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20:3; 49-56, 2005

Prevention and management of respiratory tract infections in athletes

By Ola Ronsen

ABSTRACT

Exercise-induced suppression of certain immune functions during strenuous training periods, increased exposure to foreign pathogens while travelling and sharing the same training and living facilities with a team may put athletes at increased risk of infections. To avoid disruption of crucial training and competition schedules, preventive measures are of foremost importance. However, when signs of respiratory tract infections (RTI) appear in individual athletes or among members of teams, fast and proper management becomes paramount in order to limit the disruption of training and performance capacity. The first section of this article provides a short review of clinical manifestations, diagnosis and proper management of both upper and lower respiratory tract infections. Mononucleosis among athletes is briefly discussed and some general guidelines for management of the return to regular training during the convalescence phase of this particular infection are given. This section is most pertinent to health professionals dealing with athletes with infections. The second section outlines guidelines with respect to the prevention of RTI, management strategies for athletes suffering from RTI and practical guidelines for a safe return to the normal training schedule and is aimed primarily at coaches and athletes.

AUTHOR

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Introduction

Athletes performing at high levels in their sports are most often members of a select group of people who are able to withstand the stress imposed by strenuous training and competition schedules without major illness or prolonged periods of fatigue (GLEESON, 2000; NIEMAN, 2000; RONSEN et al., 2001). Nevertheless several studies suggest that athletes are at increased risk of respiratory tract infections (RTI) (GLEESON, 2000; NIEMAN et al., 1989; NIEMAN et al., 1990; PETERS, 1997). Exercise-induced

suppression of certain immune functions during periods of strenuous training, increased exposure to foreign pathogens (microbes) while travelling and sharing the same training and living facilities with a team may contribute to this increased frequency or duration of RTI (GLEESON, 2000). Obviously, some sort of microbe (virus, bacteria, fungus, etc.) must be transmitted to the body at a certain point and have the ability to invade the respiratory tract for an RTI to occur. However, several environmental and physiological circumstances, such as heat and cold exposure, psychological stress, nutritional status and training load, are known to modulate the body's response to such pathogens and thus increase or decrease the course of the infection (PEDERSEN et al., 1994).

A recent survey among 74 Norwegian athletes participating in the 2002 Olympic Winter Games and the 2004 Olympic Summer Games showed that more than 90% of the athletes reported one or more infectious episodes during the previous year (data to be presented at ISEI Congress in 2005). Respiratory tract infections and gastroenteritis were the most common diseases reported and the duration of symptoms was mostly inside one week. However, since many suffered several infectious episodes through the year, the average number of lost training days was 15 per year. Frequent absence from vital training sessions is highly undesirable for both athletes and coaches and will most likely have a negative impact on the performance level during parts of the season. The study also showed that on average one important competition per year was lost due to illness. Finally, there was a large degree of variability in the frequency and duration of infectious diseases reported by the athletes, with some never being sick while others missed more than 30 days per year of scheduled training due to illness. This, of course, highlights the need for preventive measures among the most illness susceptible athletes.

Prevention is always preferable and superior to treatment, even the best sports medicine based treatment. Therefore, all means and methods to avoid unnecessary and unprotected exposure to microbes should be practiced in athletic settings in order to avoid loss of training and competitions due to episodes of infection (RONSEN, 2003). Consequently, athletes and coaches need to be educated and guided with regard to important preventive measures for avoiding infectious diseases.

However, all contact with unknown sources of microbes is unavoidable in the normal life style of an athlete. This makes the correct management of infectious illnesses of paramount importance in order to limit the negative consequences of the infection. Management of RTI from a physician's standpoint should always be based on a thorough medical history, an evaluation of clinical signs and symptoms,

