**Managing Acute Musculoskeletal Pain in Endurance Athletes**

*By Kristin Della Volpe with Elmer G. Pinzon, MD, MPH, DABIPP, and Jeff Chandler, MS, PT*

The popularity of endurance sports has grown steadily over the past several decades. From running to rowing to cross country to Ironman events, and century cycling events, the options for endurance training and competitive events are many. With this increased participation comes an increased risk of overuse sports injuries and resultant musculoskeletal pain. While prevention may be the best treatment, equally important is early diagnosis of acute and chronic pain conditions and referral to sports medicine/musculoskeletal pain specialists and physical therapists to prevent such injuries from progressing into more recurring, chronic pain conditions.

Endurance athletes frequently first present to their primary care provider with an acute/subacute and sometime chronic condition, such as musculosketal tendonitis or lower back pain, making a greater awareness of treatment options for common musculoskeletal pain conditions essential to care in this setting. In addition, it is important for primary care physicians to convince their patients of the importance of rehabilitation for correction of musculoskeletal abnormalities and improper training before acute/subacute conditions turn chronic.

In endurance athletes, musculoskeletal injury occurs when repetitive, cumulative forces exceed the tissue’s ability to withstand such forces either due to isolated macrotrauma—such as a rotational injury to a joint, blunt trauma, or sudden overload causing a tear—or repetitive microtrauma—such as tendonitis, nerve compression, or stress fractures. Often, specific biomechanical or physiological factors predispose an athlete to injury.

This review provides treatment options for three isolated, but common sports-related musculoskeletal injuries in endurance athletes: Achilles tendonitis/plantar fasciitis, rotator cuff tendonitis, and spine-related pain conditions. The authors discuss management from the perspective of a musculoskeletal pain physician and a physical therapist to provide a wide spectrum of approaches.

**Achilles Tendonitis/Plantar Fasciitis**

***Case vignette: [***To come: please discuss sample patient history, treatments, and outcome- Would like to cover either a high school/college/adult cross-country or endurance runner- will discuss in more detail]

***History/Pathogenesis:***

*Achilles Tendonitis:* Painful inflammation of the Achilles tendon as a result of repetitive stresses. Injury of the lower leg muscles (gastrocnemius/soleus) that leads to a degenerative tendon condition charactrerized by chronic pain and imflammation on the posterior aspect of the ankle. Predeisposing factors include- tightness of the Achilles tendon, cavus foot, functional talipes equines, or pronated foot secondary to the forefoot or hindfoot varus or tibia varus positions. Most frequently occurs in sports requiring jumping or running, especially in uneven terrain and hill-running (eg- cross-country or X-terra endurance events).

*Plantar Fasciitis:*  Inflammatory stress syndrome of the plantar fascia or plantar aponeuosis, usually at the medial plantar aponeurosis, usually at its medial calcaneal origin. It is believe that this syndrome is related to the stress on the plantar fascia from the weight of an activity compbined with weight transfer up onto the tows and leading to MTP joint extension with a “windlass” effect on the plantar fascia. Accounts for approximately >10% of all running-related injuries, and the most common cause of heel pain in runners (eg- cross-country, track, or IM/X-terra endurance events).

***Treatments/Outcomes:***

*Achilles Tendonitis:*

Relative rest (see below); new specialized-fitted shoewear (motion-control or stabilization styles); heel lift inserts; OTC or prescribes NSAIDS (oral or topical Rx); physical modalities (ice, therapeutic ultrasound, iontophoresis, phonophoresis, TENS electrical stimulation; gentle calf (gastrocnemius/soleus) stretching; videotape gait analysis of runners; soft gel heel cup inserts; orthotic or arch supports for hyperpronators; night splints or walking boots; athletic taping during competition events; orthopedic surgical options (ie- surgical debridement).

*Plantar Fasciitis:*  Relative rest (see below); new specialized-fitted shoewear (motion-control or stabilization styles); heel lift inserts; OTC or prescribes NSAIDS (oral or topical Rx); physical modalities (ice, therapeutic ultrasound, iontophoresis, phonophoresis, TENS electrical stimulation; deep transverse friction massage to the arch and tendon insertion points; gentle calf (gastrocnemius/soleus) stretching; videotape gait analysis of runners; orthotic or arch supports for hyperpronators; night splints or walking boots; athletic taping during competition events;orthopedic surgical options (ie- surgical debridement).

