Top 10 MSK and Sports Medicine Injuries in Primary Care: Diagnosis and Management

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OAFP Conference 2026

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I have no disclosers

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Learning Objectives

1. Learners will be able to evaluate common MSK/Sports injuries
2. Learners will be able to diagnose common MSK/Sports injuries
3. Learners will be able to treat common MSK/Sports injuries

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Agenda

- Why are MSK injuries important to PCPs
- What is Sports Medicine
- What are some of the most common injuries seen by PCPs
- What tools can be used by PCPs to confidently diagnose injuries
- What initial steps can be made by PCP for treatment
- When to refer
- Who to refer to

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MSK Injuries in the PCP office

- Musculoskeletal complaints account for approximately 21-25% of all primary care visits in the United States
- Musculoskeletal injuries accounted for more than 65 million healthcare visits in the United States in 2010
- Estimated annual treatment cost of $176.1 billion in primary care

- Keavy R, Horton R, Al-Dadah O. The prevalence of musculoskeletal presentations in general practice: an epidemiological study. Fam Pract. 2023 Feb 9;40(1):68-74. doi: 10.1093/fampra/cmac055. PMID: 35747902.
- Nonpharmacologic and Pharmacologic Management of Acute Pain From Non–Low Back, Musculoskeletal Injuries in Adults: A Clinical Guideline From the American College of Physicians and American Academy of Family Physicians. Ann Intern Med. 2020;172:739-748. [Epub 18 August 2020]. doi:10.7326/M19-2602

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MSK Injuries

- Musculoskeletal disorders represent the top driver of healthcare spending in the United States, with an estimated direct annual cost of $380.9 billion in 2016
- MSK disorders are the single most expensive category of health conditions across the entire healthcare system.
  - Low back and neck pain: $134.5 billion (the single highest-spending condition among all 154 health conditions analyzed)
  - Other musculoskeletal disorders (joint/limb pain, myalgia, osteoporosis): $129.8 billion
  - Osteoarthritis: $80.0 billion
- Combined, these three MSK categories alone accounted for $344.3 billion, representing the #1, #2, and #8 most expensive health conditions in the United States—surpassing diabetes ($111.2 billion), ischemic heart disease ($89.3 billion), and all other major disease categories.

Dieleman JL, Cao J, Chapin A, et al. US Health Care Spending by Payer and Health Condition, 1996-2016. JAMA. 2020;323(9):863–884. doi:10.1001/jama.2020.0734

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Sports Medicine

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Sports Medicine- Training

COMPLETE RESIDENCY IN: FAMILY MEDICINE, INTERNAL MEDICINE, PEDIATRICS, EMERGENCY MEDICINE OR PHYSICAL MEDICINE AND REHABILITATION

1 YEAR FELLOWSHIP

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Sports Medicine: What we treat

Non-Surgical MSK injuries

Acute injuries

- Bursitis
- Fractures
- Joint injuries
- Sprains, strains and tears
- Tendinitis

Chronic/Overuse Injuries

- Osteoarthritis
- Overtraining syndrome
- Stress fractures
- Tendinopathy

Sports-related conditions

- Acute illness in athletes
- Sports concussions
- Relative Energy Deficiency in Sport (RED-S)
  - Previously Female Athlete Triad

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Sports medicine: What we can do

- Diagnostic MSK Ultrasound
- Casting and Splinting
- Landmark and Ultrasound-guided injections (everywhere but the spine)
  - Cortisone (steroid)
  - Hyaluronic acid (Synvisc, Duralane, etc)
  - Platelet Rich Plasma (PRP)
  - Stem Cell
  - Prolotherapy
  - Trigger point
- Minimally invasive procedures
  - Tenotomy
  - Barbotage
  - Hydrodissection
  - Nerve block
  - Extracorporeal Shockwave Therapy (ESWT)

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Low Back Pain

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Low Back Pain -History -

Age	<50-usually a strain >50-likely degenerative disk disease
Onset	Gradual Sudden/trauma
Duration	Acute <6 weeks Subacute 6-12 weeks Chronic >12 weeks
Character	Axial Radicular
Alleviating/Aggravating factors	
Red Flag Symptoms	Fever Unexplained weight loss, history of cancer Immunosuppression IV drug use Bowel/bladder dysfunction, saddle anesthesia, progressive neurologic deficits Significant trauma

Earwood JS MD, Doles NA DO, MSMEd, Russell RS MD, PhD/MSCR. Acute Low Back Pain: Diagnosis and Management. Am Fam Physician. 2025 Nov;112(5):526-536. PMID: 41252835.

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Low Back Pain -Exam -

- assess range of motion
- palpate for midline vs paraspinal tenderness
- perform straight-leg raise testing bilaterally
- complete neurologic examination
  - strength
    - hip flexion L2
    - knee extension L3-L4
    - ankle dorsiflexion L4-L5
    - great toe extension L5
    - ankle plantarflexion S1
  - sensation in dermatomal distribution
  - reflexes
    - patellar L4
    - Achilles S1

Complete Physical Exam Review
https://www.youtube.com/watch?v=q1gX9hORtLY

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Low Back Pain -Work Up -

- **No imaging** for uncomplicated acute low back pain without red flags - routine imaging does not improve outcomes and most cases are self-limited
- **MRI lumbar spine** (preferred) or CT if MRI contraindicated for: suspected cauda equina syndrome (emergent), red flag findings suggesting malignancy/infection/fracture, or severe/progressive neurologic deficits
- **Plain radiographs** only for: trauma with fracture concern (especially in older adults, chronic steroid use, osteoporosis), or to evaluate spondylolisthesis/spinal instability
- **Labs (CBC, ESR, CRP)** if infection, malignancy, or inflammatory conditions suspected
- Consider imaging after **4-6 weeks** if pain persists despite conservative therapy and patient is candidate for epidural injections or surgery

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Low Back Pain -Treatment -

Nonpharmacologic Treatments for Nonspecific Acute Low Back Pain

Intervention	Evidence
Usual activity with no bed rest	Small improvement in pain and function in nonradicular pain
	No difference in radicular pain
Heat therapy	Improves pain and range of motion
Acupuncture	Slightly improves pain and range of motion compared with placebo and pharmacotherapy (based on low-quality individual studies)
Dry needling	Improves postprocedure pain and pain-related disability
Transcutaneous electrical nerve stimulation	Reduces pain during and immediately after treatment compared with placebo
Weight loss after bariatric surgery	Reduction or elimination of pain
Reconsider recommending	**Evidence**
Exercise, physical therapy	Conflicting evidence in improving pain or decreasing recurrence
Osteopathic manipulative therapy	Little evidence for effectiveness in the acute period, questionable improvement in subacute or chronic low back pain

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Low Back Pain -Treatment -

Pharmacotherapy for Nonspecific Acute Low Back Pain

Intervention	Evidence
NSAIDs	Low to moderate pain reduction
Single-dose or short-interval systemic corticosteroids	For radicular pain: slightly improve function and slightly improve pain at short-term follow-up; use with caution
	No improvement for nonradicular pain
Trigger point injection (lidocaine or saline)	For myofascial pain: reduces pain by 2-3 points (10-point pain scale), compared with intravenous NSAID
Reconsider recommending	**Evidence**
Nonbenzodiazepine muscle relaxants	Only small improvements in pain and function with increased adverse effects
Benzodiazepines	Low efficacy and high potential for harm
Gabapentin and pregabalin	No better than placebo in nonradicular or radicular acute low back pain
Opioids	Do not significantly reduce acute low back pain, high potential for harm, guidelines recommend against
Acetaminophen	No more effective than placebo for acute low back pain

Earwood JS MD, Doles NA DO, MSMEd, Russell RS MD, PhD/MSCR. Acute Low Back Pain: Diagnosis and Management. Am Fam Physician. 2025 Nov;112(5):526-536. PMID: 41252835.

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Low Back Pain -Treatment – -6 weeks later-

- Work-up
  - Imaging
    - Lumbar Xray
    - Lumbar MRI without contrast
  - Physical therapy, if not already done
- Referral
  - Pain Medicine
    - injections
  - Neurosurgery or Orthopedic Spine Surgeon
    - Injections or surgery
  - No need to refer to Sports Medicine
    - unless PMnR trained and does spinal injections

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Neck Pain

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Neck Pain -History -

Age	<50-usually a strain >50-likely degenerative disk disease
Onset	Gradual Sudden/trauma
Duration	Acute <6 weeks Subacute 6-12 weeks Chronic >12 weeks
Character	Axial Radicular
Alleviating/Aggravating factors	
Red Flag Symptoms	Fever, unexplained weight loss, history of cancer Immunosuppression IV drug use Progressive neurologic deficits/gait instability Significant trauma

Eldaya R, Parsons M, Hutchins T ...
ACR Appropriateness Criteria® Cervical Pain or Cervical Radiculopathy: 2024 Update
Journal of the American College of Radiology, 22, S136-S162

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Neck Pain -Exam -

- assess range of motion
- palpate for midline vs paraspinal tenderness
- perform Spurling testing bilaterally
- complete neurologic examination
  - strength
    - deltoid/shoulder abduction, C5
    - biceps/wrist extension, C6
    - triceps/wrist flexion, C7
    - finger flexion, C8
    - finger abduction T1
  - sensation in dermatomal distribution
  - reflexes
    - biceps reflex, C6
    - brachioradialis reflex, C6
    - triceps reflex, C7

Complete Physical Exam Review
https://www.youtube.com/watch?v=jgXKA-eaHxA

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Neck Pain -Work Up -

- **No imaging** for uncomplicated acute neck pain without red flags - routine imaging does not improve outcomes and most cases are self-limited
- **MRI cervical spine** (preferred) or CT if MRI contraindicated for: red flag findings suggesting malignancy/infection/fracture, or severe/progressive neurologic deficits
- **Plain radiographs** only for: trauma with fracture concern (especially in older adults, chronic steroid use, osteoporosis
- **Labs (CBC, ESR, CRP)** if infection, malignancy, or inflammatory conditions suspected
- Consider imaging after **4-6 weeks** if pain persists despite conservative therapy and patient is candidate for epidural injections or surgery

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Neck Pain -Treatment-

American College of Physicians and American Academy of Family Physicians

- Topical NSAIDs with or without menthol gel as first-line therapy (strong recommendation, moderate-certainty evidence).
- Topical NSAIDs were the only intervention that improved all outcomes
  - pain reduction at less than 2 hours
  - Pain reduction at 1 to 7 days
  - physical function
  - symptom relief
  - treatment satisfaction.
- They are among the most effective interventions for treatment satisfaction (high-certainty evidence) and are not associated with a statistically significant increase in adverse effects.

