

PFTs

ACOI Board Review 2019

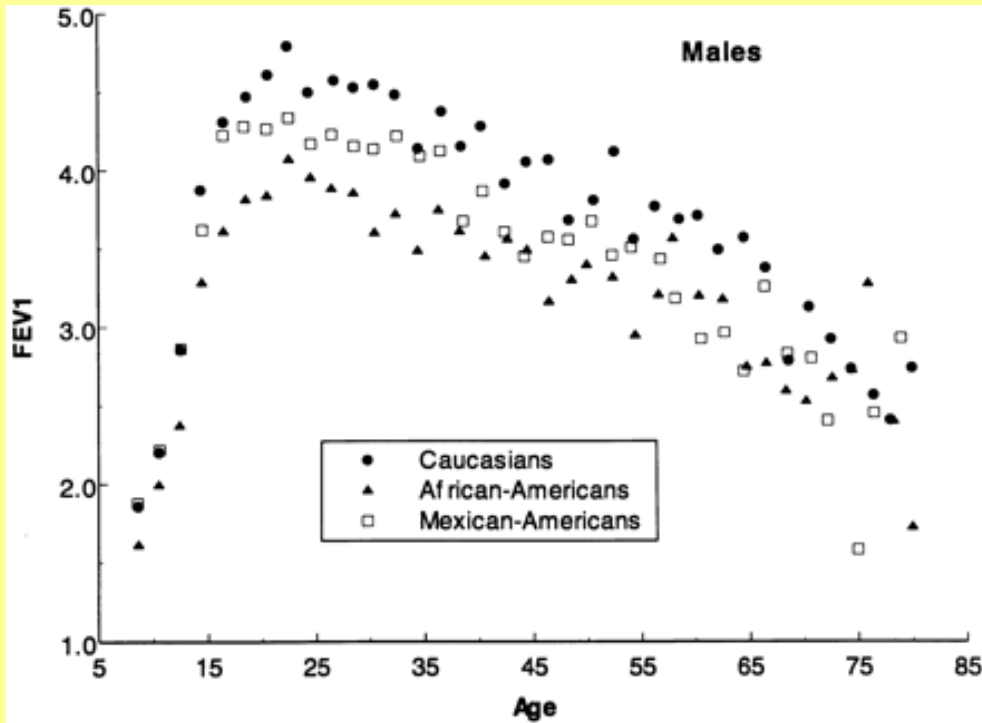
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Chairman Department of Internal Medicine
Director of the Division of Pulmonary, Critical Care
and Sleep Medicine
NOW ROWAN SOM

***In order to compute normal predicted values
you need THREE things***

- **Age** **Lungs get smaller with age**
- **Gender** **Men have bigger lungs**
- **Height** **Tall people have bigger lungs**

- **Actually you need Air temp, Baro Pressure, and race too**

Prediction Equations



Hankinson JL et al.
Am. J. Respir Crit. Care Med.
Jan 1, 1999; 159(1):179-187

Crapo RO, Morris AH, Clayton PD, and Nixon CR. Lung Volumes in Healthy Nonsmoking Adults. Bull. Europ. Physiopathol. Respir. 1982; 8:419-425.

$$\text{FVC} = 0.1524 * \text{Height(inches)} - 0.0214 * \text{Age(years)} - 4.6500 \text{ [Men]}$$

$$\text{FVC} = 0.1247 * \text{Height(inches)} - 0.0216 * \text{Age(years)} - 3.5900 \text{ [Women]}$$

$$\text{FEV1} = 0.1052 * \text{Height(inches)} - 0.0244 * \text{Age(years)} - 2.1900 \text{ [Men]}$$

$$\text{FEV1} = 0.0869 * \text{Height(inches)} - 0.0255 * \text{Age(years)} - 1.5780 \text{ [Women]}$$

$$\text{FEV1\%} = \text{Predicted FEV1} / \text{Predicted FVC}$$

$$\text{RV} = 0.0495 * \text{Height(inches)} + 0.0246 * \text{Age(years)} - 2.6830 \text{ [Men]}$$

$$\text{RV} = 0.0251 * \text{Height(inches)} + 0.0216 * \text{Age(years)} - 0.9470 \text{ [Women]}$$

$$\text{TLC} = 0.2019 * \text{Height(inches)} + 0.0032 * \text{Age(years)} - 7.333 \text{ [Men]}$$

$$\text{TLC} = 0.1499 * \text{Height(inches)} - 4.5370 \text{ [Women]}$$

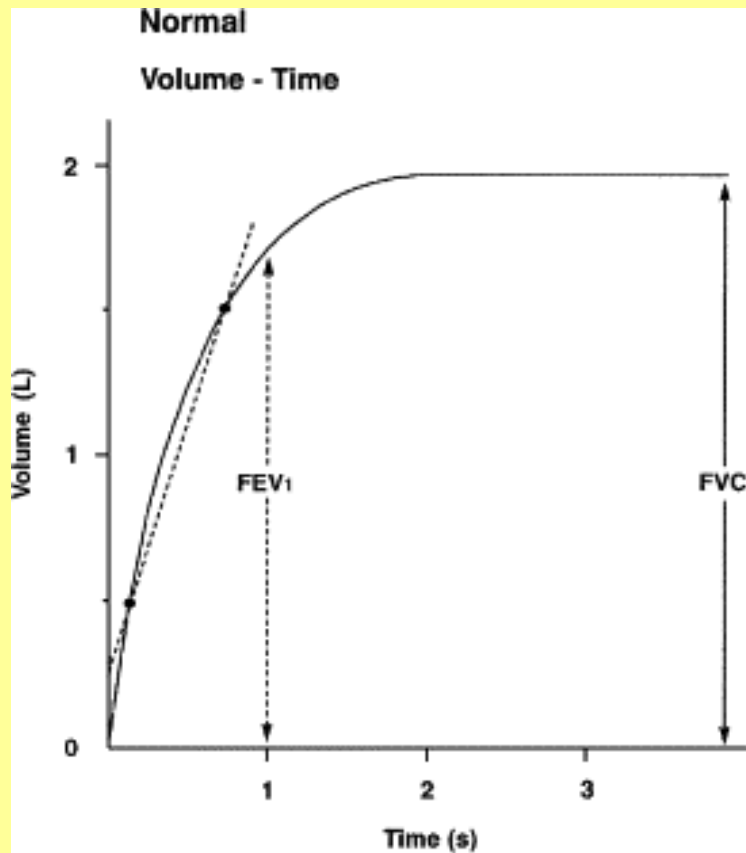
To read spirometry you only really need THREE numbers

- **FVC** **80% or >**
predicted
- **FEV1** **80% or >**
predicted
- **FEV1/FVC ratio** **75% or greater**

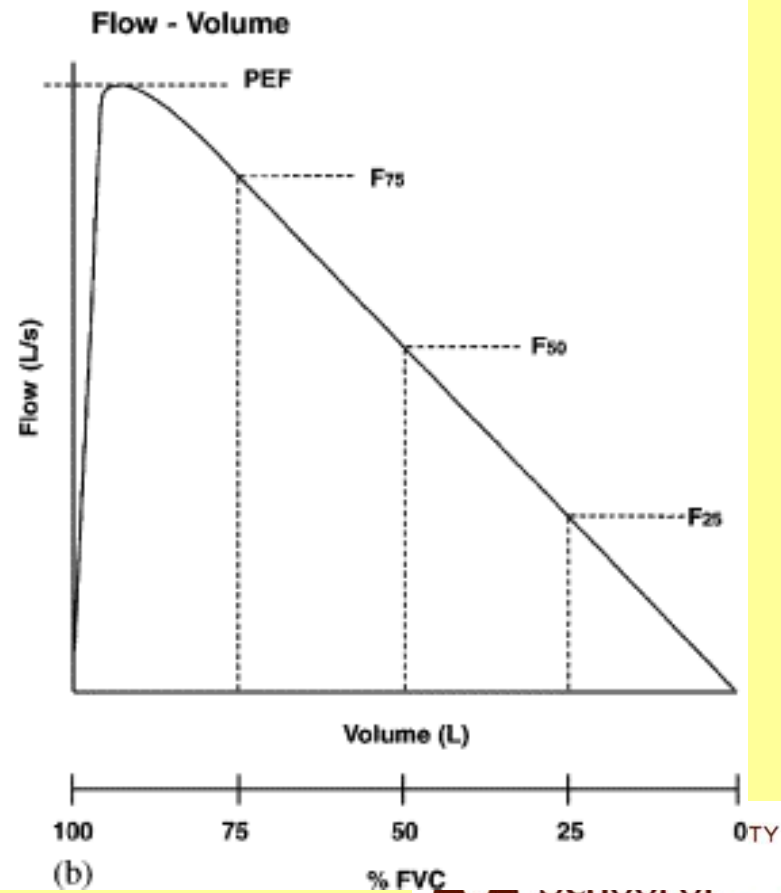
Data for spirometry can be presented in THREE ways

