Pulmonary Function Testing Case Questions

In the space that follows you will find multiple cases designed to help you learn how to interpret pulmonary function tests. Each case contains a short clinical scenario and the pulmonary function tests for that patient. For each case, you should attempt to describe the pattern of abnormality, if one is present, grade the severity of the abnormality and generate a differential diagnosis for the observed abnormality.

The cases have been provided by Kenneth Steinberg, MD from the Division of Pulmonary and Critical Care Medicine.

Abbreviations:
FVC   Forced Vital Capacity
FEV_1 Forced Expiratory Volume in One Second
TLC   Total Lung Capacity
RV   Residual Volume
DLCO   Diffusion Capacity for Carbon Monoxide
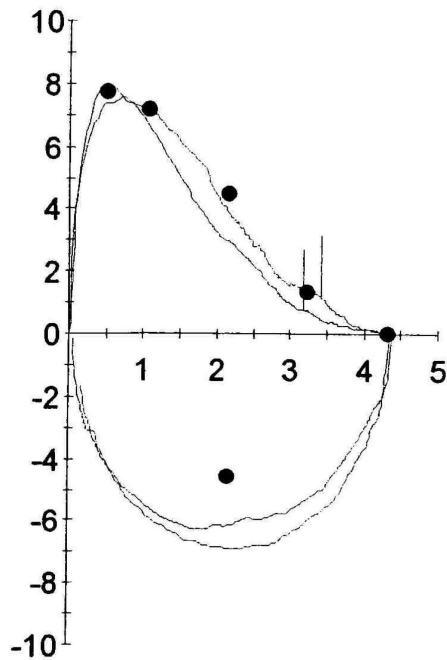BD   Bronchodilator

Case 1

A 65 year-old man undergoes pulmonary function testing as part of a routine health-screening test. He has no pulmonary complaints. He is a lifelong non-smoker and had a prior history of asbestos exposure while serving in the Navy. His pulmonary function test results are as follows:

Test	Pre-Bronchodilator (BD)			Post- BD
	Actual	Predicted	% Predicted	% Change
FVC (L)	4.39	4.32	102	-1
FEV$_1$ (L)	3.20	3.37	95	7
FEV$_1$/FVC (%)	73	78		8
FRC (L)	3.17	3.25	98	
ERV (L)	0.63	0.93	68	
RV (L)	2.54	2.32	109	
TLC (L)	6.86	6.09	113	
DLCO uncorr	25.69	31.28	82	
DLCO corr	26.14	31.28	84	

DLCO is measured in ml/min/mmHg

His flow volume loops is as follows:

Case 2

A 54 year-old man presents to his primary care provider with dyspnea and a cough. He is a non-smoker with no relevant occupational exposures.

Test	Pre-Bronchodilator (BD)			Post- BD	
	Actual	Predicted	% Predicted	Actual	% Change
FVC (L)	3.19	4.22	76	4.00	25
FEV_1 (L)	2.18	3.39	64	2.83	30
FEV_1/FVC (%)	68	80		71	4

His flow volume loop is as follows:


