SPIROMETRY in GENERAL PRACTICE

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SPIROMETRY in GENERAL PRACTICE

- **Would you manage hypertension without a sphygmomanometer???**
- **Would you manage diabetes without a glucometer???**

SPIROMETRY in GENERAL PRACTICE

PEAK EXPIRATORY FLOW RATE (PEFR)

- **Measures flow in large airways**
- **Of limited use in COPD**
- **Relationship between FEV1 and PEFR is poor in COPD (closer in asthma)**

SPIROMETRY in GENERAL PRACTICE

Spirometry measures airflow and lung volumes, and is the preferred lung function test in COPD

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TERMINOLOGY

- **FEV1 = the amount of air maximally exhaled in 1st second of exhalation**
- **FVC = the total volume of air that can be exhaled with maximum force, from maximum inhalation to maximal exhalation**

SPIROMETRY in GENERAL PRACTICE

- FVC & FEV1 expressed as volumes (litres)
- Also expressed as % of predicted values
- Predicted values dependent on age, height, and gender.
- Ratio FEV1/FVC expressed as a percentage

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Factors that influence normal values

- **Height - tall people have larger lungs**
- **Age - Respiratory function declines with age**
- **Sex - Lung volumes smaller in females**
- **Race - Peculiarly studies show Blacks and Asians as a whole have smaller lung volumes (-12%) No studies for Maoris and Pacific People.**
- **Posture - little difference between sitting and standing. Reduced in supine position.**

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OBSTRUCTION

- **FEV1 / FVC < 70%**
- **FEV1 < 80% of predicted value**
- **In severe COPD the FVC may be < 80% predicted - Much less in fact**

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Severity of Obstruction

FEV1	
Mild	>70% Predicted
Moderate	50 - < 69% Predicted
Severe	<50% Predicted

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RESTRICTION

- **Both FEV1 and FVC < 80% BUT the FEV1/FVC ratio is normal or high**

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Severity of Restriction

FVC	
Mild	**>65 - 80% predicted**
Moderate	**>50 - 65% predicted**
Severe	**<50% predicted.**

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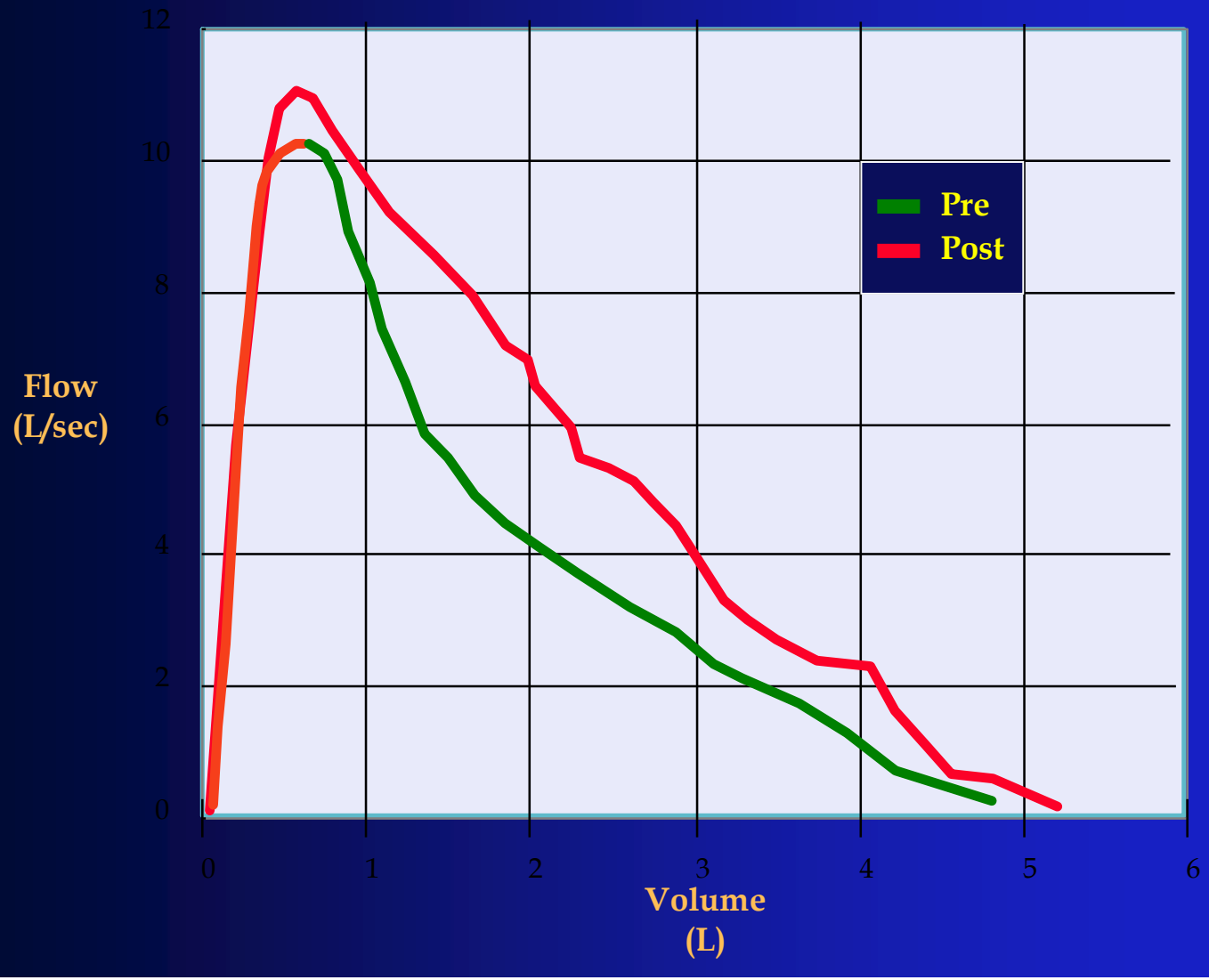
Asthma

