Pain in acute frozen shoulder, can it be distinguished?

APTA North Carolina

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WSSU

Objectives

- Review anatomic features of adhesive capsulitis
- Describe classification systems currently being used
- Discuss current literature findings to answer the question, “are there distinguishing features in acute stage adhesive capsulitis that are different from other acute MS conditions of the shoulder?”
- Demonstrate evidence-based test for adhesive capsulitis – Coracoid Pain Test
- Discuss effective treatment strategies

I was stumped…

- It started with a question:
  - IS there a difference in acute shoulder pain from frozen shoulder and other musculoskeletal conditions?
  - How do you know if the pain the patient present's with is d/t frozen shoulder or another related musculoskeletal condition?

Background

- Why is AC difficult to diagnose early in the disease process?
- How does someone develop AC with no obvious risk factors?
- Are there differentiating factors for AC in the early stage?
- Is the pain of AC different from shoulder conditions such as a biceps strain or rotator cuff tendinitis in the early stages?

If you could differentiate, would it make a difference in terms of treatment?

- If we were able to differentiate early, could it:

  - Impact outcomes from AC
  - Prevent/lessen the capsular restriction and consequently loss of ROM

Can you distinguish a difference in the PAIN?

Acute frozen shoulder pain

- Predominant symptom- pain with beginning loss of ROM towards end of first stage

Other acute painful musculoskeletal conditions

- Rotator cuff tendonitis
- Bicep's tendonitis
- Bursitis
- Anterior/subacromial impingement

Introduction

- Demographics
  - 2-5% of Americans
  - 40-60 years of age
  - Increased incidence amongst females
- Risk Factors
  - Thyroid Disease
  - DM
  - Prolonged Immobility
- Distinguishing Factors
  - Pain
  - Marked Restriction in ROM

Classification – Adhesive Capsulitis

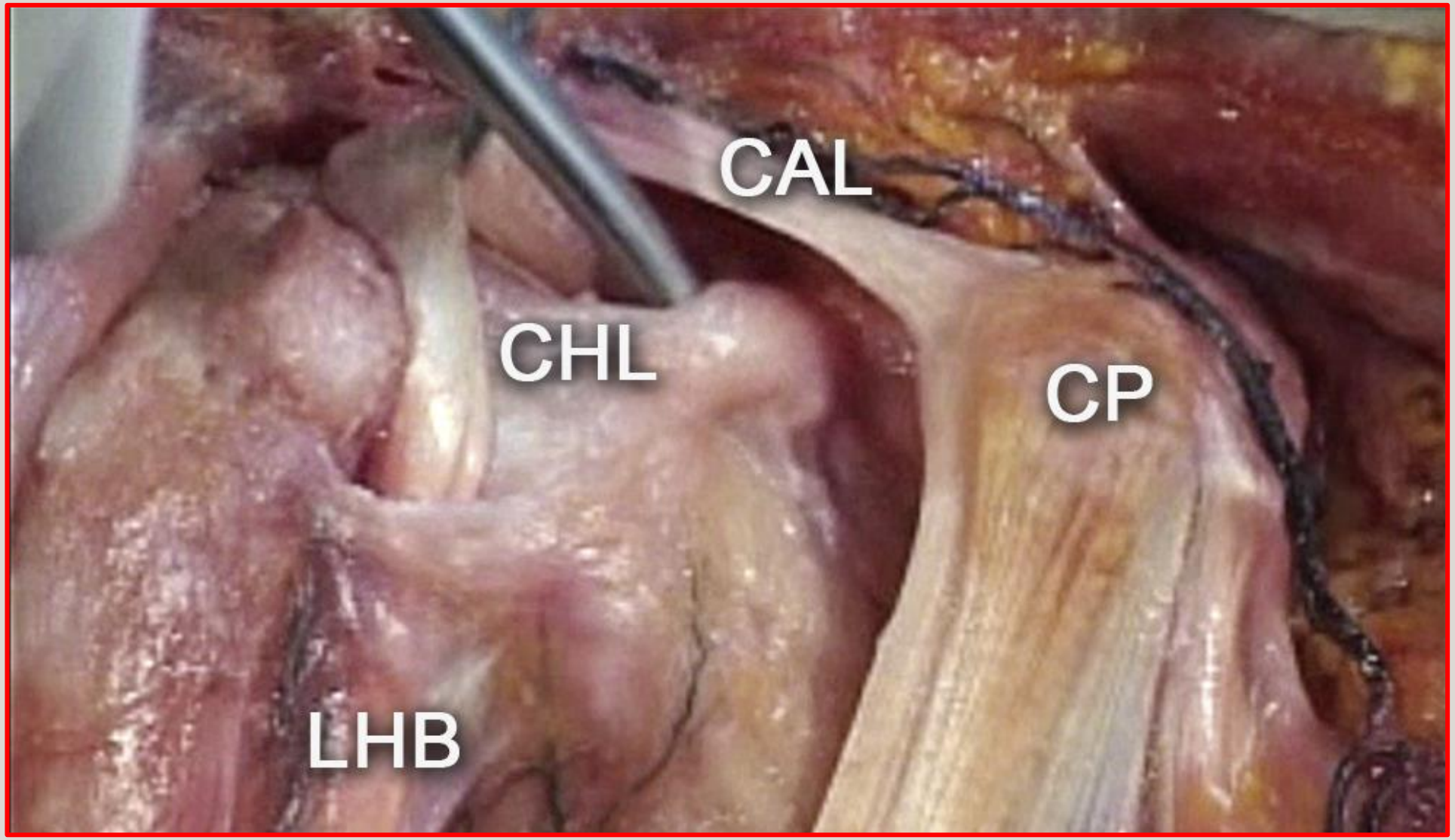
- Primary (idiopathic adhesive capsulitis)
- Secondary AC-caused by disease or pathology; further subdivided into:
  - Systemic- includes patients' w/diabetes, and thyroid disease
  - Extrinsic-AC is not directly related to the shoulder but conditions such as CVA, myocardial infarction, COPD, cervical disc disease.
  - Intrinsic-d/t known pathology of GHJ-rotator cuff tendinopathy, biceps tendinopathy, calcific tendinitis, etc.