Pred ●   Pre ———   Post ———
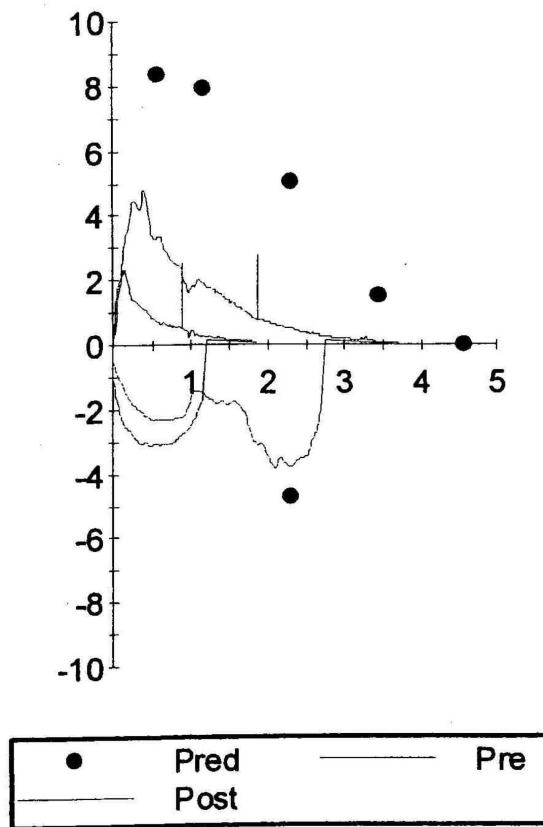
Case 3

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$_1$ (L)	0.89	3.60	25	1.89	112
FEV$_1$/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

His flow volume loop is as follows:

|			
●	Pred	---------	Pre
———	Pre	———	Post
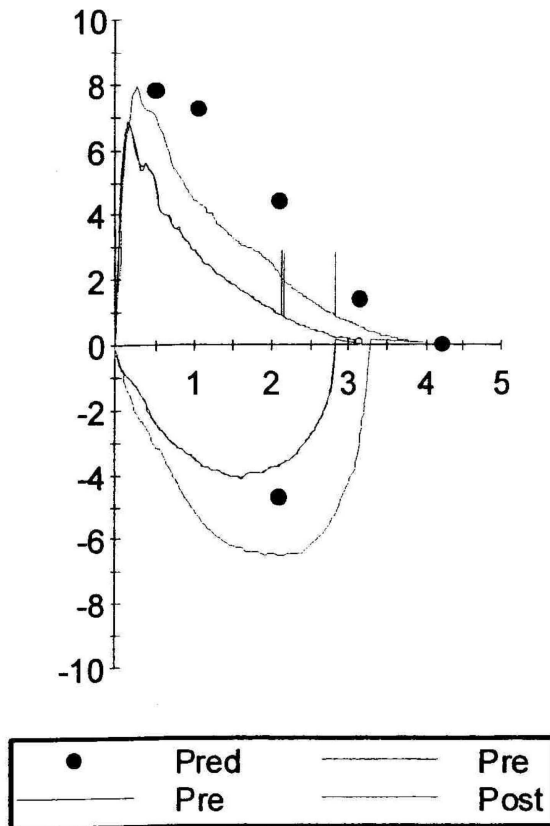
Case 4

A 25 year-old man presents to his physician with complaints of dyspnea and wheezing. He is a non-smoker. Two years ago, he was in a major motor vehicle accident and was hospitalized for 3 months. He had a tracheostomy placed because he remained on the ventilator for a total of 7 weeks. His tracheostomy was removed 2 months after his discharge from the hospital. His pulmonary tests are as follows:

| Test	Pre-Bronchodilator (BD)		
	Actual	**Predicted**	**% Predicted**
FVC (L)	4.73	4.35	109
FEV_1 (L)	2.56	3.69	69
FEV_1/FVC (%)	54	85	

His flow volume loops is as follows:
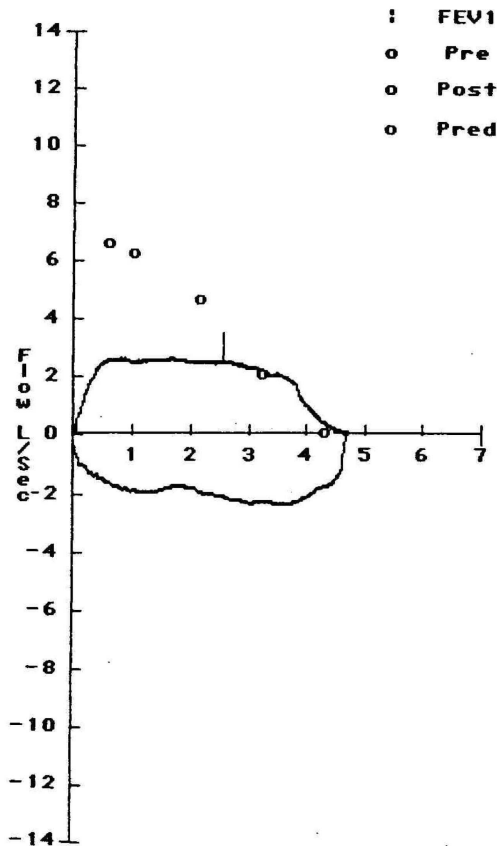
Case 5