- **Volume time curve**
- **Flow-Volume loop**
- **Numerical data**

Normal VTC and FVL

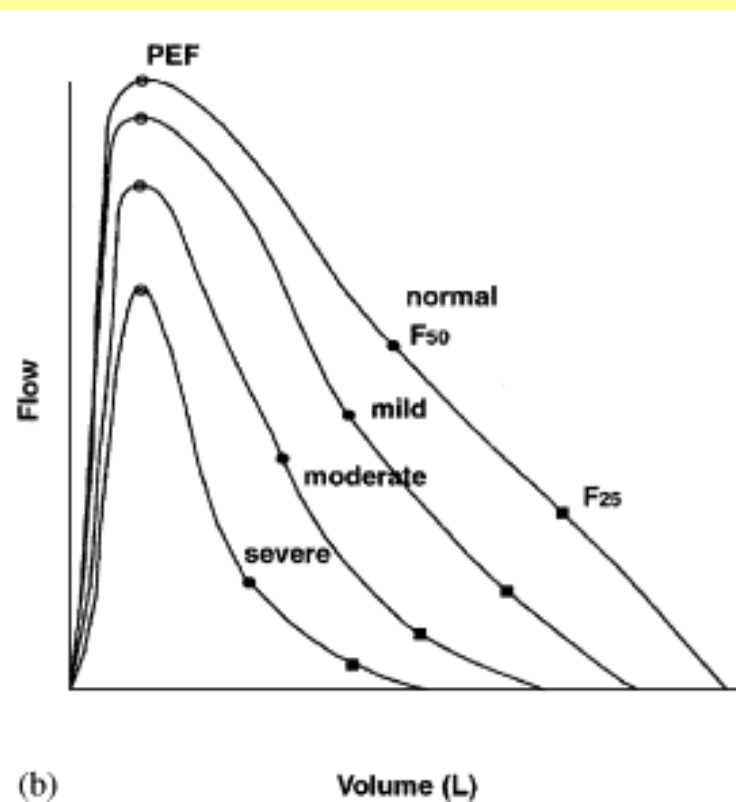
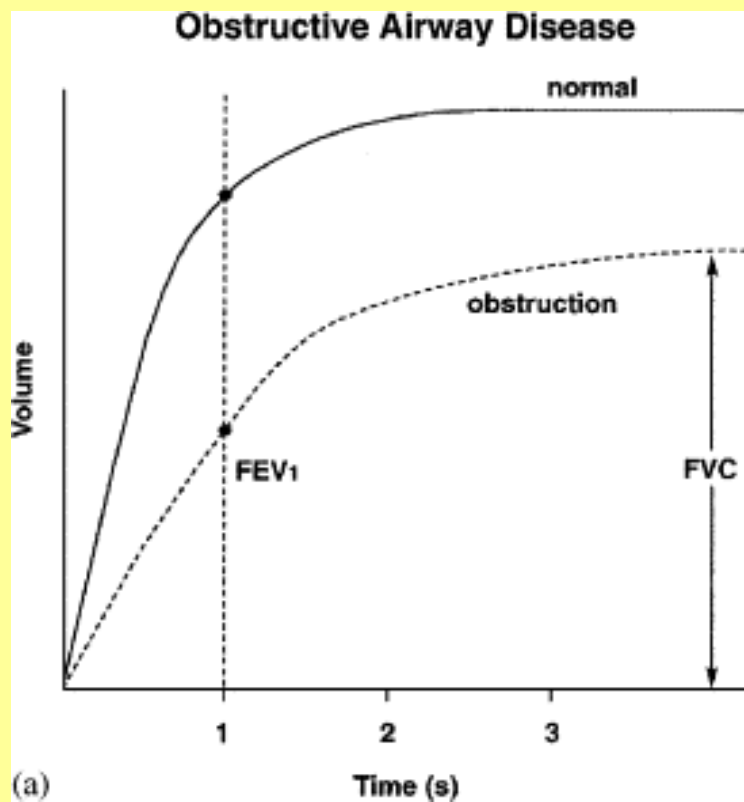


(a)

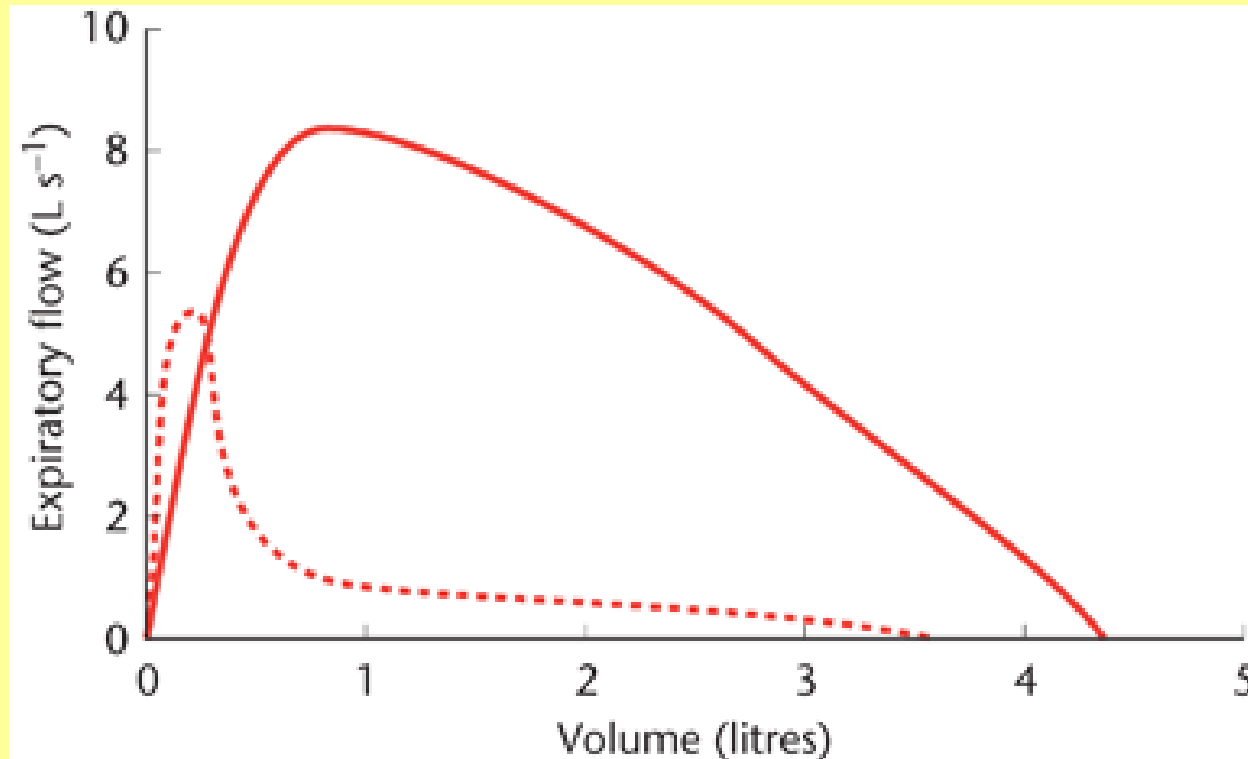


(b)

