

# Imaging Evaluation of the Pectoralis Major

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## Disclosures

- Consultant: Bioclinica
- Contractor: POCUS PRO
- Book Royalties: Elsevier
- Not relevant to this talk

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Fundamentals of Musculoskeletal Ultrasound are copyrighted  
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## Purpose:

- To review pectoralis major anatomy
  - Update on new descriptions
- To review injury classification
  - New proposed injury sequence
- To show imaging examples
  - Surgically-created tear (cadaveric model)
  - Clinical examples (US and MRI)

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## Outline: pectoralis major

- Background
- Anatomy
- Ultrasound and MRI examination
- Clinical findings
- Pectoralis major tear classification
- Imaging examples

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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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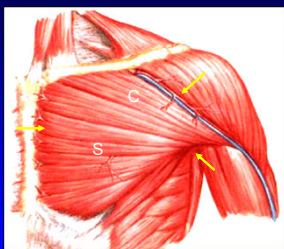
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### Pectoralis Major

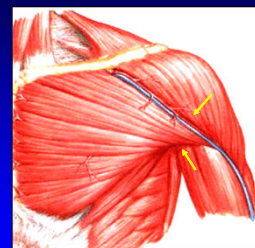
- Clavicular head:
  - Lamina from medial clavicle
- Sternal head
  - Manubrial and costal laminae



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### Pectoralis Major

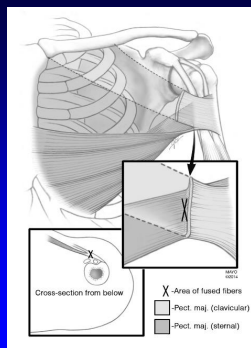
- Attachment:
  - Courses over biceps brachii long head tendon
  - Inserts lateral to biceps brachii tendon
  - Anterior humeral shaft
  - 4 – 6 cm cephalocaudad
  - Note: twisting



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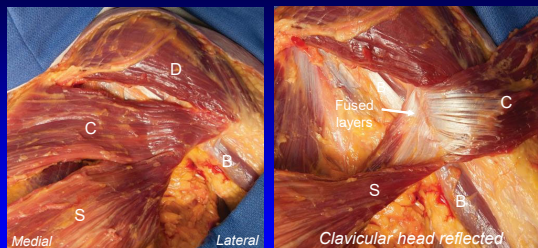
### Pectoralis Major

- 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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### Pectoralis Major



S = sternal head; C = clavicular head  
D = deltoid; B = biceps brachii

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

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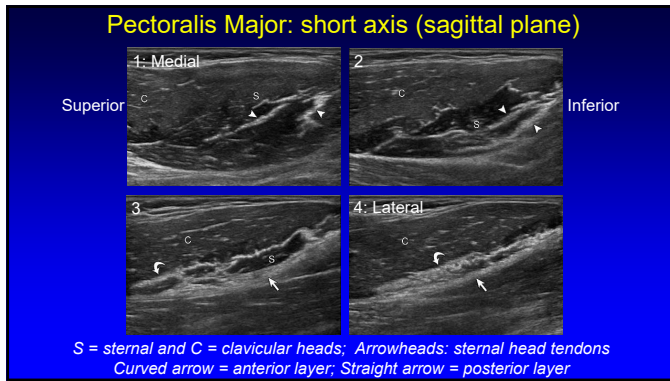
### Pectoralis Major: ultrasound

- Begin short axis over bicipital groove
- Identify biceps brachii long head
- Scan inferior to identify pectoralis major tendon superficial to biceps tendon

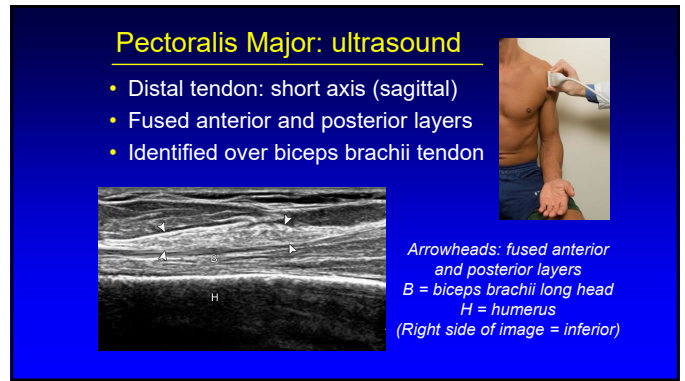


Curved arrow = anterior layer  
Straight arrow = posterior layer  
S = sternal head  
C = clavicular head  
B = biceps brachii long head  
H = humerus  
(Right side of image = lateral)