A 41 year-old woman presents to the General Internal Medicine Clinic at Harborview Medical Center complaining of dyspnea with mild exertion. She has a 10 pack-year history of smoking and a history of using intravenous drugs including heroin and ritalin. Her pulmonary function tests are as follows:

| Test	Pre-Bronchodilator (BD)			Post- BD	
	Actual	Predicted	% Predicted	Actual	% Change
FVC (L)	0.90	3.09	29	0.74	- 17
FEV$_1$ (L)	0.49	2.57	19	0.44	-10
FEV$_1$/FVC (%)	54	83		59	8
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		

Her flow volume loop is as follows:
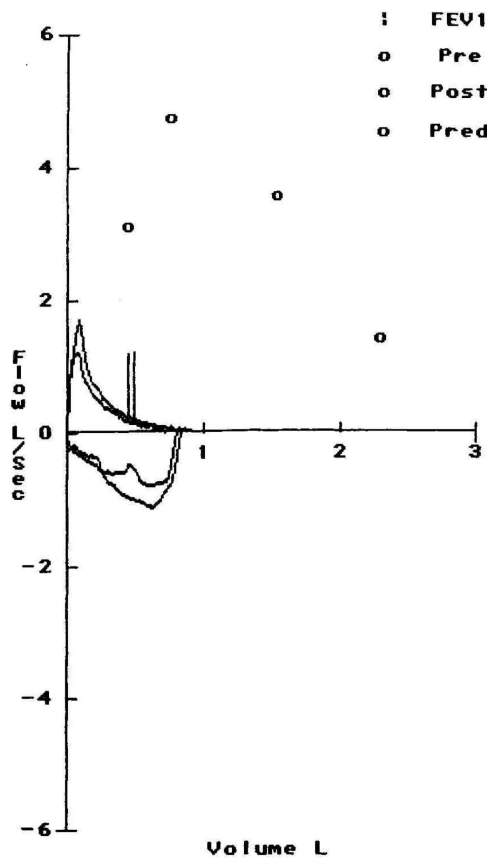
Case 6

A 30 year-old woman presents for evaluation of dyspnea on exertion which has been present for 2 months. She is a life-long non-smoker with no prior history of asthma or other pulmonary problems. She works as a receptionist at a publishing company. She has two cats and several parakeets at home. Her pulmonary function testing is as follows:

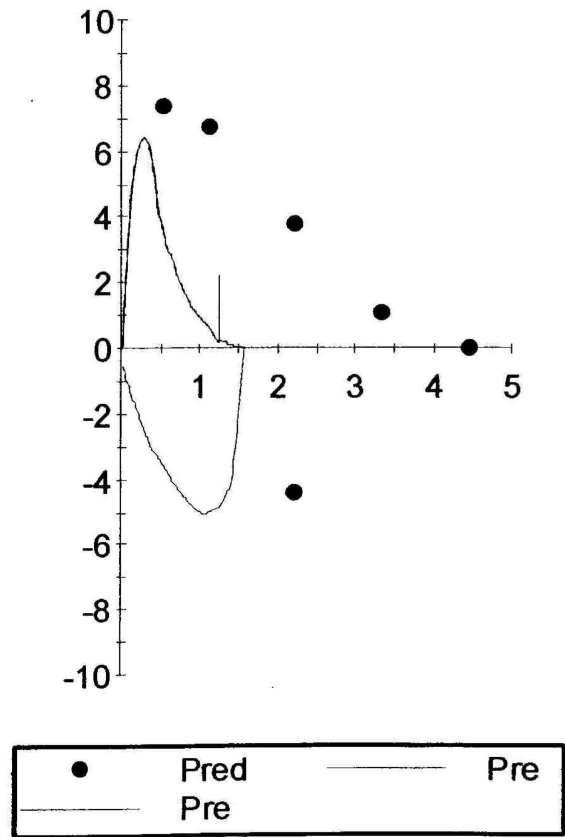| Test	Pre-Bronchodilator (BD)			Post- BD	
	Actual	Predicted	% Predicted	Actual	% Change
FVC (L)	1.73	4.37	40	1.79	4
FEV$_1$ (L)	1.57	3.65	43	1.58	0
FEV$_1$/FVC (%)	91	84		88	-3
RV (L)	1.01	1.98	51		
TLC (L)	2.68	6.12	44		
RV/TLC (%)	38	30			
DLCO corr	5.13	32.19	16		

Her flow volume loop is as follows:
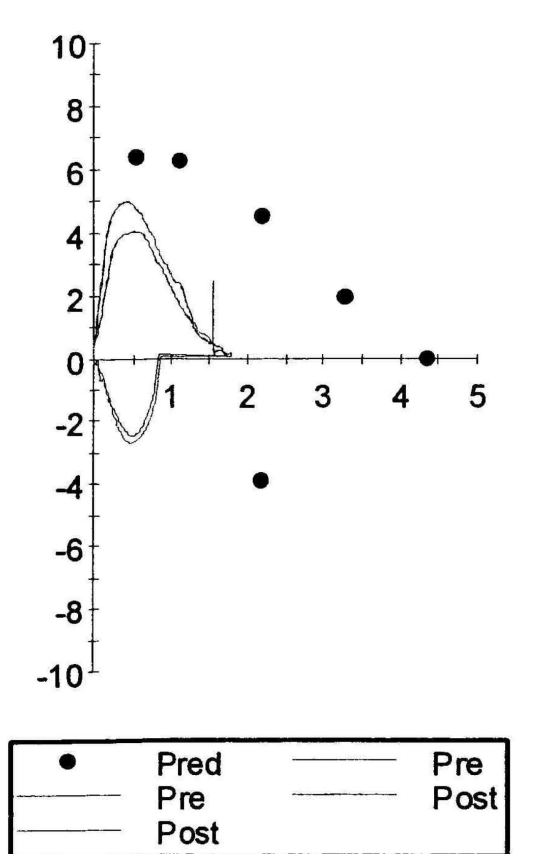
Case 7

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:

Test	Pre-Bronchodilator (BD)		
	Actual	Predicted	% Predicted
FVC (L)	1.57	4.46	35
FEV_1 (L)	1.28	3.39	38
FEV_1/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:

| ●	Pred	———	Pre
———	Pre		

Case 8

A 64 year-old woman presents with complaints of dyspnea and orthopnea. She is a life-long non-smoker. Her pulmonary function testing is as follows:

Test	Pre-Bronchodilator (BD)			Post- BD	
	Actual	Predicted	% Predicted	Actual	% Change
FVC (L)	1.00	2.51	40	1.02	3
FEV$_1$ (L)	0.61	2.00	30	0.69	13
FEV$_1$/FVC (%)	61	80		67	10
RV (L)	1.15	1.55	74		
TLC (L)	2.08	4.04	52		
RV/TLC (%)	55	39			

Her spirometry is repeated with her in the upright and supine positions:

Test	Upright	Supine
FVC (L)	0.49	0.37
FEV$_1$ (L)	0.82	0.68
FEV$_1$/FVC	0.60	0.54

