Common Knee and Shoulder Pathology

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Primary Sports Medicine

HSS Stamford

Learning Objective

I. To review Knee and Shoulder anatomy
II. Better understand diagnosis and treatment of common Knee pathology
III. Better understand diagnosis and treatment of common Shoulder pathology
IV. Understand when to refer
V. Understand when to order imaging

VI. More Material or More Indepth

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Quiz (Q1-6)

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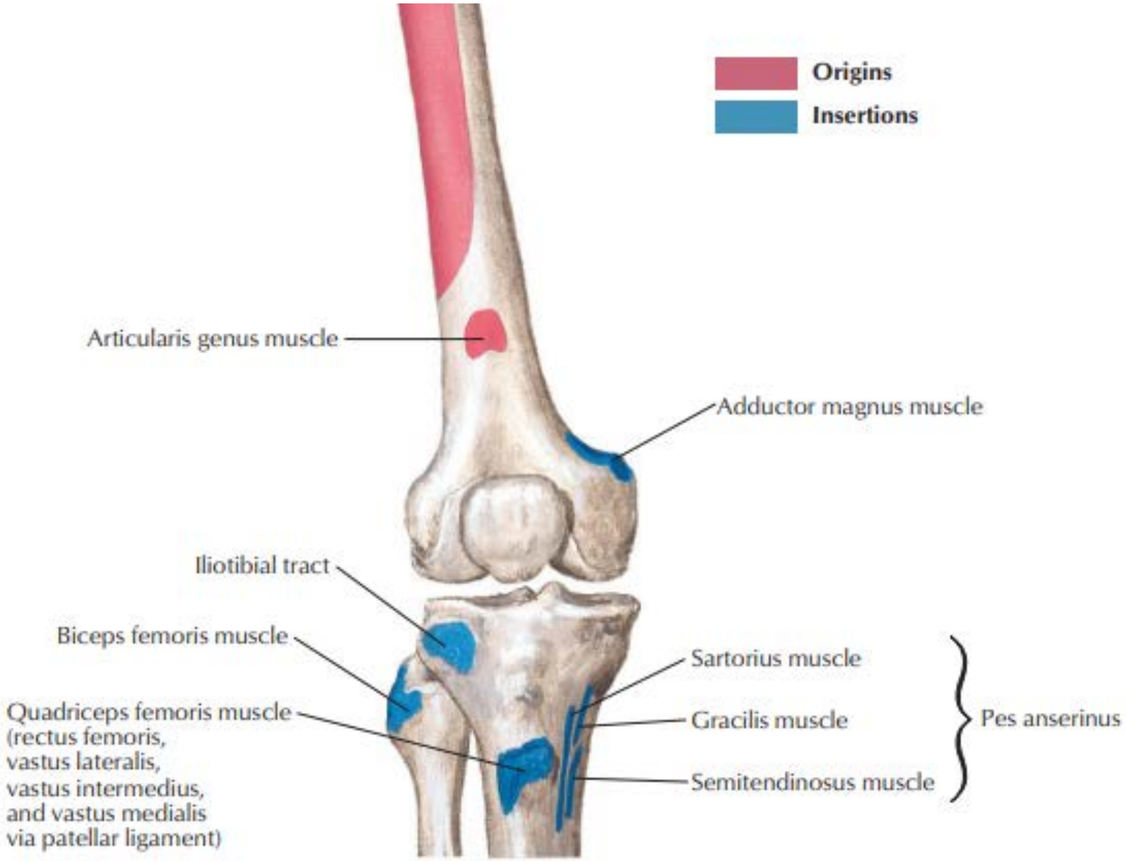
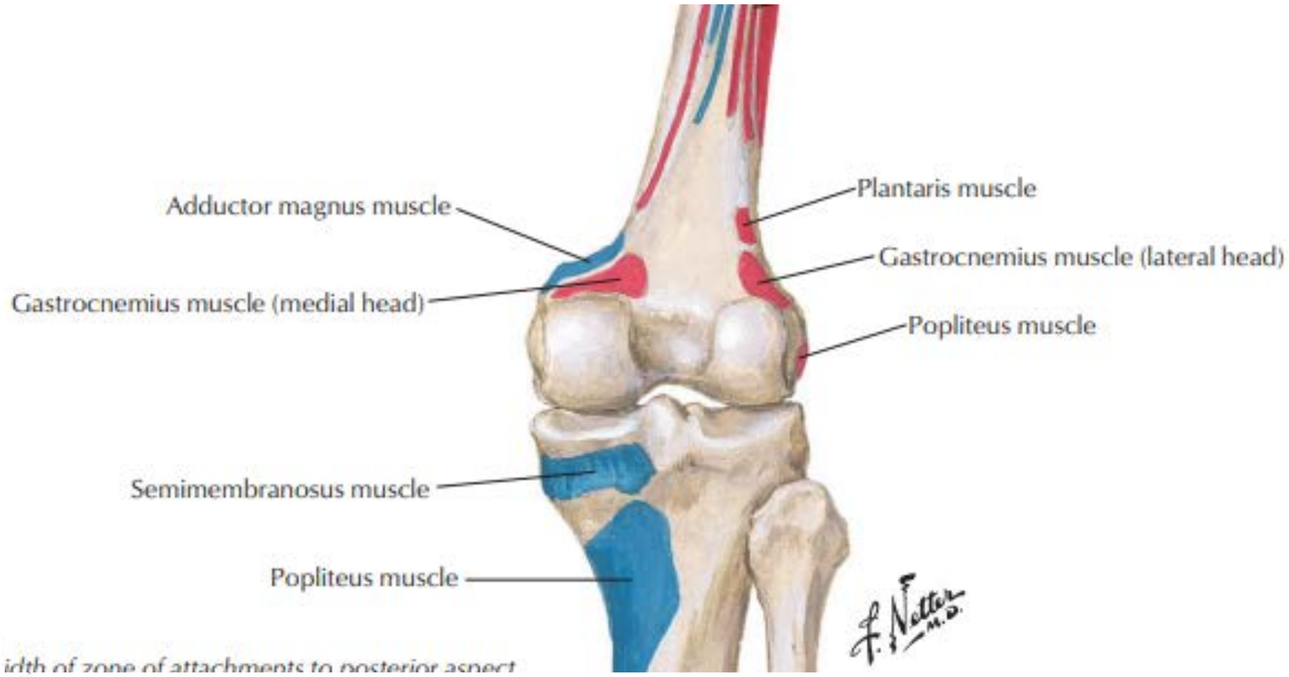
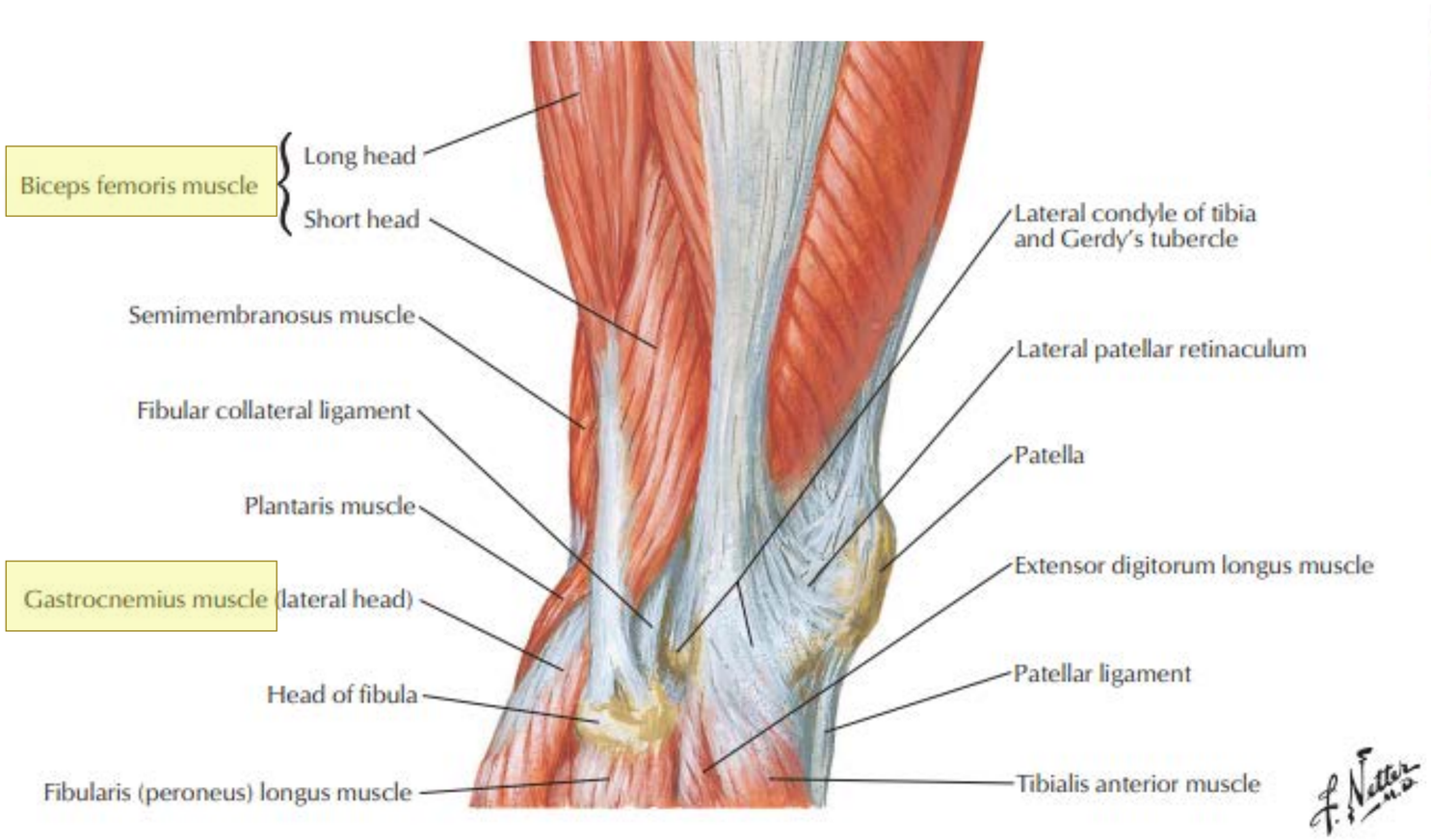
The Knee

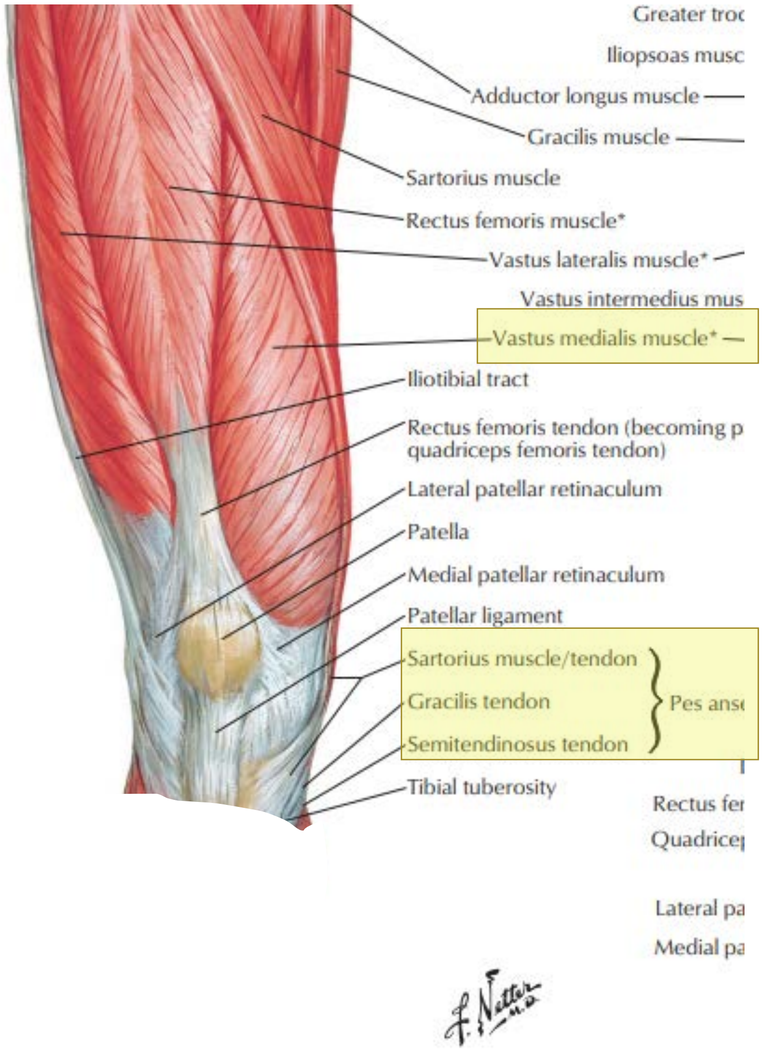
Knee Anatomy



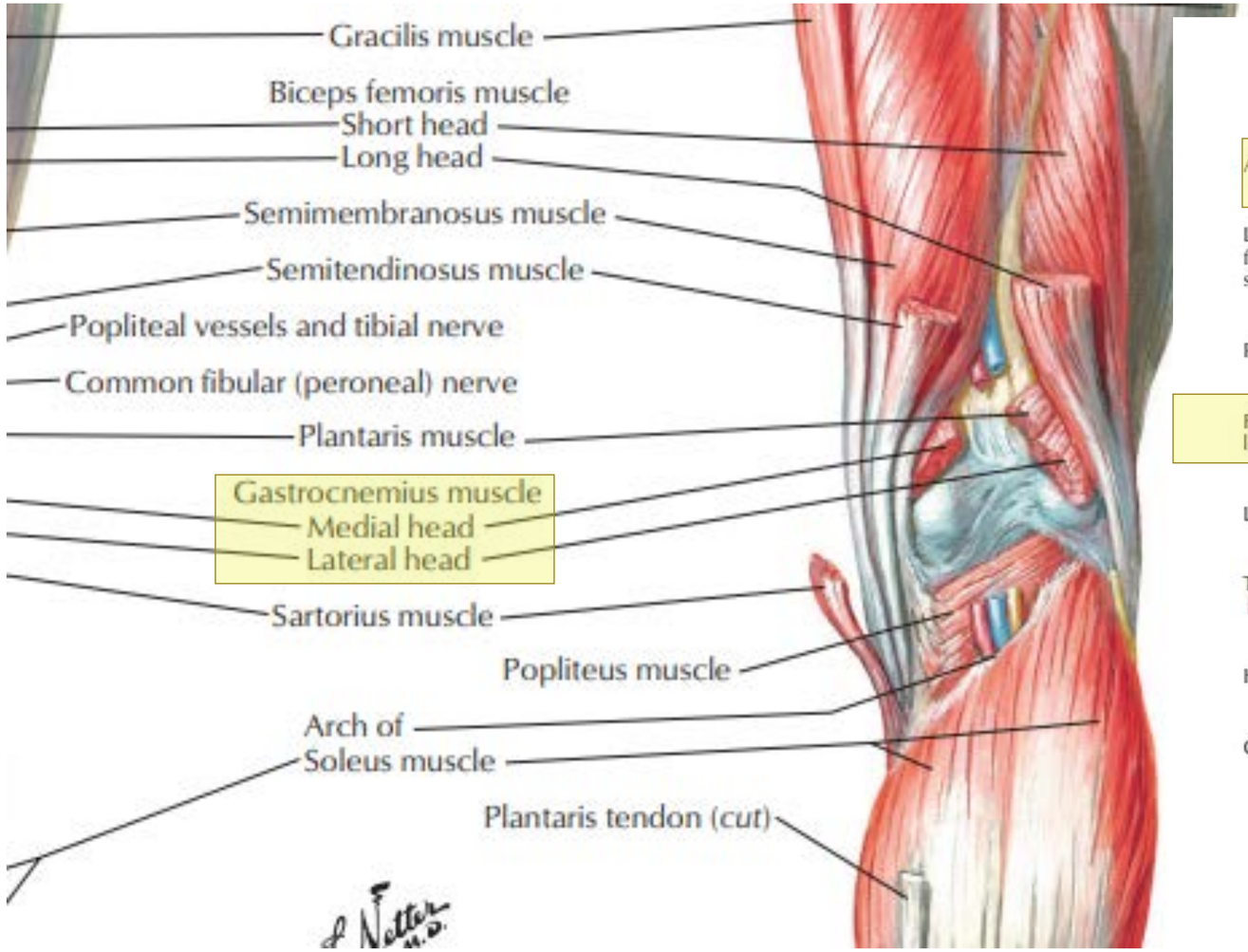


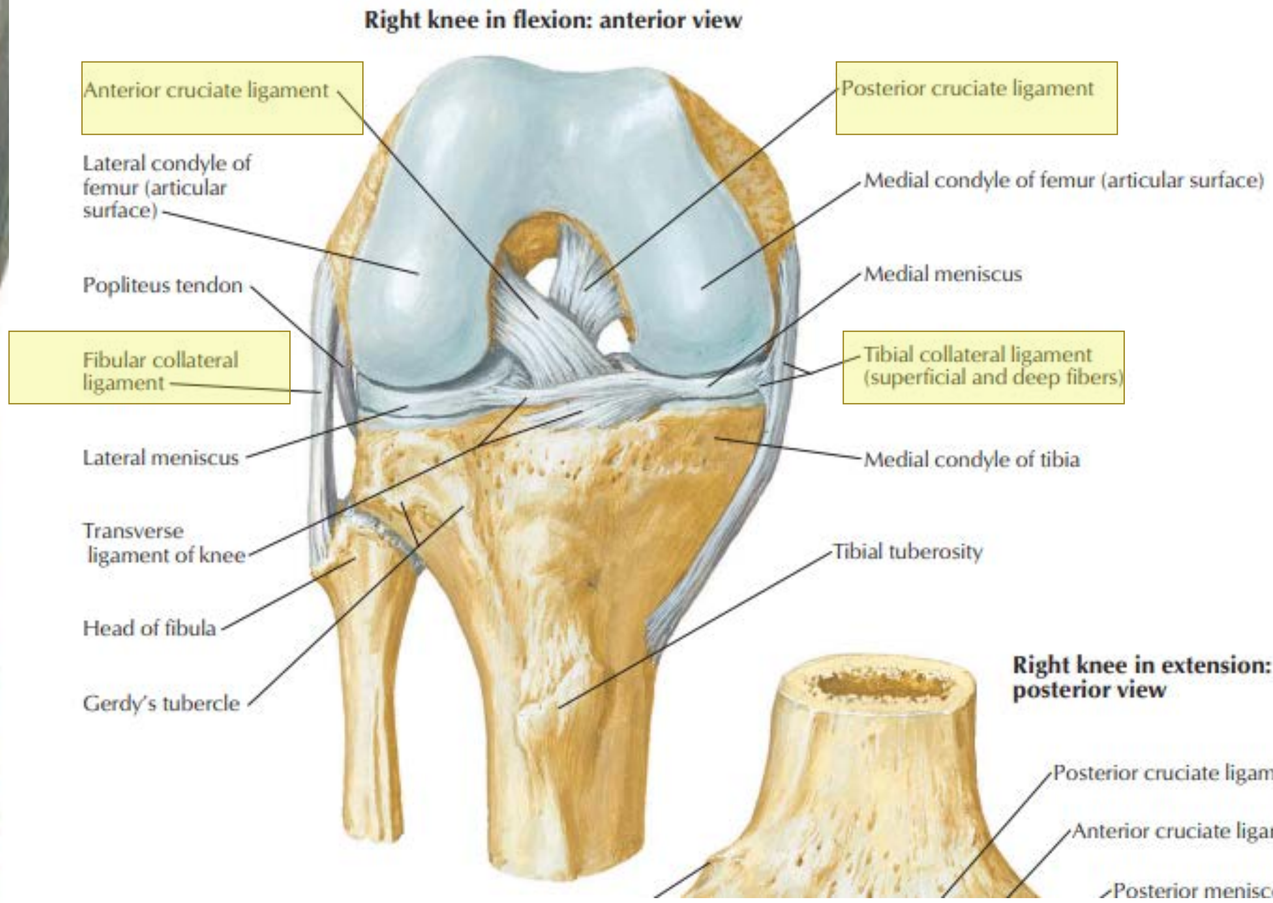
Knee Anatomy



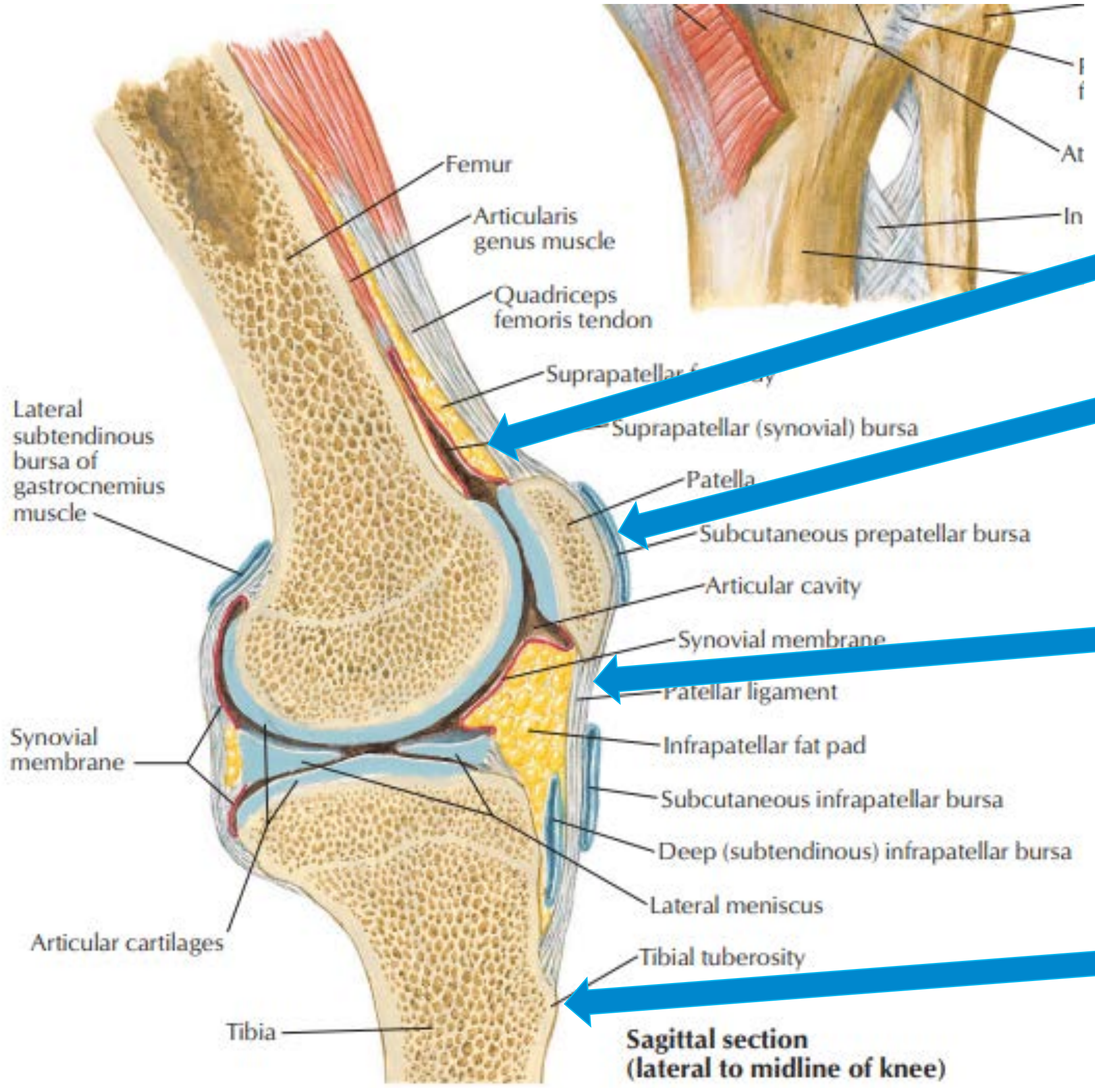


Knee Anatomy





Knee Anatomy (Location. Location. Location.)



