Case study

Tittle: Episodic Shortness of Breath: A Case of Bronchospasm in an 18 year Old Girl

Abstract

Asthma is a long-term heterogeneous inflammatory condition of the airways. It is marked by shortness of breath, wheezing, intermittent cough and bronchial hyperreactivity. It has several phenotypes and people living with asthma have atopy. Asthma can occur at any age. However, it is more common in males before puberty; then, has equal sex ratio by adulthood.

Keywords: bronchospasm, intermittent asthma, hyperinflation, bronchodialators.

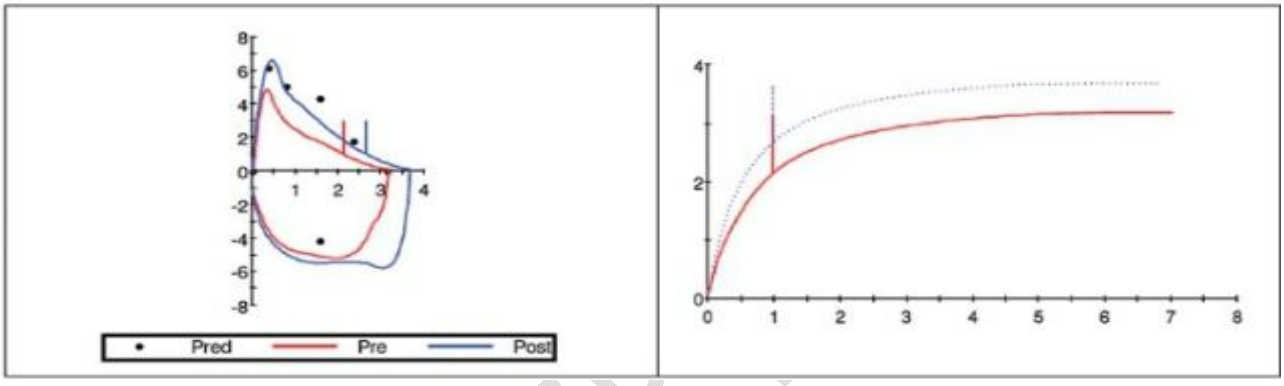
Introduction

Bronchospasm refers to the sudden constriction of the smooth muscle of the bronchi [1]. It leads to a temporary narrowing of the airways. The constriction occurs in asthma, anaphylaxis, chronic bronchitis, and emphysema [2]. Wheezing, chest tightness, coughing, and difficulty in breathing are the classical manifestations. Management of patients with the above symptoms require immediate use of bronchodilators as they reopen the airways and give lungs relief from spasms [3].

Case presentation

An 18 year old girl presents on account of intermittent dyspnea of 3 months duration. This complaint started with an upper respiratory tract infection. She finds it difficult to get breath following mild exertion and she has a sudden period of coughing. She complains that her breath produces a whistle-like sound at irregular intervals. She felt better after using her friend's albuterol inhaler and she is wondering if she is actually suffering from bronchial asthma. On examination, she breaths with no difficulty at 15 times/min and her SPO2 measures at 96% on room air. On auscultation, her lungs are clear and there was no added sound.

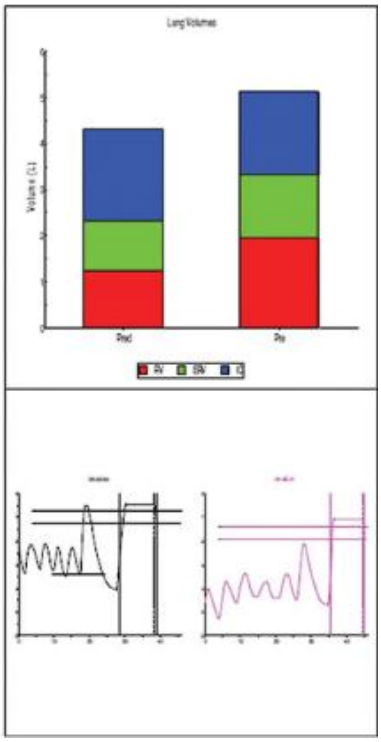
	Pre-Bronch			Post-Bronch		
	Pred	Actual	%Pred	Actual	%Pred	%Chng
— SPIROMETRY —						
FVC (L)	3.14	3.27	104	3.69	117	+12
FEV_1 (L)	2.64	2.16	81	2.68	101	+24
FEV_1/FVC (%)	85	66	77	73	85	+9
$FEF_{25-75\%}$ (L/s)	3.14	1.44	45	2.47	78	+70
FEF_{Max} (L/s)	6.14	4.83	78	6.73	109	+39
$FEF_{25\%}$ (L/s)	5.06	2.88	56	4.70	92	+62
$FEF_{50\%}$ (L/s)	4.36	1.72	39	2.82	64	+64
$FEF_{75\%}$ (L/s)	1.79	0.69	38	1.28	71	+86
FIVC (L)		3.24		3.75		+15
$FIF_{50\%}$ (L/s)	4.18	5.09	121	5.45	130	+6



