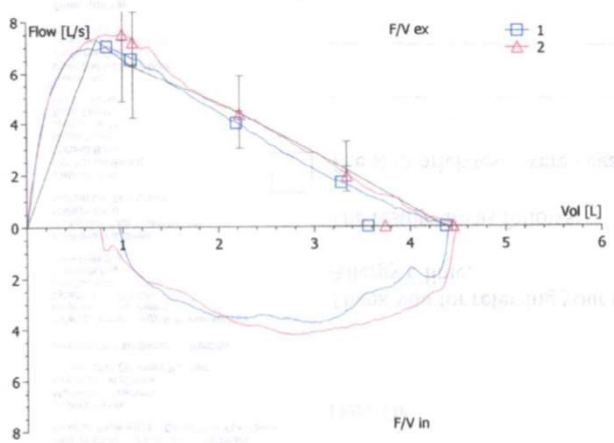
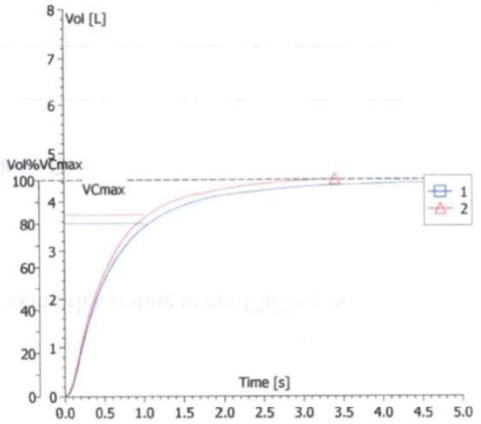
INTERPRETATION OF LUNG FUNCTION TEST- CASE BASED DISCUSSION

DR MAHESH BABU RAMAMURTHY

- 6 YEAR OLD CHILD IS SEEN WITH HISTORY OF COUGH SINCE THE PAST 3 MONTHS. DRY COUGH, MORE AT NIGHT. NO WHEEZE HEARD. HE ALSO COUGHS IN THE MORNING AFTER WAKING UP. NO HISTORY OF COUGH AFTER EXERCISE. HAS HISTORY OF SNEEZING IN THE MORNINGS.
- NO PRIOR HISTORY
- FAMILY HISTORY OF CHILDHOOD ASTHMA IN FATHER

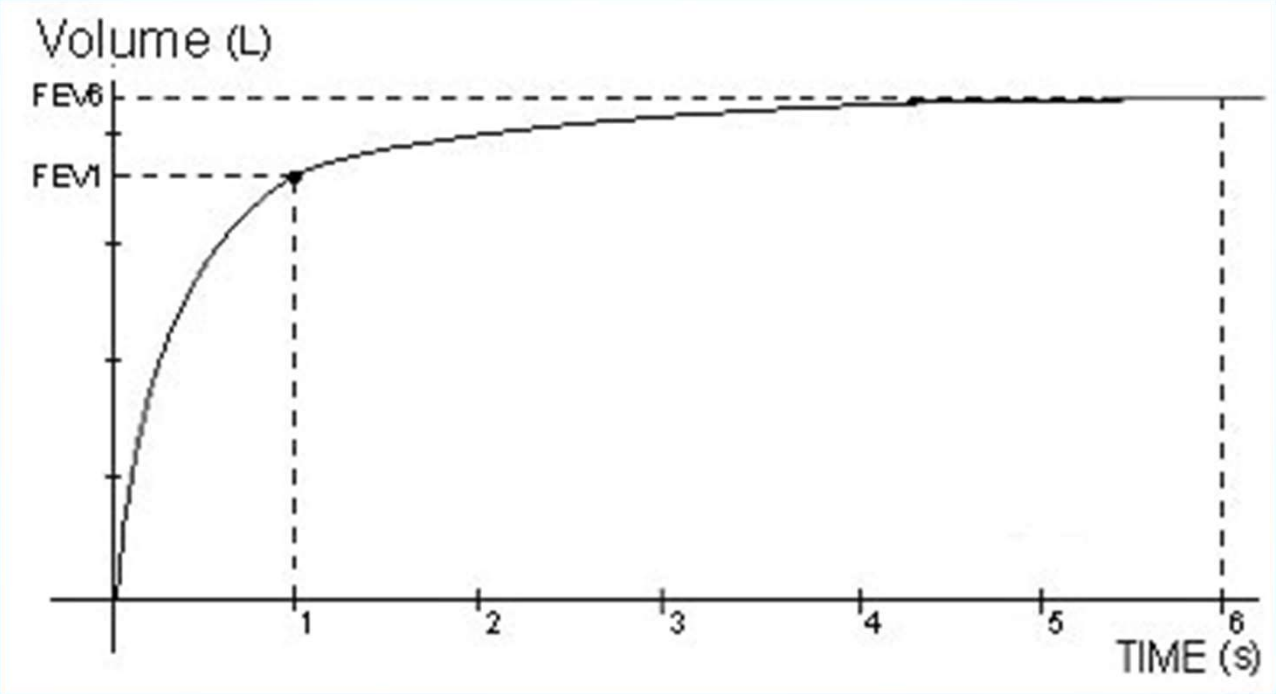
		Pred	BEST	%Pred	POST	% CHANGE
Date			20.09.17			
Time			11:21:06			
VC MAX	[L]	4.34	4.37	100.7	102.4	1.7
FVC	[L]	4.36	4.37	100.2	101.9	1.7
FEV 0.5	[L]		2.63			5.4
FEV 1	[L]	3.61	3.56	98.7	103.5	4.9
PEF	[L/s]	7.31	7.04	96.3	102.7	6.6
FEF 25	[L/s]	6.30	6.55	103.9	114.4	10.1
FEF 50	[L/s]	4.47	4.00	89.5	96.8	8.1
FEF 75	[L/s]	2.31	1.68	72.8	83.2	14.4
MMEF 75/25	[L/s]	4.06	3.43	84.6	94.0	11.1
FEV 1 % FVC	[%]	83.48	81.44	97.5	100.6	3.2
VC IN	[L]	4.34	3.43	79.0	85.2	7.9
IC	[L]	2.79				
ERV	[L]	1.50				