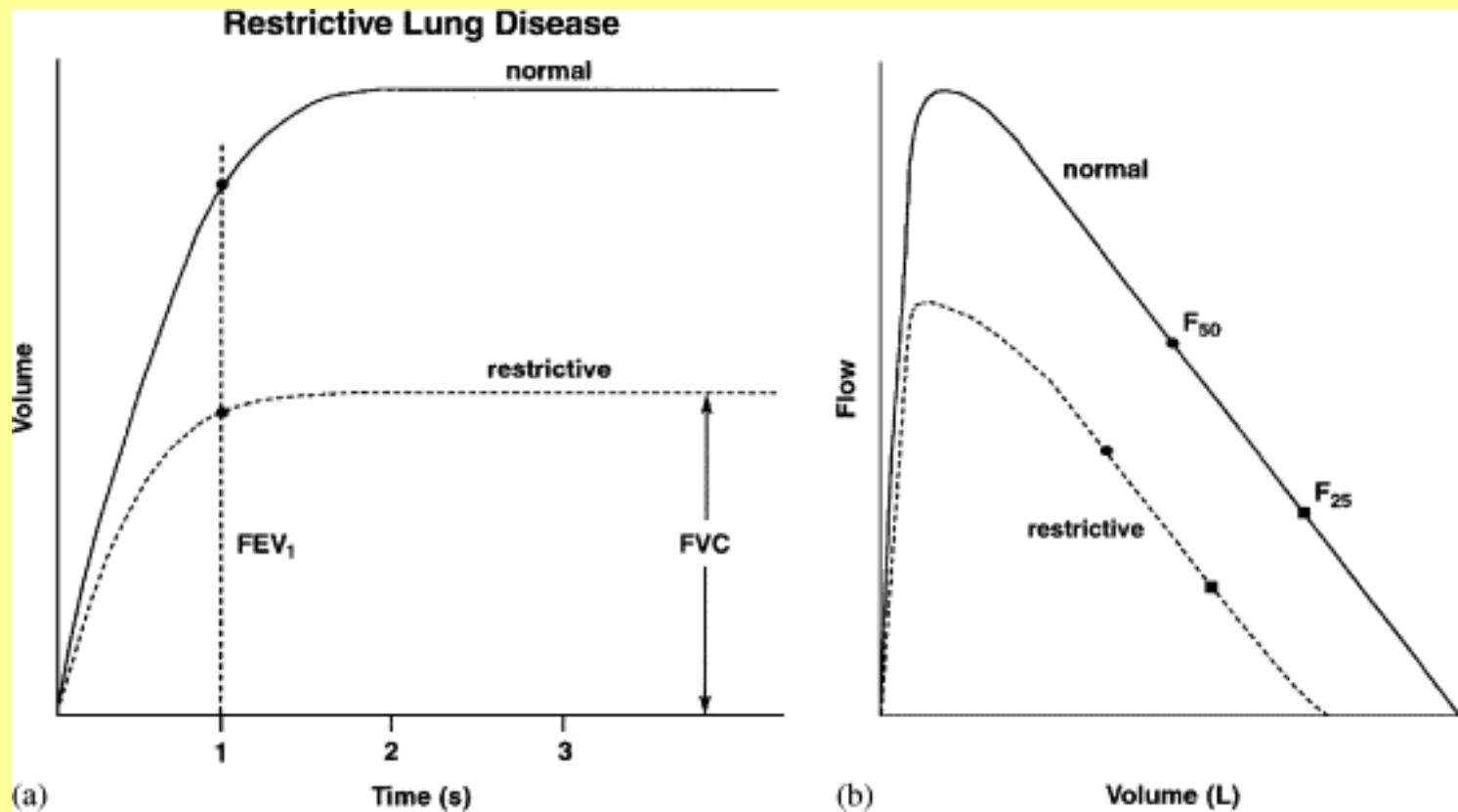
Obstructed VTC and FVL



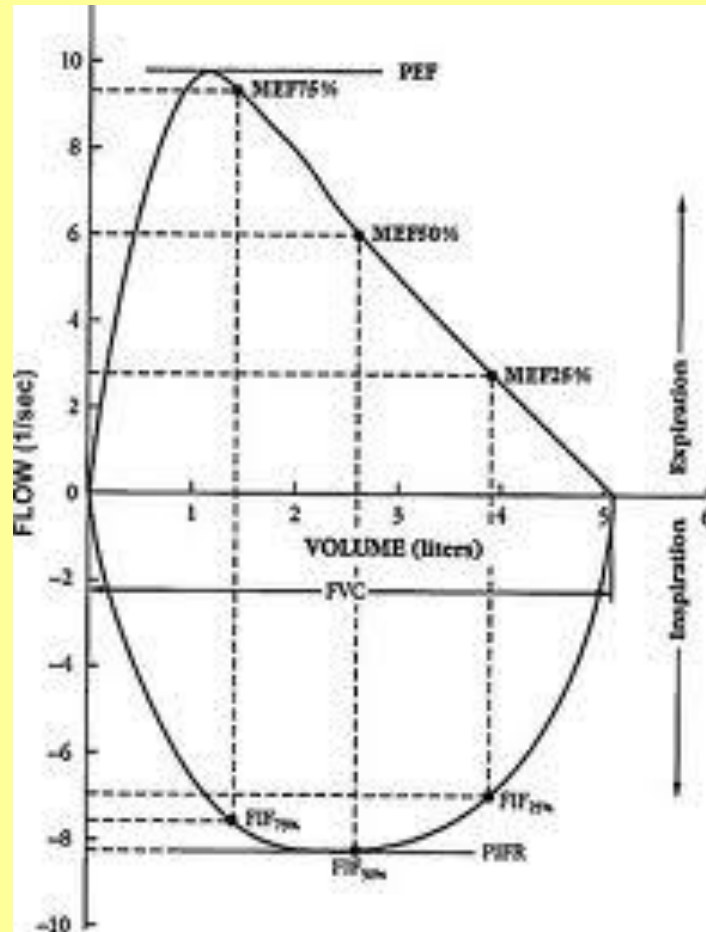
Obstruction – Airway Collapse

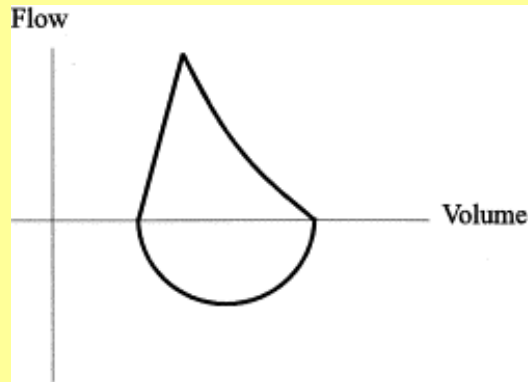


Restricted VTC and FVL

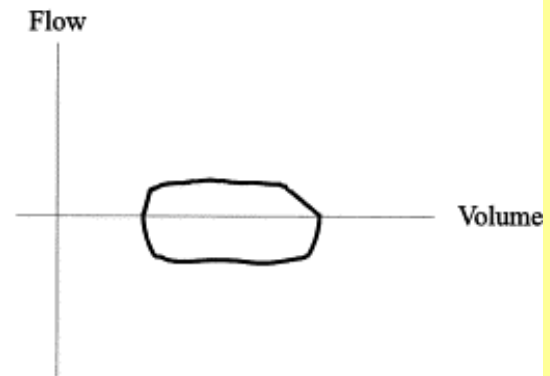


Normal Flow Volume Loop

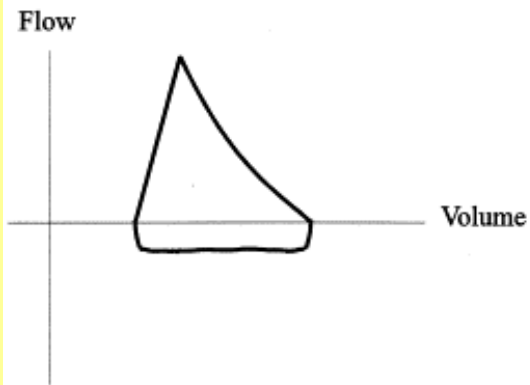




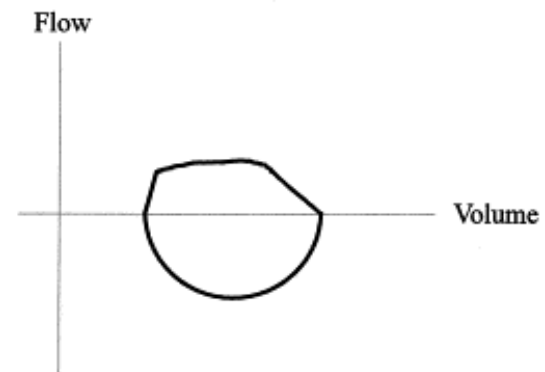
Normal Flow-Volume Loop



Fixed Large Airway Obstruction



Variable Extrathoracic Large Airway Obstruction



Variable Intrathoracic Large Airway Obstruction

Cases

- **Normal**
- **Restricted**
- **Obstructed**
- **Combined**

Patient 1

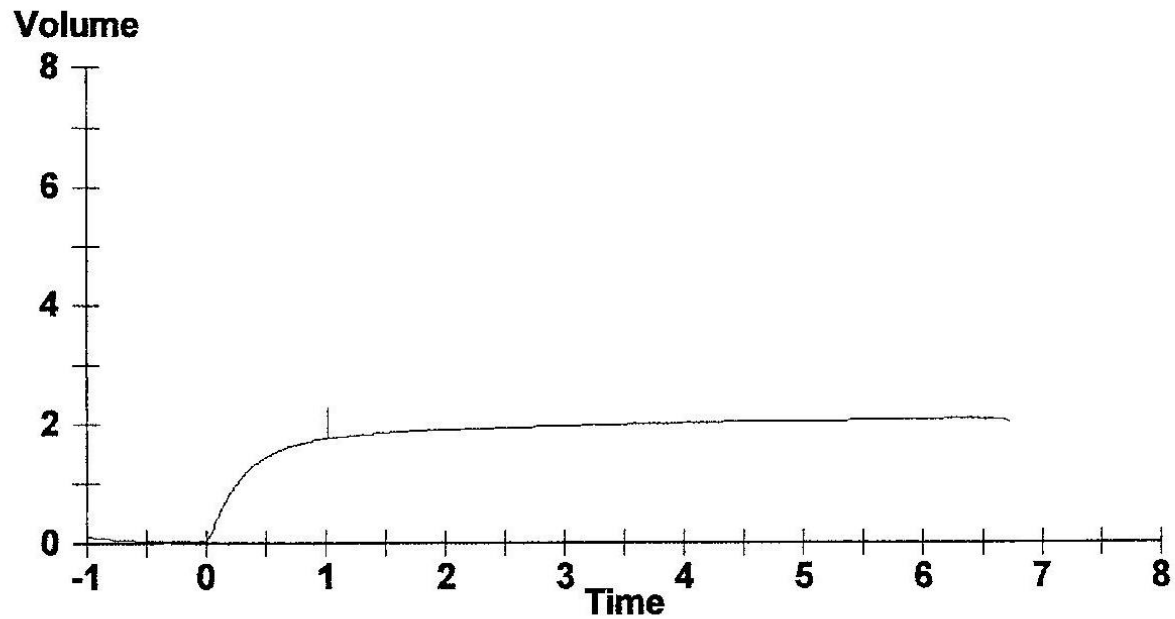
Gender: Female Room: Out-Pt

Age: 59 Race: Caucasian

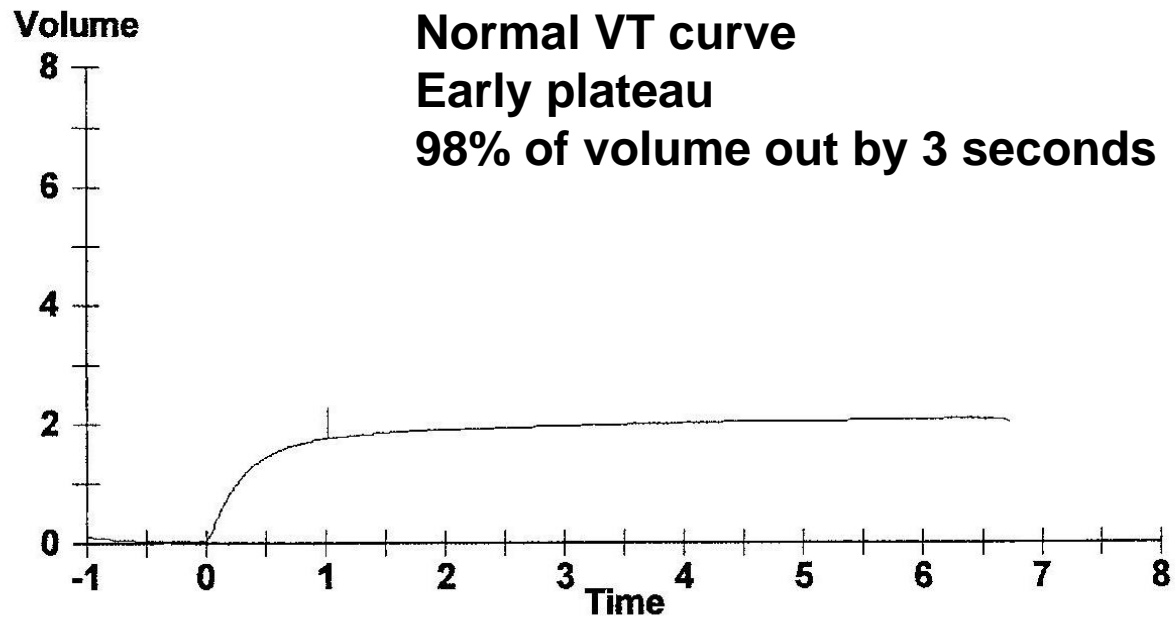
Height(in): 58 Weight(lb): 183

Any Info: ASTHMA

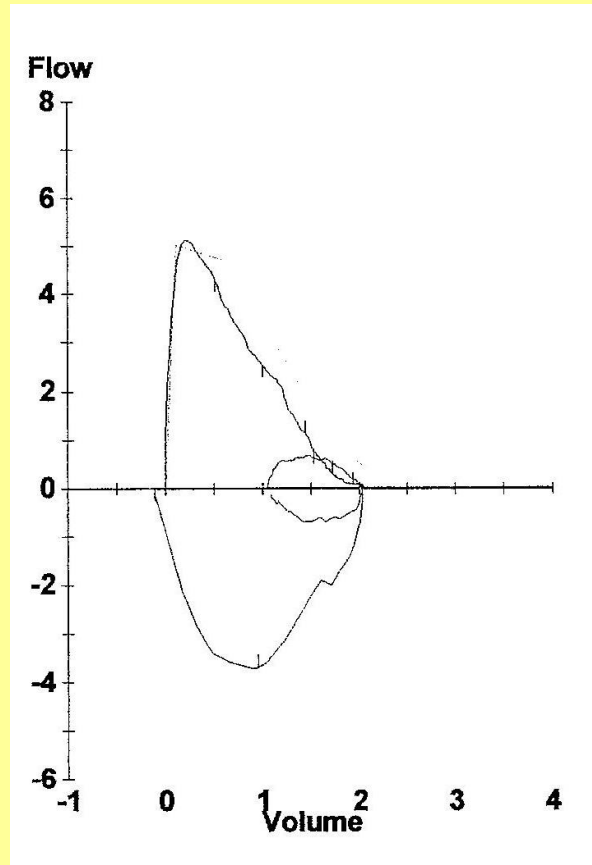
Patient 1



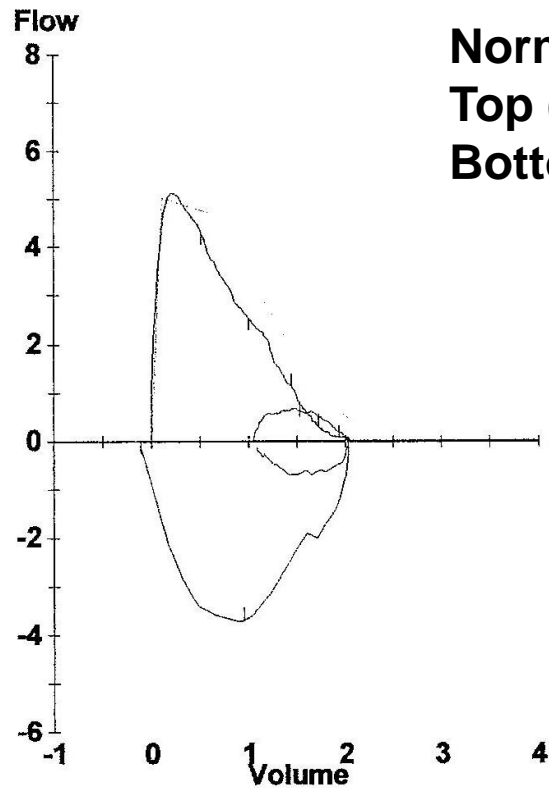
Patient 1



Patient 1



Patient 1



Normal FVL

