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

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Background

Type and intensity of exercise varies greatly

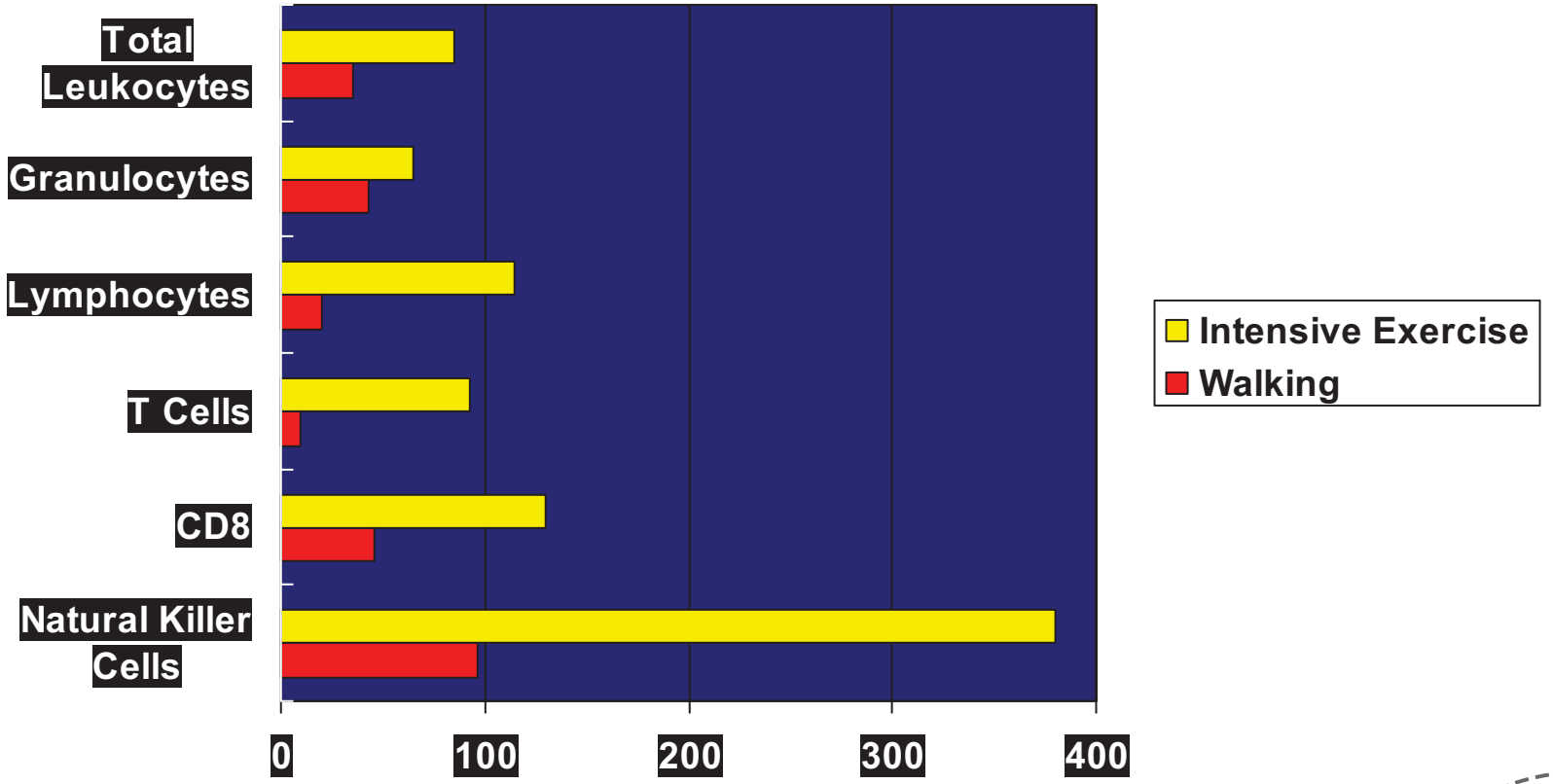
- Moderate exercise to high level competitive athletes
- Moderate/brief exercise to intense/prolonged exercise
- Individual (contact vs. non-contact) vs.
  - team (contact vs. non-contact)

Immunity

How does training affect immunity?

