Shoulder Impingment

Jong Liu

05/18/06

What is it?

- Rotator cuff impingement syndrome is a clinical diagnosis that is caused by mechanical impingement of the rotator cuff by its surrounding structures.
- Patients with impingement syndromes may present with various signs and symptoms on physical examination depending on the degree of pathology and the structures involved.

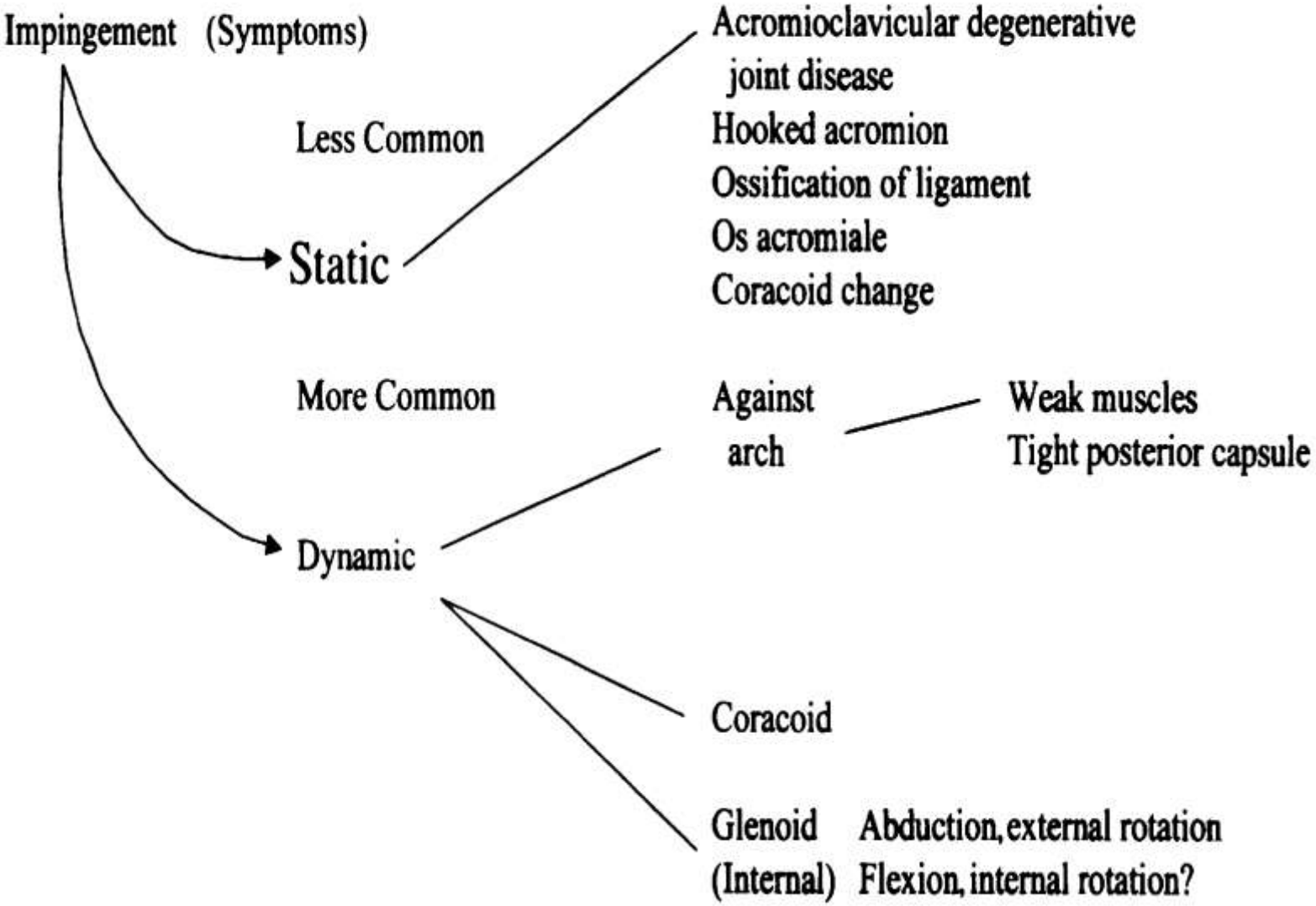

Impingement (Symptoms)
Less Common
Static
Acromioclavicular degenerative joint disease
Hooked acromion
Ossification of ligament
Os acromiale
Coracoid change
More Common
Dynamic
Against arch
Weak muscles
Tight posterior capsule
Coracoid
Glenoid (Internal)
Abduction, external rotation
Flexion, internal rotation?

Table 1. History and Physical Examination Findings for Etiologies of Impingement-Type Shoulder Pain

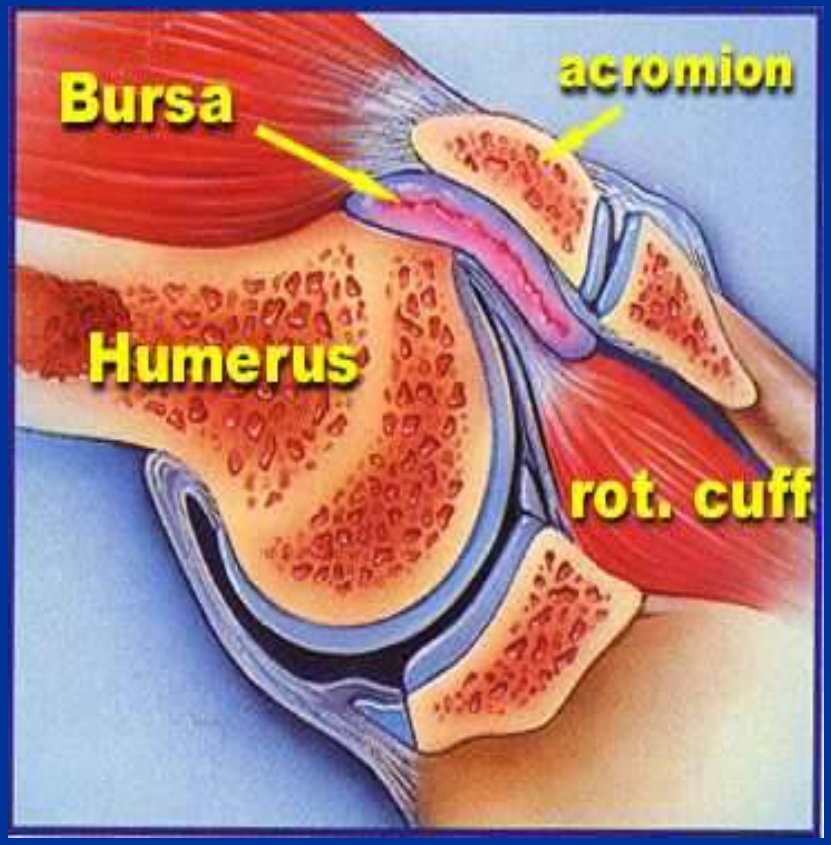
Entities	Activity	Pain Location	Association	Physical Exam: Impingement Signs Hawkins/Neer	Physical Exam: Palpation Tenderness	Physical Exam: Relocation Test	Physical Exam: Apprehension Test	Physical Exam: Internal Rotation	Imaging
Acromioclavicular joint degenerative disease	Cross-body abduction/ overhead	Acromioclavicular joint	History of acromioclavicular separation, older age	−/+	Acromioclavicular joint	−	−	−	X-ray
Hooked acromion	Overhead	Lateral	Older	+	−	−	−	−	X-ray supraspinatus outlet
Ossification of coracoacromial ligament	Overhead	Anterolateral	Older	+/−	−	−	−	−	X-ray
Os acromiale	Overhead	Fibrous union	Impingement secondary to undersurface enlargement	+/−	+	−	−	−	Axillary lateral CT MRI
Coracoid	Internal rotation/ adduction	Coracoid/anterior		Internal rotation	+	−	−	−	MRI
Weak muscles/ anterior laxity	Overhead fatigue	Anterior/posterior	Overhead throwing, repetitive	+	Anterior/posterior	+/−	?/−?	Usually ↓	MRI
Tight posterior capsule	Throw	Posterior/anterior	Long history of throwing, decreased internal rotation	+/−	−	−/+	+/−	⇊	−
Glenoid (internal) impingement	Abduction, external rotation, throwing	Posterior	Throwing fatigue	−	Posterior	+	+Extreme of external rotation	+/−	MRI in abduction/ external rotation

