The Physical Examination

A complete neurologic examination should be performed following a suspected neurogenic cause of syncope. Abnormalities of cognition and speech, visual fields, motor strength, sensation, tremor, and gait suggest an underlying neurologic disorder.

The Physical Examination

If an underlying neurologic disorder is suspected, further study and subspecialty consultation should be considered. If the event was preceded by head trauma with subsequent neurologic deficits, a computed tomography (CT) scan of the head to assess for gross intracranial pathology should be considered, but magnetic resonance imaging (MRI) will yield better resolution for structural or brain tissue pathology. Finally, if seizure activity is suspected, an electroencephalogram (EEG) may be warranted. If the event was preceded by fear, pain, prolonged standing, psychologic stress, or a medical procedure and the athlete has normal physical examination results, the diagnosis of vasovagal syncope or neurally mediated syncope can be made.

CASE REPORTS

Case 1: Cross-Country Runner with Loss of Consciousness while Running

A 15-year-old male cross country runner reported loss of consciousness with exercise during his PPE. Since he was uncertain of the details, his coaches were questioned. They said he stopped running shortly after beginning the second of a two-lap course, had a contusion and laceration to the forehead, and was confused. He denies recall of what happened after he slipped, but the coaches stated that he had fallen, struck his head on a rock, and appeared to have lost consciousness for several seconds. They denied seeing any seizure-like activity.

Key Point: Concussions can occur in sports other than traditional “contact/collision” sports and are a common cause of loss of consciousness in athletes.

Case 2: Track Athlete with Loss of Consciousness during a Race

A 21-year-old female track runner reported loss of consciousness during a 200-m race during her PPE. Her coaches said she was prone and unresponsive on the track, with tremulous activity in both upper and lower extremities lasting about 90 s, after which she was responsive and aware of her situation. She reported having three similar episodes while in high school. There were no other significant personal or family medical history, medication, or supplement use. Neurologic examination result was normal except for the transient inability to move her left arm. Brain imaging (CT and MRI) results were normal. When questioned about stress, she stated she had a previous injury, which occurred in the middle of a championship 200-m race, and she worried constantly about being injured again and unable to compete. Following 48 h of cognitive behavioral therapy, she improved and was able to move all extremities. She was diagnosed with conversion disorder as the cause of her “psychogenic” syncope.

Key Point: Apparent loss of consciousness may be psychologic in origin, especially with a history of abuse, stressful incident, or anxiety/depression. Most athletes will improve with psychotherapy. Ninety seconds of “seizure-like” activity is much longer that the hypoxia-induced convulsions of cardiac arrhythmias.

Case 3: Football Athlete with Loss of Consciousness after Practice

A 19-year-old football player has a witnessed loss of consciousness at the end of practice on an extremely warm August day. He was walking to the locker room when he was noted to wander away from the team briefly before falling to the ground in a prone position. His teammates were the first on the scene, and they described him as being clearly unconscious. He then had a brief stiffening of all four extremities that lasted 15 s. He was unconscious for nearly 5 min in total, during which time, he was noted to have sparse, shallow breathing. Upon regaining consciousness, he was combative for 5 min and acutely disoriented for 25 min. He was taken to a local emergency room via emergency medical services where he was found to be fully oriented, tired, and diffusely sore upon arrival, almost 40 min after the initial loss of consciousness. A head CT in the emergency room yielded normal results, as were basic serum laboratory evaluations. He was discharged home with a normal neurologic examination result, feeling only fatigued and sore. Follow-up MRI and EEG were performed 3 d later, and both yielded normal results. Further history examination revealed no previous similar episodes and no seizure risk factors. He was diagnosed with having a provoked seizure secondary to extreme fatigue, dehydration, and possibly increased core body temperature. He was not started on antiepileptic medication.

Key Point: Exertional heat stroke (EHS) should be immediately ruled out on site and immediate on-site cooling should be considered. Pre-event confusion, prolonged loss of consciousness (>30 s), and prolonged confusion (25 min) are all consistent with seizure and EHS. Both MRI and EEG results are frequently normal in these cases, even if epilepsy is the root cause. In this case, the diagnosis of epilepsy cannot be made, as this is his first seizure and it may have been provoked. Treatment with antiepileptic medications can be considered but is not clearly indicated.

References


3A. Personal History: Have You Ever Had Excessive Shortness of Breath or Fatigue with Exercise beyond What Is Expected for Your Level of Fitness?

