Common Injuries in Ultra-Endurance Athletes

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Disclosure Statement

Nothing to Declare
Ultra-endurance Sports

- Ultra-endurance competition is defined as events that >6 hrs in duration
  - Increasing the distance of endurance events
  - Moving the location of the events to a more challenging environment
Ultra-endurance Sports

- Ultrarunning
- Ultradistance cycling
- Ultra-swimming
- Ultra-endurance walking
- Sailing
- Ultra-nordic skiing
- Ultra-paddling
- Ultra-sled
- Multi-sports
Patagonian Expedition Race

- Taking teams of 4 through lands previously unknown to the human eye
- Takes between 6-9 days to finish the race
- Racers receive minimal assistance
- Trekking, climbing and related rope work, kayaking, mountain biking, and backcountry navigation
Iditarod Trail Invitational

- The world's longest winter ultramarathon by fat bike, foot and ski
- Follows the historic Iditarod Trail from Knik, Alaska over the Alaska Range to McGrath and to Nome in late February every year
The 4 Deserts Race Series

- The series consists of the Sahara Race (Namibia), Gobi March (China), Atacama Crossing (Chile) and The Last Desert (Antarctica)
- Competitors in the races traverse 250 km in 7 days
- Only a place in a tent and water provided
Medical Challenges

- Access to care
- Available care
  - Basic medical care
  - Point-of-care analyzer
- Transportation
- Aid stations
- Water and food
- Decision on whether or not allowing the athletes to continue the race
Injuries & Illnesses

- Overuse vs acute
- Athletes with underlying medical conditions
- Most injuries are minor
- However, you should be prepared for life-threatening injuries
Injuries & Illnesses

- MSK
- Dermatologic
- GI
- Environmental
  - Heat/cold illness
  - Altitude illness
- Fluid imbalance
- Respiratory Illness
- Exercise-Related Pain
- More serious conditions
- Trauma
2014 Leadville, WSER, & UTMB

Most common causes of inability to complete ultramarathons

- Inability to make the cut-off time: 23.3%
- Nausea and/or vomiting: 16.5%
- Injury during the race: 16.6%
- Ongoing injury: 13.4%
There were 134 visits to aid stations by 107 (21.4%) different runners. Five runners were referred to the ED.
MSK Injuries

- Typically from overuse and not dangerous among runners, but may significantly impact performance
- Anywhere from 1-24% of endurance running race injuries
- Most common injuries:
  - Patellofemoral pain (7-33%)
  - Achilles tendinopathy (8-19%)
  - IT band syndrome (7%)
- Treatment during race limited to taping, massage, and stretching
- Decision on continuing the race!
- Fractures and sprains
- Limit use of NSAIDs!
MSK Injuries

- Acute injuries are more common in cycling
  - Fracture, contusion, and sprain
- Clavicle fractures and ACJ Sprains
- Head trauma and concussion
- Mechanism of injury
  - Fall over the handle bar
  - Sliding
  - Mechanical failure
  - Collision (object, person)
  - Slipped of the pedal
- Protective equipment?
MSK Injuries

- Exertional compartment syndrome
- Exercise-Associated Muscle Cramp
- Exertional Rhabdomyolysis
  - Diagnosis?
  - Urine and blood tests
  - NSAIDs
  - Management
- Exercise-Associated Hyponatremia
Acute Kidney Injury

- Resulting from dehydration and/or exertional rhabdomyolysis (NSAID’s!)
- Early diagnosis and management is the key
- Challenge of performing lab on the field
- ~34% of subjects (~150) had AKI (only 4% had stage 2)

*Urine dipstick analysis for identification of runners susceptible to acute kidney injury following an ultramarathon*

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Skin

- Blisters are the most common reason for medical tent visits
  - 17-40% of injuries in continuous and 33-74% in multi-day ultramarathon races
  - <5% lead to cellulitis
- Can lance painful, non-bloody blisters

Skin

- Protect overlying skin with bandage or moleskin
- Chafing affects around 9% of runners - mostly groin, back, and nipple area
  - Treat with lubricants or a topical corticosteroid
Road Rash & Lacerations

