

Pain Management for Elite Athletes



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Disclosures

- BOA Nutrition
 - Medical Consultant
- Sway Medical
 - Speaker

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Objectives

- Types of Pain
- Acute pain/Gameday
- Chronic pain
- Non-Pharmacological treatment
- Pharmacological treatment
 - Oral (opioids)
 - Injections
 - Topical
 - CBD/cannabis
- Orthobiologics (not discussed)

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 International Olympic Committee consensus statement on pain management in elite athletes

- Pain is a common problem among elite athletes
 - frequently associated with sport injury
- Both pain and injury interfere with the performance of elite athletes
- Currently no evidence-based or consensus-based guidelines for the management of pain in elite athletes

Hainline B, Derman W, Verneec A, et al. Br J Sports Med 2017;51:1245–1258

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 International Olympic Committee consensus statement on pain management in elite athletes

- Typically, pain management consists of:
 - analgesics, rest and physical therapy
- More appropriately, a treatment strategy should address:
 - underlying pathophysiology
 - biomechanical abnormalities
 - psychosocial issues
- should employ therapies providing optimal benefit and minimal harm

Hainline B, Derman W, Verneec A, et al. Br J Sports Med 2017;51:1245–1258

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 **Types of Pain**

- ‘Pain management’ includes a general understanding of pain physiology, including types of pain.
- By understanding types of pain, the clinician can better recommend an appropriate treatment plan
- 3 main pain types include:
 - Nociceptive
 - Neuropathic
 - Nociplastic/algopathic/nocipathic

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Nociceptive Pain

- This type of pain is associated with tissue damage or **inflammation**
- Most commonly associated with acute sport injury
- Inflammatory pain results from the activation and sensitization of nociceptors by inflammatory mediators and is associated with swelling and inflammation



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Neuropathic Pain

- results from a lesion or disease in the somatosensory nervous system
- common in Paralympic athletes with spinal cord injury
- Extremity injuries of peripheral nerves



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Nociplastic/Algopathic/Nocipathic

- Chronic pain syndromes
 - psychophysical findings (hypersensitivity) that suggest altered nociceptive functioning
 - Fibromyalgia
 - Functional low back pain



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Mechanisms of Injury

- Acute traumatic injury
- Overuse injury
- Subacute recurrent/chronic degenerative conditions

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Non-pharmacological Treatments

- Physical Therapy
 - Modalities
 - Structure and function
- Psychological aspects of injury
 - RTP considerations
 - Team dynamics
 - goal setting, imagery, relaxation and positive self-statements
- Sleep
 - Sleep and pain have a reciprocal relationship—
 - pain disturbs sleep
 - poor sleep quality or duration increases pain levels
 - decreases pain thresholds in otherwise healthy people
- Nutrition
 - Consider anti-inflammatory diet
 - Poor evidence
 - General nutrition guidelines
 - Supplements are poorly regulated

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Surgery

- May be considered when structural problem has been identified as pain generator
- Not to be used to treat chronic pain just because other interventions have failed

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 Ketorolac in Sports: Instant Superman?



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 Ketorolac in Sports: Instant Superman

- A lot of media hype
 - Safety (cardiac, renal, GI)
 - Bleeding in contact sports
- Consent
 - “lining up to get the shot”
- Ethics of administering pain medicine to play
- Team physician pressure by coaches, athletic trainers and players?
 - Visiting team requests for injection

“You can’t feel any pain,” Armstead told ABC of his experience with the drug. “You just feel amazing.”