***Relative rest***: Patients may be advised to decrease speed work and running hills or stairs, as well as the overall intensity, duration, and/or frequency of their exercise. Biking or swimming offer good options for cardiovascular exercise in a patient who is determined to keep training.

***Stretching*:** Calf and plantar fascia stretches should be gentle at first and more aggressive as the injury calms down (see **Figure 1A and 1B**). Roller devices may be used in the office or as an at-home exercise to assist in stretching the Achilles tendon, gastrocnemius, and soleus.

***Strengthening****:* Once the inflammation has subsided, patients may begin calf raises starting in a seated position (with a weight on the knees if appropriate) and progress to a standing position and eventually off an incline (eg, a step or platform) with weights added. Therabands also may be used to strengthen the calves.

***Kinesio-taping:*** Kinesio taping may be used to inhibit or facilitate activation of muscle or soft tissue structures, as well as to increase circulation and lymphatic drainage to the injured area. For patients with acute Achilles tendonitis, taping to inhibit activation may be best. Once athletes are allowed to return to training [AT WHAT POINT? AFTER HOW ABOUT HOW LONG- Will defer this to Jeff Chandler, PT], taping to facilitate or support the tendon and calf muscle action may provide the most effective long-term outcome.

***Low-dye strapping:*** For plantar fasciitis, rigid strapping may be used to hold and support the arch (see **Figure 2**). This treatment allows patients to continue running and stand for stretches of time, and is often comfortable enough to sleep in.

***Orthotics*:** Plantar fasciitis is common in patients with biomechanical abnormalities, such as excessive pronation, high arches, or flat feet.1,2 Orthotics (custom made or over-the-counter) may be helpful in correcting these abnormalities. In addition, heel lifts may help reduce stress on the attachment of the Achilles tendon and plantar fascia to the calcaneus.

***Regenerative medicine:***Platelet-rich plasma (PRP) or stem cell injections may be used to regenerate torn or pathological tendon/ligament tissue.

***Other*:** Icing, cross-fiber massage over the tendon at the site of injury, battery powered massagers and deep tissue massage, ultrasound therapy, transcutaneous electrical nerve stimulation (TENS; for modifying pain receptors, releasing endorphins, or stimulating muscle relaxation), gait analysis, and night splints or walking boots (if severe) may be helpful at the discretion of the clinician.

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**Figure 1. Active (A) and passive (B) stretching of the Achilles tendon and plantar fascia.** Images courtesy of Dr. Pinzon and Mr. Chandler. [Dr. Pinzon: IF POSSIBLE PLEASE SEND ORIGINAL IMAGE IN HIGH RES- Will defer this to Mr. Chandler, PT- he could retake as needed]



**Figure 2. Low-dye strapping for plantar fasciitis.** Image courtesy of Dr. Chandler. [Mr. Chandler, PLEASE EMAIL HIGH RES VERSION. VERSION SENT BY TEXT IS CONVERTED TO LOW RES- Mr. Chandler will address]

**Rotator Cuff Tendonitis**

***Case vignette:*** To come: please discuss patient history, treatments, and outcome (eg- College/HS football quarterback, tennis age-grouper, master’s swimmer)

***History/Pathogenesis:***

The rotator cuff is composed of four muscles- supraspinatus, infraspinatus, teres minor, subscapularis. These muscles form a cover around the head of the humerus and whose function is to rotate the arm and stabilize the humeral head against the glenoid. Repetitive shoulder activity (especially overhead) creates degradation of the rotator cuff musculature (especially the supraspinatus) from tensile overload, insufficient blood circulation, aging, subacromial impingement, and ultimately results in tendonitis. Weakness in the rotator cuff muscles results in altered glenohumeral movement and creates impingement of the cuff muscles under the acromion and thereby enhancing the pain and inflammation.