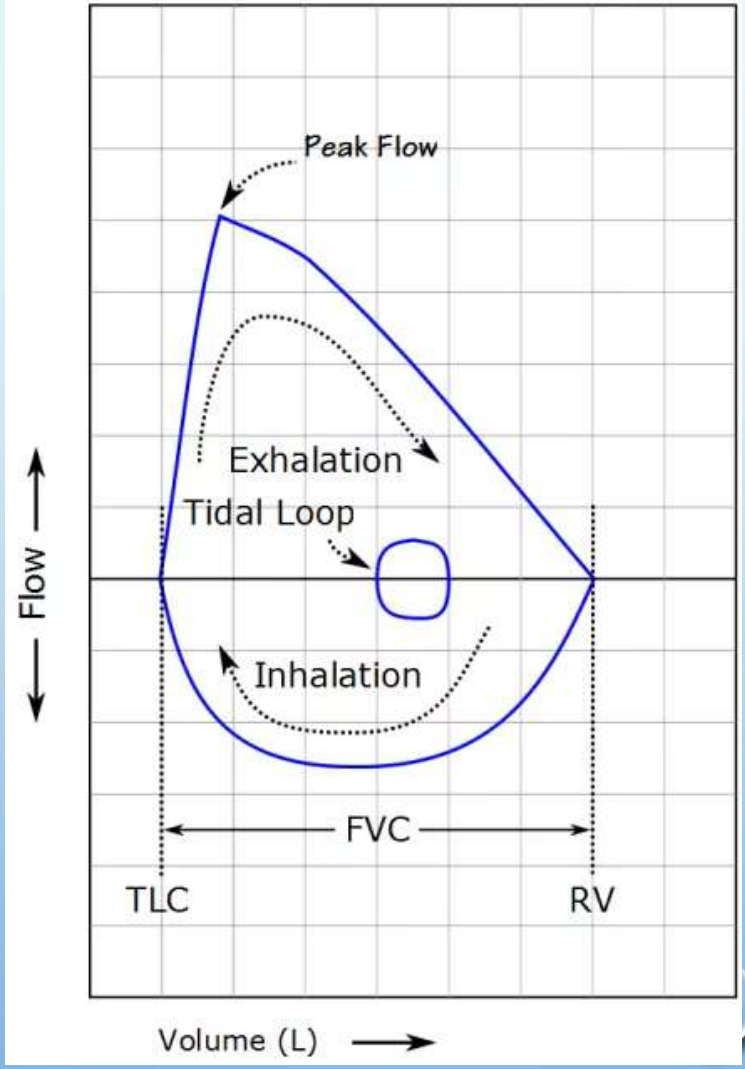


Cooperation: good ( ) moderate ( ) poor ( )

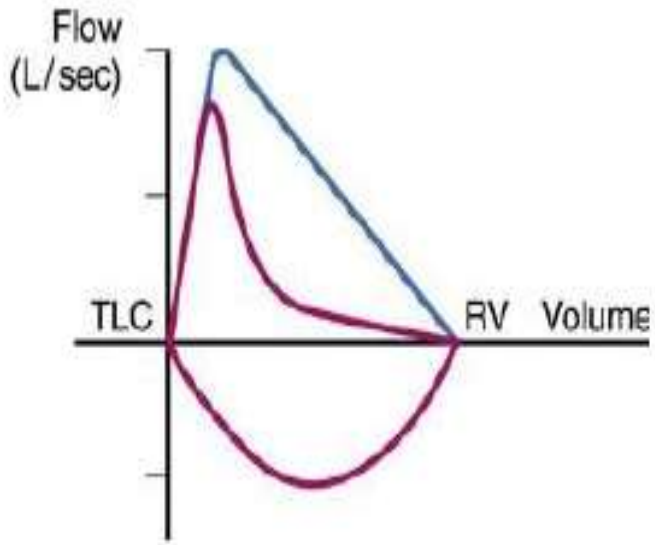
VOLUME TIME CURVE



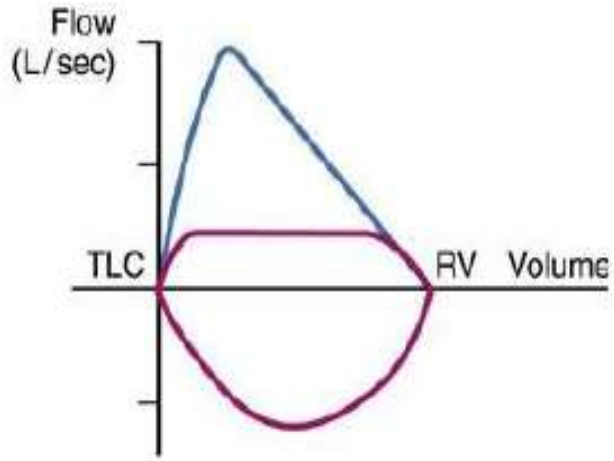
FLOW VOLUME LOOP



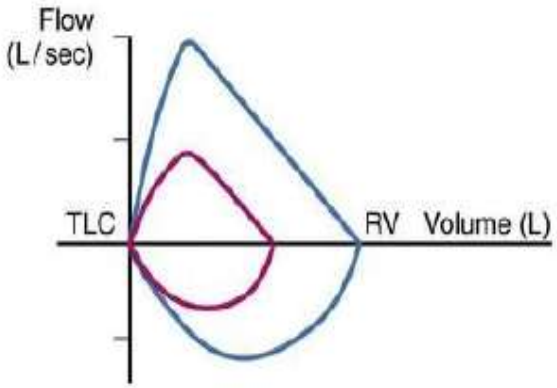
How would you interpret this Flow volume loop 1?



