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# MRI Anatomy of the Knee and Shoulder

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# Agenda

- Knee

Sagittal, Coronal FSE PD

Ligamentous (ACL, PCL, MCL, LCL) and meniscal injury

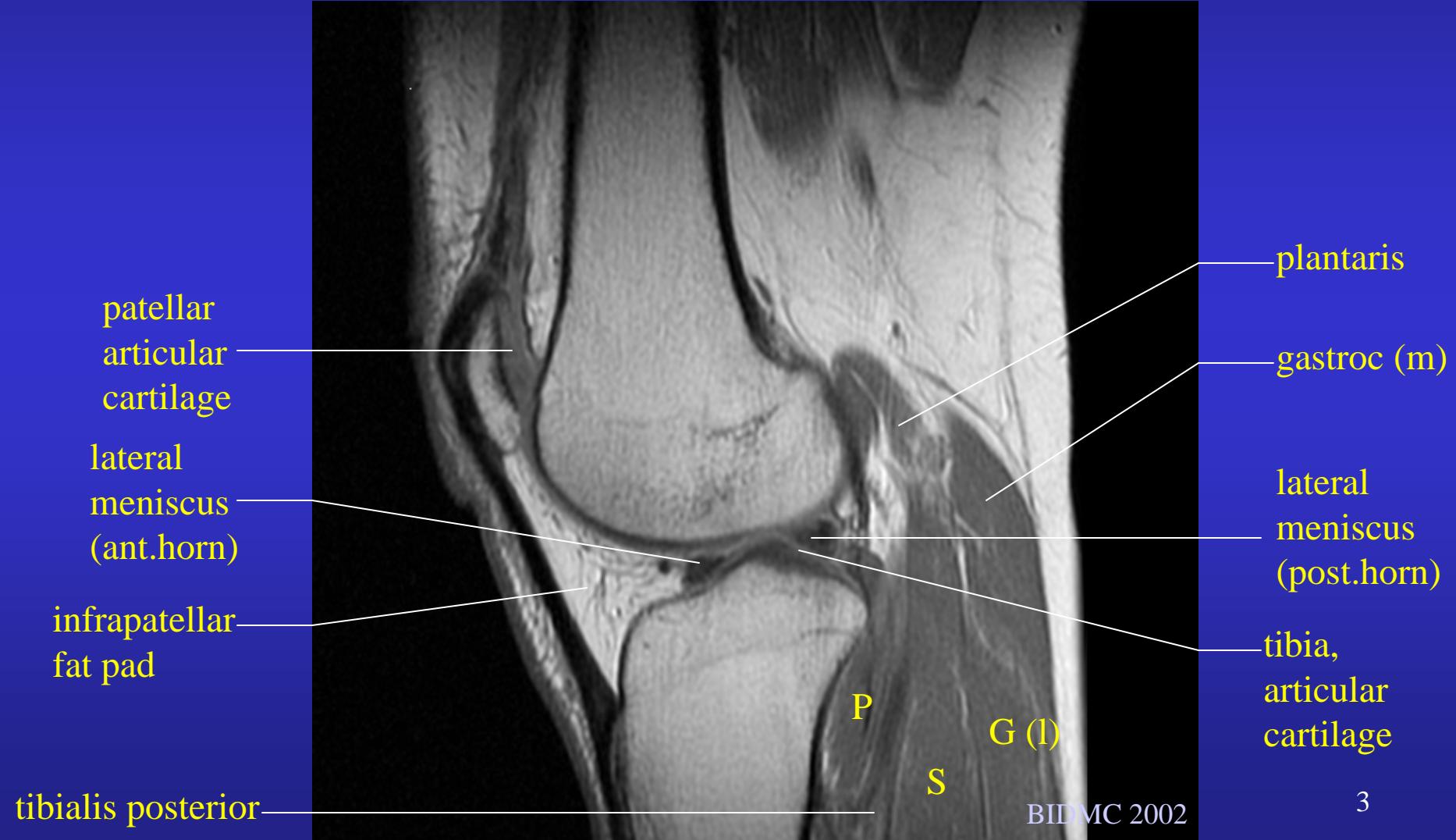
- Shoulder

Sagittal, Coronal T2WI

Shoulder impingement classification

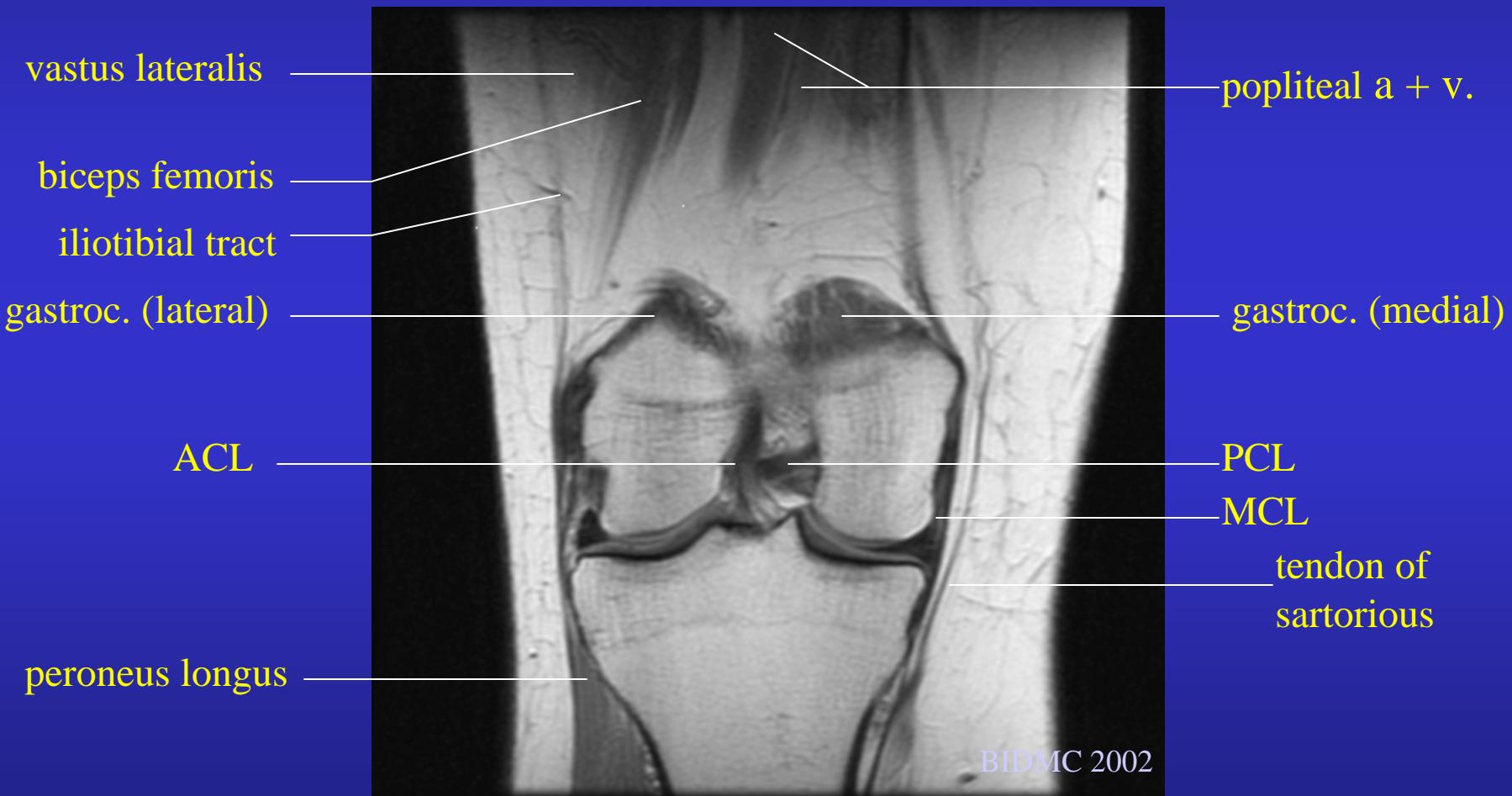


# Anatomy: Knee Sagittal





# Anatomy: Knee Coronal





# Anterior Cruciate Ligament

- Functional Anatomy

- Intra-articular, extra-synovial, extends from anterior tibia to inner portion of lateral femoral condyle
- Limits anterior translation of tibia, hyperextension, internal rotation

- Mechanism of Injury

- External rotation and abduction w/ hyperextension, direct forward displacement of tibia, internal rotation w/ fully extended knee
- Can occur in conjunction w/ meniscal tears (41-68%), injury of other collateral ligaments, osteochondral or compression fractures



# MRI Criteria for ACL rupture

## Complete Rupture

### DIRECT SIGNS:

- complete fiber disruption
- abnormal course of cruciate ligament
- intracapsular pseudomass in position of ACL

### INDIRECT SIGNS:

- acute angulation of PCL
- drawer phenomenon
- ”kissing contusions”