***Treatments/Outcomes:***

NSAIDS (oral or topical); brief course of oral prednisone; subacromial/bursitis injection with musculoskeletal diagnostic ultrasound guidance; physical modalities (ice, therapeutic ultrasound, iontophoresis, phonophoresis, topical analgesia agents; electrical stimulation TENS, relative rest (limit overhead work to allow healing/decreased inflammation); flexibility exercises (to regain full ROM); strengthening of the shoulder girdle (deltoid, rotator cuff, biceps, triceps, scapular stabilizers) through full ROM; Sports-specific training for overhead athletes; rotator cuff muscle strengthening.

***Relative rest:*** Limit overhead work [DR. Pinzon: can you describe further?]*.* relative rest (limit overhead work to allow healing/decreased inflammation);

***Stretching:*** Flexibility exercises may help regain full range of motion at the shoulder.

***Strengthening*:** Progressive resistance training using Therabands (**Figure 3**) is needed for the four rotator cuff muscles and should focus on full range of motion with gradual return to overhead activity. [Dr. Pinzon: you mentioned plyometric exercises for the rotator cuff—can you explain why explosive movements are good for this rehab? After sufficient healing has occurred and stretching is completed- can initiate plyometric exercises to develop strength and endurance for the shoulder muscles) Also, can you give an example? Is throwing and catching a medicine ball and example?] Equally important is strengthening the surrounding accessory muscles (deltoid, biceps, triceps, pectoral muscles, and scapular stabilizers) to help compensate for the deficits in the injured muscle and allow it to heal. Retraining of the scapula-humeral rhythm and periscapular muscles should be sport specific. [Mr. Chandler: you mentioned an exercise sheet that shows home exercises for rotator cuff tendonitis. Could you please email an original copy of that sheet/images if you think it is appropriate to reprint?]

***Kinesio tape:*** Kinesio taping should be used to facilitate (ie, elevate and rotate) the affected rotator cuff muscles. [Any images of a patient’s shoulder with kinesio tape that you have taken yourself?- Will defer to Mr. Chandler, PT]

***Injections and regenerative medicine***: Intra-articular injection with a steroid (short-term) or hyaluronic acid and regenerative medicine techniques (eg, PRP and stem cell injections [Where are the injections given? At the site of inflammation in the tendon?- Usually depends on locations of pathology, based upon clinical evaluation or diagnostic (MRI/U-S/CT-guided) confirmations at multiple sights- anterior/posterior/lateral/superior with musculoskeletal diagnostic ultrasound guidance.] may be effective for rotator cuff tendonitis.

***Other:*** Ice, ultrasound therapy, iontophoresis, phonophoresis, topical anesthetic skin refrigerant, and TENS .

  
**Figure 3. Rotator cuff strengthening using a Theraband.** Photo courtesy of Dr. Pinzon. [Dr. Pinzon, Do you have a copy of the original high res image? We may no longer have the original version on file- I don’t, can you have Mr. Chandler take these and send to you?]

**Spine-Related Pain Conditions**

***Case vignette:*** Cyclist with spine issues? Dr. Chandler described: cyclists are in a tucked position, and their neck/head, is in hyper-extension or excessive extension, which causes nerve impingements and facet joint inflammation.(Ironman/Exterra endurance athlete- road cycling/runner/swimmer).

***History/Pathogenesis:***

Acute/subacute pain is felt in the lower lumbar, lumbosacral, or sacroiliac /pelvic regions. Often accompanied by sciatica or radiculopathy with pain radiating distally down to the sciatic nerve or radicular nerve distribution. >90% of people experience lower back pain over their lifetime, and 5-10% will experience chronic lower back pain. Lower back pain from spondylosis, spondylolisthesis, or spondylolysis occurs most frequently in the younger adolescent (10-18 yo)/young adult population (20-30 yo) and is most common in sports emphasizing prolonged extension activities (eg- gymnastics, ballet, volleyball, weight-lifting, football, or wrestling.

