

# Imaging Evaluation of the Pectoralis Major

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## Disclosures

- Consultant: Bioclinica
- Advisor: Philips
- Book Royalties: Elsevier
- Not relevant to this lecture

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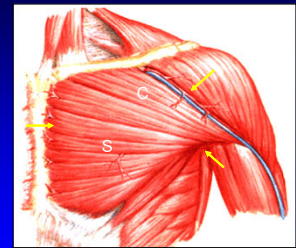
## Background:

- Ultrasound and MRI
  - Effective: diagnosis and characterization of pectoralis major injury
- Pitfalls: errors in diagnosis
  - Due to complex anatomy
  - Unfamiliar: recent redefined anatomic descriptions

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## Pectoralis Major

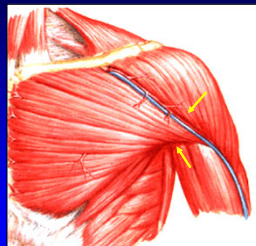
- Clavicular head:
  - Lamina from medial clavicle
- Sternal head
  - Manubrial and costal laminae



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## Pectoralis Major

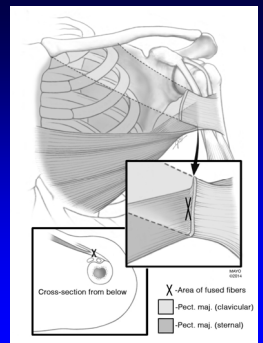
- Attachment:
  - Courses over biceps brachii long head tendon
  - Inserts lateral to biceps brachii tendon
  - Anterior humeral shaft
  - 4 – 6 cm cephalocaudad
  - Note: twisting



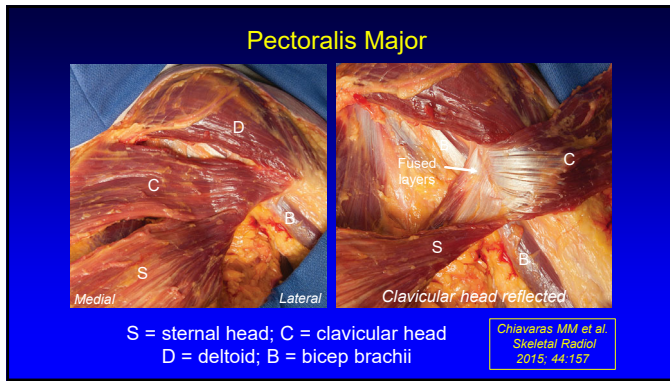
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## Pectoralis Major

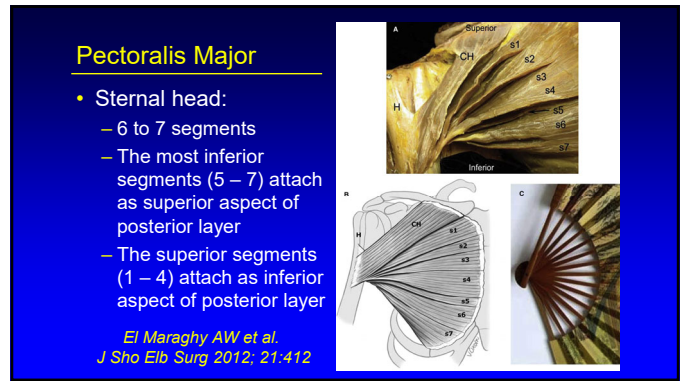
- Clavicular head:
  - Forms anterior layer
- Sternal head:
  - Forms posterior layer and inferior aspect of anterior layer
- Each layer: 2 mm thick
- "U" shaped
- Fuses 11 mm proximal to insertion