Frozen Shoulder – Stages

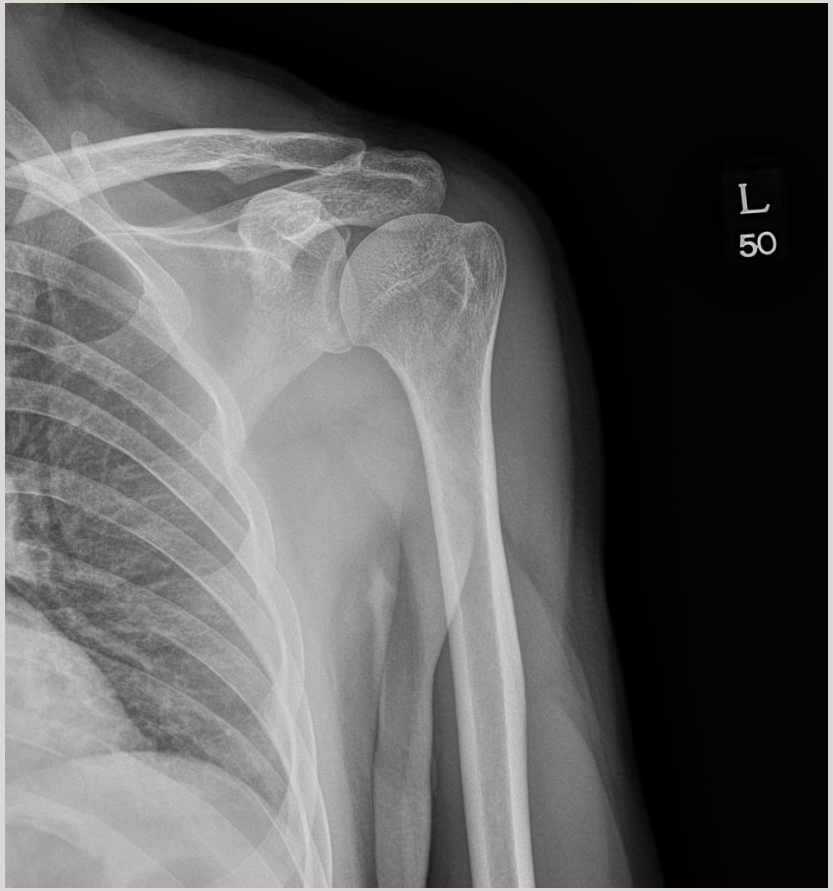
- Goes through 3-4 stages
  - Some researchers subdivide the painful (pre-freezing) stage into 2 phases- **early painful stage** were symptoms
    - May last up to 3 months, patients describe sharp pain at end ranges of motion, achy pain at rest, sleep disturbance (CPR) and no ROM restrictions
    - May be indistinguishable from other shoulder pathologies
    - **Painful (Freezing) Stage**- 3-9 months-marked by **pain** with beginning loss of ROM in all directions towards the end of this stage, Arthroscopic examination reveals aggressive synovitis/angiogenesis and some loss of motion under anesthesia, including ER, IR, Flex, and ABD CPG 50,83,89

Stages

- Frozen Stage – 9-15 months, pain may decrease but ROM limitations become pronounced
  - The synovitis/angiogenesis lessens but the progressive capsuloligamentous fibrosis results in loss of the axillary fold and ROM when tested under anesthesia.
  - Both active and passive range equally limited
  - External rotation losses first followed by losses in other directions
  - Pain at end ranges
- Thawing Stage- is characterized by pain that begins to resolve, but significant stiffness persists from 15 to 24 months after onsets of symptoms.
  - ROM loss may last as long as 10 years, may not recover complete ROM


CAL
CHL
CP
LHB

Radiograph

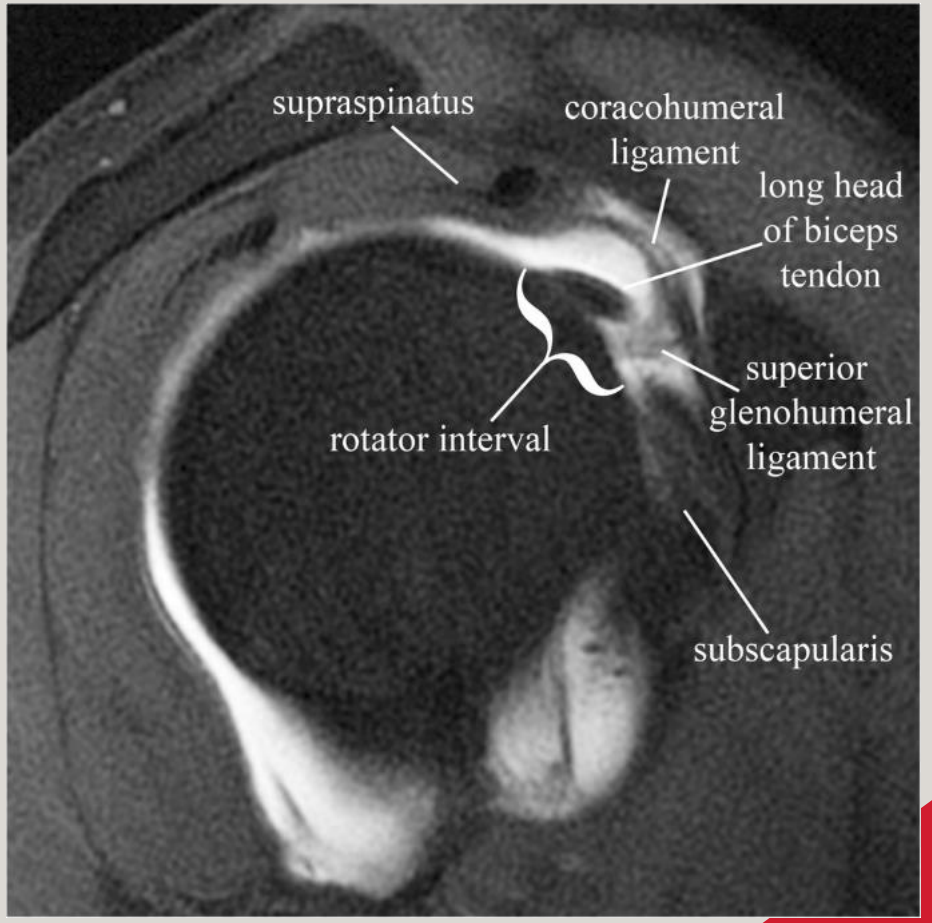


MRI

No remarkable finding detected.