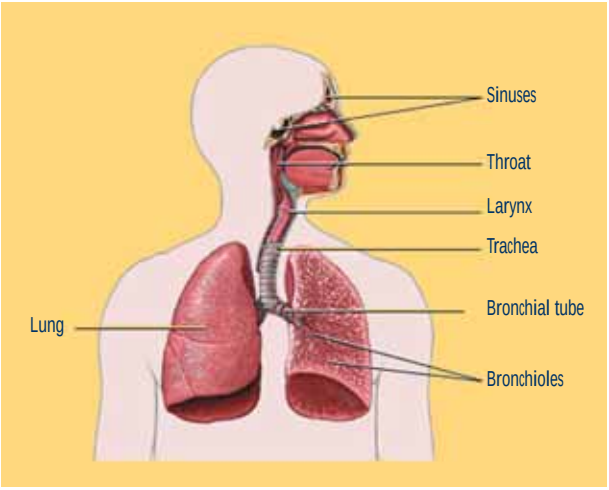

Figure 1: Location of upper and lower respiratory tract infections

a skilled physical examination and a specific microbial diagnosis.

The first section in this article outlines the basics in detection and management of RTI and is aimed at the medical personnel dealing with athletes. This part contains mostly text-book and review article material and thus is not specifically referenced (DASARAJU AND LUI, 1996, GLEESON et al., 2004, NIEMAN, 1998, NIEMAN, 2000, WEIDNER, 1994).

The second section outlines practical guidelines with respect to the management and prevention of RTI and is aimed primarily at coaches and athletes. The information here is based on a mixture of personal clinical experience from 12 years of providing medical care to Olympic athletes as well as well established knowledge in the field of infectious medicine.

Physician-based management of RTI

Upper respiratory infections: common cold, otitis, sinusitis, pharyngitis, epiglottitis and laryngotracheitis

Etiology and pathogenesis: Most upper respiratory infections are caused by viruses. In some cases, bacteria like *Haemophilus Influenzae* Type B and *Streptococcus Pyogenes* may be the primary cause of infection (sinusitis, tonsillitis, epiglottitis and laryngotracheitis/croup). An episode of viral infection may also progress into a bacterial infection in certain locations of the respiratory system. The micro-organisms enter the respiratory tract by inhalation of droplets and invade the mucosa, resulting in epithelial destruction with redness, edema and exudate.

Clinical manifestations and diagnosis: Initial symptoms of a common cold are runny, congested nose, sneezing, and/or a sore throat. Fever and a general feeling of malaise may or may not accompany these initial symptoms. Common colds typically have mild to moderate symptoms with a duration of approximately 4-7 days. Sinusitis is usually characterised by pressure pain in the forehead or maxillary bone(s) in addition to the symptoms mentioned above. Infections in the middle ear (otitis media) usually present with pressure-pain in/around the ear(s) in addition to fever and stuffy nose and are mostly seen in children. Bacterial pharyngitis/tonsillitis most often starts with high fever, glandular hypertrophy and a painfull throat. Upon inspection the tonsils are enlarged, inflamed and often covered with purulent secretion. Epiglottitis and laryngotracheitis (croup) may also cause difficulties with breathing, but are most common in children. Different strains of influenza virus appear during seasonal epidemics and are usually diagnosed on the basis of clinical manifestations such as high fever, severe feeling of malaise, myalgia and headache.

Bacterial and viral cultures of throat swab specimens or nasal discharge are used for diagnosing pharyngitis, sinusitis, epiglottitis and laryngotracheitis. Specific quick-tests (Enzyme-linked immunoassay methods) for diagnosing infections by *Streptococcus* Type A are commercially available. A rise in the C-reactive protein (CRP) to values between 10-50 mg/L may indicate a viral infection, while bacterial infections most often result in CRP values above 50 mg/L. However, these are general guidelines and must be evaluated along with clinical manifestations of an infection. Blood cultures or serological antibody titres may be helpful in obtaining a microbiological diagnosis in cases of severe or longstanding infections. A CT or MRI scan of the paranasal/cranial sinuses may be helpful in the diagnosis of recurrent or chronic sinusitis.