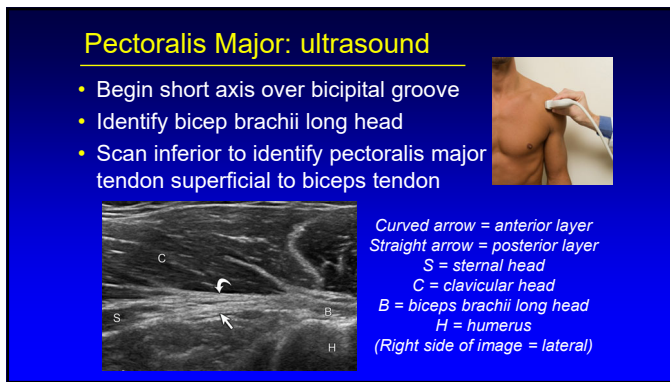
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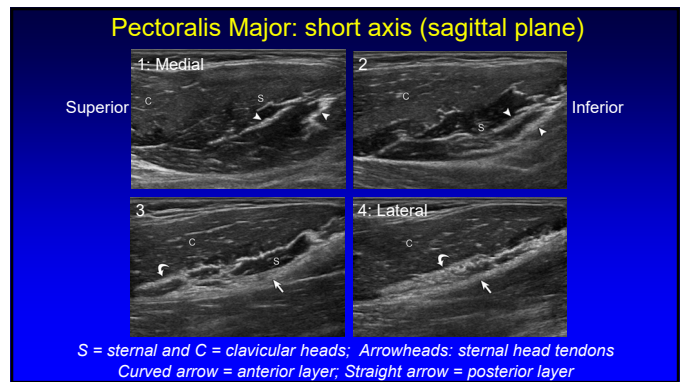
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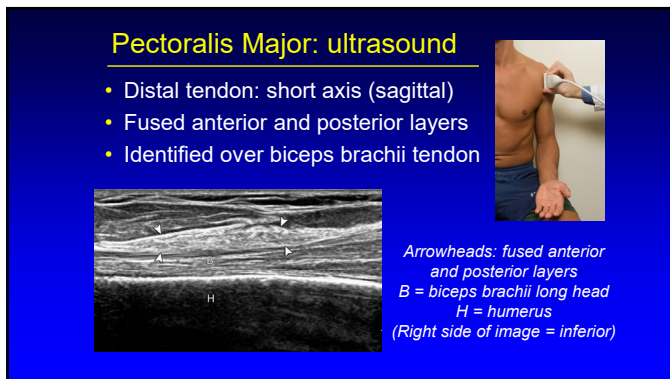
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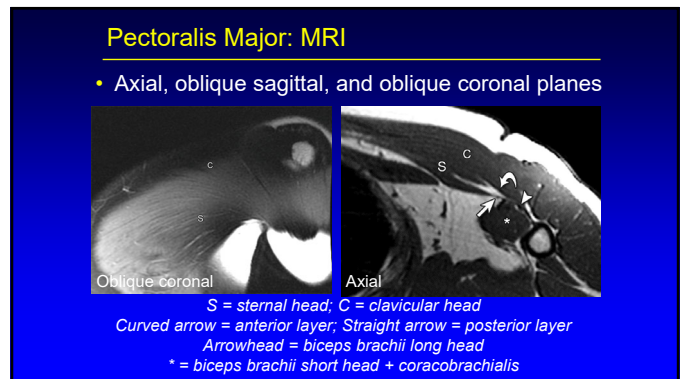
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### Clinical Presentation

- Pectoralis major tear:
  - First described in 1822
  - Butcher boy lifting a large piece of beef
- More commonly:
  - Bench press exercise, steer-riding
  - Stretch of actively contracting muscle
- Clinical:
  - Immediate pain, palpable defect
  - Ecchymosis: axilla, chest wall, upper arm



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### Pectoralis Major: tear classification

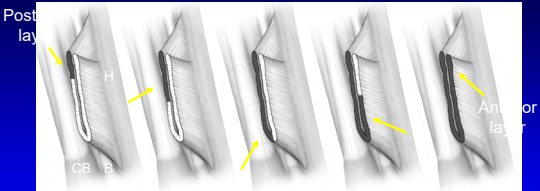
TEAR LOCATION		MANAGEMENT
I. Muscle Origin	II. Muscle Belly	Non-Operative
III. Musculotendinous Junction	IV. Intra-tendinous	Operative (Direct repair, bone tunnel, bone anchor)
V. Humeral Insertion	VI. Bony Avulsion	