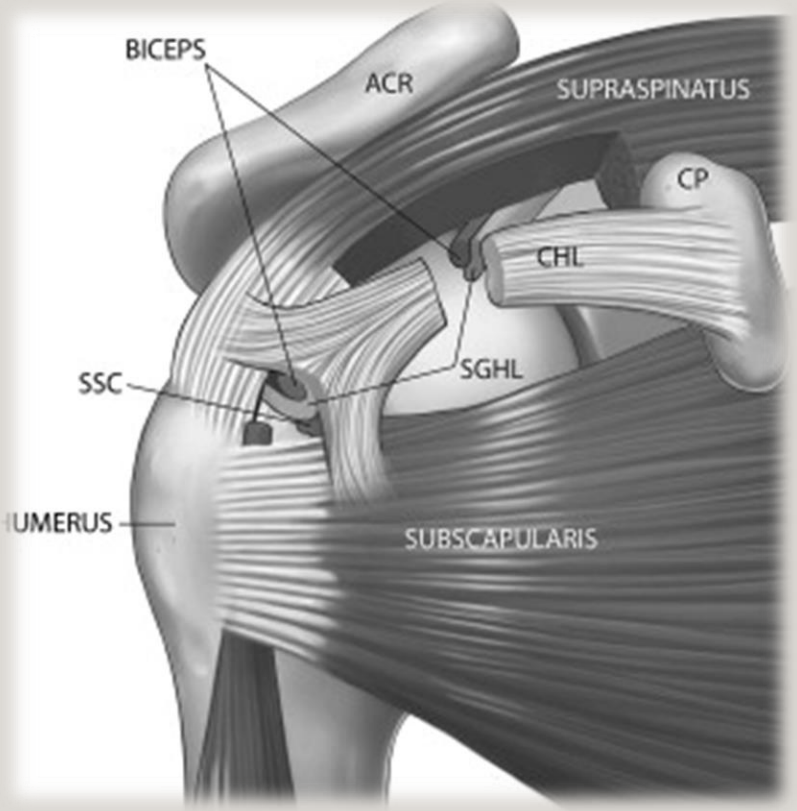
MRI Normal view of structures

Sagittal oblique MR arthrography T1 fat saturation (FS) image shows the rotator interval between the supraspinatus and subscapularis tendons containing the long head of the biceps tendon. The coracohumeral and the superior glenohumeral ligaments form a sling around the biceps tendon, referred to as the biceps pulley

