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Return to play after acute infectious disease in football players

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Abstract
Acute infectious diseases are common in athletes and can impair their ability to train and to compete. Furthermore, continuing exercise during infectious diseases may lead to prolongation or aggravation of illness with severe acute or chronic organ manifestations. Therefore, even simple infectious diseases require a sufficient period of convalescence and recovery, during which exercise may be not allowed. Nowadays, especially in professional football with high pressures on players, staff and clubs due to broad public interests as well as financial constraints, the return-to-play decision is of utmost significance. Based on previous suggestions and our own experience within amateur and professional athletes and football players, this article aims to give a short overview on return-to-play decisions after common acute infectious diseases in football players.

Keywords: football, infections, myocarditis, return to play, team physician, upper respiratory tract infection

Introduction
Acute infectious diseases are very common in athletes and can impair their ability to train and to compete. Continuing exercise during infectious diseases may lead to prolongation or aggravation of illness, combined with the risk of additional acute or chronic organ manifestations such as bronchitis or pneumonia, myocarditis, endocarditis or splenic rupture. In addition, the risk for overload and overtraining can be increased, and infection-associated fatigue can impair exercise and predispose to other injuries (Harris, 2011). However, only few data are available for return-to-play decisions in athletes after acute infectious diseases. Based on previous suggestions (Karageanes, 2007; Kruse & Cantor, 2007; Metz, 2003; Page & Diehl, 2007) and our own experience within a wide range of amateur and professional athletes, this article aims to give a short overview on return-to-play decisions after common acute infectious diseases in football players. Of course, many of the recommendations are not limited to football but have a similar meaning in other types of sport. Therefore, some statements are given for athletes in general.

General aspects
Physical examination and blood parameters
After having taken the athlete’s disease history, a comprehensive physical examination should follow even if the athlete only presents with minor symptoms or disease. Especially in high-level players, a trivial rhinorrhoea may relevantly affect their well-being and physical performance in training and competition. Besides the physical examination of the heart, lungs and abdomen, the inspection of the throat (and if necessary the ears) as well as the palpation of lymph nodes should be performed. Furthermore, body temperature should be measured and, in addition, it should be seriously taken into account to record an electrocardiogram (ECG) at rest (Figure 1).

Particularly in professional athletes, it must always be considered to obtain a venous blood sample during the first visit and possibly during later ones (Figure 1). This will allow to objectively evaluating the disease and the severity of inflammation, and might simplify the return-to-play decision. Beyond that, objective measurements may also gain legal importance in very rare cases. In athletes, the most helpful routine blood parameters of inflammation are the white blood cell count (WBCC) and C-reactive protein (CRP), whereas the blood sedimentation rate is of only minor relevance. Because procalcitonin only increases in systemic bacterial inflammation (Lee, 2013), it does not seem useful in athletes with common infections. Altogether, targeted determination of relevant disease indicators might be of great help for later return-to-play decisions.
Nevertheless, analysing blood parameters or recording an ECG may not be possible under certain conditions (e.g. in training camps or foreign countries). Therefore, in clinically clearly cured players, it seems justifiable that the return-to-play decision is based on the clinical examination alone by experienced sports physicians. In unclear cases with any doubt on the player’s health and no possibility for necessary additional examinations, the player should not return to play.

Return-to-play

Although the term “return-to-play” has been established over the years, it has to be differentiated between “return-to-training” and “return-to-competition”. Because football competition demands can hardly be controlled and inevitably include high exercise intensities, players should be completely cured before returning to competition and no doubts on their proper health should exist.

Before returning to play, football players should receive a final comprehensive medical check-up. The athlete should be free of symptoms and the physical examination without abnormal findings and blood values for inflammation must be normal (WBCC, CRP) or almost normal after a significant decrease over the last days (CRP). If necessary, an ECG at rest or (less frequently) even during exercise should be performed.

Before returning to competition, football players should return to training and exercise with mild (aerobic) intensities with no or only a mild increase in blood lactate concentrations on the first day. If well tolerated, exercise intensity can be increased stepwise from aerobic (mild) to aerobic–anaerobic (moderate) on an individual and day-to-day basis. Depending on the kind and severity of the infectious disease, after curing most of the common infectious diseases, maximal exercise intensities can be reached within a time period from 3–5 days up to 2–3 weeks.