Does training decrease or increase the risk of infection or have no affect?

Acute Changes on Immune Response



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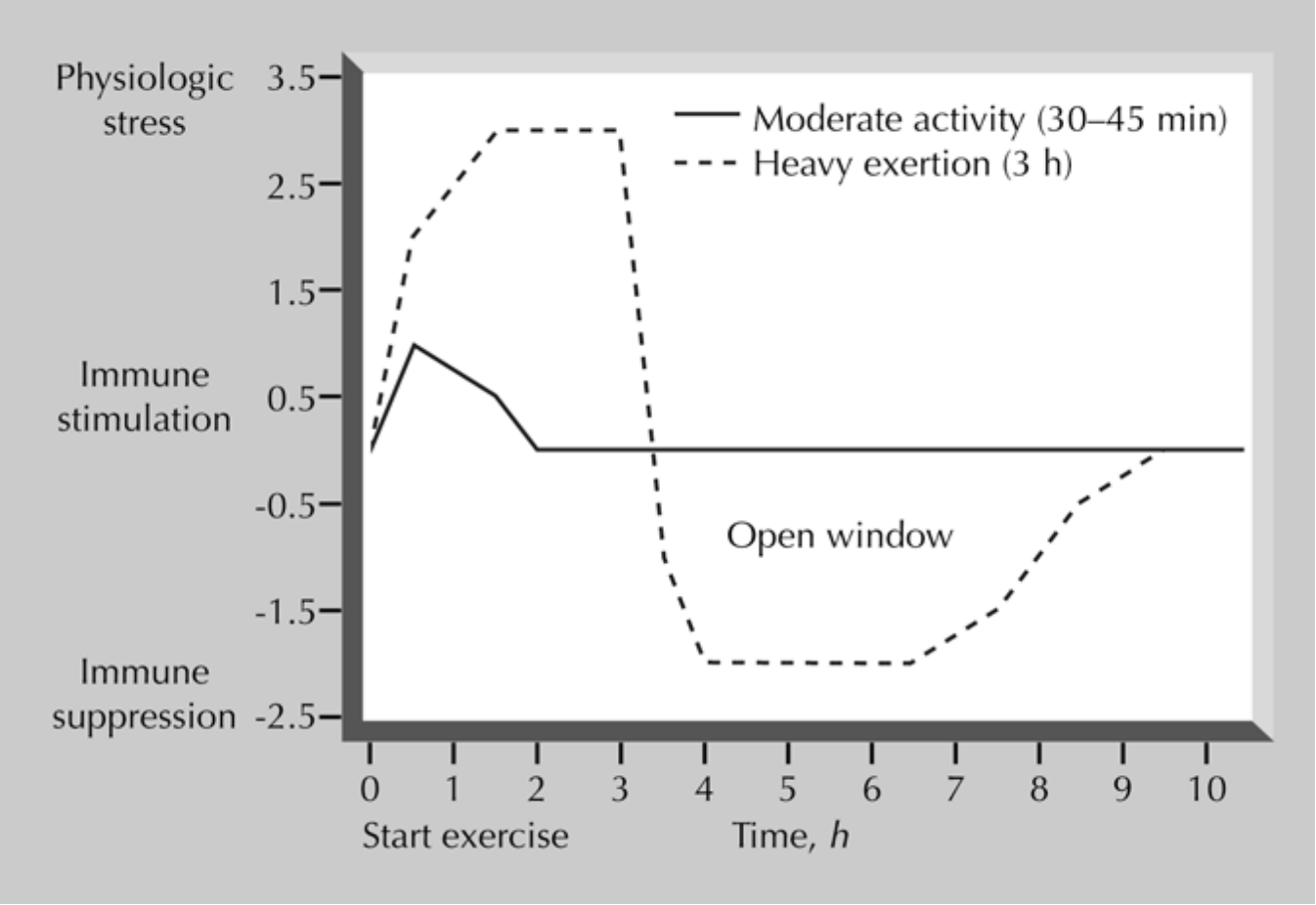
Calabrese LH. Nieman DC. Adopted from Figure 1 Exercise, immunity, and infection. JAOA. 96(3):166-76, 1996 Mar.