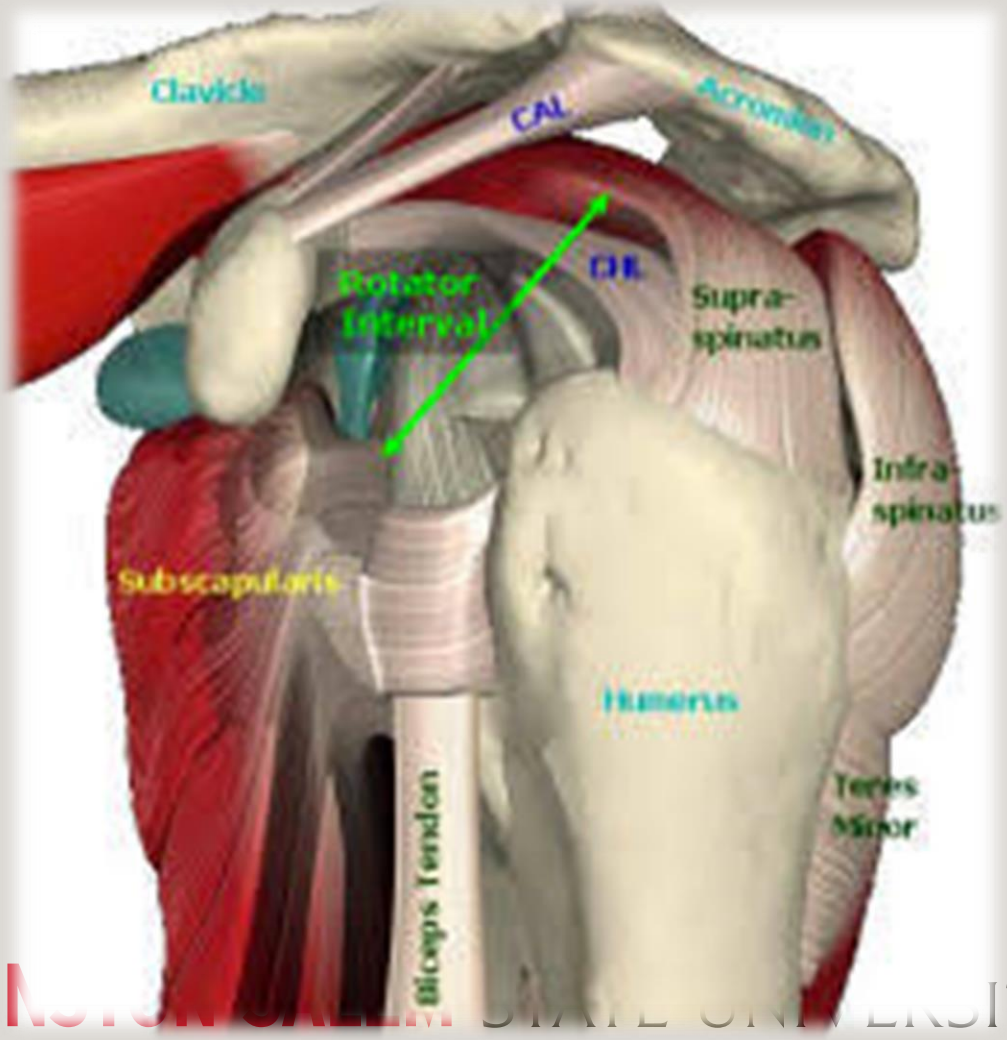


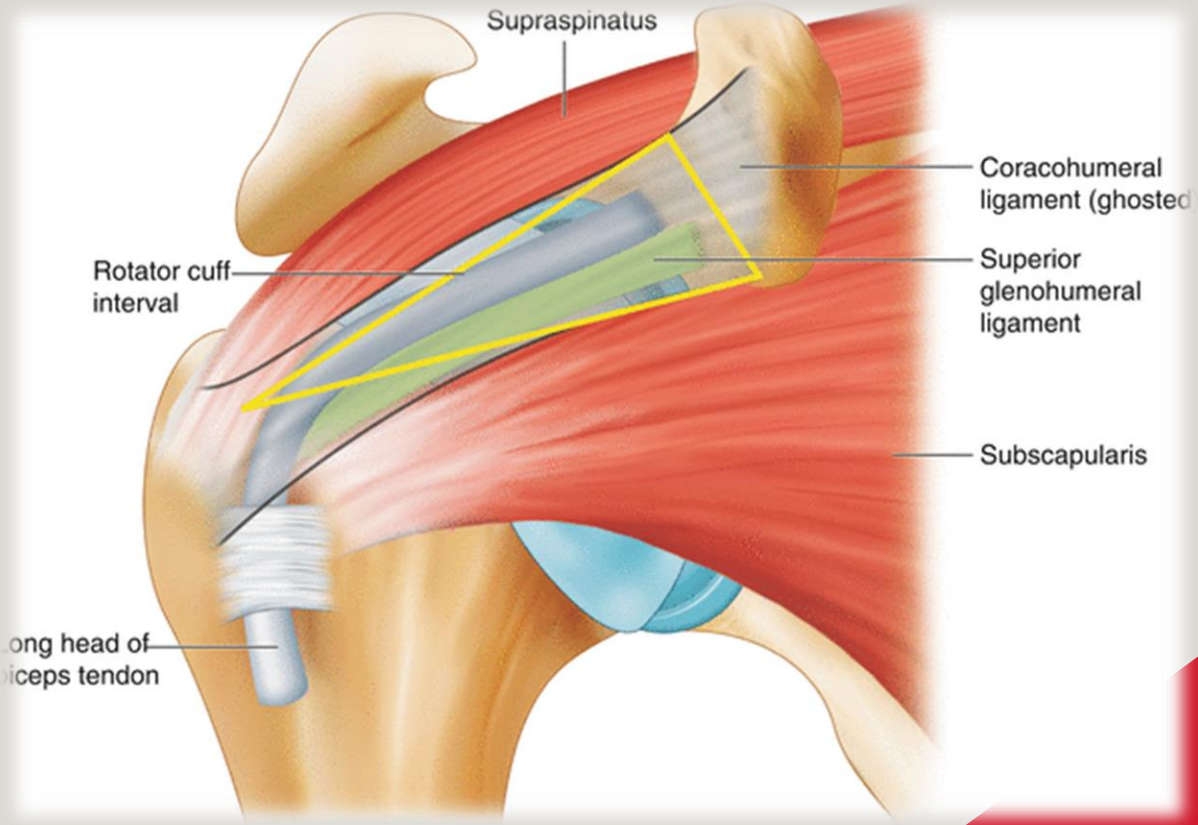
Great picture anterior structures of shoulder

Rotator interval anatomy.
ACR- acromion;
CHL- coracohumeral ligament;
CP - coracoid process;
SSC – subscapularis;
SGHL - superior glenohumeral ligament.