# MRI Criteria for ACL Rupture

## Incomplete Rupture

- thinning of ACL < 10mm
- periligamentous pseudomass in presence of intact fibers
- increased intraligamentous signal with remnants of intact fibers



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# ACL Tear



Sagittal PD



Sagittal T2WI



# Post Cruciate Ligament

- Functional Anatomy

- Extends from posterior tibia to inner aspect of medial femoral condyle
- Limits anterior translation of femur, stabilizes knee in extension

- Mechanism of Injury

- Isolated tear secondary to fall on flexed knee, assoc. w/ osseous avulsion fracture at tibial insertion site



# MRI Criteria for PCL Rupture

- confined areas of increased signal intensity along course of the ligament (= partial rupture)
- continuity disruption (= complete rupture)

# Medial Cruciate Ligament and Lateral Cruciate Ligament

- Functional Anatomy

- ➡ MCL: 8-10 cm, from medial epicondylar region to 4-5cm inferior to tibial plateau
- ➡ LCL: 5-7 cm, extracapsular, from lateral femoral epicondyle to conjoined insertion w/ biceps femoris tendon on fibular head

- Mechanisms of Injury

- ➡ MCL: valgus stress without rotation, and direct trauma with valgus stress
- ➡ PCL: varus stress with out without rotation

