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# Respiratory Tract Infections in Athletes

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The average adult experiences between 2 to 5 upper respiratory infections (URTIs) a year, which is a leading cause of physician visits and missed days of work. URTIs are one of the most common medical conditions affecting athletes. Athletes are often in close contact with others in team locker rooms, at practice, or during travel, all of which increase their risk of infection. In addition, the stress of training, traveling, competition, and environmental exposure suppresses the athlete's immune system.

## *Exercise and the Immune System*

The question of whether exercise increases the risk of URTIs has been studied by several investigators and remains controversial.<sup>1-5</sup> These studies vary widely with respect to subjects, methods, and exercise load.<sup>4</sup> Several epidemiologic studies (observational and case series) have supported the “J” curve relationship between exercise and the risk of URTI.<sup>1,2</sup> This model suggests that moderate exercise improves immune function compared with sedentary persons, but prolonged high-intensity exercise may impair immune function by release of stress hormones. A “window period” of suppressed cell-mediated immunity often follows strenuous exercise.<sup>3</sup> A dose–response relationship between exercise load and risk of URTI is difficult to prove.<sup>4</sup> It has been reported that up to 2 hours of moderate activity daily improved overall health in individuals and decreased URTIs by 29% compared with sedentary individuals.<sup>5</sup> However, in the case of more extreme physical exertion in a study of marathon racers, running greater than 97 km/wk appeared to lead to more respiratory infections. Endurance events such as marathons were associated with infection in the week post race.<sup>6</sup> However, world-class athletes may be able to tolerate heavy physiologic demands without significant immune suppression.<sup>7</sup> Unfortunately, randomized controlled trials are difficult to conduct, and the current available studies reinforce the

complex causal association between exercise and susceptibility to respiratory tract infections.<sup>4</sup>

## *Viral Upper Respiratory Tract Infections*

URTIs account for the majority of lost training time in athletes. Most URTIs are benign and self-limited, have an incubation period of 24-72 hours, and typically last 1-2 weeks. Symptoms are nonspecific and include sore throat, cough, rhinorrhea, nasal congestion, headaches, body aches, and fever. Viruses are the most frequent cause of URTI. Common viruses include rhinoviruses, coronaviruses, adenovirus, and parainfluenza virus. Human respiratory syncytial virus and metapneumovirus, which cause more severe illness in children, elderly people, and the immunocompromised, may also cause URTIs. A study evaluating athletes who had >48 hours of typical URI symptoms only found causative agents in 30% of cases using a variety of isolation techniques including serology, culture, and polymerase chain reaction (PCR) from nasopharyngeal, saliva, and blood samples.<sup>8</sup> In this study, rhinovirus was most often isolated, followed by adenovirus, *Mycoplasma pneumoniae*, *parainfluenza 3*, *Hemophilus influenza*, *Streptococcus pyogenes*, and *Staphylococcus aureus*. It is unclear whether symptoms last longer in athletes as epidemiologic studies have reported conflicting results.<sup>8,9</sup>

Viral URTIs can be transmitted through direct contact and/or aerosolization of viral particles. Person to person spread depends on the amount of time people spend together and in close communities secondary attack rates can be as high as 70%. Hand to hand contact is the most common means of transmission followed by the spread of infection through the inoculation of virus in the nose or eyes of susceptible persons. Proper hand washing in the athlete is highly encouraged as an important preventive measure.

Physical examination is nonspecific and the diagnosis is made based on clinical presentation and symptoms. Viral cultures are rarely indicated for an uncomplicated viral URTI in the outpatient setting and there is no effective antiviral therapy for the viruses most often implicated. Treatment of viral URTIs is supportive with symptom relief through use of decongestants and antihistamines as needed.<sup>9</sup>

***Return to Play.*** Limited data exist to support a well-defined timeline for return to play. Decisions for return to play should be made on a case by case basis. General consensus favors continued training with above the neck symptoms such as rhinitis and mild headache. Rest is recommended for cough, fever, and myalgias. Exercise during acute infection can cause serious complications and increases the risk of recurrence, which is about

30%.<sup>10-12</sup> Athletes who are concerned about deconditioning should be aware that 4-5 days of rest has no significant effect on fitness.