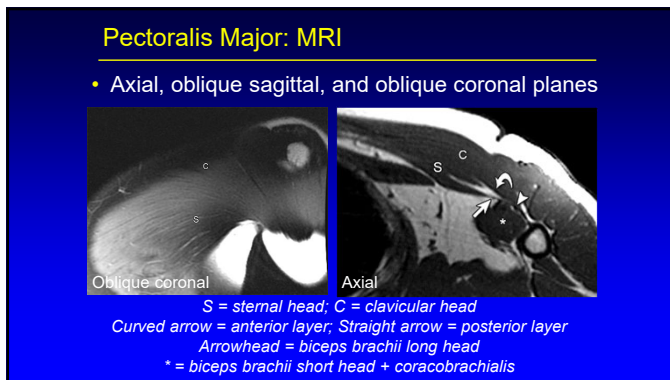
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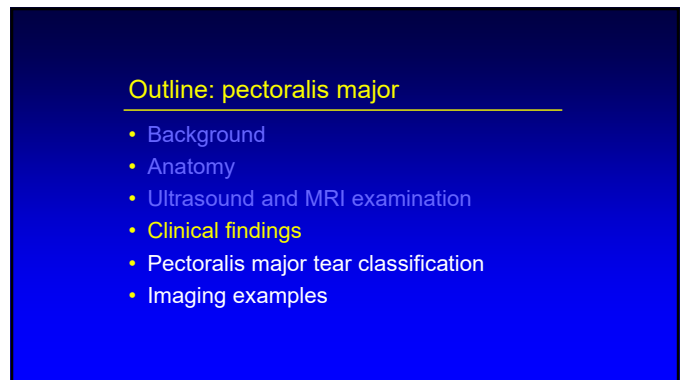
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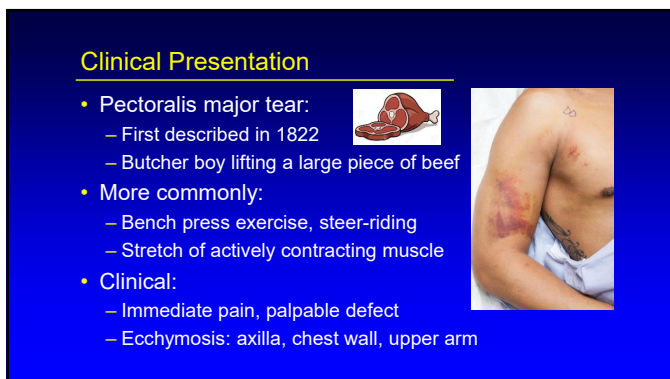
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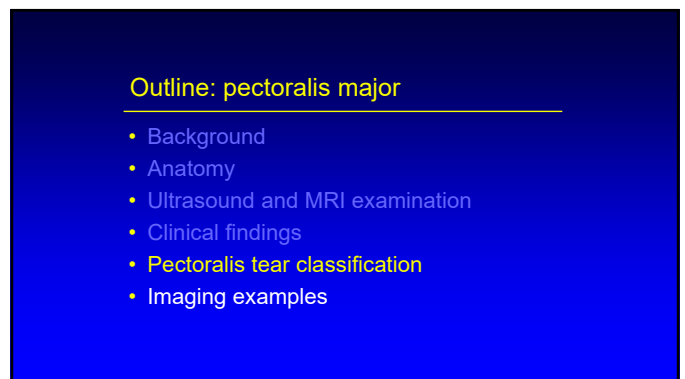
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## Pectoralis Major: tear classification

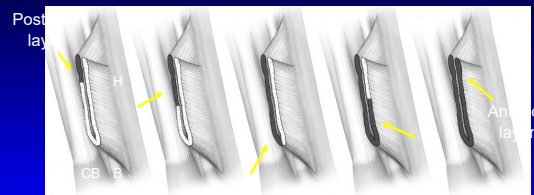
- Musculotendinous junction
  - Most common
  - Partial sternal head
- Intra-tendinous
- Humeral insertion
- Bony avulsion

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

TEAR LOCATION		MANAGEMENT
I. Muscle Origin	II. Muscle Belly	Non-Operative
III. Musculotendinous junction	IV. Intra-tendinous	Operative (Direct suture, loose harvest, bone anchor)
V. Humeral insertion	VI. Bony Avulsion	Operative (Internal fixation)

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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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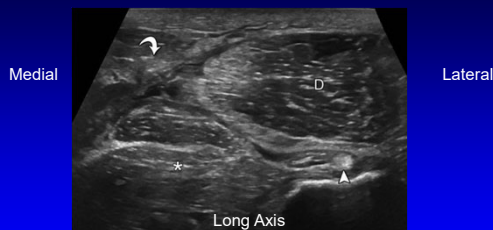
## Pectoralis Tear: imaging findings