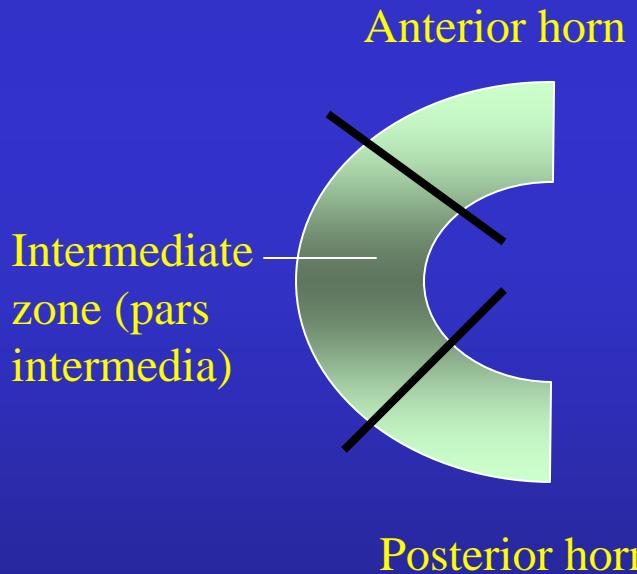
# MRI Criteria for MCL/LCL rupture

Table 1.20 Grading of the injuries of the collateral ligaments

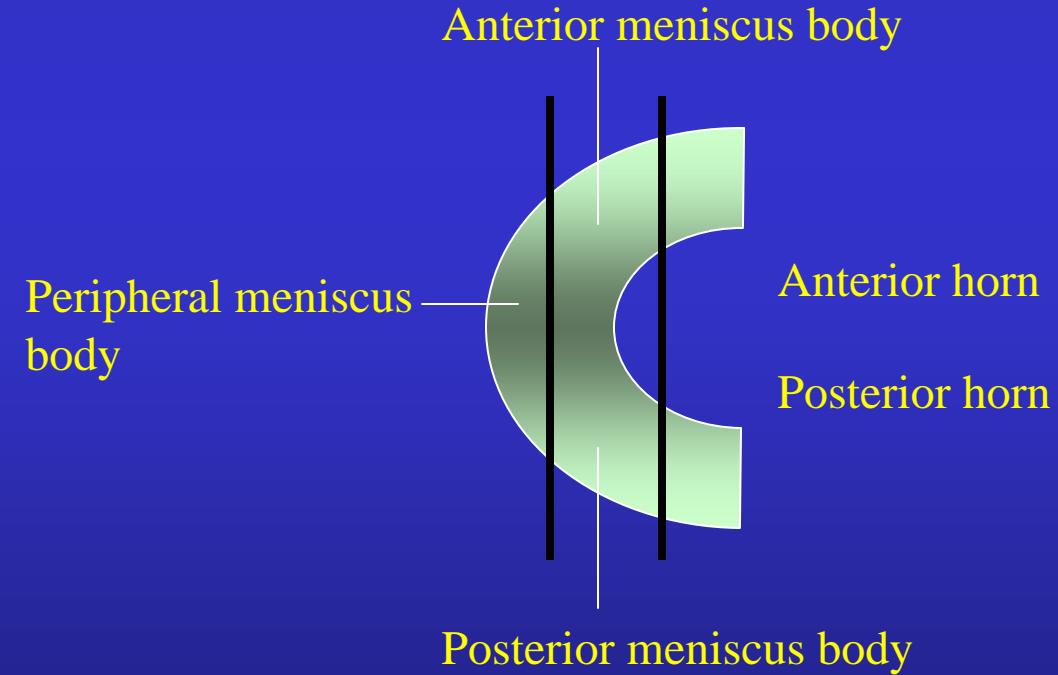
Grade	I	II	III	IV
MRI criteria	Thickened capsule	Thin or lamellated ligament	Rupture, edema, and retraction of the ligament	Rupture, edema, and retraction, plus meniscal tear and bone bruise
Schema				

# Meniscus Anatomy

- each meniscus can be divided into 3 zones
- lateral meniscus is more C-shaped, with a shorter radius



Three Units



25-50-25 Rule



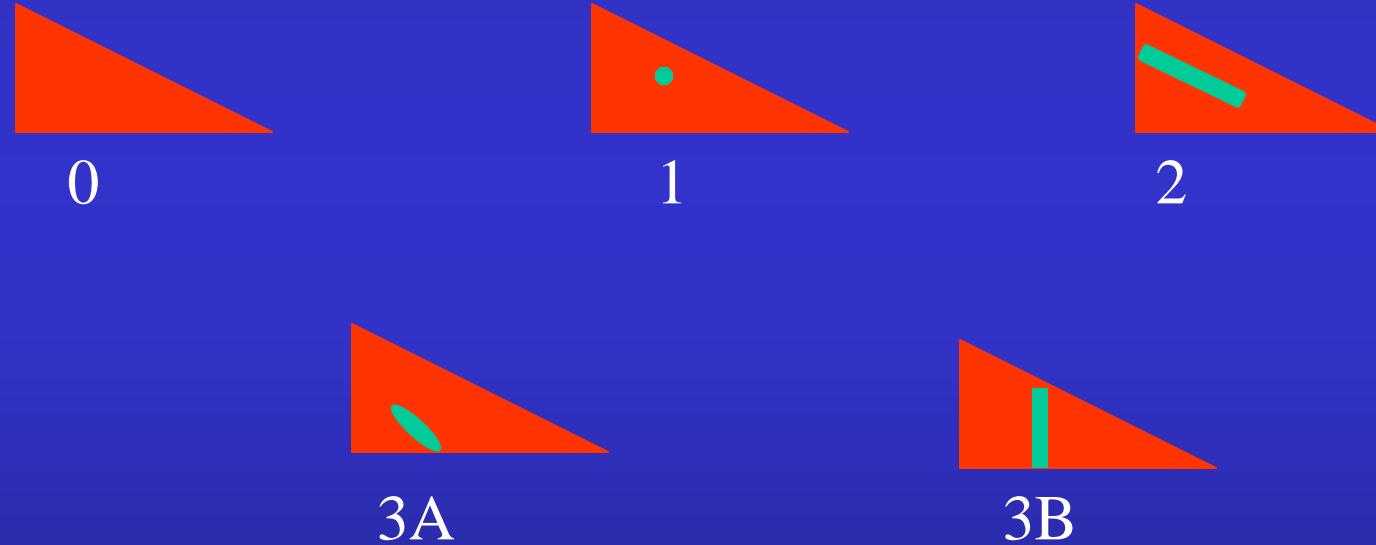
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# MRI Evaluation of Meniscal Damage