Quad Tendinosis

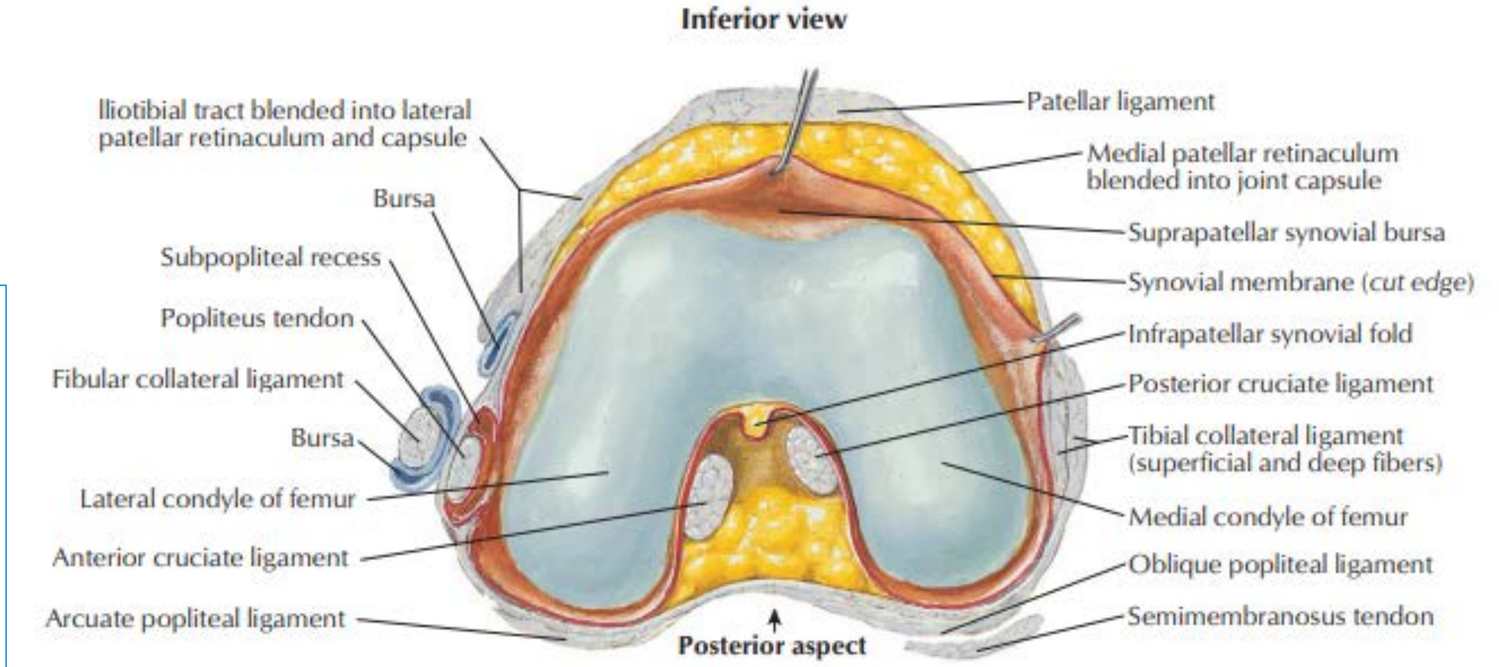
Pre-patellar bursitis

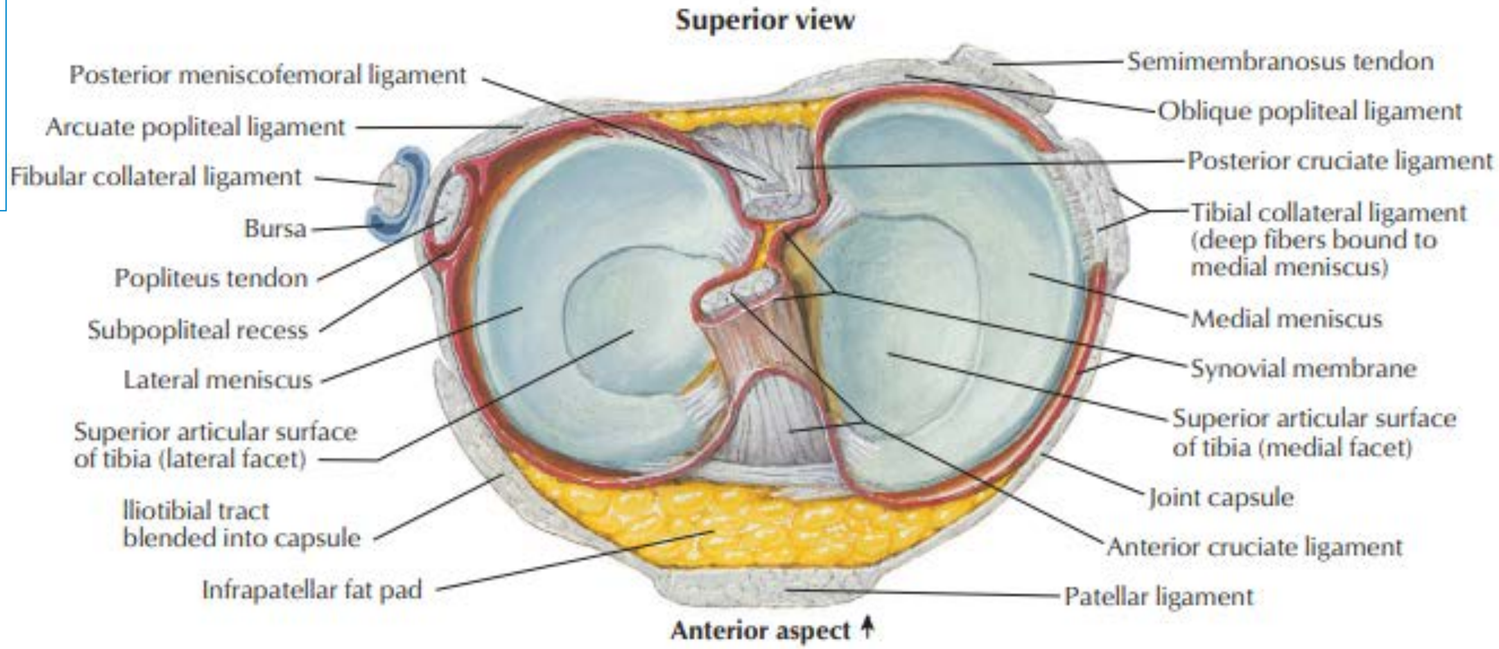
Patella Tendinosis

Osgood Schlatter's Apophysitis

Knee Anatomy

- **Intraarticular Structure**
  - **(+ Knee Effusion)**
    - Bone
    - Cartilage
    - Menisci
    - Joint capsule
    - ACL
    - PCL
- **Extraarticular**
  - LCL
  - MCL
  - Muscles and Tendons





History

I. Mechanism of Injury (MOI)
II. CODIERS:
    I. Course, Onset, Description, Intensity, Exacerbating, Remitting, Symptoms
III. Mechanical
    I. Locking, buckling, catching
IV. Night time symptoms
    I. Often with OA or bony edema
V. Swelling
    I. Timing of Effusion after injury
    II. 1-2 hr → ACL
    III. 24 hrs → meniscal

Exam

I. **Test the anatomy**
   I. Inspection
   II. Palpation
   III. ROM (PROM- Passive and AROM- Active)
   IV. Strength
   V. Neurovascular
   VI. Stability
   VII. Special Tests

Push, pull, bend, poke until you **reproduce the patient's symptoms**

Know your anatomy!

Knee Exam

I. Inspection- effusion
II. Palpation
III. ROM
IV. Strength- extension and flexion
V. Neurovascular – SLT
VI. Stability-
    I. Varus, Valgus at 0 and 30 deg
VII. Special Tests

Knee Exam

I. **Special Tests**
   I. **Milking effusion**
   II. **ACL**
      I. **Lachman**
   III. **Meniscus**
      I. **Thessaly (LR+ 39)**
      II. McMurray **(LR+ 17)**

Positive Likelihood Ratio= Sensitivity/(1-Specificity)

Negative Likelihood Ratio= (1- Sensitivity)/Specificity

https://www.aafp.org/afp/2018/1101/p576.html

Knee Exam

I. Special Tests

I. Milking effusion

I. Patient lying supine knee relaxed. Use palm to milk knee toward thigh. Then press on upper outer quadrant superior and lateral to the patella and look for fluid wave in medial superior joint

II. https://www.youtube.com/watch?v=ewjzL1lvDh0&t=73s

II. Lachman

I. With the patient supine on the examining table and the leg slightly externally rotated and flexed (20 to 30°) at the examiner's side, stabilize the femur with one hand and apply pressure to the back of the knee with the other hand, with the thumb on the joint line. A positive test result is movement of the knee with a soft or mushy end point.

II. https://www.youtube.com/watch?v=JFkbKNNa7xQ

III. Thessaly (LR+ 39)

I. Hold patient's outstretched hands while the patient stands flat footed on the floor, internally and externally rotating the affected leg three times with the knee flexed 20°. The unaffected leg should be flexed to avoid contact with the floor. Patient-reported pain at the medial or lateral joint line is a positive finding.

IV. McMurray

I. Flex the hip and knee maximally. Apply a valgus (abduction) force to the knee while externally rotating the foot and passively extending the knee. An audible or palpable snap or click with pain during extension suggests a tear of the medial meniscus. For the lateral meniscus, apply a varus (adduction) stress during internal rotation of the foot and passive extension of the knee.

https://www.aafp.org/afp/2018/1101/p576.html

Ottowa Knee Rule: When to Xray

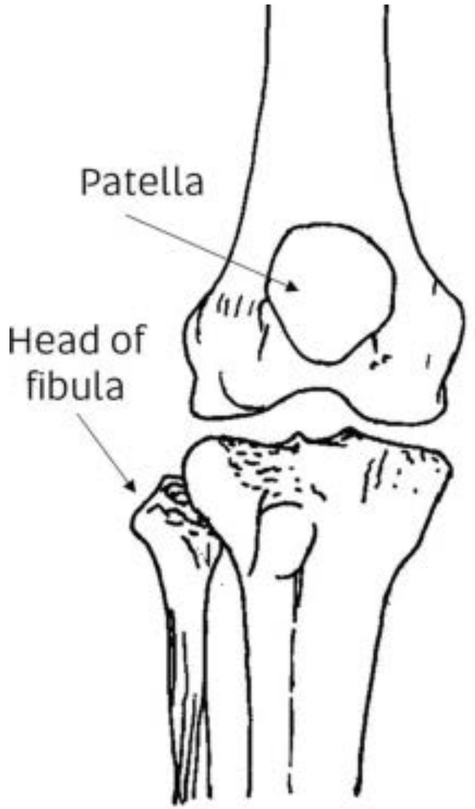


Image courtesy of researcher (JD)

Knee radiography is indicated when:

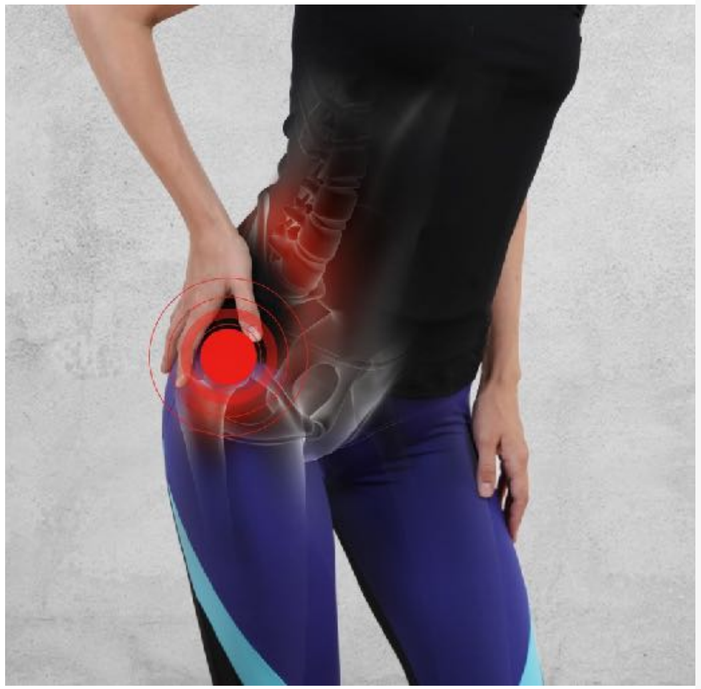
- Age 55 years or older
- Tenderness at head of fibula
- Isolated tenderness of patella
- Inability to flex to 90 degrees
- Inability to weight bear immediately and in the emergency department (4 steps)

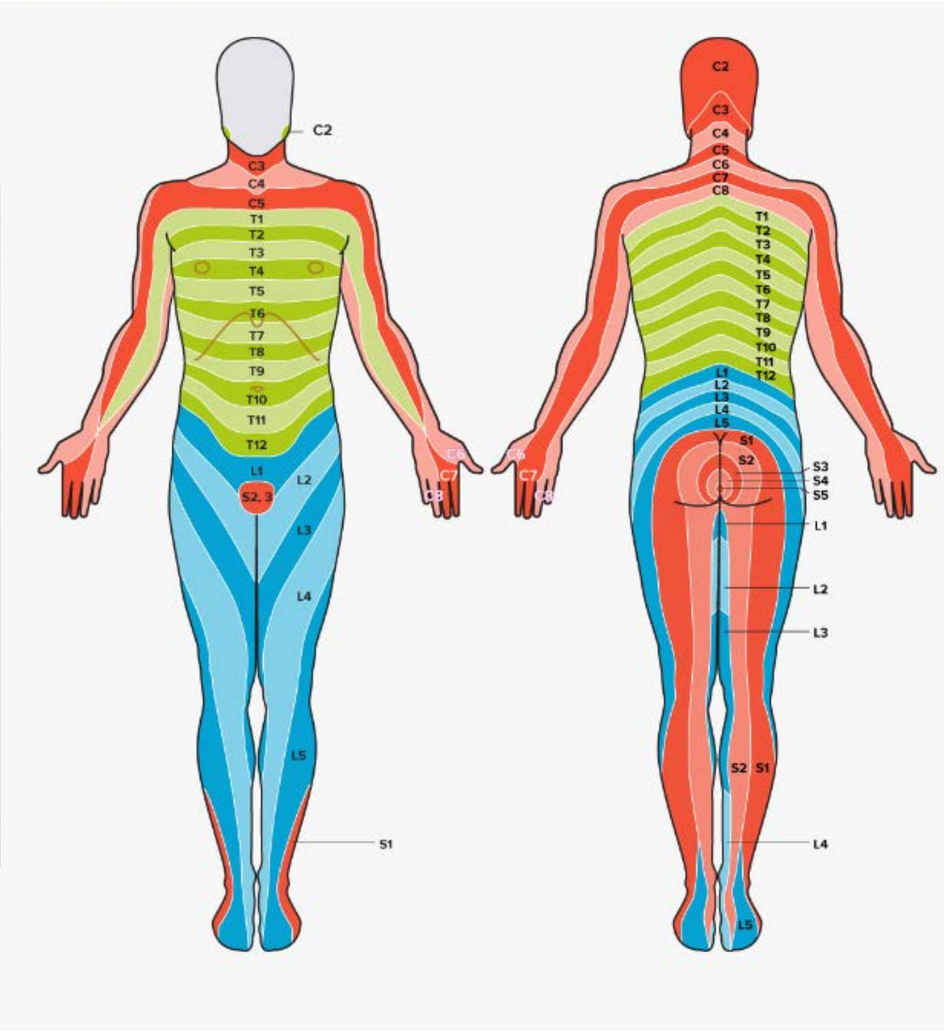
I. Xray
   I. AP/Lat
   II. Merchant or Sunrise
   III. PA flexed
      I. Most OA is in posterior joint
      II. Always weight bearing
II. MRI
   I. If acute injury with effusion consider MRI
   II. Slow to order for anterior knee pain and no injury
III. US
   I. For effusion, tendon pathology

Knee Pain differential: extrinsic

Keep DDx broad

Extrinsic/Systemic
• Hip pathology • Radiculopathy • JIA or Lymes





Knee Pain differential: Intrinsic

Anterior Knee	Medial Knee	Lateral Knee	Posterior Knee
• **PFPS**	• **Meniscus tear**	• Discoid meniscus	• Hamstring
• Hoffa Syndrome	• OCD	• LCL Sprain	• Posterolateral corner injuries
• Bursitis	• Plica	• Femoral entrapment neuropathy	• **Bakers cyst**
• Idiopathic	• Pes Anserine Bursitis/ tendonitis	• ITB syndrome	• Popliteus tendinosis
• Multipartite patella	• Hamstring Tendonitis	• **Lateral Meniscus tear**	• **OA**
• **Osgood Schlatter**	• **OA**	• Saphenous nerve entrapment	• **Gastroc Strain**
• OCD		• **OA**	
• Stress Fx			
• Patella Tendonitis			
• Quad Tendonitis			
• SLJ			
• **OA**			

Differential for Knee Pain

TABLE 1

Selected Differential Diagnosis of Knee Pain

Condition	Historical points	Physical examination tests and/or findings
Mechanical (acute)		
Collateral ligament sprain or rupture (MCL, LCL)[3-7]	Medial or lateral pain Injury from valgus (MCL) or varus (LCL) force	Pain with applied force Asymmetric gapping or laxity Associated internal derangements
Cruciate ligament sprain or rupture (ACL, PCL)[3-6,8-13]	ACL Sudden pivoting injury Audible pop Instability Effusion in 1 to 2 hours PCL Blunt trauma to anterior tibia Sudden hyperflexion or extension injury Pain with kneeling	ACL Lachman test Anterior drawer test Pivot shift test Loss of hyperextension PCL Posterior "sag" sign "Quad activation" Posterior drawer test
Medial plica syndrome[3-7]	Acute (or chronic) medial pain Overuse; onset of new activities May report mechanical symptoms (e.g., catching, clicking)	Tender mobile tissue band along medial joint line
Meniscal tear[3,5,6,9-17]	Male; age > 40 years Cutting or twisting injury while bearing weight Effusion in 24 to 48 hours Locking or giving way	Thessaly test McMurray test Joint-line tenderness Loss of extension (locked)
Patellar subluxation or dislocation[3-5,8]	Anterior pain Children or adolescents History of subluxation	Apprehension Laxity Effusion

Differential for Knee Pain

Mechanical (chronic)		
Distal patellar apophysitis (Sinding-Larsen-Johannson syndrome)[8,18]	Adolescents (10 to 13 years of age) Repetitive running, jumping, or squatting	Tenderness of inferior pole of patella Local soft tissue swelling Decreased flexibility of quadriceps and hamstrings on affected side
Iliotibial band syndrome[3-5,7]	Lateral knee pain Repetitive flexion Runners, cyclists	Poor hamstring flexibility Pain along entirety of iliotibial band
Meniscal derangement or tear[5,6,9-12,14-17,19]	Overuse Medial or lateral pain Advanced osteoarthritis	Thessaly test McMurray test
Osteoarthritis[1,3-5,20-22]	Diffuse pain Stiffness when initiating movement Exacerbated by bearing weight Age > 50 years Absence of trauma Inflammatory signs Pain worse at end of day	Chronic bony deformity Leg asymmetry Appreciable crepitus
Patellofemoral pain syndrome (chondromalacia patellae)[3,18,23-25]	Anterior pain Runners, cyclists	Patellar tilt test Inhibition "shrug" test "J" sign (abnormal tracking) Poor vastus medialis oblique tone Patellar grind
Pes anserine bursitis[3-7,18]	Medial (or anteromedial) knee pain Overuse	Tender nodule overlying antero-medial proximal tibia
Quadriceps or patellar tendinopathy (jumper's knee)[3-5,8,18,26]	Anterior pain Athletes Overuse and repetitive stress	Pain specific to the quadriceps or patellar tendon
Tibial apophysitis (Osgood-Schlatter disease)[4,8,18,26]	Adolescents; associated with growth spurt Anterior pain; atraumatic	Tenderness at tibial tubercle

Differential for Knee Pain

Inflammatory (noninfectious)		
Crystal-induced arthropathy (gout or pseudogout)[3,5,6,9,11,15,27]	Acute, atraumatic, monoarticular pain Fever is possible Older adults (> 60 years) Risk factors for gout: male or post-menopausal female, high intake of purine-rich foods, critical illness, specific medications Risk factors for pseudogout: hyperparathyroidism, hemo-chromatosis, hypomagnesemia, hypophosphatemia, osteoarthritis	Limited flexion/extension Possible effusion and erythema Arthrocentesis demonstrating crystals on microscopy Gout: negative birefringence Pseudogout: positive birefringence
Inflammatory (infectious)		
Septic joint[5,6,9,11,15]	Acute/subacute Systemic symptoms Joint swelling, pain, erythema, warmth, and joint immobility	Limited flexion/extension Effusion and erythema Arthrocentesis with Gram stain and culture Elevated white blood cell count, erythrocyte sedimentation rate, and C-reactive protein

ACL = anterior cruciate ligament; LCL = lateral collateral ligament; MCL = medial collateral ligament; PCL = posterior collateral ligament.