Francois Haddad, MD, Gherardo Finocchiaro, MD, and Jonathan Myers, PhD

The following questions can help distinguish cardiovascular from pulmonary or other causes of dyspnea. The history along with physical examination and cardiopulmonary studies
will generally determine the underlying cause of excessive shortness of breath. Table 1 summarizes different causes of dyspnea important to consider in athletes, and Table 2 summarizes ancillary studies to consider during the workup of dyspnea.

1) Is the shortness of breath recent, or has it been occurring for some time (weeks or months)? Is it consistent and reproducible in its presentation and level of exercise, or is it inconsistent?

Shortness of breath with intense exercise is a normal response, but differentiating between normal exercise-induced shortness of breath and dyspnea associated with a serious heart or lung condition is not always simple (Table 1). A sudden onset, a significant decrease in exercise performance, or an inconsistent presentation may be the first sign of cardiac or pulmonary abnormality and warrants further evaluation.

2) Is there associated chest discomfort?

Any athlete with chest pain and dyspnea at a minimum should receive a resting electrocardiogram (ECG), possibly followed by an echocardiogram and a maximal symptom-limited exercise test, provided that the athlete has had no obvious pulmonary or musculoskeletal cause.

3) Is there lightheadedness, or has the patient passed out during exercise?

Shortness of breath can be associated with rhythm disturbances during exercise. Any history of lightheadedness or passing out (syncope) should be thoroughly evaluated for the possibility of serious rhythm disturbances. Structural heart diseases associated with these symptoms include congenital aortic stenosis, hypertrophic cardiomyopathy (HCM), or rarely pulmonary hypertension.

4) Is there a family history of a serious heart condition or sudden death?

A family history of HCM or arrhythmogenic right ventricular cardiomyopathy strongly raises the likelihood of dyspnea caused by rhythm disturbances, and further investigation based on the details of the family history is indicated (see the family history section).

5) Is there a history of exercise-induced asthma (EIA), or has the individual recently moved to a new environment?

EIA is the most common reason for excessive shortness of breath in an otherwise healthy athlete.

6) Is the athlete underperforming during competition and/or experiencing excessive fatigue during regular activities?

Overtraining syndrome (OTS) should be suspected in an athlete who is undergoing heavy training or competition, and cardiovascular causes and other medical illnesses have been ruled out. OTS may be associated with chronic tiredness, unusual fatigue, or shortness of breath with normal athletic competition, underperformance, and difficulty sleeping. Loss of appetite, weight loss, heavy painful muscles, and excessive sweating may be reported.

EXERCISE TESTING

A cardiopulmonary exercise test can help differentiate between a cardiac and pulmonary cause of excessive shortness of breath with exercise. A cardiac cause should be suspected if the breathing reserve (maximal voluntary ventilation at rest divided by maximal ventilation with exercise) is normal (20% to 40%). Undiagnosed exercise-related asthma can be induced with exercise stress testing that includes the respiratory components.

CASE REPORTS

Case 1: Dyspnea Associated with a Presyncopal Episode in a Young Athlete

A 19-year-old female endurance athlete mentioned on her PPE an episode of dyspnea associated with presyncope while running on a warm day. The athlete had a remote history of chest pain, no palpitations, and no family history of cardiomyopathy or sudden death. Physical examination results were unrevealing. ECG and echocardiogram results were both normal. The athlete was cleared to restart training, and the episode was considered to be neurocardiogenic in origin.

Key Point: All athletes with dyspnea and syncope/presyncope should receive a workup that includes an ECG and resting echocardiogram. Abnormal cardiac remodeling should lead to further evaluation. In athletes, the echocardiogram protocol should include a basal short axis view to visualize the origin of the coronary arteries.

Case 2: An Unsuspecting Case of Systemic Illness

A 55-year-old national-level cyclist reported feeling shortness of breath during competition. For the last 5 years, he consistently finished in the top three for his age category, but during the last year, he finished in the mid-teens. After initial consultation, his ECG, echocardiogram, and exercise initial consultation, his ECG, echocardiogram, and exercise results were unrevealing. ECG and echocardiogram results were normal. The athlete was cleared to restart training, and the episode was considered to be neurocardiogenic in origin.

Table 1.

Nonpulmonary causes of dyspnea in the athlete.