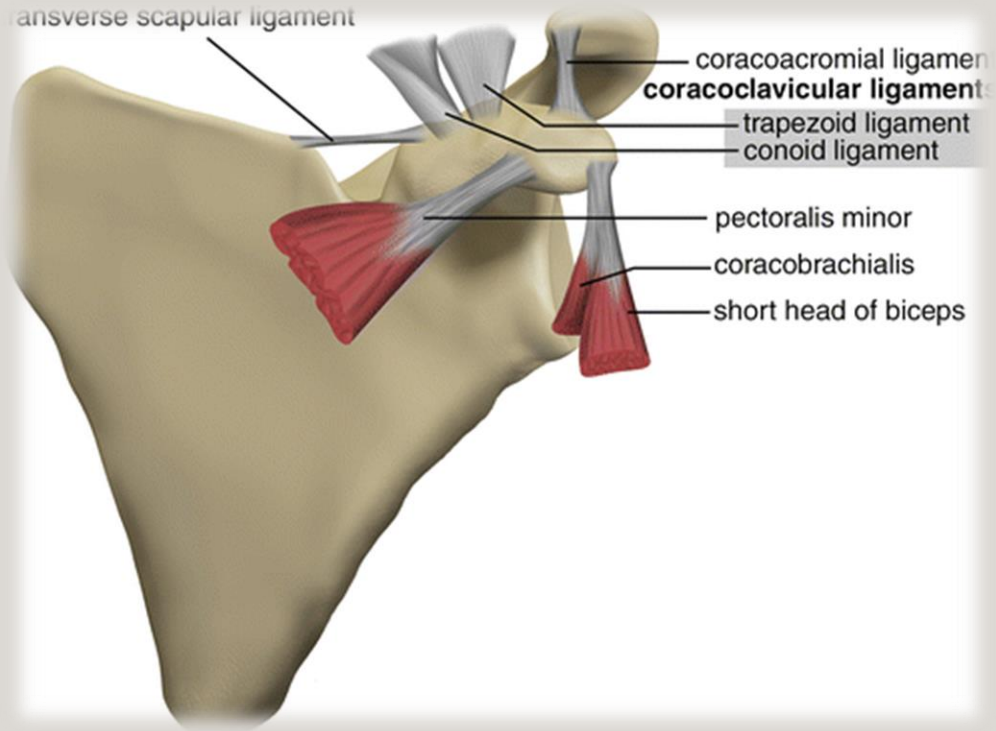


Anatomical drawing of rotator cuff interval

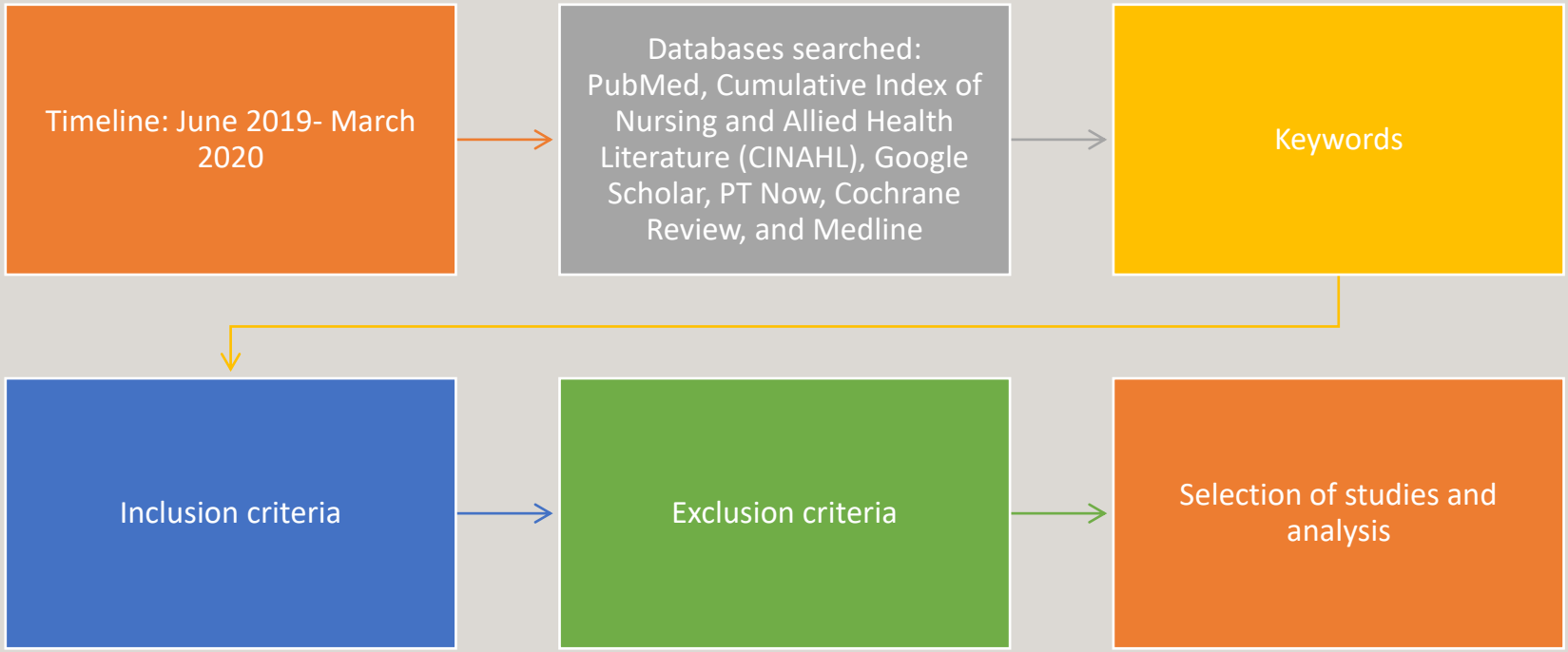




Coracoid process-lighthouse of shoulder



Methods-used to answer questions



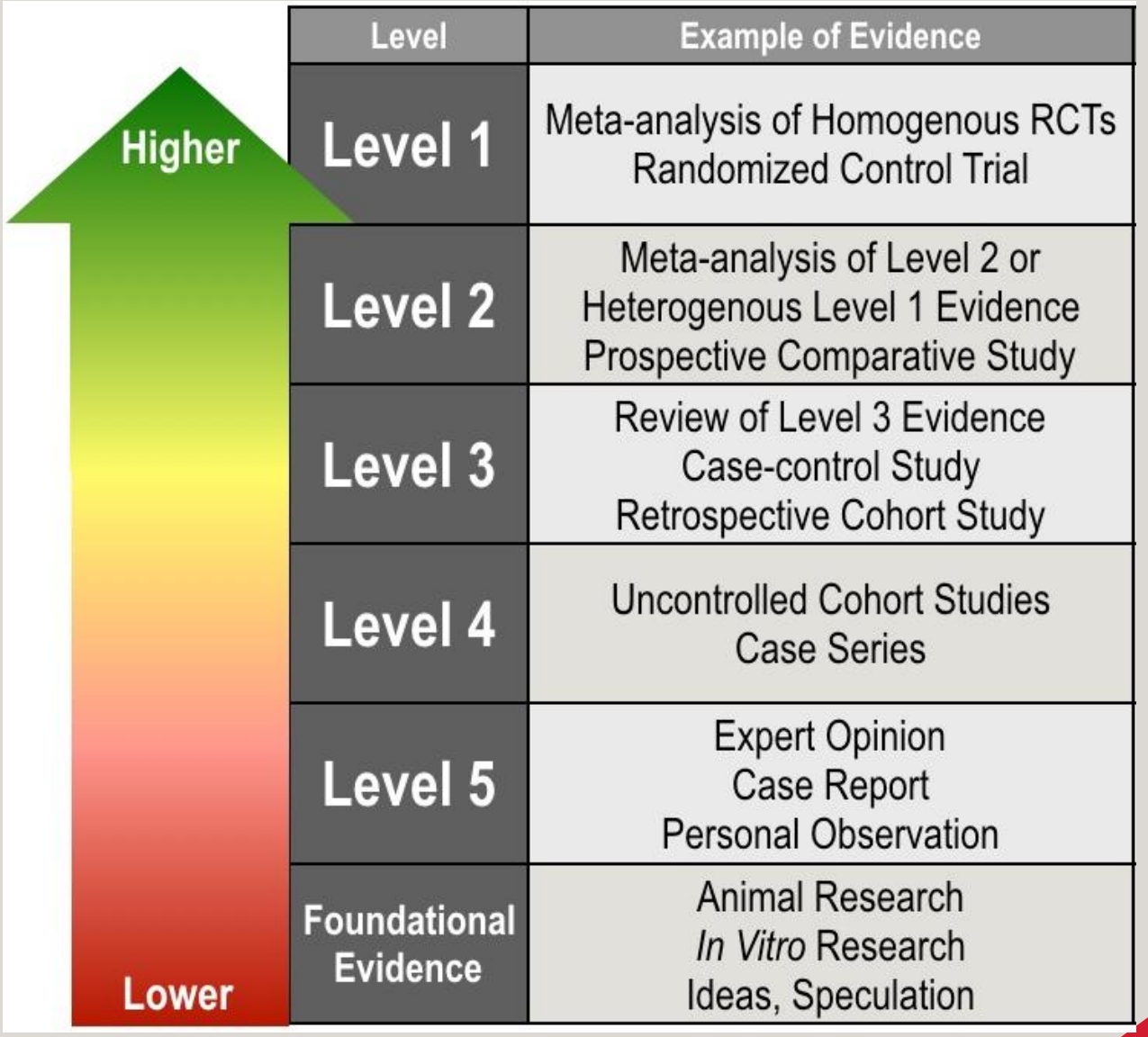
Table

Risk of Bias

Level of Evidence

Study	Type	Level of Evidence	Grade
Walmsley et al	Cross-sectional	IV	12/14
Bhale et al	Case-Control Study	IV	10/12
Candela et al	Case Study	IV	N/A
Prodromidis et al	Systematic Review	I	7/7
Cucchi et al	Narrative Review	V	9/12
Homsi et al	Case-Control Study	IV	10/12
Tandon et al	Case-Control Study	IV	10/12
Walmsley et al	Exploratory Study	IV	9/12
Ryan et al	Systematic Review	I	7/7
Akbar et al	Controlled Laboratory	V	7/12
Cher et al	Controlled Laboratory	IV	7/12
Pietrzak	Medical Hypothesis	V	10/12
Bulgen et at	Case-Control Study	IV	9/12

Levels of Evidence



Level	Example of Evidence
Level 1	Meta-analysis of Homogenous RCTs Randomized Control Trial
Level 2	Meta-analysis of Level 2 or Heterogenous Level 1 Evidence Prospective Comparative Study
Level 3	Review of Level 3 Evidence Case-control Study Retrospective Cohort Study
Level 4	Uncontrolled Cohort Studies Case Series
Level 5	Expert Opinion Case Report Personal Observation
Foundational Evidence	Animal Research *In Vitro* Research Ideas, Speculation

GRADES OF RECOMMENDATION BASED ON STRENGTH OF EVIDENCE

A Strong evidence - A preponderance of level I and/or level II studies support the recommendation. This must include at least 1 level I study

B Moderate evidence - A single high-quality randomized controlled trial or a preponderance of level II studies support the recommendation

C Weak evidence - A single level II study or a preponderance of level III and IV studies, including statements of consensus by content experts, support the recommendation

D Conflicting evidence - Higher-quality studies conducted on this topic disagree with respect to their conclusions. The recommendation is based on these conflicting studies

E Theoretical/ foundational evidence - A preponderance of evidence from animal or cadaver studies, from conceptual models/principles, or from basic science/bench research supports this conclusion

F Expert opinion - Best practice based on the clinical experience of the guidelines development team

STUDY Findings

Clinical identifiers (Walmsley et al 2009)

- Aim of this study- identify CLINICAL features that would help diagnosis primary AC in the EARLY phase.
- The purpose of this study was to establish consensus among a group of experts regarding the clinical identifiers for the first or early stage of primary (idiopathic) adhesive capsulitis using the Delphi technique.