A

Fig. 1A. Lung function tests in a patient with suspected asthma (A) The forced expiratory Volume (FEV1) is within normal range; however, the tiffeneau-pinelli index and the forced mid-expiratory flow are low [4]. This assessment was done before and after bronchodialation with flow-volume loops and graph of FVC. After bronchodilation, there is a better effect in the peripheral airways; this is represented by forced mid-expiratory flow (B) The residual volume is increased which is suggestive of hyperinflation and air trapping. The transfer factor for carbon monoxide is normal. In summary: hyperinflation, obstruction of the airways, and improvement with beta-2 againsts are in keeping with the diagnosis of asthma [4].

	Pre-Bronch			Post-Bronch		
	Pred	Actual	%Pred	Actual	%Pred	%Chng
— LUNG VOLUMES —						
SVC (L)	3.14	3.17	101			
TLC (Pleth) (L)	4.30	5.12	119			
RV (Pleth) (L)	1.23	1.95	158			
RV/TLC (Pleth) (%)	29	38	131			
TGV (L)	2.32	3.33	143			
Raw ($cmH_2O/L/s$)	1.86	3.71	199			
ERV (L)	1.16	1.38	118			
IC (L)	1.98	1.79	90			
— DIFFUSION —						
DLCOunc (mL/min/mm H_2)	17.53	27.25	155			
DLCOcor (mL/min/mm H_2)	17.53					
VA (L)	4.30	5.11	118			
DL/VA (mL/min/mm Hg)	4.08	5.33	130			



B

Fig. 1B. (A) The forced expiratory Volume (FEV1) is within normal range; however, the tiffeneau-pinelli index and the forced mid-expiratory flow are low [4]. This assessment was done before and after bronchodialation with flow-volume loops and graph of FVC. After bronchodilation, there is a better effect in the peripheral airways; this is represented by forced mid-expiratory flow (B) The residual volume is increased which is suggestive of hyperinflation and air trapping. The transfer factor for carbon monoxide is normal. In summary: hyperinflation, obstruction of the airways, and improvement with beta-2 againsts are in keeping with the diagnosis of asthma [4].

