Viral Diseases and Youth Sports: How to Handle Common Infections that Sideline Athletes

Katherine V. Yao, MD; Stanley Szybinski, MBBS; Mathew Varghese, MD; and Matthew Fazekas, MD

ABSTRACT

The coronavirus disease 2019 (COVID-19) pandemic has brought to forefront the large morbidity, mortality, and complications that viral illnesses can cause. For athletes, viral illnesses can be disruptive toward their participation in youth sports. This article outlines the details of how the most common viral illnesses affect the youth athlete and youth sports, including COVID-19, non–COVID-19 upper respiratory infections, influenza, Epstein-Barr virus, varicella, herpes, and other dermatologic infections. In this article, we review current available guidelines and recommendations on how to handle these infections in athletes during sports as well as return-to-play recommendations. [Pediatr Ann. 2021;50(11):e454-e460.]

In 2020, the coronavirus disease 2019 (COVID-19) pandemic in the United States forced shutdowns in essentially every social activity that children normally partake in, including team and individual sports that are critical to their health and development. As restrictions for sports are lifted, serious consideration needs to be given to return-to-play (RTP) policies regarding COVID-19 infections in the pediatric and adolescent population. The pandemic has also brought to the forefront considerations of how other viral infections should be handled for the best individual and public health outcomes. This article serves to review common viral illnesses that sideline youth athletes and current available RTP guidelines for these illnesses.

COVID-19

COVID-19 is a unique viral illness due to its highly contagious transmission, its morbidity and mortality rates, and its short-term and long-term cardiopulmonary, neurologic, and multisystem effects, many of which are not well understood yet. Informed policy that accounts for this and that is adjusted based on new data will be key to creating effective RTP guidelines. As COVID-19 remains a problem due to variant emergence and continued community spread, it would be helpful to have clear guidelines to help return athletes back to play as safely as possible. When discussing RTP, four important points must be considered: infectious spread, short-term respiratory capacity, long-term cardiac risks, and psychological/physical condition.

With COVID-19, transmission occurs via respiratory droplets and contact spread, and in a sports environment transmission risks include respiratory spread among close contacts, aerosolization particles from the environment or nebulizer treatments from teammates, and contaminated surfaces, such as mats, training equipment, and locker room surfaces. It is difficult to maintain social distancing and mask guidelines in sports due to many factors including, but not limited to the inability to perform effectively and safely with a mask on, the close contact nature of many sports, travel requirements for competition, and the natural tendency of youth athletes to congregate closely with teammates in social environments.

Similar to non-athletes, current guidelines recommend that any athlete who tests positive, due to the increased respiration exchange in indoor athletic environments, it is particularly important to follow these recommendations. Athletes should wait to RTP after a minimum of 10 days from the onset of symptoms plus a minimum of 7 days from symptom resolution after a respiratory illness that occurred as a result of COVID-19. These are important rules to adhere to as we have seen rapid spread of the virus among close contact groups. As sports resume in schools and communities, it
will be important for sports teams and providers to be up to date on current research and regulations.

It is also important to consider the respiratory impacts that acute COVID-19 infections can have on athletes, and current RTP guidelines are outlined in Table 1. Generally, athletes may have a persistent cough for 4 weeks after a COVID-19 infection. If there are worsening symptoms or new symptoms (new productive cough, chest pain, dyspnea), RTP should cease and reassessment should occur to rule-out pneumonia, embolism, or post-inflammatory bronchoconstriction. Moderate to severe pneumonia can also have severe impacts on the pulmonary vasculature, so any new-onset breathlessness or chest pain should include embolism on the differential and be tested for. Additionally, given the risk of myocarditis and other forms of cardiac dysfunction, it is recommended that the “neck check” rule (eg, that play be allowed if symptoms are only in the upper airway) not be implemented in evaluating RTP in the setting of COVID-19 and athletes should be held out regardless of severity of symptoms until after the quarantine criteria are met and all symptoms have resolved for at least 7 days.