Top (exp) looks like triangle

Bottom (inspir) looks like semi-circle

Patient 1

F/V Parameters		BEST	PRE-RX %PRED	PRED
FVC	Liters	2.04	88	2.34
FEV1	Liters	1.72	89	1.94
FEV1/FVC	%	84		85
FEV3	Liters	1.94	89	2.17
FEV3/FVC	%	95		81
FEF25-75%	L/sec	2.09	96	2.18
PEF	L/sec	5.12	102	5.01
FEF25%	L/sec	4.28	91	4.72
FEF50%	L/sec	2.51	88	2.87
FEF75%	L/sec	0.74	84	0.88
PIF	L/sec	3.78		
FIF50%	L/sec	3.72		

SVC Parameters

VC	Liters	2.16	92	2.34
ERV	Liters			
IC	Liters	2.05		

Patient 1

FRC Parameters

FRC	Liters	1.37	81	1.68
TLC	Liters	3.41	92	3.70
FRC Time		1.0		
RV	Liters	1.26	93	1.35
RV/TLC%		37		37

DLCO/sb Parameters

DLCOb/STPD		17.0	82	20.7
VA/BTPS		3.31		
DLCOb/VA		5.12	130	3.94

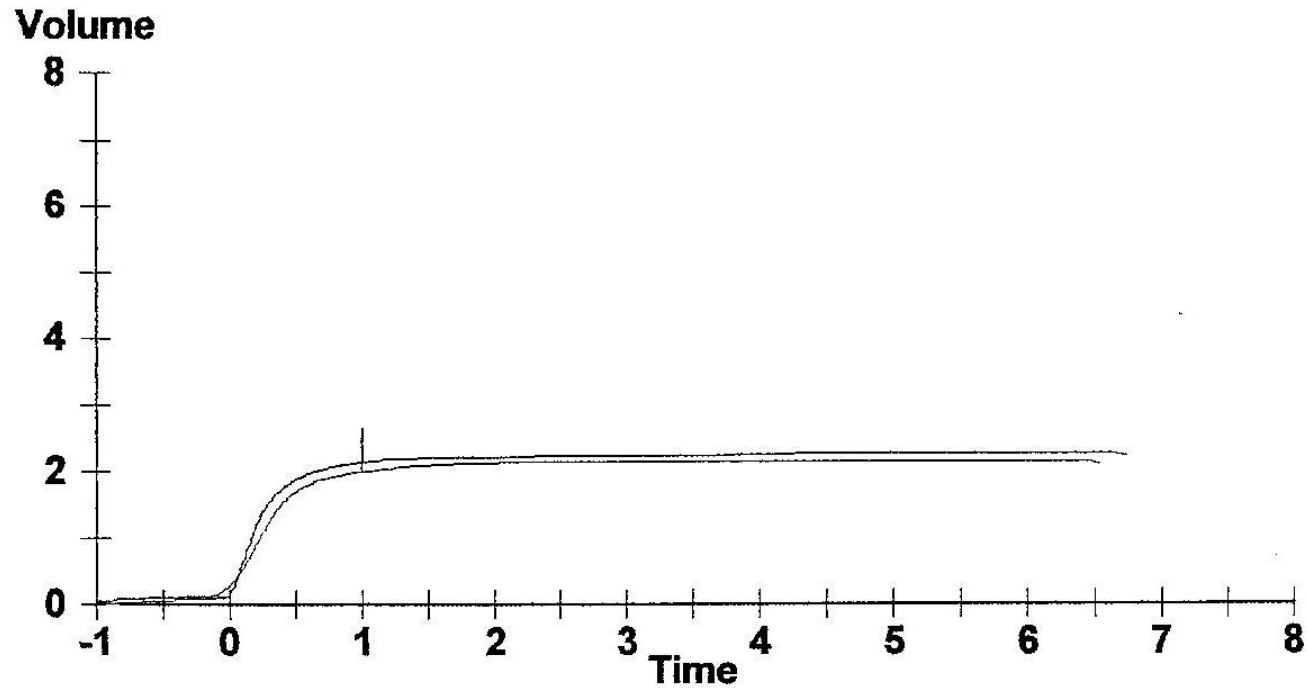
Patient 1

- **Normal – no obstructive or restrictive defect**

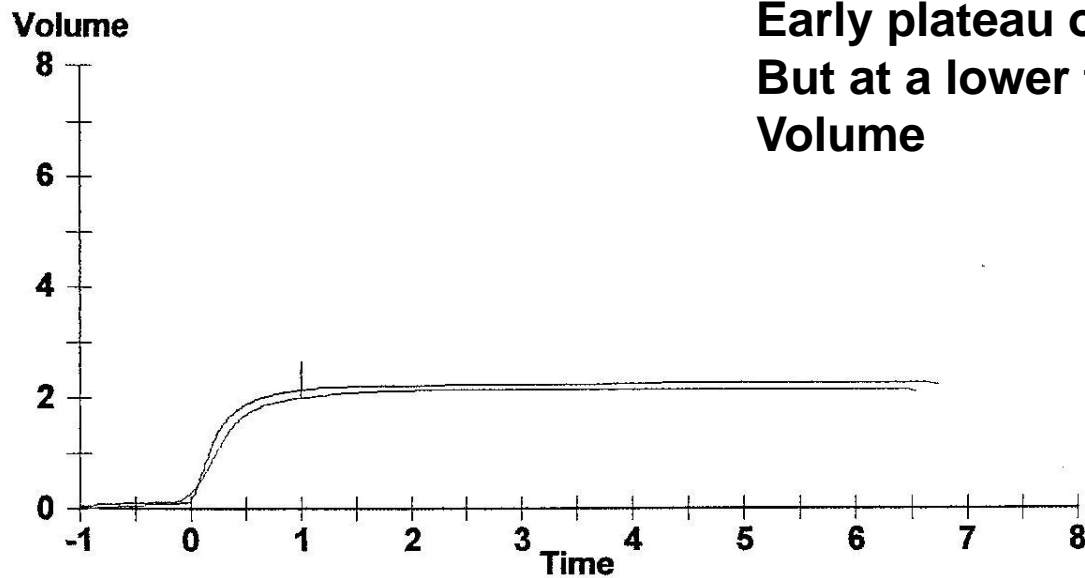
Patient 2

Gender: Male Room: Out-Pt
Age: 57 Race: Caucasian
Height(in): 73 Weight(lb): 205
Any Info: PULM FIBROSIS

