

It's Getting Harder and Harder to Breathe

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History

14-year-old female softball player with past medical history of COVID-19 January 2021 and eczema

- Covid symptoms included loss of taste, myalgias x2 days, low grade fever x1 day.
- Presented in October 2021 with chest tightness, SOB, wheezing, and cough with exertion, flute playing, and walking to class. Patient not able to complete 'suicides' at softball practice.
- First noted difficulty breathing while sprinting in February. Symptoms last for one hour after exertion.
- She has continued to play Softball but gets 'runner's pinch' at times. She plays outfield and 2nd base. She has not participated in conditioning for gym class due to symptoms.
- She denies palpitations, dizziness, chest pain, and lightheadedness at rest. She denies history of cardiac symptoms, asthma, seasonal allergies.
- She has no family history of asthma or cardiac conditions.
- She is menstruating and was recently started on OCP due to severe cramping during menstruation and heavy periods.
- She has been vaccinated against COVID-19 x2.

RECENT LABS

08/05/2021

WBC: 5.7 (4.2-11.0 K/mcL)
Hgb: 14.6 (12-15.5 g/dL)
HCT: 42.5 (36-46.5%)
PLT: 273 (140-450 K/mcL)
Ferritin : 18 (15-112 ng/mL)

VITALS

Height: 66.7 inches
Weight: 141.1 lbs
BP: 122/76
Pulse: 79
Temperature: 98.1 F (36.7 C)
Last Menstrual Period: 07/18/2021

Physical Exam

HEENT: thyroid exam and phonation normal, no cervical lymphadenopathy
Respiratory exam: no wheezing or stridor at rest, clear to auscultation in all lobes
Cardiac exam: regular rate and rhythm, no murmurs

EKG: Ventricular rate 87, PR interval 129 ms, QRS duration 77 ms, QTc 376 ms
Normal sinus rhythm without any T wave or ST segment changes.

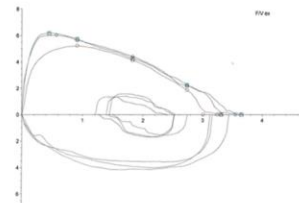
CARDIOPULMONARY EXERCISE TESTING (CPET)

Patient was exercised on a Lode Excalibur Sport cycle ergometer using 20 watt per minute ramp protocol. Resting spirometry was within normal limits.

- Patient's resting $\dot{V}O_2$ (oxygen uptake) was 4.3 ml/kg/min
- She achieved anaerobic threshold at 7 minutes and 45 seconds with $\dot{V}O_2$ 16.9 ml/kg/min at an RER of 1.01.
- Peak power output was 160 watts which was 86% of predicted.
- Anaerobic threshold occurred below normal limits at 57% of $\dot{V}O_2$ peak vs expected of 60-80%.
- $\dot{V}O_2$ peak was 29.9 ml/kg/min at 11 minutes 24 seconds with expected of 32 ml/kg/min with an RER of 1.11.
- GET ("anaerobic" threshold) was determined by change in the $\dot{V}CO_2$ - $\dot{V}O_2$ slope method and ventilatory equivalents method.
- She reached 96% of predicted maximal heart rate.
- Resting heart rate was high at 120 BPM.
- Heart rate responded appropriately to increasing workload.
- Patient exhibited a normal O2 pulse at 10.1 with a predicted value of 10.8.
- Her breathing reserve was high at 42% with normal criteria less than 35%.
- Oxygen saturation remained normal and patient did not develop any chest pain or stridor.
- Blood pressure started at 120/81 and increased to 133/85 at peak work rate.
- The patient reported tightness in her throat at exercise termination.

FEV₁

- FEV₁ was measured during CPET with a decrease of 1% after serial FEV₁ measurements.
- Spirometry testing was within normal limits.
- Patient noted transient improvement with albuterol MDI in office.



Post Cardiopulmonary Testing

30 minutes after the test the patient became anxious and felt that she was wheezing although no audible wheezing was heard.

Her PFTs remained within normal limits.

Differential Diagnosis

- Anxiety
- Physical Deconditioning
- Exercise Induced Laryngeal Obstruction (EILO)
- Exertional Chest Pain
- Post-Acute Sequelae of SARS CoV-2 infection (PASC)
- Exercise Induced Bronchoconstriction (EIB)

Lab Data and Rationale for Diagnostic Tests

- During initial evaluation there was concern for exercise induced bronchoconstriction and PASC therefore patient was screened via in office EKG and referred for CPET testing with Dr. Skiba.
- EKG was completed to rule out cardiac etiology for shortness of breath.
- CPET was consistent with a deconditioned athlete or one that is not displaying maximal effort due to patient not having reached $\dot{V}O_2$ plateau, predicted max HR, and RER greater than 1.2.
- Breathing reserve remained elevated which is also consistent with deconditioning.
- Patient had elevated resting heart rate which is also consistent with deconditioning or anxiety.

Speech Therapy Evaluation

- Patient was asked to mimic an episode that she has by showing how she appears and sounds during the episode. Office did not have room for her to perform exercise and induce a real event.
- Breathing pattern: chest, shoulder/clavicular
- Perceptual breathing quality: wheezing or stridor on inhalation
- Behavioral observations: touching of her throat
- Patient was asked to participate in exercise to become more aware of her vocal cord opening and closing.
- Therapy focused on helping patient use rescue breathing technique (imitating a yawn on inhale while exhaling with gently pursed lips). Patient tried the exercise during the session while having stridor and noted a sensation of "more hollow exchange of air through her vocal cords."
- At follow-up, patient put this technique to test during Softball practice and noted significant improvement in symptoms.
- Patient was discharged from Speech Therapy after two visits due to significant improvement and both mother and patient were happy with the progress.

Final Diagnosis: Exercise Induced Laryngeal Obstruction (EILO) and Anxiety

Typical findings of Exercise induced bronchoconstriction(EIB) include wheezing, shortness of breath, dyspnea, cough, or chest tightness with exercise. Symptoms can last for up to 10 minutes and fully resolves by 60 minutes. Physical exam is often unremarkable. Decrease in FEV₁ by 10% on serial testing is diagnostic.

EILO is characterized by development of stridor, hyperventilation, respiratory distress, and panic reactions at the peak of exercise and lasting for about 2-3 minutes after exercise. Continuous laryngoscopy during exercise is the gold standard for diagnosis which our patient refused. Test is positive if symptoms are reproduced and ideally correlate with a plateau in oxygen consumption.

PASC have been found to be associated with vocal cord paralysis in several cases. Vocal cord paralysis can be associated with stridor and hoarse voice have been noted. In the case of vocal cord paralysis, hoarseness would also be present throughout the resting period in patients.

Patient met anaerobic threshold but in setting of reduced RER and lack of meeting predicted work patient is most likely deconditioned due to these findings. Patient also had high resting HR which is consistent with her current anxiety treatment.

PCP Follow Up and Beyond

- Patient has since had resolution of symptoms after applying the breathing exercises learned in speech therapy.
- Patient had minimal improvement with albuterol inhaler.
- Patient has since followed up with PCP and Adolescent Medicine for anxiety and her birth control is being adjusted since patient noted an increase in anxiety since starting birth control in September 2021.
- Patient has no current plans to follow up with sports medicine.
- Patient has continued to play Softball.

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