

# Case Studies in Pulmonary Function Testing—Part II

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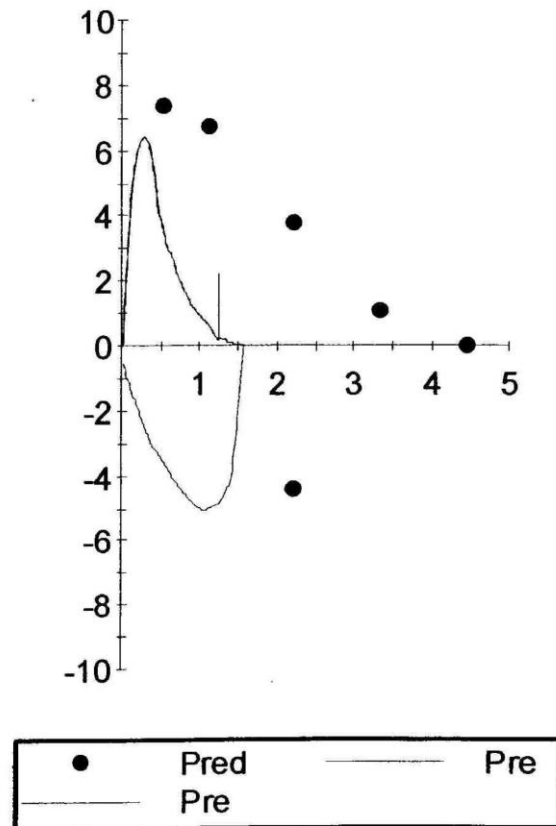
# PFT-Case 1

- ▶ 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. H

# Case 2 Cont.-His pulmonary function testing is as follows:

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

# His Flow-Volume Loop is as Follows



# Interpretation

- ▶ This patient has a reduced  $FEV_1$  and FVC with a preserved  $FEV_1/FVC$  ratio.
- ▶ The total lung capacity is reduced and the patient, therefore, has a restrictive defect.
- ▶ The flow-volume loop also has the characteristic appearance of a restrictive process – tall, narrow and a short expiratory phase.
- ▶ Based on the fact that his TLC is below 50% predicted, this would be classified as a “severe” restrictive defect.
- ▶ His DLCO is also markedly reduced indicating he has a reduced alveolar-capillary interface for gas exchange and suggesting that the cause of his restrictive process lies within the lung parenchyma.

Diagnosis: This patient was subsequent found to have *idiopathic pulmonary fibrosis*. His chest x-ray images are shown below.



# Case 2-PFT/Cardiopulmonary Exercise Stress Test

- ▶ A 5' 10", 311 lb 47 year-old male has been on disability from work at a meat packing plant due to exertional dyspnea for two years. He and his doctor are claiming that his dyspnea is due to breathing hazardous fumes at work. The firm representing the workman's compensation insurance company has ordered a cardiopulmonary stress test to help determine the cause of the dyspnea.

# PFT Case 2 - Cont.

- ▶ Below is a summary of the key results of the cardiopulmonary stress test.

Variable	Results	Reference Range	Clinical Significance
SaO <sub>2</sub> & PaO <sub>2</sub>	≥ 96% 88 torr	>95% 80-100 Torr	<b>Decreased</b> in ILD and Pulmonary Vascular Disease <b>Normal</b> in heart failure, obesity and deconditioning.
AT	59% VO <sub>2</sub> Max	> 40% VO <sub>2</sub> Max	<b>Decreased</b> in heart failure, COPD, Pulmonary Vascular Disease and deconditioning. <b>Normal</b> in Obesity
VD/VT	0.22	< 0.28	<b>Increased</b> in Heart Failure, COPD, ILD and Pulmonary Vascular Disease <b>Normal</b> in Obesity & Deconditioned.
VE/VCO <sub>2</sub> at AT	25	< 34	<b>Increased</b> in Heart Failure, COPD, ILD and Pulmonary Vascular Disease <b>Normal</b> in Obesity & Deconditioned.
Oxygen Pulse	88%	> 80%	<b>Decreased</b> in heart failure, COPD, ILD, Pulmonary Vascular Disease and deconditioning. <b>Normal</b> in Obesity



# Interpretation

- ▶ This patient's key cardiopulmonary stress testing results seem relatively normal, though the test was ended prematurely due to dyspnea. However, enough of this test could be conducted to ascertain key variables.
- ▶ All of the key variables are within normal ranges suggesting that the patient has neither a respiratory nor cardiac limitation to exercise.
- ▶ This combined with the patient's severe morbid obesity and an occupational history which is not often associated with pulmonary nor cardiac disease suggests that that dyspnea may be due to morbid obesity and perhaps malingering and not due to an occupational exposure.
- ▶ Hence, this patient should be referred to dietary counselling and perhaps may be a candidate for bariatric surgery for weight loss surgery.

# PFT Case 3

- ▶ A 61 year-old woman presents to the General Internal Medicine Clinic complaining of dyspnea with mild exertion. She has a 50 pack-year history of smoking.
- ▶ She is referred for a pulmonology consult for further assessment and care planning.
- ▶ The pulmonology practice prescribes a regimen of bronchodilators, smoking cessation, PFT's, and pulmonary rehabilitation.

# Case 3 Cont. Her Pulmonary Function Tests are as Follows:

Test	Results				
	Actual	Predicted	% Predicted		
FVC (L)	0.90	3.09	29		
FEV <sub>1</sub> (L)	0.49	2.57	19		
FEV <sub>1</sub> /FVC (%)	54	83			
RV (L)	3.83	1.49	257		
TLC (L)	4.78	4.44	108		
RV/TLC (%)	80	33			
DLCO corr	0.75	24.85	3		

# Interpretation

- ▶ This patient has evidence of air-flow obstruction, as her FEV<sub>1</sub>, FVC and her FEV<sub>1</sub>/FVC are all decreased. Her flow volume demonstrates the characteristic scooped-out appearance seen in obstructive lung disease and also demonstrates markedly reduced peak expiratory flows. Based on her FEV<sub>1</sub> of 19% predicted.
- ▶ This would be classified as “very severe” obstructive lung disease. The patient also has evidence of air-trapping, as her RV is 257% predicted.
- ▶ Her DLCO is also decreased, indicating a loss of alveolar-capillary surface area for gas exchange, thus suggesting a primary diagnosis of ***emphysema***.

# What Add'l Tests Could be Recommended to Determine Any Functional Benefit for Her Participation in Pulmonary Rehabilitation?

- ▶ A Six-Minute Walk Test would be helpful to determine changes in functional capacity of this patient due to therapy such a pulmonary rehabilitation.
- ▶ A Cardiopulmonary Exercise Stress test could also determine such changes but is much more involved and expensive and might be considered overkill.

# Selected Sources & References

- ▶ Kacmarek, Stoller, Heuer, Egan's Fundamentals of Respiratory Care, ed 12 2021.
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- ▶ Culver B, Graham B, Coates A, et al, Recommendations for a Standardized Pulmonary Function Report. An Official American Thoracic Society Technical Statement, Vol 196, (11) 2018.
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