- **Both FEV1 & FVC are reduced, but can demonstrate reversibility of at least 12%.**

Flow / Volume Curve

- X axis represents volume
- Y axis represents flow rate
- Shape depends on mechanical properties of lung.

Flow / Volume Curve



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Volume / time curve

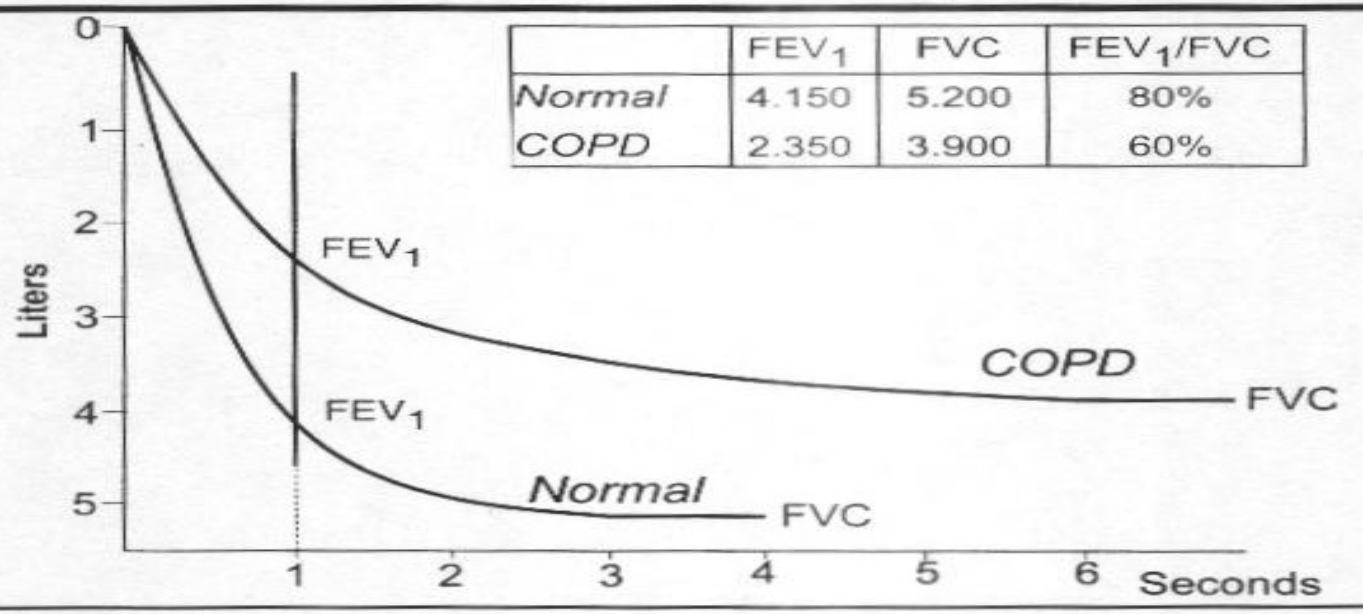
- Must be smooth
- Must plateau

ie Spirometry is only worth doing if it is done properly

COPD DIAGNOSIS

Vol / Time Curve

Figure 2: Example of Spirometric Tracings and Calculation of FEV_1, FVC, and FEV_1/FVC Ratio

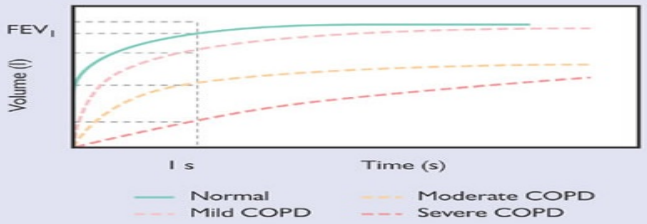


	FEV_1	FVC	FEV_1/FVC
Normal	4.150	5.200	80%
COPD	2.350	3.900	60%

Patients with COPD typically show a decrease in both FEV_1 and FEV_1/FVC. The degree of spirometric abnormality generally reflects the severity of COPD. However, both symptoms and spirometry should be considered when developing an individualized management strategy for each patient.