Patient 2

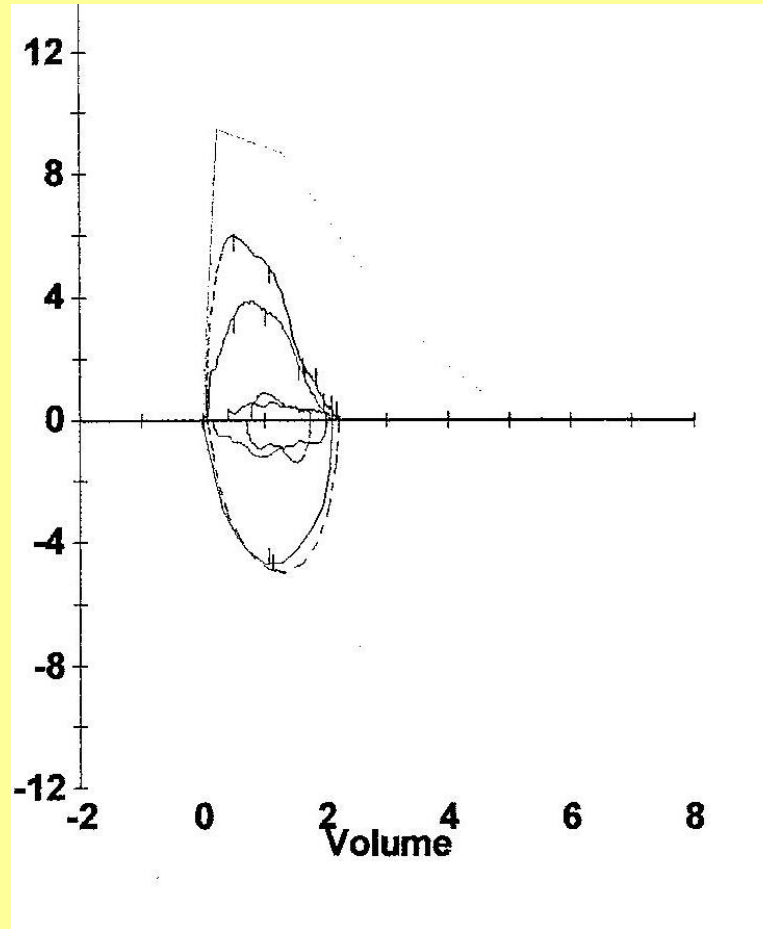


Patient 2

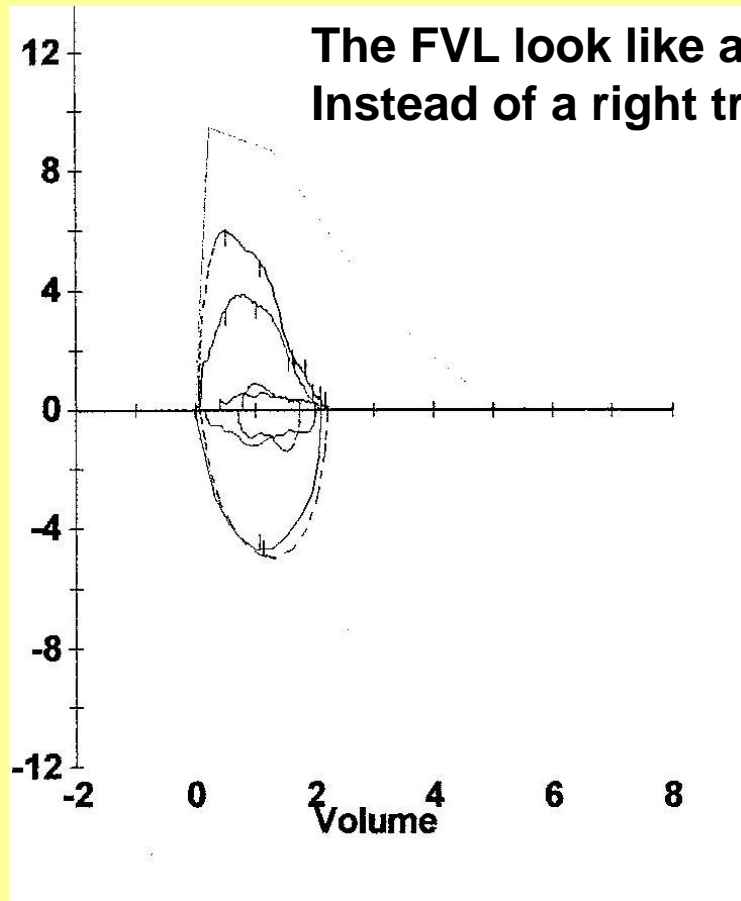


**Early plateau on VTC
But at a lower than predicted
Volume**

Patient 2



Patient 2



Patient 2

F/V Parameters		BEST	PRE-RX %PRED
FVC	Liters	2.11	41
FEV1	Liters	1.96	48
FEV1/FVC	%	93	
FEV3	Liters	** 2.11	** 45
FEV3/FVC	%	100	
FEF25-75%	L/sec	3.17	77
PEF	L/sec	** 3.83	** 41
FEF25%	L/sec	3.29	38
FEF50%	L/sec	3.54	70
FEF75%	L/sec	1.72	89
PIF	L/sec	4.80	
FIF50%	L/sec	4.73	

Patient 2

FRC Parameters

FRC	Liters	** 1.93	** 48	4.04
		** 3.81	** 51	7.42
TLC	Liters	1.4		
FRC Time		** 1.69	** 67	2.53
RV	Liters	44		36
RV/TLC%				