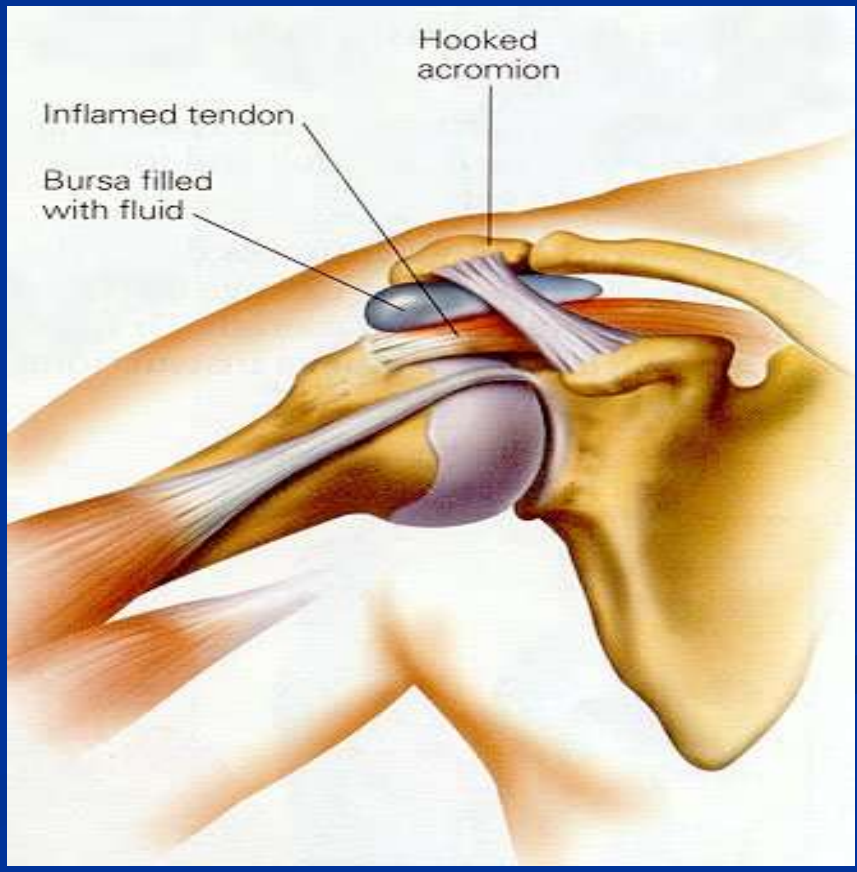
Subacromial Impingement

- Narrowing of the space between the humeral head and the coracoacromial arch (supraspinatus outlet);
- Causing entrapment of the supraspinatus tendon and subacromial bursa.
- Repeated trauma to these structures will lead to tendon degeneration/tear and bursitis.
- Patients complain of pain and tenderness over anterior or anterolateral aspect of the shoulder joint.

Subacromial Impingement

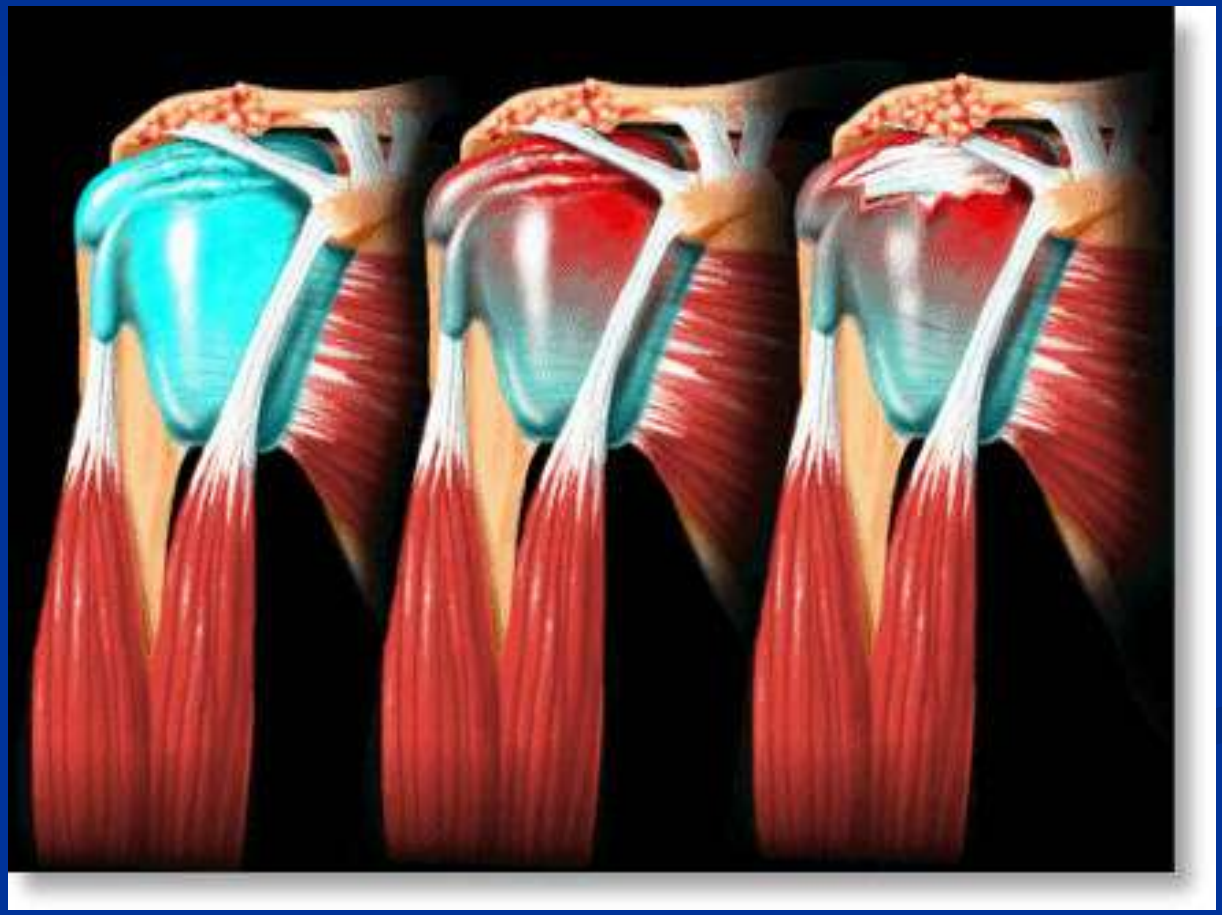
- Neer proposed that 95% of rotator cuff tears are due to chronic impingement between the humeral head and the coracoacrominal arch.





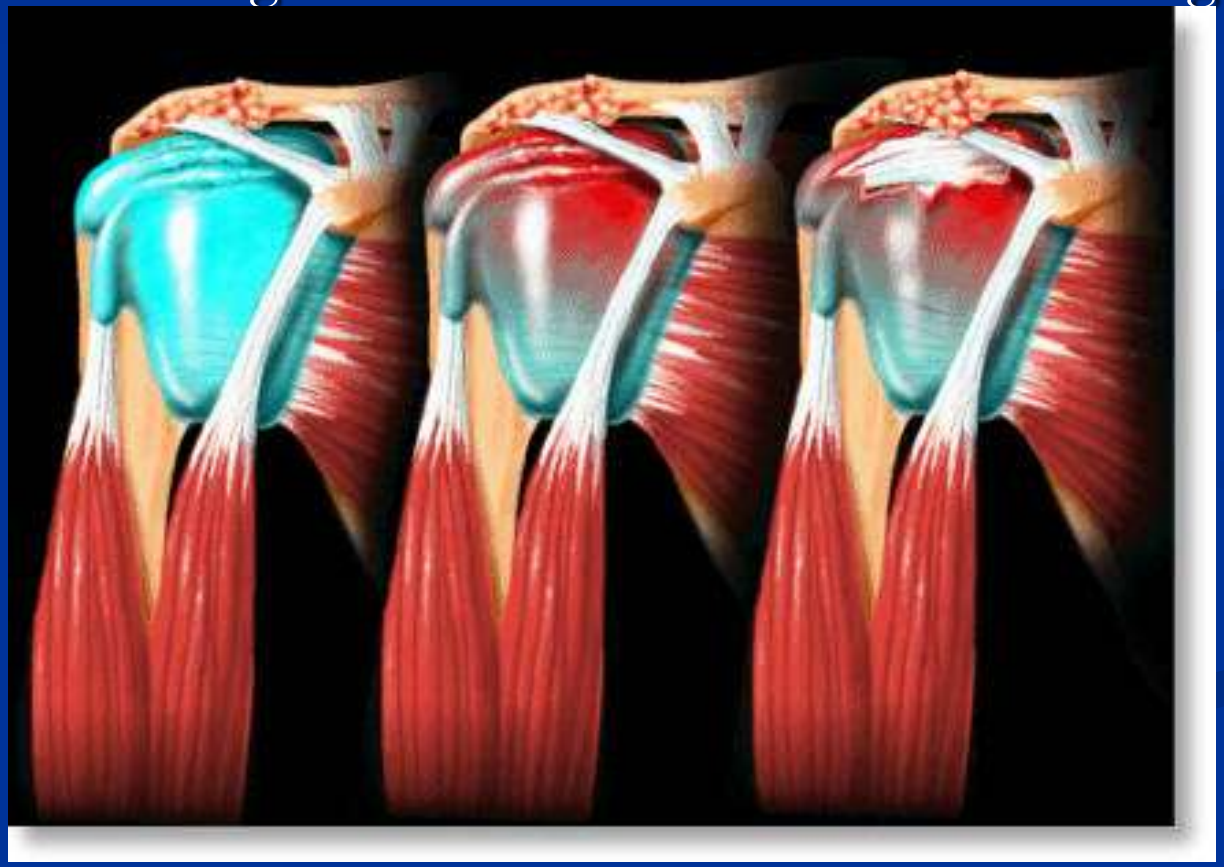
Subacromial Impingement

- Stage 1 disease consists of edema and hemorrhage of the tendon due to occupational or athletic overuse, and is reversible under conservative treatment.