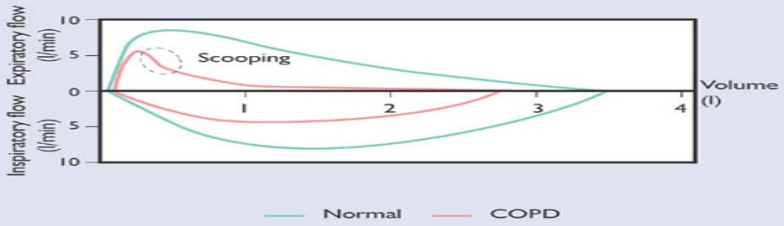
SPIROMETRY

Spirograms in COPD of varying severity



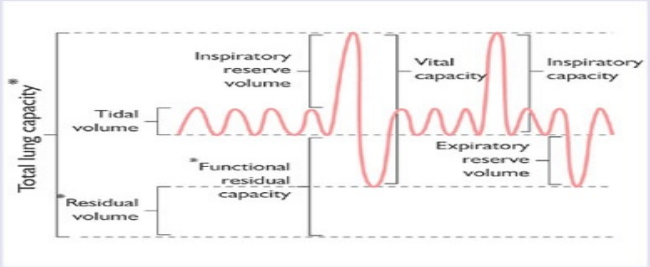
Forced vital capacity (FVC) plateau can take > 12 s

Flow volume loop: single breath forced maneuver



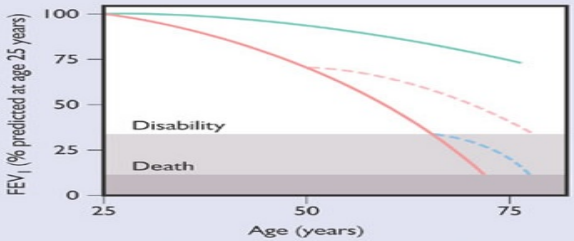
Pneumotachograph: 'scooping' caused by expiratory airway collapse

Lung volumes



* Total lung capacity, residual volume and functional residual capacity are measured by plethysmography

Natural history: decline in FEV_1 with age



Fletcher C, Peto R. *Br Med J* 1977;1:1645–8

SPIROMETRY in GENERAL PRACTICE

John, 42 years, is an area sales manager. "Chesty as a child" - Smoker - 10 pack years. He suffers from frequent "chest infections".

Spirometry

FEV1 = 3.24 (76% pred)

FVC = 4.82 (91% pred)

FEV1/FVC = 67%

Post bronchodilator

FEV1 = 4.17 (29% improvement)

SPIROMETRY in GENERAL PRACTICE

Brian - 65 yrs. Cough + SOB. Smoker 20 pack years

Spirometry

FEV1 = 1.67 (57% pred)	**Reduced**
FVC = 2.07 (55% pred)	**Reduced**
FEV1 / FVC = 81%	**Normal**
Reversibility 6%	

SPIROMETRY in GENERAL PRACTICE

Rose 55 yrs. Smoker for 30 years - 45 Pack years. Increasing SOB. Smoker's cough

Spirometry

FEV1 = 1.39 (56% pred)	**Reduced**
FVC = 2.53 (86% Pred)	**Normal**
FEV1/FVC = 55%	**Reduced**
Reversibility = 5%	**Nil significant**

SPIROMETRY in GENERAL PRACTICE

Mel 50 years. Cough and SOB. Smoker 10 pack years.

Spirometry

FEV1 = 1.6	**(60% pred)**	**Reduced**
FVC = 2.0	**(70% Pred)**	**Normal**
FEV1/FVC	**80%**	**Normal**