Open Window for Infection



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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

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Calabrese LH et al. JAOA 1996;96:166-76
Niemen DC. Immunology and Cell Biology 2000;78:496-501
Niemen DC. Current Sports Medicine Reports 2003;2:239-42

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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

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MMWR 2001 / 50(RR11);1-42

Brown LS et al. Ann Intern Med 1995;122:271-4

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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
Gastroenterology 2000 Aug;119(2):507-11

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

NCAA Committee of Competitive Safeguards and Medical Aspects of Sports: Blood borne pathogens and intercollegiate athletics

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

NCAA Wrestling Rules Book 2007: Hepatitis B

"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.”

Bleeding Injuries in Professional Football: Estimating the Risk for HIV Transmission. Annal Int Med 1995: 122(4): 271-74.

Risk for tx of HIV= <1/ 85 million game contacts per player

HIV prevalence 1/200 college men

x rate of percutaneous transmission in health care 1/300

x risk for laceration in opponent (0.41/45 players per game)

x 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

(AIDS Policy Law 1998: 13(2):12)

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 uninfected opponent/coaches/trainers

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World Health Organization:
International Federation of Sports Medicine:
Consensus Statement on AIDS in Sports 1997

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 lessions

(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

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Roberts JA. Sports Med 1986;3:296
Daniels WL. Mil Med 1985;150:8-14

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Infectious Mononucleosis

National Hockey League playoffs

Avalanche lose Forsberg

Star center has surgery to remove spleen

By Vicki Michaelis
USA TODAY

DENVER — Colorado Avalanche player Dave Reid was taking his garbage out Thursday when a neighbor, who had been listening to sports radio during her morning jog, gave him the news.

The Avalanche will begin their Western Conference final series this weekend against the St. Louis Blues without star center Peter Forsberg.

Forsberg is out for the rest of the playoffs after surgery in the wee hours Thursday to remove his ruptured spleen.

"Obviously it's a big blow to our club," defenseman Ray Bourque said at team headquarters Thursday afternoon. "But at this point in time, in this situation, you just think about his well-being."

Forsberg, 27, is expected to recover fully and likely will return to playing hockey next season, team doctor David Mellman said, adding that "you certainly can function perfectly fine without a spleen."

Team officials did not have an answer for when or how Forsberg sustained the damage to his spleen — a fist-sized organ in the upper abdomen that primarily filters blood — saying only that the symptoms did not appear until well after Colorado's 5-1 win against the Los Angeles Kings on Wednesday.

Forsberg appeared to be OK while meeting with reporters at about 11 p.m. MT Wednesday, just after the game. But within an hour, he was greeting Avalanche owner Stan Kroenke and general manager Pierre Lacroix in a downtown Denver restaurant with the words: "I've got pain in my stomach. Maybe I drank water too fast after the game."

Forsberg, nevertheless, sat down to get something to eat. Minutes later Lacroix was summoned to the restaurant manager's office, where Forsberg "was all white and in pain," according to Lacroix. The Avs' trainer, after checking Forsberg, immediately recommended he go to the hospital.

At Rose Medical Center in Denver, a CAT scan revealed the spleen damage as well as internal bleeding. By 3:15 a.m. Forsberg was headed into surgery, which took about 2 hours, Mellman said.

Forsberg was recovering Thursday and will remain at the hospital for "an indefinite amount of time," Mellman said.

The Avs have much less time to recover from the loss of the six-time All-Star if they are to keep their Stanley Cup hopes alive. They open their series against the Blues on Saturday in Denver.

Forsberg, one of the six remaining members of Colorado's 1996 Stanley Cup championship team, had four goals and 10 assists in the first two rounds of this year's playoffs.

"It hurts to have him out, but there are no excuses," said Avs center Joe Sakic, who missed two games of the Kings series with a bruised shoulder. "We're here to win a championship. It's up to us to get it done."

By David Zalubowski, AP

Short-lived celebration: Peter Forsberg, center, celebrates the Avalanche's Game 7 win Wednesday. He had surgery early Thursday.

Blues ready, remain wary

ST. LOUIS — The St. Louis Blues thought they were prepared for anything after their unlikely sweep of the Dallas Stars gave them more than a week's rest.

