Musculoskeletal injuries in the long distance runner

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Disclosure Statement

Nothing to Declare
**MSK Injuries**

- Typically from overuse and not dangerous among runners, but may significantly impact performance
- 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, analgesics, massage, and stretching
- Decision on continuing the race!
- Fractures and sprains
- Limit use of NSAIDs!
Injury Report: 2009 Leadville 100

There were 134 visits to aid stations by 107 (21.4%) different runners. Five runners were referred to the ED.
MSK Injuries

- Muscle
- Tendon
- Ligament
- Bone
- Joint
- Cartilage
- Bursae
Common Running MSK Injuries

- Muscle strains
  - Hamstring
  - Calf
  - Groin

- Tendon Injuries
  - Hamstring
  - Patellar
  - Quadriceps
  - Achilles

- Knee
  - Patellofemoral pain syndrome
  - IT Band syndrome
  - Meniscal injuries

- Back pain
  - Muscle strain
  - Disc or facet DJD
  - Radiculopathy
  - SI Joint
Patellofemoral pain syndrome (Runners knee)

- The most common reported running injury (~25%)
- Self-report in up to 25% of ultramarathon runners
- Up to 16% of runners during ultramarathon races
- Higher prevalence among young and female runners
- The etiology is multifactorial and includes overuse, poor alignment, and muscular imbalance
- Pain in the front of one or both knees
- Sometimes pain is more localized behind the patella
- Pain usually subsides following the run
Patellofemoral pain syndrome

- Physical Exam usually unremarkable
- Imaging is not indicated and usually normal, unless concern for other etiologies
Patellofemoral pain syndrome

- Management should focus on multiple aspects
  - Pain management (e.g. acetaminophen)
  - Physical therapy (stretching & strengthening programs)
  - Shoe insoles or orthotics
Patellofemoral pain syndrome

- Various taping techniques and patellar braces
- 5-10% increase in running pace may decrease the pain, but may decrease the performance as well
Iliotibial band friction syndrome

- The most common cause of lateral knee pain in runners
- ~10% incidence
Iliotibial band friction syndrome

- Proposed impingement zone at 30° of knee flexion
- Running uphill, downhill, and at slower paces (ultramarathons), may lead to a higher fraction of time in this zone
Iliotibial band friction syndrome

- Pain is usually prompted after a fixed distance, repetitive flexion and extension of the knee, or by holding the knee in 30° of flexion.
- It is relieved when the knee is held at full extension.
- As the problem progresses, the onset of symptoms begins earlier during the course of running.
Iliotibial band friction syndrome

- Management
  - Acetaminophen
  - Cryotherapy
  - Myofascial release techniques
  - Foam roller
Iliotibial band friction syndrome

- Shortening the stride length may be helpful in alleviation of the pain during the race
- Long rest and immobility in aid stations may worsen the pain and tightness
Iliotibial band friction syndrome

- Prevention with stretching
Iliotibial band friction syndrome

- Prevention with strengthening exercises
Medial tibial stress syndrome "shin splint"

- ~5% of runners
- Male > Female
- Prevalence during ultramarathon races is ~10%
- Most runners will run slower to decrease the pain during the race
- Cryotherapy, stretching, and topical analgesics may help during the race
Stress fractures

- A self-report rate of a 10% in the previous year among ultrarunners
- Foot, tibia, and femur are more common
- Diagnosis with focal tenderness and swelling
- Plain radiography is often normal for weeks
- MRI or bone scan
- Management is conservative
- A 10% reduction in stride length and an increase in the running cadence may decrease the risk of tibial stress fractures by decreasing the tibial strain forces
Case

- **Hx:**
  - HPI: A 42 yo♂ runner presents to your office c/o 1 wk hx L midfoot pain. He has been running 3-4 miles 5 times a week (~20 miles/week) for the last 6 years. His pain starts at the beginning of his run. He has been using the same brand of running shoes.
  - Ø signif. PMH/PSH/FH/S

- **PE:**
  - Mild-Mod tenderness over dorsal aspect of 3<sup>rd</sup> MT.
Case

- Imaging:
  - X-ray: AP
Case

- Imaging:
  - X-ray: oblique
Case#1 Con’t

- **Dx:** Distal L 3rd metatarsal stress Fx (with cortical break)
- **Tx:**
  - Eliminate running and jumping, ↓walking
  - Some cases would need a short-leg walking cast or boot and partial wt-bearing if painful to walk in regular shoes
  - Non-pain producing and non-wt bearing activities (swimming, biking) and “light intensity training”
  - Repeat x-rays in 3-4 weeks should show callous formation
  - Usually can return to sport 6-10 wks if compliant with tx and are not advanced too quickly.
Case