- Size
- Configuration of meniscus and signal pattern
- Depth and width of altered signal
- Location within meniscus

# Gradation of Signal Alteration in Menisci (Stoller)



# Meniscal Tear Morphology

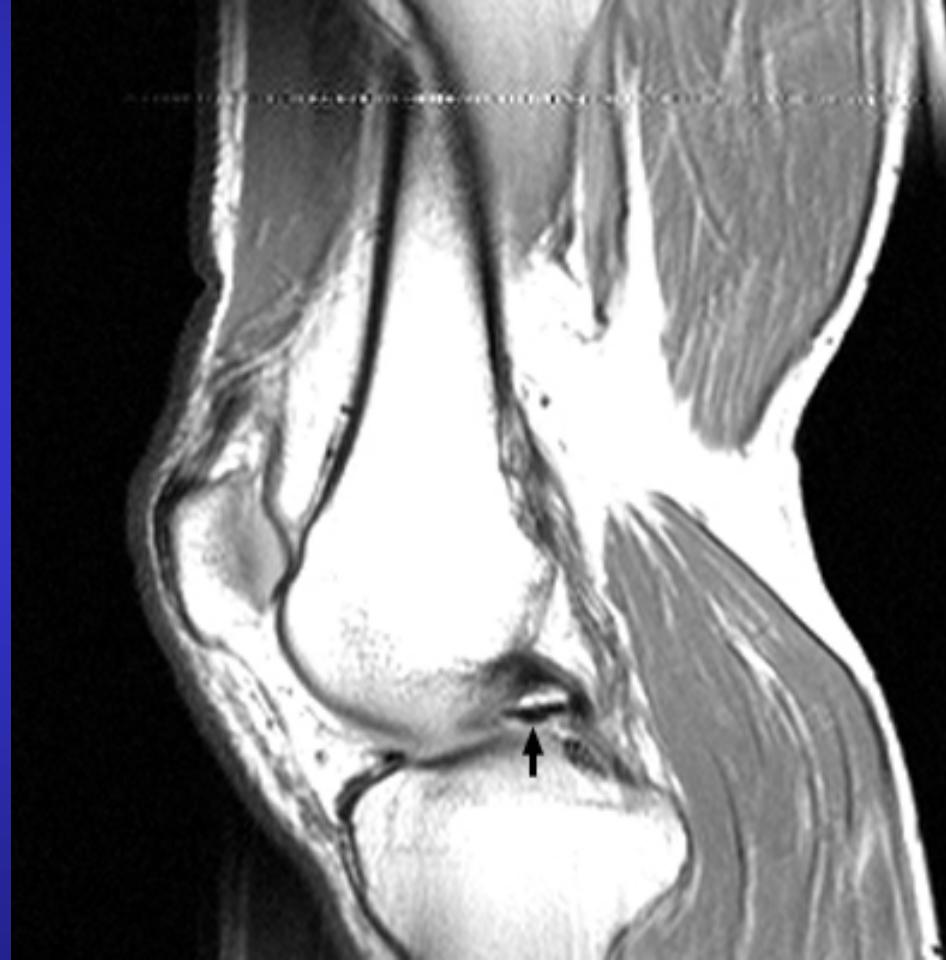
- Vertical (traumatic or degenerative)
- Horizontal (usually traumatic, posterior horn)
- Bucket-Handle Tear (subtype of vertical)
- Peripheral (within 5mm of periphery)
- Amputating (truncated free border or tip)
- Radial (traumatic or degenerative, medial)



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# Bucket-Handle Tear



Weiss KL et al. AJR. 1991; 156(1): 117-119.

# Shoulder Anatomy

- Bones (shoulder girdle, humerus)
- Joints (glenohumeral, scapulothoracic, acromioclavicular; all synovial)
- Muscles (attachments at ant/post scapula, ant/post humerus, ant/inf clavicle)
- Nerves and arteries