Respiratory tract infections

Upper respiratory tract infection (common cold)

Upper respiratory tract infections (URTIs) represent the most common acute illnesses in athletes and are usually caused by viruses. Viral URTI is a benign, self-limiting syndrome, lasting from 3–5 up to 14 days (Harris, 2011; Page & Diehl, 2007), presenting with rhinorrhea, sore throat, swallowing problems, cough, and possibly fever and malaise. Most common viruses are rhinoviruses, coronaviruses and respiratory syncytial virus, but other viruses can also lead to common cold symptoms (e.g. influenza, parainfluenza and adenoviruses).
Possible serious complications can be acute bacterial superinfections, lower respiratory tract infections and an increase in asthmatic attacks in athletes with this disease.

Athletes without fever and malaise, general body aches and pains, without symptoms below the neck and without elevated blood values for inflammation may exercise at mild to moderate intensity levels (e.g. jogging for up to 30 min), as this does not appear to be harmful for individuals who have common cold symptoms (Page & Diehl, 2007). Intensive exercise bouts (interval training, sprints and training matches) should be avoided because the immune system might be affected negatively (Friman & Ilbäck, 1998; Gabriel & Kindermann, 1997; Meyer, Gabriel, Ratz, Müller & Kindermann, 2001; Nieman, 2003; Scharhag, Meyer, Gabriel, Auracher, & Kindermann, 2002). If common cold symptoms have completely disappeared for about 2–3 days, normal (also intense) training routine can be resumed. All other athletes should receive medical follow-ups within 2–3 days, and are allowed to start with mild training when they are free of common cold symptoms and a normalisation of blood values for inflammation is present.

**Acute sinusitis**

Acute sinusitis can be caused by viruses or bacteria, but viral infection is the most common cause. Whereas viral sinusitis usually resolves within 7–10 days, bacterial sinusitis might last up to 1 month – without treatment in 75% of all cases (Page & Diehl, 2007). Consequently, acute bacterial sinusitis should be treated with antibiotics. In unclear cases or in the presence of worsening courses, additional diagnostic measures such as sinus aspirate culture or imaging studies should be considered.

Players with fever, myalgees, symptoms below the neck (e.g. cough and gastrointestinal [GI] symptoms) or elevated blood values for inflammation should not be allowed to exercise and receive continuous medical follow-ups within 2–3 days. When symptoms worsen within 5–7 days or persist longer, antibiotic therapy should be initiated for a 10- to 14-day course. Athletes with viral sinusitis without fever, with symptoms only above the neck (e.g. nasal congestion, runny nose and headaches) and normal blood values for inflammation and appropriate symptomatic care (e.g. decongestants and non-steroidal anti-inflammatory drugs [NSAIDs]) may exercise at mild intensities, but medical follow-ups should be performed in intervals of 2–3 days. Return-to-play should be allowed when symptoms have completely disappeared and blood values for inflammation have normalised, usually starting with mild to moderate exercise intensities for the first 2–3 days before exercising more intensively again.

**Acute pharyngitis**

The causes of an acute pharyngitis can be viral or bacterial, and a large number of pathogens exists (e.g. rhinovirus, coronavirus, adenovirus, influenza, herpes simplex virus, Epstein–Barr virus (EBV), Group A streptococcus, chlamydia and Neisseria). For most cases, a symptomatic treatment is sufficient. The clinical differentiation between viral and bacterial infection is difficult, but fever and the absence of conjunctivitis, cough or rhinorrhea may suggest bacterial pharyngitis (Bisno et al., 2002), which should be treated with antibiotics. NSAIDs can sufficiently reduce sore throat symptoms.

It has recently been stated by Page and Diehl (2007) that removal from competition is often unnecessary if the player is under close supervision, has no fever and systemic symptoms and is treated appropriately (antibiotic treatment in suspected or confirmed acute bacterial pharyngitis, improvement in acute symptoms within 24 h). However, we suggest that athletes with suspected or confirmed acute bacterial pharyngitis who take antibiotics should not return to play or training before they are free of fever as well as of any symptoms, and blood values for inflammation are normal.

**Infectious mononucleosis**

Infectious mononucleosis (IM; “kissing disease”) is caused by the EBV and characterised by lymphadenopathy, tonsillar pharyngitis and fever. Because symptoms can also be mild (particularly in young individuals), the disease often remains undiagnosed (Kinderknecht, 2002). But as splenomegaly occurs in about half of the patients, and splenic rupture is a possible complication (Kinderknecht, 2002), all athletes with diagnosed acute IM require close medical follow-ups including ultrasound imaging of the spleen. The treatment is symptomatic, usually including NSAIDs. If an additional antibiotic treatment may be indicated due to pharyngeal bacterial superinfection, penicillin or ampicillin must be avoided as these antibiotics can cause severe skin reactions in patients with IM.