***Treatments/Outcomes:***

Relative rest (limit excessive lifting/contact activity to allow healing/decreased inflammation); OTC or prescribed analgesias (NSAIDs, topical analgesics); physical modalities (ice, therapeutic ultrasound, iontophoresis, phonophoresis, topical analgesia agents; electrical stimulation TENS, flexibility exercises (to regain full ROM); strengthening of the core abdominal/pelvis/lumbosacral/cervical/periscapular muscles (abdominals, quadriceps, hamstrings, gluteals, pelvic/shoulder stabilizers) through full ROM; body-mechanic and postural retraining; Sports-specific training for endurance athletes; weight-lifting strengthening; nutritional counseling and weight management strategies to assist to “unload” the spine during normal activities of daily living (ADLs).

***Relative rest:*** [Dr. Pinzon please describe what this entails for spine conditions in endurance athletes?](see above)

***Stretching:*** [anything to add here? Or would stretching fall under joint mobilization section below?](see above/below)

***Strengthening:*** Improve the overall strength and conditioning of the core stabilizers (transversus abdominus, internal obliques, multifidus, and lumbar transversospinalis) as well as the small posture muscles of the spine [Dr. Chandler, can you specify which ones? erector spinae, multifidus, semispinalis, quadratus lumborum?]. Strengthening the gluteus maximus and hamstrings for hip extension also is important***.***

***Postural correction/Manual physical therapy techniques/soft tissue mobilization: [****what should this section be called****?]*** TheMcKenzie Method or Maitland mobilizations emphasizing self-correction, proper posture, body mechanics, and self-management techniques, as well as chiropractic manipulations and soft tissue mobilization may be helpful.

***Orthotics:*** Temporary lumbar supports and cervical neck bracing may be necessary.

***Injections and procedures:*** Depending upon the source of spine pain condition- may consider diagnostic/therapeutic medial branch blocks, intra-articular facet joint injections, sacroiliac joint, selective transforaminal epidural injection, radiofrequency nerve ablation, and percutaneous epidural adhesiolysis have the potential to reduce axial and radicular pain and allow patients to facilitate physical therapy strategies and to assist to continue to train and eventually lead to competition. [Dr. Pinzon, you mentioned SCS and intrathecal drug delivery systems; do you think that these are appropriate to include for endurance athletes?- Probably not, so will exclude these options]

***Other:*** Ice, TENS unit, topical anesthetics.

**Recent Advances in Sports Medicine**

Several advances made in the past decade have improved the management of acute pain conditions in endurance athletes, preventing transformation into chronic conditions. First, in addition to well-known topical analgesics or over-the-counter lidocaine ointments, compounded topical analgesic medications such as baclofen, bupivacaine, capsaicin, diclofenac, gabapentin, ketamine, and ketoprofen, tramadol [Dr. Pinzon, please check if these are appropriate to include- YES- these are all appropriate] have become more frequently used for acute and chronic pain conditions.3-5 These compounded medications can be customized to included targeted and synergistic treatments such as topic analgesics, anti-inflammatory agents, muscle relaxants, neuroleptic agents, and mild opiates.

Second, regenerative medicine has made great strides in pain medicine and sports medicine. Injections of autologous PRP or mesenchymal stem cells may help heal ligaments, tendons, cartilage, and musculoskeletal regions that are damaged by overuse sports injuries.6-10 Future high-quality studies are needed to determine the most appropriate and effective use of these agents. In addition, ultrasound guidance has markedly improved the accuracy of delivery of these regenerative medicines as well as delivery of steroid, hyaluronic, and anesthetic injections.

Furthermore, diagnostic ultrasound is being used more often in sports medicine and physical therapy offices to determine if a patient has pathology in a tendon, ligament, or muscle, particularly if a patient presents with a joint or myofascial effusion. Earlier diagnosis may allow for earlier intervention, as opposed to waiting for more costly magnetic resonance imaging results.

**Conclusion**

Conservative treatments such as exercise therapy, stretching, manual therapies, kinesiotape, and injections should be exhausted before an athlete is referred for surgery. These nonsurgical approaches may allow for the same success rates with less complications compared with surgical approaches. Early intervention for these common acute pain conditions is essential to prevention progression to chronic pain, and primary care physicians can play a key role in diagnosing these conditions and referring patients for rehabilitation.

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*Dr. Pinzon and Mr. Chandler: ANY FINANCIAL OR SUPPORT DISCLOSURES TO REPORT? None noted/None known.*

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