Post Bronchodilator 15% Reversibility

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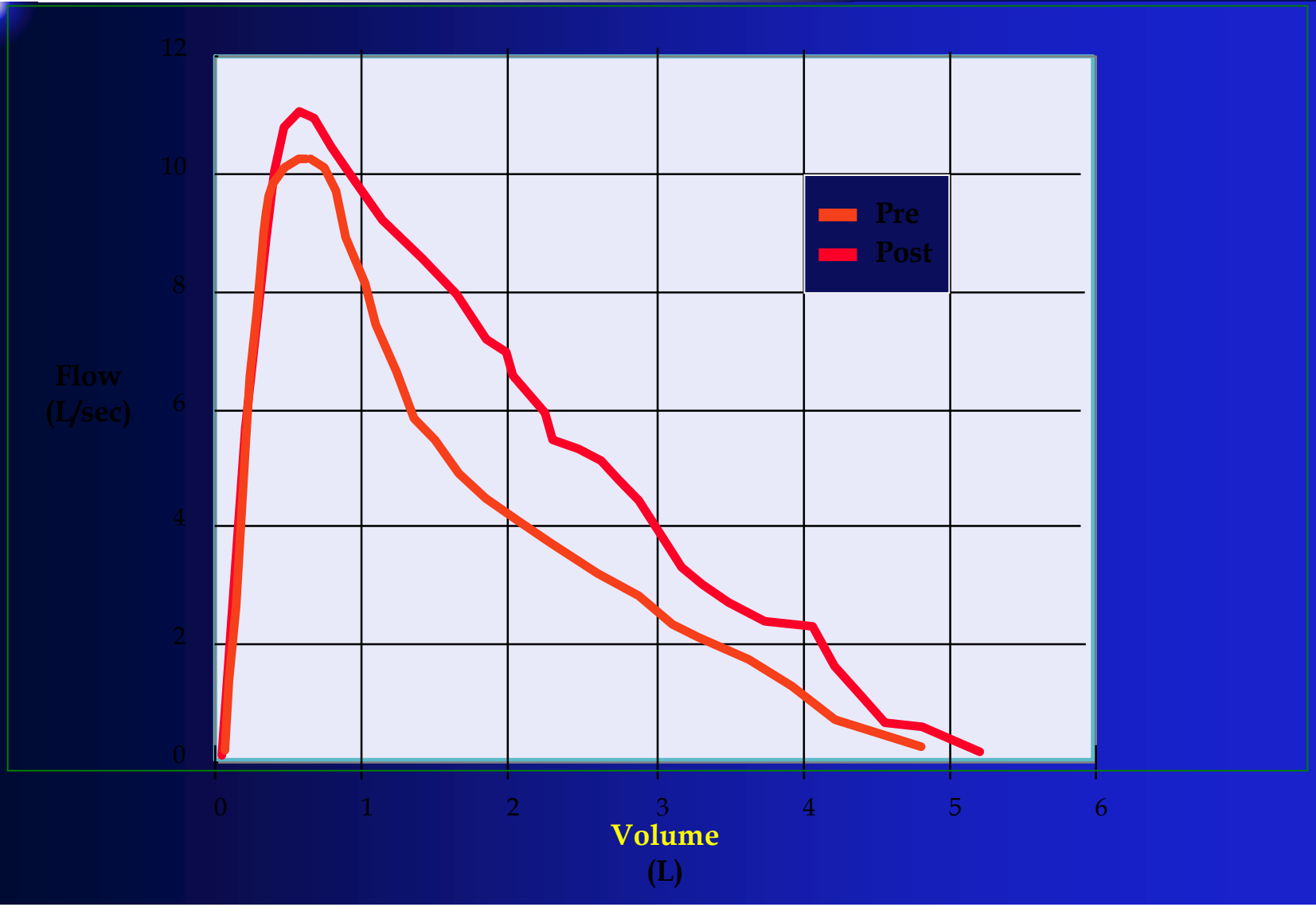
- 18 year old male
- Presented with SOBOE
- HX of childhood asthma
- This prompted his office visit
- Also has family HX of allergies

Case #1: Spirometry Results



CASE #1: SPIROMETRY

	PRE		POST	
	Meas.	%	Meas.	Change
FVC	5.35L	99%	5.67L	6%
FEV_1	3.84L	86%	4.60L	20%
FEV_1/FVC	71.8%		81%	