Based on expert opinion the following symptoms were identified:

1. There is a strong component of night pain
2. There is a marked increase in pain with rapid or unguarded movements
3. It is uncomfortable to lie on the affected shoulder
4. The patient reports the pain is easily aggravated by movement
5. The onset is generally people greater than 35 years of age
6. On examination there is global loss of active and passive range of movement
7. On examination there is pain at the end of range in all directions
8. There is global loss of passive glenohumeral joint movement

Follow-up study in 2014

Clinical Identifiers for Early-Stage Primary/Idiopathic Adhesive Capsulitis: Are We Seeing the Real Picture?

Sarah Walmsley, Peter G. Osmotherly, Darren A. Rivett

- The aim of this study was to validate any or all of the 8 clinical identifiers of early-stage primary/idiopathic adhesive capsulitis established in an earlier Delphi study.
- This was a cross-sectional study.

- Methods-
  - Sixty-four patients diagnosed with early-stage adhesive capsulitis by a physical therapist or medical practitioner were included in the study.
  - Eight active and 8 passive shoulder movements and visual analog scale pain scores for each movement were recorded prior to and immediately following an intra-articular injection of corticosteroid and local anesthetic.

Methods cont'd

- The local anesthetic was the reference standard
- Pain relief of 70% for passive external rotation was deemed a positive anesthetic response (PAR).

- **Findings-**
  - None of the clinical identifiers for early-stage adhesive capsulitis previously proposed by expert consensus have been validated in this study.
  - Clinicians should be aware that commonly used clinical identifiers may not be applicable to this stage.

Results

Clinical Identifiers

3 studies

- Unable to validate expert opinion
- Decreased in kinesthetic awareness in flexion, abduction, IR and ER compared to healthy controls
- Pain distribution was localized to dermatomes C5-C6, with increases in women vs men

Clinical Identifiers for Early-Stage Primary/Idiopathic Adhesive Capsulitis: Are We Seeing the Real Picture?

Sarah Walmsley, Peter G. Osmotherly, Darren A. Rivett

Evaluation of shoulder kinesthesia in patients with unilateral frozen shoulder

Akansha A. Bhale, Surendra K. Wani*

Adhesive capsulitis of the shoulder: pain intensity and distribution

V. Candela[1] · G. Giannicola[1] · D. Passaretti[1] · T. Venditto[2] · S. Gumina[1]

Results

Genetics

- 2 studies
  - Human leukocyte antigen B27
  - Race
  - Family History
  - Twin Studies

Is There a Genetic Predisposition to Frozen Shoulder?: A Systematic Review and Meta-Analysis.

Prodromidis AD[1], Charalambous CP

Risk Factors for Shoulder Stiffness: Current Concepts

Davide Cucchi [1 2], Antongiulio Marmotti [3], Silvana De Giorgi [4], Alberto Costa [5], Rocco D'Apolito [6], Marco Conca [7], Alessandro Russo [8], Maristella F Saccomanno [9], Laura de Girolamo [10], SIGASCOT Research Committee

Results

Imaging

- 4 studies
  - Two articles showed Increased CHL thickness in those with AC compared to control shoulders and painful shoulders
  - There was an increase in the Power Doppler Ultrasonography signal in the Rotator Cuff interval in those with AC
  - Using MRI, changes were noted in the coracohumeral ligament, axillary recess, and rotator interval in those with AC

Carlos Homsi
Marcelo Bordalo-Rodrigues
Jader J. da Silva
Xavier M. G. R. G. Stump

Ultrasound in adhesive capsulitis of the shoulder: is assessment of the coracohumeral ligament a valuable diagnostic tool?

Sonography in Diagnosis of Adhesive Capsulitis of the Shoulder: A Case-Control Study

Anupama Tandon [1], Sakshi Dewan [1], Shuchi Bhatt [1], A K Jain [2], Rima Kumari [3]

Power Doppler Ultrasonography in the Early Diagnosis of Primary/Idiopathic Adhesive Capsulitis: An Exploratory Study

Sarah Walmsley [1], Peter G Osmotherly, Colin J Walker, Darren A Rivett

The Pathophysiology Associated With Primary (Idiopathic) Frozen Shoulder: A Systematic Review