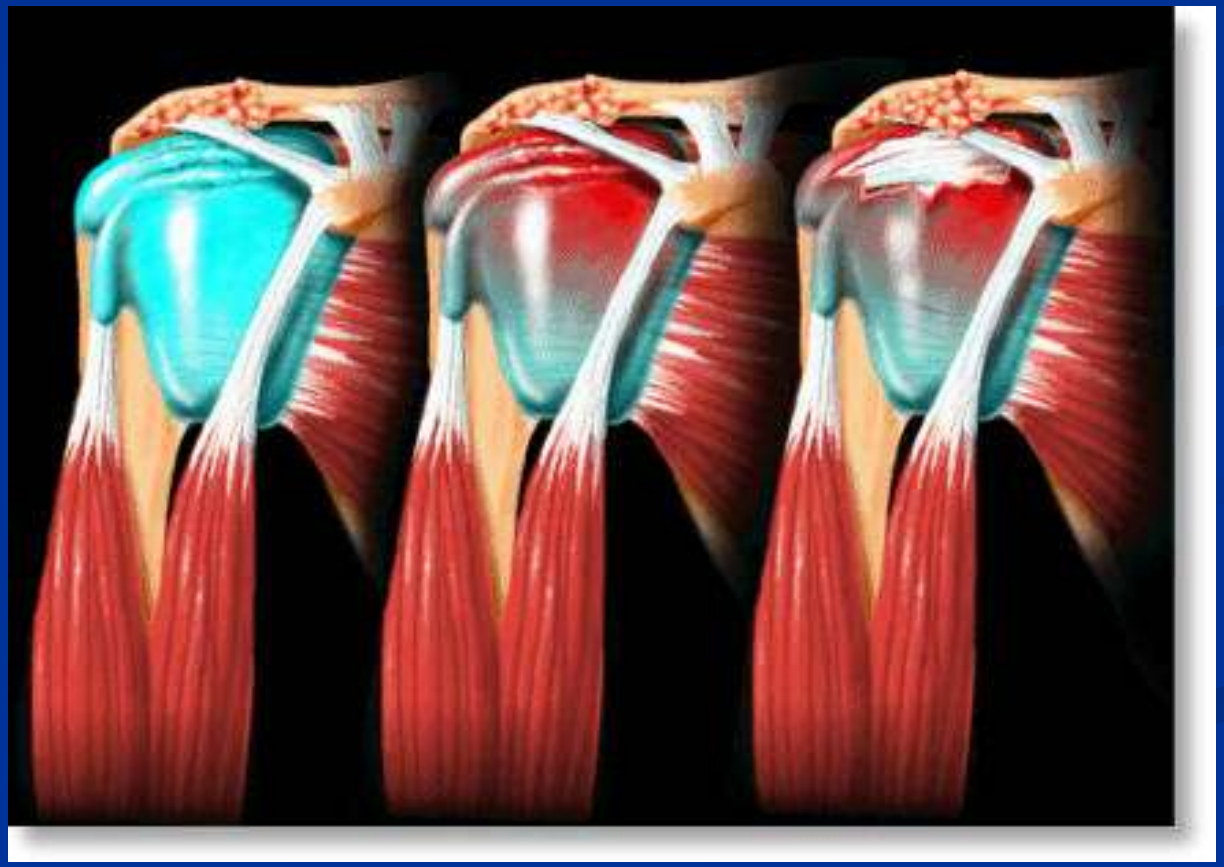
Subacromial Impingement

- Stage 2 disease shows progressive inflammatory changes of the rotator cuff tendons and the subacromial-subdeltoid bursa, and can be treated by removing the bursa and dividing the coracoacromial ligament after failed conservative management.



Subacromial Impingement

- Stage 3 disease manifests as partial or complete tears of the rotator cuff and secondary bony changes at the anterior acromion, the greater tuberosity or the acromioclavicular joint.



Subacromial Impingement

- abnormal acromial shape or position;
- subacromial enthesophytes;
- os acromiale;
- thickened coracoacromial ligament;
- acromioclavicular joint undersurface osteophytes.

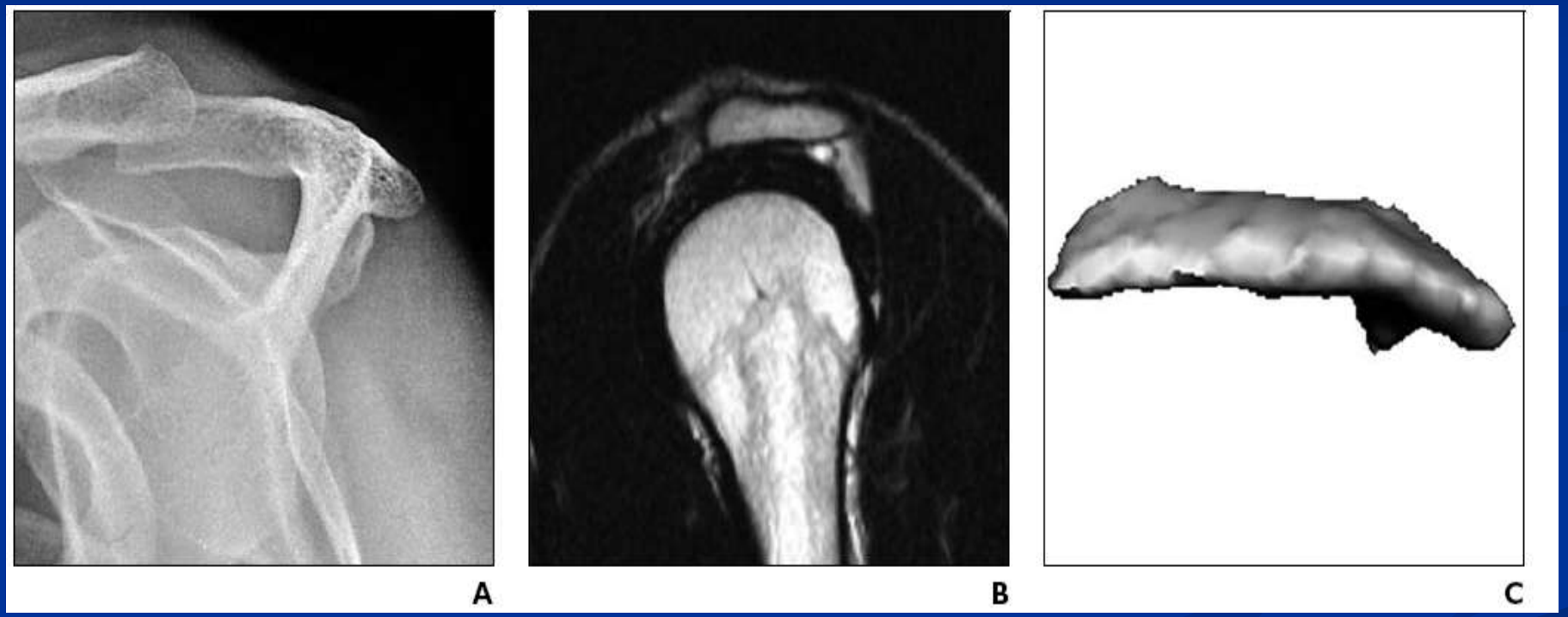
Subacromial Impingement

- Morrison and Bigliani described three types of acromion based on dried cadaver specimens and conventional outlet view radiographs.
- Type 1 acromion has a flat undersurface and is considered the physiologic shape.
- Type 2 acromion has a curved undersurface.
- Type 3 acromion has a hooked undersurface.