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Ketorolac Use

- Do you or would you give ketorolac (IM, PO, IN) for gameday use for a specific **injury**?
 - Yes, oral or IN only
 - Yes
 - No

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Ketorolac Use

- Do you or would you give ketorolac (IM, PO, IN) pre-game for a prophylactic use?
 - Yes, oral or IN only
 - Yes
 - No

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Ketorolac Use

- If you have administered ketorolac, have you ever had an athlete have a **SERIOUS** adverse reaction?
 - Yes
 - No

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Ketorolac Use

- 29% of collegiate athletes take NSAIDs prior to game
- Tokish et al. in 2002 survey of NFL teams
 - 28 of 30 at the time used injectable ketorolac
 - Average 15 players per team
 - Many players felt shot was “more powerful”
 - 6 adverse reactions (non-serious)
- South Carolina football (per *The Charleston Post and Courier*)
 - 169 injections in 13 games in 2008

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Ketorolac Use

- Sawyer et al. 2012 survey of team physicians at HS, College, Pro levels
 - 1100 respondents (60% ortho/40% PCSM), only 16% response rate
 - 79% NCAA, 43% professional, 15% HS athletes given injection
 - 49% used ketorolac injectable
 - 95.8% effective for pain relief
 - 88% no reactions, 2.9% bleeding complications, 1.9% renal complication

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New Questions of Route of Administration

- Oral (10mg tablets) 20 minutes to peak plasma concentration, 6.5 hour half-life
 - In young, healthy adults
 - Only FDA approved after IV or IM administration
 - Maximum 40mg/ day
- IM (30, 60 mg) 45 minutes to peak plasma concentration, 6.5 hour half-life
- IN (31.5 mg) 30-45 minute peak plasma concentration, 5-6 hour half-life
 - Bioavailability 67% compared to IM so 30 mg IN = 20 mg IM
- Prudent to use oral or IN instead of IM or IV administration?

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Efficacy

- Meta-analysis in the post-operative setting shows opioid sparing pain relief when 60 mg IM toradol is used
- One study of 82 patients for musculoskeletal pain relief showed no difference of IM toradol with placebo pill vs ibuprofen 800 mg with saline injection in the ED setting
- Another ED study of 119 patients showed no difference of IM toradol 60 mg vs ibuprofen 800 mg.

De Oliveira GS Jr, Aguiar D, Bezerra HT. Perioperative single dose ketorolac to prevent postoperative pain: a meta-analysis of randomized trials. Anesth. Analg. 2012;114:424-33.
 Turunro MA, Paris PM, Seaberg DC. Intramuscular ketorolac versus oral ibuprofen in acute musculoskeletal pain. Ann. Emerg. Med. 1995;26:117-20.
 Neighton ML, Purtilo KA. Intramuscular ketorolac vs oral ibuprofen in emergency department patients with acute pain. Acad. Emerg. Med. 1998;5:118-22.

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Ketorolac Use

- No documented cases of severe complications
- Lawsuit by former NFL players that ketorolac contributed to increased injuries including worsening the effects of concussions
- Do players take less opioid and other pain medications if they are given toradol?

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Take Home Points

- Ketorolac is an effective pain reliever and available in IM, IV, PO, and IN
- Long-term complications from repetitive use in young, healthy athletes has not been established
- Ethical considerations of administering gameday pain medications so athletes can play must be considered

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Soft tissue Corticosteroid Injections



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Table 1. Common conditions treated with soft tissue injections in the athlete.¹⁹

Shoulder	Subacromial Bursitis
Knee	Pes anserine bursitis Prepatellar bursitis Iliotibial band syndrome Patellar tendinitis
Hip	Trochanteric bursitis Iliotibial bursitis Iliac crest contusion (hip pointer)
Elbow	Medial epicondylitis Lateral epicondylitis Olecranon bursitis
Wrist	Carpal tunnel syndrome DeQuervain's tenosynovitis
Hand	Trigger finger
Thigh/leg	Hamstring strain Quadriceps contusion/strain Gastrocnemius strain
Foot/ankle	Achilles/tibiotarsal tendinitis Stress fracture syndrome Plantar fasciitis Mediocranial phalangeal sprain (turf toe) Interdigital neuroma (Morton's neuroma)

¹⁹Adapted from Dieckel and Holland.