<table>
<thead>
<tr>
<th>Cause</th>
<th>Comment</th>
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<tbody>
<tr>
<td>Musculoskeletal injury</td>
<td>Muscle strain, trauma, costochondritis</td>
</tr>
<tr>
<td>Myocardial ischemia</td>
<td>Rare cause of dyspnea, but always consider anomalous coronary origin in the young</td>
</tr>
<tr>
<td>Other structural cardiac causes</td>
<td>Myocarditis, pericarditis or congenital heart disease (i.e., congenital aortic stenosis limiting exercise performance), or pulmonary hypertension</td>
</tr>
<tr>
<td>Arrhythmias</td>
<td>Supraventricular tachycardia can occur in an athlete and cause exertional dyspnea</td>
</tr>
<tr>
<td>OTS</td>
<td>Associated with underperforming, waning energy, inadequate rest, and undernutrition for activity level</td>
</tr>
<tr>
<td>Chronic fatigue syndrome</td>
<td>Associated with chronic tiredness, excessive fatigue usually following a viral illness</td>
</tr>
<tr>
<td>Systemic illness</td>
<td>Anemia, infectious mononucleosis, or systemic illness should be ruled out in the presence of unexplained dyspnea or fatigue</td>
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</table>
Ecocardiogram results were considered normal, and the patient was advised to resume training. During the following year, his performance continued to drop further. A repeat echocardiogram revealed an increase in wall thickness, and an infiltrative cardiac process was suspected. Further investigation confirmed that the patient had multiple myeloma complicated by cardiac amyloidosis.

Key Point: Although a rare case, he highlights the fact that symptoms may be overlooked or underestimated in older athletes.

Case 3: Dyspnea and Pulmonary Hypertension in a Young Athlete
A young 23-year-old female rower reported progressively increasing shortness of breath during the last year with decreased exercise performance. History was unrevealing, and the physical examination result demonstrated increased second heart sound with a mild holosystolic murmur at the parasternal border. The ECG revealed borderline right axis deviation. Because of the history of progressive dyspnea and the finding on physical examination of an increased S2, an echocardiogram was ordered and results revealed a mildly enlarged right ventricle with mild tricuspid regurgitation, an estimated right ventricular systolic pressure of 42 mm Hg, and normal left ventricle size. Magnetic resonance imaging (MRI) did not show fatty infiltration. Right heart catheterization confirmed the presence of pulmonary arterial hypertension.

Key Point: Pulmonary hypertension is a rare cause of dyspnea in athletes but should be considered. An MRI should be obtained in patients with evidence of disproportionate right heart enlargement, especially in nonendurance sports.

3B. Personal History: Have You Ever Had Excessive Shortness of Breath or Fatigue with Exercise beyond What Is Expected for Your Level of Fitness?

Jon-Emile S. Kenny, MD  and Stephen Ruoss, MD

The following questions can help distinguish cardiovascular (CV) from pulmonary or other causes of dyspnea:

1. Are there associated non-pulmonary symptoms such as palpitations, pre-syncope, and/or chest pain?

   The presence of cardiac-associated symptoms should prompt evaluation for processes including exercise-induced pulmonary arterial hypertension, cardiomyopathies, and valvular abnormalities.

2. Does dyspnea occur suddenly and unexpectedly, or does it occur regularly and predictably with exercise?

   Intrinsic pulmonary causes of excessive dyspnea with exercise should occur with nearly every episode of exertion. An exception to this statement might be a particular environmental trigger (e.g., cold air) that occurs intermittently with exercise. Truly paroxysmal episodes of excessive dyspnea should raise suspicion for nonpulmonary diseases manifesting as paroxysmal dyspnea, including cardiac arrhythmias or hyperventilation syndrome.

3. When does dyspnea occur during exercise?

   The onset of dyspnea at peak exercise may suggest a CV-related arrhythmia or exercise-induced vocal cord dysfunction (VCD) or laryngeal spasm; symptoms often regress as exercise intensity is reduced. In contrast, exercise-induced bronchoconstriction (EIB) is reliably most intense at 10 to 15 min of maximal exercise and tends to resolve gradually over 1 h of sustained exercise. Repeat exercise bouts within 4 h of initial symptoms tend to reduce dyspnea in EIB.

4. Is there audible wheezing or stridor during the dyspnea episode, and does it occur with inspiration, expiration, or both?

   Audible wheezing during expiration is a strong clinical clue for EIB. However, if noticed during inspiration (stridor), especially if there is no expiratory wheeze and the sounds are associated with hoarseness, VCD should be considered.

5. Are there environmental triggers of dyspnea beyond that of exercise?

   Allergic individuals are more likely to have EIB and/or exercise-induced asthma. Typical asthmatic triggers such as pollens, cold air, molds, air pollution, animal dander, cigarette or wood smoke, and others can suggest bronchospasm as the underlying etiology.

6. Is there an associated cough, and is it productive?

   The presence of a nonproductive cough during exercise may be a result of bronchoconstriction. However, cough occurring in the absence of exercise or when not exposed to an environmental trigger may suggest intrinsic airway