Medical conditions affecting sports participation

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Medical conditions in sport

- Muscle cramps
- Infections
- Allergies
- Dietary supplements
- Overtraining and staleness
- Fluid and hydration
- Epilepsy
- Travel and “jet lag”
- Other conditions

Classification: Skeletal Muscle Cramps

1. Pathological
   a) Neurological disease - motor neuron disease, peripheral neuropathies, radiculopathy
   b) Systemic disorders - Fluid and electrolytes, Drugs, Others eg. Malignancy, uraemia

2. Benign
   a) Common benign cramps - Nocturnal
   b) Pregnancy related
   c) Familial benign
   d) Exercise associated muscle cramps (EAMC)

Exercise Associated Skeletal Muscle Cramp (EAMC)

Painful, spasmodic, involuntary contractions of skeletal muscle that occur during, immediately after, or within 24 hours after muscular exercise


Epidemiology of EAMC

1. Lifetime prevalence:
   - Runners: 67% (Kantarowski, 1990)
   - Tri-athletes: 79% (Sulzer R, Schwellnus M, 2001)
   - Cyclists: 60% (Grundling C, Schwellnus M, 1994)
   - Club Rugby: 52% (Tindall R, Schwellnus M, 2003)

2. Incidence
   - Marathon: 18% (Kantarowski, 1990)
   - Professional rugby (seasonal): 2% (Holtzhausen L, Schwellnus M, 2001)

3. Frequency after an event:
   - Marathon: 10-22% of admissions
   - Ultra-marathon: 29% of admissions
   - Ironman: 55% of admissions

What are the possible causes of EAMC in athletes?

- Inherited congenital muscle and metabolic abnormalities
- Abnormal serum electrolytes
- Dehydration
- Creatine supplementation
- Heat
- Novel “isolated” causes
**Do athletes with acute EAMC have altered serum electrolytes?**

- Prospective study with case control component
- Three clinical studies (runners and triathletes) fail to show a relationship between alterations in serum electrolyte concentrations and EAMC
- Evidence for the relationship between abnormal serum electrolytes and EAMC is anecdotal


**Dehydration hypothesis**

- Literature: Anecdotal observations at best
- Possible mechanism: Not known (? systemic)
  - EAMC are localized not generalized
  - Evidence is anecdotal
  - Clinical studies do not confirm relationship

**Are athletes with acute EAMC dehydrated?**

- Prospective study with case control component
- Two clinical studies (runners and triathletes) fail to show a relationship between dehydration and EAMC
- Evidence for the relationship between dehydration and EAMC is anecdotal


**Creatine supplementation hypothesis**

- Recent suggestions linking creatine supplement use to cramps in athletes
- Evidence is anecdotal
- Clinical studies required

- Mechanism not clear: ? Increased compartment pressure

**Is EAMC in sport (rugby) related to the use of creatine supplements?**

- Although there may be more frequent use of creatine supplements in rugby players who cramp, creatine appears to have no effect or even relieve cramping


**What causes EAMC? (Common hypotheses)**

- Inherited congenital

So then, what causes cramping (EAMC) in athletes?

- Heat
- Creatine supplementation
- Novel “isolated” causes
Pathophysiology of EAMC

- Excitation increased
- Inhibition decreased
- Increased muscle spindle activity
- Inner range muscle contraction
- Decreased Golgi tendon organ activity
- Inhibition decreased
- Increased muscle "excitability" (baseline EMG activity)

**CRAMP**

Is muscle fatigue associated with EAMC?

- Runners
  - Not fatigued
  - Fatigued
- Cyclists
  - Not fatigued
  - Fatigued

Is increased exercise duration related to the onset of EAMC?

- Rugby Union
  - Stage of match
- Marathon runners
  - Distance (km)

Is there increased neuromuscular activity during fatigue?

- Ia afferent activity of the muscle spindle during ramp stretch
- Ib afferent activity of the Golgi tendon organ during ramp stretch

Is there increased neuromuscular activity during fatigue (human model)?

- 10 runners with EAMS and 10 matched control non-cramping runners
- Laboratory based submaximal treadmill running hot to fatigue
- Integrated EMG activity of non-exercising (triceps) and exercising muscles (quadriceps, hamstrings, calf)
- IEMG every 30 min (during 1 min rest period - baseline EMG activity)

- Tricep (Non active)
- Quad
- Ham
- Calf

**Adapted from Nelson et al, Med Sci Sport 17(4), 1985**
**Adapted from Hutton et al, Med Sci Sport 18(1), 1986**
**Sulzer N, 2003 (MSc thesis, University of Cape Town)**
Do athletes with acute EAMC have increased neuromuscular activity?