Where do I put the needle?

Nepple et al. Soft tissue injections in the athlete. Sports Health. Oct/Nov 2009

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Areas of Injection with consistent benefits

- Lateral epicondylitis
 - Short-term relief (<6 weeks)
 - Meta-analysis of randomized trials
- Medial epicondylitis
 - Single randomized trial
- Even though histological studies showing no inflammatory cells
- DeQuervain's
 - Improvement in 80% of cases with pooled literature review
- Trigger finger
 - 60-64% benefit compared to 16-20% with local anesthetic

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Observational studies with some benefit

- Pes anserine bursitis
 - 70% improvement over NSAIDs
- Trochanteric bursitis
 - 77% at 1 week, 69% at 6 weeks
- Morton's neuroma
 - About 50%
- No control groups with these studies

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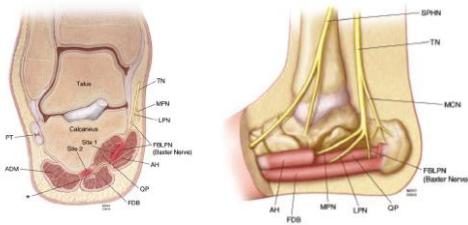
Little or no benefit

- Achilles tendinopathy
- Subacromial for rotator cuff disease
 - Koester et al. in 2007 with systemic review found "little reproducible evidence"
- Plantar heel pain
 - Randomized controlled trials show no benefit

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Baxter's Nerve Injection for Plantar Fasciitis

- Baxter's first brar nerve
- provi three quad minir brevi:
- also p heel l



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Baxter's Nerve Injection for Plantar Fasciitis



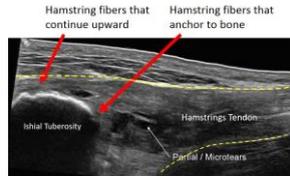
Figure 3. Stepwise ultrasonographic visualization of Baxter's nerve and cryoablation. A, Sonography of the tarsal tunnel showing the neurovascular structures and tendons. The inset in the left lower corner shows the US probe position with relation to the foot. B, Sonography just caudal of the tarsal tunnel showing branching of the posterior tibial nerve into medial and lateral plantar nerves. The block in the left lower corner shows the US probe position with relation to the foot. C, Sonography just caudal to Figure 3B position showing the take-off of BRN from the lateral tibial nerve. The inset in the left lower corner shows the US probe position with relation to the foot. D, Orientation of the probe for US-guided BRN block at proximal entrapment site. Needle insertion is from proximal to distal foot. E, US-guided BRN block highlighted with blue block arrow between adductor hallucis and quadratus plantae. White arrow shows direction of the needle (green) with second blue block arrow. AH indicates abductor hallucis; Ant, anterior; BRN, Baxter's nerve; FSL, flexor digitorum longus tendon; FHL, flexor hallucis longus tendon; LFN, lateral plantar nerve; MPN, medial plantar nerve; Post, posterior; OP, opponens digitorum; Talus, foot; Tibialis posterior tendon; US, ultrasound.

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Hamstring injections

- Levine et al. study in 58 NFL players
 - Retrospective review
 - No control
 - Minor hamstring injury, mid-substance
 - 2cc 1% lidocaine, 4mg dexamethasone
 - No activity for 48h, compression, ice
 - Only 16% (9) players missed a game
 - No complications



Levine WN, Bergfeld JA, Tessendorf W, Moorman CT. Intramuscular corticosteroid injection for hamstring injuries: a 13-year experience in the National Football League. *Am J Sports Med* 2005; 33:297-300

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General recommendations

- After failed NSAIDS, ice, rest, PT only
- No more than 3 in an area weeks apart
 - Repeat only if relief from previous injections
- Period of rest for protection post-injection
 - How long?
- Do not inject tendons!
- Not on gameday
- Not around infections
- Orthobiologics?