- Musculotendinous junction
  - Most common
  - Partial sternal head
- Intra-tendinous
- Humeral insertion
- Bony avulsion

*El Maraghy AW et al. J Sho Elb Surg 2012; 21:412*

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### Pectoralis Major Tear Classification




- Partial tear: if only one layer (anterior or posterior)
  - Full-width versus incomplete width of a layer
  - Tear sequence: posterior to anterior (arrows)

CB = coracobrachialis; B = biceps brachii; H = humerus

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### Pectoralis Tear: imaging findings

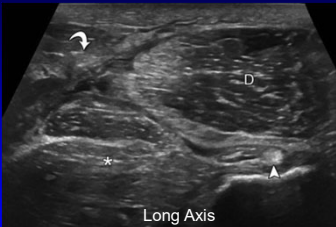
- Full-thickness (anterior + posterior layers):
  - Retracted tendon + hemorrhage over coracobrachialis / short head biceps
  - No tendon over biceps brachii long head
  - Fluid/edema at humerus
  - Anterior displacement of biceps brachii tendon



Connell DA, et al. Radiology 1999;210:785  
Weaver JS, et al. J Ultrasound Med 2005;24:25

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### Case 1: full-thickness, full-width tear



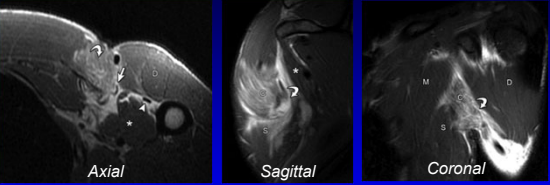
Medial Lateral

Long Axis

Curved arrow = torn and retracted pectoralis major  
\* = short head biceps brachii + coracobrachialis  
Arrowhead = biceps brachii long head; D = deltoid

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### Case 2: full-thickness, full-width tear



Axial Sagittal Coronal

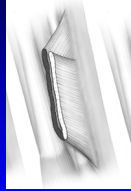
Curved arrow = torn and retracted pectoralis major  
Arrow = tendon stump  
\* = short head biceps brachii + coracobrachialis  
Arrowhead = biceps brachii long head; D = deltoid  
S = sternal and C = clavicular heads; M = pectoralis minor

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### Pectoralis Tear: imaging findings

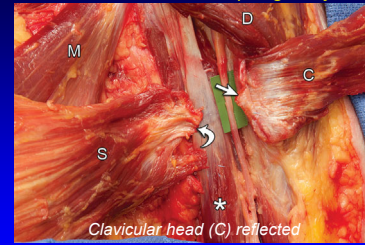
- Partial thickness

- Posterior layer torn (sternal head)
- Medial to fused anterior / posterior layers
- Intact tendon superficial to biceps long head (fused anterior + posterior layers)
- Fluid: musculotendinous junction or deltopectoral groove
- Intact clavicular head



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### Case 3: partial-thickness, full-width sternal head tear (surgically created)

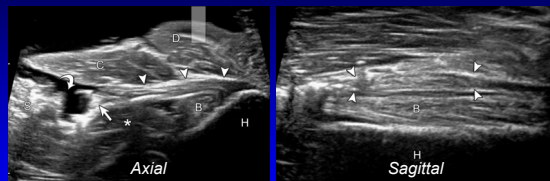


Curved arrow = torn sternal head (S); Arrow = posterior layer  
 \* = short head biceps brachii + coracobrachialis  
 M = pectoralis minor; D = deltoid