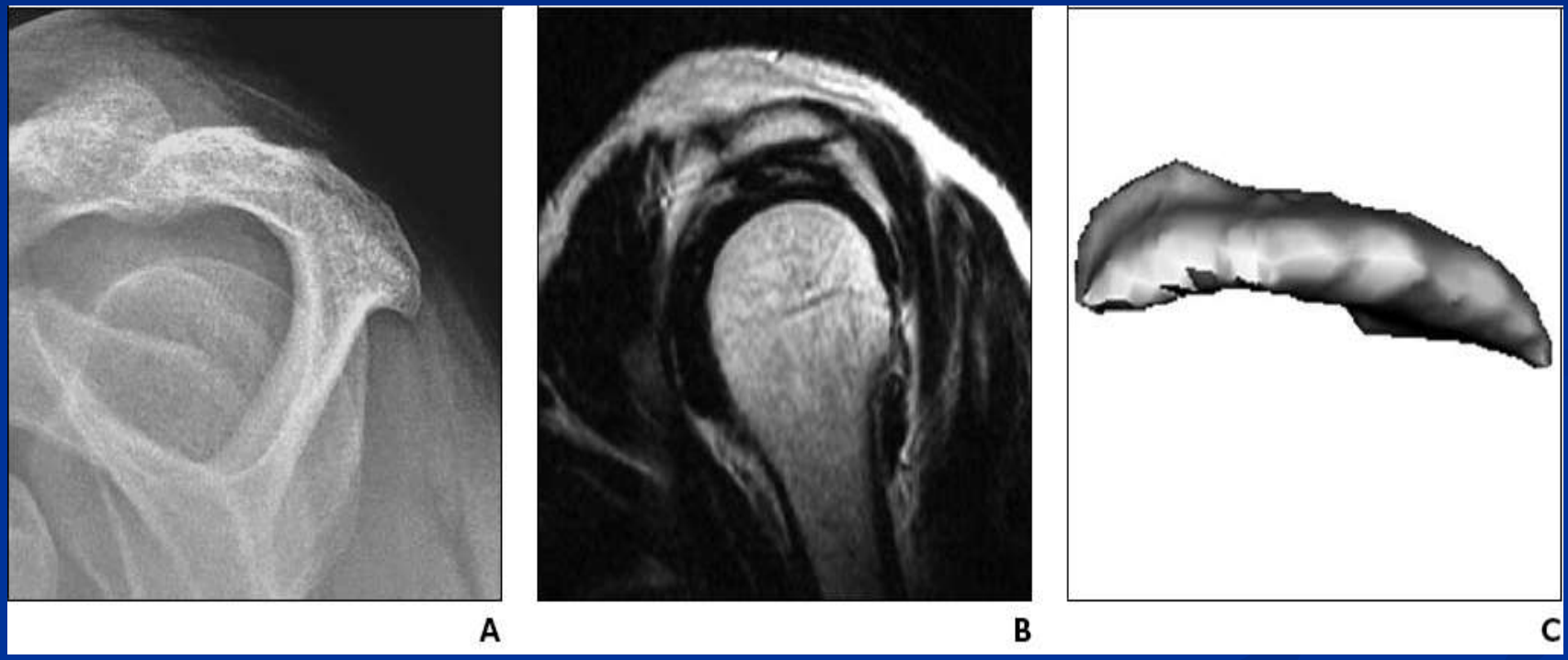
Subacromial Impingement

- Both type 2 and 3 acromion are considered abnormal variants that predispose individuals to impingement of supraspinatus beneath the acromion, and increase the likelihood of developing rotator cuff tear.