Information from references 1 and 3 through 27.

Quiz (Q7-9)

Let’s Vote!!

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Acute Mechanical Knee: MCL Sprain

I. **Description**
   I. Tear or sprain of MCL
   II. MOI Valgus Force
   III. Can be in conjunction with ACL and meniscus tear (be suspicious if effusion)

II. **Presentation**
   I. Medial knee pain

III. **Exam**
   I. Swollen medial knee
   II. Bruising +/-
   III. + Valgus stress test at 30 Deg flexion
   (gapping would indicated bigger tear)

IV. **Treat**
   I. Grade 1-2: RICE and Rehab
   II. Grade 3: complete tear, maybe not painful with testing but sign
   gapping → Refer. Likely Bracing and rehab

Differential diagnosis

ACL
Meniscus tear
Tibial plateau fracture
Physeal injury (pediatric)
Patella dislocation

Acute Mechanical Knee: ACL rutpure

I. **Description**
   I. MOI: most often non contact planting and twisting
      I. Hyperextension or extreme valgus
II. **Presentation**
   I. Report “Pop”
   II. Immediate swelling (2 hr→ balloon knee)
   III. Instability, deep pain
   IV. Pain can be medial or lateral
III. **Exam**
   I. Large effusion
   II. + Lachman, pivot shift
IV. Imaging
   I. Xray and MRI
V. **Treat**
   I. Refer or ortho
   II. Linear athlete or compensator might be non-op candidate
   III. SX → 1 year rehab

Differential diagnosis

MCL
Meniscus tear
Tibial plateau fracture
Physeal injury (pediatric)
Patella dislocation

Quiz (Q10-12)

HSS

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Acute Mechanical Knee: Meniscal tear

I. **Description**
   I. MOI: flexion and twisting knee

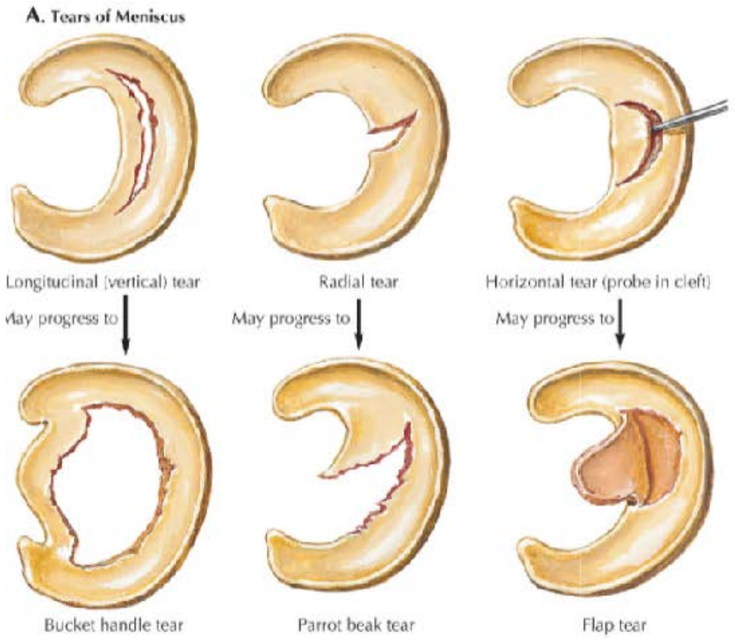
II. **Presentation**
   I. **Medial or lateral knee pain**
   II. **Clicking, locking, catching, instability**
   III. **Swelling at 24 hrs**

III. **Exam**
   I. Effusion
   II. Joint line TTP
   III. Pain with knee flexion (meniscal grind test/Steinman test)
   IV. + thessaly

IV. Imaging
   I. Xray
   II. MRI If acute MOI and no OA

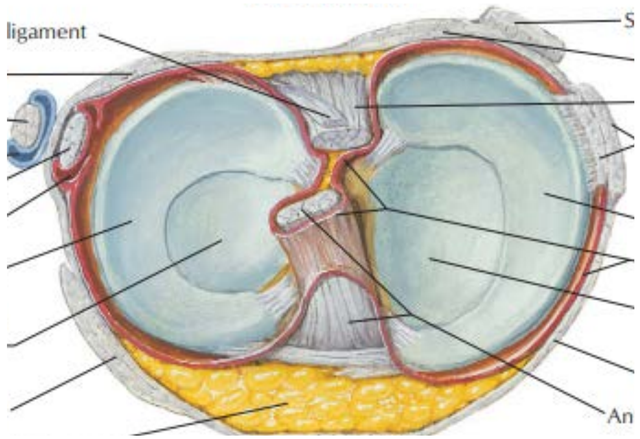
Differential diagnosis

MCL/LCL
ACL
OCD
Tibial plateau fracture
Physeal injury (pediatric)



Acute Mechanical Knee: Meniscal tear

I. Treatment
   I. Acute often trial 6 wks non-op with NSAIDs, PT, maybe injections
   II. If mechanical sxs → Surgery
   III. If complete root tear → surgery
II. Prognosis
   I. Often take 3 months or more for full recovery
   II. Deep knee flexion while weight bearing is usually last activity to return



B. Tear of posterior horn of the medial meniscus as seen on MRI

C. Arthroscopic appearance of meniscal tear

D. Discoid meniscus variations. Oblique tears are most commonly seen and are best treated by arthroscopic partial meniscectomy (APM). Vertical-longitudinal tears involving the peripheral third are best managed by repair. Radial split tears are usually secondary to trauma, and when the split extends to the capsular rim, repair should be attempted in young people, if at all possible. Bucket-handle tears are more likely to cause locking of the knee. Horizontal (cleavage) and symptomatic degenerative tears are best treated by APM.

Let’s Compare Meniscal Tears

Dx	Acute Meniscus	Degenerative Meniscus	OA Flare
Presentation	Acute Injury/fall.	Often no known MOI, increase activity	Gradual stiffness and pain
Epidemiology	< 40 yo (generally)	> 40 yo	>50 yo
Effusion	Yes w/I 24 hrs	Maybe, sometimes delayed	Maybe, insidious
Xray	No OA	OA	OA
Treatment	RICE, NSAIDs, PT, Maybe Sx	CSI, NSAIDs, PT, Knee Injections	CSI, NSAIDs, PT, Knee Injections

Chronic Mechanical Knee Pain

Chronic Mechanical Knee Pain: Osteoarthritis

I. **Description**
   I. Degenerative desease of joint
   II. Erosion of cartilage, hypertrophy of bone (osteophytes), subchondral schlerosis.
   III. Leading cause of disability in US
II. **Presentation**
   I. Insidious onset knee pain and stiffness
   II. Worse with activity
   III. *+/- effusion*
   IV. *Theater sign*
   V. *Morning stiffness < 30 min (if longer consider RA)*
III. **Risk factors**
   I. **Female, obesity, age, previous injury, occupation**
IV. **Exam**
   I. **Jt line TTP and/or Patella facet TTP**
   II. **Loss of ROM**

Differential diagnosis

Meniscal tear
Bursitis
PFPS
Gout/pseudogout
RA
Septic Arthritis
Referred pain:
Hip path
Radiculopathy

Chronic Mechanical Knee Pain: Osteoarthritis

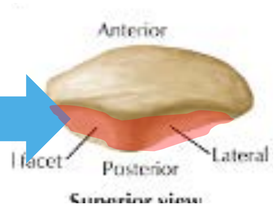
I. Treat
   I. Goals: reduce pain
      I. Maintain mobility
      II. Slow progression
   II. Low impact exercise and strengthening
      I. Cycling, elliptical, short walks
      II. Quad strengthening
   III. Oral medications
      I. NSAIDs and Tylenol (consider for flares <2 wks)
   IV. Intraarticular medicines
      I. CSI
      II. HA
      III. PRP
      IV. Stem Cell
   V. Surgery: Knee replacement. severe OA, Daily pain, loss of function and QOL

Case

13 yo male soccer player with 6 weeks of knee pain

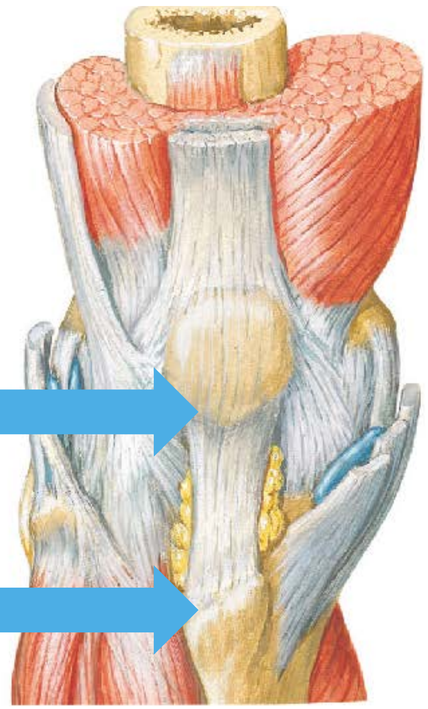
- Pain getting worse, no known injury
- Parents see him limping on field
- NSAIDs and ice
- Playing travel and school soccer 7 days a week
- Exam
  - No effusion, full ROM, no ligamentous laxity
  - **Tenderness>>>**

PFPS



SLJ/Patella Tendonitis

Osgood Schlatter’s



General Treatment Approach for overuse injuries

Identify inciting factor

EDUCATE

Reduced to Subthreshold Activity

Address deficits and imbalance

EDUCATE

Gradual progression back to sport

EDUCATE

Apophysitis

Osgood-Schlatter disease (12-15)

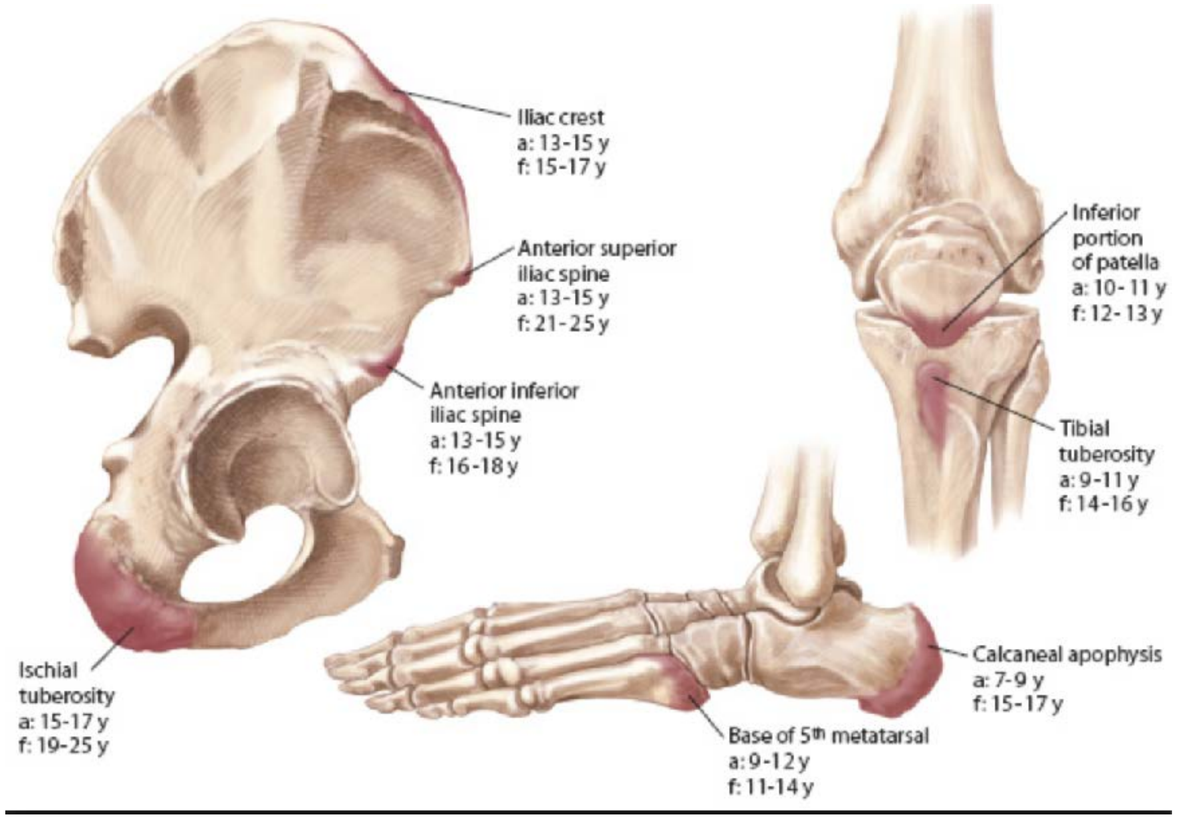
Sinding-Larsen-Johansson syndrome (9-12)

Sever’s disease (8-13)

Iselin’s disease (9-12)

Pelvic apophysitis (14-18)

Medial epicondyle apophysitis (8-15)



General Treatment Approach - Apophysitis

Activity Modification

- Pain guided activity (subthreshold)

Symptomatic therapy

- Icing, NSAIDs, modalities

Stretching and physical therapy (Address deficits: flexibility and strength)

Generally Self-limited but morbidity can be high (eg. Fear, inactivity, depression)

Follow up and educate

Apophysitis: Osgood-Schlatter's

Hx

- Insidious onset Anterior Knee pain
- Age 12-15 yo
- pain with running and jumping

Pathophysiology

- Some studies have shown e/o tendon involvement on imaging. (Rosenberg 1
- Repetitive stress causing small avulsio fractures in a susceptible apophysis

Risk Factors

- 2018 prospective cohort study by Wata al, looking at 37 male soccer players fo players with history of Severs (OR 5.25), center of gravity while kicking (OR 1.4), BMI (OR 1.9)

Elevated BMI

H/o Severs

Weakness

Inflexibility

- 151 PFP and 51 OSD and 50 controls
- Adolescent with OSD demonstrated **reduced** **extension strength** compared to ed controls. (P<.05; effect size, 1.25)
- scents with PFP had **reduced hip sion strength** compared to pain free (P<.05; effect size, 0.73), and only girls FP and OSD had **lower hip abduction th.**
- ective cohort study of 150 athletes **larger weight, higher BMI, quadriceps muscle ess and reduced flexibility** of hamstring es as significant risk factors for OSD se 2015)

- 2020 cross sectional study by Rathleff et al

Apophysitis: Osgood-Schlatter's

Exam

- TTP at Tibial tuberosity
- Flexibility/strength

TX

- Activity Modification- Pain guided
  - Flexibility/strength
  - Cho-Pat Strap??? Knee Pad
  - Injection dextrose/lido conflicting
    - RCT 51 athletes with superior pain free participation (Topol 2011)
    - RCT 47 knees saline vs. dextrose found no diff (Nakase 2019)
  - Low Quality evidence for ESWT but appears safe (Lohrer 2012)
  - **Operative – very rare**
  - **Prevention: training modification, warm ups, NMT, alternate high load days with lower load**

Differential diagnosis

PFP
Patella tendonitis
SLJ
Fat pad impingement
stress fx
avulsion fx
bone tumor

Apophysitis: Osgood-Schlatter's

Activity Modification and Knee Strengthening for Osgood-Schlatter Disease: A Prospective Cohort Study

- 2020 Case Series with 51 adolescents with OSD participating in 12 week intervention consisting of **activity ladder**, knee strengthening, and gradual RTP with successful outcome being much improved or improved (Rathleff 2020)
- Intervention
  - **0-4 wk avoid** painful activities, isometric strengthening, and education
  - **5-12 wk progress** to lunges and activity ladder progression

Apophysitis: Osgood-Schlatter's

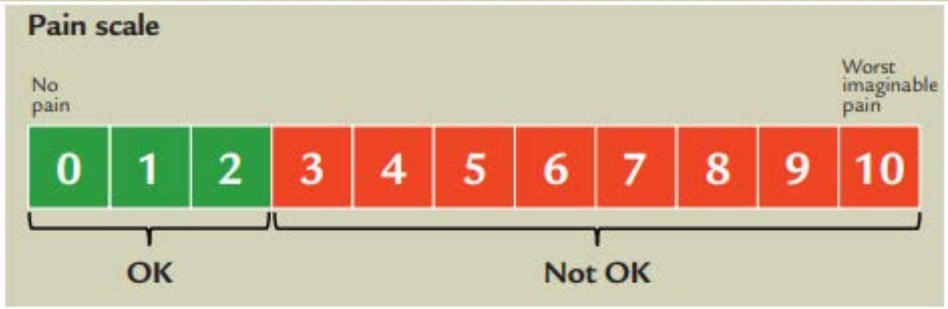
Key things to do

Week 1-4

- Activity Modification (avoid activities that aggravate your knee pain
- Static holds of the thigh (10 repetitions of 30 seconds, every day)
- Pelvic lifts (3 sets of 10 repetitions, every other day).