Chiavaras MM et al. Skeletal Radiol 2015; 44:157

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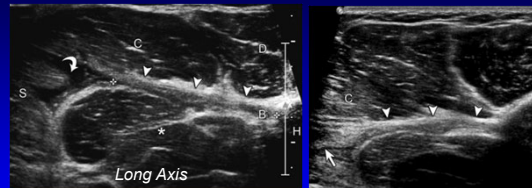
### Case 3: partial-thickness, full-width sternal head tear (surgically created)



Curved arrow = torn sternal head (S); Arrow = posterior layer  
Note: intact fused anterior and posterior layers (arrowheads) over biceps brachii long head tendon (B)  
 \* = short head biceps brachii + coracobrachialis  
 D = deltoid; H = humerus

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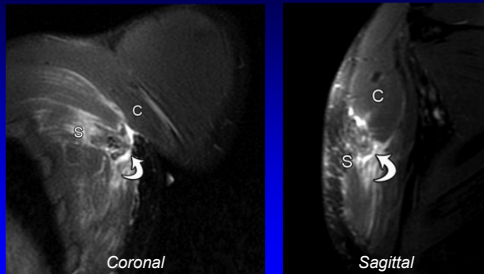
### Case 4: partial-thickness, full-width sternal head tear



Curved arrow = torn sternal head (S)  
Note: intact fused anterior and posterior layers (arrowheads) over biceps brachii long head tendon (B)  
 \* = short head biceps brachii + coracobrachialis  
 C = clavicular head; D = deltoid; H = humerus

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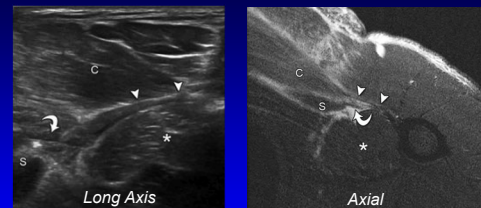
### Case 4: partial-thickness, full-width sternal head tear



Curved arrow = sternal head (S) retracted tear  
 C = clavicular head

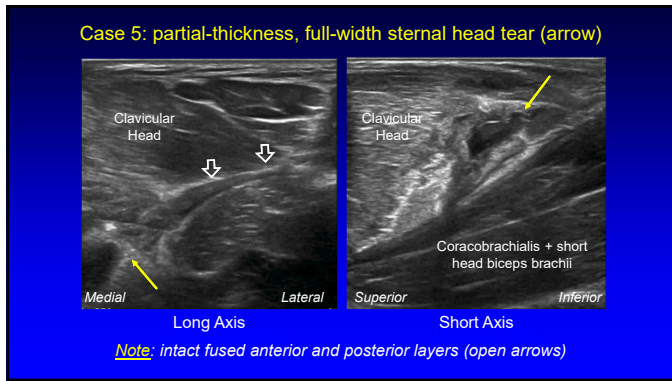
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### Case 5: partial-thickness, full-width sternal head tear

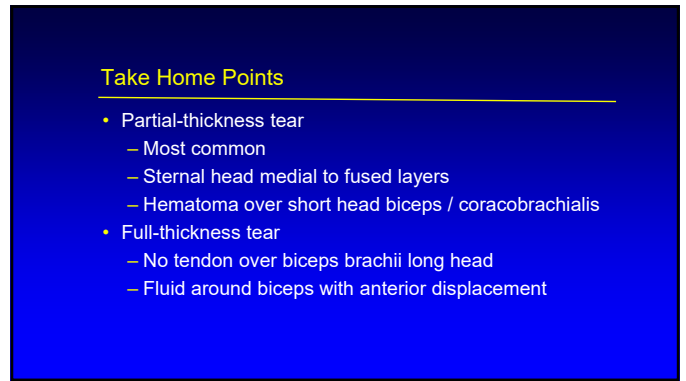


Curved arrow = torn sternal head (S)  
Note: intact fused anterior and posterior layers (arrowheads) over biceps brachii long head tendon (B)  
 \* = short head biceps brachii + coracobrachialis  
 C = clavicular head