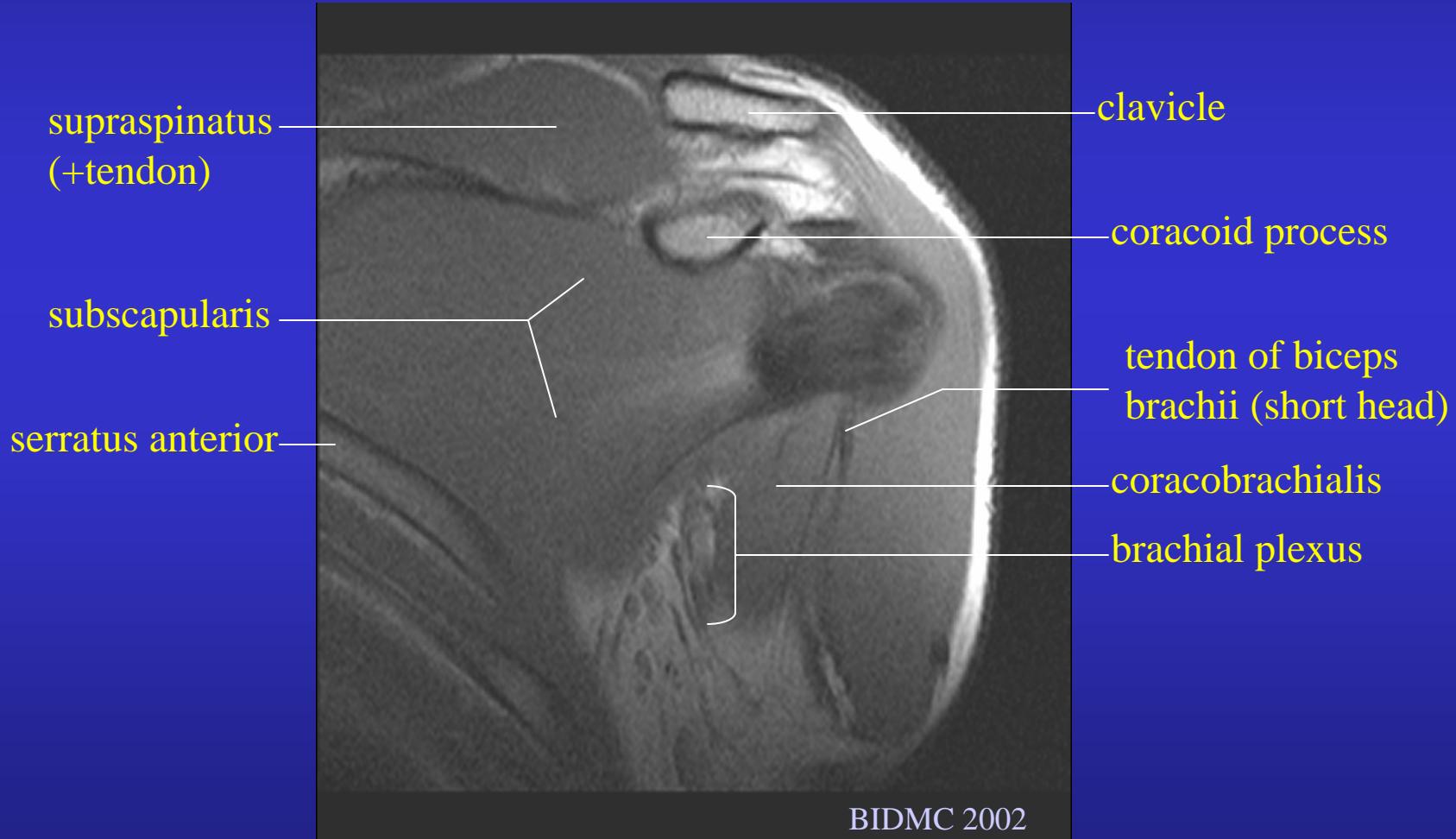


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# Shoulder

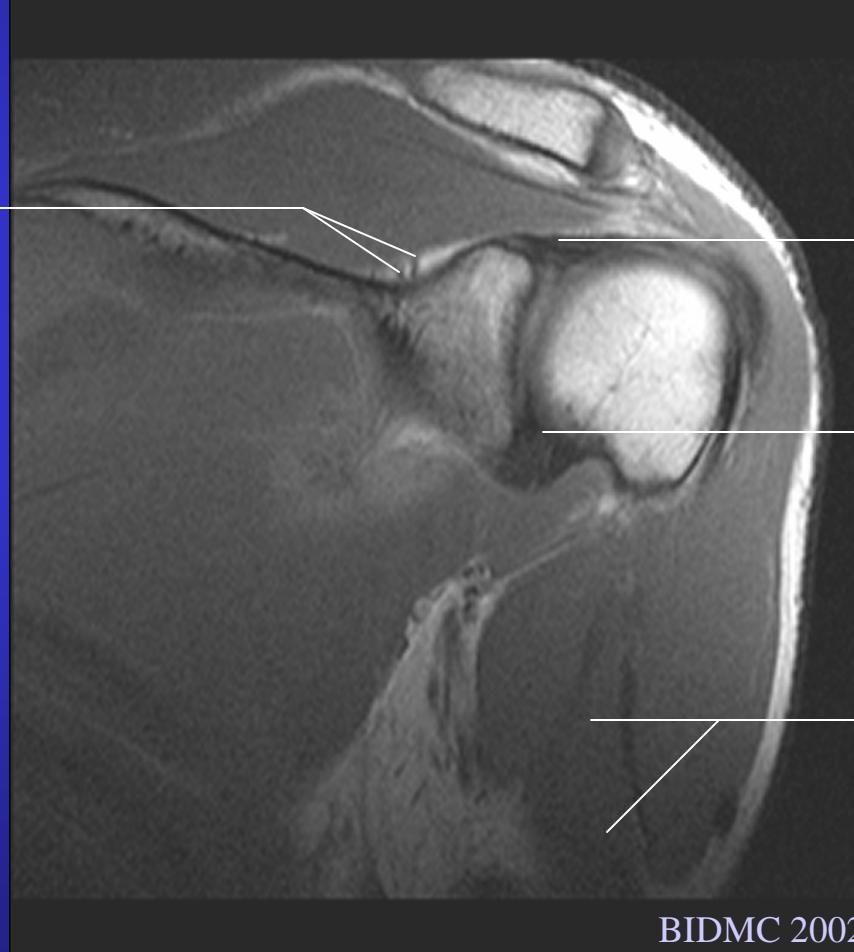
## Anatomy: Coronal 1



# Shoulder

## Anatomy: Coronal 2

suprascapular a. + n.