Conclusion: Etiology of EAMC

- Exercise associated muscle cramping occurs as a result of an imbalance between the excitatory and inhibitory input to the alpha motor neuron
- Muscle fatigue is associated with changes in neural control of skeletal muscle activation, resulting in an inability to relax the muscle

Schwellnus M: Phys Sports Medicine, Nov, 1999

Prevention of EAMC in athletes

Prevent fatigue
1. Adequate training
2. Adequate nutrition
3. Avoid exercise in hot and humid conditions to avoid premature fatigue

? Stretching
? Sensitize the Golgi tendon organ

Infections in sports

Spectrum of clinical problems in players

- Exercise and upper respiratory tract infections (URTI)
  - Acute infection and risk of sudden death (myocarditis)
  - Regular training and a protective effect
  - Post exercise URTI
  - Exercise performance post infection
  - Exercise and HIV disease
  - Risk of transmission in contact sports
  - Transmission of pathogens during sports
    - Skin infections (fungal, herpes)
    - Water borne infections (gastrointestinal)
- Anti-microbial therapy and exercise performance
- Anti-microbial therapy and tendon injury
  - Antibiotics (Quinolones - ciprofloxacin, ofloxacin, levofloxacin, gatifloxacin, norfloxacin)

Exercise and upper respiratory tract infections

- Does regular exercise training protect against URT infection?
- Does an URT infection impair rugby performance during recovery?
- Are post URT symptoms after an exercise bout (rugby game) due to infection?
- Are there nutritional or other strategies to reduce the risk of post exercise URT “infections”?
- When can rugby players with URT symptoms continue with exercise training? - clinical guidelines

Does increased exercise training increase the risk of URT “infections”

What is the relationship between “exercise training” load and risk of URTI?

Risk of URTI

Exercise intensity, duration, frequency

Modification

What is the risk of URTI after an acute bout of exercise?

1. Regular exercise performed at moderate intensity is associated with:
   - positive effects on the immune system
   - epidemiological evidence of decreased risk of symptoms of URTI

2. An acute high intensity or prolonged exercise bout may be related to a transient increased risk of infection

What is the relationship between exercise training load and risk of URTI?

Regular exercise performed at moderate intensity is associated with:

- Positive effects on the immune system
- Epidemiological evidence of decreased risk of symptoms of URTI

An acute high intensity or prolonged exercise bout may be related to a transient increased risk of infection.

Controlled clinical trial (Pre-post infection):
- 5 subjects
- Assessments: Pre illness, Days 0, 2, 4, and 6 post illness
- Underwent re-training to same weekly distance as pre illness
- Detrained for same period of illness (range 5-13 days)
- Assessments as for illness

Does an acute URT infection decrease muscle peak torque (strength) during recovery?

- Controlled clinical trial (Pre-post infection)
- 5 subjects
- Assessments: Pre illness, Days 0, 2, 4, and 6 post illness
- Underwent re-training to same weekly distance as pre illness
- Detrained for same period of illness (range 5-13 days)
- Assessments as for illness

Does an acute URT infection decrease endurance capacity (VO2 peak) during recovery?

- Controlled clinical trial (Pre-post infection)
- 5 subjects
- Assessments: Pre illness, Days 0, 2, 4, and 6 post illness
- Underwent re-training to same weekly distance as pre illness
- Detrained for same period of illness (range 5-13 days)
- Assessments as for illness

Exercise testing completed at Day 0, 2, 5, and 8 post iatrogenic Rhinovirus (16) inoculation in healthy subjects was not different from that of a control group.


Are viral cultures positive in runners presenting with URT 0-10 days after an ultra-marathon?

There were no positive viral cultures in either the asymptomatic (n=36) or the symptomatic groups (n=34) of runners pre and post race.

Are bacterial cultures positive in runners presenting with URT 0-10 days after an ultra-marathon?

The majority of athletes completing an ultra-marathon with symptoms of URT “infections” do not have positive cultures for bacteria or viruses.


What are the postulated nutritional factors that may reduce the risk of URTI in athletes during training?

- Anti-oxidants (Vitamins C, E and A)
- Amino acids (glutamine, arginine)
- Lipids (fat intake 30-50% daily intake, n-3 fatty acids)
- Trace elements (Zinc, iron, selenium, copper)
- Carbohydrates

When can an athlete with a respiratory tract infection train?