As we are seeing more long-term effects from COVID-19 affecting youth athletes particularly with cardiomyopathies that are exacerbated with exercise, guidelines evolve as we learn more about the pathophysiology, risks, and prevalence of this occurrence. As of now, the underlying etiology of COVID-19–induced cardiomyopathy appears to be due to a combination of factors including systemic inflammatory response of cytokine storm, with contributions from hypoxemia, right ventricular strain due to pulmonary vasoconstriction, thromboembolic complications, and viral myocarditis. Current cardiac guidelines can be seen in Table 2. If there is impaired function seen on cardiac imaging, the patient should rest for 48 hours and then troponin levels should be measured. In elite athletes, troponins are an even less specific finding, as elevated levels may be signs of either viral myocarditis or secondary to intense training regimens.

Finally, it is important to consider not only the physical but also the mental well-being of athletes before RTP. Being personally infected or having loved ones infected has a large mental and emotional impact that should be accounted for when assessing for readiness. Counseling or psychotherapy should be considered for those having difficulty coping or for those experiencing emotional distress. Physical deconditioning can also result from either the effects of the infection or the amount of time away from physical activity due to the quarantine requirements after being infected or exposed. For each week without training, there can be a loss of 10% of overall fitness. Muscle disuse can lead to decreased flexibility and range of motion and may contribute to increased risk of injury. A progressive training regimen should be implemented for any athlete returning after an infection with or exposure to COVID-19. There is much more to learn about the overall effects of COVID-19 and our RTP guidelines should continue to evolve based on the most up-to-date evidence.

**UPPER RESPIRATORY INFECTIONS AND INFLUENZA**

Non–COVID-19 upper respiratory infections (URIs) are one of the most common ailments among the general population and athletes. It is one of the most common reasons for noninjury-related presentations to sports medicine clinics and accounts for 35% to 65% of illness presentations. URIs are commonly caused by viral vectors such as rhinovirus, Coxsackie A and B virus, echovirus, adenovirus, coronavirus, respiratory syncytial virus, influenza (A, B, and C) virus, parainfluenza virus, and Epstein-Barr virus (EBV).

Although URIs are the most prevalent illnesses among athletes and the general population, there are no clear RTP guidelines. It has become increasingly important not only to create and follow guidelines for COVID-19, but also to do so for other viral infections and URIs. Identifying specific viral illnesses early and preventing the spread is key to providing a safe and healthy environment for youth sports and for promoting public health safety.

URI symptoms can include sore throat, headache, fatigue, runny nose, nasal congestion, and watery eyes. More severe symptoms may manifest such as fever and sometimes myalgias, which are more common in influenza. For URIs, medical providers have often used a “neck check” guide when evaluating RTP. In this case, an athlete with only “above the neck” symptoms such as runny nose, nasal congestion, and sore throat may be safe to RTP if the athlete should be held out of sport. Any athlete with “below the neck” symptoms such as severe cough, fever, myalgias, or gastrointestinal symptoms should remain out of sport until symptoms resolve. Any athlete experiencing chest pressure or chest pain should also remain out of sport until symptoms resolve or until further testing is done as viral infections, for which at least 20 have been implicated, can result in myocarditis. There have been recommendations that fever should be resolved for 24 hours without the use of antipyretics before RTP.
URIs are generally self-limited infections that resolve with supportive measures. Prophylactic measures such as regular hand washing, good hygiene, containment of coughing and sneezing, consistent, adequate nutrition, hydration, and sleep are important in preventing illness. Mindful practicing of distancing and decreasing exposure to sick contacts is essential in preventing spread of disease. If identified early, influenza A and B can be treated with neuraminidase inhibitors within 72 hours of symptom onset to decrease morbidity and length of illness. Other supportive treatment for URIs commonly include over-the-counter antipyretics, decongestants, and expectorants. First-generation antihistamines should be used with care due to anticholinergic effects that can result in dehydration, heat, and fatigue issues. Decongestants should also be used with care due to risk of dehydration and hyperthermia. It is also notable that some decongestants and bronchodilators are prohibited in some sports and may be on the prohibited by the World Anti-Doping Agency.14

**EPSTEIN-BARR VIRUS**

Infectious mononucleosis is commonly encountered by student athletes, and the clinical presentation is typically a combination of pharyngitis, cervical lymphadenopathy, fatigue, fever, abdominal pain, and occasionally a rash; however, the clinical picture can vary greatly and may present with atypical signs and symptoms. Laboratory findings can include atypical lymphocytosis on a complete blood count with differential. Diagnosis can be made with heterophile antibody testing (mononuclear spot test); however, this test has a higher degree of false negatives (25%) within the first week of illness.15 A more sensitive test is EBV antibodies, which can help differentiate acute infection versus past or latent infection. Treatment of acute EBV infection is typically symptomatic care as with other viruses, unless complications arise.

