Infectious Diseases in Sports Medicine

The Sports Medicine Core Curriculum Lecture Series
Sponsored by an ACEP Section Grant
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Infectious Disease and the Athlete

Background

Immunity

Types of infection associated with athletics

Immunizations
Background

Type and intensity of exercise varies greatly
Moderate exercise to high level competitive athletes
Moderate/brief exercise to intense/prolonged exercise
Individual (contact vs. non-contact) vs.
  team (contact vs. non-contact)
Immunity

How does training affect immunity?

Does training decrease or increase the risk of infection or have no affect?
Acute Changes on Immune Response


Calabrese LH. Nieman DC. Adopted from Figure 1 Exercise, immunity, and infection. JAOA. 96(3):166-76, 1996 Mar.
Open Window for Infection

Niemen DC. Figure 2 Current perspective on exercise immunology. Current Sports Medicine Reports 2003;2(5):239-42
Theory of Training and Infection Risk

Tissue injury causes stimulation of the immune system.

Moderate/strenuous exercise with rest allows for rebuilding of tissue and does not over stress the immune system.
Theory of Training and Infection Risk

Moderate training decreases risk of infection
Intense training increases risk of infection
“Open window period” of infection vulnerability @ 3-72 hours
Over-training or excessive exercise may chronically alter immune function
Clinical/Epidemiologic Studies

Epidemiologic studies
  Elevated URTI risk in heavy training and 1-2 weeks following competitive endurance races
Small randomized exercise training studies
  Moderate daily exercise reduces risk of URTI
Tough to control for confounders
  sleep, diet, travel, other variables

Calabrese LH et al. JAOA 1996;96:166-76
Niemen DC. Immunology and Cell Biology 2000;78:496-501
Guidelines for the Athlete

- Keep other stresses to a minimum
- Well balanced diet
- Avoid over-training and chronic fatigue
- Adequate sleep
- Avoid rapid weight loss
- Keep hands away from eyes and nose
- Avoid sick contacts before important events
Types of Infections

Blood borne pathogens
Respiratory illness
Other viral illnesses
Skin and soft tissue infections
Issues with Blood Borne Pathogens

High risk behavior
  - Appear more common in the athlete
Transmission during athletic event
Needle use with anabolic steroids
Risk of Transmission

Needle stick

HBV 30%
HCV 3%
HIV 0.3%

NFL HIV transmission study

Approximately in 1:80 million games
One case per 4000 years

MMWR 2001 / 50(RR11);1-42
Reported Transmission

Outbreak of Hepatitis B in athletics
High school sumo wrestling-bleeding reported: 5/10 infected
Japanese football team- 11/65 members infected
Case of HIV transmission
Soccer players with head lacerations
Infected individual also worked in drug rehab
Case of HCV transmission from fist fight
(implications for boxing)

Kashiwagi S et al. JAMA 1982;248
Arch Intern Med 2000 Sep 11;160(16):2541-5
Torre D et al. Lancet 1990;335:1105
General Principles

NCAA guidelines 1992 in event of bleeding
“…leave the field of play…be given appropriate medical treatment…should not return to the game…without approval of medical personnel.”

If blood on uniform, needs to be disinfected or uniform changed.

Any bleeding needs to be controlled and lacerations covered.
General Principles

No harm to clinically well HIV patients to participate in strenuous, high level athletics

Standard precautions

Hepatitis B vaccination
Hepatitis B:

Acute infection: remove while symptomatic (fatigue, fever)
Acute infection: remove from close contact play while HBAg+ (marker of infectivity), persists up to 20 weeks

Chronic HBV infection:

- HBeAg+ remove indefinitely
“If a student athlete develops acute HBV illness, it is prudent to consider removal of the individual from combative, sustained close-contact sports (e.g., wrestling) until loss of infectivity is known. (The best marker for infectivity is the HBV antigen, which may persist up to 20 weeks in the acute stage.) Student athletes in such sports who develop chronic HBV infections (especially those who are e-antigen positive) should probably be removed from competition indefinitely, due to the small but realistic risk of transmitting HBV to other student-athletes.”
HIV transmission thru wounds in sports

Per CDC ~ 14 % all new cases HIV in 12-24 yo
No validated cases of transmission in athletics
Greg Louganis story
NCAA: “no recommended restriction of student-athletes merely because they are infected with HIV, although one court has upheld the exclusion of an HIV positive athlete from the contact sport of karate.”
Risk for tx of HIV = <1/ 85 million game contacts per player
HIV prevalence 1/200 college men
rate of percutaneous transmission in health care 1/300
risk for laceration in opponent (0.41/45 players per game)
risk for any bleeding injury per game per player (3.46/45)