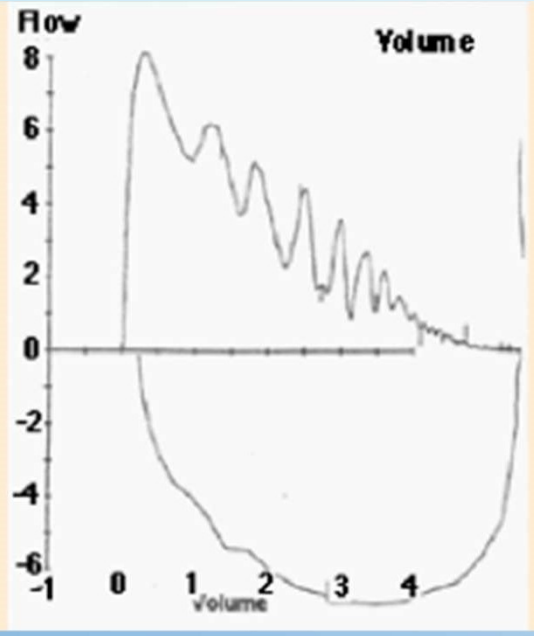
What is your interpretation of this flow volume loop2 ?



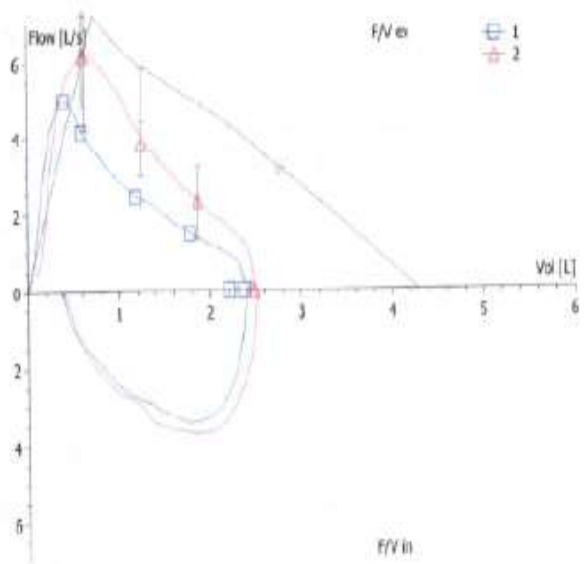
What is your interpretation of this flow volume loop 3 ?



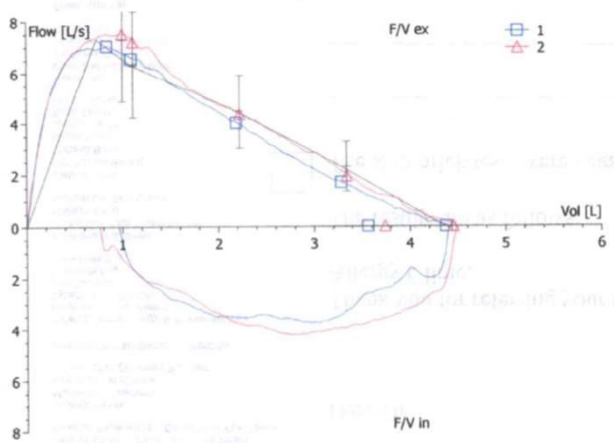
What is your interpretation of this flow volume loop 4?

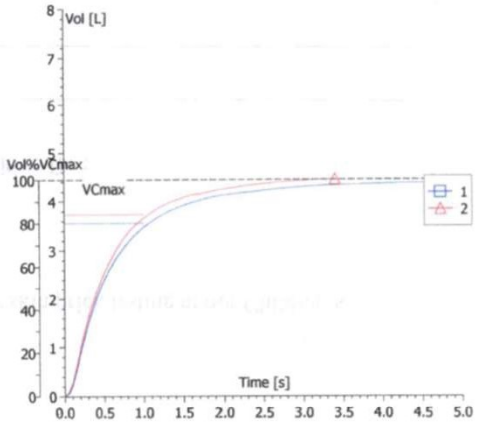


How do you interpret this flow volume loop 5 ?



		Pred	BEST	%Pred	POST	% CHANGE
Date			20.09.17			
Time			11:21:06			
VC MAX	[L]	4.34	4.37	100.7	102.4	1.7
FVC	[L]	4.36	4.37	100.2	101.9	1.7
FEV 0.5	[L]		2.63			5.4
FEV 1	[L]	3.61	3.56	98.7	103.5	4.9
PEF	[L/s]	7.31	7.04	96.3	102.7	6.6
FEF 25	[L/s]	6.30	6.55	103.9	114.4	10.1
FEF 50	[L/s]	4.47	4.00	89.5	96.8	8.1
FEF 75	[L/s]	2.31	1.68	72.8	83.2	14.4
MMEF 75/25	[L/s]	4.06	3.43	84.6	94.0	11.1
FEV 1 % FVC	[%]	83.48	81.44	97.5	100.6	3.2
VC IN	[L]	4.34	3.43	79.0	85.2	7.9
IC	[L]	2.79				
ERV	[L]	1.50				