Arnold MJ. Management of Acute Pain from Non-Low Back Musculoskeletal Injuries: Guidelines from AAFP and ACP. Am Fam Physician. 2020 Dec 1;102(11):697-698. PMID: 33252899.

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Neck Pain -Treatment-

American College of Physicians and American Academy of Family Physicians

- As second-line therapy
  - oral NSAIDs to reduce pain and improve physical function
  - oral acetaminophen to reduce pain
  - (conditional recommendation, moderate-certainty evidence).
- Oral NSAIDs
  - reduced pain at less than 2 hours and at 1 to 7 days
  - associated with greater likelihood of symptom relief
  - associated with increased risk for gastrointestinal adverse events including GI bleeding, abdominal pain, constipation, diarrhea, dyspepsia, nausea, and vomiting (moderate-certainty evidence).
- Acetaminophen
  - reduced pain at less than 2 hours and at 1 to 7 days on a 10-cm visual analogue scale
  - Clinicians should assess patients' risk factors (gastrointestinal and renal) and treatment preferences when choosing between oral NSAIDs and acetaminophen.

Arnold MJ. Management of Acute Pain from Non-Low Back Musculoskeletal Injuries: Guidelines from AAFP and ACP. Am Fam Physician. 2020 Dec 1;102(11):697-698. PMID: 33252899.

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Neck Pain -Treatment-

American College of Physicians and American Academy of Family Physicians

- Opioids should be avoided
- Acetaminophen plus opioids improved intermediate pain at 1 to 7 days (high-certainty evidence)
- tramadol was ineffective
- opioids increased the risk for gastrointestinal and neurologic harms (moderate-certainty evidence)
- Six percent of individuals at low risk for opioid abuse develop prolonged opioid use after receiving opioid therapy for short-term pain, with higher risk in cases of physical comorbidity, increased age, and opioid prescriptions for longer than seven days.

Arnold MJ. Management of Acute Pain from Non-Low Back Musculoskeletal Injuries: Guidelines from AAFP and ACP. Am Fam Physician. 2020 Dec 1;102(11):697-698. PMID: 33252899.

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Neck Pain -Treatment-

Other pharmacologic treatments

- Muscle relaxants for acute neck pain- useful
- Oral steroids for radicular pan-anecdotal
- Trigger point injections with local anesthetic (lidocaine, bupivacaine) for myofascial pain

Hurley RW, et. al. Consensus practice guidelines on interventions for cervical spine (facet) joint pain from a multispecialty international working group. Reg Anesth Pain Med. 2022 Jan;47(1):3-59. doi: 10.1136/rapm-2021-103031. Epub 2021 Nov 11. PMID: 34764220; PMCID: PMC8639967.

Steen JP, Jaiswal KS, Kumbhare D. Myofascial Pain Syndrome: An Update on Clinical Characteristics, Etiopathogenesis, Diagnosis, and Treatment. Muscle Nerve. 2025 May;71(5):889-910. doi: 10.1002/mus.28377. Epub 2025 Mar 20. PMID: 40110636; PMCID: PMC11998975.

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Neck Pain -Treatment-

Non-pharmacologic treatments

- Physical Therapy –moderate quality evidence
- Motor control exercises: yoga, pilates, tai chi, qigong –very low quality evidence
  - Combining motor control with segmental exercises provided moderate to very large pain reduction
- Manual Therapy –low-certainty evidence
- Acupuncture—systematic review significantly reduces pain intensity
- TENS-very low certainty

Gross A, Kay TM, et.al. Exercises for mechanical neck disorders. Cochrane Database of Systematic Reviews 2015, Issue 1. Art. No.: CD004250. DOI: 10.1002/14651858.CD004250.pub5. Accessed 15 April 2026.

de Zoete RM, Armfield NR, McAuley JH, Chen K, Sterling M. Comparative effectiveness of physical exercise interventions for chronic non-specific neck pain: a systematic review with network meta-analysis of 40 randomised controlled trials. Br J Sports Med. 2020 Nov 2:bjsports-2020-102664. doi: 10.1136/bjsports-2020-102664. Epub ahead of print. PMID: 33139256.

Price J, Rushton A, Tyros I, Tyros V, Heneghan NR. Effectiveness and optimal dosage of exercise training for chronic non-specific neck pain: A systematic review with a narrative synthesis. PLoS One. 2020 Jun 10;15(6):e0234511. doi: 10.1371/journal.pone.0234511. PMID: 32520970; PMCID: PMC7286530.

Amir Qaseem, Robert M. McLean, David O'Gurek, et al; Nonpharmacologic and Pharmacologic Management of Acute Pain From Non–Low Back, Musculoskeletal Injuries in Adults: A Clinical Guideline From the American College of Physicians and American Academy of Family Physicians. Ann Intern Med.2020;173:739-748.

Xie CR, et al Effectiveness of Acupuncture for Neck Pain: Systematic Review and Meta-analysis with Trial Sequential Analysis. J Pain Res. 2025 Nov 25;18:6297-6316. doi: 10.2147/JPR.S558059. PMID: 41322280; PMCID: PMC12664314.

Martimbianco ALC, Porfirio GJM, Pacheco RL, Torloni MR, Riera R. Transcutaneous electrical nerve stimulation (TENS) for chronic neck pain. Cochrane Database of Systematic Reviews 2019, Issue 12. Art. No.: CD011927. DOI: 10.1002/14651858.CD011927.pub2. Accessed 15 April 2026.

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Neck Pain -Treatment – -6 weeks later-

- Work-up
  - Imaging
    - Cervical Xray
    - Cervical MRI without contrast
  - Physical therapy, if not already done
- Referral
  - Pain Medicine
    - injections
  - Neurosurgery or Orthopedic Spine Surgeon
    - Injections or surgery
  - No need to refer to Sports Medicine
    - unless PMnR trained and does spinal injections

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Knee Pain

Acute Injury, age <40

-ACL, Meniscus, PFS-

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Things to consider

- Trauma or not?
- Effusion or not?
- Location of pain (medial, lateral, anterior, posterior)

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Most common knee complaints

- Patellofemoral pain syndrome (PFPS)– poor patellar tracking
- Meniscus
- ACL

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Patellofemoral pain syndrome -presentation-

- Anterior knee pain
- Pain with knee flexion
  - Squats
  - Stairs
  - Prolonged sitting
- There can be a patellar pop, catching, grinding, giving away or instability
- Physical Exam
  - Patellar facet tenderness
  - J sign
  - Pain with patellar grind test
  - Pain with double leg squat
  - Weakness with single leg squat

Duong V, Oo WM, Ding C, Culvenor AG, Hunter DJ. Evaluation and Treatment of Knee Pain: A Review. *JAMA*. 2023;330(16):1568–1580. doi:10.1001/jama.2023.19675

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Patellofemoral pain syndrome -workup- & -treatment-

- Workup
  - None
  - X-rays ?
    - Weight-bearing AP and notch, lateral view, and axial patellar view at 30° or 45° of knee flexion (e.g., Merchant and sunrise views)
- Treatment
  - Physical Therapy
- Referral
  - Sports Medicine
    - after no improvement with 6 weeks of PT
    - cannot tolerate PT as it is too painful

Duong V, Oo WM, Ding C, Culvenor AG, Hunter DJ. Evaluation and Treatment of Knee Pain: A Review. *JAMA*. 2023;330(16):1568–1580. doi:10.1001/jama.2023.19675

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Meniscus Tear

- Presentation
  - Acute onset
  - Often a twist mechanism present
  - Plant and turn
  - Patient may describe a pop
  - Clicking or locking
- Physical Exam
  - Effusion present
  - Medial/lateral joint line tenderness: 83% sensitivity, 83% specificity
  - McMurray test: 61% sensitivity and 84% specificity
  - Thessaly test: 64% sensitivity and 53% specificity when performed alone

Duong V, Oo WM, Ding C, Culvenor AG, Hunter DJ. Evaluation and Treatment of Knee Pain: A Review. *JAMA*. 2023;330(16):1568–1580. doi:10.1001/jama.2023.19675

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Meniscus -workup- & -treatment-

- Workup
  - X-rays ?
    - Rule out osteoarthritis
  - MRI ?
    - Traumatic tear that cannot be confirmed clinically by an orthopedist
    - Persistent symptoms without clear diagnosis
    - Preoperative planning to specify tear type and evaluate ligaments
    - Concerning symptoms (unexplained weight loss, night sweats) to exclude malignancy
- Treatment
  - Physical Therapy –FIRST LINE
    - 3 months or longer as first line treatment
  - At least 4-6 week trail period of non operative management
- Referral
  - Sports Medicine –if wanting to continue non operative approach
  - Orthopedic Surgery—if wanting to pursue surgery

Duong V, Oo WM, Ding C, Culvenor AG, Hunter DJ. Evaluation and Treatment of Knee Pain: A Review. *JAMA*. 2023;330(16):1568–1580. doi:10.1001/jama.2023.19675