Such complications include peritonsillar abscess or chronic fatigue syndrome; however, the most worrisome complication and the limiting factor for RTP purposes is splenomegaly and possible splenic rupture, which can be fatal if left unnoticed.15 RTP protocols are not as clear for acute EBV infection. A clinician should follow a patient’s constellation of symptoms first and foremost. Hepatosplenomegaly does occur in approximately 50% of patients and is typically the limiting factor in RTP. Some studies suggest waiting 3 weeks before RTP, whereas others recommend up to 6 weeks or even 8 weeks until an athlete should RTP. Unfortunately, the role of using ultrasound to monitor splenic size is inconsistent.15 Thus, clinicians need to consider the overall clinical picture of the patient, the sport in which the athlete participates in (contact vs non-contact), and objective data such as physical examination to help guide safe RTP guidance for each athlete to have a discussion with the athlete and their parent or guardian about the potential risk.

**BACTERIAL SKIN AND SOFT TISSUE INFECTIONS**

Bacterial skin infections are some of the most common skin and soft tissue infections in athletes. Clinical syndromes caused by these infections can range from minor infections such as impetigo and folliculitis to more potentially serious infections including cellulitis, erysipelas, and abscess formation (Table 3). Impetigo, a superficial bacterial infection of the skin that results in blistering of the skin with open lesions or the classic “honey crusting,” usually only needs topical antibiotic therapy, whereas more serious infections such as abscess formation usually require incision and drainage followed by a course of oral...
antibiotics and potentially parenteral antibiotic therapy as well.\textsuperscript{16} The increase in incidence of community-acquired methicillin-resistant \textit{Staphylococcus aureus} has created some challenges in choosing empiric antibiotic therapy as there are no specific signs or symptoms that can be used to differentiate methicillin-sensitive \textit{S. aureus} as opposed to methicillin-resistant \textit{S. aureus}.\textsuperscript{17}

Nonetheless, the RTP criteria remain similar and includes the following: no new skin lesions for 48 hours without evidence of moist, exudative, or draining lesions.\textsuperscript{17} This must also include at least 72 hours of antibiotic therapy. Providers should not cover active lesions to allow for participation. If there are any questionable lesions, then a gram stain and/or culture may be required as well. It is common practice for training rooms to use anti-staphylococcal cleaning supplies and devices to limit staphylococcus exposure and transmission; however, there is limited evidence showing significant reduction in transmission rates. However, having a policy and an outline of procedures in place for cleaning equipment and early identification and treatment of staphylococcal infections may limit the skin infections.\textsuperscript{18}

**HERPES SIMPLEX VIRUS 1 AND 2**

Herpes simplex virus (HSV) types 1 and 2 are common infectious agents in both athletes and the general population. The mode of transmission is almost always from direct skin-to-skin contact. The major risk of HSV infection is when there is ocular involvement, which needs to be recognized early and treated as herpes keratitis (involvement of the cornea), can lead to scarring, clouding of the cornea, and even blindness.\textsuperscript{19}

Regarding athletes, those with underlying skin conditions, such as atopic dermatitis, are at increased risk for transmission of HSV likely due to the disruption in the epidermal barrier. Primary herpes outbreaks usually are more severe and present with systemic symptoms such as fatigue, fever, pharyngitis, and tender cervical lymphadenopathy.\textsuperscript{20,21} Typically, a few days after the system symptoms, the patient will develop small 1- to 2-mm diameter clusters of vesicles that will coalesce with a slightly erythematous base. Most of these infections typically occur within 8 days of exposure.

The virus is spread along the sensory nerve tissue and replicates in the ganglia. Clinicians may see multiple dermatomes involved and it can affect both sides of the face, head or neck area, and even into the upper extremities and trunk.\textsuperscript{20}

Recurrent HSV infection typically has a milder course, has less systemic symptoms, and typically has fewer vesicles at the time of outbreak. The virus lays dormant in the ganglia and thus the recurrence will typically occur along the same dermatomal distribution as previous. The vesicles typically last 8 to 10 days but treatment with oral anti-viral agents can shorten the duration to 2 to 5 days.