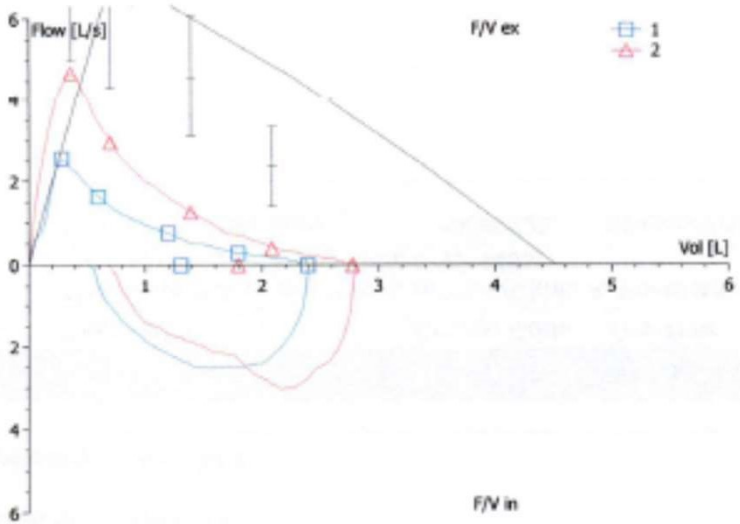


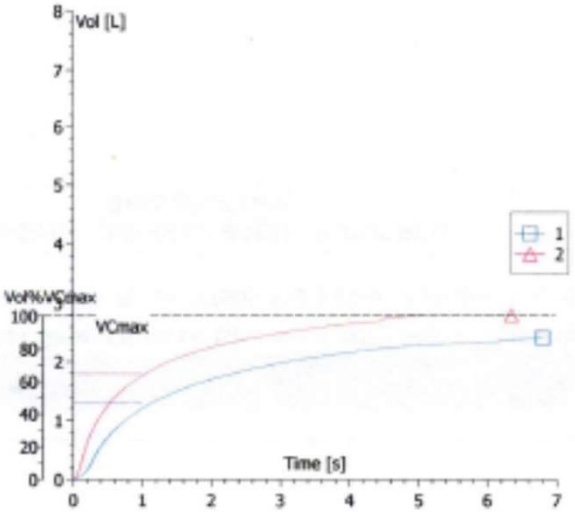
Cooperation: good ( ) moderate ( ) poor ( )

What is your interpretation of this spirometry?

- 14 YEAR OLD BOY COMES WITH HISTORY OF CHRONIC COUGH AND WHEEZE SINCE THE AGE OF 5 YEARS. COUGHS IN THE EARLY HOURS OF MORNING AND ALSO AFTER ANY ACTIVITY AND EXERCISE. HAS RESPONDED WELL TO SALBUTAMOL, AND HAS BEEN ON PRN PREVENTERS.
- ALSO HAS SYMPTOMS OF AR
- STRONG FAMILY HISTORY OF ASTHMA
- HE IS WELL OTHERWISE.. NO OTHER CO-MORBIDITIES.

		Pred	BEST	%Pred	POST	% CHANGE
Date			22.12.14			
Time			15:15:25			
VC MAX	[L]	4.48	2.39	53.4	61.9	16.0
FVC	[L]	4.51	2.39	53.0	61.5	16.0
FEV 0.5	[L]		0.90			48.7
FEV 1	[L]	3.73	1.30	35.0	48.1	37.6
PEF	[L/s]	7.51	2.57	34.2	62.6	83.2
FEF 25	[L/s]	6.46	1.63	25.2	45.6	80.8
FEF 50	[L/s]	4.58	0.76	16.6	27.4	65.0
FEF 75	[L/s]	2.37	0.28	11.8	16.9	42.9
MMEF 75/25	[L/s]	4.17	0.62	14.9	23.2	55.2
FEV 1 % FVC	[%]	83.40	54.50	65.4	77.5	18.6
VC IN	[L]	4.48	1.84	41.1	46.8	14.0
IC	[L]	2.87				
ERV	[L]	1.56				

