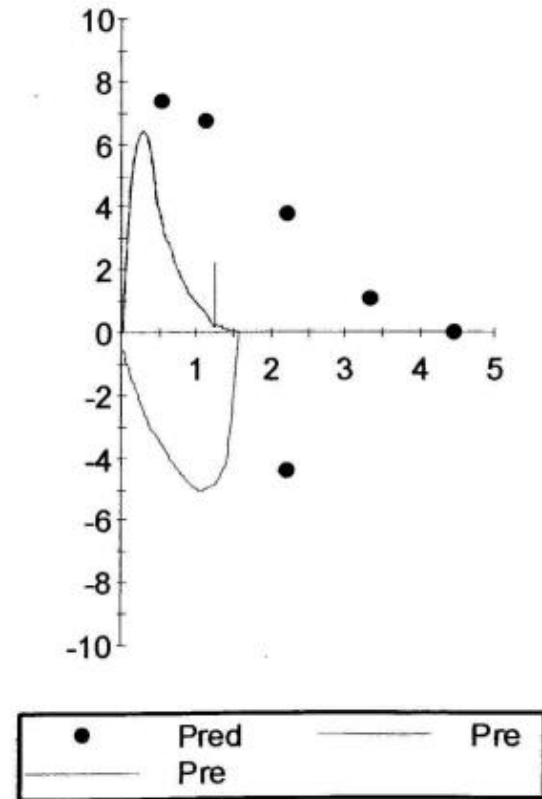
# *Spirometry*

Test	Pre-Bronchodilator (BD)		
	Actual	Predicted	% Predicted
FVC (L)	1.57	4.46	35
FEV <sub>1</sub> (L)	1.28	3.39	38
FEV <sub>1</sub> /FVC (%)	82	76	
FRC	1.73	3.80	45
RV (L)	1.12	2.59	43
TLC (L)	2.70	6.45	42
RV/TLC (%)	41	42	
DLCO corr	5.06	31.64	16



# Flow-Volume Loop

His flow-volume loop is as follows:



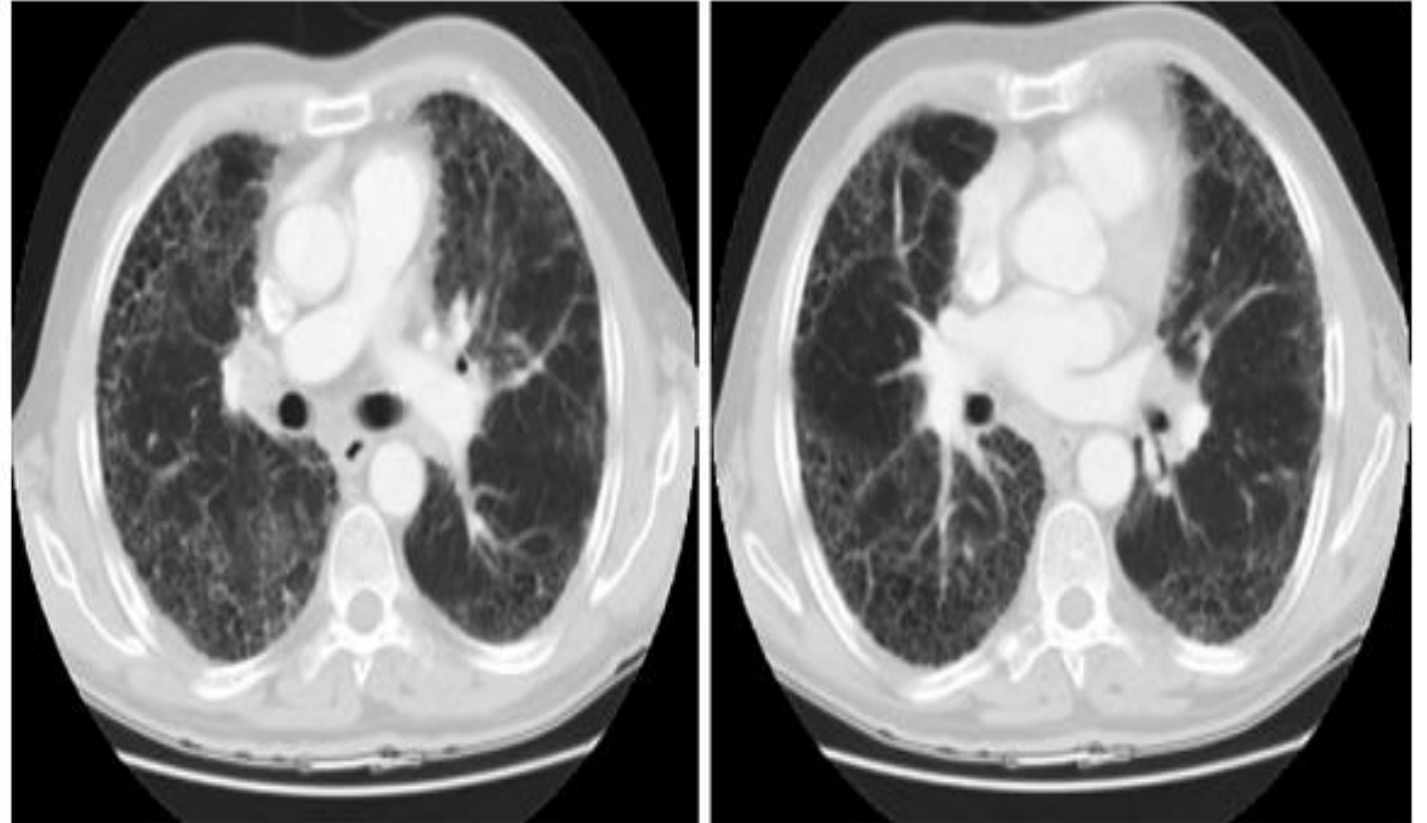
# *PA and Lateral Chest X-Ray*

- Decreased lung volumes
- Reticulonodular opacities
- Ground-glass opacification
- Cyst appearance



# Chest CT Images

- Interstitial B-lines
- Bibasilar reticular opacities



# Case 2 Interpretation

- This patient has a reduced FEV1 and FVC but a normal FEV1/FVC ratio, what does this tell you?
  - The total lung capacity is reduced and the patient, therefore, has a restrictive defect.
- The flow-volume loop is tall, narrow, and a short expiratory phase. What kind of process is this?
  - Characteristic appearance of a restrictive process
- The TLC is below 50% predicted, what would you classify this as?
  - A “severe” restrictive defect.
- His DLCO is also markedly reduced? Why is this happening?
  - He has a reduced alveolar capillary interface for gas exchange and suggesting that the cause of his restrictive process lies within the lung parenchyma.
- Based on the X-ray/CT images findings and PFT values, what would you say is a possible diagnose?
  - This patient was found to have idiopathic pulmonary fibrosis.