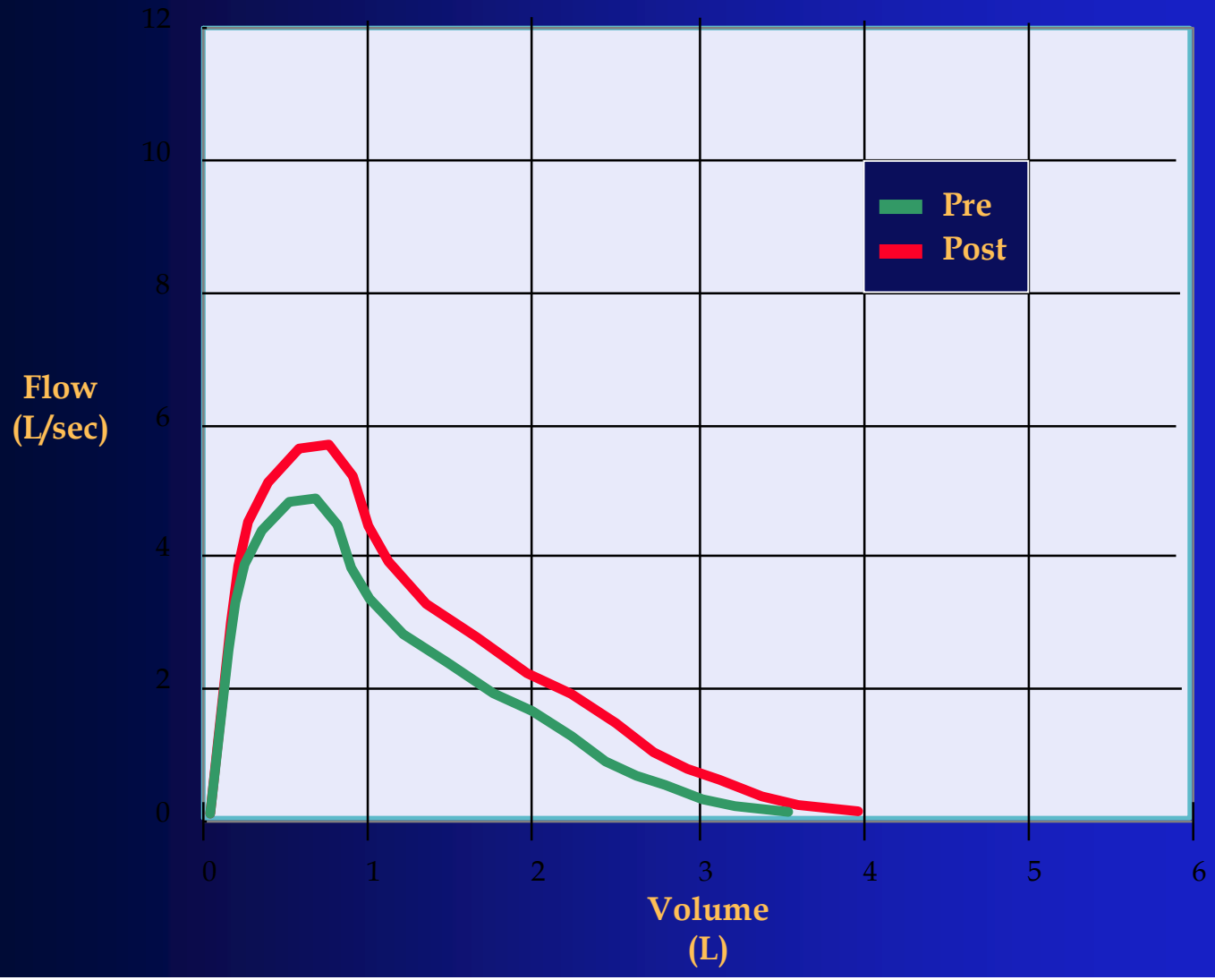
CASE #1: Diagnosis

- Asthma

Case #2: History

- 44 year old woman
- cc: fatigue with dry cough, SOBOE
- Past HX:
  - **Ex-smoker**
  - **Chronic asthma**
  - **A few extrinsic allergies**
- Family HX = positive for emphysema

Case #2: Spirometry Results



CASE #2: SPIROMETRY

	PRE		POST	
	Meas.	%	Meas.	Change
FVC	4.65L	109%	4.85L	4%
FEV_1	2.60L	79%	2.80L	8%
FEV_1/FVC	56%		58%	

Case #2: Diagnosis And Treatment

- Query Moderate COPD
- Needs
  - Full PFTs
  - CXR

CASE #3: HISTORY

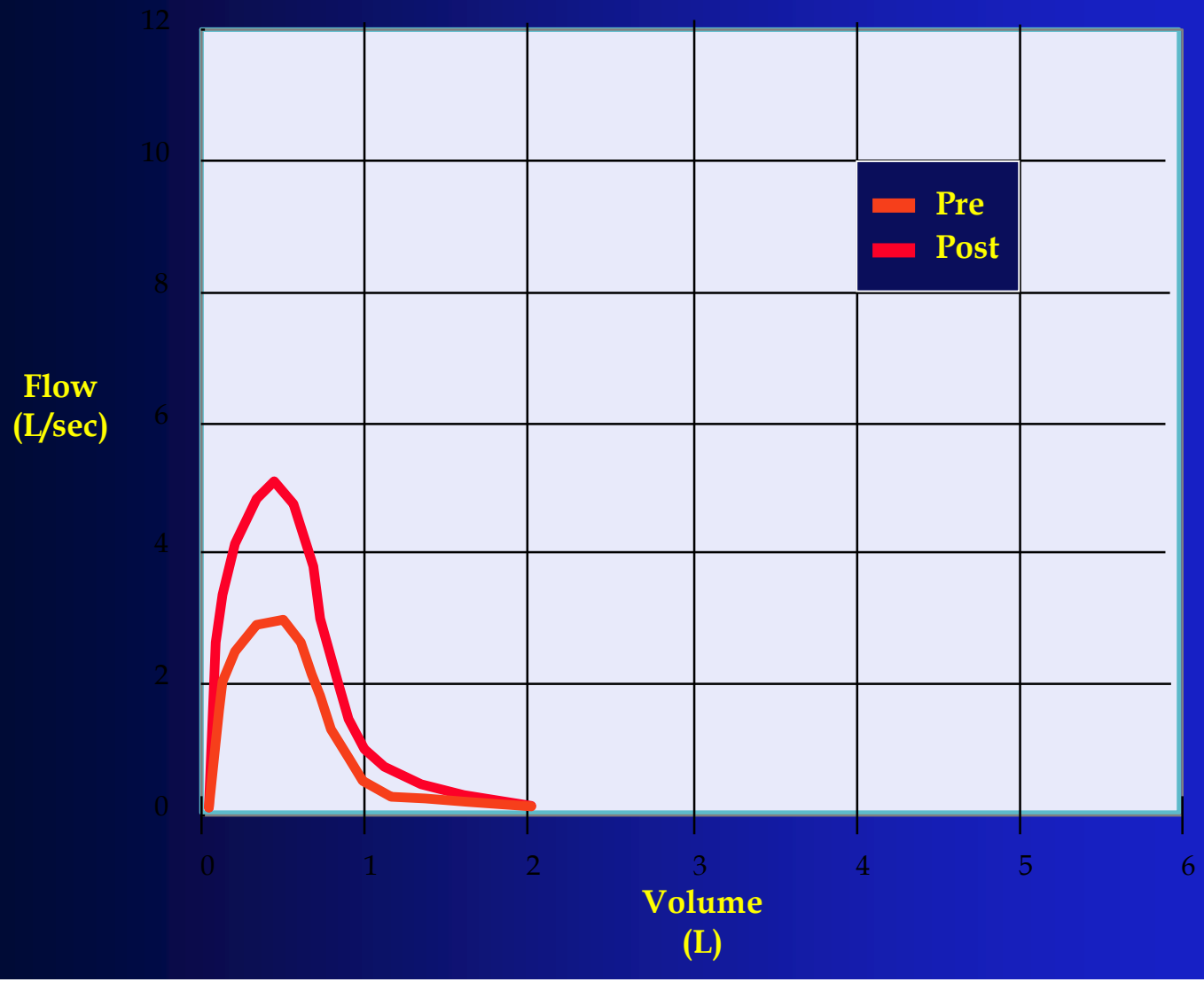
- 39 year old woman
- Smoker
- ++Extrinsic allergies
- SOBOE with white sputum x