tendon of biceps  
brachii m. (long  
head)

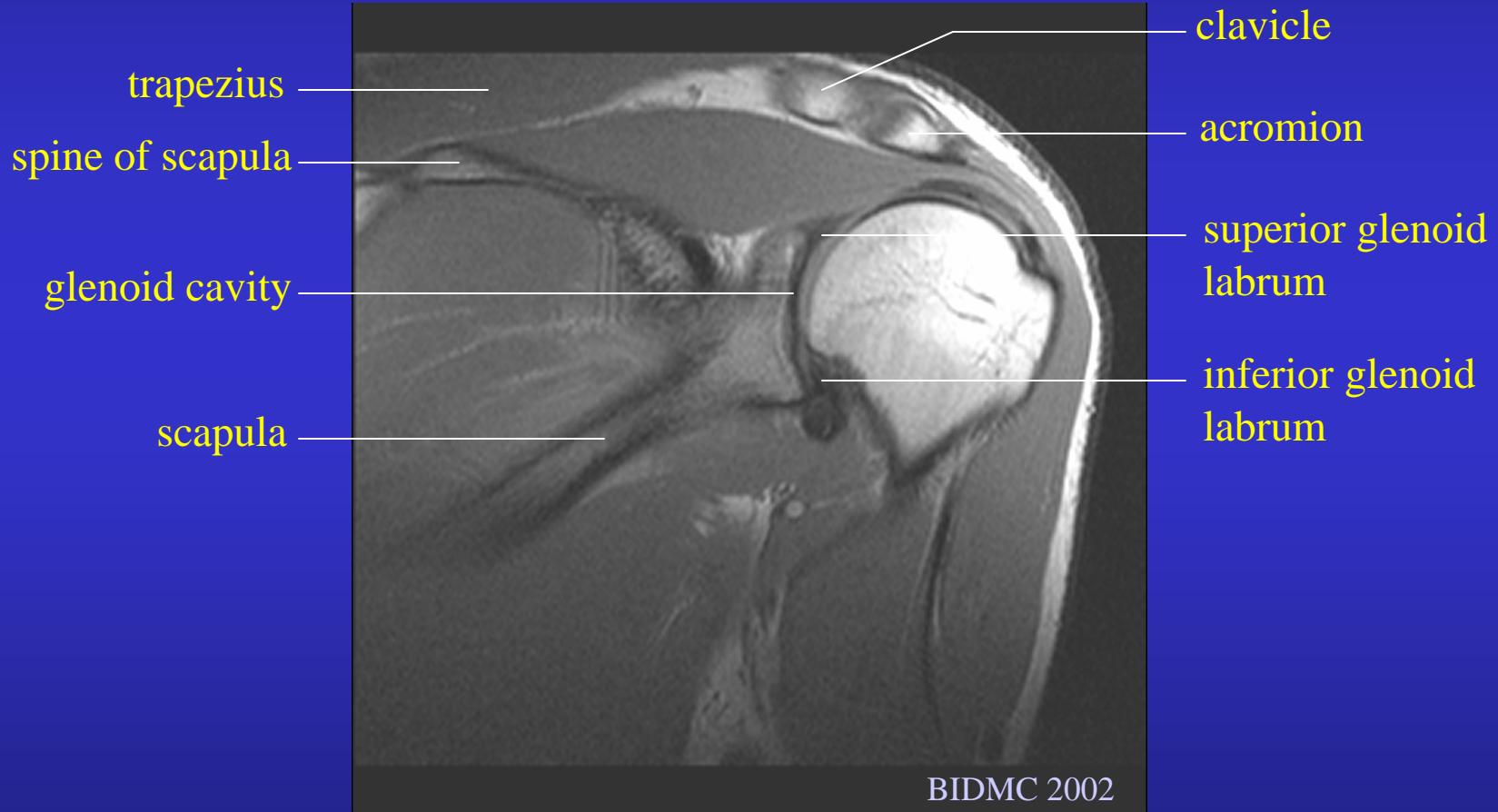
glenohumeral  
ligament

biceps brachii m.  
(short and long  
head)