Extrapolation: single HIV tx during NFL season=0.017,
1/58 seasons
Relative Risk

HIV transmission in NFL 1992:
1/85 million game contacts

HIV transmission woman to man sexual intercourse: 26/10,000

Death by air travel: 1/1.6 million flights
HIV and Boxing

2 reports of transmission HIV during bloody fistfights

*JAMA 1994: 272:433-4*  
*Lancet 1992: 339:246*
AIDS Policy

Pennsylvania: (Mandatory) HIV testing of all professional boxers and kickboxers within 60 days of licensure

Colorado: HIV+ students barred from school sports: Poudre School District
(Body Posit 1999: 12(3):41)
AMSSM/AOSSM
Joint Position Statement on
HIV and Other Blood Borne Pathogens in Sports

HIV infection alone is insufficient grounds to prohibit
athletic competition
No rational basis for supporting mandatory blood borne
pathogen testing
Confidentiality
The physician is not liable for failure to warn the uninfecte
Physician is not liable for failure to warn the uninfected opponent (legal responsibility lies with the HIV+ athlete)

Uninfected athlete assumes some of the risk
Americans with Disabilities Act
42 U.S.C. Section 12101 et seq. July 26, 1990

Prohibits discrimination in public accommodations
Requires reasonable accommodations
Requires integration/inclusion
Requires adaptations to make accessible
Covers public and private sector
ADA and HIV

U.S. Supreme Court:
Upheld HIV+ is ‘handicapped’ and entitled to protection from unlawful discrimination

Caveat: “a place of public accommodation is entitled to exclude a disabled individual from participating in its program where the individual poses a direct threat to the health and safety of others”; threat must be real, based on unbiased information, attempts made to eliminate risk
Excluding HIV+ students from sports

1999 Poudre School District, Colorado
Policy statement
- requires physical exam
- requires parents, doctors, and school officials to be involved in participation decisions in those with “serious communicable diseases”
- names HIV and AIDS in its language
ACLU: discrimination under ADA
AIDS Case Law

4th U.S. Circuit Court of Appeals: HIV+ 12 yo boy can be barred from group karate lessons
(Montalvo v Radcliffe, AIDS Policy Law 1999: 14(4):1,8)

did not violate Title III of ADA, referred to criteria regarding risk: nature, duration, severity, and probability of transmission (fatal, no known cure)

risk of transmission cannot be eliminated by reasonable accommodation (combat style martial arts incurs injuries)

need to protect public health outweighed case of discrimination based on disability
Viral Respiratory Illnesses

Viral respiratory illnesses
more disability to athletes than all other diseases combined

Enteroviral infections
Subclinical myocarditis
Exercise leading to arrhythmic death

? Increased severity with exhaustive exercise
? Reduced performance

Daniels WL. Mil Med 1985;150:8-14
Infectious Mononucleosis

One of most common infections during peak sports activity

90% infected by age 30

Symptoms last 3 weeks, lethargy can persist
# Symptoms/findings of Mono

## Common
- LAN: 94%
- Pharyngitis: 84%
- Malaise: 82%
- Fever: 76%
- Splenomegaly: 52%
- Atypical Lymph: 90%
- Transaminitis: 90%
- Heterophile positive: 85-90%
- Lymphocytosis: 70%

## Uncommon
- Myalgia: 20%
- Hepatomegaly: 12%
- Rash: 10%
- Jaundice: 9%
- Arthralgia: 2%

Complications

Serious complication in up to 5%

Most common

Group A beta hemolytic strep (7-30%)
Upper-airway obstruction (0.1-1%)

**Splenic rupture (0.1-0.2%)**

- Reported in 0.1-0.5 % of those with EBV mono
- More than half spontaneous
- Usually occurs 2-21 days from onset of symptoms
- Rarely up to 7 weeks

Rash after amox/amp exposure

Asgari MM et al. Yale J Biol Med 1997;70:175-82
Splenic Rupture in IM: A Sports Medicine Dilemma

Period of greatest risk in days 4-21
Risk is associated with spleen enlargement
In many splenic ruptures spleen was not palpable and palpable spleen is normal in 3% of the population
Many splenic ruptures are spontaneous
Spleen rupture past 28 days is rare
Splenic rupture can sometimes be the presenting sx of IM

Splenic Rupture in IM: A Sports Medicine Dilemma

Spleen size not correlated with:
- Clinical history
- Clinical exam
- Symptoms
- Duration of illness
- Measured u/s spleen size
- Liver enzyme elevation

….no studies exist that can safely predict risk!