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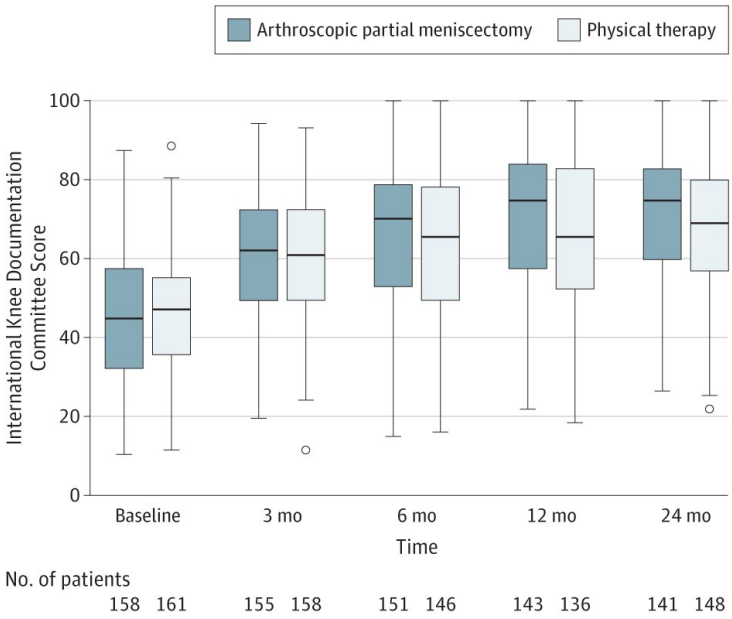
Meniscus ESCAPE Trial



van de Graaf VA, Noorduyn JCA, Willigenburg NW, et al. Effect of Early Surgery vs Physical Therapy on Knee Function Among Patients With Nonobstructive Meniscal Tears: The ESCAPE Randomized Clinical Trial. JAMA. 2018;320(13):1328–1337. doi:10.1001/jama.2018.13308

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Meniscus -workup- & -treatment-

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ACL injury

- Presentation
  - Noncontact injuries (>70% of cases)
    - Sudden deceleration, pivoting, or landing maneuvers
  - Contact injuries
    - Translational force applied to the anterior aspect of a fixed lower leg
  - Audible "pop", immediate pain
  - Sensation of instability or "giving out"
  - Rapid effusion with hemarthrosis (within 2 hours)
  - Difficulty/inability to continue activity/full weight bearing
- Physical Exam
  - Effusion present
  - Lachman Test: sensitivity of 85% and specificity of 94%
  - Pivot Shift Test: highly specific (98%) but less sensitive (24%)
  - Anterior Drawer Test: sensitivity and specificity in chronic conditions (92% and 91%, respectively) but performs poorly in acute settings
  - Lever Sign Test: sensitivity of 79% and specificity of 92%

Huang Z, Liu Z, Fan C, Zou M, Chen J. Value of clinical tests in diagnosing anterior cruciate ligament injuries: A systematic review and meta-analysis. Medicine (Baltimore). 2022 Aug 5;101(31):e29263. doi: 10.1097/MD.0000000000029263. PMID: 35945782; PMCID: PMC9351841.

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ACL -workup- & -treatment-

- Workup
  - X-rays
    - Rule out fracture
    - Segond Fracture
      - Avulsion fracture of lateral tibial plateau associated with ACL
  - MRI
- Treatment—while awaiting MRI/surgery referral
  - Physical Therapy (3-8 weeks)
    - Improves postoperative outcomes
  - Protected weight bearing
  - Anything in a straight line as long as not painful
- Referral
  - Sports Medicine –if wanting non operative approach, straight line activities
  - Orthopedic Surgery—if wanting to pursue surgery

Zakharia A, Zhang K, Al-Katanani F, Rathod P, Uddandam A, Kay J, Murphy B, Ogborn D, de Sa D. Prehabilitation prior to anterior cruciate ligament reconstruction is a safe and effective intervention for short- to long-term benefits: A systematic review. Knee Surg Sports Traumatol Arthrosc. 2025 Dec;33(12):4148-4166. doi: 10.1002/ksa.12631. Epub 2025 Apr 25. PMID: 40276858.

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Knee exam

- https://www.youtube.com/watch?v=M8RyFNN1ZRw

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Knee Pain

Osteoarthritis

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Knee OA -presentation-

- Age > 45 years
- Symptoms
  - Activity related knee pain
  - Brief morning stiffness
  - Functional limitations
  - Swelling
  - Buckling/giving way
  - Crepitus
- Risk Factors
  - Older age
  - Female sex
  - Obesity
  - Previous knee injury
  - Occupational factors
  - Knee malalignment
  - Quadriceps muscle weakness

Duong V, Oo WM, Ding C, Culvenor AG, Hunter DJ. Evaluation and Treatment of Knee Pain: A Review. *JAMA*. 2023;330(16):1568–1580. doi:10.1001/jama.2023.19675

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Knee OA -Physical Exam- & -Work-up-

- Physical Exam
  - Crepitus: 89% sensitivity, 60% specificity
  - Bony Enlargement: 55% sensitivity, 95% specificity
  - Restricted Range of Motion: 17% sensitivity, 96% specificity
- Work up
  - None
  - Xrays
    - **Weight-bearing AP!!!**
  - MRI
    - Persistent mechanical symptoms with **objective** locking (possible displaced meniscal tear)
    - Suspicion of subchondral insufficiency fracture
    - Suspicion of tumor or infection requiring urgent treatment

Duong V, Oo WM, Ding C, Culvenor AG, Hunter DJ. Evaluation and Treatment of Knee Pain: A Review. *JAMA*. 2023;330(16):1568–1580. doi:10.1001/jama.2023.19675

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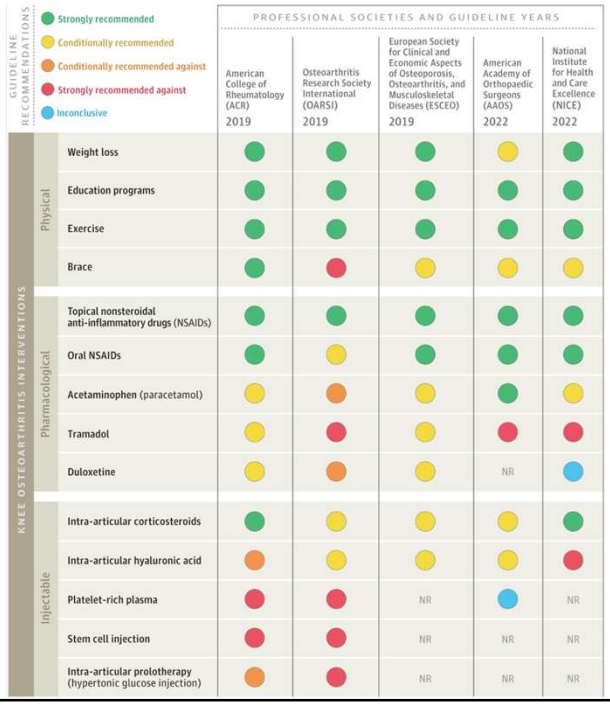
Knee OA -Referral-



Duong V, Oo WM, Ding C, Culvenor AG, Hunter DJ. Evaluation and Treatment of Knee Pain: A Review. *JAMA*. 2023;330(16):1568–1580. doi:10.1001/jama.2023.19675

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Knee OA -Treatment-

- Sports Medicine
  - Not ready for surgery
  - Injections for pain management
- Orthopedic Surgeon
  - Ready for total knee replacement
  - Wanting information on total knee to plan

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Sports Medicine -Injections for knee OA-

- **Corticosteroid injections** are strongly recommended for short-term pain relief.
  - Large pain reduction and functional improvement for up to 6 weeks
  - Useful adjunct for acute flares or upcoming life events
  - Not recommended for regular use
    - Triamcinolone every 3 months for 2 years resulted in greater cartilage loss than saline
    - greater OA progression on MRI compared to controls and hyaluronic acid
- **Intraarticular ketorolac (Toradol) injection** provides comparable pain relief to corticosteroid injection for knee osteoarthritis, with similar efficacy lasting up to 3-6 months.
  - ketorolac is not mentioned in major osteoarthritis treatment guidelines (ACR 2019, AAOS 2022, NICE 2022), which focus primarily on corticosteroid injections as the standard intraarticular therapy.
- **Hyaluronic acid injections** - Recommendations are inconsistent across guidelines
  - Some evidence suggests 2-4 injections provide moderate pain relief at 3 months
- **Combined corticosteroid plus hyaluronic acid** may provide superior pain relief compared to hyaluronic acid alone at 2-4 weeks, 24-26 weeks, and 52 weeks.
- **Other intraarticular therapies** (platelet-rich plasma, stem cells, prolotherapy) - Strongly recommended against or have uncertain long-term effectiveness

- Duong V, Oo WM, Ding C, Culvenor AG, Hunter DJ. Evaluation and Treatment of Knee Pain: A Review. *JAMA*. 2023;330(16):1568–1580. doi:10.1001/jama.2023.19675
- Jurgensmeier K, Jurgensmeier D, Kunz DE, Fuerst PG, Warth LC, Daines SB. Intra-articular Injections of the Hip and Knee With Triamcinolone vs Ketorolac: A Randomized Controlled Trial. J Arthroplasty. 2021 Feb;36(2):416-422. doi: 10.1016/j.arth.2020.08.036. Epub 2020 Aug 22. PMID: 32950343.