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# Shoulder

## Anatomy: Coronal 3

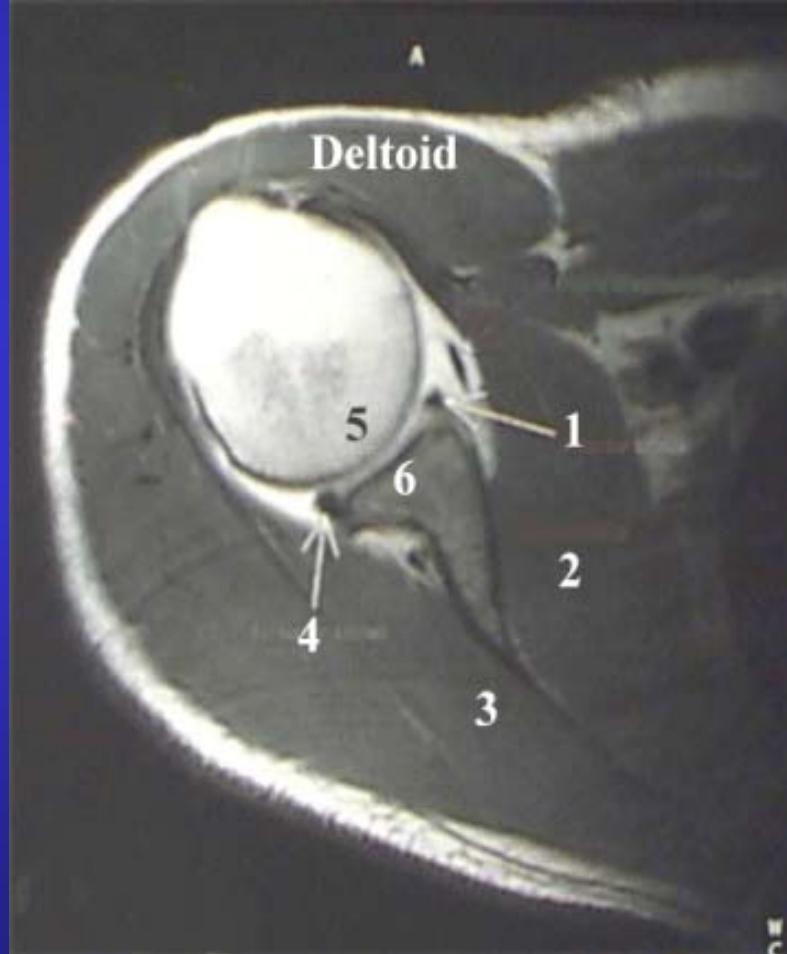




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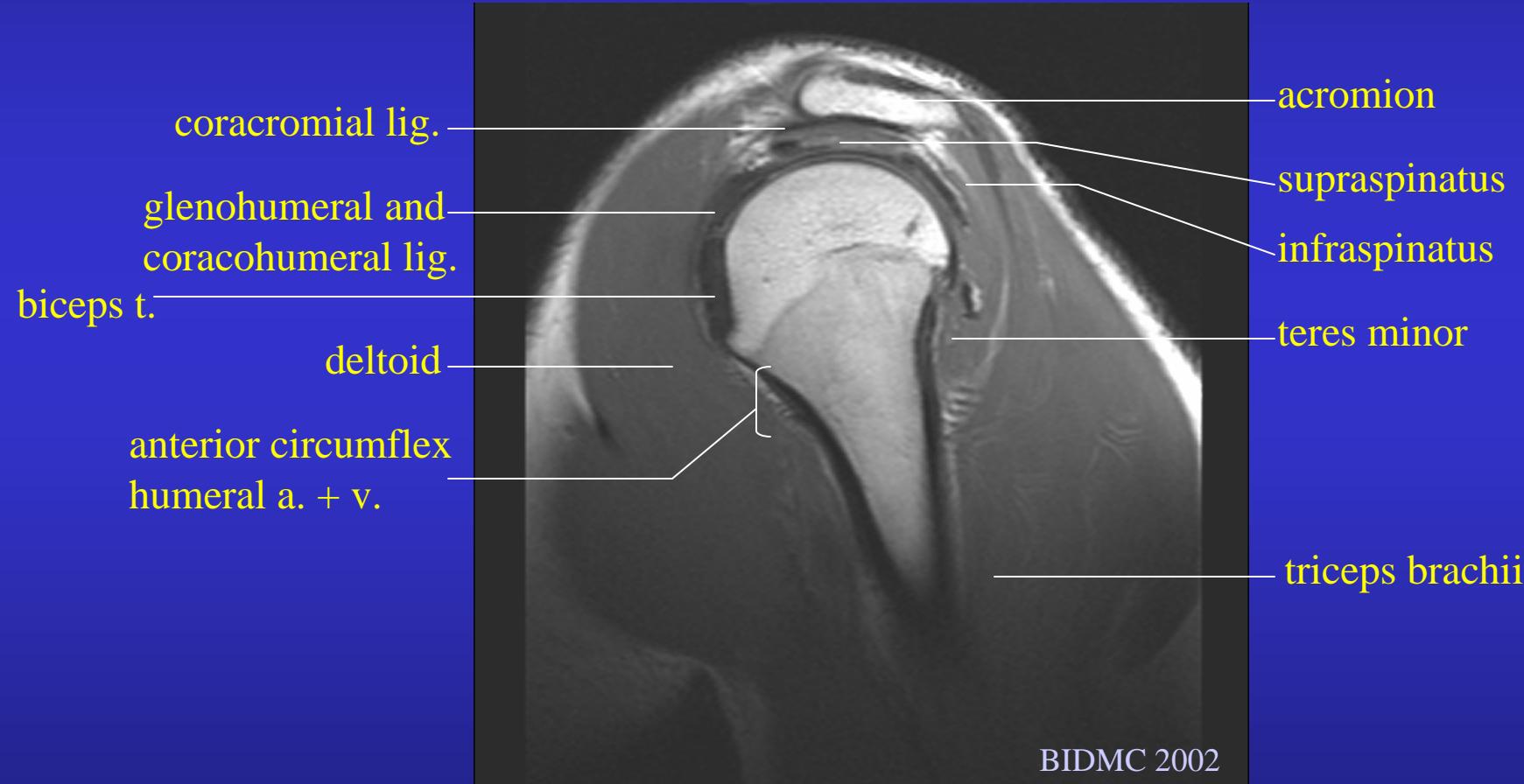
# Glenohumeral Joint