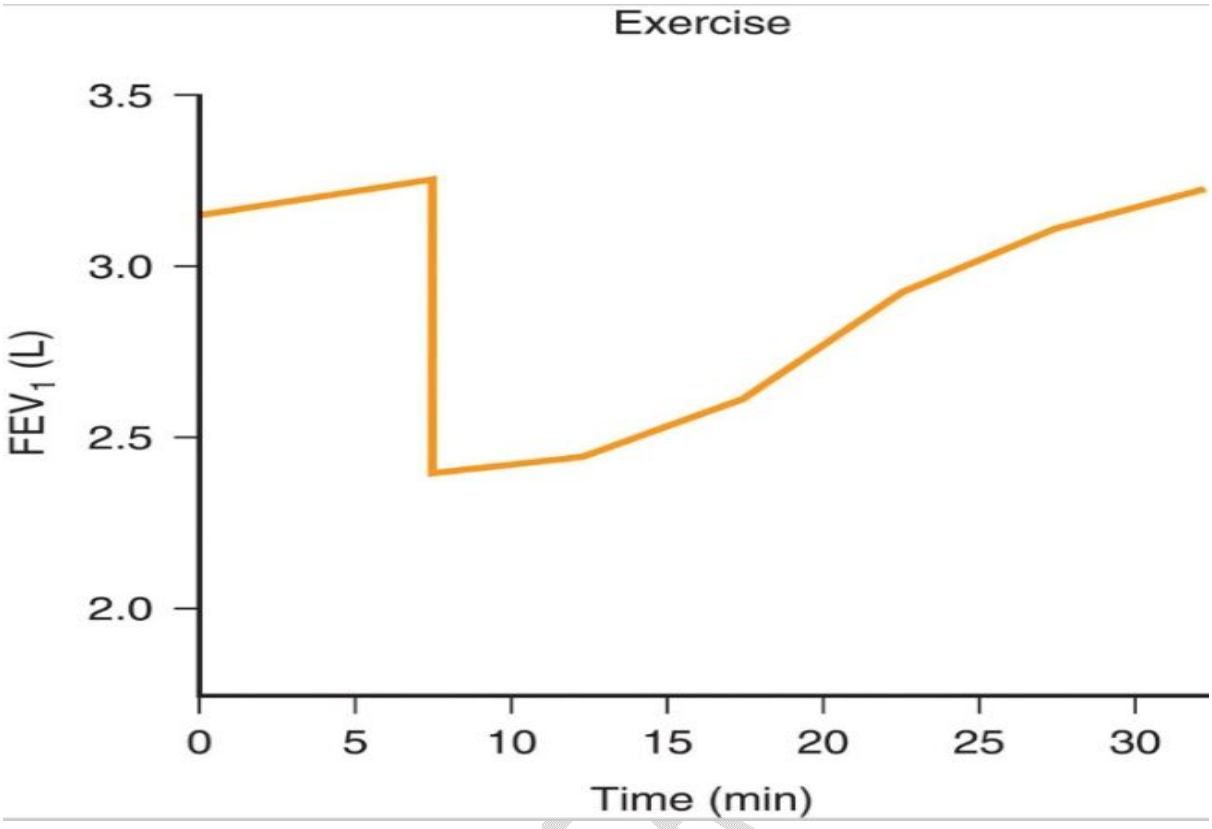


Fig. 2. There is a quick decrease in FEV1, accompanied by progressive recovery. The photograph shows FEV1 in a patient with sports-induced asthma [5].

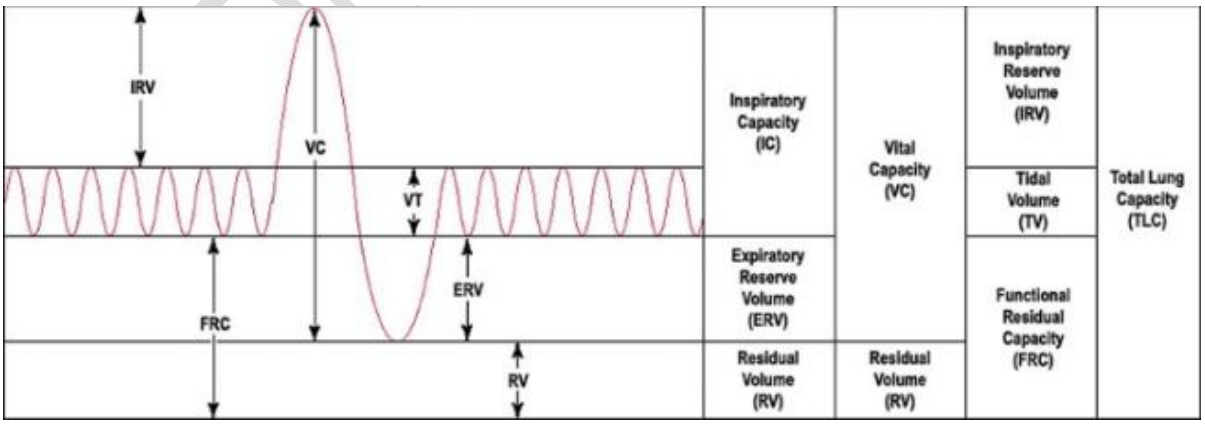


Fig. 3. The graph shows how tidal volume is related to vital capacity and other prime volumes [6].

Discussion

The patient's complaints are in keeping with asthma [7]. Spirometry will be very important in deciding if there is a proof of obstructive pulmonary disease since this patient has clinical pictures of bronchospasm. However, in asymptomatic patients, spirometry results are always normal in mild asthma. Methacholine challenge test may be used to diagnose asthma as well, but this has to come after a basic spirometry test. Even though chest x-ray and CT can show an unknown development, they are not recommended for people with no evidence of bronchospasm. Bacterial pneumonia is a possible cause of bronchospasm which can be identified using the chest x-ray, however, the patient does not have fever followed by a severe bacteria infection. Arterial blood gas levels will be extremely important if the patient has signs of respiratory distress [8]. NB: You must suspect an imminent respiratory failure if a patient with acute exacerbation of asthma and a respiratory rate greater than normal has normal ABG level [9]. CO2 is expected to decrease in patients with abnormally rapid breathing. However, a normal arterial blood gas with a normal CO2 level is suggestive of respiratory muscle fatigue and early respiratory failure. Additionally, all concentrations should be on FEV1/FVC ratio as they decrease first in asthma. The forced expiratory volume decreases first as the lung continues to get obstructed. Airway obstruction should be suspected when the ratio of FEV1/FVC becomes less than 0.70. This abnormality should be called an intermittent asthma if she is given an inhaled albuterol months back and she comes back complaining of dyspnea, and wheezing; and if these complaints are caused by mild exercise and cold weather; and if she makes use of the albuterol inhaler more than one time every week; and if she wakes up at night dyspneic and coughing [10]. Patient should continue with the albuterol inhaler as she still responds well to it and has no respiratory difficulty. Inhaled steroids like triamcinolone should be prescribed when symptoms occur more than two days every week. NB: The rule of twos says: all the patients who have more than two asthma exacerbations every week needing rescue drugs or who wake with night symptoms more than two times every month, should be prescribed an antiinflammatory drug like inhaled steroid. Inhaled steroids are more effective than the leukotriene inhibitors; so the antileukotriene should only be administered immediately when the patient stops responding to steroids. They are not used to replace inhaled steroids, they are added to the regimen [11].