## Acute Sinusitis

While the common cold is self-limiting, prolonged and worsening URTI symptoms may suggest acute bacterial sinusitis, which can develop in about 2% of adults after a viral URTI.<sup>13</sup> *Streptococcus pneumoniae*, other streptococci, *H. influenzae*, *Moraxella catarrhalis*, and *S. aureus* are common bacterial causes of sinusitis. Acute bacterial sinusitis often follows viral or allergic rhinitis. Symptoms may include nasal congestion, purulent nasal discharge, fever, headache, facial pain, or maxillary tooth discomfort. Antibiotics should be considered for symptoms lasting >10 days or severe symptoms such as fever, facial pain, or periorbital swelling. While amoxicillin is preferred, emerging resistance has led to the use of amoxicillin-clavulanate (Augmentin), macrolides, and fluoroquinolones. Providers should consider local resistance patterns and patient risk factors when prescribing antibiotics. Symptomatic treatment with antihistamines, decongestants, and nasal steroids may also be beneficial.

## Acute Pharyngitis

Acute pharyngitis and tonsillitis account for approximately 50% of outpatient antibiotic use and 19 million clinic visits annually.<sup>14</sup> Pharyngitis may be viral or bacterial in origin and may be indistinguishable on clinical presentation. Most sore throats are due to viruses such as coronavirus, rhinovirus, adenovirus, enterovirus, influenza, parainfluenza, herpes simplex virus, Epstein-Barr virus (EBV), and HIV. Bacterial pathogens include Group A beta-hemolytic STREP (GABHS), and other bacterial pathogens including *mycoplasma*, *chlamydia*, *Corynebacterium*, anaerobic streptococci, and *Neisseria gonorrhoeae* in sexually active patients.

GABHS accounts for approximately 10% of cases of acute pharyngitis in adults with much higher rates in children.<sup>15</sup> This is an important infection in athletes because of its ability to spread quickly from person to person via contact with droplets of saliva or nasal secretions. Crowded areas such as locker rooms, schools, and barracks favor spread. Interestingly, virulence of the bacteria may be enhanced in the process of spreading by natural selection. While much lower than children, carriage rates among adults is likely around 5% but varies by population.<sup>16</sup> Untreated, convalescent patients can transmit infection also. Prompt use of antibiotics minimizes secondary spread.<sup>9</sup> The Centor criteria (fever

>38°C, lack of cough, pharyngotonsillar exudates, tender anterior cervical adenopathy) does not distinguish most bacterial and viral cases; thus, rapid testing and culture should be performed on suspected cases. In addition to pharyngeal findings in GABHS infection, a scarlet rash may appear on the body. Identification and treatment of GABHS is important to minimize the risk for complications. Treatment prevents lymphadenitis, abscess, sinusitis, bacteremia, pneumonia, and acute rheumatic fever but does not prevent post streptococcal glomerulonephritis. Greater than 24 hours of close contact with the index patient in the week preceding symptoms was associated with carriage or infection.<sup>16</sup> Screening and treatment may be considered in these cases.

Symptomatic relief, including the use of nonsteroidal anti-inflammatory drugs, is appropriate for most cases of acute pharyngitis except in the case of GABHS, where antibiotics are indicated.

**Return to Play.** Athletes with suspected or confirmed acute GABHS pharyngitis should be considered contagious until they have had antibiotic therapy for 24 hours and it is recommended that they not participate in play.<sup>9</sup>

## *Pneumonia*

Athletes may be at slightly higher risk for pneumonia, especially in the winter season. However, recurrent lower respiratory tract infections should prompt evaluation for underlying immunodeficiency. Bacterial, viral, and, rarely, fungal causes should all be considered, although the latter concerns athletes traveling to areas with endemic fungi. *S. pneumoniae* is the most common cause of bacterial pneumonia. Other “typical” organisms include *H. influenzae*, *S. aureus*, Group A beta-hemolytic streptococci, and *M. catarrhalis*. Atypical organisms include *M. pneumoniae*, *Chlamydophila pneumoniae*, *Chlamydia psittaci*, and *Legionella*.