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Potential complications

- Local hypopigmentation
- Fat atrophy
- Tendon rupture or weakening
- ? Chondral effects
 - Studies are mixed
 - Local anesthetic used
- Steroid "flare"
- Systemic side effects
 - More with soft tissue vs intra-articular
 - Vasovagal, increased BP, flushing
 - Hyperglycemia up to 5 days with DM

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Local anesthetic Injections

- Na⁺ channel blockade which disrupts nerve conduction
- Many agents available depending on onset, duration of anesthesia, etc
- Signs of toxicity: flushing, hives, chest or abdominal pain, nausea, cardiac arrhythmia, seizures
- Surprising there are not many studies looking at gameday injections...not!
 - Luckily the Aussies have given us a couple to look at...

Orchard JW. Benefits and risks of using local anesthetic for pain relief to allow early return to play in professional football. Br J Sports Med. 2002;36:209-213.
Orchard JW. Is it safe to use local anesthetic painkilling injections in professional football? Sports Med. 2004;34(4):209-219

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Australian Rules FB and rugby

- 221 injections in joints and soft tissues over 6 years
- 1.7 players per game (10.7%) given bupivacaine w/wo epinephrine
- 86 (38.9%) injections were given for injuries sustained during that game
- most common sites of injection were:
 - rib, iliac crest, acromioclavicular joint, finger/thumb, and ankle

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Major Complications

- distal clavicle osteolysis following acromioclavicular joint injection
 - (n = 2)
- partial rupture of the Achilles tendon following local injection for tendinopathy
- chronic adductor tendinopathy following local injection for a partial tear
- prepatellar bursal infection
- carpal/radiocarpal degenerative disease after local injection for a scapholunate ligament tear done in an attempt to delay surgery until the offseason

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Minor complications

- inadvertent blocks of the lateral femoral cutaneous nerve following an iliac crest hematoma injection (n = 3)
- inadvertent partial sensory nerve blocks of the ankle (n = 2)
- worsening of a first metacarpal fracture
- sternoclavicular sprain
- rupture of the plantar fascia



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Conclusions

- Low-risk, high-benefit injections can be achieved at the following areas:
 - acromioclavicular joint, fingers, second through fifth metacarpals, ribs/sternum, iliac crest, and plantar fasciitis
- High-risk injections:
 - ankle sprains, tendon injuries, prepatellar/olecranon bursitis, first metacarpal injuries, and radiocarpal injuries
- The International Rugby Board has subsequently banned painkilling injections.
- Most other governing bodies, including the NFL and the National Collegiate Athletic Association, leave their use to the discretion of the treating team physician

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Risks of local injection

- A 1992 NFL Players Association survey found that 45% of players received local anesthetic injections immediately before competition at some point during their careers
- Orchard documented 5 litigation cases concerning the long-term negative consequences of local anesthetic injections in American professional sports (including the NFL and the National Basketball Association)
- local anesthetic injection into injured tendon, ligament, and muscle is likely to be associated with an increased risk of rupture or worsening of the traumatic or degenerative process
- Removal of pain as a feedback mechanism exposes the already compromised structure to the extreme forces seen with sporting competition

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Topical medications

- Advantage: Minimal systemic absorption
- Disadvantage: Local reaction/adhesive reaction
- Topical diclofenac
 - Gel or patch
- Lidocaine patch 5%
- Many custom preparations from compounding pharmacies
 - Include muscle relaxants, nerve agents, etc

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Where can you inject Gameday?

- For some, anywhere you want!
- Usually local anesthetic only
- AC joint
- Hip pointer
- Intercostal rib
- Avoid major and weight-bearing joints
- Some fractures?