No training at all
- Muscle or joint pain
- Fever
- Chest pain
- Cough
- Increased resting heart rate
- Breathlessness

Trial of training (10 min of easy to moderate exercise and re-assess)
- Only mild symptoms above the neck (Neck check) – blocked nose, runny nose, mild sore throat

Herpes simplex infections in rugby players

Epidemiology
At least 6 reports in rugby players (Scrum box, Herpes rugbiorum)

Microbiology
Herpes simplex Type I (saliva) and Type II (genital secretions)

Spread
Spread by direct contacts from infected individuals (common) or symptomatic carriers (1-15% adults)

Incubation period
2-12 days

Skin infections in contact sports

- Viral infections
  Herpes simplex
- Bacterial infections
  S. aureus, Streptococcus pyogenes
  Clostridium tetani
- Fungal infections
  Tinea

Blood borne infections in contact sports

- HIV infection
- Hepatitis B
- Hepatitis C

What is the risk of HIV disease in contact sports?

No case described (in soccer)
Potential for blood and tissue products transfer on field
Risk of on field transmission is related to:
1. Prevalence in the populations
2. Risk of contact
3. Risk of open bleeding wound
4. Risk of transfer of virus when two wounds make contact (same as needle stick injury)

Risk of "off field" transfer higher (NB: traveling team)
Universal guidelines for management of bleeding wounds
Traveling to high risk area
Acute exposure treatment pack

Gastro-intestinal infections in contact sports

- Travel (food, water)
- "Locker room" infections
- ? Transmission on field

Can gastro-enteritis be transmitted through playing contact sport (rugby)?

Descriptive study: Football players who ate meals served before a match (Team A) and players on the opposing team (B) who became ill were interviewed.
Primary cases: Players who had vomiting or diarrhoea 10-50 hours after eating
Secondary cases: Onset of symptoms > 50 hours after meal or had symptoms without having eaten the contaminated meal
Stool samples: Examined by electron microscopy and by a reverse-transcription-polymerase-chain-reaction (RT-PCR) assay

Relative risk of illness, transmission for:
1. Transmission of a virus causing acute gastro-enteritis occurred among players during a football game
2. Persons with acute gastroenteritis should be excluded from playing contact sports

How common are allergies in elite athletes?

- Exercise induced bronchospasm
- Skin (skin prick tests)
- Upper respiratory tract (Allergic rhinitis)
- Prevalence of atopy in most sport is unknown
- Survey of 74 Super 12 rugby players (3 teams)
  9.5% use medication for EIB
  5.6% use topical corticosteroids for allergic sinusitis

What is the prevalence of EIB in sports?

<table>
<thead>
<tr>
<th>Study</th>
<th>Athletes</th>
<th>Prevalence</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sonna et al., 2001</td>
<td>Army recruits</td>
<td>7%</td>
<td>X-country skiing, 50%</td>
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<tr>
<td>Wilber et al., 2000</td>
<td>Olympic winter</td>
<td>22%</td>
<td>Females = males, Medal winners</td>
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<td></td>
<td>sport athletes</td>
<td></td>
<td></td>
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<tr>
<td>Thorst et al., MSSE, 2001</td>
<td>Cross-country</td>
<td>14%</td>
<td>Symptoms poor predictor of EIB</td>
</tr>
<tr>
<td>Rundell et al., MSSE, 2001</td>
<td>Elite winter</td>
<td>26%</td>
<td>Self reported symptoms</td>
</tr>
<tr>
<td>Derman et al., 2002</td>
<td>Elite Summer</td>
<td>13%</td>
<td>overdiagnose EIB</td>
</tr>
<tr>
<td></td>
<td>Olympic athletes</td>
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</tbody>
</table>
What is the prevalence of skin atopy (+ve skin prick tests) in other sports?

- South Africa 81 athletes
- Australia 214 athletes

Katzevis et al., J Allergy Clinical Immunology 106(2), 2000

What is the incidence of atopy in Olympic Athletes, Iron Man Tri-athletes & Ultra-marathon runners?

- 81 Olympic athletes
- 66 Triathletes
- 112 Two Oceans

Derman W et al., SAMJ 92(5) 2002
Tune W, Schwellnus M, et al., 2002

What is the clinical importance of allergy (atopy) in elite athletes?

1. High incidence of allergy in elite athletes (double normal population)
2. Cause as yet unidentified
3. Different allergy profiles in different sports
4. Allergies linked to poor performance
5. Essential part of medical work-up/pre-season evaluation of elite athletes

Thank you for your attention