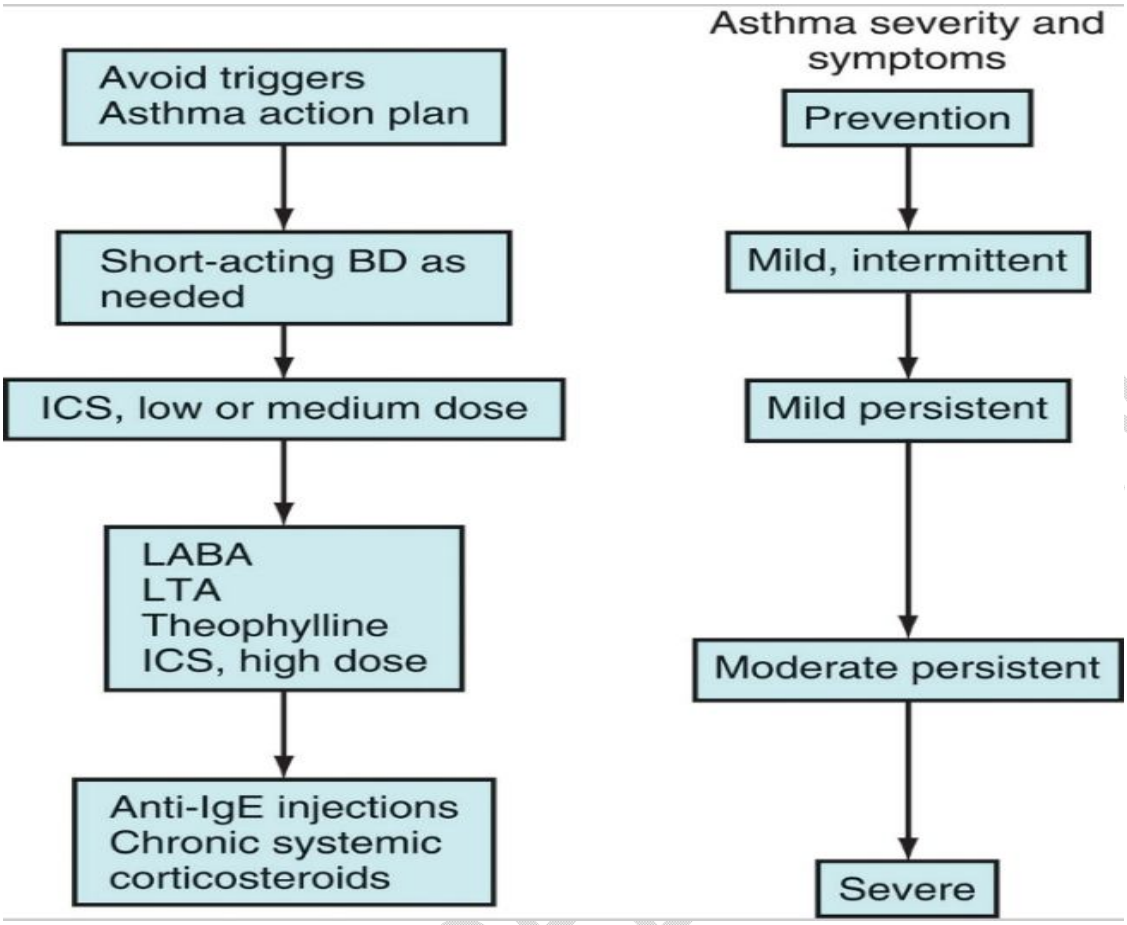


Fig. 4. Stepwise approach for managing asthma. Frequent use of beta-2 agonists following bronchoconstriction, abnormal pulmonary function, and frequent nocturnal awakening, characterize severity of asthma. Drugs are prescribed for patients who use short-acting beta2 agonist more than two times every week to prevent or control symptoms. Normally, treatment is started with inhaled steroids, followed by supplemental controller drugs. Long-term steroids, or anti-igE therapy is recommended for people with recalcitrant asthma. Steroid inhaler, anti-igE, long acting beta2 agonist, and leukotriene receptor antagonist [12].

Conclusion

Asthma is a long-standing heterogeneous inflammatory disease of the airways. It is associated with irregular airflow inhibition and bronchial hyperresponsiveness which can reverse spontaneously or follow beta-2 agonist treatment.

References

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