From week 5 and onwards

- Exercises with body weight
- Gradual increase in knee loading activities using the activity ladder

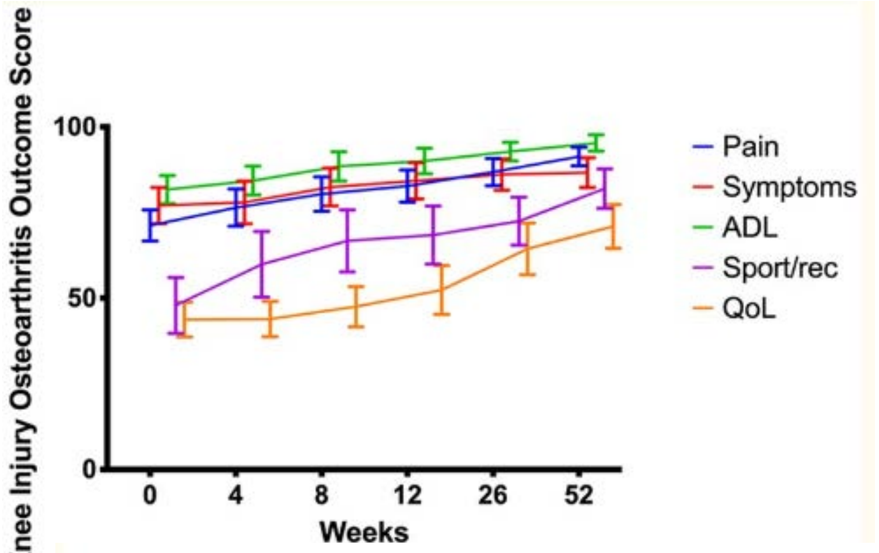


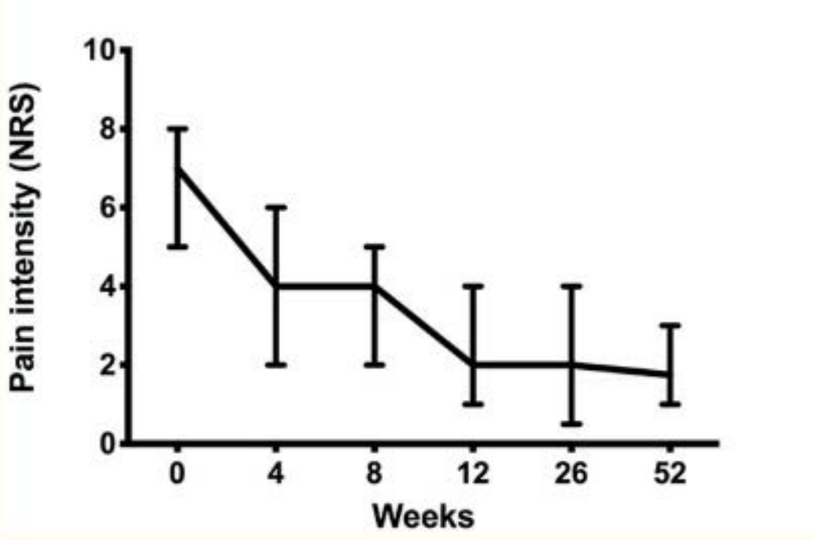
1. Light walking/cycling
2. Faster walking/medium to hard cycling
3. Slow running
4. Stairs
5. Running in medium pace
6. Skipping
7. Jumping
8. High speed running, turning and jumping
9. Warm-up and 1/2 training
10. Warm-up and full training
11. Match/competition

Apophysitis: Osgood-Schlatter's

Tx

- At 12 wks
  - 80% success with pain (reporting: improved or much improved)
  - 16% RTP
- 12 Months
  - 90% success with pain
  - **69% RTP (not great)**





Apophysitis: Osgood-Schlatter's

Prognosis: Most resolve with fusion of apophysis, but some pain may persist into **adulthood (up to 10%)**

- Retrospective study showed 60% of patients had persistent knee pain with avg duration of 90 months. 54% with knee pain decreased sport participation vs. 35% of those without knee pain (Guldhammer 2019)
- Survey based Cohort Study evaluating knee pain at 2 years found 56% with pain at baseline continued to have pain at 2 years (4.5 RR) (Rathleff 2016)

Even though the disorder is benign, the recovery can be prolonged and cause absence from sports and exercise

Patellofemoral Pain Syndrome (PFPS)

Prevalence of > 10% of adolescents

25% of Adult Knee Pain

Chronic Mechanical Knee Pain: Patellofemoral Pain Syndrome (PFPS)

I. Description
   I. Anterior knee pain (chondromalacia patella – bad cartilage)
II. Hx
   I. Ant knee pain with running, squatting, stairs, theater sign
   II. **Painful Down Stairs**
III. Exam
   I. Hip/knee/ankle alignment
   II. Patellar tracking and VMO bulk
   III. +/- TTP Patellar facet
   IV. Pain with eccentric stepdown
   V. Single Leg Squat with dynamic valgus
   VI. Knee effusion uncommon
IV. Imaging often normal

Patella Compression / grind test

Differential diagnosis

Quad tendinosis
Patella tendinosis
OCD
OA
Bursitis
Patella subluxation/d/l
Stress Fx

Referred pain:
Hip path
Radiculopathy

Chronic Mechanical Knee Pain: Patellofemoral Pain Syndrome (PFPS)

Exam

- **Pain with eccentric stepdown**
- Single Leg Squat with dynamic valgus
- Knee effusion uncommon

Differential diagnosis

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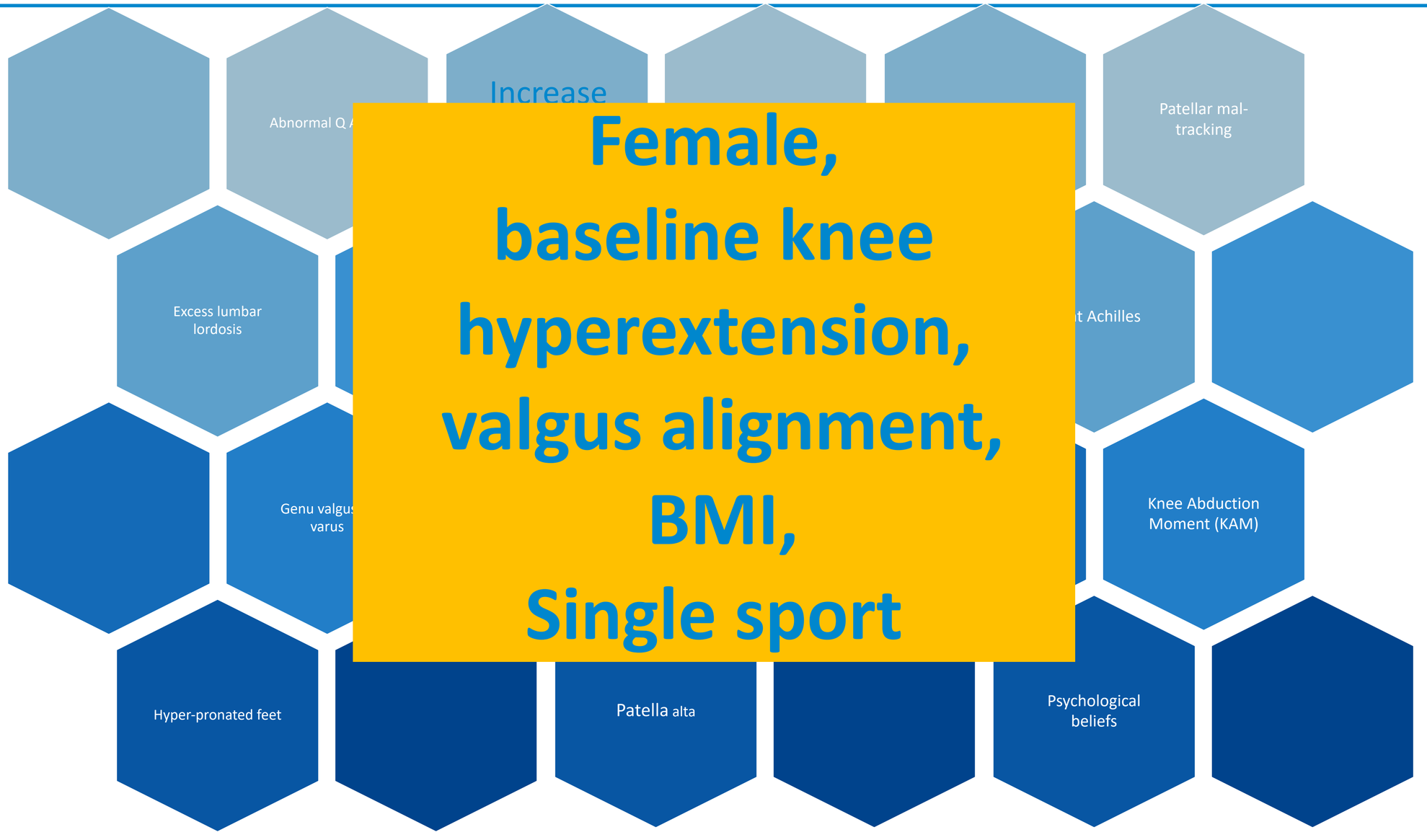
Stress Fx

Referred pain:
Hip path
Radiculopathy

PFPS Contributing factors



Female, baseline knee hyperextension, valgus alignment, BMI, Single sport

Chronic Mechanical Knee Pain: Patellofemoral Pain Syndrome (PFPS)

I. Imaging
   I. Consider Xrays if effusion or failed treatment
   II. Rarely need MRI
II. Treatment
   I. Activity Modification: avoid running, jumping, squatting
   II. PT: knee stability, quad strength, Close kinetic chain
      I. Typical approach used in adults may not be as effective in adolescents (Rathleff et al.)
   III. Little evidence for
      I. NSAIDs
      II. Bracing, Taping and orthotics (though relatively benign)
   IV. IA injections: HA or PRP
   V. Sx: if failed conservative refer
      I. Consider alignment surgery or chondroplasty

Differential diagnosis

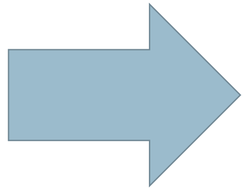
Quad tendinosis
Patella tendinosis
OCD
OA
Bursitis
Patella subluxation/d/l

Referred pain:
Hip path
Radiculopathy

PFPS

Prognosis

- Those with a diagnosis of PFP had 1.26 higher RR of knee pain at 2 years and were more likely to stop or reduce sports (Rathleff 2016)
- Multiple retrospective studies knee pain for 14+ years
- Fear Avoidance beliefs and kinesiophobia → associated with pain and function deficit in adolescents with patellofemoral pain (Selhorst et al 2020)

Sedentary adolescents  Obese Adult

What do we Tell our Patients?

This pain can last for years? You may always have pain?

- Play through pain
- Limit activity based on pain
- Avoid painful activities
- Change sports

8 % athletes drop out of sport due to fear of injury (Grimmer 2000)

Only 65% RTP after an injury despite functional recovery (most studies evaluating RTP after ACL or chondral injury)

How can we best support psychologic health and participation in sports?

When to hold out of Sport?

Unable to perform sport specific movements

Loss of ability to protect

Severe Pain

Risk of further injury

Consider Referral

Quiz (Q13-16)

HSS

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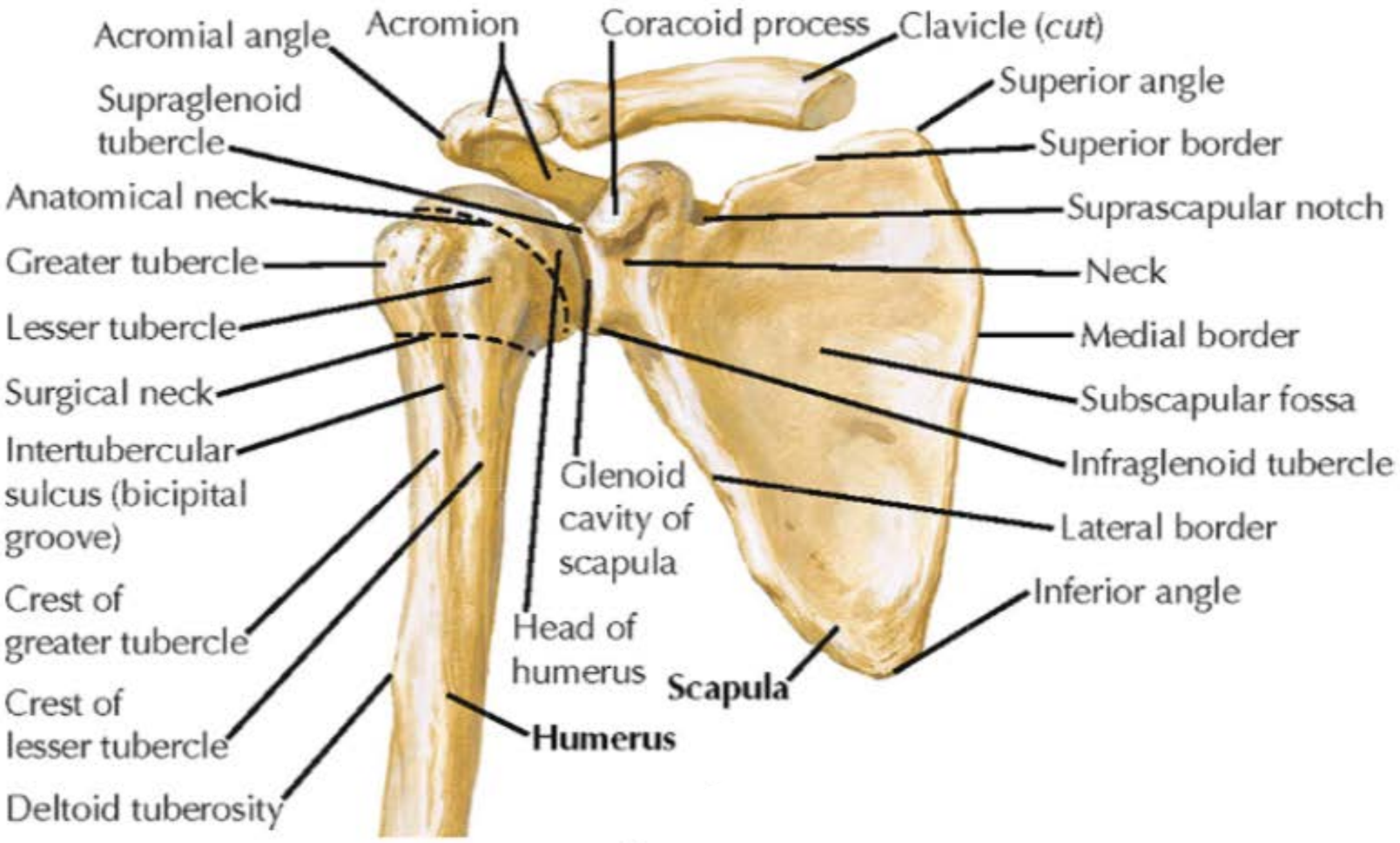
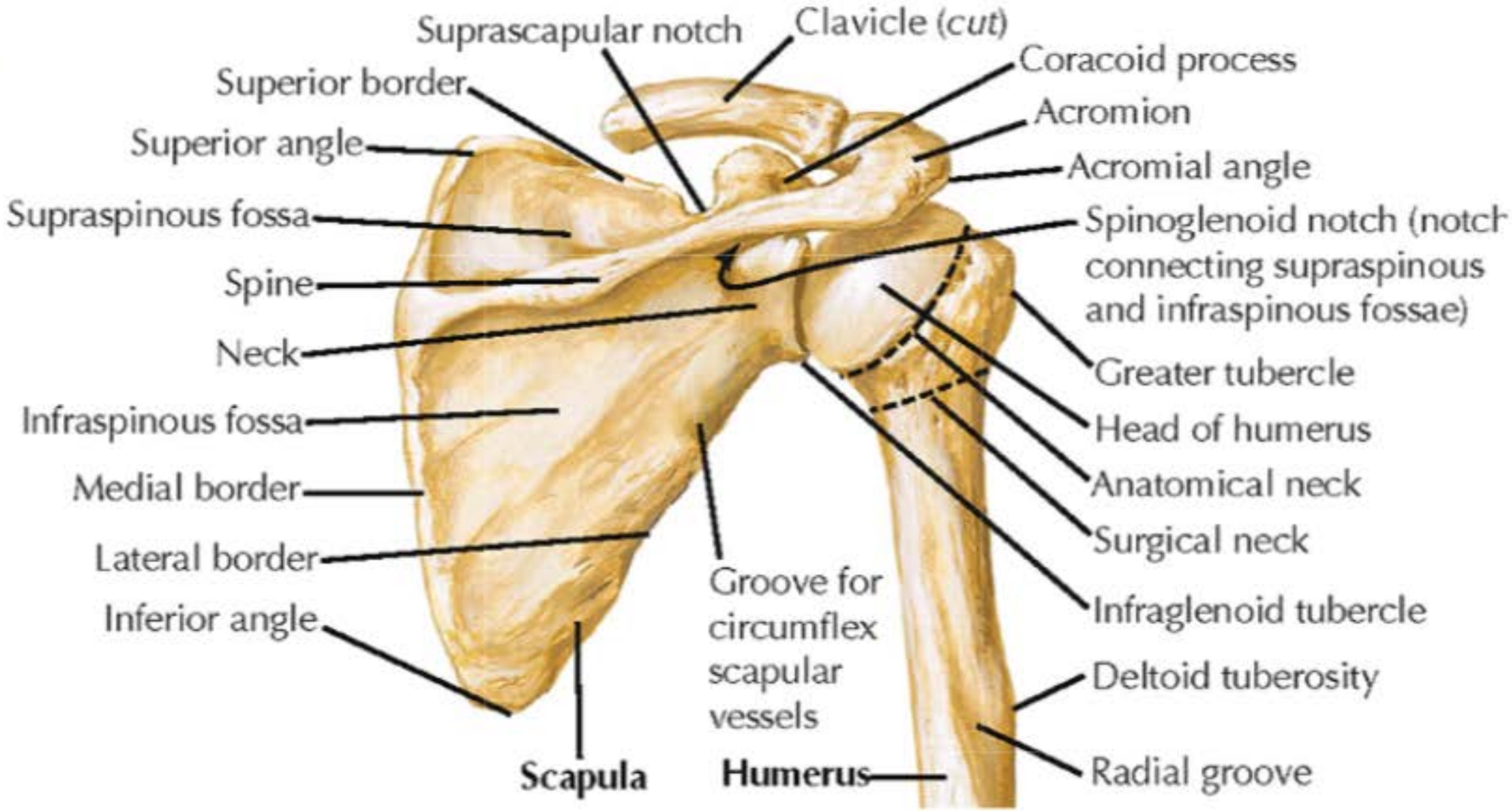
The Shoulder

Shoulder Anatomy



- 180° of abduction comes from motion in two joints (2:1 ratio)
- 120° from the glenohumeral joint
- 60° from the scapulothoracic joint

Shoulder Anatomy



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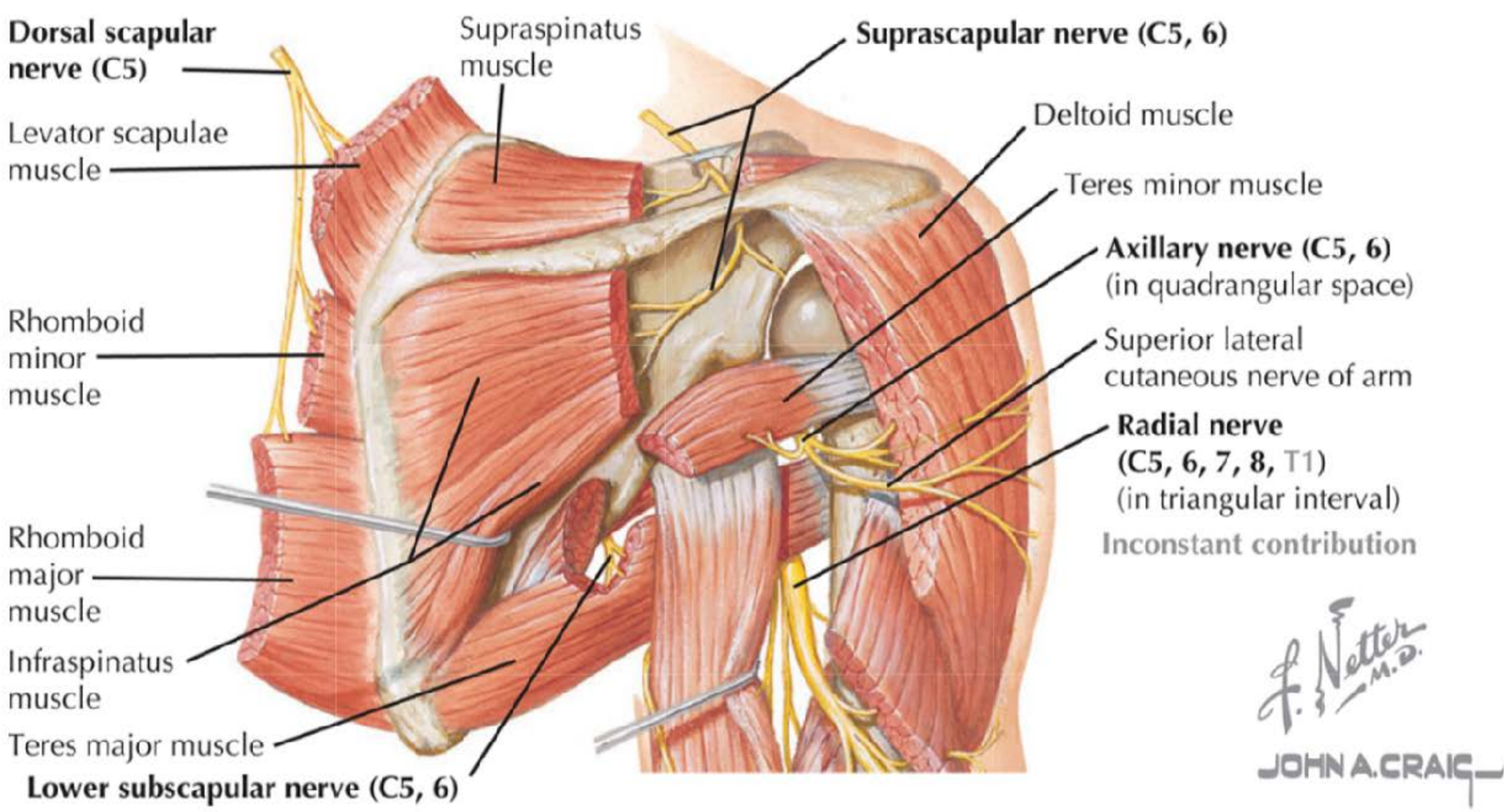