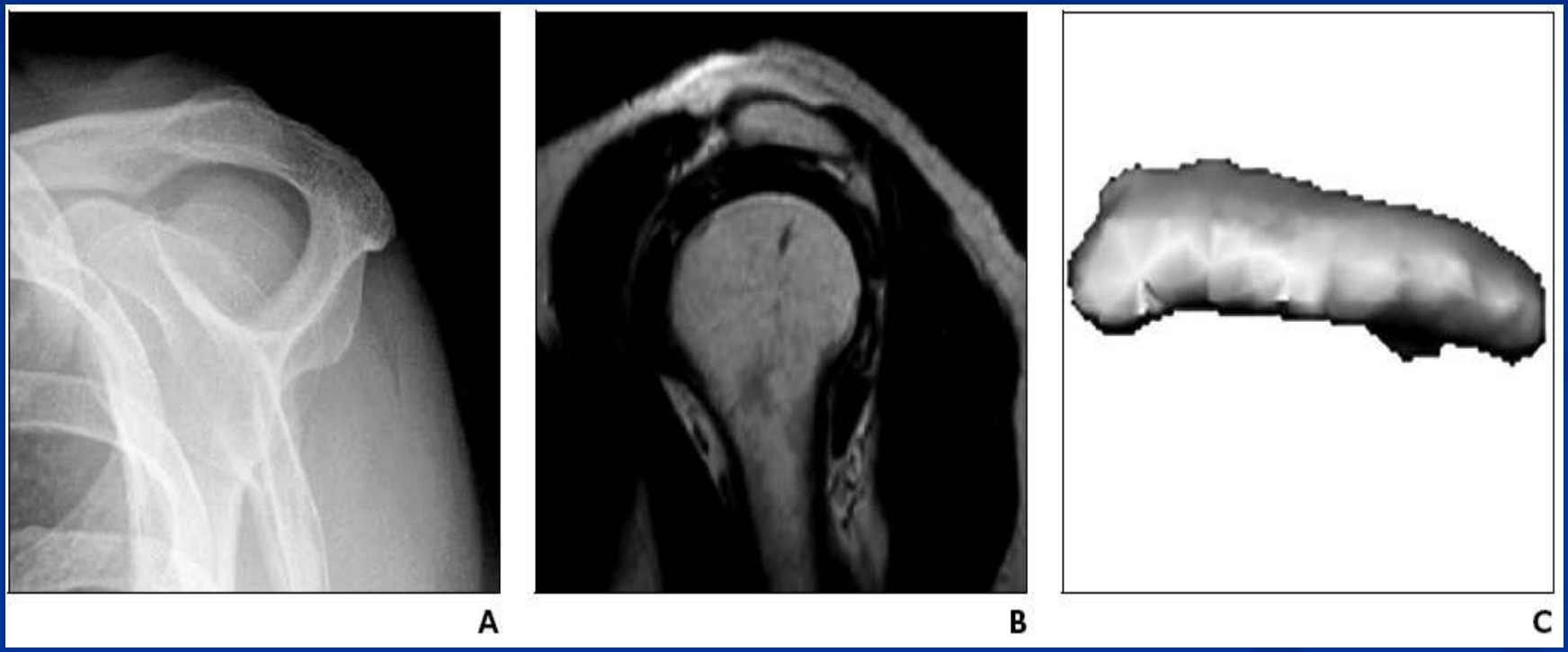
Type I



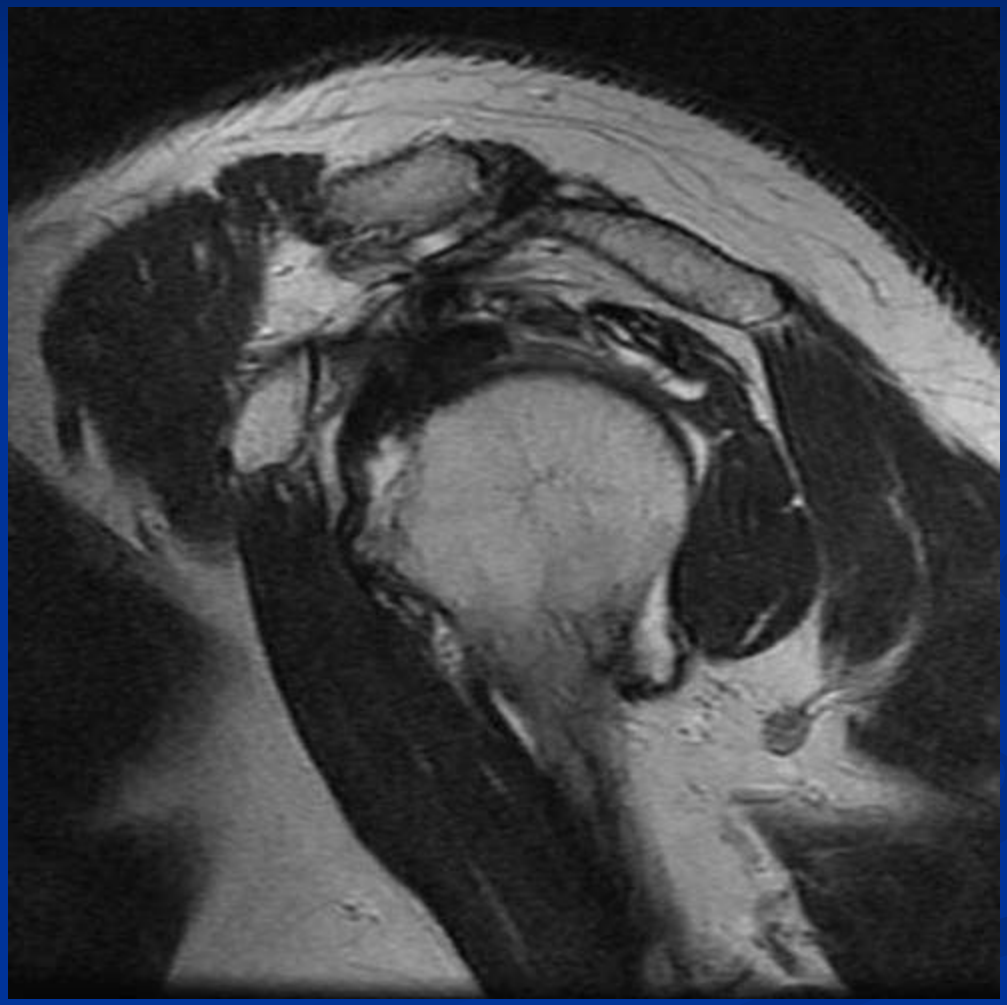
Type II



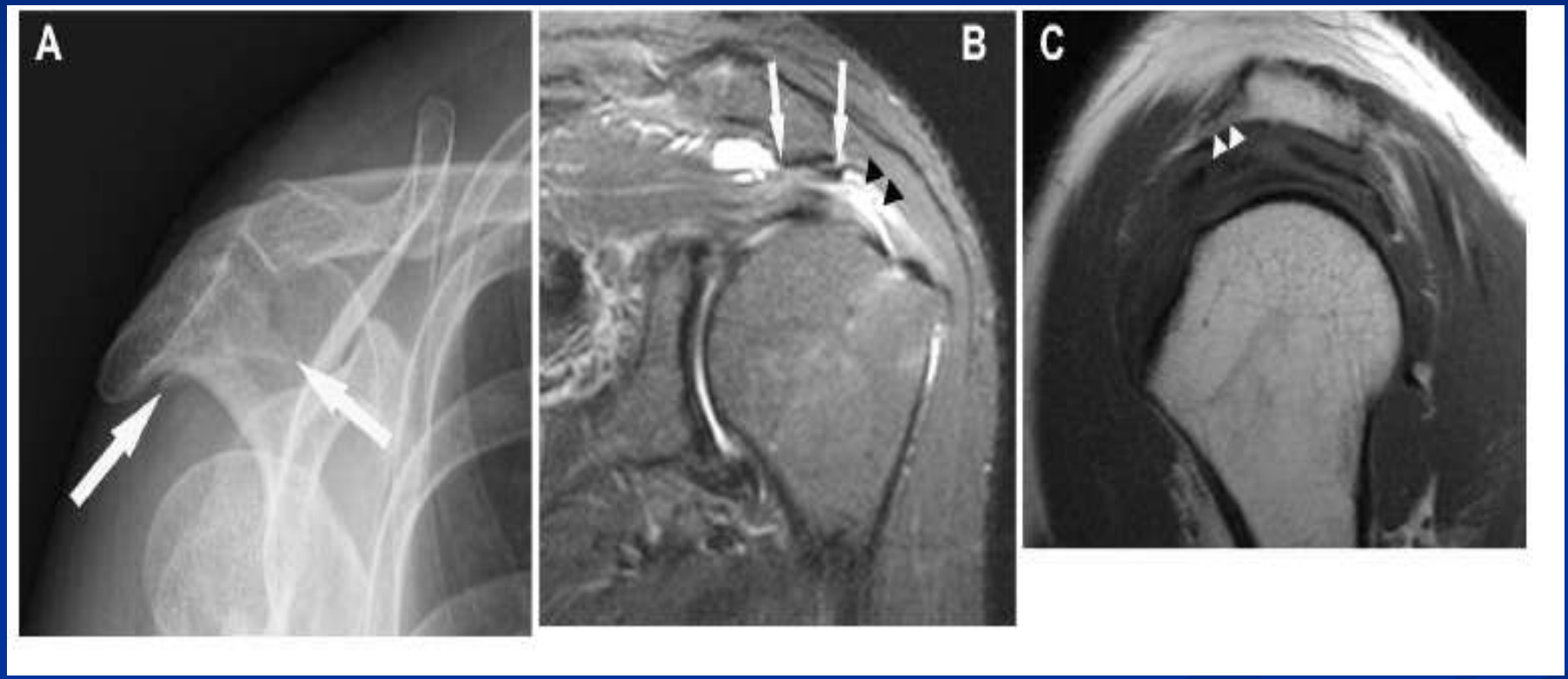
Type III



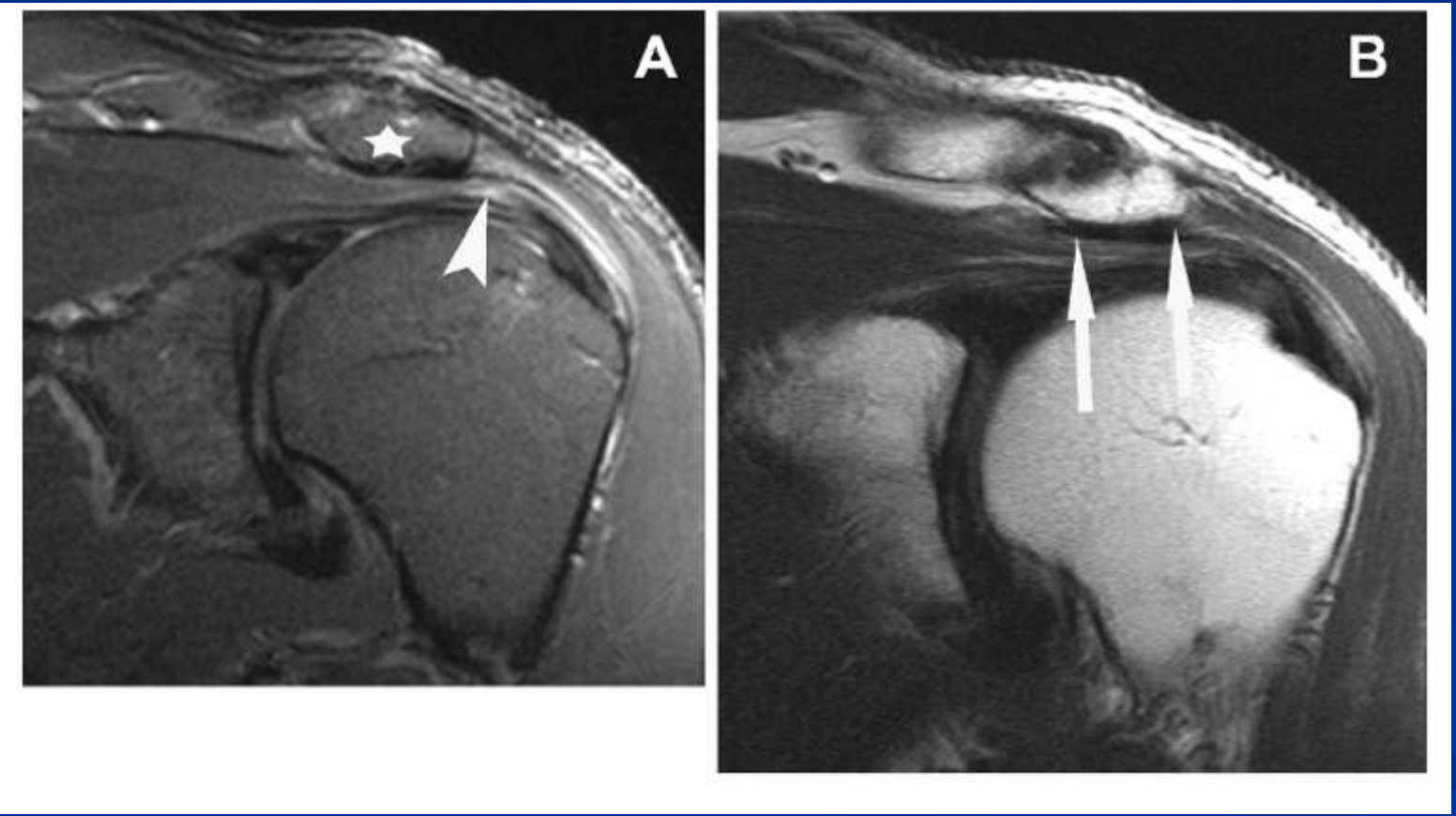
Type III Acromion



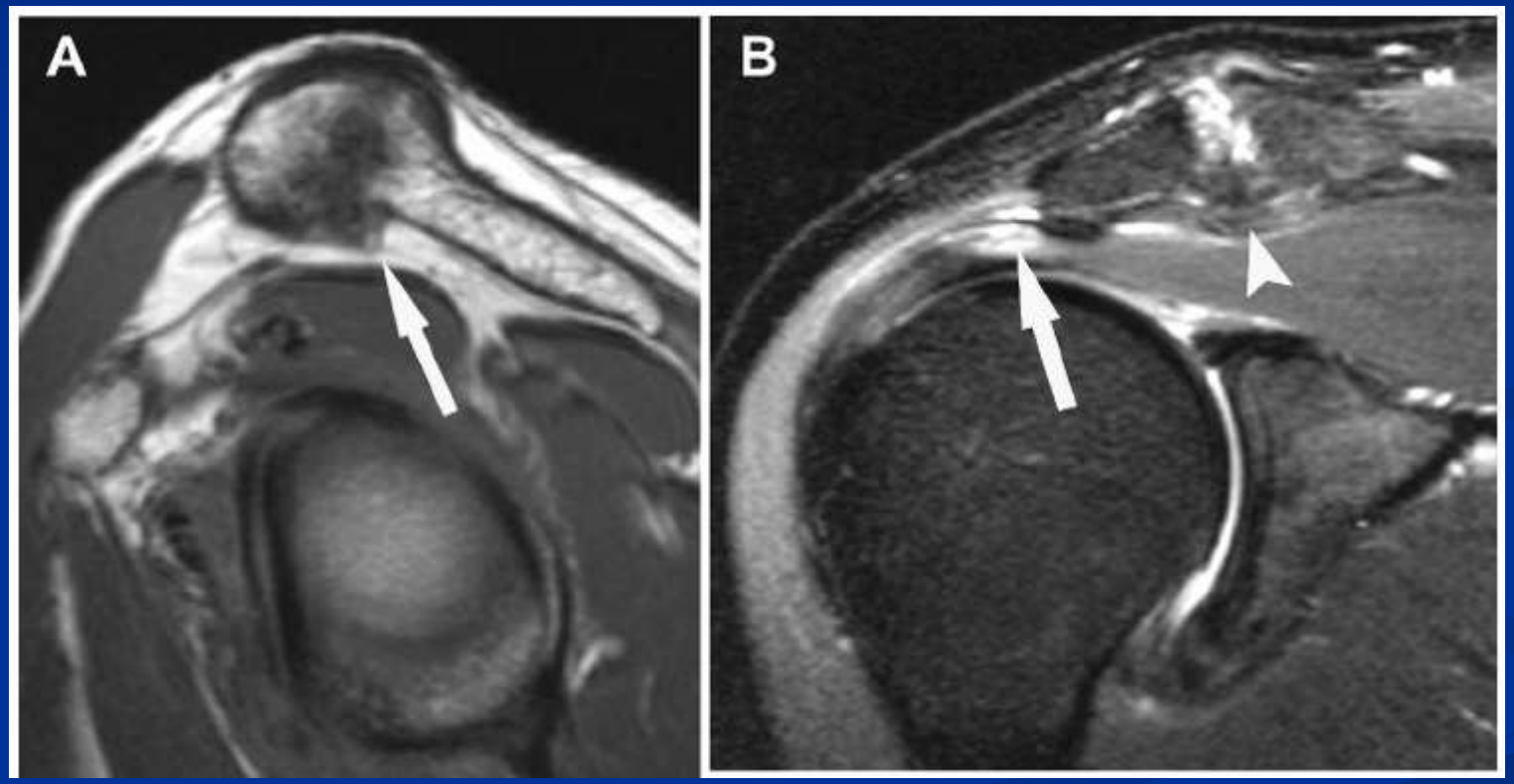
Subacromial Enthesophyte



Low lying acromion

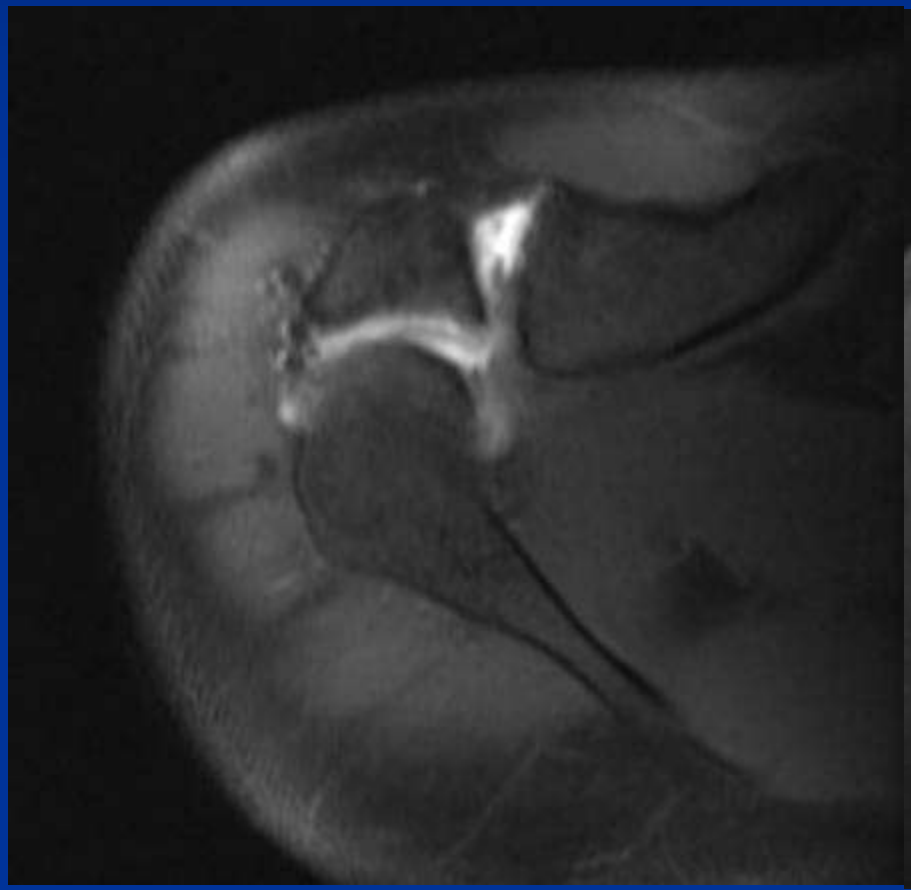


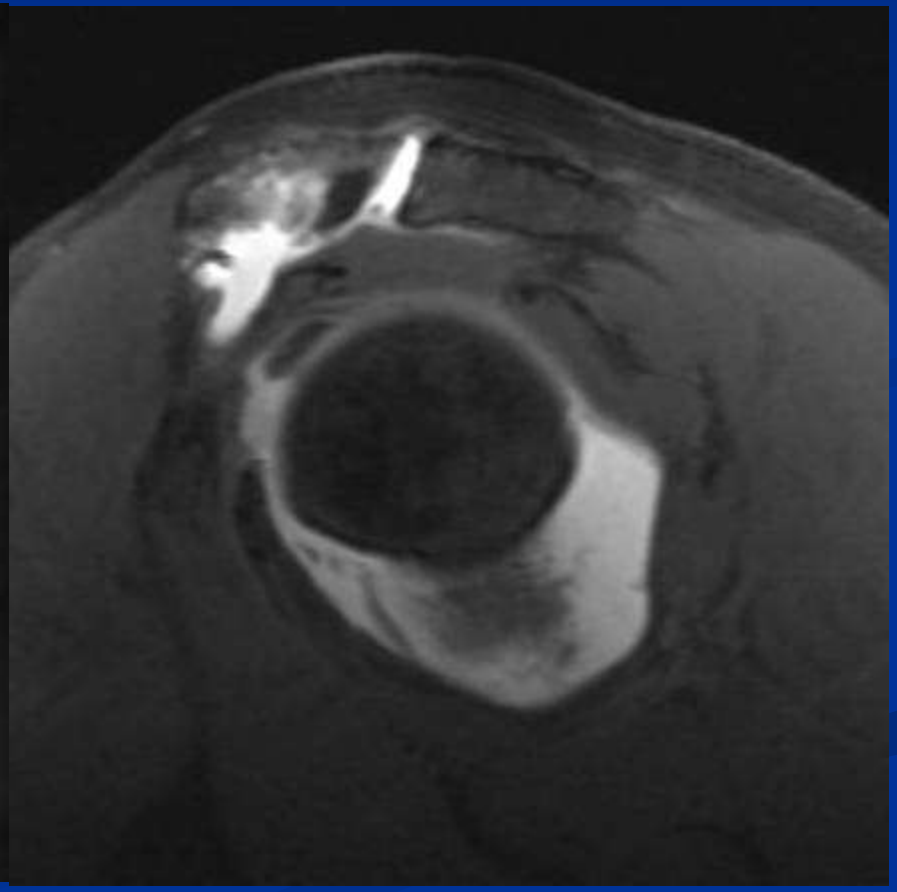
AC Joint Undersurface Osteophyte



Thickened Coracoacromial ligament