1. Anterior labrum
2. Subscapularis
3. Infraspinatus
4. Posterior labrum
5. Humerus
6. Glenoid cavity

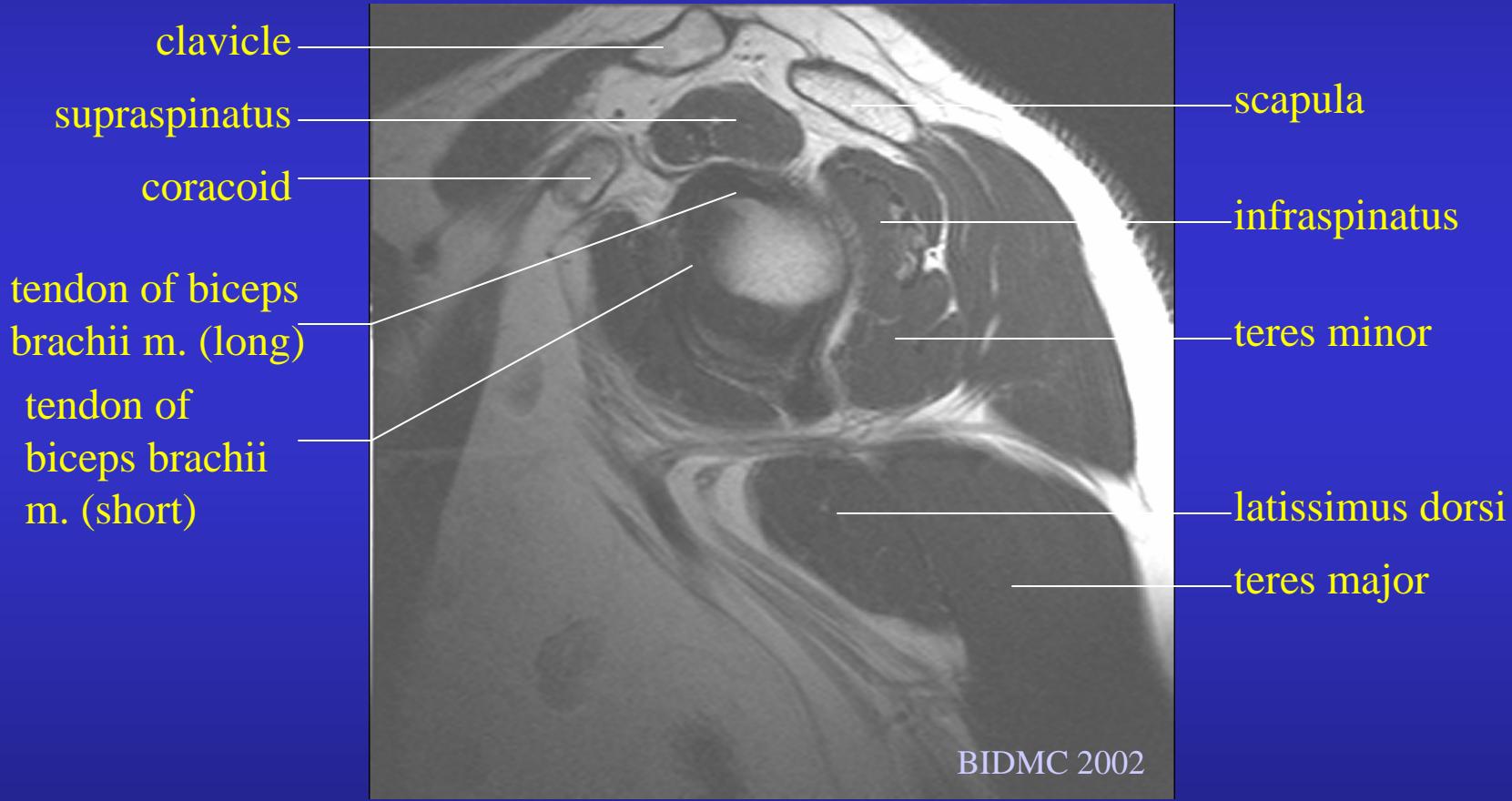
# Shoulder

## Anatomy: Sagittal 1



# Shoulder

## Anatomy: Sagittal 2



# Shoulder impingement syndrome

- Stage I: <25 yrs., w/ edema and hemorrhage
- Stage II: 25-40 yrs., w/ tendinitis and fibrosis of rotator cuff, thickening of subacromial bursa
- Stage III: > 40 yrs., = tear

# References

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Weiss KL, Morehouse HT, Levy IM. Sagittal MR images of the knee: a low-signal band parallel to the posterior cruciate ligament caused by a displaced bucket-handle tear. *AJR Am J Roentgenol.* 1991; 56(1): 117-9. Slide 17.

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# Acknowledgements

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