It is wise to remember that several of the clinical manifestations that are characteristic of bacterial tonsillitis and pharyngitis are similar to the onset of mononucleosis,

Table 1: Guidelines for return to exercise after mononucleosis

1. Before starting light exercise (brisk walking, easy cycling, light resistance training etc), have 5-7 days without febrile episodes and lethargy or other systemic symptoms.
2. Ensure a substantial decrease in EB antibody titre and liver enzymes (ALAT, ASAT).
3. Limit the exercise sessions to 20-30 minutes with a low intensity (pulse rate < 120 bpm) every other day for the first week.
4. Avoid exercise modes that may cause increased pressure or pounding to the abdomen
5. Observe the tolerance to each exercise session and during the recovery day thereafter.
6. Discontinue the exercise if relapse or worsening of earlier symptoms.
7. Consult with your physician before commencing exercise again.
8. If acceptable tolerance to first week of exercise, continue the next week with 30-45 minute sessions with a moderate intensity (pulse rate < 140 bpm) every other day.
9. Have a physician perform a clinical exam and lab assessment before progressing towards further normalisation of the training schedule.
10. Exclude the possibility of hepatosplenomegalia (enlarged liver and spleen) in those athletes returning to contact sport by an ultrasound or CT scan of the upper abdomen.
11. Always respect signs and symptoms of relapse and/or intolerance to progressing exercise load and consult with a physician about continuing exercise or not.

an infection caused by the Epstein Bar virus. However, mononucleosis is a systemic infection that affects lymphatic glands in most of the body, the liver and spleen, and often causes prolonged high fever, lethargy, swelling of the lymphatic nodes and organs, in addition to the symptoms of throat infection. When it coincides with a bacterial tonsillitis/pharyngitis, proper antibacterial therapy should be administered even though antibiotics do not affect the EB viral infection. If strenuous physical exercise is performed during the initial or convalescence phase of mononucleosis, this may lead to increased morbidity (worsening of the clinical manifestations) and/or relapse with a more prolonged recovery period (SEVIER, 1994). Therefore, it is essential to recognise this infection at an early stage with specific Enzyme-linked immunoassay tests and/or serologic detections of specific antigens and/or antibodies to the Epstein Bar virus. The clinical manifestation of mononucleosis may be mild in childhood and thus not specifically recognised and diagnosed. However, when it appears in adolescents or adults, the symptoms are usually much more severe and long standing with higher risks of relapses during the convalescence period.

With respect to a return to exercise and sports participation, it is important that the physician and the athlete use an individual approach based on the improvement of symptoms, clinical sign and lab results (DOMMERBY et al., 1986, SEVIER, 1994). However, some general guidelines may be helpful to the physician and athlete in this process. These are summarised in Table 1.

Treatment: Common viral infections of the upper respiratory tract are treated symptomatically and include such measures as nasal washings with sodium cloride, nasal decongestions (beware of possible banned substances for athletes), non-steroidal anti-inflammatory drugs, paracetamol, acetaminophen, or other analgesics. The main strategy is to facilitate drainage of excessive exudate from the mucosa of the upper airways and prevent stagnation of infected exudate in sinuses, nasopharynx and ear. A purulent sinusitis will in most cases be successfully treated with a beta-

lactamase resistant antibiotic such as amoxicillin or a cephalosporin for 10-14 days. Pharyngitis/ tonsillitis with *beta-hemolytic streptococci* should be treated with Penicillin G for the same number of days. Other bacterial infections should be treated with proper antibiotics, in accordance with the results of a good clinical evaluation and microbiological diagnosis. Epiglottitis and laryngotracheitis (croup) that results in major breathing problems (stridor and cyanosis) must be treated immediately with proper medication facilitating airway expansion, preferably in hospitals. Epiglottitis caused by *Hemophilus influenzae* bacteria needs to be treated with antibiotics. Surgical treatment should be considered in cases of recurrent bacterial tonsillitis and chronic sinusitis.

Vaccine against *Haemophilus influenzae* Type B infections and specific seasonal influenza viruses are commercially available. The influenza vaccine is altered annually according to the change in seasonal epidemics around the world, and thus needs to be taken each year to acquire specific immunisation. The need for such vaccines is questionable for healthy people but may be considered in athletes prone to recurrent or prolonged infections during a season with multiple competitions.