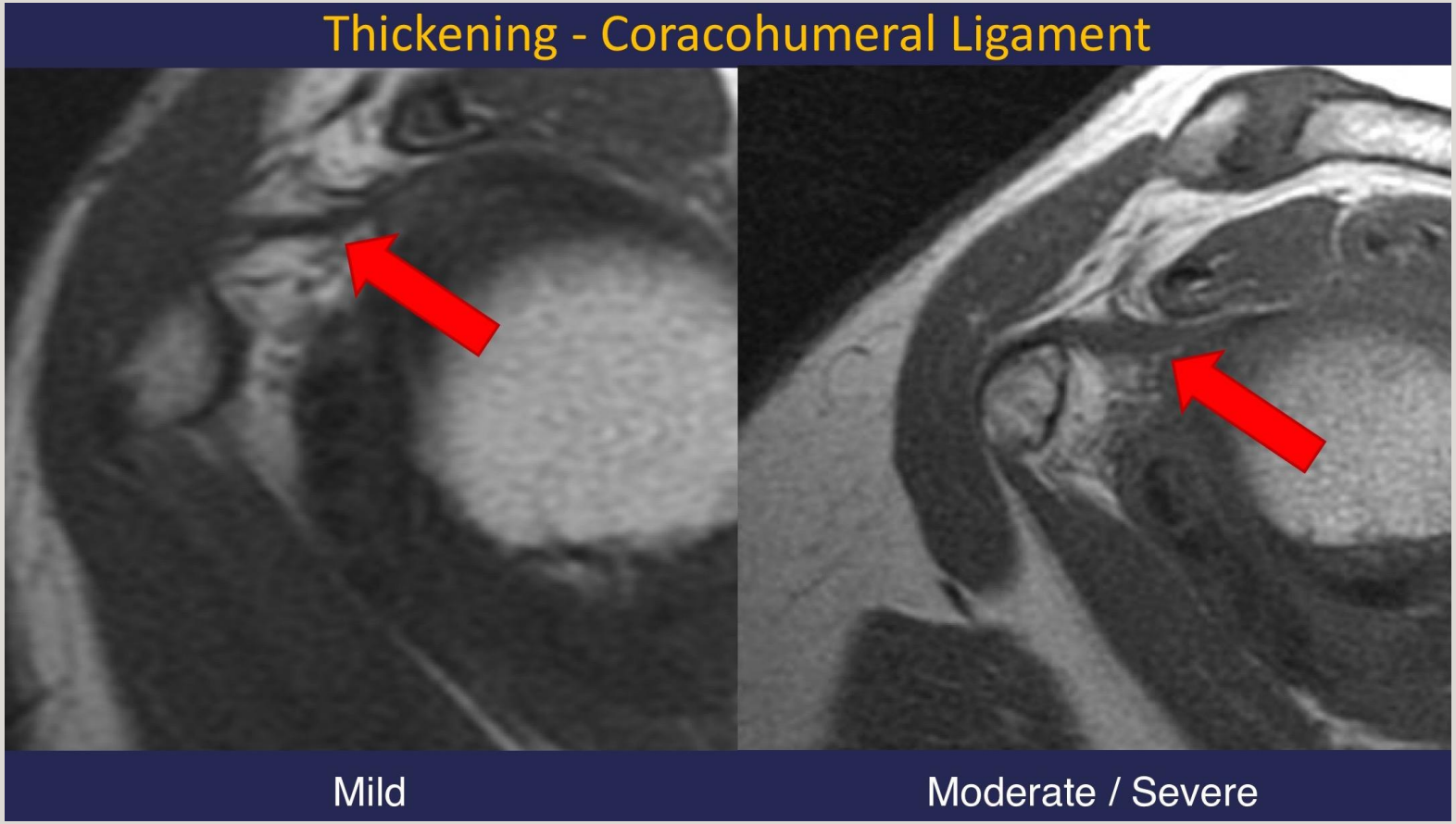
Victoria Ryan [1 2], Hazel Brown [3], Catherine J Minns Lowe [4], Jeremy S Lewis [5 6]

MRI-Rotator Cuff Interval

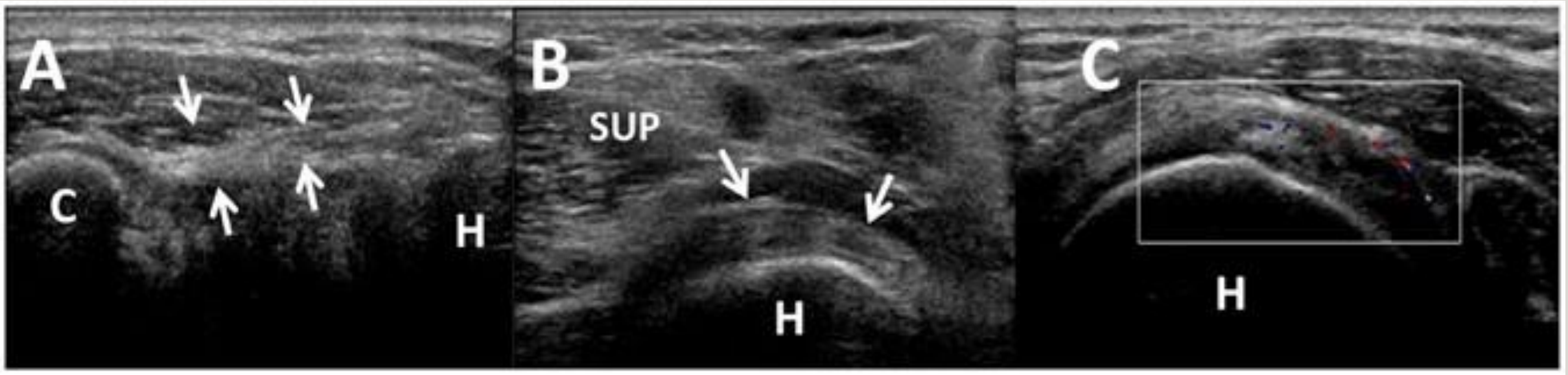
Post IV gadolinium enhanced sagittal T1-weighted image with fat-suppression demonstrates enhancement in the rotator interval region (arrows), confirming the diagnosis of adhesive capsulitis. The long biceps tendon (short arrow), supraspinatus muscle (Sup), subscapularis (Sub), and Coracoid (Cor) are indicated.

MRI of shoulder (AC)

Thickening of coracohumeral ligament



Ultrasound image



US findings of frozen shoulder patients: (**A**) Gray-scale US showed a thickened CHL (arrowheads); (**B**) Gray-scale US showed a thickened inferior capsule; (**C**) Color Doppler detected an increased vascularity and echotexture in the rotatol cuff interval; C, coracoid; SUP, supraspinatus tendon; H, humeral head

Results

Histologic

- 4 articles
  - Increases of the alarmin molecule HMGB-1, subsynovial vascularity, and fibroblastic hypercellularity
  - Increased fibroblast markers for CD248 CD146, VCAM-1, and PDPN
  - Increased levels of cytokine production and neuro-immune activation
  - Decreased Serum IGA

Alarmins in Frozen Shoulder: A Molecular Association Between Inflammation and Pain

Jonathon Z.B. Cher, Moeed Akbar, MRes, PhD, Susan Kitson, BSc, more... Show all authors

Fibroblast Activation and Inflammation in Frozen Shoulder

Moeed Akbar [1], Michael McLean [1], Emma Garcia-Melchor [1], Lindsay An Crowe [1], Paul McMillan [1], Umberto G Fazzi [2], David Martin [2], Angus Arthur [2], James H Reilly [1], Iain B McInnes [1], Neal L Millar [1 2]

Adhesive Capsulitis: An Age Related Symptom of Metabolic Syndrome and Chronic Low-Grade Inflammation?