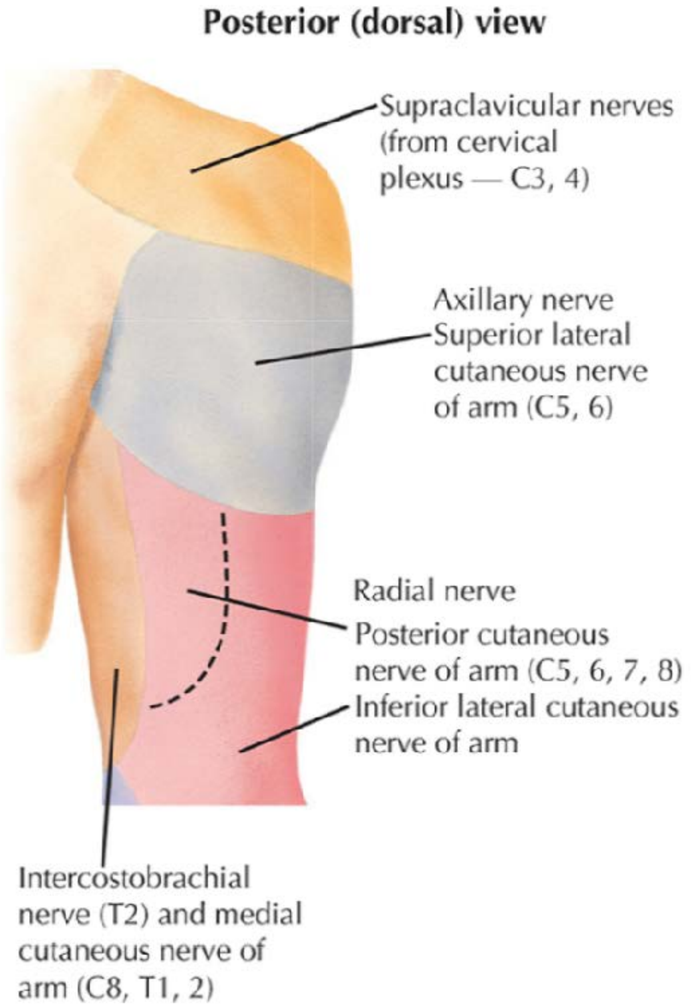

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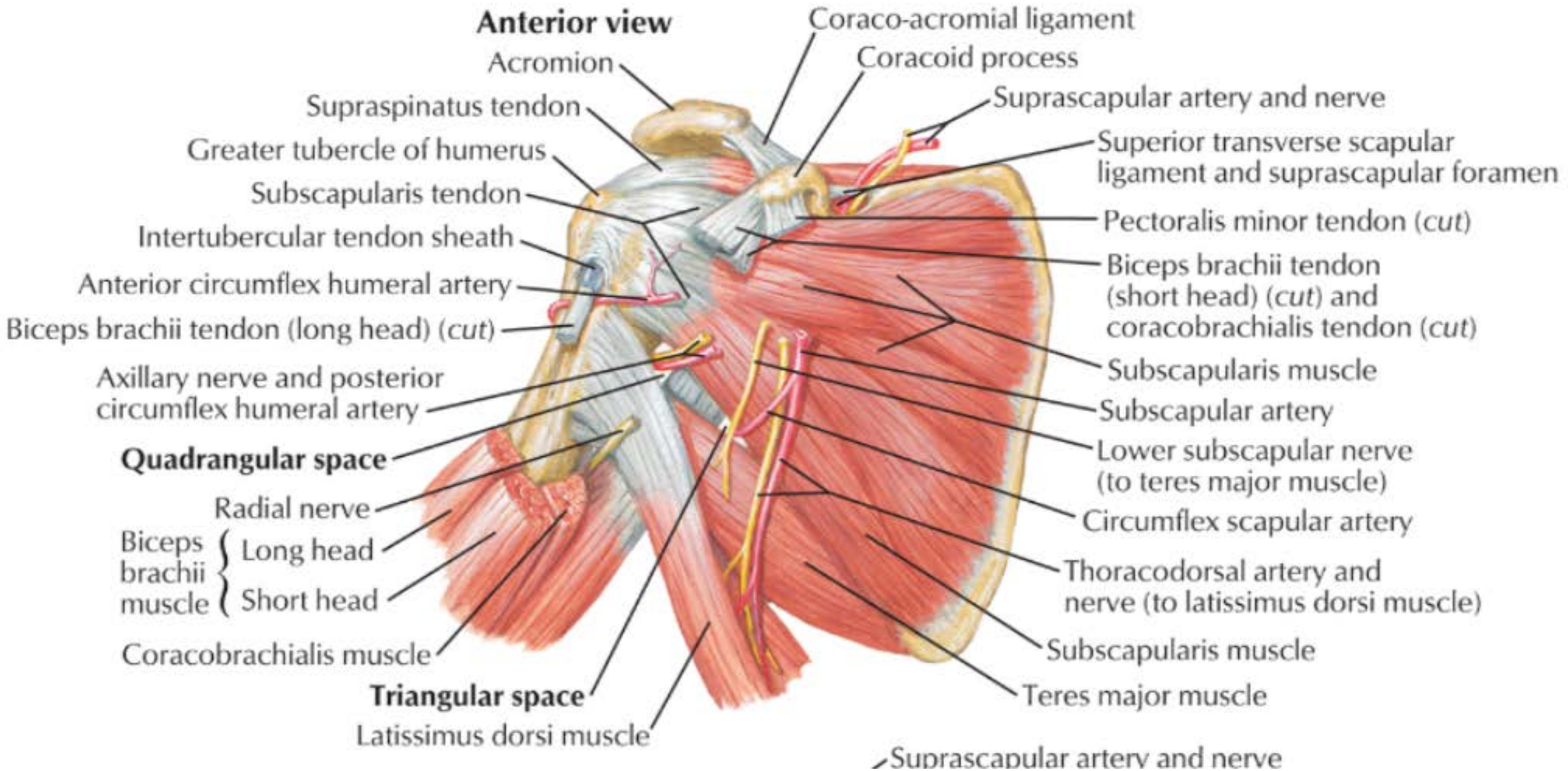
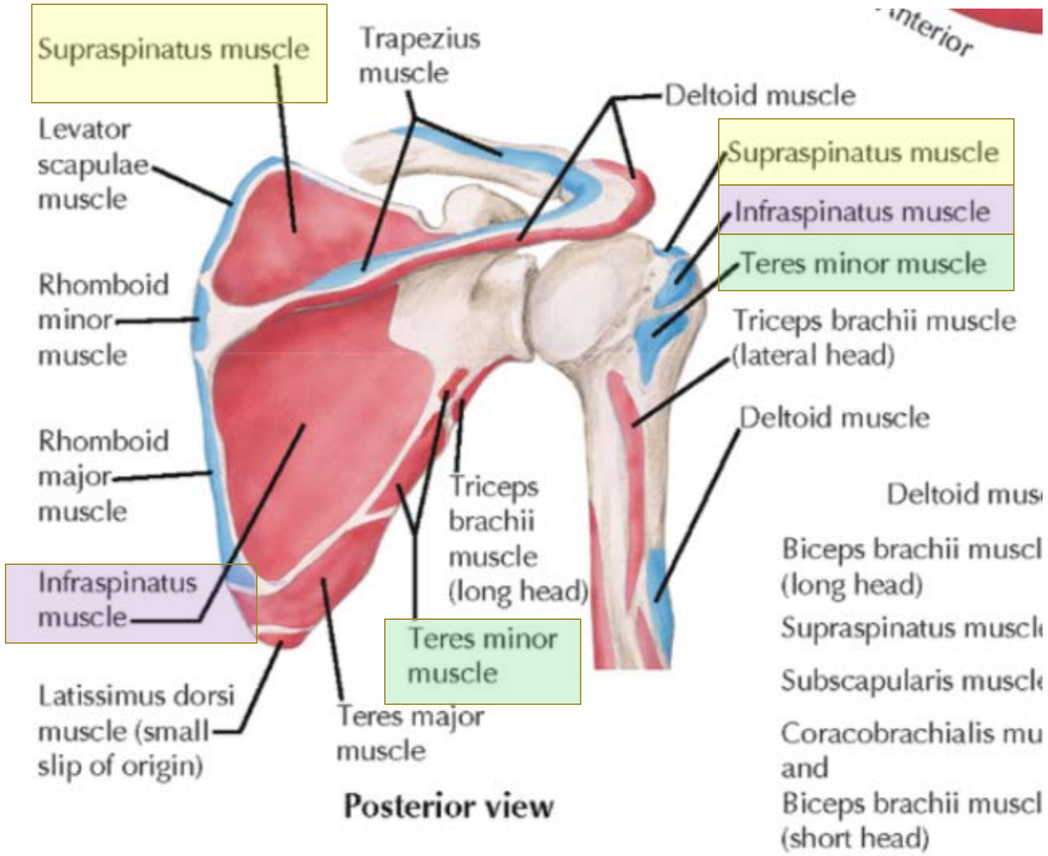


Shoulder Anatomy

MUSCLE	ORIGIN	INSERTION	NERVE	ACTION	COMMENT
		ROTATOR CUFF			
Supraspinatus	Supraspinatus fossa (scapula)	Greater tuberosity (superior)	*Suprascapular*	Abduct FF arm stability	Trapped in impingement, #1 torn rotator cuff tendon
Infraspinatus	Infraspinatus fossa (scapula)	Greater tuberosity (middle)	*Suprascapular*	ER arm, stability	Weak ER: cuff tear or ss nerve lesion in notch
Teres minor	Lateral scapula	Greater tuberosity (inferior)	*Axillary*	ER arm, stability	Rarely torn rotator cuff tendon
Subscapularis	Subscapular fossa (scapula)	Lesser tuberosity	Upper and lower *subscapular*	IR, adduct arm, stability	At risk from anterior approach



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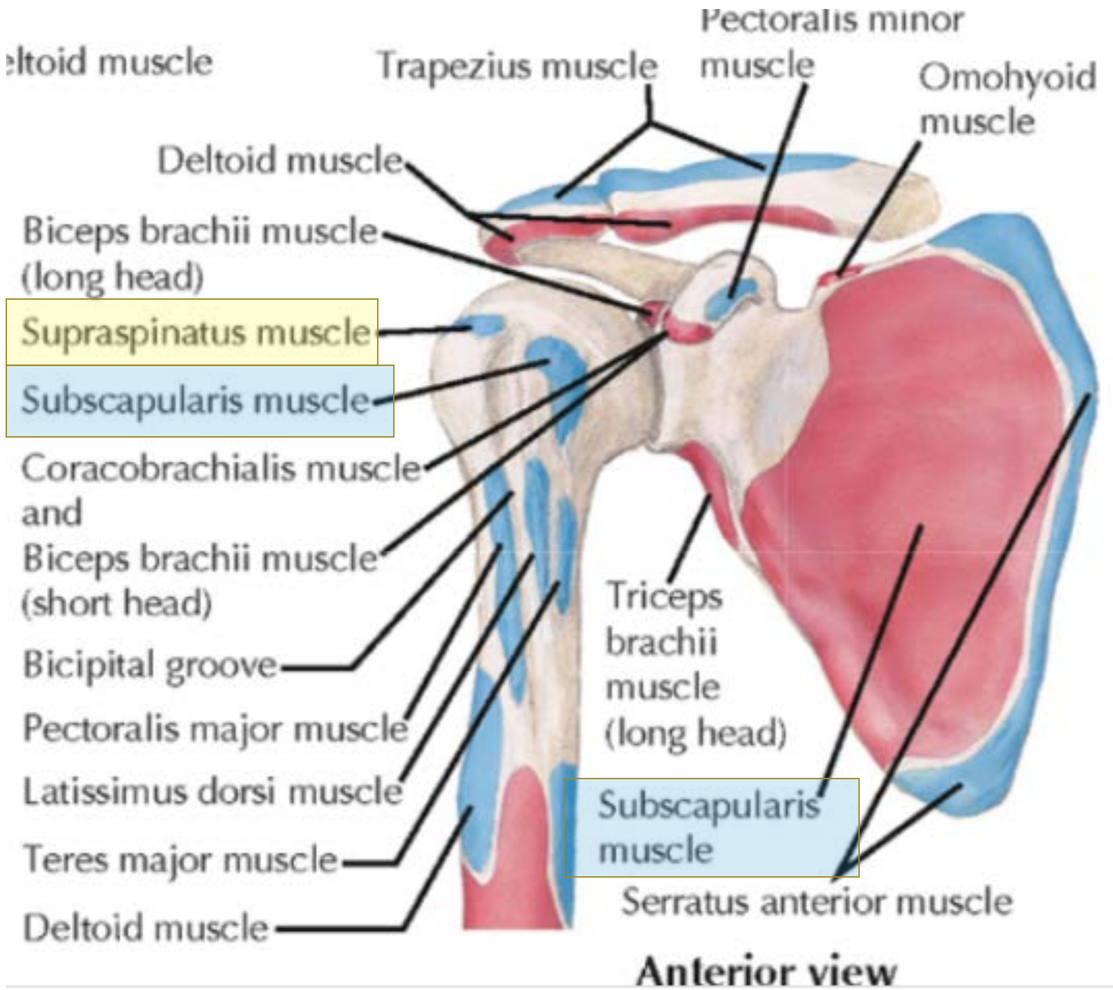

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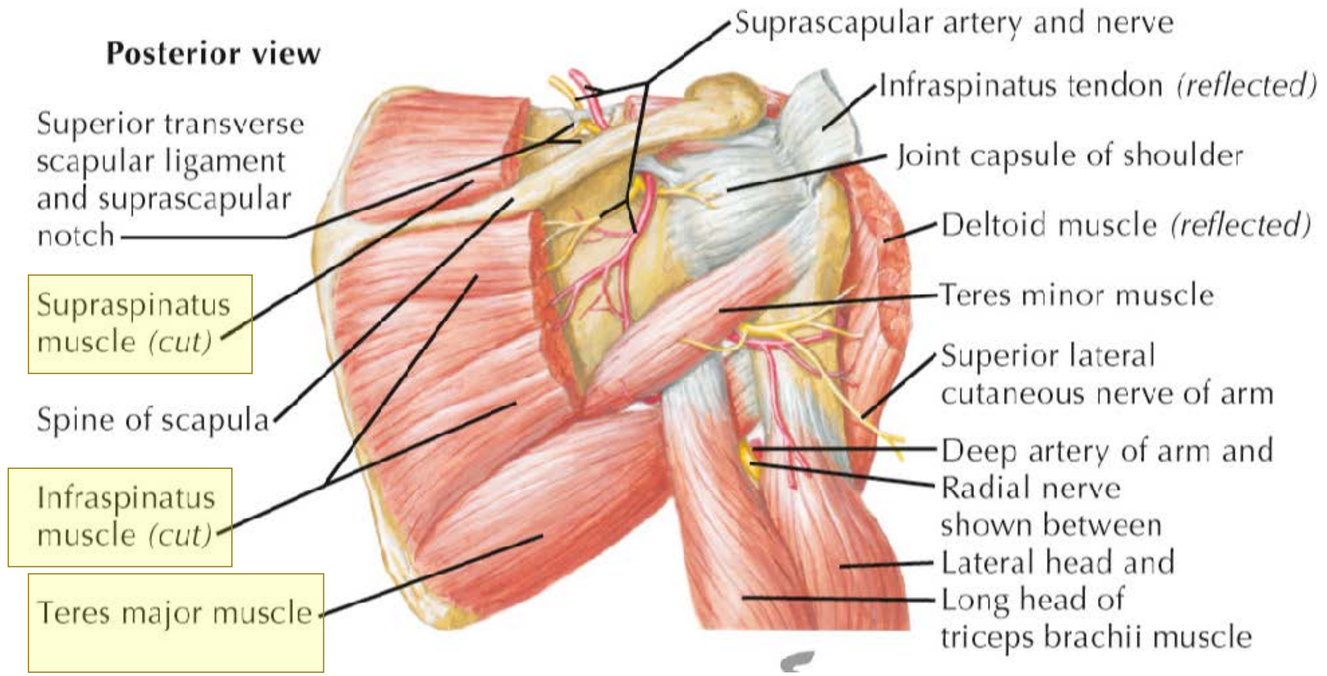


Shoulder Exam

Diagnosis: Exam

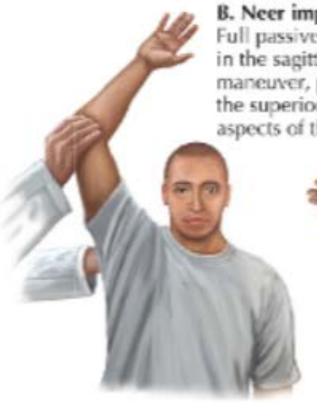
I. Test the anatomy
   I. Inspection
   II. Palpation
   III. ROM (PROM- Passive and AROM- Active)
   IV. Strength
   V. Neurovascular
   VI. Stability
   VII. Special Tests

Push, pull, grind, poke until you **reproduce the patients symptoms**

Know your anatomy!

A. Hawkins impingement sign. Arm is placed in full passive internal rotation with the arm at 90° of abduction in the plane of the scapula.

B. Neer impingement sign. Full passive, forward flexion in the sagittal plane. In this maneuver, pain is elicited in the superior and lateral aspects of the shoulder.



C. Lag sign. Larger tears result in loss of both active forward flexion and external rotation. Weakness of forward flexion elevation without a shrug sign.

Examiner places patient's arm to obtain full passive external rotation, thereby distinguishing this from a frozen shoulder (Plate 1-33).

When released, arm drifts inward toward abdomen, demonstrating weakness of the external rotators of the cuff (intraspinatus teres minor).

D. Abdominal compression test

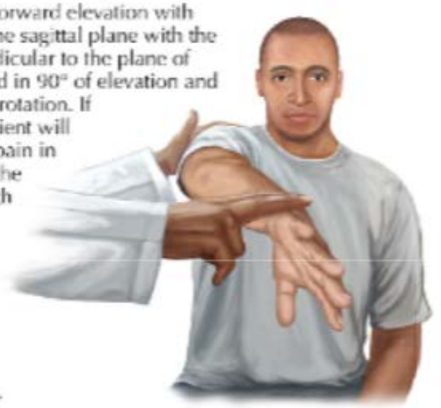
Consistent with loss of subscapularis tendon attachment to the left shoulder to the lesser tuberosity. Patent unable to internally rotate the arm and place the elbow parallel to the torso.

Examiner able to passively internally rotate arm demonstrating that the patient's inability to do this is a result of weakness, not loss of passive range of motion.

Positive lift-off rest (left shoulder) or internal rotation lag sign

E. Three-part O'Brien sign

1. Resisted forward elevation with the arm in the sagittal plane with the arm perpendicular to the plane of the body and in 90° of elevation and full internal rotation. If positive, patient will experience pain in the front of the shoulder with downward pressure on the arm.

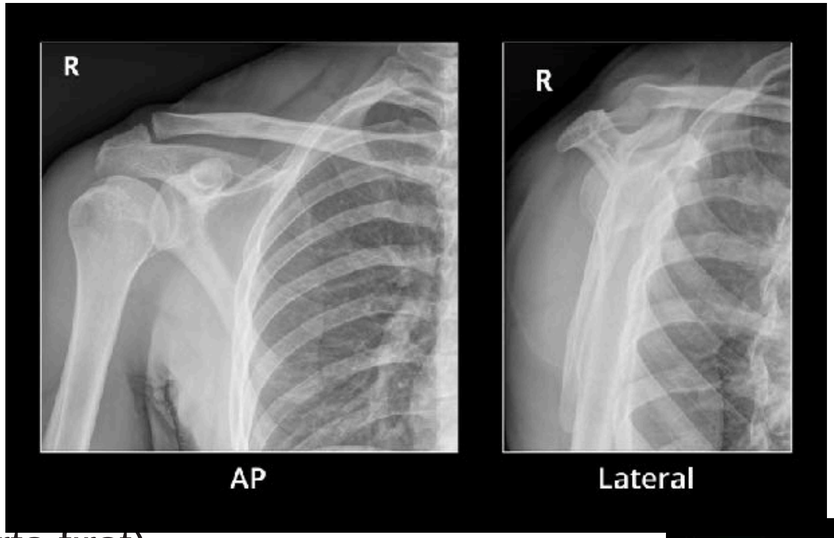


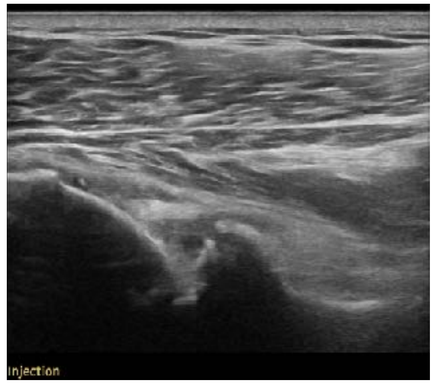
2. Relief of pain or a significant decrease in pain is associated with external rotation of the arm while otherwise maintaining the forward elevation position.