- Common in trail running and cycling
- Important to have pressure irrigation
  - Remove debris
  - Explore wound
- Topical lidocaine for symptom relief
- Cover with sterile dressing and hold with mesh sleeve if extremity
- Can consider repair if superficial, but may need to refer athlete if large/deep
Subungual Hematomas

- Occur in 3-10% of runners
- Treated by piercing the skin at the tip of the nail, if possible
- Can pierce nail with a clean, wide-bore hypodermic needle or heated paper clip
Hydration Issues

- Correct management of fluids/nutrition is essential
- Sweat losses up to 0.5-2 L/hr
- “Drink to thirst” strategy recommended
  - Previously >7% BW loss grounds for disqualification
  - Elite runners can have ≥8% BW loss w/o significant sx
- Risk over-hydrating and causing hyponatremia
- Oral rehydration preferred over IV, if not vomiting
- Add sodium and carbohydrates for exercise >1hr
- Caffeine does NOT contribute to dehydration at moderate levels (<5 Red Bulls/day)
Weight check

- What is the evidence?
- Best to use as guidance for hydration status of runners
Metabolic/GI Issues

- Average runner utilizes 500-800 Kcal/hr during a 100-mile ultramarathon
- Most runners can only ingest 200-300 Kcal/hr, so caloric deficit cannot be avoided
- Further complicated by GI distress (n/v, abd cramping, diarrhea) – occurs in over 1/3 of athletes
- Usually improves w/ reduced exercise intensity
- Anti-emetics (e.g. ondansetron) utilized for n/v

Exercise-Associated Collapse

- Inability to stand/walk d/t dizziness or syncope after ceasing exercise
- Caused by postural drop in systolic BP from an impaired baroreflex, vasodilation, and a loss of the lower leg muscle “pump action”
- Affects 1% of ultramarathon runners and has been observed in up to 56% of non-finishers

Exercise-Associated Collapse

- Treatment includes Trendelenburg positioning, PO hydration, and skin surface cooling.
- Generally recover quickly and can be released from medical station within an hour.
  - If s/s of dehydration and inability to tolerate PO, may need IV fluids.
- Prophylaxis w/ compression stockings, cooling skin surface during running, ensuring adequate glucose levels, and avoid abrupt cessation of exercise.
- Important to r/o other causes for collapse.

Respiratory Illness

- Common in all ultra-endurance sports
- Air quality
- Asthma
- Exercise-induced bronchospasm
- Allergic and non-allergic rhinosinusitis
- Swimming-induced pulmonary edema
- Water aspiration
  - Salt water?
  - Near-drowning
Open Water Swimming

• Environmental conditions
  • Water/air temperature
  • Water current
  • Water quality (aquatic fauna/flora)
• Animal exposure
  • Jellyfish, rays, fish, sharks, dolphin, seals, snakes
• Chaffing
• Exhaustion and fatigue
• Reliance on race support
• Plan for the temperature, current, and other water conditions as well as endemic threats
Thermal-Related Disorders

- Most serious are heat stroke and hypothermia
- Must use rectal thermometer to accurately assess core body temperature

<table>
<thead>
<tr>
<th>Condition</th>
<th>Signs and Symptoms</th>
<th>Cause</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat stroke</td>
<td>High CBT[usually ≥40°C (104°F)] and severe neurologic impairment (i.e., irritability, seizures, confusion, psychotic behavior, ataxia, and coma)</td>
<td>Thermoregulatory failure. Excess heat gain w/ inadequate heat loss.</td>
<td>Immediate and aggressive cooling. Options include: an air conditioned vehicle, fanning, sponging, and ice bath immersion; transfer to hospital after initial stabilization</td>
</tr>
<tr>
<td>Hypothermia</td>
<td>CBT &lt;35°C (95°F), tachypnea, hyperhypotension, shivering, fatigue, weakness; severe hypothermia is CBT &lt;32°C (90°F)</td>
<td>Water immersion (crossing rivers) and nocturnal running in lower temps. Worsened by hypoglycemia.</td>
<td>Remove wet clothes and insulate body with blankets and garments (passive rewarming); external active rewarming (e.g., hot water circulating blankets) for moderate to severe hypothermia</td>
</tr>
</tbody>
</table>
Thermal-Related Disorders