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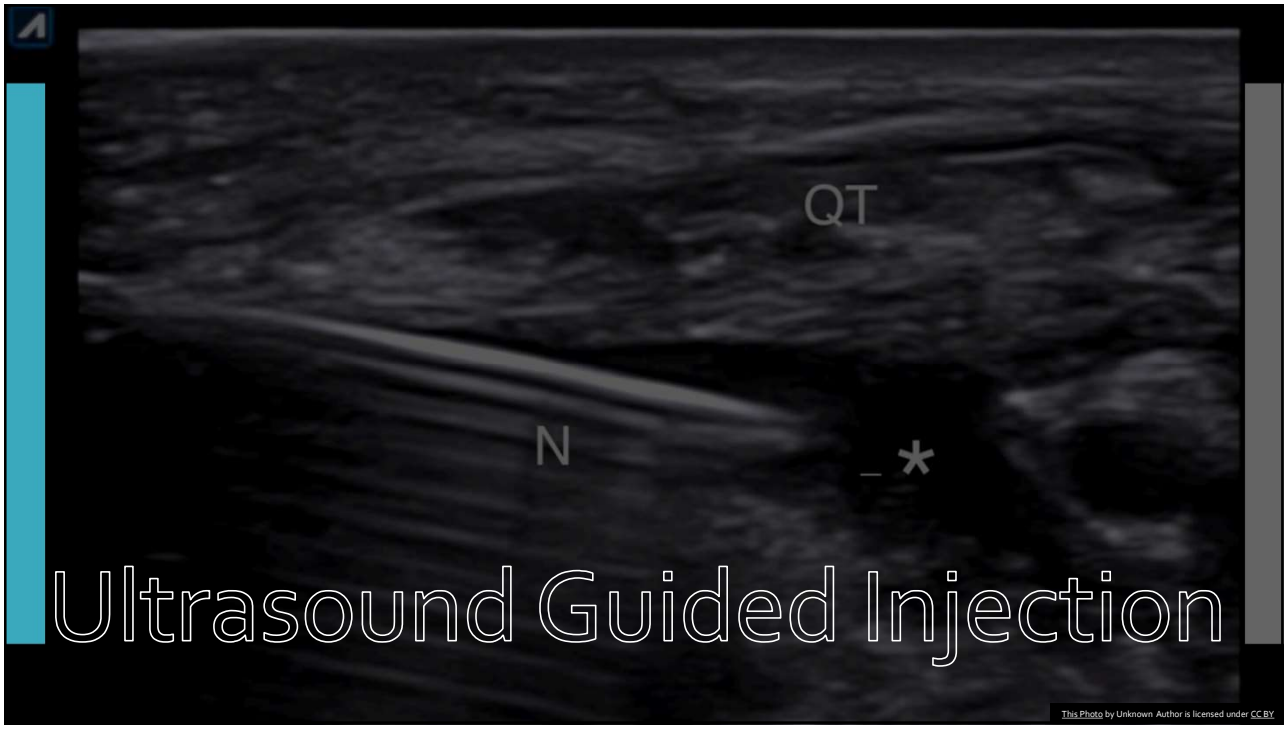

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	Level of Evidence				
	Level 1, Mean (Range), %	Level 2, Mean (Range), %	Level 3, Mean (Range), %	Level 4, Mean (Range), %	Level 5, Mean (Range), %
GH joint					
USGI	100 (97-100)[8,15,39,42,46,49]	91 (89-93)[5,38]	—	100[16]	—
LMGI	64 (27-100)[7,10,24,31,40,43,47]	73 (10-100)[5,11,17,25,26,28,38,60,61]	—	—	—
Hip joint					
USGI	99 (97-100)[8,27,41,44,45]	—	—	100[30]	100[44]
LMGI	—	73 (67-78)[12,50]	—	—	—
Knee joint					
USGI	95 (75-100)[8,21,23,32,36,37]	98 (96-100)[59]	—	100[16]	100[20]
LMGI	81 (62-100)[10,19,21–23,31,32,36,37,48]	74 (55-100)[5,9,10,13,26]	—	—	—
SI joint					
USGI	40[18]	—	100[34]	—	—
LMGI	—	—	—	—	—

Why US guided injections?

Finnoff, J., et al. (2015) AMSSM Position Statement: Interventional Musculoskeletal Ultrasound in Sports Medicine. Journal of Sports Medicine 25(1): 6-22

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	Level of Evidence				
	Level 1, Mean (Range), %	Level 2, Mean (Range), %	Level 3, Mean (Range), %	Level 4, Mean (Range), %	Level 5, Mean (Range), %
SC joint					
USGI	—	—	—	—	—
LMGI	—	78 (74-82)[79]	—	—	—
AC joint					
USGI	—	95 (90-100)[63,70]	—	—	—
LMGI	—	52 (33-72)[63,69,70,72,78]	—	—	0[26]
Elbow joint					
USGI	—	—	—	100[16]	—
LMGI	97 (83-100)[26,31]	—	—	—	—
Distal RU joint					
USGI	—	100[77]	—	—	—
LMGI	—	—	—	—	—
Wrist joint					
USGI	100[8]	—	—	100[16]	—
LMGI	74 (50-97)[26,31]	—	—	—	—
STT joint					
USGI	—	100[74]	—	—	—
LMGI	—	80[74]	—	—	—
Proximal TF joint					
USGI	—	100[76]	—	—	—
LMGI	—	58[76]	—	—	—
TT joint					
USGI	—	100 (100)[66,71,80]	—	100[16]	—
LMGI	64 (50-77)[26,31]	87 (78-100)[65,66,80]	—	—	—
ST joint					
USGI	—	97 (90-100)[66,71,75]	—	—	—
LMGI	—	89 (68-100)[66–68]	—	—	—
Elbow, wrist, TT joint					
USGI	—	100[52]	—	—	—
LMGI	—	29[52]	—	—	—

Finnoff, J., et al. (2015) AMSSM Position Statement: Interventional Musculoskeletal Ultrasound in Sports Medicine. Journal of Sports Medicine 25(1): 6-22

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	Level of Evidence				
	Level 1, Mean (Range), %	Level 2, Mean (Range), %	Level 3, Mean (Range), %	Level 4, Mean (Range), %	Level 5, Mean (Range), %
CMC joint					
USGI	—	94[82]	100[52]	—	—
LMGI	—	—	0[26,52]		
MCP joint					
USGI	—	—	—	—	—
LMGI	97[31]	—	—	—	0[26]
IP joint					
USGI	—	—	100[52]	—	—
LMGI	—	—	0[52]	—	0[26]
TMT joint					
USGI	—	64[66]	—	—	—
LMGI	—	25[66]	—	—	—
MTP joint					
USGI	—	100[71,83]	100[52]	—	—
LMGI	—	—	0[52]	—	—
MCP and PIP joints					
USGI	—	—	96[81]	—	—
LMGI	—	—	59[81]	—	—

Finnoff, J., et al. (2015) AMSSM Position Statement: Interventional Musculoskeletal Ultrasound in Sports Medicine. Journal of Sports Medicine 25(1): 6-22

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What is PRP?

- Preparation of autologous human plasma with an increased platelet concentration produced by centrifuging a larger volume of a patient's own blood
- Platelets contain a plethora of growth factors and mediators in their alpha granules
  - TGF-β1 (Transforming Growth Factor Beta 1)
  - PDGF (Platelet-Derived Growth Factor)
  - bFGF (Basic fibroblast growth factor)
  - VEGF (Vascular endothelial growth factor)
  - EGF (Epidermal growth factor)
  - IGF-1 (Insulin like growth factor)
- Normal human platelet count ranges anywhere from 150,000 to 350,000/μL
- Improvements in bone and soft tissue healing have been demonstrated with concentrated platelets of up to 1,000,000/μL

Le, et. al. (2018) Current Clinical Recommendations for the Use of Platelet-Rich Plasma. Current Reviews in Musculoskeletal Medicine. 11: 624-634

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Leukocytes and PRP

- Leukocyte-rich PRP (LR-PRP) preparations, defined as having a neutrophil concentration above baseline
  - Pro-inflammatory effects
  - Elevate catabolic cytokines, IL-1β, TNF-α and metalloproteinases, which may antagonize the anabolic cytokines contained within platelets
- Leukocyte-poor PRP (LP-PRP) preparations, defined as having a leukocyte (neutrophil) concentration below baseline.
  - Anti-inflammatory effects
  - IL-4 and IL-10
  - IL-10 may also suppress the release of inflammatory mediators (IL-1β, TNF-α, IL-6) and block the inflammatory pathway by neutralizing nuclear factor-kB activity

Le, et. al. (2018) Current Clinical Recommendations for the Use of Platelet-Rich Plasma. Current Reviews in Musculoskeletal Medicine. 11: 624-634

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Le, et. al. (2018)

Preparation

There is no general consensus on the optimal PRP preparation with respect to concentration of blood components and there are currently many different commercial PRP systems that are available on the market

Curr Rev Musculoskelet Med (2018) 11:624–634

Table 1 Commercially available PRP systems and their PRP preparations

System	Company	Blood volume required (mL)	Concentrated volume produced (mL)	Processing time (min)	PPP produced?	Increase in [platelets] (times baseline)	Platelet capture efficiency (% yield)
Leukocyte-rich PRP							
Angel	Arthrex	52 [6]	1–20[a]	17 [6]	+	10[a]	56–75% [6]
GenesisCS	EmCyte	54 [6]	6 [6]	10 [6]	+	4–7 [6]	61 ± 12% [6]
GPS III	Biomet	54 [6]	6 [6]	15 [6]	+	3–10 [6]	70 ± 30% [6]
Magellan	Isto Biologics/Arteriocyte	52 [6]	3.5–7 [6]	17 [6]	+	3–15 [6]	86 ± 41% [6]
SmartPReP 2	Harvest	54 [6]	7 [6]	14 [6]	+	5–9 [6]	94 ± 12% [6]
Leukocyte-poor PRP							
Autologous conditioned plasma (ACP)	Arthrex	11 [7]	4 [7]	5 [7]	–	1.3 [7]	48 ± 7% [7]
Cascade	MTF	18 [8]	7.5 [8]	6 [8]	–	1.6 [8]	68 ± 4% [8]
Clear PRP	Harvest	54[a]	6.5[a]	18[a]	+	3–6[a]	62 ± 5%[a]
Pure PRP	EmCyte	50[a]	6.5[a]	8.5[a]	+	4–7[a]	76 ± 4%[a]

[a] Data obtained from manufacturers' promotional literature or internal studies

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Athrex Angel

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Le, et. al. (2018)

Blood Volume Required (mL)	Concentrated volume produced (mL)	Processing time (min)	PPP produced ?	Increase in platelets times baseline	Platelet capture efficacy (% yield)
52	1-20	17	+	10	56-75

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[a] Data obtained from manufacturers' promotional literature or internal studies

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Arthrex ACP

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Le, et. al. (2018)

Blood Volume Required (mL)	Concentrated volume produced (mL)	Processing time (min)	PPP produced ?	Increase in platelets times baseline	Platelet capture efficacy (% yield)
11	4	5	-	1.3	48+/-7