3. To complete the exam the arm is tested against resistance with full internal rotation and the arm in 90° of elevation with the arm in the plane of the scapula (Jobe's test position or "empty" can position). When pain in this position is substantially less than that in the first postion, this helps confirm that the pain is not from the superior part of the rotator cuff (i.e., the rotator cuff supraspinatus), but from the biceps tendon, superior labrum, or subscapularis tendon insertion sites.

Diagnosis: Imaging

I. Xray
   I. At least 3 views
      I. AP (int, ext rotation), Lat, Axillary, outlet
      II. Look for elevated humeral head, OA, fx
II. MRI
   I. Evaluate soft tissue
   II. Arthrogram?? (not usually required, send to sports first)
III. US
   I. Dynamic, bedside, great resolution





Quiz (Q17-18)

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Common Pathology

Differential for Shoulder Pain

First Consider **Extrinsic** sources

Keep DDx broad

Extrinsic causes of shoulder pain

Neurologic
Cervical nerve root compression (C5, C6)
Suprascapular nerve compression
Brachial plexus lesions
Herpes zoster
Spinal cord lesion
Cervical spine disease
Abdominal
Hepatobiliary disease
Diaphragmatic irritation (eg, splenic injury, ruptured ectopic pregnancy, perforated viscus)

Cardiovascular
Myocardial ischemia
Axillary vein thrombosis
Thoracic outlet syndrome
Thoracic
Upper lobe pneumonia
Apical lung tumor
Pulmonary embolus

Differential for Shoulder Pain

- Fracture (clavicle, humerus, scapula), contusion
- **RC disorder: impingement, tear, calcific tendonitis**
- **Subacromial bursitis**
- Scapulothoracic dyskinesis (adolescents)
- AC joint pathology (AC separation/OA, osteolysis)
- **Biceps tenosynovitis or tear**
- Acromial apophysitis or os acromiale
- **Glenohumeral joint OA**
- Glenohumeral joint instability (acute dislocation or chronic multidirectional instability)
- **Adhesive capsulitis**
- Labral tear or associated bony pathology
- Muscle strain (trapezius, deltoid, biceps)
- Other: autoimmune, rheumatologic, referred pain, septic joint (biliary/splenic, cardiac, pneumonia/lung mass)

Differential for Shoulder Pain

Age-related causes and clinical characteristics of intrinsic shoulder pain

Age	Disorder	Clinical characteristics
Adolescents and young adults	Overuse injuries	Pain and loss of function associated with a particular athletic activity
	Acromioclavicular sprain	Focal pain over acromioclavicular joint; history of trauma
	Shoulder instability	Minor trauma, high risk of recurrence
Middle-aged and older individuals	Rotator cuff tendinopathy or impingement syndrome	Pain, difficulty with active abduction and external rotation, pain at night, crepitus may be felt with lifting arm beyond 60° in impingement syndrome
	Rotator cuff tears	Pain and inability to actively abduct the arm, passive abduction is preserved
	Subacromial bursitis or inflammatory synovitis	Features resemble rotator cuff tendinopathy, may be seen with rheumatoid arthritis, polymyalgia rheumatica, or crystal-induced arthritis
	Adhesive capsulitis (frozen shoulder)	Pain, stiffness, and marked loss of shoulder motion; risk factors include diabetes mellitus and prolonged immobilization
	Bicipital tendinitis	Pain and tenderness anteriorly within the bicipital groove
	Osteoarthritis	Associated with damage to the rotator cuff, rheumatoid arthritis, or chondrocalcinosis
	Myofascial pain	Diffuse soft tissue tenderness in the shoulder region and over the chest wall

Shoulder Instability

I. **Description:** Defined as symptomatic, abnormal translation of the humeral head on the glenoid; instability can be classified in several ways—*direction of instability* (**anterior, posterior, multidirectional**), *traumatic versus atraumatic,* and *degree of instability*

II. ***Anterior dislocation is most common***

   i. *Multi-directional instability (MDI) in young athletes*

III. **Presentation**

   I. Can present with pain, feeling of weakness, instability, or recurrent dislocations

   II. *Bankart/Hillsachs lesions in young athletes with acute dislocation*

   III. *RC tear in older population 40+*

IV. **Exam**

   I. Acute dislocations, the lateral shoulder will lose its normal contour with fullness present anteriorly. The arm is held in slight abduction and in external rotation.

   II. neurovascular examination is important. **Axillary nerve** most commonly injured (lat deltoid)

   III. **Sulcus sign, Apprehension test, relocation test,** and **load and shift test**.

Differential diagnosis

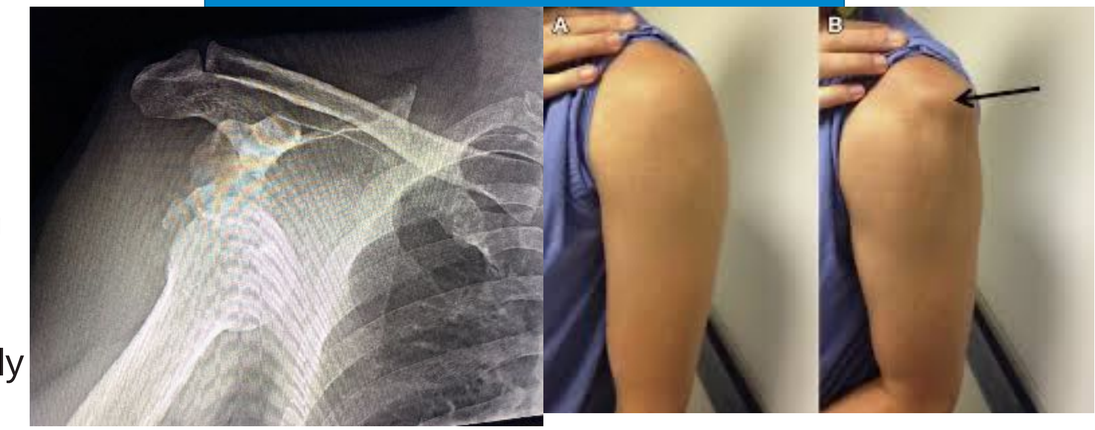
Multidirectional instability (MDI)

Rotator cuff tear

SLAP lesion/Labral tear

proximal humerus fracture

Scapular Fx (rare)



Shoulder Instability

I. **Imaging**
   i. *Xray: eval for bony bankart (westpoint) or Hillsachs (stryker notch)*
   ii. *MRI: labral or cuff pathology*

II. ***Treatment***
   i. *If acute→ relocate shoulder (many techniques)*
      i. *Rest 4-6 weeks, sling initially for comfort*
   ii. *Stabilize shoulder with dynamic stabilizers (RC and scapular stabilizers PT)*
   iii. *Recurrent d/l or large bony defects→ Surgery*

III. **Prognosis**
   i. **re-dislocation rate is approximately 90%** in patients aged <20 years and decreases with increasing age

Biceps Tendonosis

I. **Description**
   I. Tendon injury/irritation of long head biceps tendon (LHBT)
   II. **Often secondary** process in conjunction with pathologic changes to surrounding structures in the shoulder such as rotator cuff pathology, impingement syndrome, bursitis, and AC joint disorders
   III. Degeneration coupled with overuse or mal-use

II. **Presentation**
   I. Anterior Shoulder Pain

III. **Exam**
   I. Tenderness anteriorly over the bicipital groove
   II. Speed's, Yergason's, and upper cut tests are positive
   III. Because of its association with impingement, Hawkins' and Neer's tests are often positive

Differential diagnosis

RC

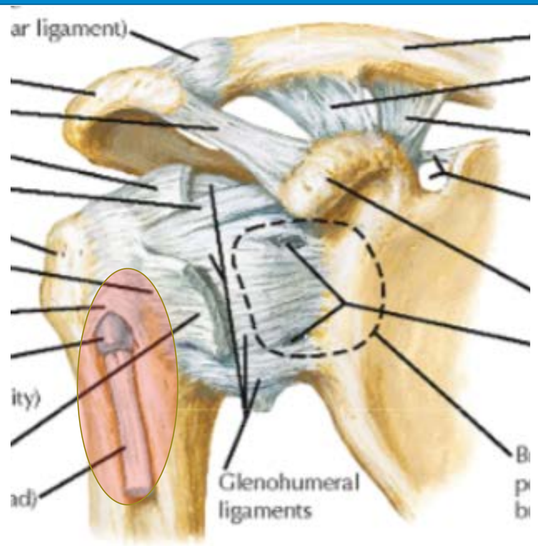
Impingement

GH OA

LHBT rupture

Calcific tendonitis

LHBT Subluxation

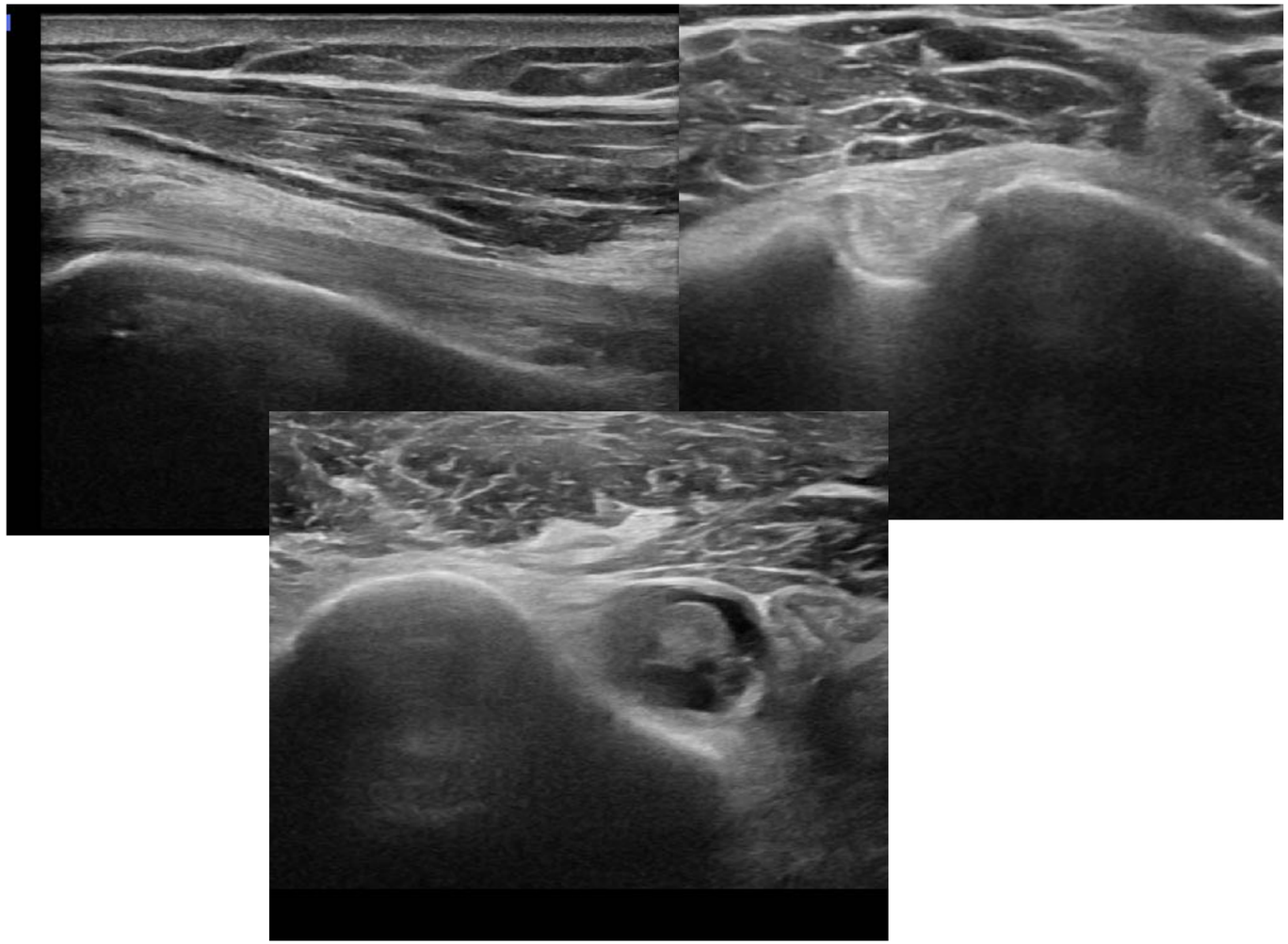


Biceps Tendonosis

I. **Imaging**
   i. *Xray: often normal*
   ii. *MRI: Tendon tears*
   iii. *US: heterogeneity (irregular), effusion, calcium of LHBT*

II. ***Treatment***
   i. *Slow progressive strengthening with PT and HEP*
   ii. *Injection*
   iii. *If chronic may need sx (tenotomy or tenodesis)*

III. **Prognosis**
   i. Typically 3-4 month recovery
   ii. *May be chronic and recurrent*
   iii. *Increased risk of rupture?*



Quiz (Q19-21)

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Rotator Cuff Pathology: Impingement/Tendonosis

I. **Description**
   I. Impingement syndrome encompasses a spectrum of pathologies, including subsacromial bursitis, rotator cuff tendinopathy, and partial-thickness rotator cuff tears.
   II. Usually >40 yo
   III. 70% shoulder pain

II. **Presentation**
   I. anterolateral shoulder pain that radiates to the lateral arm
   II. Exacerbated by overhead activities
   III. Night Pain (lateral shoulder)

III. **Exam**
   I. Atrophy (chronic), Weakness, Lag, Drop arm
   II. Pain with resistance testing (and sometimes weakness)
   III. Painful arc indicative of RC injury
   IV. Impingement findings (Hawkins, Neer)

Differential diagnosis

RC tear
RC tendonopathy
Bursitis
Radiculopathy
Adhesive Capsulitis
Glenohumeral OA
Biceps pathology

- **Supraspinatus testing**
  - Strength testing
  - Champagne toast
  - **Job test/Empty can**
  - Drop arm
  - Impingement tests
- **Infraspinatus**
  - **External rotation** weakness/pain/lag
- **Teres minor**
  - External rotation testing, hornblower's
- **Subscapularis**
  - Internal rotation weakness/pain
  - Liftoff test
  - **Belly press** test

Rotator Cuff Pathology: Impingement/Tendonosis

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Radiculopathy
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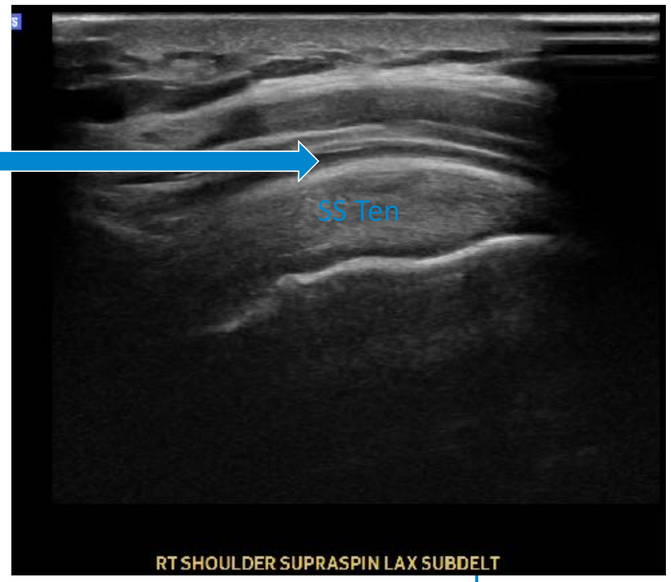
Glenohumeral OA
Biceps pathology



Rotator Cuff Pathology: Impingement/Tendonosis

I. **Imaging**
   I. *Xray: Elevated humeral head, OA?, Calcific tendonopathy*
   II. *MRI: Most definitive, consider if patient is considering surgery or unclear diagnosis*

II. ***Treatment***
   I. *PT: ROM and strengthening*
      I. *Slow progressive strengthening for tendonopathy and stability training*
   II. *Subacromial CSI*
   III. ***When to refer:***
      I. *Concern for large tear (significant weakness, drop arm, elevated humeral head on xray)*

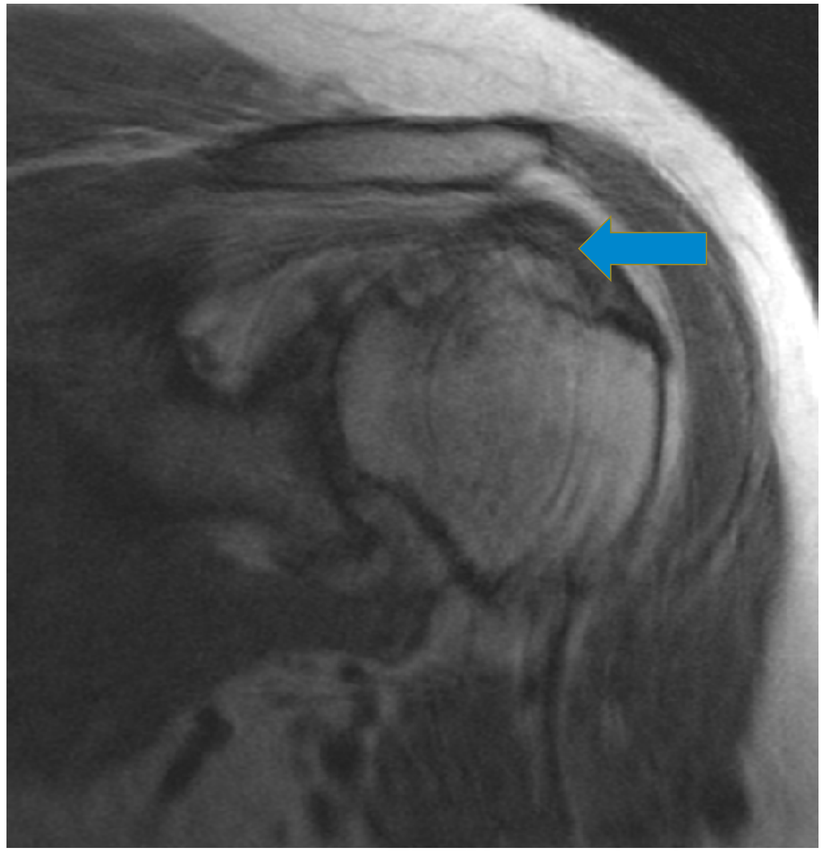
III. **Prognosis**
   I. 3+ month recovery (**chronic problem → chronic recovery**)
   II. Can be recurrent (fix underlying problem)
   III. PT/HEP needs to become regular practice
   IV. Rarely require surgery

Considerations for Acute RC Tear

I. **Presentation**
   I. Acute fall or injury. Lifting overhead injury
   II. Weakness and pain
   III. Radiates to lateral arm, night pain

II. **Exam**
   I. Likely painful arc and weakness
   II. If acute pain with notable weakness or drop arm consider MRI

III. **Imaging**
   I. *Elevated humeral head → consider MRI*
   II. *MRI can often show a lot of small things. Correlate clinically! Also, if tear >2cm and weakness strongly consider surgery*



Considerations for Acute RC Tear

Types of Tears
Partial Thickness: Bursal Sided
Partial Thickness: Articular sided
Full Thickness