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Opioid Use and Athletes



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Opioid Use After Common Sports Medicine Procedures: A Systematic Review

- 8 studies including 816 patients with a mean age of 43.8 years
- Mean of 610, 197, and 613 MMEs were prescribed to patients after arthroscopic procedures of the shoulder, knee, and hip
- more than half of patients discontinued opioid use within 3 days of surgery
- 31%, 34%, and 64% of the prescribed opioids provided after shoulder, knee, and hip arthroscopy, respectively, still remained
 - arthroscopic rotator cuff repair had the highest opioid consumption (471 MMEs), with 1 in 4 patients receiving a refill
- 64% were unaware of the appropriate disposal methods for surplus medication

Sheth et al. Sports Health 2020

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Table 4. Strategies and recommendations for safe opioid prescribing

Strategies and Recommendations (Level of Evidence)	
Preoperative	(1) Assess for history of opioid use, dependence, tolerance, and risk factors for opioid-related morbidity and mortality prior to surgery (4) (2) Educate patients regarding expectations of pain using in-office handouts/video advising patients on pain control through the postinjury, preoperative, and postoperative phases of care (1)
Perioperative	(1) Multimodal analgesia including regional anesthetics (1)
Postoperative	(1) Multimodal analgesia including regional anesthetics (1) (2) Procedure-specific prescribing (3) (3) Provide patients with several opioid prescriptions for smaller individual amounts (2) (4) Provide patients with explicit instructions on appropriate opioid safekeeping and disposal guidelines (3) (5) Consider opioid contract (5)

Sheth et al. Sports Health 2020

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How to Dispose of Unused Medication

- Check with pharmacist for take back program
- Check with local DEA law enforcement
- Flush down toilet
- Dispose in trash unlabeled with coffee grounds, dirt or cat litter in sealed bag

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Cannabinoids

- 2 major cannabinoids derived from Cannabis
- THC and CBD
- 2 types of cannabinoid receptors have been identified in the ECS
- CB1 receptor in the central nervous system
 - regulate excitatory and inhibitory neurotransmitters
- CB2 receptor present on immune cells
 - reduce inflammatory response
- Together both CB1 and CB2 receptors have roles in mediation of inflammatory pain

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BLUF

lack of consistent high-quality evidence for application of cannabinoid therapy for common athletic related indications

Research involving cannabinoid therapies in athletes is sparse

approximately 1 in 4 athletes report using cannabis

Docter S, Khan M, Gohal C, et al. Cannabis Use and Sport: A Systematic Review. Sports Health. 2020;12(2):189-199
Mauer, G, et al. Understanding Cannabis-Based Therapeutics in Sports Medicine. Sports Health Nov/Dec 2020;12(6):540-546

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 Considerations for Therapeutic Use in Athletes

- Acute Pain
 - Very limited small studies have not shown benefit
- Recovery
 - CBD has been linked to improvement in sleep at higher doses
 - Stimulating effects noted at lower doses
- Concussion
 - Proposed therapeutic effects are based on pre-clinical data demonstrating that modulating the ECS after traumatic brain injury (TBI) can have protective effects from these types of injuries

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 Considerations for Therapeutic Use in Athletes

- Chronic Pain
 - pain reduction and an opioid-sparing effect
- systematic review
 - 18 good-quality, randomized-controlled studies in the treatment of chronic non-cancer pain
 - various routes of administration and doses
 - modest efficacy overall
 - no serious adverse effects

Lynch ME, Campbell F. Cannabinoids for treatment of chronic non-cancer pain: a systematic review of randomized trials. *Br J Clin Pharmacol.* 2011;72:735-744

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 Safety and Side Effects

- FDA is clear that CBD
 - Has potential to cause harm, including liver injury, interactions with other drugs (prescription and nonprescription)
 - Can cause increased sedation or drowsiness when combined with other central nervous system depressants such as alcohol
 - short-term side effects of CBD
 - Somnolence
 - gastrointestinal distress
 - irritability/agitation
 - all of which can be improved with stopping CBD or decreasing the dose
 - long-term effects of how CBD affects the developing brain, fetus or breastfed newborn, and any potential reproductive effects is unknown

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