Editorial Commentary: Exercise-induced Dyspnea

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Abstract

The evaluation of exercise-induced dyspnea (EID) in otherwise healthy children and adolescents is often limited to a specific cause such as exercise-induced asthma or vocal cord dysfunction. However, modest degrees of bronchospasm or vocal cord dysfunction may occur in the absence of dyspnea. Testing that does not include concurrence of dyspnea with an abnormality may provide misleading information to the detriment of the patient. This commentary describes the limitations of two recent publications in Pediatric Pulmonology. Reproducing the patient's dyspnea during cardiopulmonary monitoring provides the etiology of at least 7 causes of EID.

Commentary

Two recent publications in Pediatric Pulmonology have addressed the important topic of exercise-induced dyspnea (EID) in children and adolescents.[1,2] The varied etiologies of EID and the lack of diagnostic standards can present a challenge for the physician encountering an otherwise well patient with exertional dyspnea. The retrospective report by Pederson and colleagues described diagnoses from an observational study of 214 children with EID in the Swiss Paediatric Airway Cohort (SPAC)*. The final diagnoses for the exercise-induced symptoms of those children were based on the previous symptom history, treatments, physical

* SPAC included children referred to pediatric outpatient clinic of participating Swiss hospitals.

examination, and testing. Tests reviewed included spirometry, body plethysmography, bronchodilator response, fraction of exhaled nitric oxide, allergy tests, chest x-ray, and bronchial challenge tests; no cardiopulmonary stress testing was performed. The authors determined from examination of the previously obtained data that etiologies of exercise-induced symptoms were different from the referring physician's diagnoses. More than half of the patients were given a final diagnosis of exercise induced asthma, although only a third of the total patient population were tested for exercise induced bronchospasm (EIB). About a third of the patients were diagnosed with extrathoracic and intrathoracic dysfunctional breathing with or without asthma. However, the authors did not provide any definitions for these disorders or the criteria used for reaching those diagnoses.

The study by Ersson and colleagues evaluated the prevalence of EIB and laryngeal obstruction in healthy adolescents.[2] They described 98 attendees of a sports high school who completed a questionnaire about dyspnea with exercise. A history of dyspnea with exercise was reported in 41 while 57 indicated no such history. All underwent a test for EIB defined as a decrease of 10% in the one second forced expiratory volume (FEV_1). Based on the criteria used, EIB was identified in 8 of 41 with dyspnea and in 16 of 57 without dyspnea. Continuous laryngoscopy during exercise was also performed on 75 subjects. Thirty-four had a history of dyspnea on exertion of whom 5 were observed to have exercise-induced laryngeal obstruction (ELO). Three of the 41 without dyspnea were noted to have ELO. The conclusion from this study was that EIB and ELO were poorly predicted by symptoms.

Unfortunately, the methodologies used in these reports result in presumptuous conclusions about etiologies of EID because the specific pathophysiology associated with exercise-induced dyspnea (EID) was not examined by either of these recent publications.[1,2] The

actual etiology of EID requires identifying the physiology associated with the patient's exertional dyspnea.[3,4,5] That requires reproducing the patient's dyspnea during cardiopulmonary monitoring. This includes heart rate, ventilation pattern, oxygen utilization, carbon dioxide production, inspiratory and expiratory airflow, visualization of airway if needed because of decreased inspiratory airflow, and blood gas measurements at the time symptoms are reproduced.[5] When that was done in 117 otherwise healthy adolescents, diagnoses were not limited to bronchospasm and laryngeal obstruction (Table 1). Of importance is that 74 of 117 of the patients had dyspnea on exertion associated with normal physiological limitation. This typically occurs when anaerobic metabolism, that occurs normally at high levels of exercise, results in lactic acid accumulation. That induces an attempt to compensate for the resulting metabolic acidosis with respiratory alkalosis by increasing respiration. This increased respiratory drive when ventilation physically cannot be further increased is perceived by some subjects as dyspnea.

Prevalence of EIB in the normal population and in athletes has been described previously.[6] EIB was also observed in children with rhinitis but no asthma diagnosis and in the absence of associated dyspnea.[7] EIB was also reported in children with decreased levels of physical activity and no clinical evidence of asthma.[8] Burnett and colleagues reported an EIB prevalence of 43% in college athletes, most having no respiratory symptoms.[9] Thus, EIB occurs in the absence of both dyspnea and asthma. Is EIB of clinical importance in the absence of dyspnea?[10] Does a 10% decrease in FEV_1 from exercise in the absence of associated dyspnea support the diagnosis of exercise-induced asthma? A more stringent criteria using a cutoff value of 15% found dyspnea associated with EIB to be positive in only 11 of 117 children referred because of exercise induced dyspnea (Table 1).[3]

The following conclusions emanate from the above discussion of the two recent publications in Pediatric Pulmonology,[1,2] our previous work on the subject and review of the literature.

- A modest degree of EIB does not confirm the diagnose of asthma and has ~~no~~ little clinical relevance if not concurrently associated with the patient's symptoms of dyspnea,
- Identification of ELO not concurrently associated with the patient's symptoms of dyspnea has ~~no~~ little clinical relevance to an individual with EID,
- Since ELO can occur from different anatomical abnormalities with different treatment implications, the specific abnormality should be identified by direct visualization.
- Results that test only for specific causes of EID require that the patient's dyspnea be concurrent with results of that test,
- The various etiologies of EID in Table 1 can be best identified by reproducing the patient's symptoms of dyspnea during cardiopulmonary stress testing.

Table 1. Diagnoses among 117 children referred to the University of Iowa Pediatric Allergy and Pulmonary Division because of exercise-induced dyspnea between 1996 and 2003. Treadmill exercise sufficient to reproduce symptom were performed with continuous cardiopulmonary monitoring.[3]

Disorder identified	Number of patients
Exercise-induced bronchospasm	11
Vocal cord dysfunction	13
Restrictive physiology	15
Exercise-induced laryngomalacia	2
Exercise-induced hyperventilation	1
Exercise-induced supraventricular tachycardia	1
Normal physiologic limitation	74

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