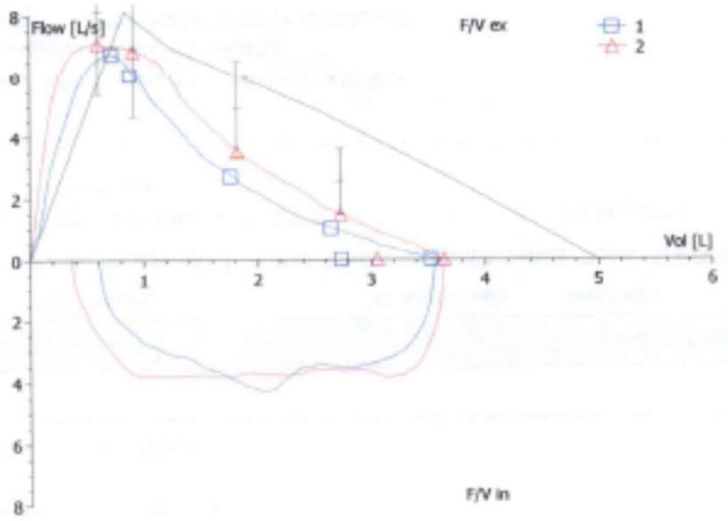


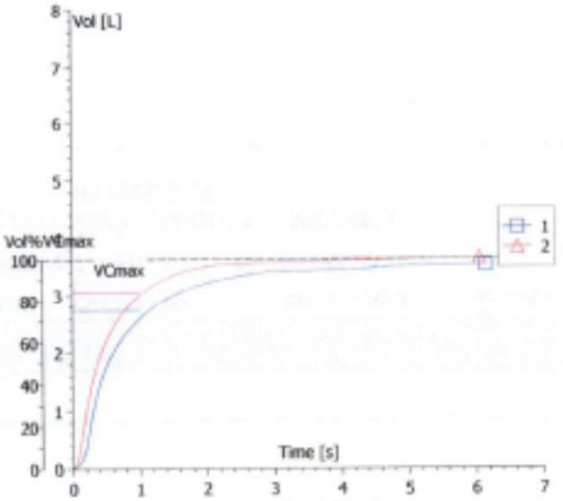


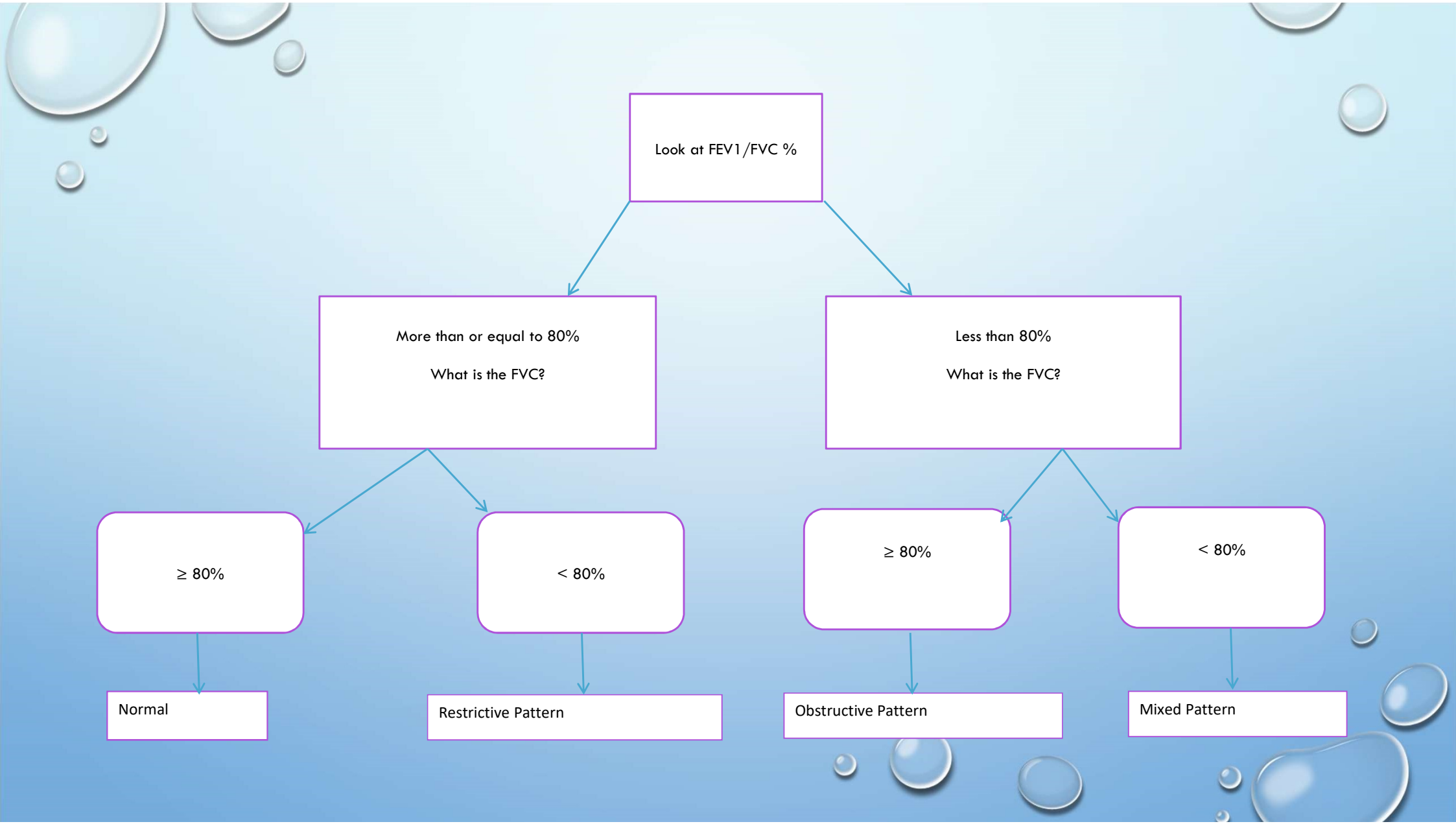
How do you intrepret this spirometry?

When poll is active, respond at **PollEv.com/mahesh** Text **MAHESH** to **+61 429 883 481** once to join

		Pred	BEST	%Pred	POST	% CHANGE
Date			30.08.17			
Time			11:44:39			
VC MAX	[L]	4.93	3.52	71.5	73.8	3.2
FVC	[L]	4.99	3.52	70.6	72.9	3.3
FEV 0.5	[L]		2.09			12.1
FEV 1	[L]	4.11	2.73	66.5	74.1	11.5
PEF	[L/s]	8.13	6.74	82.9	87.2	5.1
FEF 25	[L/s]	6.95	6.04	86.9	98.4	13.2
FEF 50	[L/s]	4.93	2.69	54.5	70.9	30.1
FEF 75	[L/s]	2.55	1.00	39.2	56.2	43.6
MMEF 75/25	[L/s]	4.51	2.19	48.5	66.3	36.5
FEV 1 % FVC	[%]	83.15	77.66	93.4	100.8	8.0
VC IN	[L]	4.93	2.99	60.6	66.4	9.5
IC	[L]	3.12				
ERV	[L]	1.73				