DLCO/sb Parameters

DLCOb/STPD	** 7.6	** 28	26.9
VA/BTPS	3.43		
DLCOb/VA	2.22	56	3.99

Patient 2

- **A restrictive defect is present**
- **No obstructive defect**

Patient 3

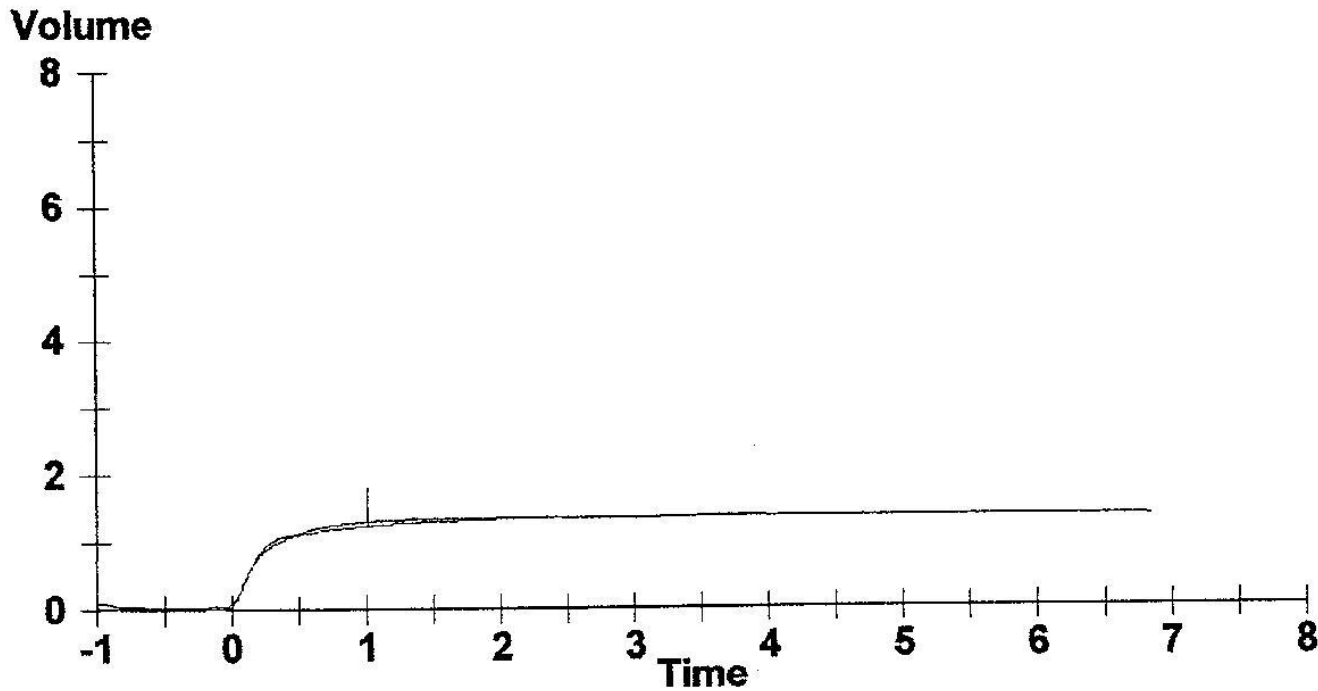
Gender: Female Room: Out-Pt

Age: 59 Race: Caucasian

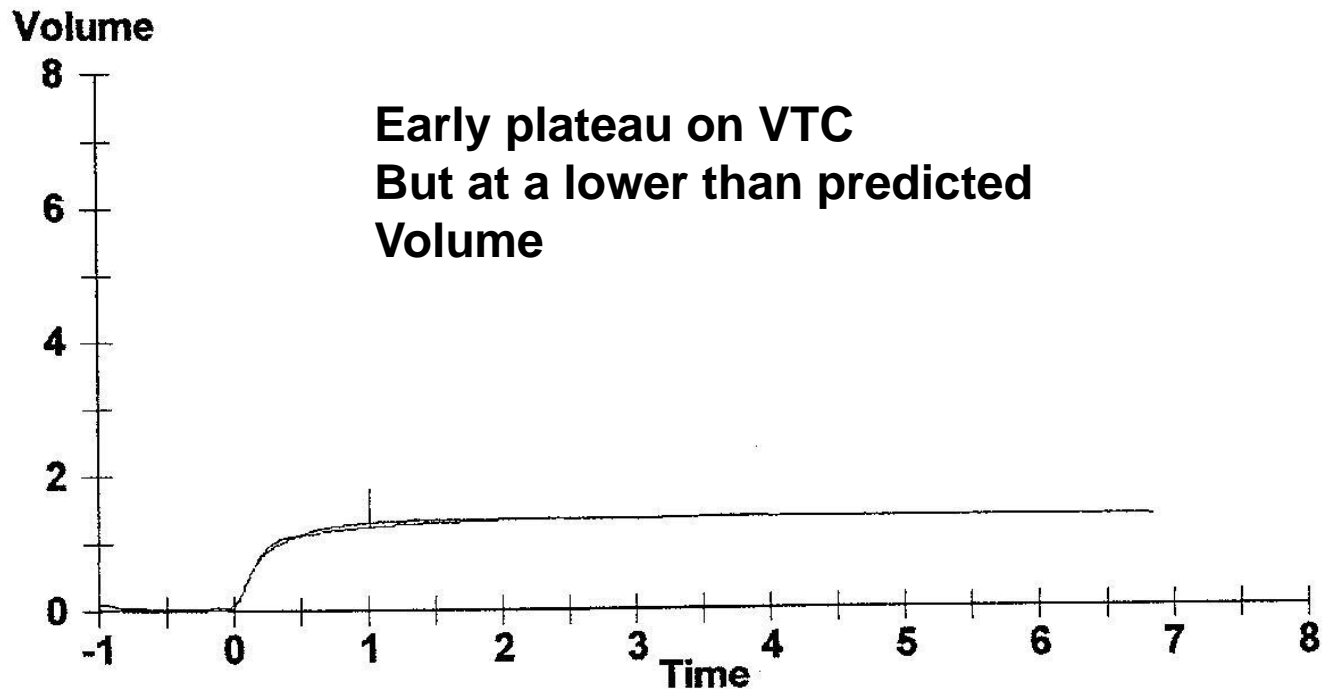
Height(in): 63 Weight(lb): 143

Any Info: ILD,ASTHMA

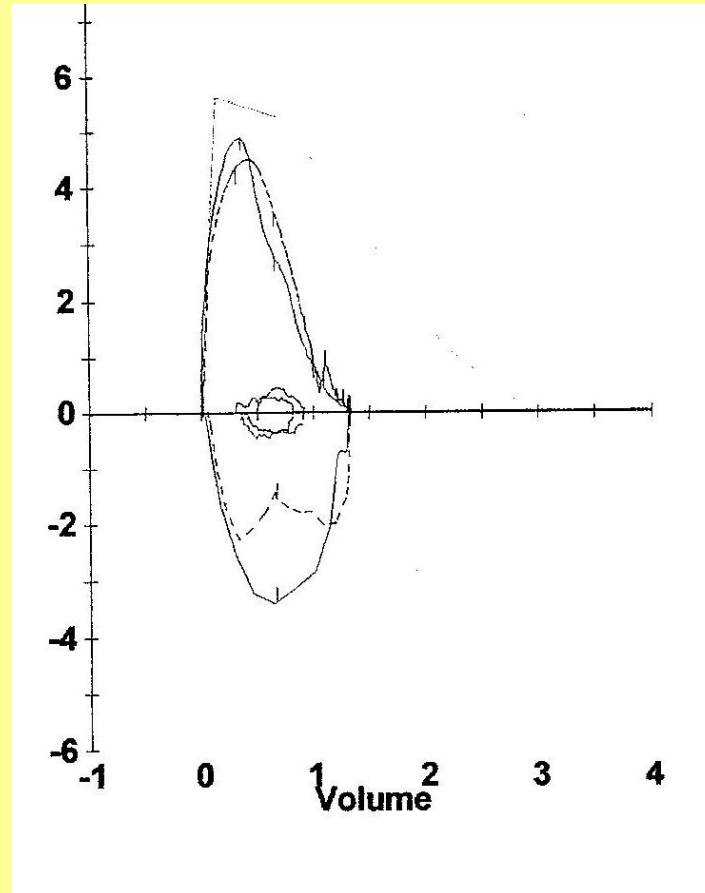
Patient 3



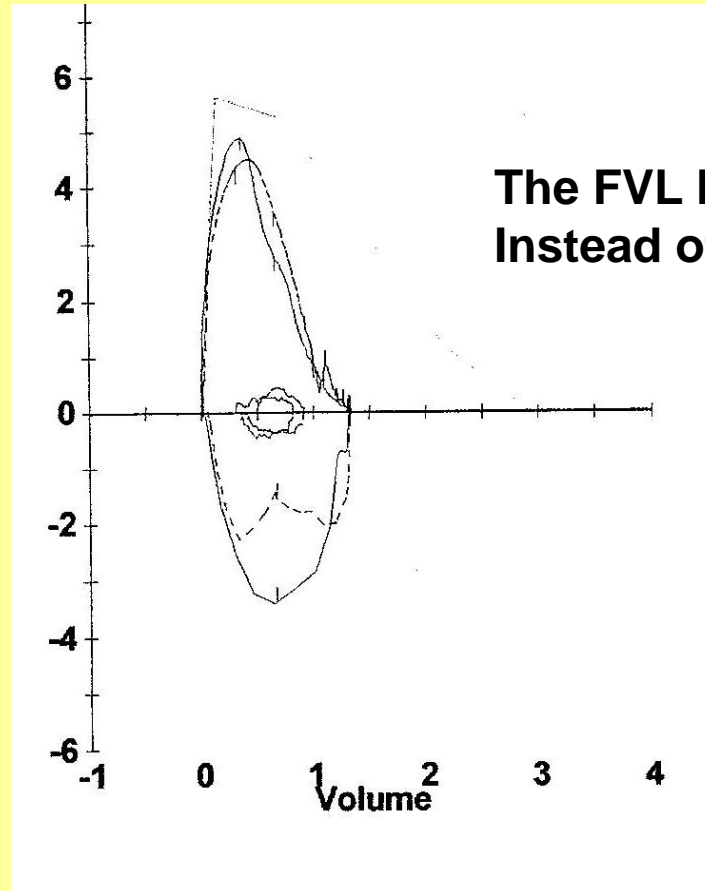
Patient 3



Patient 3



Patient 3



Patient 3

F/V Parameters		BEST	PRE-RX
			%PRED
FVC	Liters	1.34	46
FEV1	Liters	1.22	51
FEV1/FVC	%	91	
FEV3	Liters	** 1.34	** 51
FEV3/FVC	%	100	
FEF25-75%	L/sec	2.30	89
PEF	L/sec	4.90	87
FEF25%	L/sec	4.85	92
FEF50%	L/sec	2.76	84
FEF75%	L/sec	0.84	76
PIF	L/sec	3.43	
FIF50%	L/sec	3.40	