- Full-thickness (anterior + posterior layers), full-width (entire tendon):
  - 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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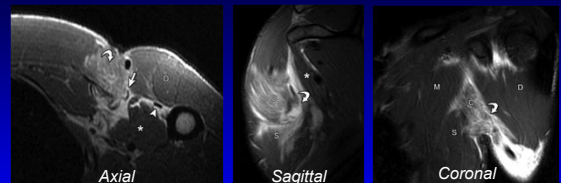
## Case 1: full-thickness, full-width tear



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



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

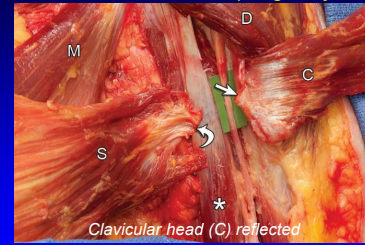
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### Pectoralis Tear: imaging findings

- Partial thickness, full-width
  - 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)

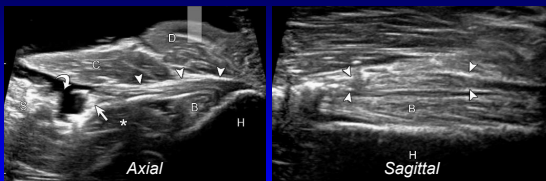


Curved arrow = torn sternal head (S); Arrow = posterior layer  
 \* = short head biceps brachii + coracobrachialis  
 M = pectoralis minor; D = deltoid

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

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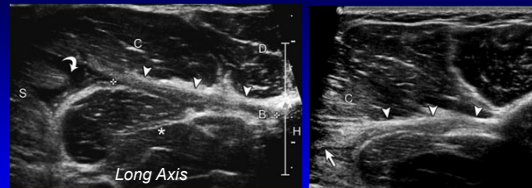
### Case 3: partial-thickness, full-width sternal head tear (surgically created)



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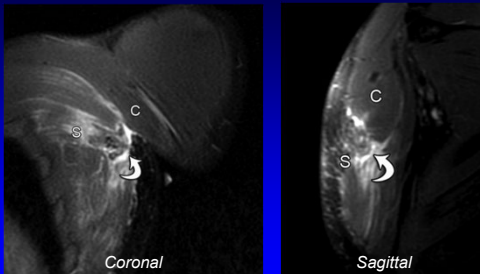
### Case 4: partial-thickness, full-width sternal head tear



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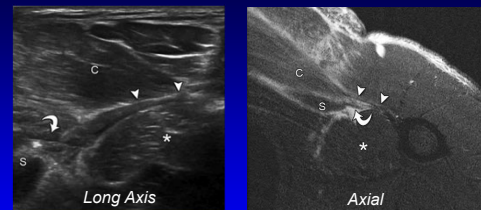
### Case 4: partial-thickness, full-width sternal head tear



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

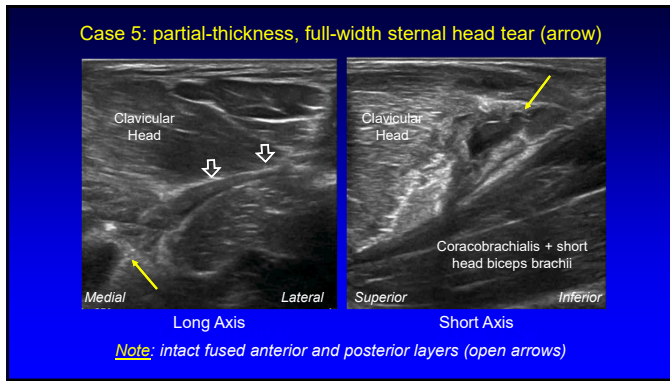
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### Case 5: partial-thickness, full-width sternal head tear



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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### Take Home Points (1)

- Anatomy
  - Clavicular head does not twist but instead covers sternal head
  - Sternal head twists
    - Inferior fibers insert superiorly

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### Take Home Points (2)

- Full-thickness, full-width tear
  - Retracted tendon:
    - Over coracobrachialis and short head biceps brachii
  - No visible tendon over biceps brachii
  - Fluid around biceps with anterior displacement

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### Take Home Points (3)

- Partial-thickness, full-width tear
  - Sternal head most common (posterior):
    - Musculotendinous
  - Retracted tendon:
    - Over coracobrachialis and short head biceps brachii
  - Intact tendon over biceps brachii
    - Fused distal anterior and posterior layers

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Thank you!

Syllabus on line and other educational material:  
[www.jacobsonmskus.com](http://www.jacobsonmskus.com)

Twitter handle: @jjacobsn

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