Athletes with acute IM should not participate in any sport for 3 weeks after the first clinical symptoms, as splenic rupture typically occurs during that period (Putukian et al., 2008). After 3 weeks, asymptomatic athletes can return to training, starting with mild intensities (but avoiding contact sports) if (1) values for inflammatory markers and liver enzymes are normal; (2) fever is not present; (3) pharyngitis is resolved; (4) the spleen is not enlarged or painful.
and (5) there are no signs in the resting ECG for myocarditis. Fulfilling all these criteria, after 4 weeks the athlete can return to more intensive exercise as well as contact sports. However, full recovery usually takes 2–3 months, but in some cases may even take longer.

Influenza

Caused by influenza viruses, influenza usually appears seasonally during autumn and winter months as an acute respiratory disease typically with a sudden onset which can lead to acute bronchitis. Malaise, myalgias, headache, cough, sore throat and high fever are typical symptoms. Complications can be bacterial superinfections, pneumonia, otitis media, meningitis, encephalitis, myocarditis, myositis, rhabdomyolysis and Guillain–Barré syndrome. After an incubation period of 1–5 days, the acute disease persists for about 8–10 days.

Players with influenza should have close medical follow-ups to control for possible complications. Furthermore, a symptomatic athlete should be kept away from teammates or training rooms to prevent infections from other athletes and staff. Return to training and competition can only be allowed when the disease has resolved completely, meaning that the athlete is free of all symptoms including a normal respiratory status, and laboratory inflammatory markers are normal. Training intensities should be mild for the first 2–3 days, and can be increased moderately within 1–2 weeks. As a preventive measure, vaccination of players should be considered before the winter season.

Acute bronchitis

As an inflammation of the mucous membranes of the bronchial tree, acute bronchitis is caused by viruses in about 90% of the cases (e.g. influenza, parainfluenza, adenovirus, rhinovirus, coronary virus and respiratory syncytial virus). The most common bacteria involved in acute bronchitis are Mycoplasma pneumoniae and Chlamydia pneumoniae. In contrast to URTI, cough with or without sputum production is the dominant symptom in acute bronchitis, which can persist up to 3 weeks (Kruse & Cantor, 2007). As fever can be present but is not typical in acute bronchitis, influenza or pneumonia should be considered as differential diagnoses. Symptomatic treatment is sufficient, and antibiotics are rarely indicated (Gonzales et al., 2001; Snow, Mottur-Pilson, & Gonzales, 2001).

Players with acute bronchitis should receive close medical follow-ups and kept away from exercise until resolution of symptoms. For return to play, the athlete should be completely free of all symptoms, laboratory inflammatory markers should be normal (WBC) or almost normal with a significant decrease within the last days. Training should be started with mild exercise intensities for 2–3 days, followed by a moderate increase within the following days.

Pneumonia

Pneumonia represents an acute infection of the pulmonary parenchyma by viruses and other organisms, resulting in typical pneumonias (e.g. mostly caused by Streptococcus pneumoniae in very young and adults). Frequent symptoms are fever, cough (with sputum in typical pneumonias), myalgias, headache, malaise and anorexia. Usually an empiric oral antibiotic therapy can be started with macrolides. Antibiotic therapy should be initiated in community-acquired pneumonias for 7–10 days and in atypical pneumonias for 10–14 days.

Pneumonia has to be considered a serious illness, requiring an increased recovery time for the athlete compared to URTIs. A reactive airway disease, caused by transient airway hyper-responsiveness with a temporary decrease in the 1 s forced expiratory volume, is a common complication in athletes (Kruse & Cantor, 2007). It usually resolves after 3 weeks, but can also persist longer and last up to 2 months (Kruse & Cantor, 2007). Therefore, athletes with reactive airway disease may have to be treated temporarily with a short-term inhaled bronchodilator.

Players with pneumonia should be informed about an increased recovery time. They should be allowed to return to play, when they are completely free of symptoms and laboratory inflammatory markers are normal. Training should be started with mild exercise intensities for 2–3 days and can be advanced with a moderate increase over the following days. Athletes who have been treated with macrolides should receive a resting ECG before returning to exercise, as macrolides are known to prolong the QT interval and a long QT-syndrome increases the risk for a sudden cardiac death during exercise.