RTP criteria for clinicians include that the lesions must have a firm, adherent crust at time of participation without evidence of secondary bacterial infection.\textsuperscript{20} There should not be any new blisters for 72 hours or more and patients should have completed 120 hours or more of antiviral therapy. The patient must not have any systemic symptoms and the clinician may not cover active vesicles to allow for participation.

**TINEA**

Tinea infections are fungal infections predominantly caused by the dermatophyte \textit{Trichophyton tonsurans}, which is

<table>
<thead>
<tr>
<th>Symptom severity</th>
<th>Cardiac recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>No signs or symptoms</td>
<td>No additional cardiac investigation</td>
</tr>
<tr>
<td>Mild to moderate symptoms managed at home</td>
<td>7 days symptoms free, full examination, ECG, and echocardiogram before RTP.</td>
</tr>
<tr>
<td>Persistent symptoms longer than 14 days</td>
<td>Full examination, ECG, and cardiac MRI. If MRI is normal, then cardiopulmonary exercise testing and 24-hour Holter ECG to follow (stepwise to avoid intense training in the setting of impaired function). If all testing is normal, the patient is cleared to RTP. If there are abnormalities, physicians should defer to RTP guidelines for myocarditis.</td>
</tr>
<tr>
<td>If requiring hospitalization</td>
<td>Conduct the entire testing (continue in stepwise fashion but conduct 24-hour Holter ECG regardless of imaging). If all testing is normal, the patient is cleared to RTP. If there are abnormalities, physicians should defer to RTP guidelines for myocarditis.</td>
</tr>
</tbody>
</table>

**Abbreviations:** ECG, electrocardiogram; MRI, magnetic resonance imaging; RTP, return-to-play.

*If patients clear testing, they are clear to RTP. If there are signs of cardiomyopathy or other cardiac defects, it is important to defer to relevant guidelines, such as Pelliccia et al.\textsuperscript{26} Many of these recommendations break down into individual cases or specific dysfunctions that are not the overall focus of this article, but are important to keep in mind. Adapted from Wilson et al.\textsuperscript{4}
SPECIAL ISSUE ARTICLE

responsible for the majority of cutaneous tissue fungal infections.\textsuperscript{2,23} Largely considered a "nuisance" infection, tinea corporis gladiatorum (TCG) or "ringworm" affects about 60% of collegiate and 52% of high school wrestlers each season.\textsuperscript{21,23} Tinea corporis gladiatorum is typically spread via direct skin-to-skin contact from a person with active lesions.\textsuperscript{24} After exposure, symptoms typically appear within 3 to 5 days. The lesion usually starts as a small erythematous macule that grows and becomes more annular up to 8 cm in diameter, but typically smaller than that. The outer border of the lesion can be erythematous and with scaling or flaking, whereas the central area may be clear, brown, or erythematous as well. The lesions typically occur in exposed areas of the skin such as the scalp, face, upper torso, and extremities.\textsuperscript{24}

Diagnosis of TCG is typically a clinical diagnosis but can be difficult at times especially for less experienced clinicians. If needed, application of potassium hydroxide 10% solution on the lesion will dissolve human cells and allow the hyphae to be visualized easily under low power microscopy to confirm the diagnosis and is highly sensitive and specific for diagnosis.\textsuperscript{22} Unfortunately, many athletes will start using over-the-counter anti-fungal medications prior to presentation and can make this diagnosis more difficult and a fungal culture may be needed but can take up to 3 weeks for growth and diagnosis, making it impractical. Thus, empiric treatment with topical or oral anti-fungal agents is advised.

Studies have shown that a superficial tinea infection may take up to 21 days to eradicate.\textsuperscript{21} This leads to an issue for the clinician as keeping an athlete out of sport for 21 days for a largely "nuisance" infection may be impractical. The current guidelines for RTP suggest oral or topical treatment for 72 hours or more on skin and 14 days on scalp, and active infections may be covered to allow participation, which is different than other skin infections such as \textit{Staphylococcus aureus} or HSV.\textsuperscript{21}

MOLLUSCUM CONTAGIOSUM

Molluscum contagiosum is considered another "nuisance" infection. It is a viral infection caused by a poxvirus and typically presents as multiple small papules about 2 to 10 mm in diameter. The papules have a small dimple in the center and do not typically have any surrounding erythema. The infection is spread via direct skin-to-skin contact especially if the papules rupture during contact sports as the fluid within these papules are highly virulent.\textsuperscript{21,25} The affected areas are typically on areas of exposed skin.