Os Acromiale





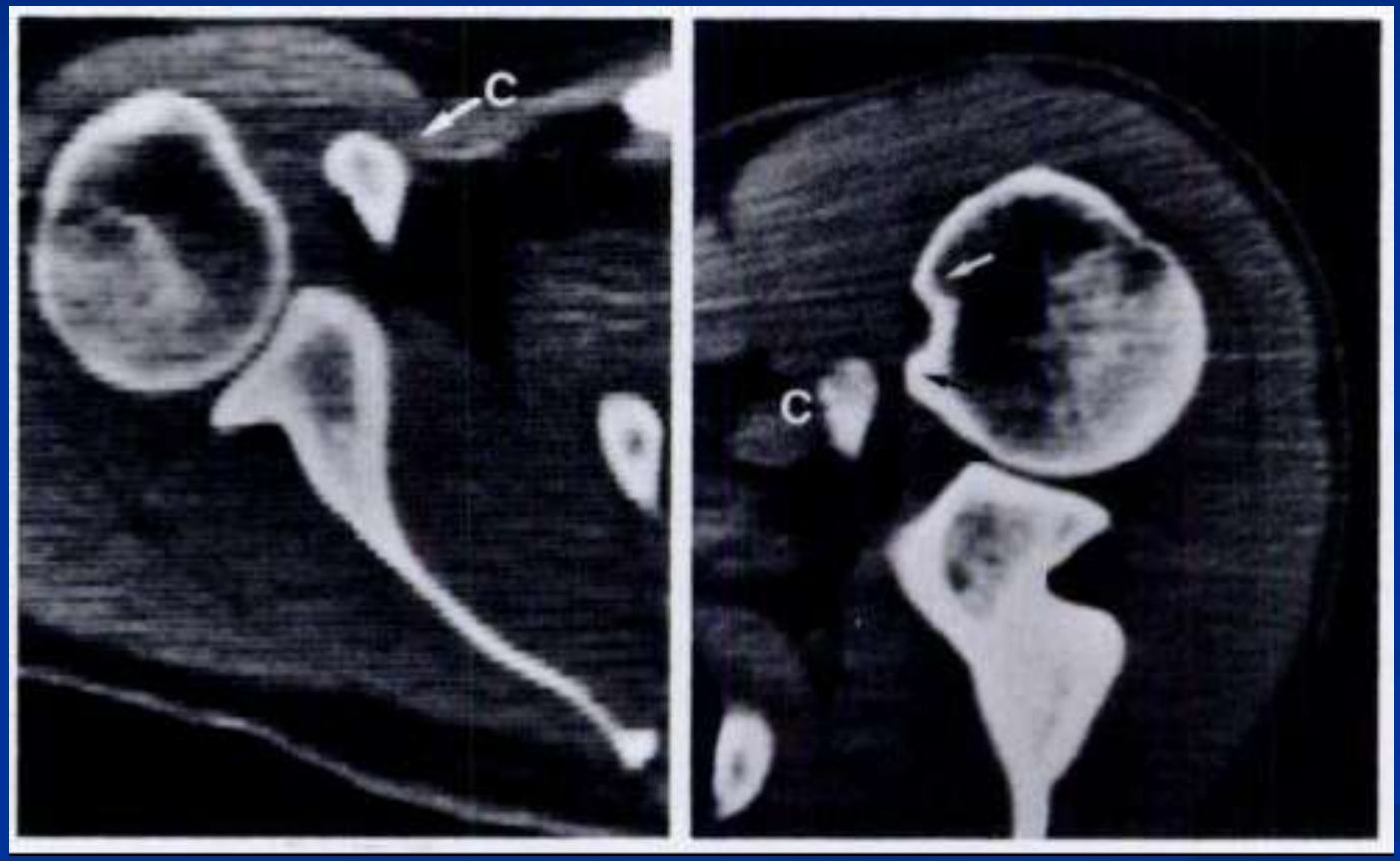
Subcoracoid Impingement

- The coracoid process may cause anterior impingement when the coracohumeral distance is decreased.
- This distance must be large enough to accommodate the articular cartilage of the humerus, the subscapularis tendon, the subscapularis bursa and the rotator interval tissue, and portions of the insertions of the coracoacromial ligament and the conjoint tendon.