Top Myths in Sports Medicine

If the spleen is not enlarged in mononucleosis it should be safe to participate in contact sports…
Mononucleosis in Athletes

Return To Play 21-30 d

*Hosey et al.* Ultrasound assessment of spleen size in collegiate athletes. Figure 2. *BJSM 2006;40:251-254*

Baseline spleen size varies


Acute IM develop some degree of spleen enlargement

Acute IM infection resolves within 4-6 weeks
Splenic Rupture in IM: A Sports Medicine Dilemma

Radiographic evaluation
U/S, CT, MRI, plain film, radioisotope
Spleen variable shape and size
Can vary with size and weight
U/S most commonly used secondary to being easy to perform and amenable to repeat exam
Without baseline exam difficult to determine “normal” size, follow back to normal

Return to Play Decisions in IM

Based mainly on risk of spleen rupture
Decision individualized
No hard evidence, based more on understanding of the disease

General guidelines:
- No strenuous activity for minimum 21 days
- Limited noncontact aerobic activity at 3 weeks after symptom onset if no fever, hydrated, asymptomatic and no splenomegaly
- Full clearance at 4 weeks if continuing to do well

Keep in mind it may take 3 months for athlete to return to pre-illness fitness
Return to Play Decisions in IM

When to image the spleen?
- If pushing the envelope and trying to RTP early
- Equivocal exam at 4 weeks
- High risk for abdominal trauma
- If have baseline spleen measurements
Norovirus Infection

“Winter vomiting illness”
Brief, self limited: fever, vomiting, diarrhea
Airborne transmission as well on contact

Players with acute gastroenteritis should be excluded from competition
Skin and Soft Tissue Infections

- Herpes simplex virus
- Fungal
- Streptococcal soft tissue infections
- Staphylococcal soft tissue infections
  - Community acquired (associated) MRSA
Herpes simplex virus

*Herpes gladiatorum* (wrestlers), *rugbeiorum* (rugby) “scrum pox.”
Numerous outbreaks described
Highest risk of transmission when active lesions
Lesions in wrestlers most commonly on (R) side of face and body (grappling positions)
Most tournaments require dermatologic clearance

Goodman RA et al. JAMA 1994;271:862-7
Sevier TL. Med Clin N Amer 1994;78:389-412
Herpes Gladiatorum Outbreaks - Minnesota


1999 Minnesota high school outbreak 19 teams over 42 d with 64 cases, transmission rate 32%
Exposure to vesicles average 4-11d
Misdiagnosed as folliculitis
Lesions resolve 10-14d

2001 Minnesota summer camp 17% incidence during outbreak - all were not on prophylaxis

72% of outbreaks on face, neck, head
Correlate with handedness: 86% RH -> 74% Right HG
96% Ventral surface
Prophylactic valacyclovir
28 d wrestling camp
Reduced clinical HG by 87% compared to prior years
Seronegative individuals remained seronegative
NCAA Guidelines on RTP
Wrestling Rules Book 2007: HG

Primary HG/Herpes simplex:
Withdrawal if systemic signs/symptoms
(fever, malaise, sore throat, lymphadenopathy, conjunctivitis)
or skin lesions, including herpes labialis

No new blisters <72 hours old
No moist lesions- All lesions dried with crust
On antivirals >120 hours
Questionable lesions must have Tzanck smear/culture/HSV antigen
Active lesions shall not be covered to allow participation
NCAA Guidelines on RTP
Wrestling Rules Book 2007: HG

Secondary HG:
Blisters must be completely dry and crusted
Appropriate dosage of systemic antiviral > 120 hours at the time of the meet or tournament.
Active herpetic infections shall not be covered to allow participation.

Questionable Cases
1. Tzanck prep and/or HSV antigen assay (if available).
2. Wrestler’s status deferred until Tzanck prep and/or HSV assay results complete.