1st Rapid Cooling

Then call 911 and transport
Thermal-Related Disorders

- **Frostnip**
  - Result of superficial cold-induced vasoconstriction in the skin usually occurring at freezing temperatures.
  - Skin blanching and numb patches mostly in the nose, ears, chin, and cheeks
  - Immediate rewarming can prevent tissue loss and long-term damage
  - Is reversible and resolves rapidly with gentle rewarming without any sequelae
Thermal-Related Disorders

- **Frostbite**
  - A freezing injury to the skin & underlying tissues with formation of crystals in the extracellular space between cells
  - Occurs at a $T < 0^\circ C$ (32°F)
  - Exposed areas (nose, ears, cheeks, and digits) are affected (>50% in the toes)
  - Constrictive and wet clothes increase the risk of frostbite
  - Do not rewarm the area through rubbing as it increases the risk of further tissue damage
  - The best treatment approach is rapid rewarming with warm water (37-40°C)
## High Altitude

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<th>Treatment</th>
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<tr>
<td><strong>AMS</strong></td>
<td>Headache, anorexia, nausea, vomiting, dizziness, fatigue, difficulty sleeping</td>
<td>Slow ascent, acetazolamide, ibuprofen</td>
<td>Descent, acetazolamide, dexamethasone, supplemental oxygen</td>
</tr>
<tr>
<td><strong>HAPE±</strong></td>
<td>Dyspnea at rest, tachycardia at rest, wet cough, tachycardia, dyspnea on mild exertion, rales, wheezing</td>
<td>Slow ascent, nifedipine</td>
<td>Descent, supplemental oxygen, nifedipine, phosphodiesterase-5 inhibitors (e.g., sildenafil); portable hyperbaric chambers¥</td>
</tr>
<tr>
<td><strong>HACE€</strong></td>
<td>Altered mental status or ataxia in a person with AMS or HAPE</td>
<td>Slow ascent, acetazolamide</td>
<td>Descent, dexamethasone, acetazolamide, supplemental oxygen, portable hyperbaric chambers¥</td>
</tr>
</tbody>
</table>

*Acute Mountain Sickness; ±High Altitude Pulmonary Edema; €High Altitude Cerebral edema; ¥only for severe cases when descent is not feasible
Concerning Problems

- Cardiac arrest
- Thermal-related disorders
- Hyponatremia or severe dehydration
- Exertional rhabdomyolysis and AKI
- Asthma exacerbation
- HAPE/HACE
- Major trauma
- Mass casualty – i.e. natural disasters, terrorist attack
Cardiac Arrest

- Runners that collapse on course are more concerning than those crossing finish line (EAC)
- Cardiac arrest and sudden cardiac death (SCD) are rare, but devastating
  - Estimated between 1:57,000 and 1:259,000 participants
- Usually older males in last part of the race with atherosclerosis or hypertrophic cardiomyopathy
- Prompt resuscitation (CPR, AED) is essential
  - Survival rates decrease 7-10% every minute defibrillation is delayed

Major Trauma

- Rare, but serious, event in endurance races
  - Fall
  - Animal attack
  - Lightning strike
  - Terrorist attack
  - Hit by cars

- Challenging in remote environments due to limited equipment and prolonged transport times
  - Ensure effective communication and emergency transport system in place
Major Trauma

- Supplies may include:
  - Portable airway tools - supraglottic airways and mouth-to-mask devices are encouraged d/t portability
  - Basic hemorrhage control w/ bandaging, hemostatic agents, and/or tourniquets
  - Splinting materials for extremity fractures
  - IV fluids are a lesser priority, but may be helpful
  - C-collars and backboards
    - Cervical spine clearance in the field is feasible and lessens need for resource-intensive evacuations

Harris et al. BMJ. 2012.
References

Questions