  1 week

CASE #3: HISTORY

- 3 visits to the ER in previous 2 days
- No previous measure of airflow(ie PEFR
- or Spirometry).
- Treated with Antibiotics
- Little improvement
- Family history is positive for asthma

Case #3: Spirometry Results



CASE #3: SPIROMETRY

	PRE		POST	
	Meas.	%	Meas.	Change
FVC	1.75L	49%	2.50L	43%
FEV_1	1.10L	39%	1.50L	36%
FEV_1/FVC	63%		60%	

CASE #3: Diagnosis

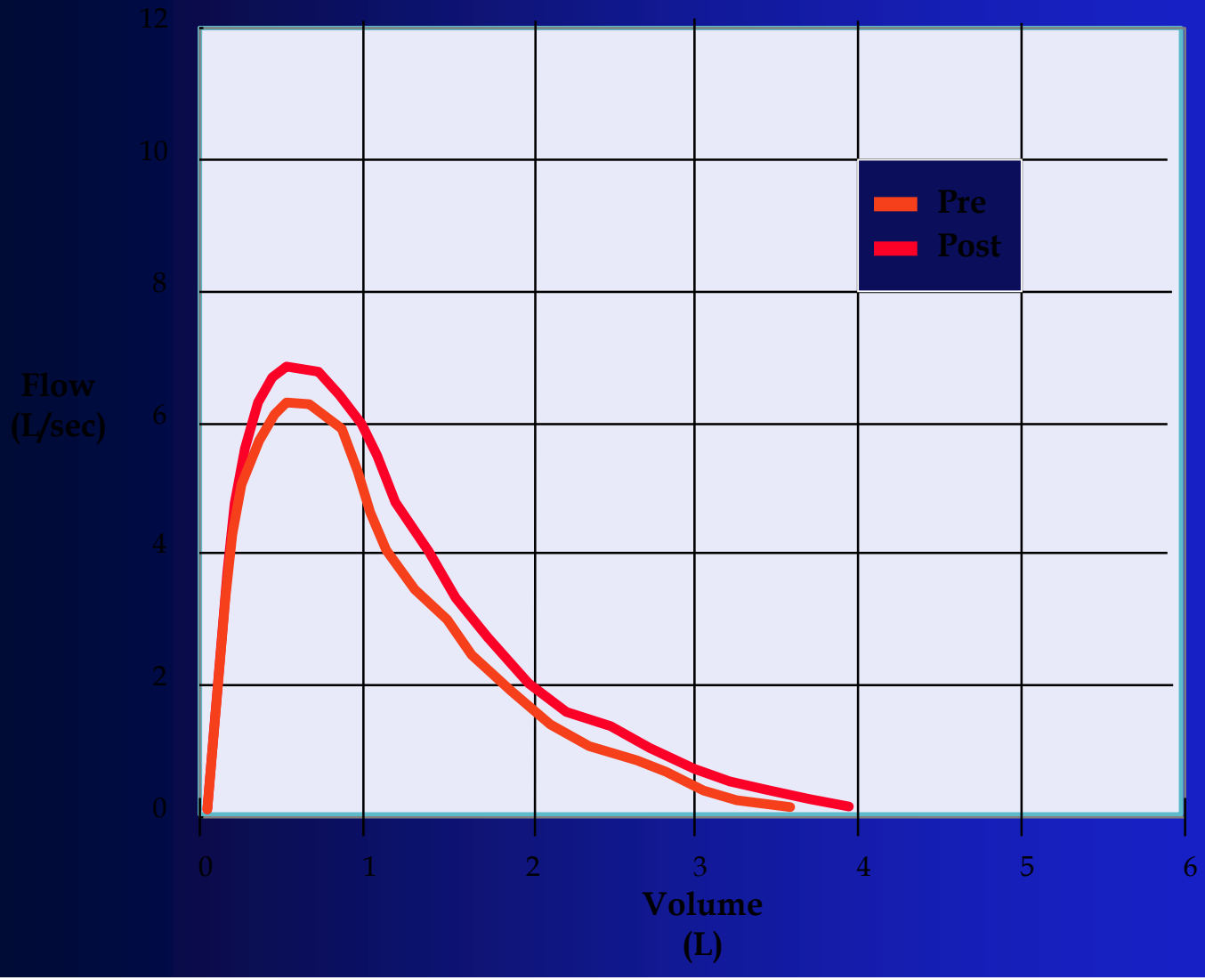
- Reversible obstruction
- Does not reverse to normal-Why?