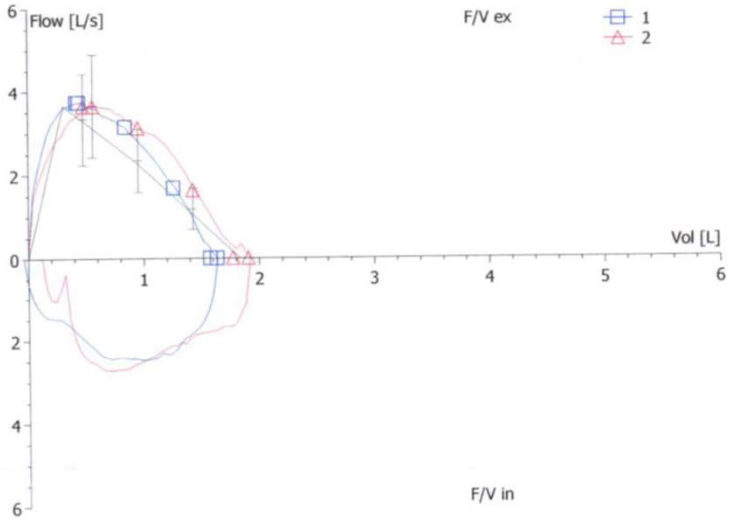


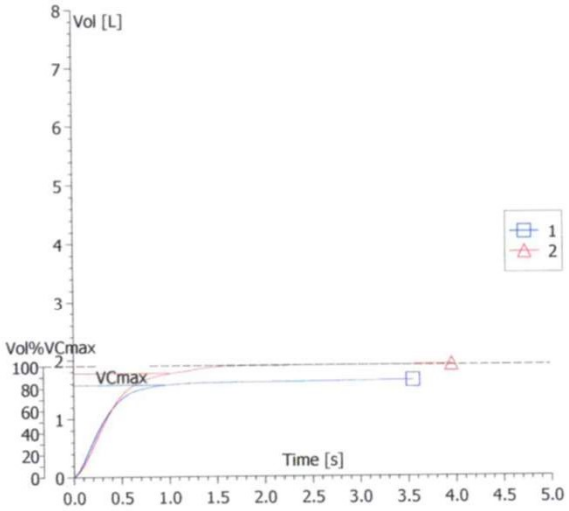



Look at FEV1/FVC %
More than or equal to 80%
What is the FVC?
Less than 80%
What is the FVC?
≥ 80%
< 80%
≥ 80%
< 80%
Normal
Restrictive Pattern
Obstructive Pattern
Mixed Pattern

- 5 YEAR OLD GIRL WITH HISTORY SUGGESTIVE OF ASTHMA. STRONG FAMILY HISTORY OF ASTHMA.
- CLINICAL EXAMINATION NORMAL
- SPIROMETRY DONE

		Pred	BEST	%Pred	POST	% CHANGE
Date			22.09.17			
Time			15:17:46			
VC MAX	[L]	1.91	1.68	87.9	99.6	13.3
FVC	[L]	1.83	1.63	89.2	103.8	16.3
FEV 0.5	[L]		1.38			7.7
FEV 1	[L]	1.54	1.58	102.0	114.6	12.3
PEF	[L/s]	3.66	3.73	102.1	99.4	-2.6
FEF 25	[L/s]	3.33	3.73	112.0	109.1	-2.6
FEF 50	[L/s]	2.35	3.14	133.7	132.7	-0.8
FEF 75	[L/s]	1.20	1.68	139.9	136.1	-2.7
MMEF 75/25	[L/s]	2.02	2.67	131.9	138.6	5.0
FEV 1 % FVC	[%]	85.31	96.36	113.0	109.0	-3.5
VC IN	[L]	1.91	1.68	87.9	93.5	6.4
IC	[L]	1.33				
ERV	[L]	0.60				





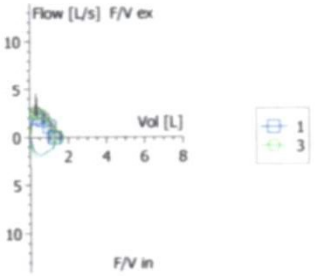
How do you inerpret the spirometry of this 5 year old?

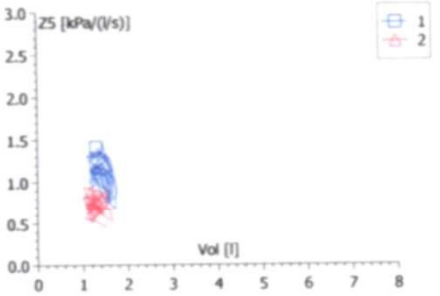
- 4 YEAR OLD BOY WITH HISTORY OF COUGH IN THE PAST 3 MONTHS. 2 EPISODES OF DRY NOCTURNAL COUGH, NOT ASSOCIATED WITH WHEEZE.. HAS BEEN TREATED WITH SALBUTAMOL NEBS DURING THE EPISODES WITH GOOD EFFECT. HAS BEEN REFERRED TO THE CLINIC.
- NO OTHER INTERVAL SYMPTOMS. NO EIB.
- FAMILY HISTORY OF AR IN FATHER AND ASTHMA AS CHILD
- UNABLE TO DO A SPIROMETRY?

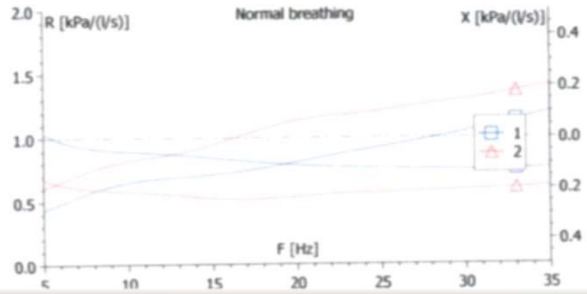
How would you proceed to investigate and diagnose asthma in this child?

IMPULSE OSCILLOMETRY (IOS)

		Pred	BEST	%Pred	%POST	%CHANGE
Date			27091			
Time			09:55			
FVC	[L]	1.67	1.34	80.5		
VC IN	[L]	1.75	1.30	74.4		
FEV 1	[L]	1.41	1.28	90.8		
FEV 1 % VC MAX	[%]	85.47	95.16	111.3		
PEF	[L/s]	3.40	2.01	59.2		
FEF 75	[L/s]	1.12	1.11	99.2		
FEF 50	[L/s]	2.19	1.77	80.9		
FEF 25	[L/s]	3.11	1.99	64.0		
VT	[L]	0.32	0.47	147.6	132.3	-10.3
Z at 5 Hz	[cmH2O/(L/s)]	10.65	10.94	102.7	67.4	-34.4
R at 5 Hz	[cmH2O/(L/s)]	9.97	10.55	105.8	69.1	-34.7
R at 20 Hz	[cmH2O/(L/s)]	6.35	8.01	126.2	86.1	-31.8
X at 5 Hz	[cmH2O/(L/s)]	-3.56	-2.90	81.4	56.8	-30.3
Resonant frequency	[1/s]		28.28			-42.1
Rcentral	[cmH2O/(L/s)]		5.57			-20.9
Rperipheral	[cmH2O/(L/s)]		6.12			-16.7







- 14 YEAR OLD BOY IS SEEN IN CLINIC WITH HISTORY OF COUGH AFTER PLAYING SOCCER IN SCHOOL IN THE PAST 6 MONTHS. HE COUGHS AND WHEEZES FOR 15 MIN AND IS THEN BETTER. HE HAS NO INTERVAL SYMPTOMS.
- NO PRIOR HISTORY. NO FAMILY HISTORY OF ASTHMA.
- HIS SPIROMETRY IS NORMAL

How would you prove your diagnosis?