Lower Respiratory Infections: bronchitis, bronchiolitis and pneumonia

Etiology and pathogenesis Lower respiratory infections may be viral or bacterial. Viruses cause most cases of bronchitis and bronchiolitis. In community-acquired pneumonias, the most common bacterial agent is *Streptococcus pneumoniae*. Atypical pneumonias are cause by such agents as *Mycoplasma pneumoniae*, *Chlamydia pneumoniae* and viruses. Organisms enter the distal airway by inhalation, aspiration of gastric content or by hematogenous seeding. The pathogen multiplies in or on the epithelium, causing inflammation, increased mucus secretion and impaired mucociliary function, which may lead to airway obstruction.

Clinical manifestations and diagnosis: Lower respiratory infections are usually characterised by cough, sputum production, shortness of breath and/or tachypnea, fever, generalised malaise, and/or chest pain. Patients with pneumonia and bronchopneumonia may also exhibit non-respiratory symptoms such as, headache, myalgia, nausea and abdominal pain.

Auscultation of the lungs often reveals a characteristic crepitating sound or reduced ventilation in localised (lobar pneumonia) or

Table 2: Guidelines for prevention of infections among athletes

1. Make sure that you are up to date with all vaccines needed at home and for travels.
2. Minimise contacts with infected/sick people, animals and contagious objects.
3. Keep your distance from people who are coughing, sneezing or have a “runny nose”.
4. Wash hands regularly, before meals, and after direct contact with potentially contagious people, animals, blood, secretions, public places, bathrooms, etc.
5. Use disposable paper towels and limit hand to mouth/ nose contact when suffering from RTI symptoms.
6. Quickly isolate a team member with RTI symptoms and move his/her roommate to other accommodation.
7. Check air condition/ventilation systems for potential contagious material.
8. Do not use other people’s drinking bottles, cups, cutlery, etc.
9. Wear proper outdoor clothing and avoid getting cold and wet after exercise.
10. Protect upper and lower airways from being directly exposed to cold and dry air during strenuous exercise, by using facial mask etc. at temperatures below -15°C.
11. Practice good recovery routines, including proper nutrition and rehydration.

Table 3: Guidelines for exercise during episodes of RTI in athletes

First day of illness

- Cease strenuous exercise or competitions when experiencing RTI symptoms such as:
  - Sore throat or coughing
  - Runny or congested nose
- Cease all exercise when experiencing additional RTI symptoms such as:
  - Muscle/joint pain and headache
  - Fever and generalised feeling of malaise
- Drink plenty of fluids, keep from getting wet and cold, and minimise life-stress
- Consider use of topical therapy with nasal drainage, decongestants and analgesics if fever
- Report illness to a team physician or health care personnel and keep away from other athletes if you are part of a team training or travelling together

Second day

- If you have a fever (temp >37.5-38°C) or increased coughing: No training !!
- If no fever or malaise and no worsening of "above the collar"-symptoms: Light exercise (pulse < 120bpm) for 30-45 minutes by yourself (indoors during winter)

Third day

- If fever and RTI symptoms persist: Consult your (team) physician by phone or at office
- If no fever or malaise and no worsening of initial symptoms: Moderate exercise (pulse < 150bpm) for 45-60 min, preferably by yourself and indoors

Forth day

- If no symptom relief: Do not try to exercise but make an office visit to your doctor
- If first day of improved condition: Follow the guidelines of "return to exercise" in Table 4

more generalised (bronchopneumonia) areas. A two-way chest X-ray may be helpful in differentiating between pneumonia, bronchopneumonia and other causes of persistent cough and lower airway symptoms. A differential count of white blood cells and measurement of CRP may be helpful in the initial assessment of respiratory infections. However, a specific microbial diagnosis requires a specimen from sputum or nasal discharge to be cultured for bacteria, fungi and viruses. Blood cultures and/or serologic detections of antigens and antibodies can also be used to identify several micro-organisms. Enzyme-linked immunoassay methods and detection of nucleotide fragments specific for the microbial antigen in question by DNA probe or polymerase chain reaction can offer a rapid diagnosis.