Severe untreated asthma or COPD

CASE #4: HISTORY

- 32 year old man
- Recent pneumonia with persistent SOBOE
- No wheezing
- No sputum production

Case #4: Spirometry Results

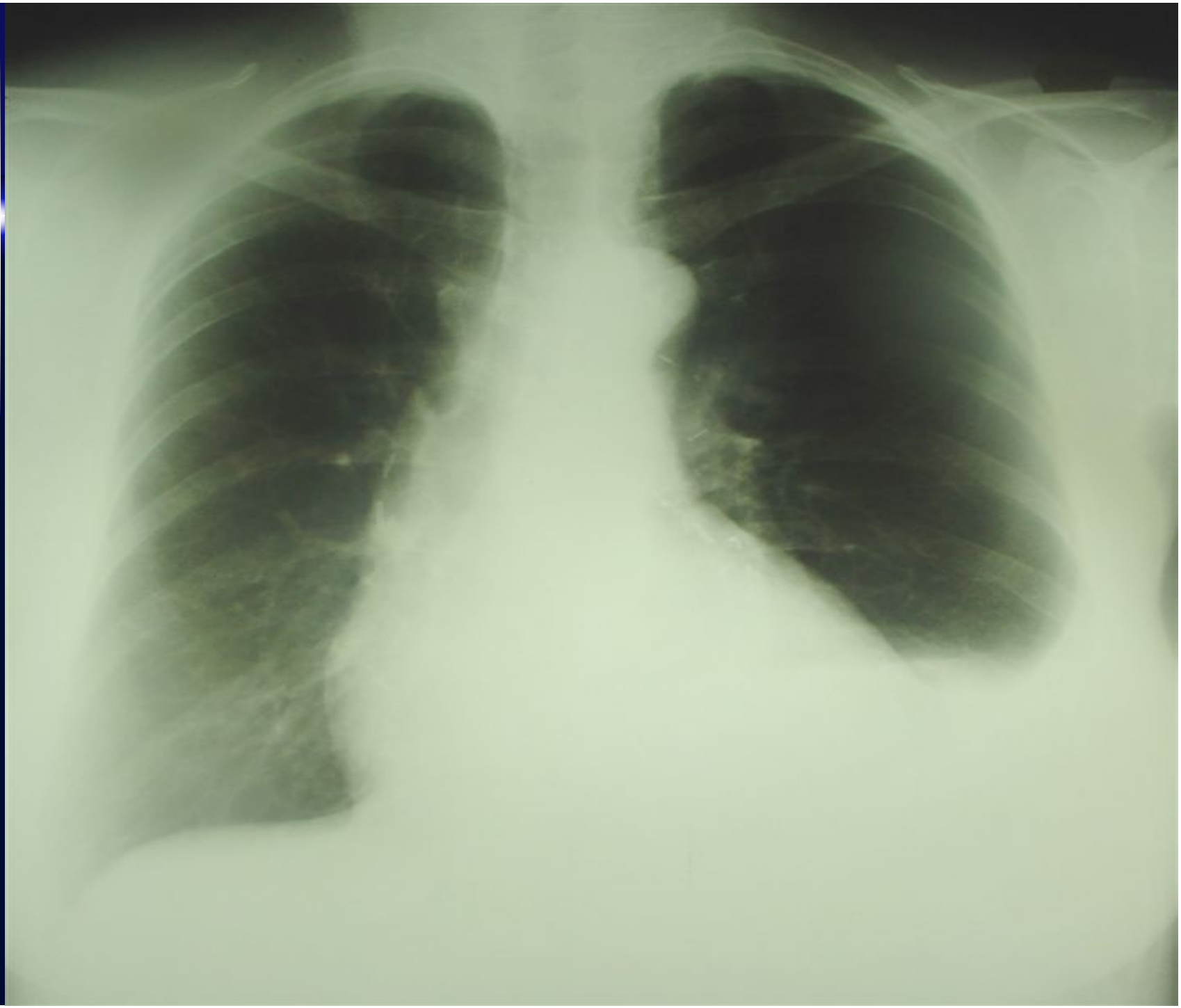


CASE #4: SPIROMETRY

	PRE		POST	
	Meas.	%	Meas.	Change
FVC	2.87L	52%	3.00L	5%
FEV_1	2.38L	56%	2.50L	5%
FEV_1/FVC	83%		83%	