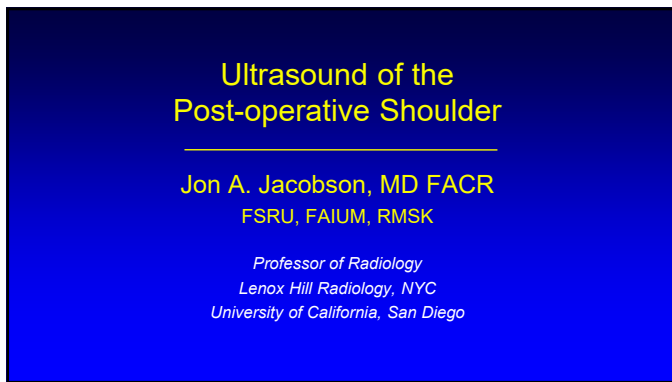
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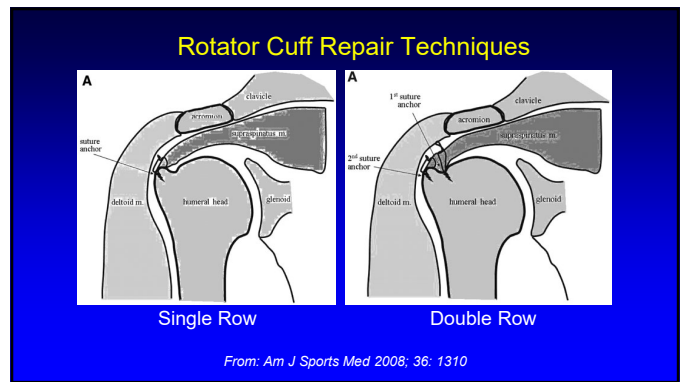
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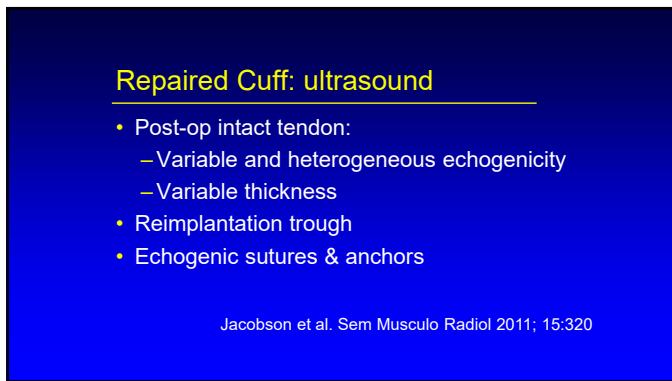
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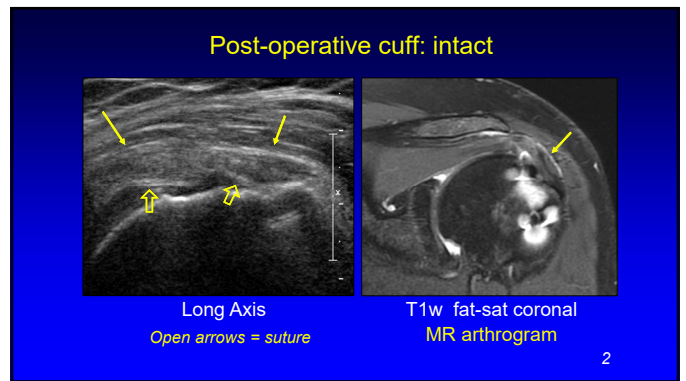
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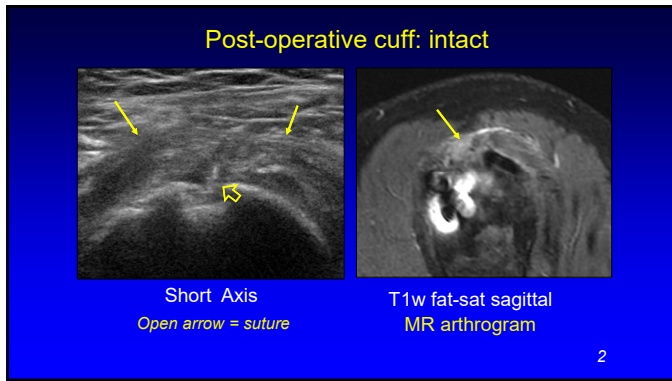