Her flow volume loop in the upright position is as follows:

|			
●	Pred	---------	Pre
————	Pre	————	Post
————	Post		
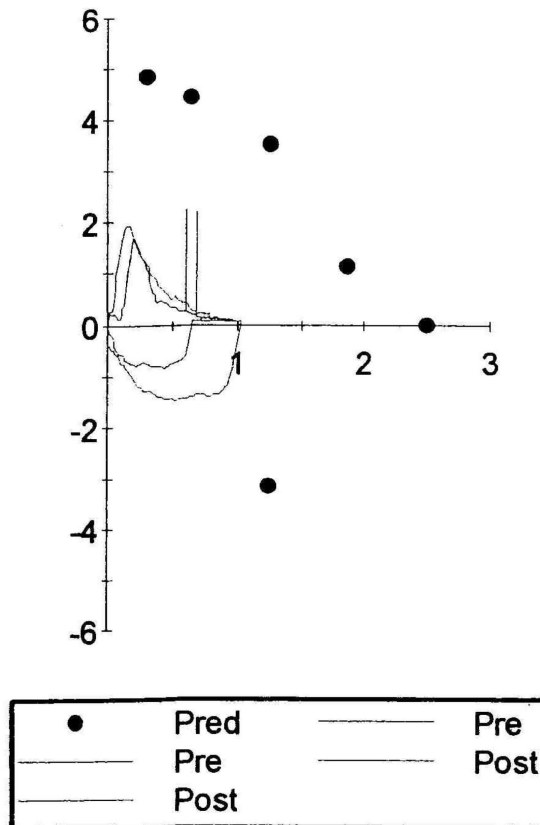
Case 9

A 35 year-old previously healthy man presents with dyspnea, fevers, chills and night sweats for the past 2 months. He is a non-smoker with no concerning habits or occupational exposures. His pulmonary function tests are as follows:

| Test	Pre-Bronchodilator (BD)		
	Actual	**Predicted**	**% Predicted**
FVC (L)	1.66	4.48	37
FEV$_1$ (L)	0.94	3.67	26
FEV$_1$/FVC (%)	57	82	
RV (L)	1.39	1.66	84
TLC (L)	3.06	5.96	51
RV/TLC (%)	45	29	

His flow volume loop is as follows:
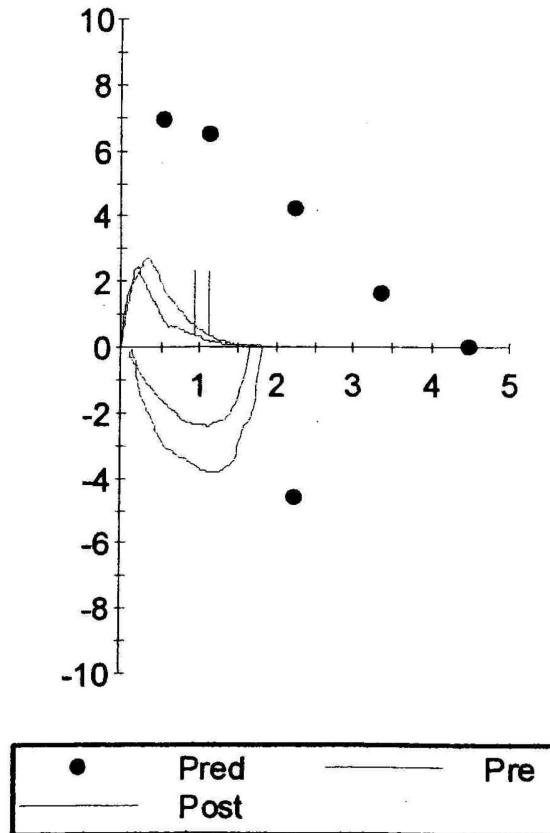
Case 10

A 53 year-old woman presents with increasing dyspnea on exertion. She denies cough, fevers, hemoptysis, weight loss or sweats. She was previously an active runner but has had to cut back significantly because of her symptoms with exercise. She does note occasional chest pain with exercise but has not had any syncope or palpitations. Her pulmonary function tests are as follows:

Test	Pre-Bronchodilator (BD)			Post- BD	
	Actual	Predicted	% Predicted	Actual	% Change
FVC (L)	2.38	2.87	83	2.23	-6
FEV$_1$ (L)	1.95	2.31	84	1.93	-1
FEV$_1$/FVC (%)	82	81		87	
RV (L)	1.69	1.58	107		
TLC (L)	4.26	4.36	98		
RV/TLC (%)	40	36			
DLCO corr	9.96	23.25	43		

DLCO is measured in ml/min/mmHg

Her flow volume loop is as follows:
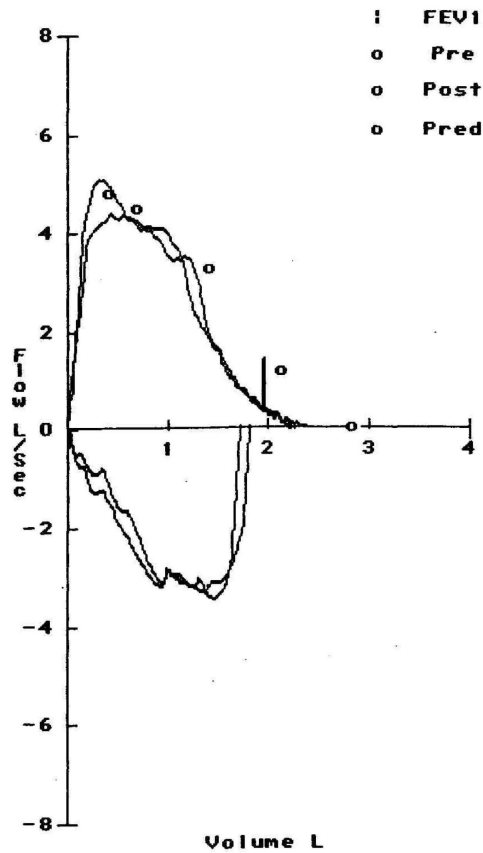
Case 11

A 36 year-old woman presents with a several month history of worsening dyspnea on exertion and exercise limitation. She is a life-long non-smoker and has no history of asthma or other known pulmonary diseases. She has had to stop going out with her weekly running group because she can no longer keep up with her friends. Her pulmonary function testing is as follows:

Test	Pre-Bronchodilator (BD)		
	Actual	Predicted	% Predicted
FVC (L)	0.88	3.34	26
FEV_1 (L)	0.87	2.87	30
FEV_1/FVC (%)	99	86	
RV (L)	1.61	1.40	115
TLC (L)	2.49	4.73	53
RV/TLC (%)	65	29	
DLCO corr	20	26.6	75

A flow-volume loop is not available for this case.

What other tests should you consider ordering on this patient?

Case 12

A 44 year-old woman with cirrhosis secondary to chronic alcohol abuse and Hepatitis C presents with complaints of increasing dyspnea. She reports that her dyspnea is worse when she is sitting upright or walking but improves when she is lying flat. She is an active cigarette smoker. On exam, she has a room air oxygen saturation of 88% in the sitting position and a room air oxygen saturation of 96% in the supine position. Her pulmonary function testing is as follows.

Test	Pre-Bronchodilator (BD)			Post- BD	
	Actual	Predicted	% Predicted	Actual	% Change
FVC (L)	3.94	3.69	107%	3.86	-2
FEV$_1$ (L)	2.76	3.03	91%	2.85	3
FEV$_1$/FVC (%)	70	82			
RV (L)	1.89	1.86	102		
TLC (L)	5.67	5.40	105		
RV/TLC (%)	33	33			
DLCO corr	10.22	28.22	36		

DLCO is measured in ml/min/mmHg

A flow-volume loop is not available for this case.