- Imaging:
  - X-ray 4 ½ wk later (oblique)
Case

- Imaging:
  - MRI 7 wks later
Sesamoid stress injuries

- It normally transfers up to 50% of body weight
- This load can reach >300% during the run (push-off)
- Common pathologies among runners
  - Sesamoiditis
  - Osteochondritis
  - Acute stress fractures
- Account for 1% of running injuries
- Prevalence during ultramarathons is unknown
Sesamoiditis

- A painful condition of the sesamoid complex due to repetitive stress
- Crepitus, tenderness and pain on dorsiflexion of the 1st MTP joint are the main clinical findings
- Normal radiographic findings
Sesamoid Fractures

- Acute Fx
  - Uncommon
  - Plantar ecchymosis may be present
  - Can be seen on X-rays
Sesamoid stress injuries

- **Management**
  - Often conservative
  - Plantar (sesamoid) pads may help
  - Biomechanical evaluation and orthotics
  - Injection?
  - Return to running gradual after symptoms are resolved
Chronic exertional compartment syndrome

- The 2nd most common cause of chronic leg pain in athletes
- Pain usually subsides following cessation of the run
- If the pain does not resolve after the race, the athlete should be referred to the ED to R/O acute compartment syndrome
- Other symptoms and signs of an acute compartment syndrome (tingling, pale skin color, paralysis, and inability to feel the pulse) may not be present
Chronic exertional compartment syndrome

- Diagnosis (clinical and compartment measurement)
- Delay in Dx/Rx may cause significant consequences
- Surgery (compartment fasciotomy) may be warranted if the symptoms do not resolve with conservative management
Exercise-associated muscle cramping

- One of the most common conditions faced by ultramarathoners
- The most common (57%) cause of premature race termination in a 250-km off-road ultramarathon
- In a survey study, 5% of 161-km ultramarathon runners reported muscle cramping as their main reason to drop out of the race
- Mainly in the gastroc-soleus complex, hamstrings, or quadriceps muscles
Exercise-associated muscle cramping

- Fatigue and increased excitatory activity of neuromuscular units seems to be the most likely mechanism
- Electrolyte imbalance?
- Risk factors among ultramarathoners:
  - Increased relative exercise intensity
  - Previous history
  - Pre-existing muscular damage
Exercise-associated muscle cramping

- Management
  - Rest
  - Various massage techniques
  - Passive stretching
  - Hydration?
  - Salt?
Meniscal injuries

- 5% of running injuries presenting to a large sports medicine center
- Increase in the average age of ultramarathoners seems to be a risk.
- In one MRI study of 22 asymptomatic non-professional athletes, running a marathon race did not cause major changes to the menisci
- Continue the race decision depends on symptoms and desire to complete the race
Plantar fasciitis

- Accounts for ~8% of all running injuries
- Male > Female
- Self-reported 1-year prevalence of 10% among ultramarathon runners
- Diagnosis is usually clinical
  - Pain and tenderness over the medial plantar calcaneal tubercle
- Differentiating from calcaneal stress Fx may be difficult
Plantar fasciitis

- Management
  - Cryotherapy
  - Topical analgesic preparations
  - Acetaminophen
  - Stretching
    - Roller foam
    - Golf ball
  - Strengthening
Plantar fasciitis

- Plantar fascia rupture is rare and can happen during the race
- Sudden increase in pain while running combined with a palpable defect
- Continue the race?
Lower extremity tendinopathies

- Relatively common in runners
- The exact prevalence among ultramarathoners is unknown
- Ruptures or partial tears are rare
  - May present as a defect or significant increase in pain in the area
  - May prevent the runner from completing the race
Lower extremity tendinopathies

- Management of tendinopathies in general:
  - Biomechanical adjustment
  - Physical therapy with focus on strengthening exercises (e.g. eccentric), and stretching
  - No good evidence (yet!) invasive modalities (dry needling, PRP injection, or prolotherapy have any therapeutic effects on tendinopathies
Patellar tendinopathy

- ~5% of patients presenting to sports medicine clinic
- The exact prevalence among ultramarathon runners is unknown
- Diagnosis is usually made by history and physical examination (point tenderness).
Achilles tendinopathy

- In one study the self-reported 1-year prevalence among ultramarathoners was 12%.
- Degenerative changes in the tendon start long before it becomes symptomatic.
- Possibly due to effects of repetitive microtrauma on the tendon.
- Non-insertional (midportion) tendinopathy is the most common type (at the avascular zone 2-6cm proximal to the insertion).
Achilles tendinopathy