GI infections

Causes for GI infections can be food borne, viral, bacterial or parasitic (Karageanes, 2007). Foodborne illness typically results from toxins in the food due to bacterial growth as well as from bacterial, viral or parasitic contamination or toxins of harmful algal species (Karageanes, 2007). Typical symptoms can be nausea, vomiting, diarrhoea, abdominal cramping and fever. Depending on the kind of virus, bacteria or parasite, illness duration can last from hours to days, but usually should not last longer than 1 week.
The most common cause of gastroenteritis may be food contamination by toxins from bacteria, usually starting suddenly with nausea, abdominal cramping, vomiting and diarrhoea as a reaction of the GI tract to the ingested toxin and ending after some hours. Most GI infections are self-limited, but in bacterial or parasitic GI infections treatment with antibiotics can be indicated (Karageanes, 2007). Based on own experiences, in athletes with GI infections serum markers of inflammation (especially CRP) are usually higher than in athletes with URTIs.

Players with GI infections should receive close medical follow-ups as diarrhoea can lead to severe dehydration and electrolyte imbalances. Often severe malaise over the first few days makes decisions about eligibility for sport easy, and players do not feel as if they were able to train or compete. After GI infections, they can return to play when (1) they are asymptomatic and afebrile; (2) blood values for inflammatory markers, haematocrit, electrolytes and liver enzymes are normal (or clearly decreasing) and (3) body weight is normal or almost normal after adequate rehydration. Athletes should start to train with mild exercise intensities, which can be progressively increased within a few days.

**Cardiac infections**

**Myocarditis and pericarditis**

Myocarditis and pericarditis can be caused by a variety of infectious and non-infectious agents. Both diseases can be isolated, but often are combined and named peri-myocarditis. Infections can be caused by many viruses (e.g. coxsackievirus, adenovirus, cytomegalovirus, echovirus, hepatitis virus, herpes virus, EBV, influenza and HIV) and bacteria (e.g. staphylococcus, pneumococcus, streptococcus, haemophilus and Neisseria). The clinical presentation can be broad, ranging from asymptomatic states to severe acute heart failure requiring cardiac assist devices or heart transplantation. Myocarditis and peri-myocarditis can also induce life-threatening arrhythmias, chronic heart failure and dilated cardiomyopathy. In addition, pericarditis can progress to a pericarditis constrictiva. Both diseases may lead to sudden cardiac death (Htwe & Khardori, 2012).

Recommendations for return-to-play decisions in athletes with myocarditis/peri-myocarditis have been given by the 36th Bethesda Conference and the European Society of Cardiology (Maron & Zipes, 2005; Pelliccia et al., 2005). A re-convalescent period of about 6 months should follow the onset of clinical manifestation. Athletes may return to training and competition, when (1) they are asymptomatic; (2) the 12-lead ECG has normalised and relevant arrhythmias are absent on Holter monitoring; (3) laboratory markers of inflammation, myocardial necrosis and heart failure are normal and (4) cardiac function, wall motions and dimensions are normal at rest and during exercise.

Athletes with isolated pericarditis can return to training and competition when (1) they are asymptomatic; (2) the 12-lead ECG has normalised, and relevant arrhythmias are absent on Holter monitoring; (3) serum markers of inflammation, myocardial necrosis and heart failure are normal and (4) a normal cardiac function and no evidence of effusion by echocardiography are present (Maron & Zipes, 2005; Pelliccia et al., 2005). Close medical follow-ups should be performed in the first period, after having returned to training and play in intervals of 3–6 months (Maron & Zipes, 2005; Pelliccia et al., 2005). If myocarditis progresses to dilated cardiomyopathy or chronic pericardial disease results in constriction, athletes should be disqualified from all competitive sports (Maron & Zipes, 2005; Pelliccia et al., 2005).

**Non-medical factors**

The influence of public pressure and psychological factors especially in professional football players should also be taken into account by the sports or team physician when the player returns to competition. Perceived expectations from the media and supporters as well as from teammates may put pressure on football players to return to training and play prematurely. Additionally, although athletes may be doubtless healthy after an infectious disease, their transient reduced physical fitness after illness may not allow a performance at their best. Such reduced physical fitness leading to underperformance may also lead to a loss of self-confidence. Under special circumstances, therefore, it might be wise not to return to play too early to protect the athlete, and let him train until he has regained the necessary physical fitness and self-confidence for competition. Ideally, the decision to return to play should be made in agreement between the physician, player and the coach.

**Conclusion**

Return-to-play decisions after acute infectious diseases in football players warrant thorough monitoring of the disease course and it has to include a final medical check-up and, if possible, measurements of venous blood parameters of inflammation (especially in professional players). Furthermore, it should be taken into account if the player returns to training or to competition, because training allows a stepwise and more careful return to exercise whereas
competition might require higher and less controllable exercise intensities with negative side effects on health, performance over time and possibly self-confidence.

References