SVC Parameters

VC	Liters	1.34	46
ERV	Liters	0.11	
IC	Liters	0.88	

Patient 3

FRC Parameters

		** 1.20	** 45
FRC	Liters	** 2.08	** 44
TLC	Liters	1.1	
FRC Time		** 0.74	** 42
RV	Liters	36	
RV/TLC%			

DLCO/sb Parameters

DLCOsb/STPD	** 8.3	** 42
VA/BTPS	1.77	
DLCOsb/VA	4.68	119

Patient 3

- **A restrictive defect is noted**
- **No obstruction is present**

Patient 4

Gender: Male

Room: Out-Pt

Age: 68

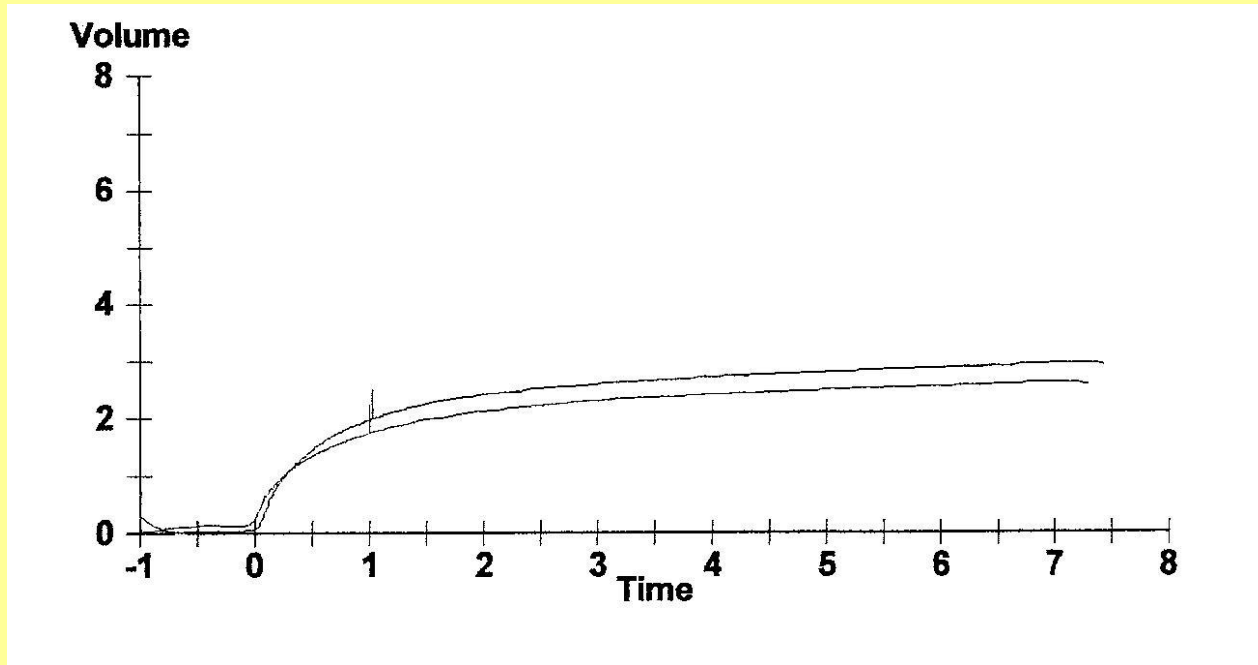
Race: Caucasian

Height(in): 72

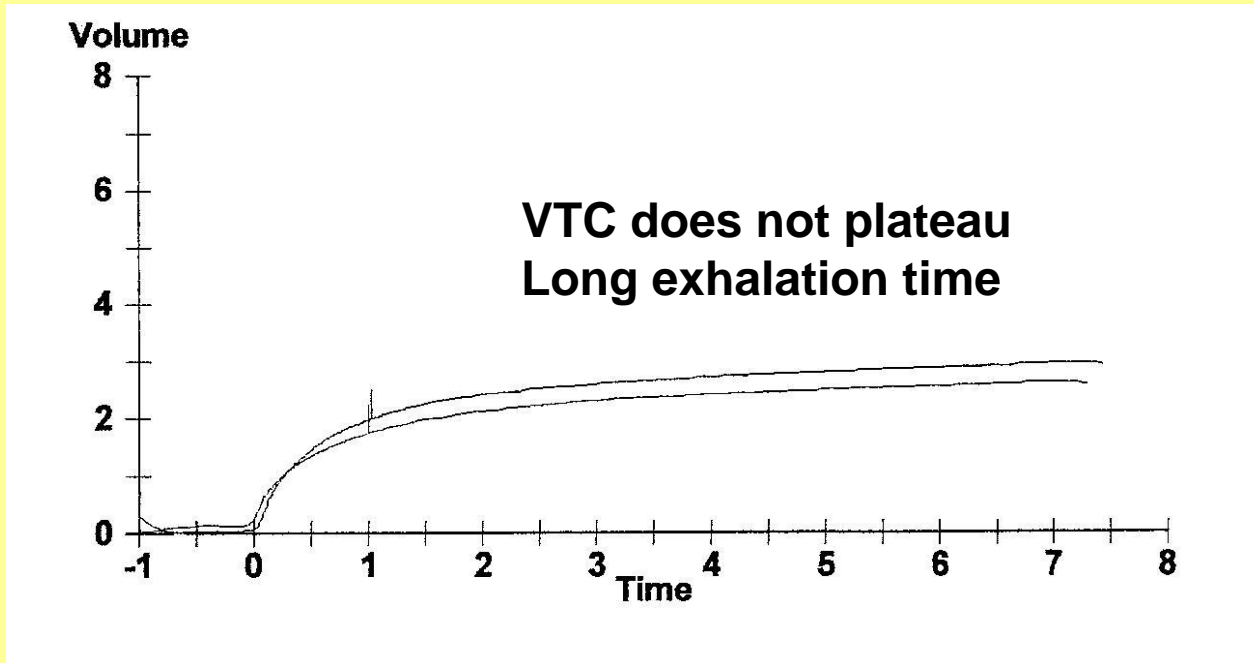
Weight(lb): 214

Any Info: COPD

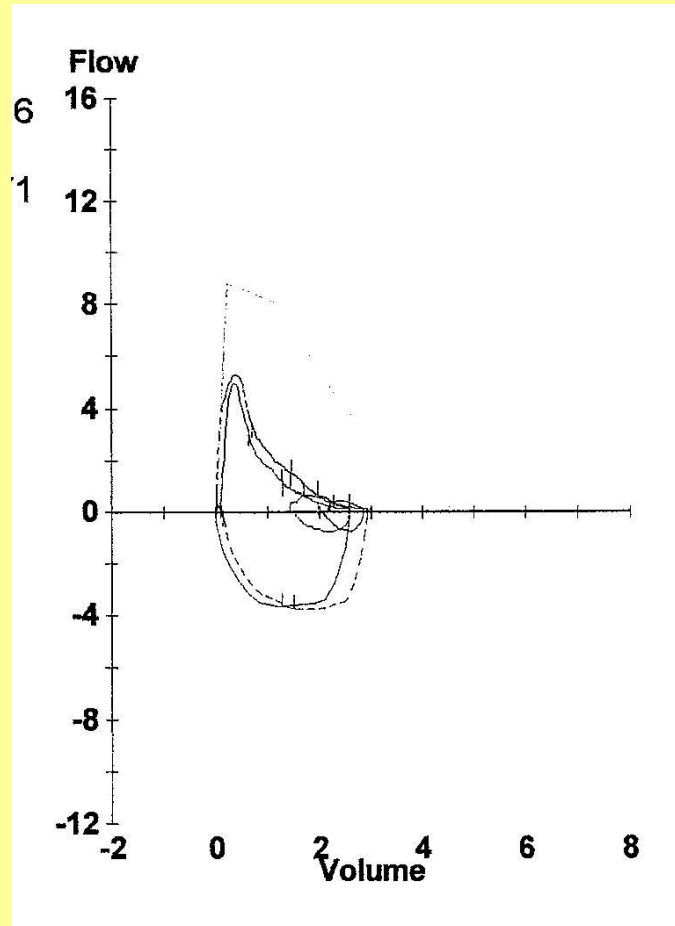
Patient 4



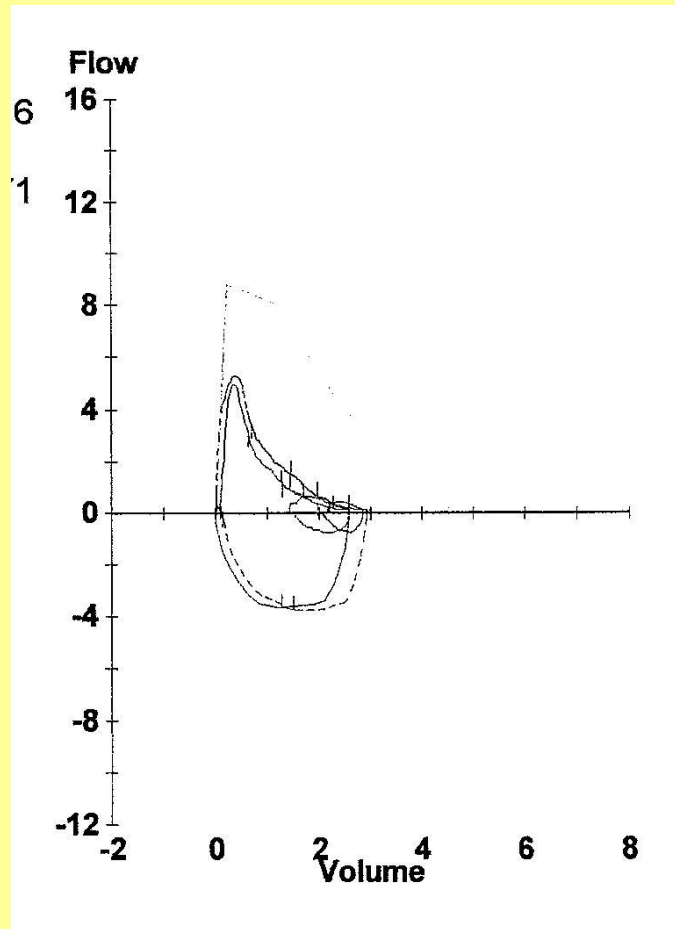
Patient 4



Patient 4



Patient 4



**The line between PEF
And RV becomes concave
Instead of straight
Indicates airflow obstruction**

Patient 4

F/V Parameters		BEST	PRE-RX
			%PRED
FVC	Liters	2.60	56
FEV1	Liters	1.69	46
FEV1/FVC	%	65	
FEV3	Liters	** 2.27	** 55
FEV3/FVC	%	87	
FEF25-75%	L/sec	0.94	26
PEF	L/sec	4.97	56
FEF25%	L/sec	3.06	38
FEF50%	L/sec	** 1.11	** 25
FEF75%	L/sec	0.35	22
PIF	L/sec	3.81	
FIF50%	L/sec	3.70	

SVC Parameters

VC	Liters	2.61	56
ERV	Liters		
IC	Liters	2.88	

Patient 4

FRC Parameters

FRC	Liters	3.58	94	3.79
TLC	Liters	6.46	92	7.02
FRC Time		2.0		
RV	Liters	** 3.85	** 145	2.65
RV/TLC%		** 60		40

DLCO/sb Parameters

DLCOb/STPD		18.9	77	24.6
VA/BTPS		4.97		
DLCOb/VA		3.82	103	3.71

Patient 4

- **A mild obstructive defect is noted.**
- **No restriction is identified by TLC**
- **TLC is used rather than FVC to determine restriction**