Max Pietrzak [1]

Discussion

Walmsley et.al 2014

Local anesthetic: 00mm to 100mm

- Need a pain relief score of greater than 70% in external rotation to confirm a positive result
- No statistical significance, no validation but used in practice
- Lack of appropriate understanding of adhesive capsulitis in its early stage

Discussion

Bhale et.al 2019

- Joint proprioception during shoulder movements in 41 subjects with unilateral frozen shoulder in the freezing or frozen stage and 41 healthy age matched controls
  - Results: significant shoulder kinesthetic deficits in patients with unilateral frozen shoulder
  - Treatment protocol for AC should include joint kinesthetic rehabilitation
  - Further research needed to assess if joint kinesthetics should be used as a clinical identifier to diagnose AC

Discussion

Genetic Link

- Prodromidis
  - 7 studies, 4 looked into HLA-B27
    - 2 distinguished link between AC vs. control population
  - Addition study: strong family link (twin studies, immediate family members, or racial demographics)
- Cucchi
  - Two first degree relatives (identical twins, father daughter, and two brothers)
  - Gene polymorphisms of Interleukin6 (IL-6) and matrix metalloproteinase-3 (MMP-3) have shown strong correlation to AC, albeit postoperatively

Discussion

Imaging

- Homsi et.al 2006
  - Differences of the coracohumeral ligament between patients with AC, painful shoulders, and asymptomatic shoulders.
  - After ultrasound: painful shoulders have a coracohumeral ligament thickness of 1.39mm, asymptomatic 1.34mm, and AC group was 3mm

Discussion

Sonography

Tandon et.al 2017

- 90 subjects & 3 groups (AC, painful shoulder, and control)
- Coracohumeral ligament was significantly thicker higher in the AC group
- 96.7% in the AC group had restricted external rotation, 10% painful shoulder, & 0% control group
- Potential to become the preferred imaging modality to diagnosis AC

Discussion

Power Doppler Ultrasonography (PDUS)

Walsmley et.al 2013

- 41 participants: required shoulder pain for less than 9 months
- 12 of the 41 had increased PDUS signals
  - Rotator interval area correlating with an increase in vascularity to the area
- Could be a useful imaging tool to identify some patients with early-stage AC

Discussion

Ryan et.al 2016

- Systematic Review (focus: primary frozen shoulder and its pathophysiology)
  - 1 article: 13 different studies (3 focused on MRI)
  - 1st study
    - 46 participants
  - 2nd study
    - 90% demonstrated a superior subscapularis recess sign, 1.5% of controls and 6% with superior cuff tear
  - 3rd study
    - 132 participants
    - AC average 3.99mm, control average 3.08= statistically significant

Conclusion

- Limitations
- Unique study
- Unable to give definitive answers
- Able to describe advanced techniques and procedures diagnosing frozen shoulder

Clinical Relevance

Physical therapists are limited to the use of clinical identifiers for the early detection of AC

- active and passive range of motion
- patient pain complaints

Future Implications

- Multidisciplinary
- Additional studies likely to confirm

Clinical Assessment- Coracoid Pain Test 2010 (Carbone et al)

- Sensitivity 96% Specificity 87-89%
- Palpate ACJ, anterior/lateral subacromial area, and coracoid process
  - Ask for pain response on 0-10 scale at each point
  - Positive test is when pain at coracoid process is 30% or 3 points higher on the VAS than the other 2 areas
  - Rationale for test:
    - On MRI findings suggest thickening of coracohumeral ligament, the rotator interval and the coracoid triangle
- According to Carbone et al, "*The coracoid pain test could be considered as a pathognomonic sign in physical examination of patients with stiff and painful shoulder".*

It matters whether treating Primary or Secondary frozen shoulder

- Medical Management strategies for PRIMARY frozen shoulder
- Pre-freezing/painful stage
  - Palliative and injection therapy
- Frozen Stage
  - Suprascapular nerve block and distension hydroplasty
- Thawing stage
  - Manipulation under anesthesia
  - Arthroscopic capsular release

Primary may have more of a central sensitization component

Pre-Freezing Stage

- Neuroscience education
- Tactile discrimination
- Graded motor imagery (GMI)
- Aggressive PT is early stage detrimental
- Modalities
  - Shortwave diathermy
  - US
  - ES
  - PROM/Stretching – short of resistance (weak evidence)

Sawyer et.al 2018

- Freezing stage
  - CPM for sort-term pain relief, no benefit for improving ROM or function
  - Deep heat can be used
  - US at this stage does not have a direct benefit
  - Inconclusive evidence exist re: effectiveness of joint mobilization BUT when compared with treatments that included manual therapy, mobs seemed to have a favorable effect on ROM and pain
  - Using a tailored approach of both manual therapy, stretching exercise, while accounting for tissue irritability was helpful
    - Treated fewer times/week- once/week for 12 weeks with HEP of stretching

Frozen Stage Primary AC (Buchbinder et.al 2008)

Suprascapular nerve block

- Produced faster and more complete resolution of pain and improved ROM than intra-articular injections

Distension hydroplasty

- Short-term benefits in terms of pain, function, and ROM movement

Thawing Stage

- Manipulation under anesthesia (MUA)
  - Successful when stiffness is the primary symptom
  - May need to be repeated
  - Risk of humeral fracture
  - NO difference in ROM or patient outcomes when compared with arthroscopic release

Summary

- Very challenging and complex condition
- Aggressive therapy can be detrimental
- Focus on pain management and gentle ROM
- These patient may require medical management

Secondary AC (Kelley et.al 2013)

- Respect the stage patient in
- Is patient more pain or stiff dominant?
- Can be treated more aggressively BUT based on LEVEL of irritability

If high irritability characterized by

- High levels of reported disability on standardized self-reported outcome tools
- Pain occurs BEFORE end ranges of active or passive movement
- Active ROM is significantly less than passive ROM d/t pain

If HIGH irritability, consider

- low intensity jt mobs, grades I and II
- Mobility exercises in pain-free passive and active assisted ROM (not into resistance)

Kelley et.al 2013

Low irritability characterized by-

- Minimal levels of disability on standardize self-report outcomes
- Pain occurs with OP into end ranges of passive movement
- Active ROM same as passive

If LOW irritability, consider-

- End range jt mobs, high amplitude (grades III and IV) and long duration into tissue resistance
- Stretching exercises-progress duration into tissue resistance w/o causing posttreatment tissue inflammation and pain
- Procedures to integrate gains in mobility into normal scapulohumeral movement during functional activities at home and work.

Management Ideas

- Joint mobilization with lateral distraction
- Muscle Energy Techniques
- Mobilization with movement
- Give progressive exercise/HEP that incorporates the NEW range gained
- As movement increases-above 110-120° begin to strengthen muscles around scapula (as needed)
  - Lower trap
  - Middle trap
  - Serratus Anterior

Management cont’d

- Muscle length-evaluate scapulothoracic mobility
  - Pectoralis major
  - Pectoralis minor
  - Latissimus dorsi
- Incorporate functional activities
  - Return to activity
  - Return to work, etc.

Evaluation QR Codes

APTA North Carolina

Session Evaluation QR Code

Conference Evaluation QR Code

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