Recurrent herpes labialis or herpes gladiatorum should be considered for season-long prophylaxis with acyclovir or Valtrex.
Superbug Scare: Virginia District's Schools Scrubbed; Teen Not First to Succumb to Deadly Infection
Wednesday, October 17, 2007

Fox News Online

Bacteria that killed Virginia teen found in other schools

†17-year-old student died of drug-resistant strain of bacteria on Monday
†Methicillin-resistant Staphylococcus aureus, MRSA, blamed for his death
†MRSA cases also reported in Connecticut, Maryland, Ohio, Michigan
†MRSA killed more people than HIV/AIDS in 2005, new study finds
†CNN Online, October 18, 2007
### Invasive MRSA, July 2004-December 2005

<table>
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<th></th>
<th>Community Associated</th>
<th>Health Care-Associated</th>
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<tr>
<td></td>
<td>n=1226</td>
<td>n=5191</td>
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<tr>
<td>Bacteremia</td>
<td>65.1 %</td>
<td>77.4 %</td>
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<tr>
<td>Pneumonia</td>
<td>14.0 %</td>
<td>11.9 %</td>
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<tr>
<td>Cellulitis</td>
<td>22.7 %</td>
<td>8.8 %</td>
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<tr>
<td>Osteomyelitis</td>
<td>8.1 %</td>
<td>8.0 %</td>
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<tr>
<td>Endocarditis</td>
<td>12.6 %</td>
<td>6.6 %</td>
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<tr>
<td>Septic Shock</td>
<td>3.8 %</td>
<td>4.5 %</td>
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<tr>
<td>Overall rate</td>
<td>4.6/100,000</td>
<td>17.6/100,000</td>
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<tr>
<td>Crude death rate</td>
<td>0.5/100,000</td>
<td>3.2/100,000</td>
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Estimated total cases-94,360
Estimated number of deaths-18,650

Limitations
1. Previous estimates based upon bacteremias only
2. Underestimation of amount of health care associated
3. Urban setting
4. Crude in-hospital deaths

Klevens et al, JAMA 2007;298:1763-71
Community-acquired MRSA

20-70 % of community-acquired S. aureus
Soft tissue, necrotizing fasciitis, pneumonia
SCCmec type IV
Panton-Valentine leukocidin
    Leukocyte killing toxin
Outbreaks in football, wrestling, rugby, fencing

MMWR 2003;52:793-5
Community-acquired MRSA in Contact Sports

More common on extremities
Mimic spider bites
Often starts at site of abrasion from turf, razor, contact
Associated with BMI, position on field, sharing bar soap
cMRSA in Athletic Teams

**Identifiable risks:**
Turf burns/abrasions
Shaving: 7X
Chafing
Sharing of towels and equipment
Prolonged physical contact
Sharing bar soap: 15X
Previous antibiotic usage
Not showering before communal tubs/equipment
Management of CA-MRSA

Drain abscesses
Work hard to culture

Often susceptible to clindamycin, trimethoprim/sulfamethoxazole, second generation tetracyclines

Severe infections - vancomycin
linezolid, daptomycin and tigecycline are more expensive
Immunizations

MMR
TdaP
Varicella
Hepatitis B
Hepatitis A
Influenza
Meningococcal
General Prevention Measures

Good hygiene
Prompt recognition and management of infectious diseases
Vaccinations
Prevention of blood exposure
Education and training of officials, coaches, trainers and athletes

Mast EE et al. Sports Med 1997;24:1-7
Basic Hygiene

No sharing of common source drinking
No sharing of towels, pads, razors, other equipment
No sharing of ointment/powders from common containers
Shower with soap (dispenser) after practice/competition
Athletic clothing laundered after each use

Mast EE et al. Sports Med 1997;24:1-7
NCAA Restrictions

Antibacterials 72 hours

Bacterial skin infections

† impetigo
† erysipelas
† carbuncle
† staphylococcal disease
† folliculitis (generalized)
† hidradenitis suppurativa
NCAA Restrictions

Antivirals 120 hours

- herpes simplex
- herpes zoster (chicken pox)
- molluscum contagiosum
NCAA Restrictions

Antifungals 72 hours

Scalp 2 weeks oral tx

- tinea corporis (ringworm)
- tinea versicolor
NCAA Restrictions

Parasitic skin infections
pediculosis
scabies
Take Home Points

Athletes with contagious skin infections (MRSA, HSV, fungal) may need to be restricted from participation.
Be aware of NCAA guidelines.
Be aware of legal issues relating to blood-borne infections and sports.
Restrict exercise for about one month after a new case of infectious mononucleosis.