Patient 5

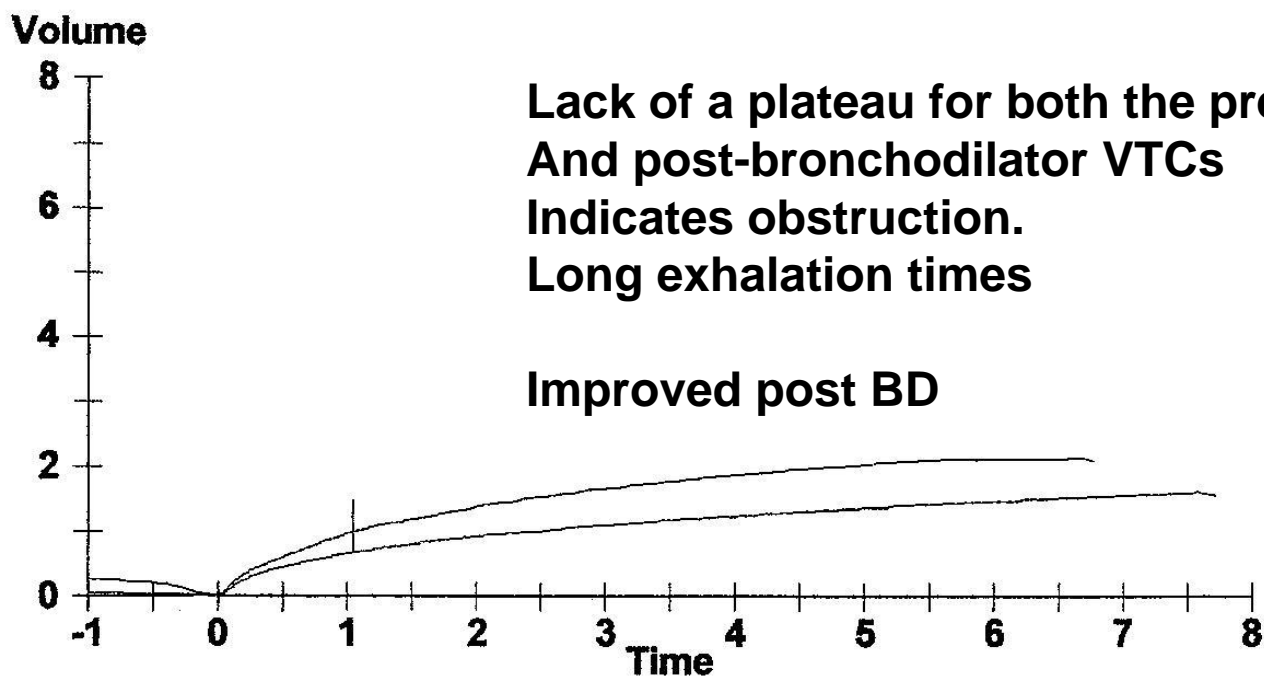
Gender: Female Room: Out-Pt

Age: 57 Race: Caucasian

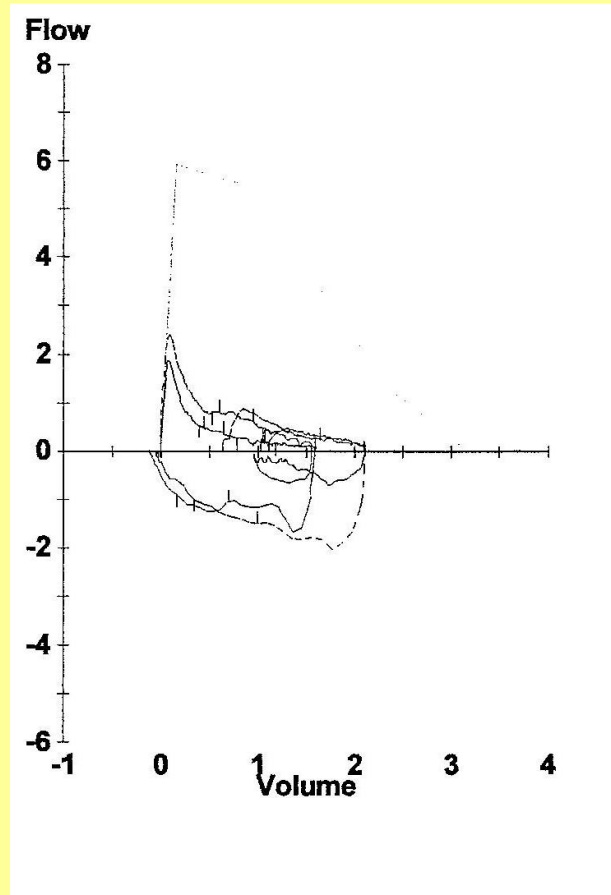
Height(in): 65 Weight(lb): 100

Any Info: COPD

Patient 5



Patient 5



**The line between PEF
And RV becomes
concave
Instead of straight
Indicates airflow
obstruction.**

Improved post BD

Patient 5

F/V Parameters		BEST	PRE-RX
			%PRED
FVC	Liters	1.58	50
FEV1	Liters	0.65	25
FEV1/FVC	%	41	
FEV3	Liters	** 1.08	** 38
FEV3/FVC	%	68	
FEF25-75%	L/sec	0.24	9
PEF	L/sec	** 1.88	** 32
FEF25%	L/sec	0.52	9
FEF50%	L/sec	** 0.26	** 7
FEF75%	L/sec	0.15	12
PIF	L/sec	1.70	
FIF50%	L/sec	1.08	

SVC Parameters

VC	Liters	2.10	66
ERV	Liters	0.29	
IC	Liters	1.81	

Patient 5

RX	POST-RX			
	PRED	BEST	% PRED	% Chg
	3.17	2.12	67	34
	2.57	0.96	37	48
	83	45		
	2.84	1.65	58	52
	86	78		
	2.78	0.45	16	90
	5.93	** 2.40	** 40	28
	5.53	0.79	14	51
	3.49	** 0.45	** 13	77
	1.24	0.26	21	78
		2.06		21
		1.51		40

Patient 5

FRC Parameters

FRC	Liters	3.42	105	3.27
TLC	Liters	5.23	102	5.12
FRC Time		2.1		
RV	Liters	** 3.13	** 165	1.90
RV/TLC%		** 60		37

DLCO/sb Parameters

DLCOsb/STPD		12.5	75	16.7
VA/BTPS		3.14		
DLCOsb/VA		3.99	100	3.99

Patient 5

- **Severe obstructive defect with significant improvement after bronchodilator treatment**
- **Air trapping is present**
- **No restriction is noted**

Patient 6

Gender: Male

Room: Out-Pt

Age: 62

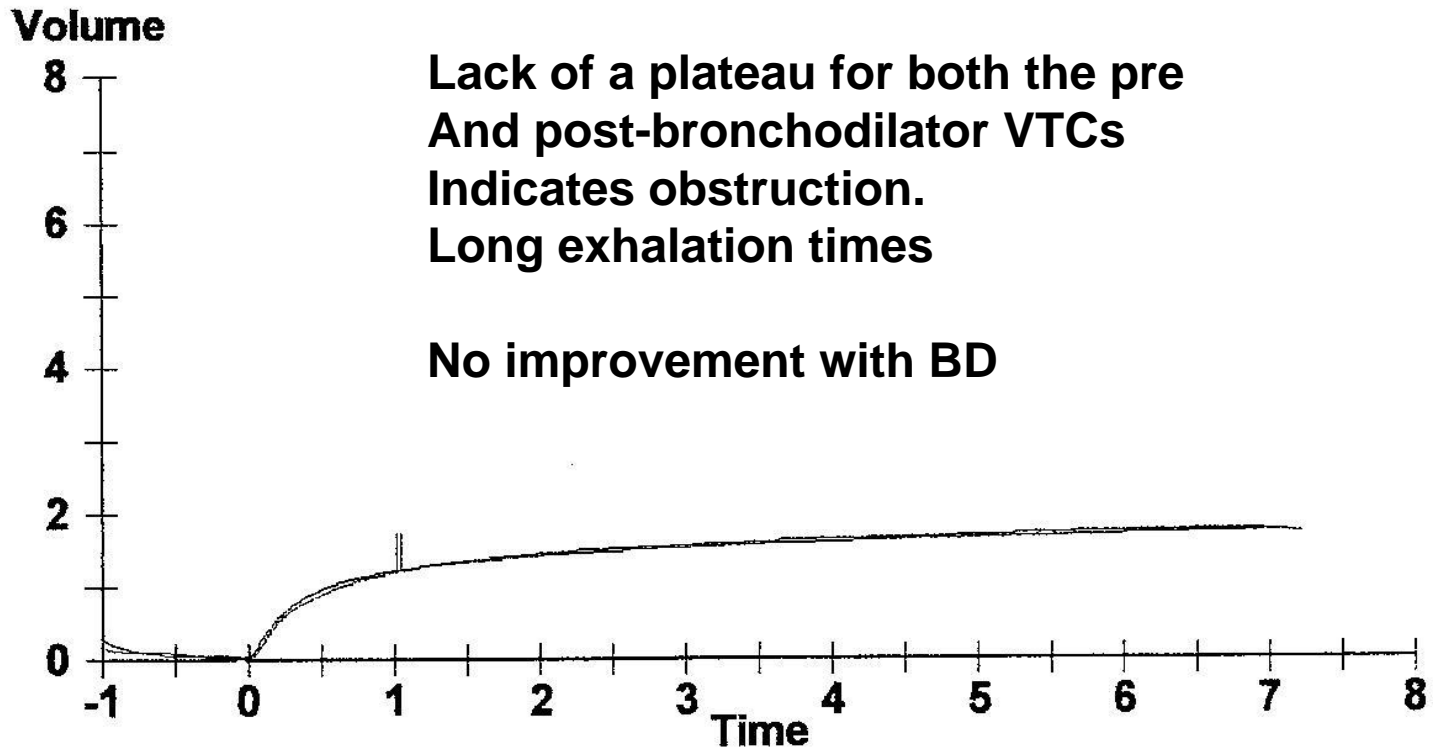
Race: Caucasian

Height(in): 65

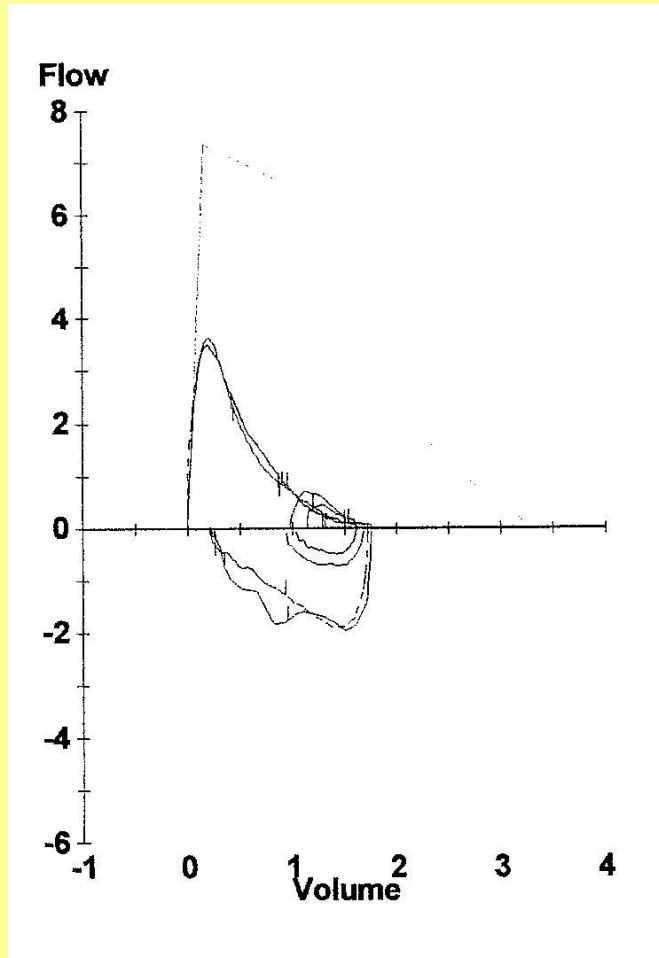
Weight(lb): 221

Any Info: COPD

Patient 6



Patient 6



**The line between PEF
And RV becomes concave
Instead of straight
Indicates airflow
obstruction.**

Not improved post BD

Patient 6

F/V Parameters		BEST	PRE-RX %PRED
FVC	Liters	1.76	53
FEV1	Liters	1.19	45
FEV1/FVC	%	68	
FEV3	Liters	1.54	47
FEV3/FVC	%	87	
FEF25-75%	L/sec	0.70	25
PEF	L/sec	3.62	49
FEF25%	L/sec	2.31	34
FEF50%	L/sec	0.86	25
FEF75%	L/sec	0.24	20
PIF	L/sec	1.99	
FIF50%	L/sec	1.76	

SVC Parameters

VC	Liters	1.76	53
ERV	Liters		
IC	Liters	1.61	

Patient 6

FRC Parameters

FRC	Liters	2.41	93	2.58
		** 4.02	** 74	5.44
TLC	Liters	1.2		
FRC Time		2.26	109	2.06
RV	Liters	** 56		38
RV/TLC%				

DLCO/sb Parameters

DLCOs _{sb} /STPD	** 15.2	** 63	24.0
VA/BTPS	3.21		
DLCOs _{sb} /VA	4.74	123	3.86

Patient 6

- **Combined obstructive and restrictive defect**