Cough, sputum production, shortness of breath, chest pain, and fever are the most common presenting symptoms in pneumonia. In an athlete who presents with respiratory symptoms it is important that vital signs be reviewed closely as they will help determine if outpatient therapy is appropriate or inpatient monitoring is warranted. Abnormal auscultatory findings on physical examination and an infiltrate on chest radiograph indicate pneumonia and help differentiate between pneumonia, an inflammation of pulmonary parenchyma, and bronchitis. Sputum cultures, serologies, and urinary antigen are helpful diagnostic tools. Commonly used urinary antigens include pneumococcus, *Legionella pneumophila* Type 1, and histoplasmosis. A macrolide or doxycycline is recommended

in previous healthy individuals with community-acquired pneumonia. If risk factors for resistance such as recent antimicrobial use, recent hospitalization, alcoholism, or immunosuppression exist, a respiratory quinolone or beta-lactam and macrolide combination is recommended.<sup>9,17,18</sup>

In the patient with continued fever, complications such as pleural effusion or empyema should be considered.

Reactive airways may also occur after community-acquired pneumonia and may last from weeks to months. Symptoms may be managed with bronchodilator therapy.

*M. pneumoniae* causes upper and lower respiratory tract infections, especially in the 5-20 age group. Attack rates among family members have been reported to be near 90% and immunity tends not to be longlasting.<sup>19</sup> This is pertinent to athletes living in close quarters. Incubation time is 2-3 weeks. Gradual onset of respiratory symptoms usually precede headache, fever, and cough with minimal sputum production. Confirmation of diagnosis can be difficult. Rapid PCR of sputum samples have limited sensitivity and IgM serology often fails to develop in adults. PCR and serology in combination have been recommended.<sup>20</sup> The fastidious nature of *mycoplasma* makes in vitro growth difficult. Chest radiograph findings of diffuse interstitial involvement and extrapulmonary involvement such as bullous myringitis, arthritis, and skin eruptions may aid in diagnosis. Some evidence suggests *mycoplasma pneumoniae* may contribute to the development of asthma.<sup>21</sup>

Symptoms of viral pneumonias due to influenza A and B viruses can be mitigated by the use of neuraminidase inhibitors such as oseltamivir and zanamivir if given within 72 hours. These agents have no documented activity against other viruses associated with pneumonias. Coccidiomycosis, histoplasmosis, and blastomycosis are potential respiratory pathogens for athletes training or competing in an area with these endemic fungi; however, most infections are asymptomatic.

While asthma and allergies may be the most common causes of chronic cough in athletes, health care providers should be aware of the recent increase incidence of *Bordetella pertussis* infections in young adults.<sup>22</sup> Persistent cough >2 weeks in an adult may be due to *B. pertussis* in 12%-30% of cases. Diagnosis can be made by PCR of nasopharyngeal aspirate. Pertussis is highly communicable, reaching 80% in households among unimmunized contacts and 20% in immunized contacts. Macrolides and trimethoprim-sulfamethoxazole are effective agents. Athletes who have confirmed or probable pertussis should be isolated for 5 days from beginning of treatment. Athletes known to be in close contact with

a known or suspected case of pertussis should receive prophylactic antibiotic therapy with a macrolide.

***Return to Play.*** Athletes treated with appropriate therapy usually have improvement in their symptoms in 72 hours. The athlete should be afebrile before return to competition and training should be resumed slowly. To prevent spread among athletes, in the case of influenza, the athlete should be kept from the training room practices and competitions until 5 days after the onset of symptoms.<sup>11,17</sup>

## ***Prevention***

Athletes should be immunized against seasonal influenza. In addition, a booster dose of the acellular pertussis vaccine (available as Tdap) should be administered in young adults to reduce the transmission of pertussis.<sup>23</sup> The pneumococcal polysaccharide vaccine is recommended for athletes with asthma who have cochlear implants, or chronic medical conditions. Preventive infection-control measures should be taken to avoid infection. These include regular hand washing, minimal contact with sick persons, and the avoidance of sharing personal items. Adequate rest and proper nutrition are vital to a healthy immune system.<sup>11,17</sup>

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