- Usually runners have gradual onset of pain which deteriorates after uphill running or sprinting (toe-running).
- Physical examination may reveal swelling, local tenderness, crepitus, decreased flexibility of the gastroc-soleus complex, and increased thickness of the tendon (chronic cases)
Posterior tibial tendinopathy

- Stabilizes the medial longitudinal arch.
- ~0.6% of patients presenting to a sports medicine clinic had a posterior tibial tendon injury
Posterior tibial tendinopathy

- Its dysfunction can stress the ligaments of the hindfoot and midfoot, resulting in a painful acquired flatfooted deformity
- Medial ankle instability may occur due to deltoid ligament injury in severe cases
- An acute increase in pain or drop in the medial arch warrants discontinuing the race
Anterior tibial tendinopathy

- ATT is the main foot dorsiflexor
- It is more common among long distance runner >45 yrs
- ATT dysfunction or rupture is uncommon and results in foot drop and a slapping gait
- If gait or running form is affected in a way that further injury is a concern, the runner should be advised to withdraw from the race
Peroneal tendinopathy

- Peroneal tendon injuries (tendinopathy, subluxation, and ruptures) are uncommon
- ~0.7% of patients presenting to a sports medicine clinic
- Persistent lateral ankle pain and chronic lateral ankle instability are usually linked to the peroneal tendinopathy
Peroneal tendinopathy

- Running on uneven ground and muscle fatigue may lead to peroneal tendon problems in ultramarathon runners
- New snapping symptoms or acute lateral pain posterior to the lateral malleolus may signal subluxation or longitudinal tendon tear, and may require a runner to withdraw from the race
Exertional rhabdomyolysis

- Breakdown of skeletal muscle fibers resulting in the release of muscle proteins into the circulation
- Exercise-related muscle pain, swelling, stiffness, and muscle weakness
- Serum creatine kinase (CK) elevation
- CK should be at least 5 to 10 times the upper normal limit
- Men and African Americans tend to show higher serum CK level possibly due to larger muscle mass
- Many athletes may experience high levels of CK without rhabdomyolysis
Exertional rhabdomyolysis

- Prevalence of symptomatic ER among ultramarathon runners is unknown, although significant exertion or exercise may increase CK levels without complications.
- Skenderi et al reported mean CK of 44,000 U/L in 39 asymptomatic runners of a 246-km continuous race.
- We found similar results during 2014 Leadville 100.
- Mean serum CK of 83 asymptomatic runners after the race was 13,253 U/L.
Table 1. Demographic information of participants.

<table>
<thead>
<tr>
<th>Participants’ characteristics</th>
<th>Subjects with prerace samples (n = 64)</th>
<th>Subjects with postrace samples (n = 83)</th>
<th>Subjects with both pre- and postrace samples (n = 36)</th>
<th>All runners in the race (n = 669)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year); mean (range)</td>
<td>43 (19–68)</td>
<td>42 (24–68)</td>
<td>43 (26–68)</td>
<td>40 (19–74)</td>
</tr>
<tr>
<td>Male gender; n (%)</td>
<td>51 (80)</td>
<td>68 (82)</td>
<td>28 (78)</td>
<td>560 (84)</td>
</tr>
<tr>
<td>BMI (kg/m²); mean (range)</td>
<td>23.3 (18.8–28.9)</td>
<td>22.8 (18.8–28.9)</td>
<td>22.7 (18.8–28.9)</td>
<td>23.4 (16.9–31.0)</td>
</tr>
<tr>
<td>Race completion status; n (%)</td>
<td>Finished</td>
<td>30 (47)</td>
<td>65 (78.3)</td>
<td>352 (52)</td>
</tr>
<tr>
<td></td>
<td>Did not finish</td>
<td>34 (53)</td>
<td>18 (21.7)</td>
<td>317 (47)</td>
</tr>
</tbody>
</table>
Figure 1. Postrace (a) alanine aminotransferase (ALT), (b) aspartate aminotransferase (AST), and (c) lactate dehydrogenase (LDH) versus creatine kinase (CK).
Exertional rhabdomyolysis

- May result in myoglobinuria (cola-colored urine)
- ER is the most common cause of exercise-associated acute kidney injury (AKI) in athletes.
- Risks increases by use of NSAIDs during the race and underlying renal problems
- Runners with dark urine should be evaluated for renal function and serum CK level.
- Management starts with oral rehydration.
- Close monitoring in the ER and sometimes hospitalization is required
References

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