Subcoracoid Impingement

- Gerber's study in normal subjects with conventional CT of the shoulder demonstrates average distance between medially rotated humeral head (the lesser tuberosity) and the coracoid tip is 8.6 mm. Forward flexion combined with medial rotation reduced the coracohumeral distance to an average of 6.7 mm (30). A coracohumeral space of less than 6 mm was considered diagnostic of subcoracoid stenosis.

Subcoracoid Impingement



Subcoracoid Impingement

- 1. Idiopathic – anatomic abnormality of the coracoid process such as longitudinally or laterally displaced coracoid process, or developmental enlargement of the coracoid process.
- 2. Iatrogenic – surgical procedures involving the coracoid process, such as bone block procedures for anterior instability of the shoulder, posterior glenoid neck osteotomies for posterior instability of the shoulder, and acromionectomies for rotator cuff tears.
- 3. Traumatic – fractures of the lesser tuberosity or the coracoid process, and subsequent malunion that leads to decreased subcoracoid space.
- 4. space-occupying lesions in the subcoracoid space such as ganglions, calcifications, and amyloid deposits.

Subcoracoid Impingement

- Most patients complain of pain and tenderness in the anterior aspect of the shoulder, which is exacerbated by various degrees of flexion, adduction, and rotation.
- The pain is thought to be caused by impingement of the subscapularis tendon between the lesser tuberosity and coracoid process.

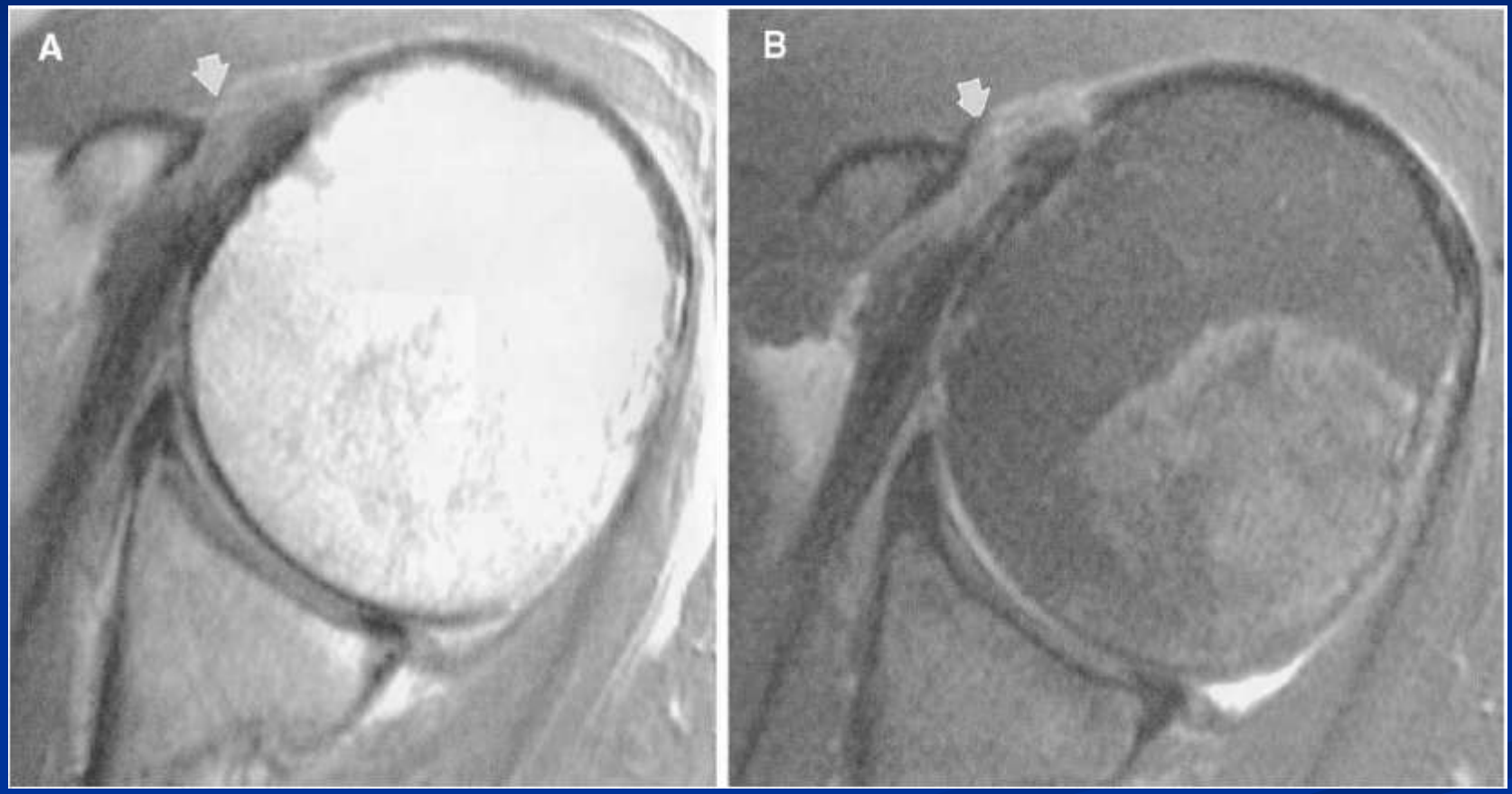
Modified Kennedy-Hawkins Sign

Test performed with the arm flexed 90°, adducted 10°, and internally rotated

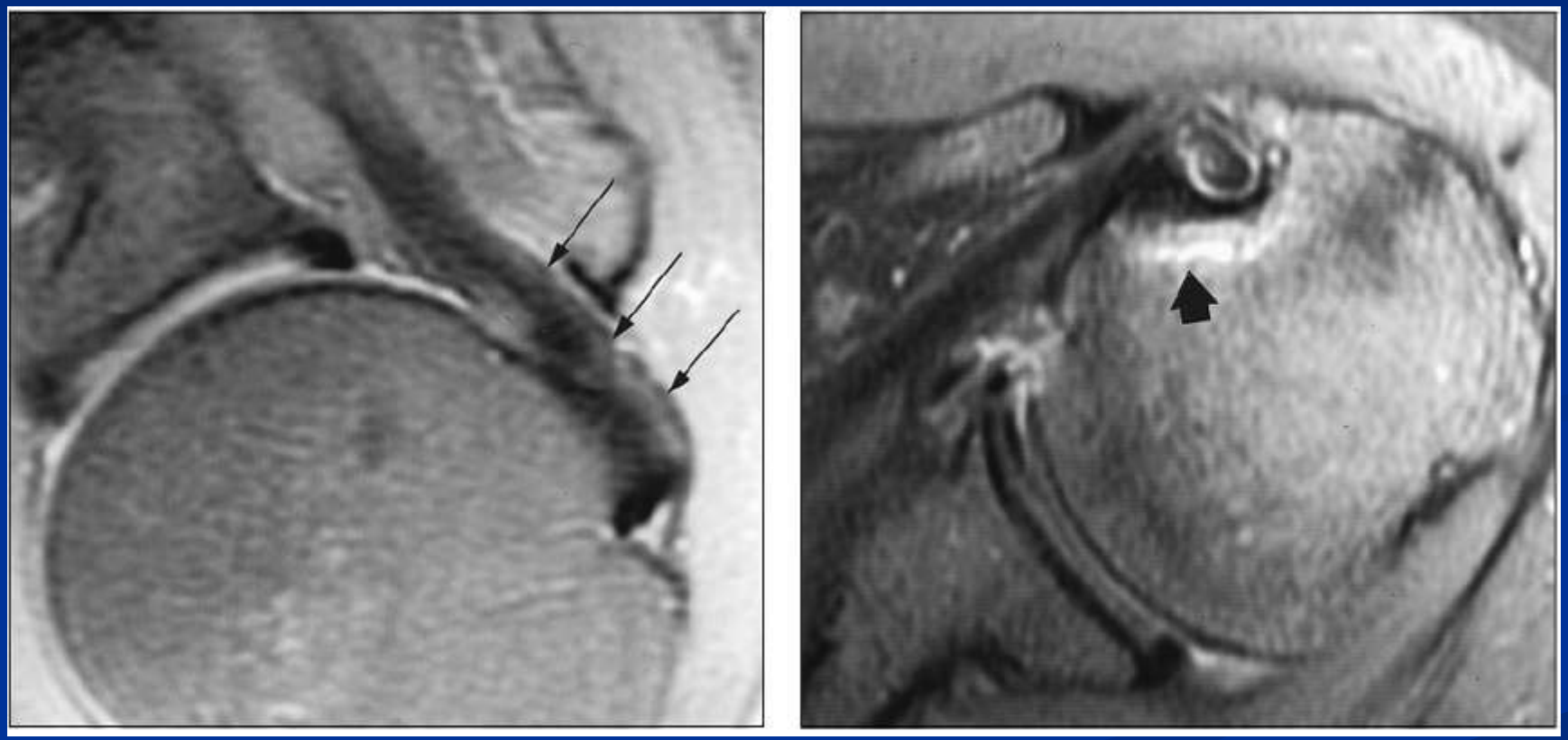
Subcoracoid Impingement

- MR axial and oblique sagittal images are used to evaluate the coracohumeral space and subcoracoid impingement.
- Subscapularis tendon partial or full thickness tear and biceps tendon instability has been reported in patients with clinical diagnosis of subcoracoid impingement.