Anything, that is, but the out-of-left-field news that Colorado Avalanche linchpin Peter Forsberg was out for the playoffs after the removal of a ruptured spleen.

The news whipped around the Blues dressing room after Thursday's morning skate. Concern about a fellow player overshadowed a strong determination not to fall into the trap of thinking his absence will make their task easier.

"We've got to go out and play whether he's in there or whether the backup goalie goes in," Blues captain Chris Pronger said. "Players get injured all the time. That's part of playoff hockey. How teams handle it makes them champions."

The Blues have seen their share of team-shaking injuries this year: an eye injury to Al MacInnis and Pronger's broken forearm. So far the damaging playoff injuries have been on the opposing side. Pronger has little sympathy for anyone who suggests the Blues have benefited.

"Nobody was singing the blues when we were losing for 2 months and we were injured," he said. "That's why the development of young players and having guys stepping up is so important. He's a big part of their team, but he's not the only person on their team."

By Staci D. Kramer

Penguins 3, Sabres 2

Pittsburgh	0	1	1	1–3
Buffalo	0	1	1	0–2

First period — Scoring: None. **Penalties:** Morozov, Pit (roughing), 17:27; Gilmour, Buf (roughing), 17:27.

Second period — Scoring: 1, Buffalo, Dumont 4 (Barnes, Audette), 1:50. 2, Pittsburgh, Peterson 3 (power play) (Straka, Jagr), 8:15. **Penalties:** Boughner, Pit (roughing), 7:20; Gilmour, Buf (roughing), 7:30; Grattan, Buf (roughing), 7:30; Jonsson, Pit (interference), 10:05; Zhitnik, Buf (tripping), 10:50; Jagr, Pit (obstruction hooking), 13:10; Lang, Pit (high sticking), 19:36.

Third period — Scoring: 3, Buffalo, Heinze 3 (power play) (Wesley, Gratton), 0:32. 4, Pittsburgh, Lang 3 (Straka, Jagr), 9:00.

Overtime — Scoring: 5, Pittsburgh, Kasparaitis 1 (Lang, Jagr), 13:01. **Penalties:** None.

Shots on goal:

Pittsburgh	5	7	6	10	– 28
Buffalo	7	8	10	5	– 30

Power-play opportunities: Pittsburgh 1-of-2, Buffalo 1-of-3. **Goalies:** Pittsburgh, Snyders (30 shots, 28 saves; record: 8-5-0). Buffalo, Hasek (28, 25; record: 7-6-0). **A:** 18,690. **Referees:** Kovarski, Devorski. **Linesmen:** Scapinello, Driscoll.

One of most common infections during peak sports activity

90 % infected by age 30

Symptoms last 3 weeks, lethargy can persist

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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 %

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Aurwaerter PG et al. Clin Sports Med 2004:485-97

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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

Maki DG et al. Am J Sports Med 1982;10:162-73
Farley Dr et al. Mayo Clin Proc 1992;67:846-53
Asgari MM et al. Yale J Biol Med 1997;70:175-82
Johnson MA et al. Am J Roentgenol 1981;136:111-4
Waninger KN et al. Clin J Sport Med 2005;15:410-16
Putukian M et al. Clin J Sport Med 2008;18:309-315

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

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Waninger KN et al. Clin J Sport Med 2005;15:410-16
Putukian M et al. Clin J Sport Med 2008;18:309-315

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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!

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Waninger KN et al. Clin J Sport Med 2005;15:410-16
Putukian M et al. Clin J Sport Med 2008;18:309-315