Treatment: Symptomatic treatment is used for most viral infections of the lower respiratory tract. Cough reducing medications should for the most part be restricted to conditions of dry, non-productive coughing, and athletes must be careful not to use medications with banned substances. The inflammatory reaction during an acute episode of bronchitis may lead to temporary constriction of the bronchial airways and ventilatory obstruction (asthma). Such conditions need to be properly diagnosed and treated with bronchio-dilatory medications and inhalation steroids. Bacterial bronchitis and pneumonias

Table 4: Guidelines for return to exercise after respiratory tract infections

1. Make sure that you have one day without fever and with improvement of RTI symptoms before returning to exercise.
2. Observe the body's reaction to your first exercise session before starting on a new session.
3. Stop physical exercise and consult you physician if:
- New episode with fever or worsening of initial symptoms
- Persistent coughing and exercise-induced breathing problem
4. Use the same number of days to step up to normal training as spent off regular training because of illness.
5. Observe closely your tolerance to increased exercise intensity and take an extra day off if you do not recovering satisfactorily.
6. Use proper outdoor clothing and specific cold air protection for airways when exercising in temperature below –10°C the first week after RTI.

are treated with antibiotics, according to the identification of a specific micro-organism and its sensitivity/resistance pattern to selected antibiotics.

Athlete-based prevention and management of RTI

There is no single method or measure that completely eliminates the risk of contracting a RTI, but there are several effective ways of reducing the number of infectious episodes incurred over a period. Some of these measures are scientifically founded while others are supported mostly by clinical and personal experience. In essence, it is all about avoiding transmission of microbes from one person to another! It is important to underline that virus and bacteria causing RTI may be both *received* by and *passed on* from the same individual. This means that one should pay as much attention to preventing transmission of potentially contagious material *from oneself to others* as the opposite way, *from others to oneself*. Therefore, the "golden rule" of practising the same standard of hygiene when you are in contact with others as you expect others to practice towards you, should be the general objective of RTI prevention. A list of the most common preventive measures and practical guidelines against RTI infections, but also against any contagious disease, is given in Table 2.

Even if one meticulously practises all the important preventive measures that athletes, coaches and medical support staff can put up against respiratory tract infections, it is everybody's experience that RTI, nevertheless, takes its toll, both on individual athletes and in teams. Therefore, it is crucial that all episodes of RTI, including the initial symptomatic phase are well managed and that the spread of microbes between members of a team or family is limited. For athletes on a training schedule, the obvious question when initial symptoms of RTI appears is about continuing, decreasing or stopping their regular exercise.

The athletes themselves must make the first assessment on these matters and then consult with a physician to make clinically based decision. Nevertheless, some general "rules of thumb" may be offered to guide the athlete and his support team to make the best choices on *if* and *how* exercise should be continued through an infectious episode. The guidelines are summarised in Table 3. In a similar fashion, and with the same constraint of not substituting these guidelines for physician based individual advice, further strategies for safe and healthy return to a regular training schedule are given in Table 4. It must be emphasised that the author cannot be responsible for the individual medical outcome of adhering to these guidelines.

Summary

Although regular exercise seems to have a stimulatory effect on the immune system and thus may decrease the risk of respiratory tract infections, both personal experience as well as some scientific evidence support the contention that athletes may be at increased risk of RTI during periods of intense training and competition. Several factors may explain this phenomenon, including training-induced immune suppression, increased exposure to foreign microbes while travelling, as well as sharing of training and living facilities, which increase the exposure as well as the transmission of pathogens. Most of the common microbes that cause RTI are relatively harmless for healthy people with the possible exception of the Epstein Bar virus, which causes mononucleosis. Nevertheless, if extreme environmental factors, stress and strenuous training schedules are imposed on a person who has contracted a respiratory infection it may result in significant aggravation and protraction of the symptoms and physiological disturbances in the body. Thus, immediate diagnostic assessment and patient management is imperative to reduce the negative consequences on the health as well as on the performance level of the athlete. However, the most effective way of fighting respiratory tract infection for an athlete may be to apply common-sense preventive measures against transmission of contagious material in his/her environment and life style.

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