Target HR 160 (80 **% predicted Max HR)**

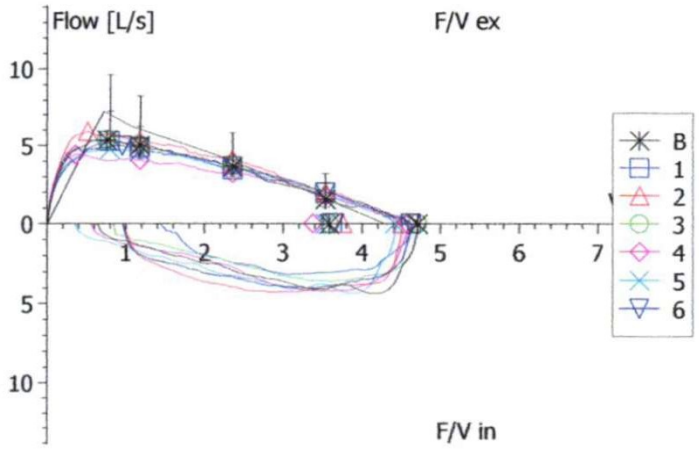
Minutes	Polar	Oximeter	Treadmill	Elevation	PE	Comments
Baseline	77		0	0		
0:30	81		3.0	2.0		
1:00	90		5.0	2.0		
1:30	107		6.5	2.0		
2:00	113		6.5	2.0		
2:30	120		7.5	2.0		
3:00	130		7.5	2.0		
3:30	130		7.7	2.5		
4:00	134		7.7	2.5		
4:30	140		8.2	2.5		
5:00	149		8.5	2.5		
5:30	154		8.5	2.5		
6:00	163		8.5	2.5		
6:30	168		8.5	2.5		
7:00	169		8.5	2.5		
7:30	172		8.5	2.5		
8:00	177		8.5	2.5		
8:30	180		8.5	2.5		
9:00	181		8.5	2.5		
9:30	180		8.5	2.5		
10:00	181		8.5	2.5		

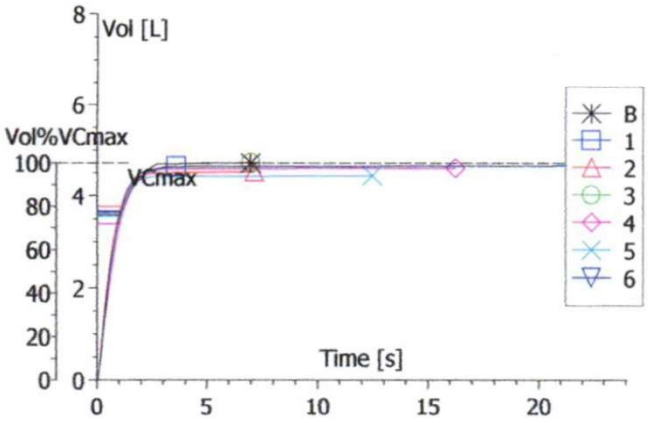
Symptom	Hx	During	After
Coughing			
Wheezing			
Stridor			
SOB		✓	✓
Chest Tightness			
Chest Pain			
Other			

Time taken to reach 80% HR 6 mins

Time above Target 4 mins

Total Time 10 mins





	FEV 1	FVC	FEV1p	FVCp	PEF
Pred	3.55	4.29			7.21
BASELINE	3.62	4.63	102.07	107.9	5.25
Immediately after running	3.75	4.51	105.75	105.0	5.89
05 mins	3.58	4.71	101.00	109.9	5.36
10 mins	3.38	4.58	95.24	106.7	4.41
15 mins	3.54	4.42	99.84	103.0	4.76
20 mins	3.65	4.63	102.99	107.8	4.97

Expected 80% Max HR for patient= 160 bpm

Duration of exercise at HR > 80% Max = 4 min

Maximum HR during exercise = 181 bpm

Treadmill speed at stable state = 8.5 km/hr

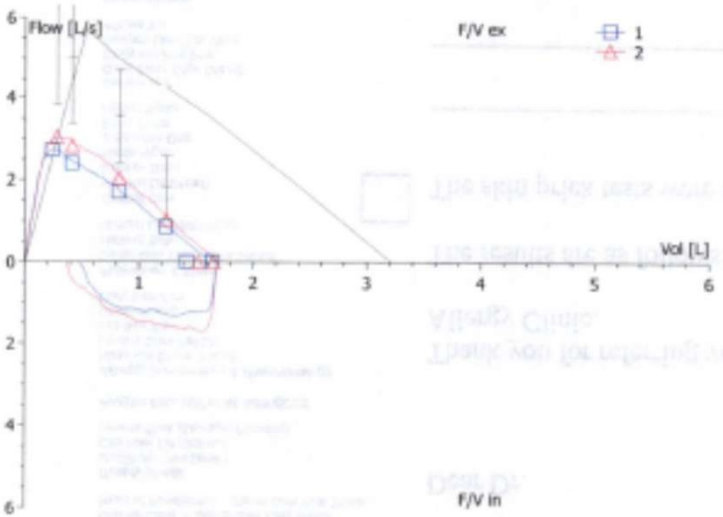
% change in FEV1 after exercise = -6 (Post-Pre divided by Pre x 100)