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[a] Data obtained from manufacturers' promotional literature or internal studies

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Pure PRP Emcyte

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Le, et. al. (2018)

Blood Volume Required (mL)	Concentrated volume produced (mL)	Processing time (min)	PPP produced ?	Increase in platelets times baseline	Platelet capture efficacy (% yield)
50	6.5	8.5	+	4-7	76+/-4

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[a] Data obtained from manufacturers' promotional literature or internal studies

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Harvest Smart Prep PRP

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Le, et. al. (2018)

Blood Volume Required (mL)	Concentrated volume produced (mL)	Processing time (min)	PPP produced ?	Increase in platelets times baseline	Platelet capture efficacy (% yield)
54	7	14	+	5-9	94+/-12

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Clear PRP	Harvest	54[a]	6.5[a]	18[a]	+	3–6[a]	62 ± 5%[a]
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[a] Data obtained from manufacturers' promotional literature or internal studies

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Cost of PRP

- Kits range $100-$1500
- Charge in Oregon $600-$2,500
- Out of Pocket

- Providence-Tanasbourne
  - Arthrex ACP
  - Charge $680

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PRP for Knee OA

- A 2024 network meta-analysis of 48 studies (9,338 knees) found that at ≥6-month follow-up,
  - PRP had the highest probability of improvement in both pain and function (SUCRA 91.54)
  - followed by bone marrow aspirate concentrate (76.46)
  - hyaluronic acid (53.12)
  - corticosteroids (15.18)
  - PRP injections have been shown to provide longer-lasting effects compared to the short-term benefit of corticosteroid injections.
- PRP injections have been shown to provide longer-lasting effects compared to the short-term benefit of corticosteroid injections.

- Jawanda H, et.al. Platelet-Rich Plasma, Bone Marrow Aspirate Concentrate, and Hyaluronic Acid Injections Outperform Corticosteroids in Pain and Function Scores at a Minimum of 6 Months as Intra-Articular Injections for Knee Osteoarthritis: A Systematic Review and Network Meta-analysis. Arthroscopy. 2024 May;40(5):1623-1636.e1. doi: 10.1016/j.arthro.2024.01.037. Epub 2024 Feb 7. PMID: 38331363.
- Laver L, Fiet.al. The use of injectable orthobiologics for knee osteoarthritis: A European ESSKA-ORBIT consensus. Part 1-Blood-derived products (platelet-rich plasma). Knee Surg Sports Traumatol Arthrosc. 2024 Apr;32(4):783-797. doi: 10.1002/ksa.12077. Epub 2024 Mar 4. PMID: 38436492.

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PRP for Knee OA -Consensus statements-

- The **American Academy of Orthopaedic Surgeons (AAOS)** provides a **limited recommendation** that platelet-rich plasma (PRP) **may reduce pain and improve function** in patients with symptomatic knee osteoarthritis
- The **European Society of Sports Traumatology, Knee Surgery and Arthroscopy (ESSKA)** 2024 consensus reached strong agreement that:
  - There is sufficient preclinical and clinical evidence to support PRP use in knee osteoarthritis (Grade A recommendation)
  - Clinical evidence supports effectiveness in **mild-to-moderate disease**
  - PRP provides longer-lasting effects than corticosteroids with a safer profile
  - PRP may be considered a **first-line injectable treatment option** for nonoperative management
- The **American Medical Society for Sports Medicine (AMSSM)** published a 2021 position statement on regenerative medicine in sports medicine, which addresses PRP for knee osteoarthritis. According to the AMSSM, research suggests that **PRP injections are more effective in reducing pain and improving function than steroid or hyaluronic acid injections for knee OA, particularly in those who are younger and have mild to moderate disease**.

- Management of Osteoarthritis of the Knee (Non-Arthroplasty): Evidence-Based Clinical Practice Guideline. American Academy of Orthopaedic Surgeons (2021). 2021.
- Laver L, Filardo G, Sanchez M, Magalon J, Tischer T, Abat F, Bastos R, Cugat R, Iosifidis M, Kocaoglu B, Kon E, Marinescu R, Ostojic M, Beaufils P, de Girolamo L; ESSKA-ORBIT Group. The use of injectable orthobiologics for knee osteoarthritis: A European ESSKA-ORBIT consensus. Part 1-Blood-derived products (platelet-rich plasma). Knee Surg Sports Traumatol Arthrosc. 2024 Apr;32(4):783-797. doi: 10.1002/ksa.12077. Epub 2024 Mar 4. PMID: 38436492.
- Finnoff, Jonathan T. DO*; Awan, Tariq M. DO†; Borg-Stein, Joanne MD‡; Harmon, Kimberly G. MD§; Herman, Daniel C. MD, PhD¶; Malanga, Gerard A. MD‖; Master, Zubin PhD**; Mautner, Kenneth R. MD††,‡‡; Shapiro, Shane A. MD§§. American Medical Society for Sports Medicine Position Statement: Principles for the Responsible Use of Regenerative Medicine in Sports Medicine. Clinical Journal of Sport Medicine 31(6):p 530-541, November 2021. | DOI: 10.1097/JSM.0000000000000973

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Shoulder Pain

Rotator Cuff

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Rotator Cuff Pain -Presentation-

- Lateral Shoulder Pain
  - Radiating to upper outer arm
- Night Pain
  - Difficulty sleeping on affected side
- Pain with overhead activities
- Painful abduction (between 60-120 degrees)
- Tendonitis: more gradual onset
- Acute tear: onset after trauma
  - Fall on outstretched arm, catching heavy object
  - Immediate marked weakness
- Degenerative Tear: onset similar to tendonitis, but more weakness

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Rotator Cuff Pain -Exam-

Physical Exam Review

https://www.youtube.com/watch?v=VcCAHbiEcZo

Table 3. Accuracy of Physical Examination Maneuvers for Rotator CuffDisease or Full Rotator CuffTears From Quality Level 1-2 Studies [a]

Finding	Rotator Cuff Condition	Studies, No.	% (95% CI)		LR (95% CI)	
			Sensitivity	Specificity	Positive	Negative
Pain provocation tests						
Painful arc[45]	Disease	1	71 (60-83)	81 (68-93)	3.7 (1.9-7.0)	0.36 (0.23-0.54)
Cross-body adduction[45]	Disease	1	75 (64-85)	61 (46-76)	1.9 (1.3-2.9)	0.42 (0.26-0.68)
Hawkins[44,45,48]	Disease	3[b]	76 (56-89)	48 (23-74)	1.5 (1.1-2.0)[c]	0.51 (0.39-0.66)[d]
Neer[45,48]	Disease	2[e]	64-68	30-61	0.98-1.6	0.60-1.1
Yocum[48]	Disease	1	79 (61-97)	40 (10-70)	1.3 (0.75-2.3)	0.53 (0.17-1.7)
Passive abduction[48]	Disease	1	74 (54-93)	10 (0-29)	0.82 (0.58-1.1)	2.6 (0.35-20)
Strength tests						
External rotation lag[47]	Full tear	1	47 (21-71)	94 (85-100)	7.2 (1.7-31)	0.57 (0.35-0.92)
Internal rotation lag[47]	Full tear	1	97 (88-100)	83 (70-96)	5.6 (2.6-12)	0.04 (0.0-0.58)
Drop arm[45]	Disease	1	24 (13-34)	93 (85-100)	3.3 (1.0-11)	0.82 (0.70-0.97)
Dropping sign[47]	Full tear	1	73 (51-95)	77 (62-92)	3.2 (1.6-6.5)	0.35 (0.15-0.83)
Gerber (lift-off test)[44,48]	Disease	2[e]	34-68	50-77	1.4-1.5	0.63-0.85
Composite test for pain or weakness						
External rotation resistance[44f]	Disease	1	63 (49-77)	75 (69-82)	2.6 (1.8-3.6)	0.49 (0.33-0.72)
Full can[45]	Disease	1	75 (64-85)	68 (54-83)	2.4 (1.5-3.8)	0.37 (0.23-0.60)
Patte[48]	Disease	1	58 (36-80)	60 (30-90)	1.4 (0.62-3.4)	0.70 (0.34-1.5)
Empty can (Jobe)[44,45,48]	Disease	3[b]	71 (49-86)	49 (42-56)	1.3 (0.97-1.6)[c]	0.64 (0.33-1.3)[g]
Resisted abduction[48]	Disease	1	58 (36-80)	20 (0-45)	0.72 (0.55-8.1)	2.1 (0.55-8.1)
Combinations of findings						
Hawkins and Neer (both positive)[46]	Disease	1	78 (66-90)	50 (22-78)	1.6 (0.87-2.8)	0.43 (0.20-0.96)

Abbreviation: LR, likelihood ratio.

[a] See eTable 2 in Supplement for results evaluated in 1 or more studies.

[b] Random-effects univariate estimates used because there were only 3 studies.

[c] I^2 = 45%, P = .16.

[d] I^2 = 0%, P = .75.

[e] Range because the test was only evaluated in 2 sets of data.

[f] Described as Patte test in Salaffiet al, [44] executed as external rotation resistance test.[25]

[g] I^2 = 70%, P = .04.

Hermans J, Luime JJ, Meuffels DE, Reijman M, Simel DL, Bierma-Zeinstra SMA. Does This Patient With Shoulder Pain Have Rotator Cuff Disease? The Rational Clinical Examination Systematic Review. JAMA. 2013;310(8):837–847. doi:10.1001/jama.2013.276187

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Rotator Cuff Pain -Work up-

- Imaging
- Xray
  - Osseous abnormalities associated with rotator cuff impingement
  - Coincidental pathology (calcific tendinitis, glenohumeral osteoarthritis)
  - Anatomy predisposing to impingement
  - Full thickness tear
- Advanced Imaging (MRI vs Ultrasound)
  - **Routine imaging in primary care settings is not recommended** because rotator cuff tears may be incidentally found when imaging is performed for other indications.
    - Diagnosis is uncertain after clinical examination
    - Surgical intervention is potentially indicated
    - Information on tear extent or muscle degeneration is desired
    - **After 4-6 weeks of failed conservative therapy**

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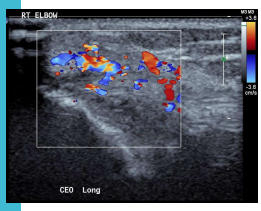
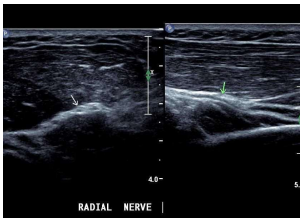
Why Ultrasound?