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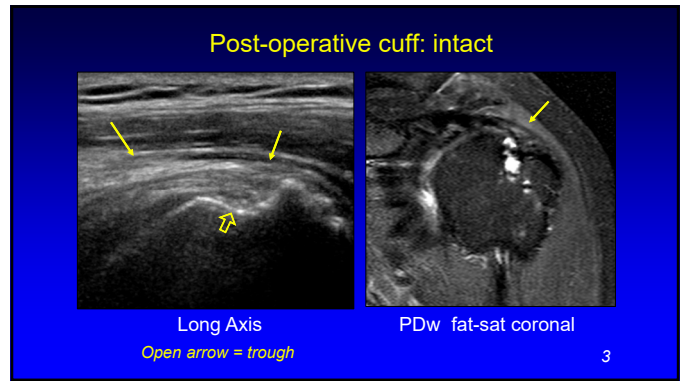


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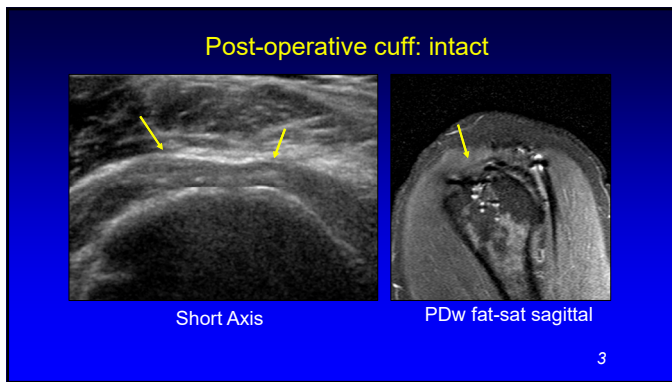




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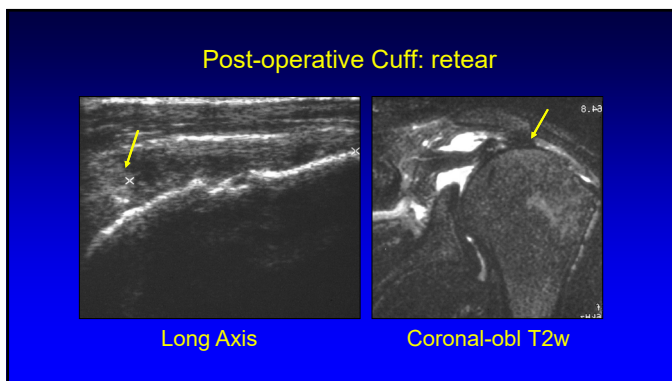
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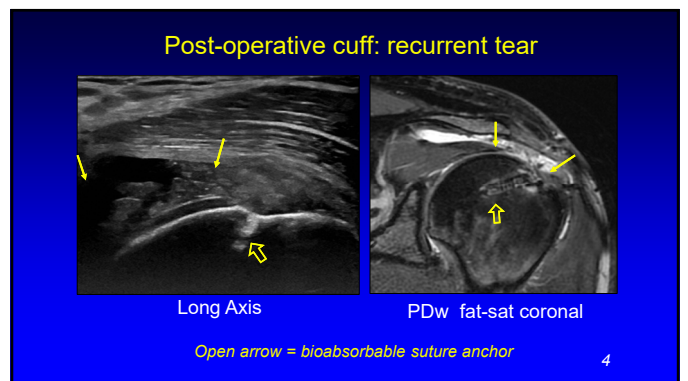
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- Post-operative Rotator Cuff
- Recurrent tear:
    - Defined tendon defect
      - Ultrasound: anechoic or hypoechoic
      - MRI: fluid or contrast signal
    - Tendon non-visualization (ultrasound)
    - Tendon retraction