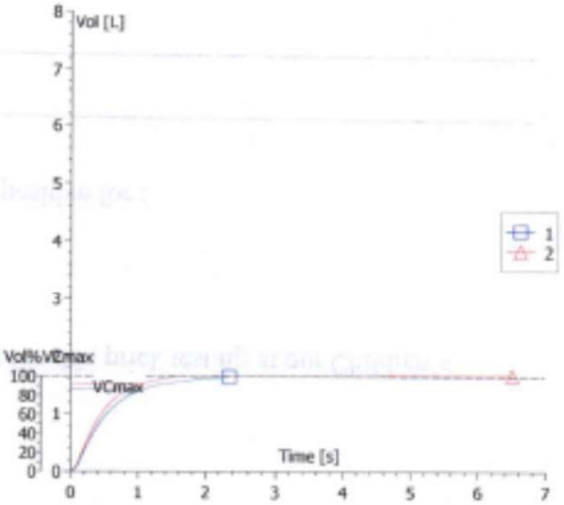
% change in FVC after exercise = -4

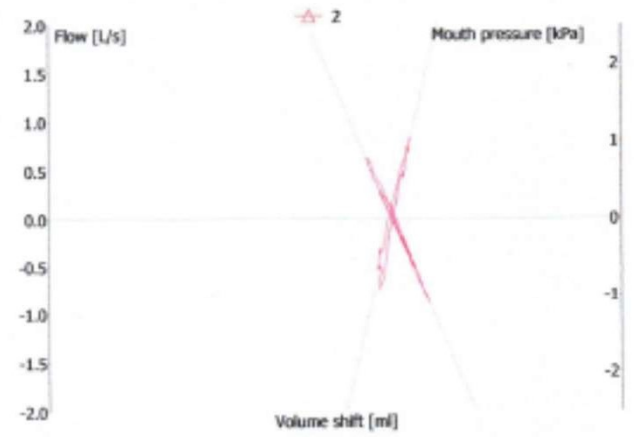
Patient's effort: Excellent / (Good) / Moderate / Poor

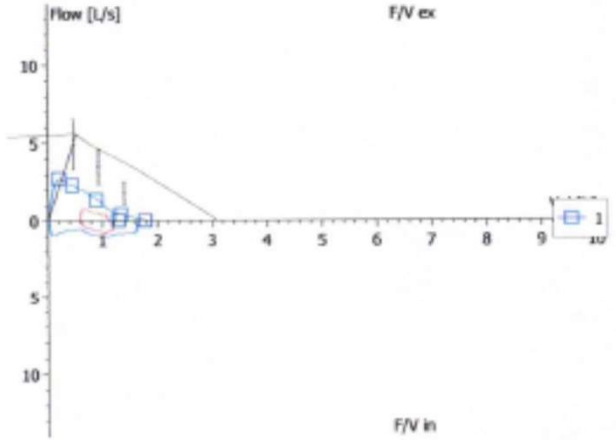
- 14 YEAR OLD GIRL WITH IDIOPATHIC SCOLIOSIS REFERRED BY ORTHOPEDICS FOR PULMONARY EVALUATION PRIOR TO SURGERY FOR HER SCOLIOSIS.
- SHE IS ASYMPTOMATIC OTHERWISE.
- THIS IS HER SPIROMETRY

		Pred	BEST	%Pred	POST	% CHANGE
Date			20.09.17			
Time			11:51:36			
VC MAX	[L]	3.25	1.65	50.6	50.9	0.5
FVC	[L]	3.22	1.65	51.2	51.5	0.5
FEV 0.5	[L]		1.04			10.8
FEV 1	[L]	2.68	1.42	53.1	56.6	6.5
PEF	[L/s]	5.73	2.72	47.5	52.7	10.8
FEF 25	[L/s]	5.03	2.40	47.6	56.0	17.6
FEF 50	[L/s]	3.56	1.71	48.0	57.4	19.5
FEF 75	[L/s]	1.83	0.86	46.9	55.5	18.3
MMEF 75/25	[L/s]	3.17	1.55	48.8	55.9	14.6
FEV 1 % FVC	[%]	84.19	86.39	102.6	108.7	5.9
VC IN	[L]	3.25	1.25	38.4	39.8	3.7
IC	[L]	2.15				
ERV	[L]	1.08				









		Pred	BEST	%Pred
Date			31.03.17	
Time			14:42:53	
SR tot	[kPa*s]	0.53	1.02	191.8
SR eff	[kPa*s]	0.53	0.89	167.0
R tot	[kPa*s/L]	0.27	0.51	191.6
R eff	[kPa*s/L]	0.27	0.44	166.9
ITGV	[L]	2.01	1.71	85.1
ERV	[L]	1.04	0.67	64.4
RV	[L]	0.94	1.04	110.7
TLC	[L]	4.10	2.89	70.5
RV % TLC	[%]	24.36	35.92	147.5
VC IN	[L]	3.14	1.29	41.2
FVC	[L]	3.09		
FEV 1	[L]	2.58		
FEV 1 % VC MAX	[%]	84.27		
PEF	[L/s]	5.56		
FEF 25	[L/s]	4.89		
FEF 50	[L/s]	3.46		
FEF 75	[L/s]	1.78		
FEV 1 % FVC	[%]	84.27		

SUMMARY

- LUNG FUNCTION TESTS ARE QUITE USEFUL IN A VARIETY OF CLINICAL SCENARIOS
- IT HAS TO BE A CHILD FRIENDLY LUNG FUNCTION LAB
- ONE NEEDS TO CHOOSE THE TESTS APPROPRIATELY AND INTERPRET THE RESULTS IN LIGHT OF THE CLINICAL PICTURE

THANK YOU

drmaheshbabu@gmail.com