- There are no contraindications to Ultrasound
- Dynamic or movement-related imaging
- Compare bilateral structures
- Patient feedback
- Doppler
- Long structures
- Covered by most insurances





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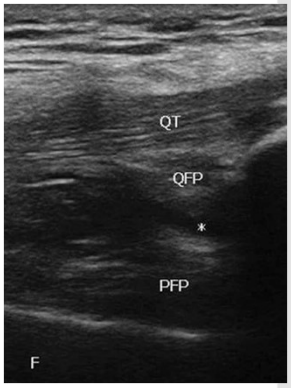
What is MSK Ultrasound?

- Uses sound waves to produce pictures of muscles, tendons, ligaments, and joints throughout the body.
- Helps to diagnose
  - Sprains
  - Strains
  - Tears
  - Tendonitis
  - Inflammation
  - Bursitis
  - Nerve entrapment
  - Cysts
  - Foreign body
  - Other soft tissue pathology



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Rotator Cuff Pain -Treatment-

- Conservative Treatment
  - Relative Rest
  - NSAID
  - Physical Therapy
  - Corticosteroid Injection
    - Short term pain relief
- Surgery
  - Failed conservative treatment (typically 4-6 weeks to 3 months)
  - Younger, active patients (<65 years)
  - Smaller tears (<1.5-2 cm)
  - Low fear-avoidance behavior
  - Acute traumatic full-thickness tears in young, active patients
  - Full-thickness tears with persistent symptoms after rehabilitation

Common Occupational Upper Extremity Musculoskeletal Disorders. American Family Physician. 2025. Hall S, Compton MR.

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Rotator Cuff Pain -Tenotomy-

- Ultrasound-guided percutaneous tenotomy
  - Chronic Rotator Cuff Tendinopathy
    - 22 g needle
    - Tenex
    - Tenjet
- **Indications**
  - **Chronic tendinopathy** (typically >3-6 months duration)
  - **Failed conservative treatment** (physical therapy, NSAIDs, injections)
  - **Ultrasound-confirmed tendinosis** (hypoechoic changes, neovascularization, calcification)
  - **No complete tendon tears** (tendinosis without full-thickness rupture) [3]
  - Alternative to surgical intervention in appropriate candidates
- **Pain Improvement**
  - Meta-analysis of percutaneous ultrasound-guided needle tenotomy (PUNT) across tendon sites
  - **Short-term** (<3 months): SMD 2.5 points improvement (95% CI: 2.0-3.0)
  - **Intermediate-term** (3-6 months): SMD 2.2 points (95% CI: 1.8-2.7)
  - **Long-term** (>6 months): SMD 3.6 points (95% CI: 2.8-4.5)
- **Functional Improvement**
  - **Short-term**: SMD 1.4 points (95% CI: 1.1-1.8)
  - **Intermediate-term**: SMD 1.8 points (95% CI: 1.3-2.2)
  - **Long-term**: SMD 2.1 points (95% CI: 1.6-2.6)

Shomal Zadeh F, Shafiei M, Shomalzadeh M, Pierce J, Thurlow PC, Chalian M. Percutaneous ultrasound-guided needle tenotomy for treatment of chronic tendinopathy and fasciopathy: a meta-analysis. Eur Radiol. 2023 Oct;33(10):7303-7320. doi: 10.1007/s00330-023-09657-2. Epub 2023 May 6. Erratum in: Eur Radiol. 2023 Oct;33(10):7353-7354. doi: 10.1007/s00330-023-09822-7. PMID: 37148349.

72

Rotator Cuff Pain -Tenotomy with PRP-

- The 2026 study by Brilakis et al. was a **retrospective analysis of ultrasound-guided peritendinous leukocyte-poor PRP injections for chronic rotator cuff tendinopathy and partial-thickness tears**
- **Study Design and Population**
  - 105 patients (mean age 54.8 years) with symptomatic chronic rotator cuff tendinopathy or partial-thickness tears
  - Mean follow-up of 47 months (range 24-72 months)
  - All patients received ultrasound-guided peritendinous injections of leukocyte-poor PRP
  - Patients had failed conservative management including physical therapy
- **Key Findings**
  - The study demonstrated **excellent sustained pain relief and functional improvement**:
  - **VAS pain scores** reached 0 at rest, at night, and with movement at final follow-up
  - **SANE scores** improved from baseline to surpass the minimal clinically important difference (MCID)
  - **ASES scores** similarly exceeded MCID thresholds
- Improvements were maintained throughout the medium-term follow-up period

Brilakis E, Ioannidis K, Roumeliotis L, Papatzikou M, Hovsepian JM, Marín Fermín T. Peritendinous leucocyte-poor platelet-rich plasma injections improve symptomatic chronic rotator cuff tendinopathies and partial-thickness rotator cuff tears: A retrospective study with medium-term follow-up. Knee Surg Sports Traumatol Arthrosc. 2026 Apr;34(4):1414-1420. doi: 10.1002/ksa.70272. Epub 2026 Jan 11. PMID: 41521711.

73

Rotator Cuff Pain -Calcific tenonitis- & -Barbotage-

- **Barbotage** (ultrasound-guided needling and lavage) is a **minimally invasive percutaneous procedure** for treating calcific tendonitis of the rotator cuff that involves **needle aspiration and irrigation of calcific deposits** under ultrasound guidance.
- **Clinical Outcomes**
  - Evidence regarding barbotage effectiveness is mixed:
  - **Short-term benefits (1 year)**: One RCT found barbotage combined with subacromial corticosteroid injection superior to corticosteroid injection alone at 1 year, with mean Constant scores of 86.0 versus 73.9 (p=0.005) and greater calcification reduction (11.6 mm versus 5.1 mm, p=0.001).
  - **Long-term outcomes (5 years)**: The same cohort showed **no significant differences** at 5-year follow-up between barbotage plus corticosteroid versus corticosteroid alone (Constant scores 90 versus 87, p=0.58).

de Witte PB, Kolk A, Overes F, Nelissen RGHH, Reijnierse M. Rotator Cuff Calcific Tendinitis: Ultrasound-Guided Needling and Lavage Versus Subacromial Corticosteroids: Five-Year Outcomes of a Randomized Controlled Trial. Am J Sports Med. 2017 Dec;45(14):3305-3314. doi: 10.1177/0363546517721686. Epub 2017 Sep 12. PMID: 28898104.

74

Shoulder Pain

OA

75

Shoulder Pain
OA
-Presentation-

- Age >60
- Radiographic evidence of degenerative changes has been found in 17-20% of adults over age 65, with prevalence rates reaching 94% in women and 85% in men over age 80
- Risk factors
  - previous shoulder injuries
  - occupations requiring heavy lifting
  - participation in overhead sports
- Symptoms
  - Long history of pain and stiffness
    - Though can present with acute exacerbation
  - Sleep disturbance
  - Falling asleep or nighttime waking
    - Pain at rest and with motion
  - Decreased range of motion
  - Diffuse pain rather than local

Khazzam, Michael MD, FAAOS; Gee, Albert O. MD, FAAOS; Pearl, Michael MD, FAAOS. Management of Glenohumeral Joint Osteoarthritis. Journal of the American Academy of Orthopedic Surgeons 28(19):p 781-789, October 1, 2020. | DOI: 10.5435/JAAOS-D-20-00404

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Shoulder Pain
OA
-Exam-
&
-Work up-

- Physical Exam
  - Global reduction in range of motion
  - Passive external rotation with arm at the side
  - No pain to palpation at AC joint
  - Abnormal scapular motion as adaptation
- Work Up
  - Xrays
  - MRI
    - The diagnosis is unclear after clinical examination and radiographs
    - Surgical planning
      - Evaluation of glenoid cartilage status and rotator cuff integrity

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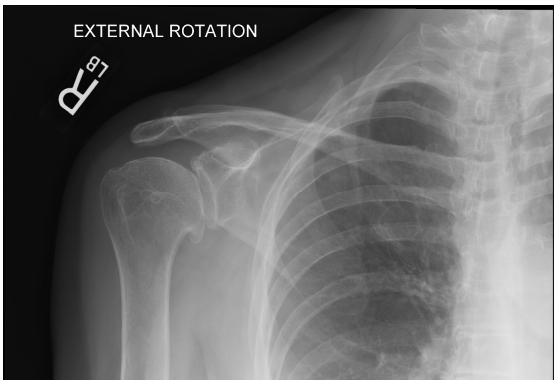

Xray

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Shoulder Pain OA -Treatment- & -Referrals-

- Physical Therapy
  - Early vs Severe osteoarthritis
- Injections
  - Corticosteroid
  - Hyaluronic Acid-not approved in the USA
  - PRP
- Surgery
  - Total Shoulder
  - Reverse Total Shoulder

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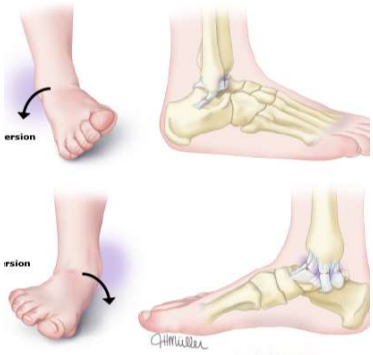
Ankle Pain

