Vocal Cord Dysfunction Masquerading As Exercise-Induced Bronchoconstriction

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**Introduction**

- Exercise-induced bronchoconstriction (EIB), formerly exercise-induced asthma, has a prevalence of 5-20% in the general population and may affect up to 90% of patients with symptomatic asthma.
- Presents as shortness of breath, chest tightness, and cough 10-15 minutes after initiation of exercise with a 4 hour latency period after symptoms
- Pathophysiology thought to be related to dramatic increases in minute ventilation of large volume, cool, dry air, leading to bronchospasm
- EIB is typically diagnosed and treated based on symptoms alone
- However, not all patients with these symptoms have EIB, and alternative diagnoses such as exercise-induced vocal cord dysfunction (EIVCD) are difficult to differentiate without objective testing

**Case Presentation**

- 42 yo F with no significant medical history, presented with dyspnea and chest tightness, starting 20-30 minutes into running exercise, resolved with rest
- Symptoms started 5 years ago
- Given an albuterol inhaler and later montelukast by her PCP, without improvement
- Referred to pulmonology and underwent EVH testing
- Test was sufficient, but negative for EIB (post-EVH FEV1 <10).
- However, the inspiratory limb of her post-exercise flow volume loop was flattened (Image 1)
- Referred to ENT for VLS
- VLS showed paradoxical vocal cord function with rapid and forced breathing
- She was diagnosed with exercise-induced vocal cord dysfunction (EIVCD)
- She underwent outpatient speech language therapy with significant improvement

**Eucapnic Voluntary Hyperventilation (EVH)**

- EVH is a bronchoprovocation test, which stimulates exercise while maintaining patient CO2 levels
- Baseline spirometry followed by breathing the test gas mixture (5% CO2, 74% N, 21% O2) at a target minute ventilation (30x FEV1) for 6 minutes
- Spirometry is then performed at 3, 5, 10, 15, and 20 minute time points following simulated exercise
- EVH is diagnostic if average maximum voluntary ventilation per minute (MVV) is >60%
- A positive test is defined as a >10% decrease in any post-EVH FEV1

**Data for EVH**

- EVH was first used at Walter Reed Army Medical Center in 1985
- The results were reproducible and consistent on repeat EVH evaluations [7]
- A standardized protocol was created in 2001 by Anderson et al. [6]
- EVH has been compared against exercise testing and methacholine challenge tests with similar NPV and superior PPV [2, 9]
- EVH is now considered the gold standard of EIB diagnosis [3]
- Patients with EIB without asthma had higher inflammatory mediators in sputum following a (+) EVH, than EVH negative patients [8]
- Multiple studies have shown a correlation between inspiratory flow volume loop flattening and vocal cord dysfunction, later found on VLS [4, 5]

**Treatment Algorithm for EIB**

![Algorithm 1: Diagnostic and Treatment Approach to EIB](Image 2)

**Discussion**

- Patients presenting with symptoms consistent with EIB should be considered for objective testing with EVH, especially if failing first line therapy
- EVH has been well studied in elite athletes and academic centers, and is being increasingly utilized in community settings
- EVH can also show inspiratory flow volume loop abnormalities, which are suggestive alternative conditions such as EIVCD
- EIVCD is treated with speech therapy, as opposed to bronchodilators for EIB
- Utilization of EVH can likely decrease inappropriate medication use and healthcare utilization and increase accuracy of treatment

**References**