Treatment and RTP are focused on removal of the lesion and prevention of further spread. This can be achieved by curetting the lesions or by burning the lesions with a hyfrecator. Treated lesions can be covered and the athlete can RTP immediately.

SCABIES AND PEDICULOSIS

Other common infections among athletes includes scabies and pediculosis (head, body, and pubic hair lice). Both infections are caused by ectoparasites. These infections are easily treatable; however, unless a clinician has a high suspicion, they may be difficult to diagnose. The mode of transmission is via direct skin-to-skin contact; however, the symptomatology that follows may not

TABLE 3. Summary of Common Infectious Conditions and Return-to-Play Recommendations

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return to play</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin and soft tissue Bacterial infections</td>
<td>No new lesions for 48 hours 72 hours or more of antibiotic therapy No moist, exudative, or draining lesions Do not cover active infections to allow participation Perform Gram staining for questionable lesions and avoid return-to-play pending results</td>
</tr>
<tr>
<td>Herpes zoster and gladiatorum</td>
<td>Must have firm, adherent crust at time of participation No evidence of secondary bacterial infection No new blisters for 72 hours or more 120 hours or more of antiviral therapy No systemic symptoms Do not cover active infections to allow participation</td>
</tr>
<tr>
<td>Tinea</td>
<td>Oral or topical treatment for 72 hours or more on skin and 14 days on scalp May cover active infections to allow participation</td>
</tr>
<tr>
<td>Molluscum contagiosum</td>
<td>Curette and cover</td>
</tr>
<tr>
<td>Pediculosis</td>
<td>Must be completely treated before wrestling No evidence of active infestation</td>
</tr>
<tr>
<td>Scabies</td>
<td>Scabies preparation for review under light microscopy</td>
</tr>
</tbody>
</table>

Adapted from Wilson et al.\textsuperscript{6}
be present for up to 4 weeks after the initial contact, which poses a clinical challenge for early detection and treatment.

Pediculosis typically presents as itching in hair-covered parts of the body. The diagnosis is clinical and involves visualization of living lice or nits which are unhatched eggs. Treatment involves permethrin, phenothrin, or carbaryl shampoos.

Scabies on the other hand presents with pruritus as well as a rash that may resemble vesicles, pustules, and even nodules. It is important to look for these rashes in the web spaces between the fingers and toes. A hallmark feature is that of burrowing tracks underneath the skin. Although not necessary for diagnosis, the definitive diagnosis can be made via visualization of larvae in skin scrapings under low-power microscopy. The treatment is with topical permethrin cream. In addition to the above treatments, prevention of spread is also just as important and includes cleaning of bedding, towels, and any other fomites that may be present. They should be washed in hot water with regular dry detergent with a water temperature of over 122°Fahrenheit. RTP consists of negative scabies prep at time of competition and completed treatment for pediculosis without visualization of live lice or nits.

**VARICELLA ZOSTER VIRUS**

Varicella zoster virus (VZV) infections have been reported in athletes, however; it is becoming increasingly less common in the era of widespread vaccinations. Nonetheless, a clinician must always keep in mind the possibility of VZV infection or reactivation especially in older athletes who may have had primary VZV infection as a child as opposed to the immunization. The VZV infection typically presents as a generalized, pruritic and vesicular rash. It consists of many lesions (up to 500) that are in varying stages of development and crusting. Systemic symptoms may be present such as fever but otherwise are uncommon. Disease in children and athletes who are immunized is typically milder and atypical as compared to people who are unvaccinated. The diagnosis is typically clinical and can be confirmed with polymerase chain reaction testing of vesicular fluid, direct fluorescent antibody assay, or a VZV culture.

If an athlete is suspected to have VZV infection, the athlete should be isolated until the diagnosis is ruled out or until all of the lesions have crusted over. If a child is vaccinated, they should remain in isolation until no new lesions develop within a 24-hour period. Antiviral treatments such as acyclovir or valacyclovir is not routinely recommended as there is only a modest decrease in symptom severity and duration.

**CONCLUSION**

Viral illness remains disruptive toward participation in youth sports. A concise RTP plan remains the best mechanism to decrease time loss from sport, prevent disease spread, and lessen long-term complications secondary to disease.

**REFERENCES**