80

Ankle sprain -Presentation-

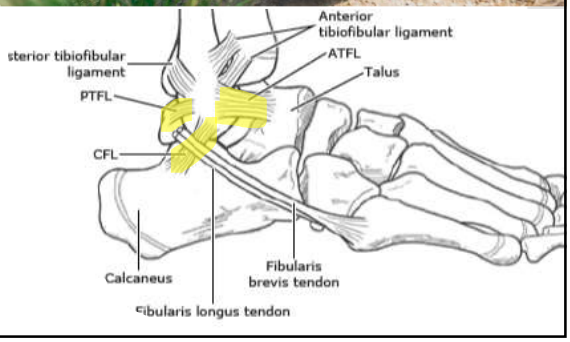
- Most common injury
  - Lateral vs medial
  - Grade: 1-3
    - 1: stretch, minor tearing (1-3 weeks recovery)
    - 2: moderate, partial tearing (2- 4 week recovery)
    - 3: complete tear (instability) (8 -12 week recovery)



81

Lateral ankle sprain

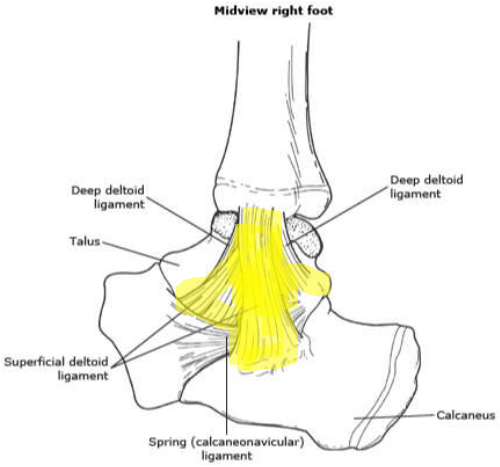
- Most common 85% of sprain
- Anterior talofibular ligament (ATFL)
  - Weakest ligament and most susceptible to tear
  - Inverted plantar flexed ankle
- Calcaneofibular (CF)
- Posterior talofibular (PTF)



82

Medial ankle sprain

- Medial ankle or deltoid ligament sprain
  - Not as common
  - Need a greater force
  - Eversion mechanism
  - Longer to recover



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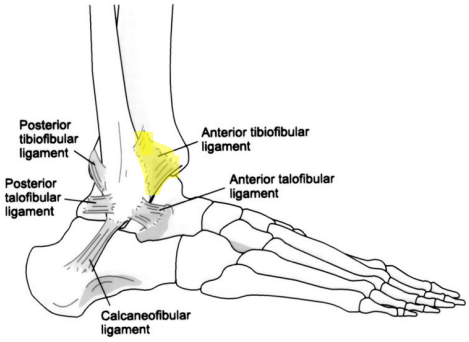
High ankle sprain

- High ankle sprain of syndesmotic sprain
  - 1-11% of ankle sprains
  - More with contact sports
  - External rotation with hyper-dorsiflexion



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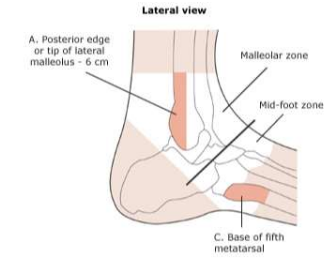
Ankle exam

- https://www.youtube.com/watch?v=sZ7HXCoTzbo

85

Ottowa ankle rules

- Pain in malleolar zone AND
- Have bony tenderness at distal end of fibula (lateral malleolus) or medial malleolus
- Unable to bear weight
- Bony tenderness at base of the 5th met or navicular



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Treatment

- Early Functional Rehab
- Grade 1-2: compression/functional bracing, ice, elevation modified activity, weight bearing as tolerated
- Grade 3: brief period of immobilization (<10 days) in boot or stirrup brace
- Comprehensive rehabilitation program including range of motion exercises, stretching, strengthening, neuromuscular proprioceptive training, and sport-specific exercises

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Hip Pain

OA

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Hip OA -Presentation-

- Age >60
- Groin or anterior hip pain
- Worsens with weight bearing
- Morning stiffness <30 minutes
- "C-sign"
- Described as stabbing, sharp, dull
- Worse with stairs, squats, prolonged sitting
- Patient may lean away from affected side when seated to reduce hip flexion

The Non-Surgical Management of Hip & Knee Osteoarthritis (OA) (2020).Department of Veterans Affairs. 2020. Matthew Bair MD MS, John Cody MD, Jess Edison MD, et a

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Hip OA -Physical Exam-

Table 2. Physical Examination Findings and Likelihood of Hip Osteoarthritis With Positive Likelihood Ratio of 2.0 or Greater or Negative Likelihood Ratio of 0.5 or Less[a]

Feature	No. (%)[b]	% (95% CI) or % Range			
		Sensitivity	Specificity	Positive Likelihood Ratio	Negative Likelihood Ratio
General Findings					
Abductor weakness[20]	220 (14)	44 (24-65)	90 (85-94)	4.5 (2.4-8.4)	0.62 (0.43-0.88)
Limp[26]	165 (73)	85 (76-92)	43 (31-55)	1.5 (1.2-1.9)	0.35 (0.20-0.61)
Pain on Palpation					
Inguinal ligament tenderness[20]	220 (29)	60 (39-79)	75 (68-81)	2.4 (1.6-3.8)	0.53 (0.33-0.87)
Tensor fascia lata tenderness[20]	220 (23)	40 (21-61)	80 (73-85)	2.0 (1.1-3.4)	0.75 (0.54-1.1)
Pain on Movement and Provocation Tests					
Squat causing posterior pain[27]	72 (53)	24 (8.2-47)	96 (86-99.5)	6.1 (1.3-29)	0.79 (0.62-1.0)
Groin pain on abduction or adduction[27]	72 (14)	33 (15-57)	94 (84-99)	5.7 (1.6-20)	0.71 (0.52-0.97)
Scour test[27c]	72 (36)	62 (42-82)	74 (60-86)	2.4 (1.4-4.3)	0.51 (0.29-0.90)
Pain on hip adduction[20,26]	410 (58)	68-80	46-54	1.5-1.5	0.43-0.59
Pain on hip internal rotation[20,26]	412 (68)	82-88	38-39	1.4-1.4	0.31-0.45
Tests of Motion					
Restricted movement[21]					
3 planes	39 (16)	NA[d]	NA[d]	4.4 (2.4-8.3)	NA[d]
2 planes	46 (18)	NA[d]	NA[d]	1.5 (0.90-2.6)	NA[d]
1 plane	63 (25)	NA[d]	NA[d]	1.3 (0.85-2.0)	NA[d]
0 planes	102 (41)	NA[d]	NA[d]	0.91 (0.78-1.1)	NA[d]
Decreased hip adduction[20e]	220 (26)	80 (59-93)	81 (75-86)	4.2 (3.0-6.0)	0.25 (0.11-0.54)
Decreased hip internal rotation[20,26-28e]	788 (30)	66 (47-81)	79 (57-92)	3.2 (1.7-6.0)	0.43 (0.31-0.60)
Decreased range of movement[4f]	230 (51)	75 (66-82)	74 (65-82)	2.9 (2.1-4.0)	0.34 (0.25-0.47)
Decreased hip extension[20e]	220 (37)	76 (55-91)	68 (61-75)	2.4 (1.8-3.2)	0.35 (0.17-0.71)
Decreased hip external rotation[20e]	220 (40)	76 (55 - 91)	64 (57-71)	2.1 (1.6-2.8)	0.37 (0.19-0.76)
Decreased hip abduction[20e]	220 (58)	88 (69-98)	46 (38-53)	1.6 (1.3-2.1)	0.26 (0.09-0.77)

Abbreviation: NA, not applicable.

[a] eTable 5 provides results from individual studies and findings not meeting likelihood ratio thresholds.

[b] With proportion (%) of hips with each clinical finding.

[c] The Scour test is an impingement test where the examiner compresses the femoral neck against the acetabulum while the femur is at maximal flexion and while applying axial pressure, the knee is moved in an arc toward the shoulders. A positive test consists of "bumps" in movement, pain, or patient apprehension with the motion.

[d] For ordinal data shown from 0 planes to 3 planes, sensitivity and specificity do not apply. Results shown as serial likelihood ratios to show the increasing likelihood of restricted movements from 0 to 3 different affected planes.

[e] Measured with goniometer and/or comparison with contralateral hip.

Metcalfe D, Perry DC, Claireaux HA, Simel DL, Zogg CK, Costa ML. Does This Patient Have Hip Osteoarthritis? The Rational Clinical Examination Systematic Review. JAMA. 2019;322(23):2323–2333. doi:10.1001/jama.2019.19413

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Hip OA -Physical Exam-

- https://www.youtube.com/watch?v=yluzGVcWEsg

91

Hip OA -Work up-

- None
- Xray
- MRI
  - Suspicion of subchondral insufficiency fracture
  - Concern for avascular necrosis (especially with risk factors: corticosteroid use, alcohol, smoking, hemoglobinopathies)
  - Evaluation for tumor or infection
  - Conditions requiring different, more urgent treatment than OA
  - Early diagnosis of femoral neck stress fracture (not visible on early radiographs)

Hip Pain in Adults: Evaluation and Differential Diagnosis. American Family Physician. 2021. Chamberlain R.