Considerations for Acute RC Tear

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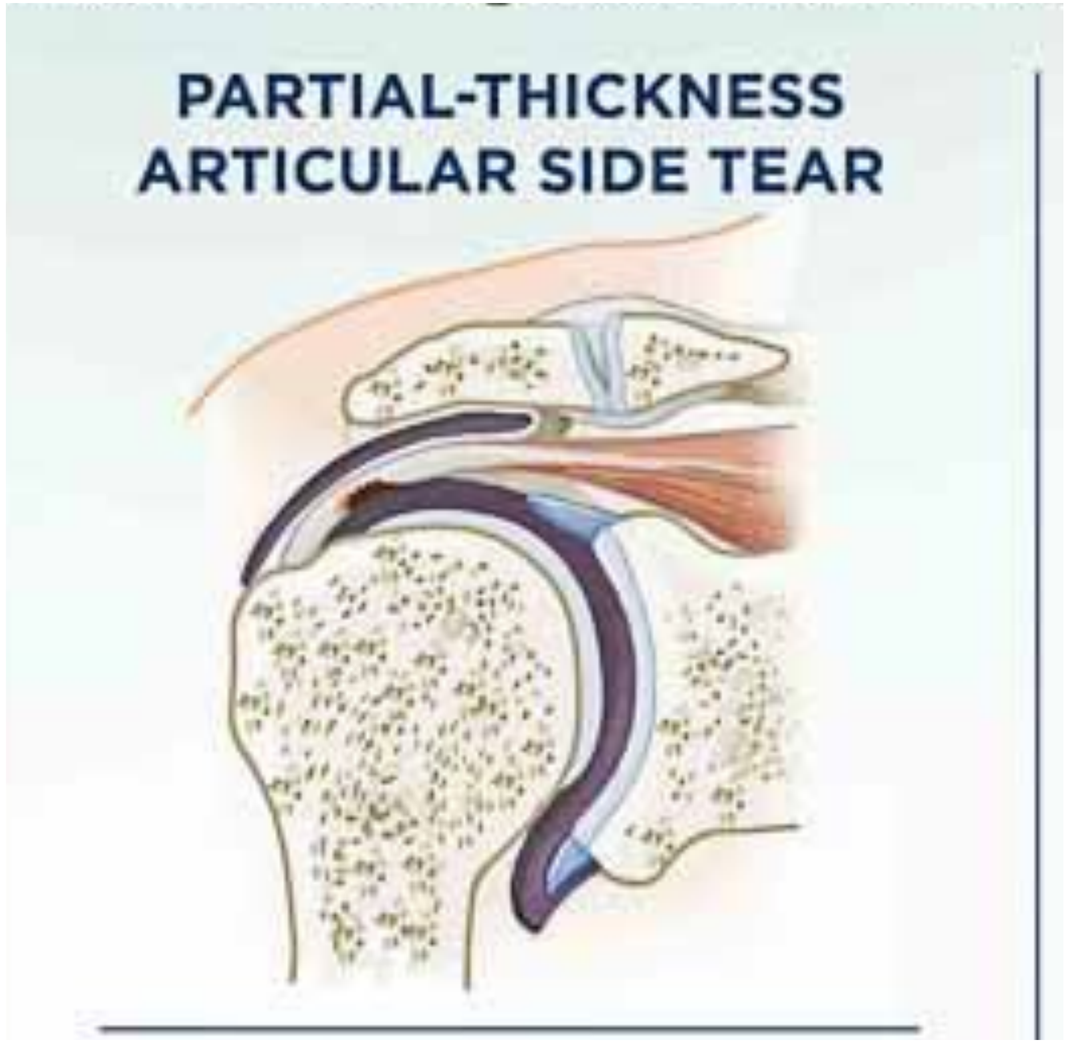

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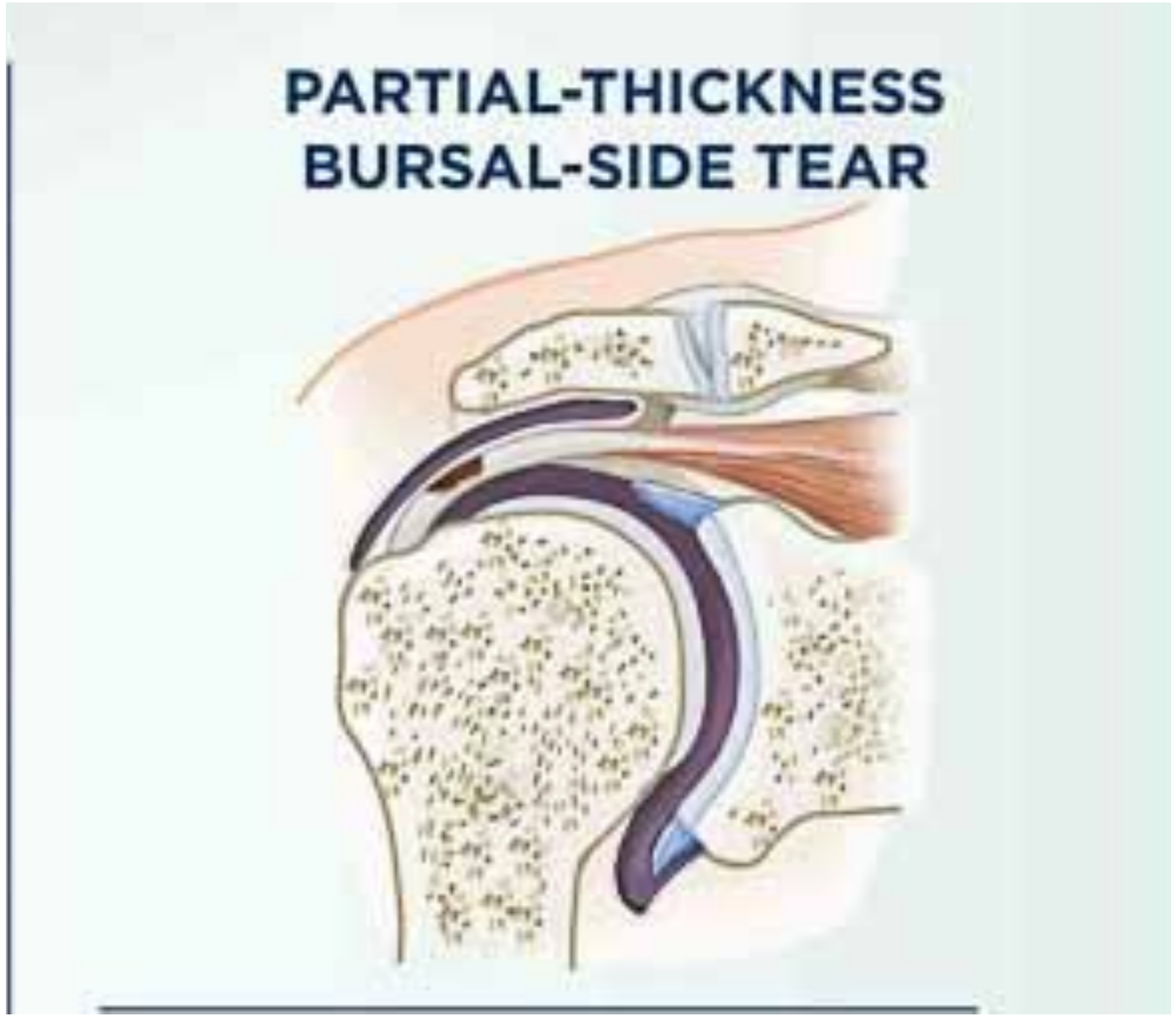
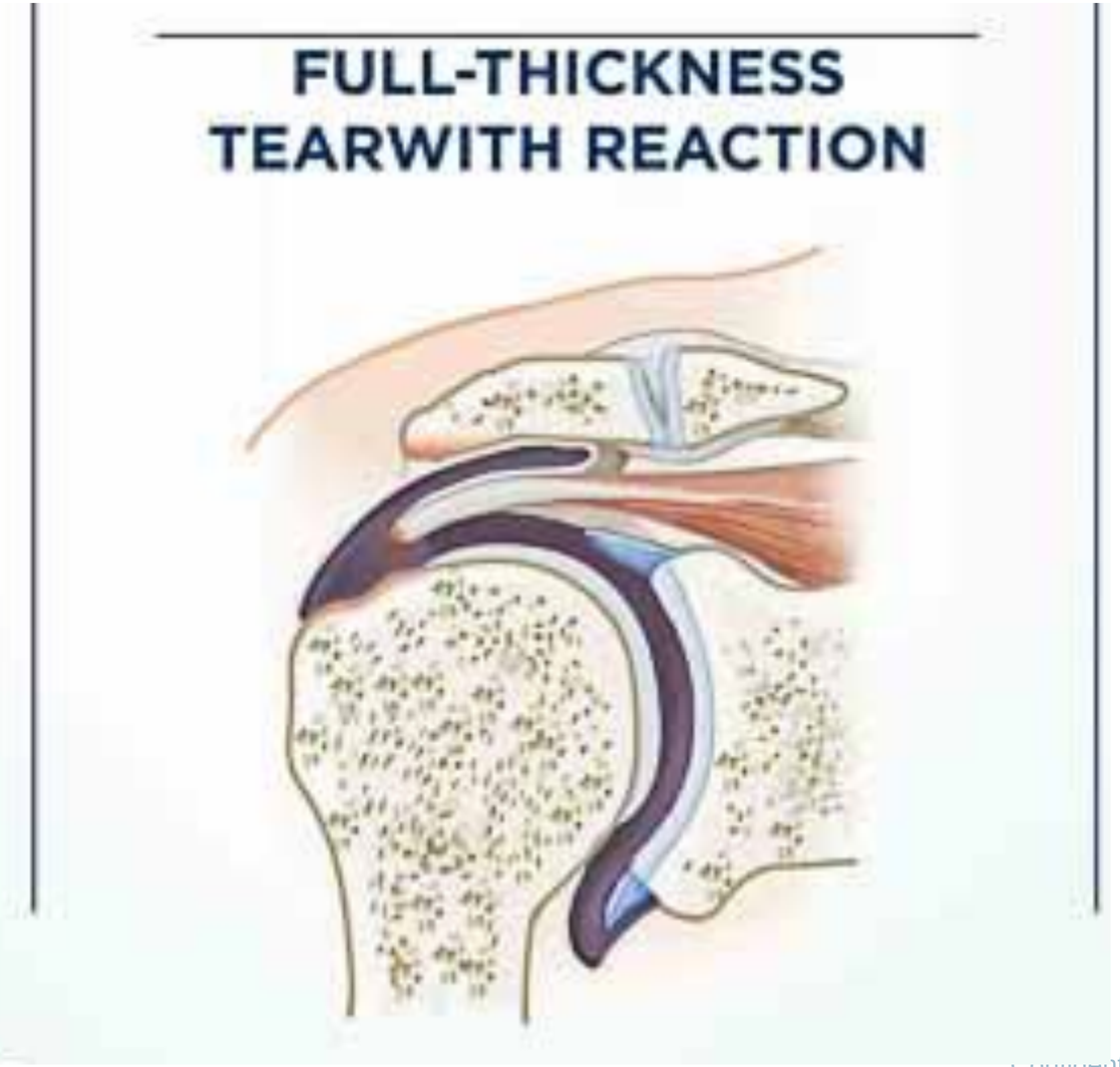
Full Thickness



Considerations for Acute RC Tear

Types of Tears
Partial Thickness: Bursal Sided
Partial Thickness: Articular sided
Full Thickness



Considerations for Acute RC Tear

I. *Prognosis*
   I. *Non-op*
      I. *3 months*
   II. *Op*
      I. *6 mon to 1 year to get back to overhead sports*
      II. *Only 50% professional athletes return to same level (better RTP with rec athletes)*

Operative versus nonoperative treatment for the management of full-thickness rotator cuff tears: a systematic review and meta-analysis

Christine C. Piper MD, Alice J. Hughes MD, Yan Ma PhD, Haijun Wang PhD and Andrew S. Neviaser MD

Journal of Shoulder and Elbow Surgery, 2018-03-01, Volume 27, Issue 3, Pages 572-576, Copyright © 2017 Journal of Shoulder and Elbow Surgery Board of Trustees

- 270 pts, 59-65yo, full thickness tears
- VAS difference of 1 point (not clinically sig)
- There was a statistically significant improvement in outcomes for patients managed operatively compared with those managed nonoperatively. The differences in both Constant and VAS scores were small and **did not meet the minimal difference considered clinically significant**. Larger studies with longer follow-up are required to determine whether clinical differences between these treatments become evident over time.

Considerations for Acute RC Tear

Many Factors consider age, activity level, other pathology (GH OA), comorbidities, timing, chronicity of injury

Acute tendon injuries always have best surgical results but this does not mean that all acute injuries need surgery

Non-Operative	Operative
Small tear < 2cm Chronic tear (trial) Intact strength Older patients Less Active patients	Complete tear Failed conservative mgmt Large tear Younger patients < 40 yo

Considerations for Acute RC Tear

I. *Tips for Management*

I. *Start gentle ROM at home (Codman) → PT → slow progressive strengthening*

II. *Avoid yanking, jerking, tugging and heavy lifting (<10 lbs) or excessive over head lifting*

III. *3+ month rehab (chronic problem → chronic rehab)*

IV. *Occasionally steroid inj for pain control (be cautious, may increase risk of tendon weakening/rupture or delaying healing)*

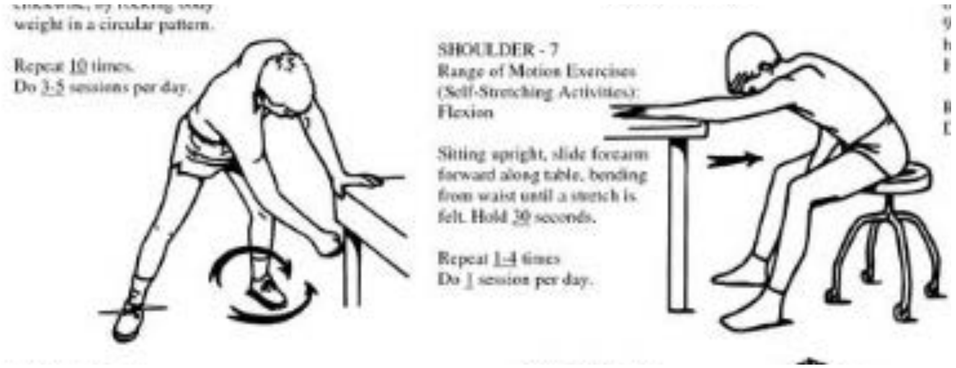
V. *NSAIDs PRN*

VI. *May consider PRP injections (data is variable)*

VII. *Specialist can aspirate calcific deposits*

VIII. *Possibility of tear progression*

IX. *Operative recovery is painful and long, but might be best in highly active individuals*



Codman Exercises

FallonClinic

Rehabilitation & Sports Medicine
Frozen Shoulder

SHOULDER - 26
Range of Motion Exercises:
Pendulum (Circular)

Let arm move in a circle clockwise, then counter-clockwise, by rocking body weight in a circular pattern.

Repeat 10 times.
Do 3-5 sessions per day.

SHOULDER - 7
Range of Motion Exercises (Self-Stretching Activities): Flexion

Sitting upright, slide forearm forward along table, bending from waist until a stretch is felt. Hold 30 seconds.

Repeat 1-4 times
Do 1 session per day.

SHOULDER - 11
Range of Motion Exercises (Self-Stretching Activities): External Rotation (alternate)

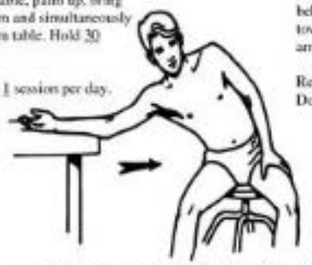
Keep palm of hand against door frame, and elbow bent at 90°. Turn body from fixed hand until a stretch is felt. Hold 30 seconds.

Repeat 1-4 times
Do 1 session per day.

SHOULDER - 9
Range of Motion Exercises (Self-Stretching Activities): Abduction

With arm resting on table, palm up, bring head down toward arm and simultaneously move trunk away from table. Hold 30 seconds.

Repeat 1-4 times Do 1 session per day.



SHOULDER - 73
Towel Stretch for Internal Rotation

Pull involved arm up behind back by pulling towel upward with other arm. Hold 30 seconds.

Repeat 1-4 times
Do 1 session per day.

SCAP SETS

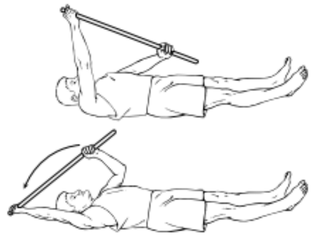
Pull your shoulders back, pinching the shoulder blades together. Do not let the shoulders come forward. Hold 5-10 seconds.

Repeat 10 times
Do 1 session per day.

RANGE OF MOTION AND STRETCHING EXERCISES
Impingement Syndrome

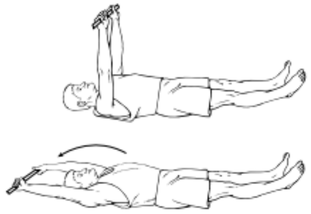
These are some of the *initial* exercises you may start your rehabilitation program with until you see your physician, physical therapist, or athletic trainer again or your symptoms resolve. Please remember:

- Flexible tissue is more tolerant of the stresses placed on it during activities.
- Each stretch should be held for 20 to 30 seconds.
- A *gentle* stretching sensation should be felt.



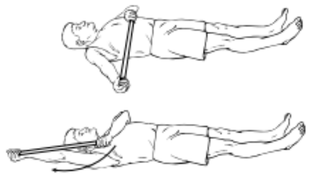
RANGE OF MOTION • **Shoulder Flexion, Single Arm**

1. Lie on your back. Grasp the bottom of a stick, handle of an umbrella, or blade of a golf club in your hand as shown.
2. Using the stick, raise your arm overhead as shown until you feel a gentle stretch. Lead with your thumb in a "thumbs up" position.
3. Repeat this exercise ____ times, ____ times per day. Hold each repetition for ____ seconds.



RANGE OF MOTION • **Shoulder Flexion, Double Arm**

1. Lie on your back holding a stick in both hands, keeping your hands shoulder width apart.
2. Raise both hands over your head until you feel a gentle stretch.
3. Repeat this exercise ____ times, ____ times per day. Hold each repetition ____ seconds.



RANGE OF MOTION • **Shoulder Abduction, Single Arm**

1. Lie on your back holding a stick, umbrella handle, or golf club in your hand as shown. The hand should be in the "thumbs up" position.
2. Using the stick, slowly push your arm away from your side and as far overhead as you can without pain. Push until you feel a gentle stretch.
3. Repeat this exercise ____ times, ____ times per day. Hold each repetition for ____ seconds.

Quiz (Q22-26)

Join by Web

1. Go to **PollEv.com**
2. Enter **NICKSGRIGNOLI247**
3. Respond to activity

Join by Text

1. Text **NICKSGRIGNOLI247** to **+33 6 44 60 09 54**
2. Text in your message

Total Results: 0

Powered by Poll Everywhere

Adhesive Capsulitis (Frozen Shoulder)

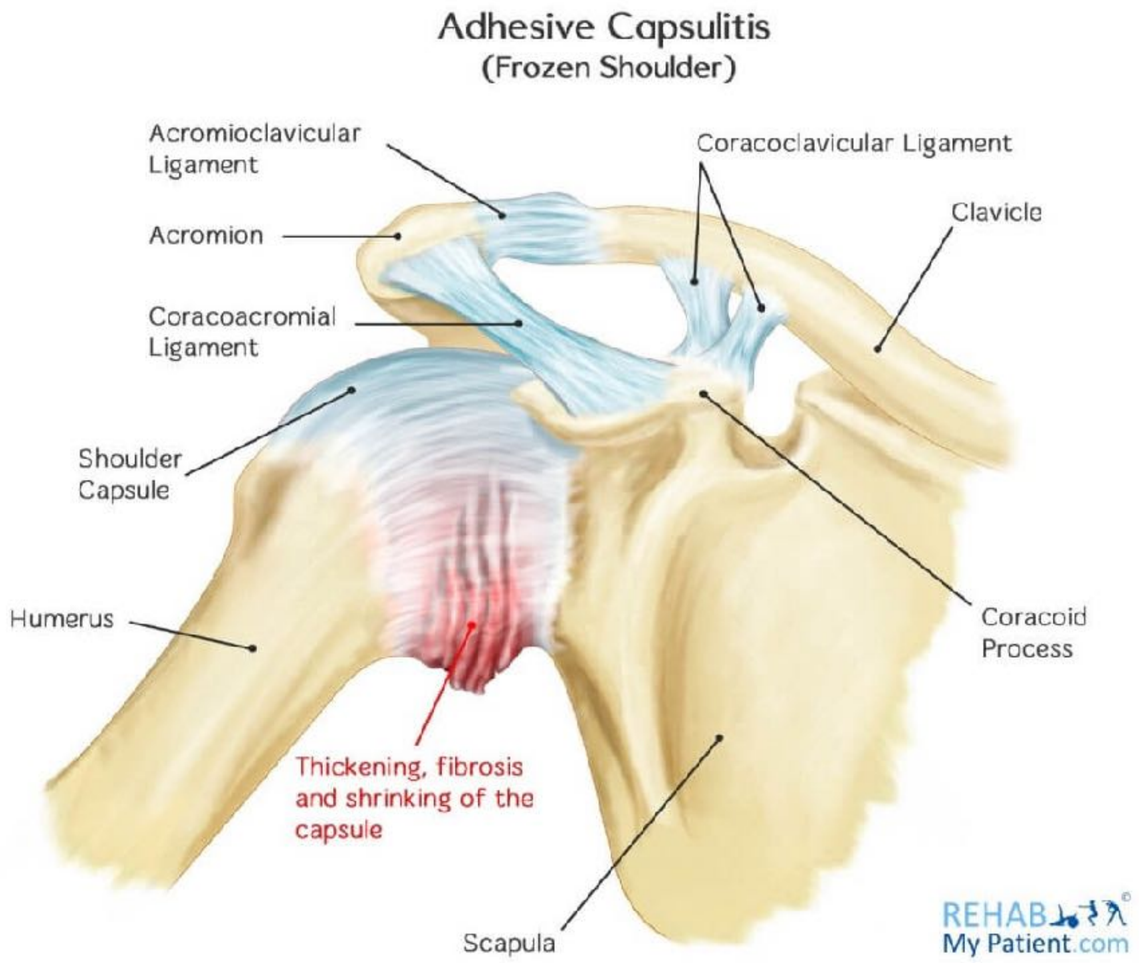
I. **Description**
   i. thickening, fibrosis, and contraction of glenohumeral joint capsule with adherence to the humeral head
   ii. Risk factors: DM, thyroid, > 40 yo, prolonged immobilization

II. **Presentation**
   i. Pain and loss of ROM (“can’t put on clothes” “bra strap” “reach into back pocket/seat belt”)
   ii. *Atraumatic, progressive shoulder pain*
   iii. ***Three clinical phases***
      i. ***Painful phase:*** painful phase, insidious onset of nocturnal pain, progresses to pain at rest, no restriction of ROM, may last 2 to 9 mo
      ii. ***Freezing Phase:*** frozen or adhesive phase, progressive limitation of ROM in all directions, lasts 4 to 12 mo or longer
      iii. ***Thawing Phase:*** thawing or regressive phase; symptoms gradually improve over 5 to 24 mo.