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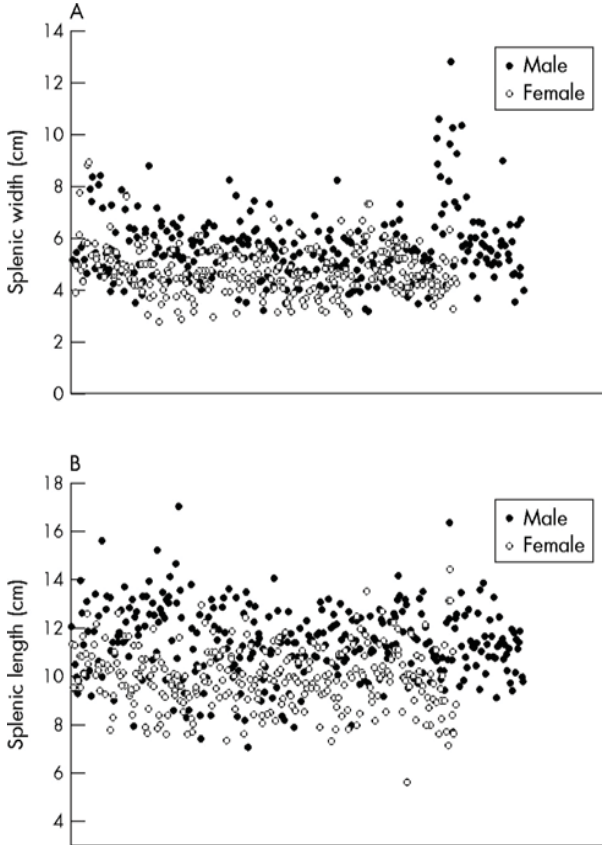
Top Myths in Sports Medicine

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

"Natural History of Spenomegaly in Athletes with Acute Infectious Mononucleosis"
Hosey et al. AMSSM 2006. *CJSM* 16(5):439, September 2006.

"Ultrasonographic evaluation of splenic enlargement in athletes with acute infectious mononucleosis." *Hosey et al. Br J Sports Med.* 2008;42:974-977.

Acute IM develop some degree of spleen enlargement

Acute IM infection resolves within 4-6 weeks

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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

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Spielmann AL et al. Am J Roentgenol. 2005;184:45–49.
Hosey RG et al. Br J Sports Med. 2006;40:251–254.

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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

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

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Herpes Gladiatorum Outbreaks- Minnesota

1989 NEJM 325(13):906-910, 1991. 60/175 wrestlers at a camp

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

Jpn J Inf Dis 59: 6-9, 2006. "Prophylactic Valcyclovir to Prevent Outbreaks of Primary Herpes Gladiatorum at a 28 day Wrestling Camp"

Prophylactic valacyclovir

28 d wrestling camp

Reduced clinical HG by 87% compared to prior years

Seronegative individuals remained seronegative

NCAA Guidelines on RTP
Wresting 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
Wresting 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.

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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

	Community Associated	**Health Care-Associated**	
		Community Onset	Hospital Onset
	n=1226	n=5191	n=2375
Bacteremia	65.1 %	77.4 %	75.5 %
Pneumonia	14.0 %	11.9 %	16.1 %
Cellulitis	22.7 %	8.8 %	4.8 %
Osteomyelitis	8.1 %	8.0 %	6.0 %
Endocarditis	12.6 %	6.6 %	2.5 %
Septic Shock	3.8 %	4.5 %	4.2 %
Overall rate	4.6/100,000	17.6/100,000	8.9/100,000
Crude death rate	0.5/100,000	3.2/100,000	2.5/100,000

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

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

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Community-acquired MRSA

20-70 % of community-acquired *S. aureus*

Soft tissue, necrotizing fasciitis, pneumonia

SCC*mec* type IV

Panton-Valentine leukocidin

- Leukocyte killing toxin

Outbreaks in football, wrestling, rugby, fencing

Fridkin SK et al. N Engl J Med 2005;352:1436-44
Kaplan SL et al. Clin Infect Dis 2005;40:1785-91
MMWR 2003;52:793-5
Rihn JA et al. Amer J Sports Med 2005;33:1924-9

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

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Clin Infect Dis 2004;39:1446-53.
N Engl J Med. *2005;352:468-475.*

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cMRSA in Athletic Teams

<u>Identifiable risks</u>:
Turf burns/abrasions
Shaving: 7X
Chafing
Sharing of towels and equipment
Prolonged physical contact
Sharing bar soap: 15X
Previous antibiotic useage
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

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

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

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NCAA Restrictions

Antibacterials 72 hours

Bacterial skin infections

- impetigo
- erysipelas
- carbuncle
- staphylococcal disease
- folliculitis (generalized)
- hidradentitis 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