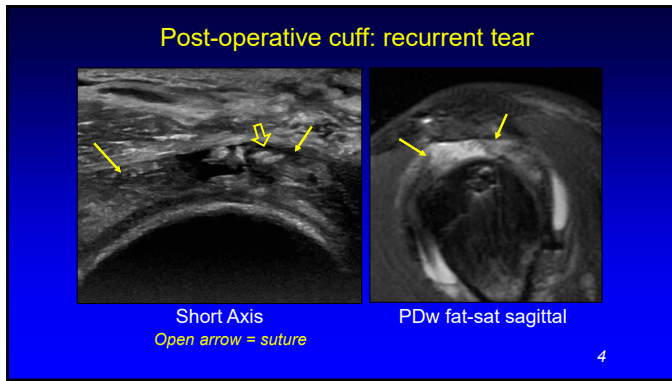
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**Recurrent Cuff Tear: ultrasound results**

- Sensitivity = 95%, specificity = 90%, accuracy = 94%<sup>1</sup>
- Tendon defects at 1 year may heal<sup>2</sup>
- Defects increase in size with decreased strength but may be asymptomatic<sup>3</sup>
- Structural integrity does not correlate with pain or function<sup>4</sup>

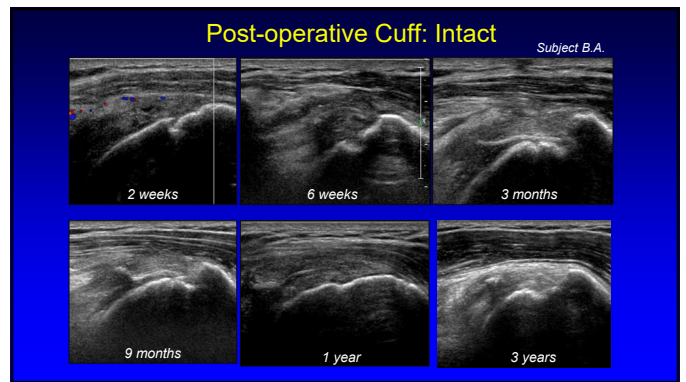
<sup>1</sup>Yen, Clin Imaging 2004; 28:69  
<sup>2</sup>Nho, Am J Sports Med 2010; 37:1938  
<sup>3</sup>Dodson, Am J Sports Med 2010; 38:35  
<sup>4</sup>Russell RD et al. JBJS 2014; 96A:265

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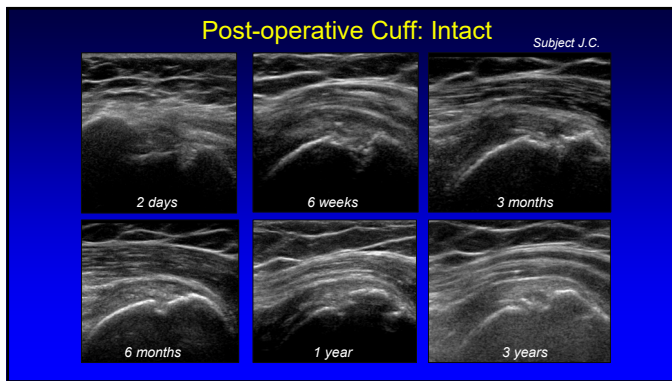
**Rotator Cuff Repair:**

- How does the repaired tendon appear at specific time points after surgery?
- How does the appearance change over time?
- When should the tendon appear "normal"?

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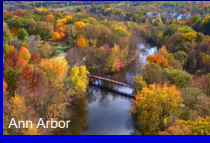
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**Take-home Points**

- Repaired rotator cuff:
  - Most recurrent tears: within 3 months
  - Appears somewhat normal by 6 – 9 months
  - Diagnose retear if obvious defect
  - If equivocal, follow-up scan

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Thank you!



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[www.jacobsonmskus.com](http://www.jacobsonmskus.com)