CASE #4: Diagnosis And TREATMENT:Moderate Restriction

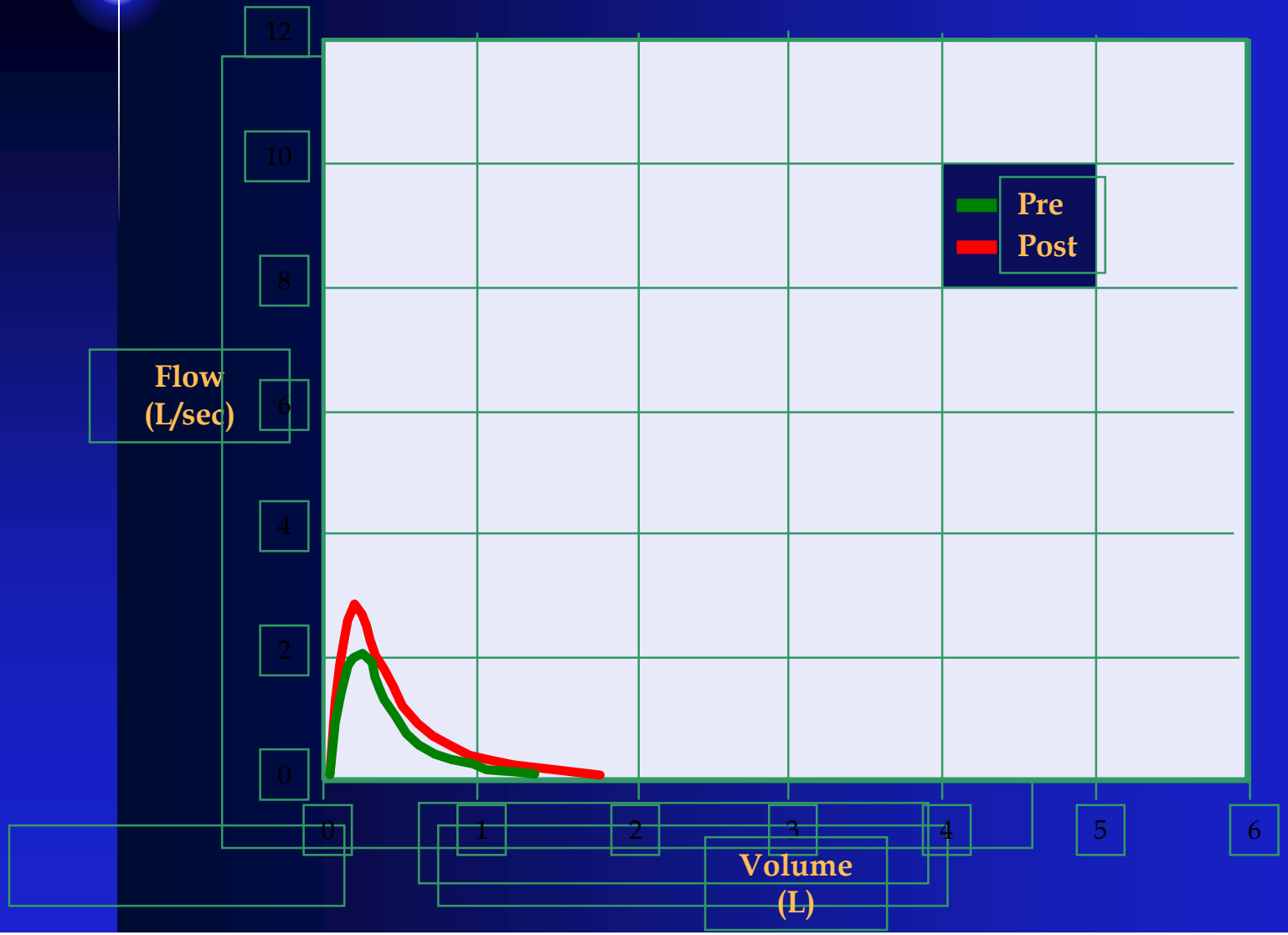
- ? Further pulmonary function tests to confirm etiology
- Many potential causes
- This case: Restriction with decreased residual volume and Normal CO diffusion capacity
- Diaphragmatic eventration/paralysis due to old MVA
- Moral: Look at the x-Ray



CASE # 5: HISTORY

- 52 Year old woman
- SOBOE X 4 years
- Limited to walking less than 1 block
- No hemoptysis
- History of breast cancer

Case #5: Spirometry Results



CASE #5: SPIROMETRY

	PRE		POST	
	Meas.	%	Meas.	Change
FVC	1.36L	42%	1.92L	41%
FEV_1	0.60L	22%	0.86L	43%
FEV_1/FVC	44%		45%	

CASE #5: Diagnosis And TREATMENT: COPD+/- Asthma

- CXR?
- Treat for asthma or COPD?
- Steroid trial?
- Pulmonary Rehab