92

Hip OA -Treatment-

- Exercise
- Physical Therapy
- Weight Loss
- NSAID
- Acetaminophen
- Duloxetine

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Hip OA -Referral-

- Sports Medicine
  - Injections
    - Lidocaine –diagnostic
    - Corticosteroid—potentially therapeutic
    - Hyaluronic Acid—not approved in USA
    - PRP—maybe for early OA
- Orthopedic Surgeon
  - Total Hip Replacement

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Elbow Pain

Medial and Lateral Epicondylitis

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Medial and Lateral Epicondylitis -Presentation-

- Lateral Epicondylitis (Tennis Elbow)
  - Extensor carpi radialis brevis
  - Aggravated by gripping, lifting, wrist extension
- Medial Epicondylitis (Golfer's Elbow)
  - Pronator teres and flexor carpi radialis
  - Aggravated by throwing, wrist flexion, forearm pronation
- Insidious onset
- Tenderness over epicondyle

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Medial and Lateral Epicondylitis -Physical Exam-

- https://www.youtube.com/watch?v=toutJMk9DG8

97

Medial and Lateral Epicondylitis -Work Up-

- Education
  - Majority of cases resolves in 1-2 years without intervention
- sadkj

Wolf JM. Lateral Epicondylitis. The New England Journal of Medicine. 2023;388(25):2371-2377. doi:10.1056/NEJMcp2216734

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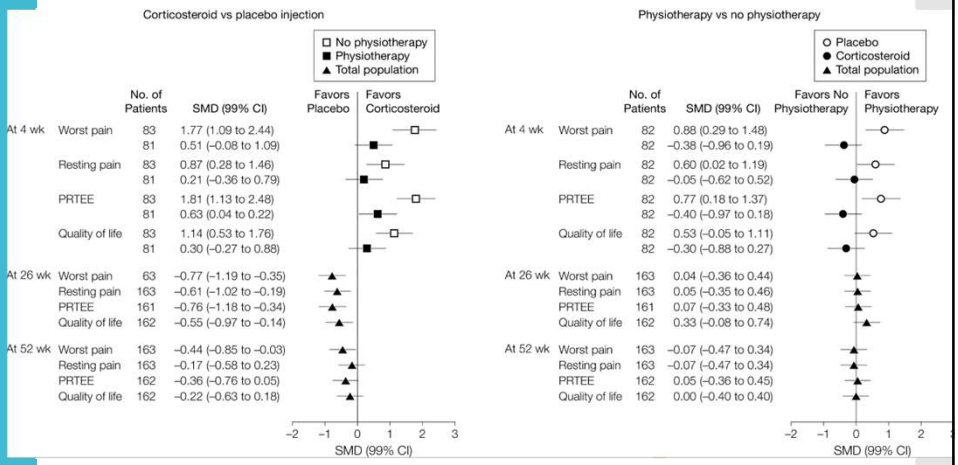
Medial and Lateral Epicondylitis -Work Up-



Coombes BK, Bisset L, Brooks P, Khan A, Vicenzino B. Effect of Corticosteroid Injection, Physiotherapy, or Both on Clinical Outcomes in Patients With Unilateral Lateral Epicondylalgia: A Randomized Controlled Trial. JAMA. 2013;309(5):461–469. doi:10.1001/jama.2013.129

99

Medial and Lateral Epicondylitis -Treatment

- None
- Xray
- When to order imaging
  - **Refractory symptoms** after 6–12 weeks of conservative treatment **Diagnostic uncertainty** — when the differential includes UCL tear, radial tunnel syndrome, occult fracture, or intra-articular pathology
  - **Mechanical symptoms** (locking, clicking, limited ROM)

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Concussion

101

Changes to Concussion Management: Exercise is good

Relative (not strict) rest that included ADLs and reduced screen time in indicated immediately and into the first 2 days after injury.

Light intensity activity and physical activity like walking and that does not exacerbate symptoms in the first 24-48 hours following a concussion

Reduced screen time in the first 48 hours after injury

After 48 hours, encourage return to ADLS and home activities which do not increase symptoms more than 2 points on a 0-10 scale.

How much exercise?

- Ok to increase symptoms by 2 points during activity as long as it comes back down to baseline within an hour of stopping activity

A referral for rehab is recommended at the 2-4 week mark when symptoms are persisting, worsen or not progressive.

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Concussion Management: Referrals

Initial Referrals

- Physical Therapy
- Occupational Therapy
- Speech Therapy
- Behavioral Therapy

Consider if not improving

- Neuro-optometry
- Neuro-psych

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Consensus statement

Table 2 Return-to-sport (RTS) strategy—each step typically takes a minimum of 24 hours

Step	Exercise strategy	Activity at each step	Goal
1	Symptom-limited activity	Daily activities that do not exacerbate symptoms (eg, walking).	Gradual reintroduction of work/school
2	Aerobic exercise **2A—Light** (up to approximately 55% maxHR) **then** **2B—Moderate** (up to approximately 70% maxHR)	Stationary cycling or walking at slow to medium pace. May start light resistance training that does not result in more than mild and brief exacerbation* of concussion symptoms.	Increase heart rate
3	Individual sport-specific exercise Note: If sport-specific training involves any risk of inadvertent head impact, medical clearance should occur prior to Step 3	Sport-specific training away from the team environment (eg, running, change of direction and/or individual training drills away from the team environment). No activities at risk of head impact.	Add movement, change of direction
Steps 4–6 should begin after the resolution of any symptoms, abnormalities in cognitive function and any other clinical findings related to the current concussion, including with and after physical exertion.			
4	Non-contact training drills	Exercise to high intensity including more challenging training drills (eg, passing drills, multiplayer training) can integrate into a team environment.	Resume usual intensity of exercise, coordination and increased thinking
5	Full contact practice	Participate in normal training activities.	Restore confidence and assess functional skills by coaching staff
6	Return to sport	Normal game play.	

*Mild and brief exacerbation of symptoms (ie, an increase of no more than 2 points on a 0–10 point scale for less than an hour when compared with the baseline value reported prior to physical activity). Athletes may begin Step 1 (ie, symptom-limited activity) within 24 hours of injury, with progression through each subsequent step typically taking a minimum of 24 hours. If more than mild exacerbation of symptoms (ie, more than 2 points on a 0–10 scale) occurs during Steps 1–3, the athlete should stop and attempt to exercise the next day. Athletes experiencing concussion-related symptoms during Steps 4–6 should return to Step 3 to establish full resolution of symptoms with exertion before engaging in at-risk activities. Written determination of readiness to RTS should be provided by an HCP before unrestricted RTS as directed by local laws and/or sporting regulations.

HCP, healthcare professional; maxHR, predicted maximal heart rate according to age (ie, 220-age).

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SCOAT6™

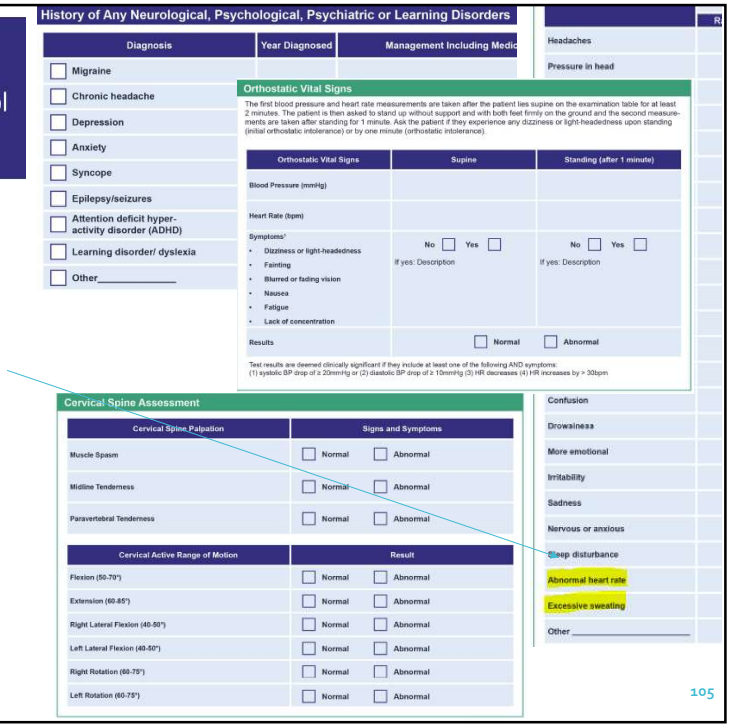
Sport Concussion Office Assessment Tool

For Adults & Adolescents (13 years +)

Office based, 72 hrs after injury

Different from SCAT 6 bc left off "don't feel right" from symptoms score and added " abnormal HR" and " excessive sweating"

Exam: orthostatic vitals, C spine, neuro, tandem gait, dual task gait



History of Any Neurological, Psychological, Psychiatric or Learning Disorders

Diagnosis	Year Diagnosed	Management Including Medic
☐ Migraine		
☐ Chronic headache		
☐ Depression		
☐ Anxiety		
☐ Syncope		
☐ Epilepsy/seizures		
☐ Attention deficit hyper-activity disorder (ADHD)		
☐ Learning disorder/ dyslexia		
☐ Other_____		

Orthostatic Vital Signs

The first blood pressure and heart rate measurements are taken after the patient lies supine on the examination table for at least 2 minutes. The patient is then asked to stand up without support and with both feet firmly on the ground and the second measurements are taken after standing for 1 minute. Ask the patient if they experience any dizziness or light-headedness upon standing (initial orthostatic intolerance) or by one minute (orthostatic intolerance).

Orthostatic Vital Signs	Supine	Standing (after 1 minute)
Blood Pressure (mmHg)		
Heart Rate (bpm)		
Symptoms[1] • Dizziness or light-headedness • Fainting • Blurred or fading vision • Nausea • Fatigue • Lack of concentration	☐ No ☐ Yes If yes: Description	☐ No ☐ Yes If yes: Description
Results	☐ Normal ☐ Abnormal	

Test results are deemed clinically significant if they include at least one of the following AND symptoms:
(1) systolic BP drop of ≥ 20mmHg or (2) diastolic BP drop of ≥ 10mmHg (3) HR decreases (4) HR increases by > 30bpm

Cervical Spine Assessment

Cervical Spine Palpation	Signs and Symptoms
Muscle Spasm	☐ Normal ☐ Abnormal
Midline Tenderness	☐ Normal ☐ Abnormal
Paravertebral Tenderness	☐ Normal ☐ Abnormal

Cervical Active Range of Motion	Result
Flexion (50-70°)	☐ Normal ☐ Abnormal
Extension (60-85°)	☐ Normal ☐ Abnormal
Right Lateral Flexion (40-50°)	☐ Normal ☐ Abnormal
Left Lateral Flexion (40-50°)	☐ Normal ☐ Abnormal
Right Rotation (60-75°)	☐ Normal ☐ Abnormal
Left Rotation (60-75°)	☐ Normal ☐ Abnormal

Headaches
Pressure in head
Confusion
Drowsiness
More emotional
Irritability
Sadness
Nervous or anxious
Sleep disturbance
Abnormal heart rate
Excessive sweating
Other _____

Presentation Title

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