Differential diagnosis

RC tear
RC tendonopathy
Bursitis
Radiculopathy
Glenohumeral OA
Biceps pathology
PMR
Fracture
Referred Pain

Adhesive Capsulitis (Frozen Shoulder)

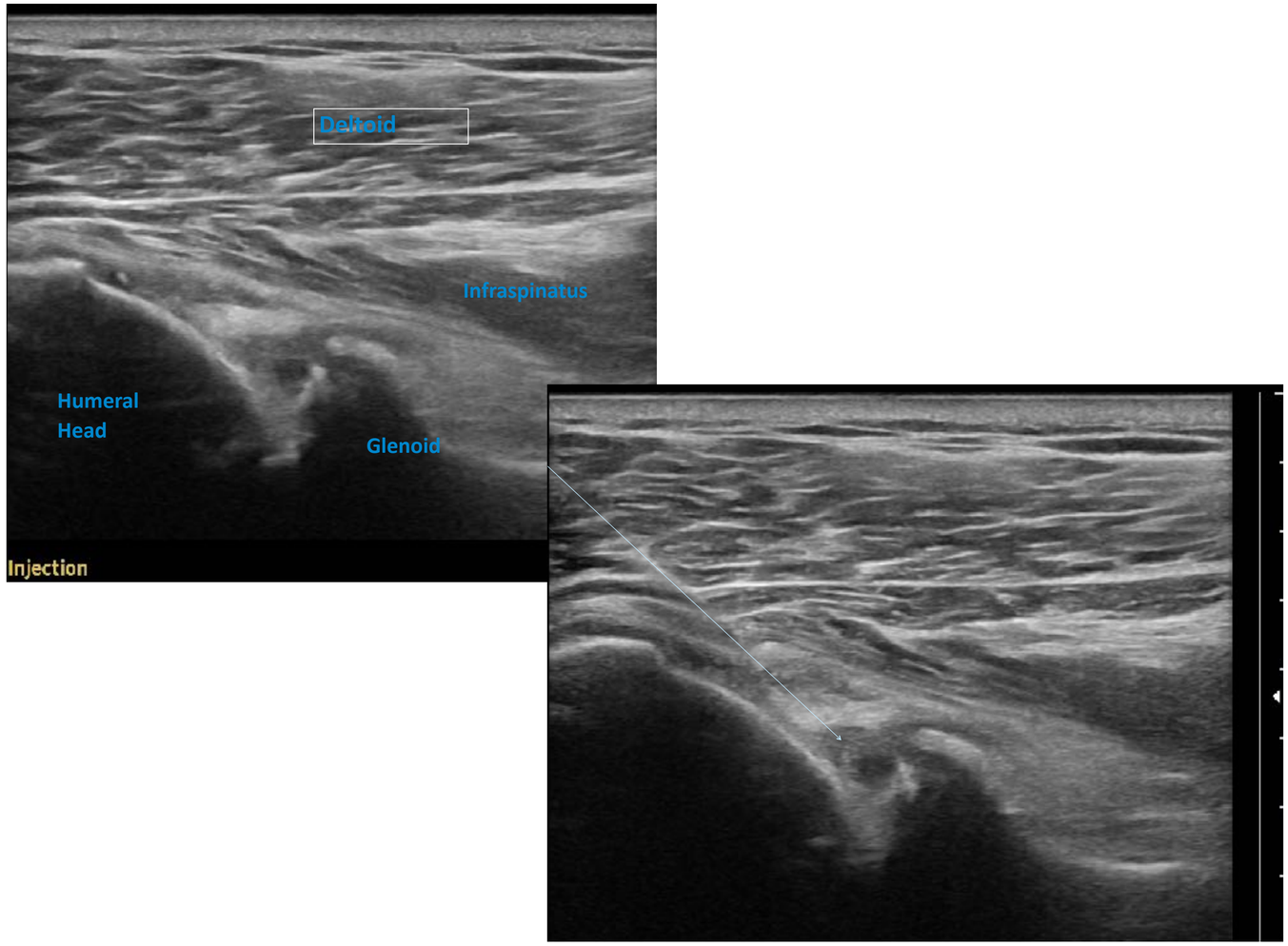


I. **Exam**
   I. Pain with active and passive shoulder movements at end range
      I. Often external ROM limited first
   II. Impingement and biceps testing may be positive

II. **Imaging**
   I. *Xray: often wnl*
   II. *MRI:* slight thickening in the joint capsule and the coracohumeral ligament.

Adhesive Capsulitis (Frozen Shoulder)

I. ***Treatment***
   1. *High volume GH jt CSI*
   2. *Most spontaneously recover in 18-30 months*
   3. *ROM and strengthening*
   4. ***Failed conservative***
      1. ***Manipulation under anesthesia (MUA) or capsular release***
   5. ***When to refer:***
      1. *Failed conservative therapy*
      2. *For US guided GH CSI*



Glenohumeral Osteoarthritis (GH OA)

I. **Description**
   I. wear and tear of the articular cartilage of the glenoid, labrum, and humeral head
   II. Risk factors: age, prior trauma to shoulder or overhead athlete, h/o OA,

II. **Presentation**
   I. Usually older >70 yo
   II. Pain and loss of ROM
   III. Gradual, deep shoulder pain
   IV. Morning stiffness
   V. Crepitus

Differential diagnosis

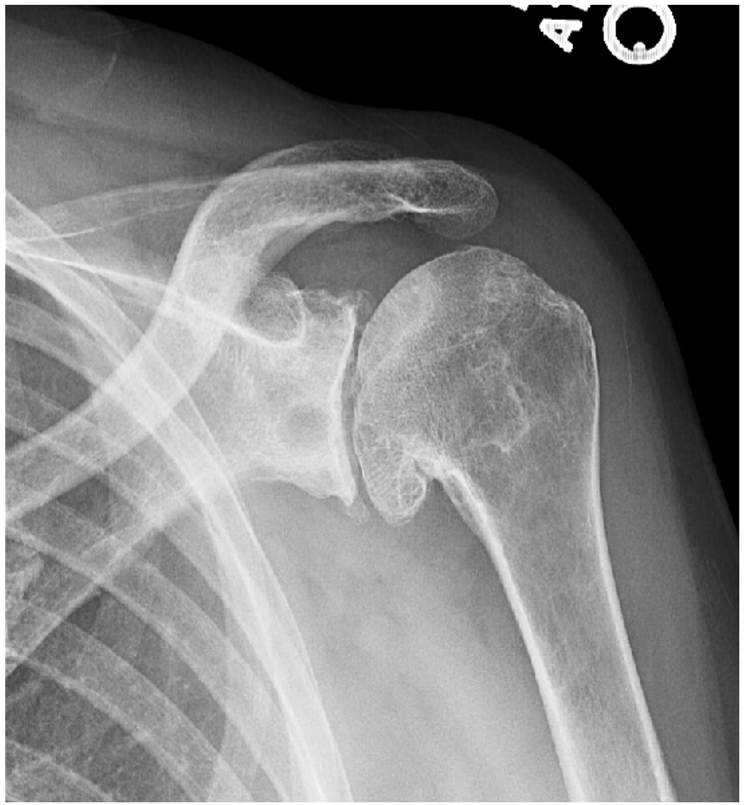
RC tear
RC tendonopathy
Bursitis
Radiculopathy
Frozen shoulder
Biceps pathology
PMR
Fracture
Referred Pain

Glenohumeral Osteoarthritis (GH OA)

I. **Exam**
   I. Pain and crepitus with ROM
   II. Sometimes instability on exam
   III. Pain with humeral glide testing or sulcus test (may also have pain with most active movements and testing, often non-specific)
   IV. Decreased

II. **Imaging**
   I. *Xray: GH jt space narrowing (mainstay of dx)*
   II. *MRI:* usually not indicated

III. **Tx**
   I. NSAIDs
   II. GH JT CSI
   III. PT and Activity modification
   IV. Surgery with arthroplasty (anatomic vs. reverse shoulder)
      I. Pain and function poor, pt preferance
      II. Fail conservative therapy
      III. Wearing glenoid



Lets Compare

Dx	RC pathology	Frozen Shoulder	GH OA
Presentation	Acute or chronic, night pain, lat shoulder pain	Subacute atraumatic pain → stiffness	Gradual stiffness and pain
Epidemiology	>40 yo	50-70 yo	> 70 yo
Risk Factors	Trauma	DM, thyroid, immobility	Prior injury, OA
Exam	Painful arc, impingement, weakness	Pain at end range	crepitus
ROM	PROM intact, AROM painful	Limited both PROM and AROM	Limited both PROM and AROM
Imaging	MRI mainstay for dx	Xray often normal	Get Xray → GH jt narrowing
Treatment	• PT → CSI • If large tear → Sx	• Time (1.5 yrs) and ROM • High volume GH CSI	• GH CSI • Shoulder replacement

Quiz (Q27-28)

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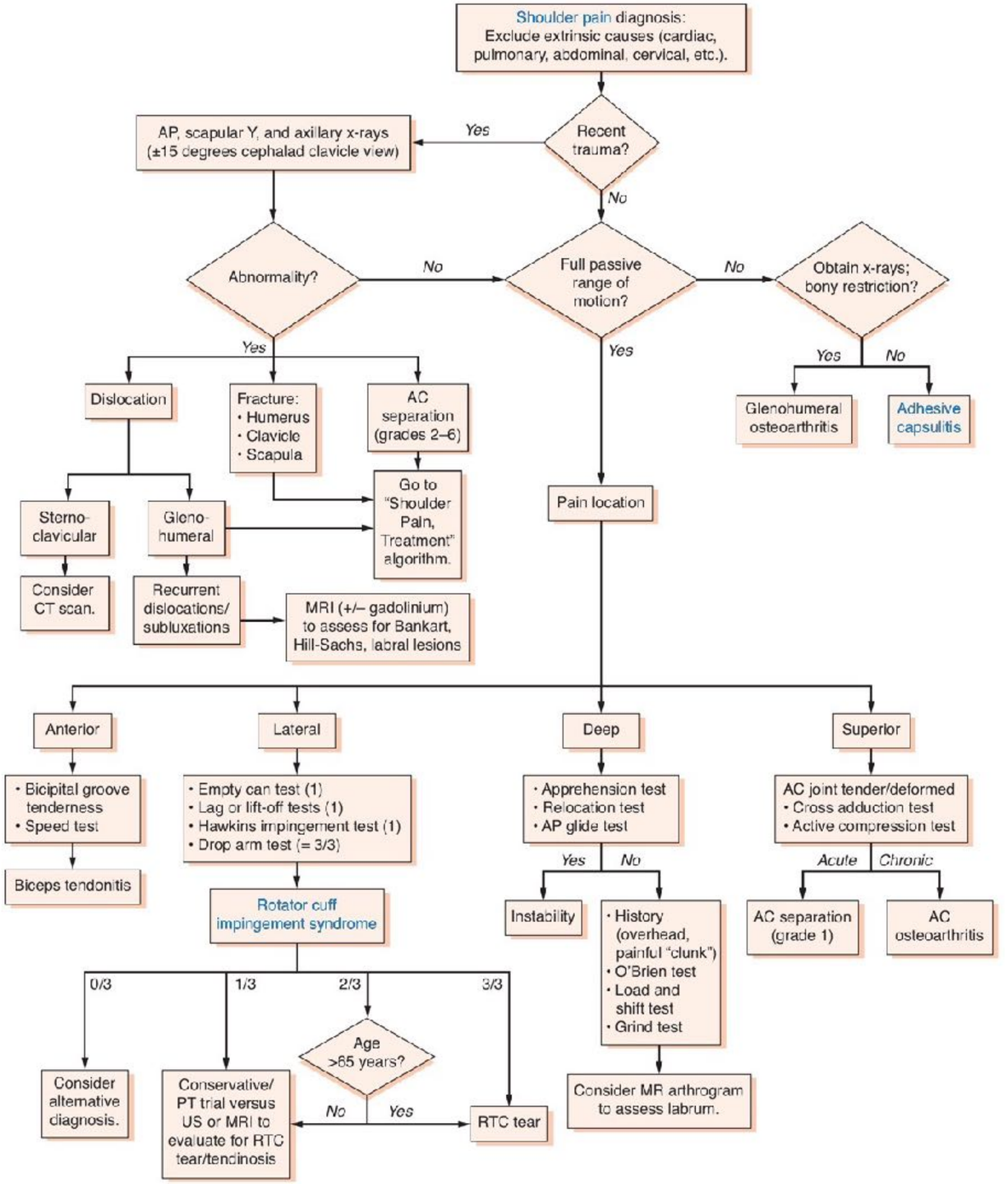
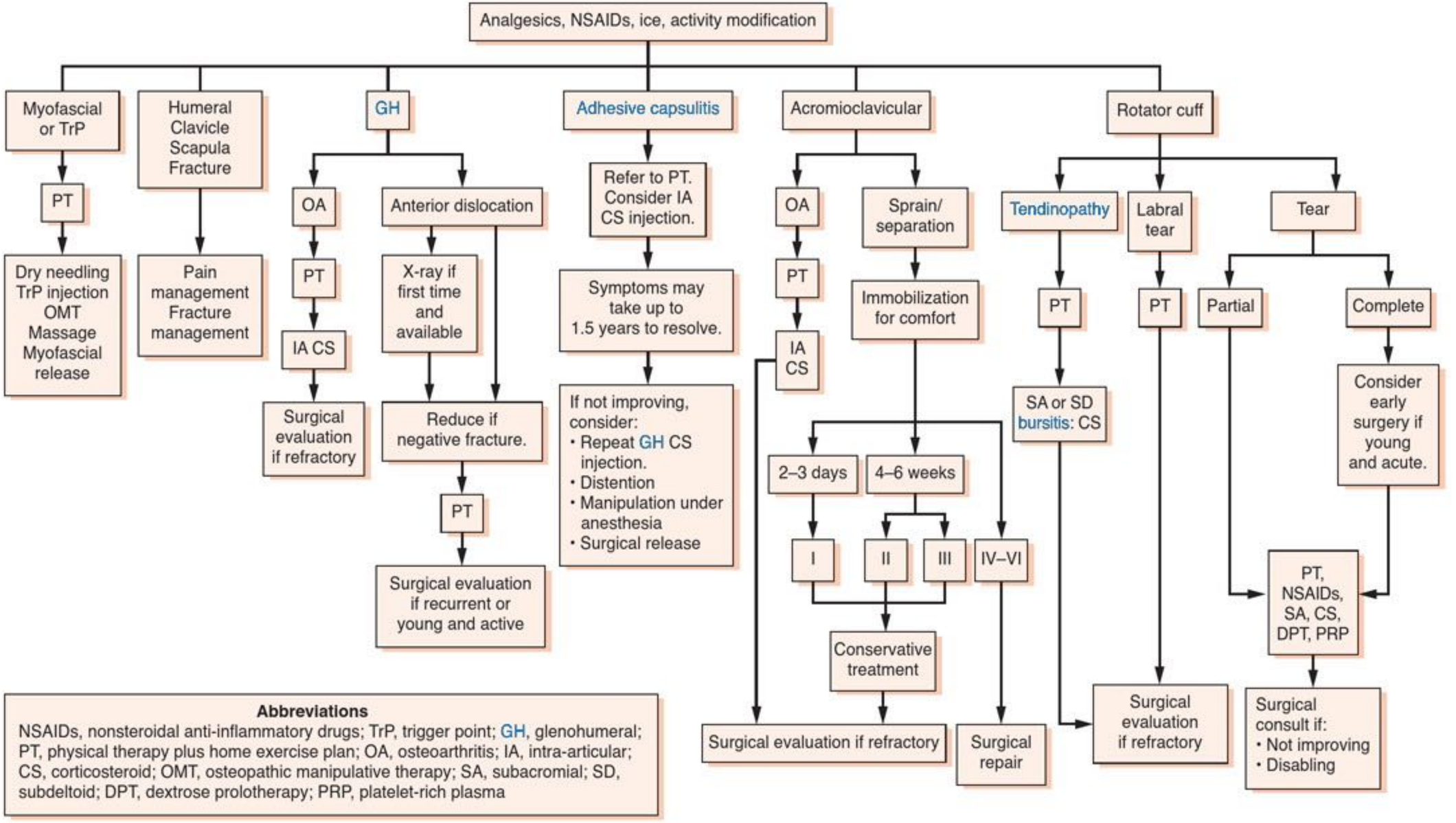

Shoulder pain diagnosis:
Exclude extrinsic causes (cardiac, pulmonary, abdominal, cervical, etc.).
Recent trauma?
Yes
AP, scapular Y, and axillary x-rays (±15 degrees cephalad clavicle view)
No
Abnormality?
No
Full passive range of motion?
No
Obtain x-rays; bony restriction?
Yes
No
Yes
Yes
No
Dislocation
Fracture:
• Humerus
• Clavicle
• Scapula
AC separation (grades 2–6)
Glenohumeral osteoarthritis
Adhesive capsulitis
Sterno-clavicular
Gleno-humeral
Go to "Shoulder Pain, Treatment" algorithm.
Pain location
Consider CT scan.
Recurrent dislocations/ subluxations
MRI (+/– gadolinium) to assess for Bankart, Hill-Sachs, labral lesions
Anterior
Lateral
Deep
Superior
• Bicipital groove tenderness
• Speed test
• Empty can test (1)
• Lag or lift-off tests (1)
• Hawkins impingement test (1)
• Drop arm test (= 3/3)
• Apprehension test
• Relocation test
• AP glide test
AC joint tender/deformed
• Cross adduction test
• Active compression test
Yes
No
Acute
Chronic
Biceps tendonitis
Rotator cuff impingement syndrome
Instability
• History (overhead, painful "clunk")
• O'Brien test
• Load and shift test
• Grind test
AC separation (grade 1)
AC osteoarthritis
0/3
1/3
2/3
3/3
Age >65 years?
Consider alternative diagnosis.
Conservative/ PT trial versus US or MRI to evaluate for RTC tear/tendinosis
No
Yes
RTC tear
Consider MR arthrogram to assess labrum.


Analgesics, NSAIDs, ice, activity modification
Myofascial or TrP
PT
Dry needling
TrP injection
OMT
Massage
Myofascial release
Humeral
Clavicle
Scapula
Fracture
Pain management
Fracture management
GH
OA
PT
IA CS
Surgical evaluation if refractory
Anterior dislocation
X-ray if first time and available
Reduce if negative fracture.
PT
Surgical evaluation if recurrent or young and active
Adhesive capsulitis
Refer to PT. Consider IA CS injection.
Symptoms may take up to 1.5 years to resolve.
If not improving, consider:
• Repeat GH CS injection.
• Distention
• Manipulation under anesthesia
• Surgical release
Acromioclavicular
OA
PT
IA CS
Surgical evaluation if refractory
Sprain/ separation
Immobilization for comfort
2–3 days
4–6 weeks
I
II
III
IV–VI
Conservative treatment
Surgical repair
Rotator cuff
Tendinopathy
PT
SA or SD bursitis: CS
Surgical evaluation if refractory
Labral tear
PT
Surgical evaluation if refractory
Tear
Partial
Complete
Consider early surgery if young and acute.
PT, NSAIDs, SA, CS, DPT, PRP
Surgical consult if:
• Not improving
• Disabling
Abbreviations
NSAIDs, nonsteroidal anti-inflammatory drugs; TrP, trigger point; GH, glenohumeral; PT, physical therapy plus home exercise plan; OA, osteoarthritis; IA, intra-articular; CS, corticosteroid; OMT, osteopathic manipulative therapy; SA, subacromial; SD, subdeltoid; DPT, dextrose prolotherapy; PRP, platelet-rich plasma

Resources for MSK management

I. The 5-minutes sports medicine consult
II. Netter's Sports Medicine
III. Netters Concise orthopaedic anatomy
IV. https://www.orthobullets.com/ online resource

V. Call Me, Cell 610-724-8571

https://www.aafp.org/afp/2018/1101/p576.html

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1 Blachley Road
Stamford, CT
Office: 203-705-0982

Resources for MSK management

I. Knee evaluation AAFP
   I. https://www.aafp.org/afp/2018/1101/p576.html

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