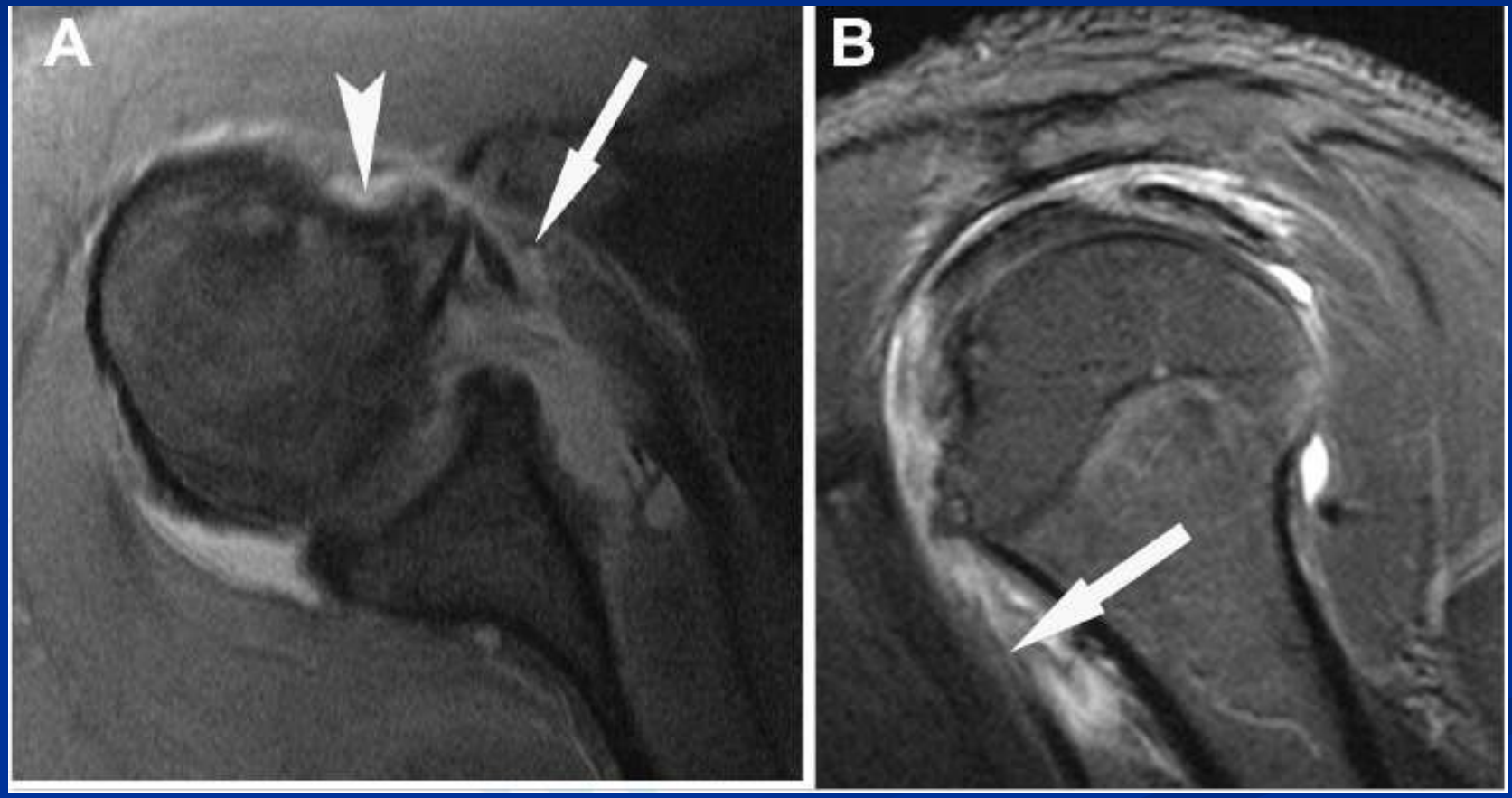
Subcoracoid Impingement



Subcoracoid Impingement



Subcoracoid Impingement



Secondary Extrinsic Impingment

- In patients with symptoms of secondary extrinsic impingement, the coracoacromial outlet is usually normal.
- Overhead-throwing athletes can develop glenohumeral joint instability secondary to fatigue and overloading of the rotator cuff muscles caused by chronic microtrauma and weakening of the anterior capsule.
- This instability will cause abnormal superior translation of the humeral head and lead to dynamic narrowing of the coracoacromial outlet.
- Instability can also occur in the scapulothoracic joint, and cause abnormal scapular motion and result in dynaminc narrowing of the coracoacromial outlet.

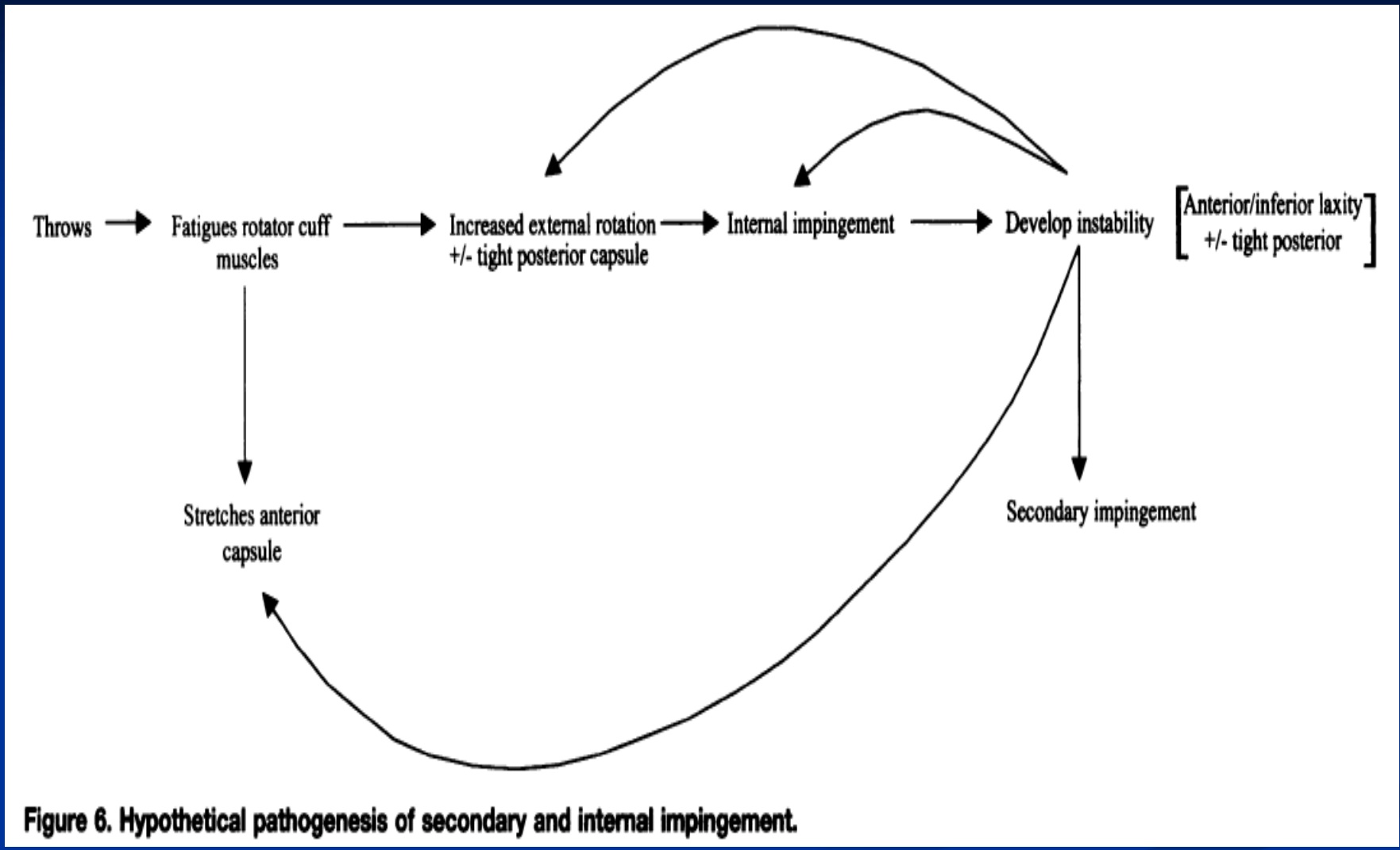


Figure 6. Hypothetical pathogenesis of secondary and internal impingement.

Secondary Extrinsic Impingment

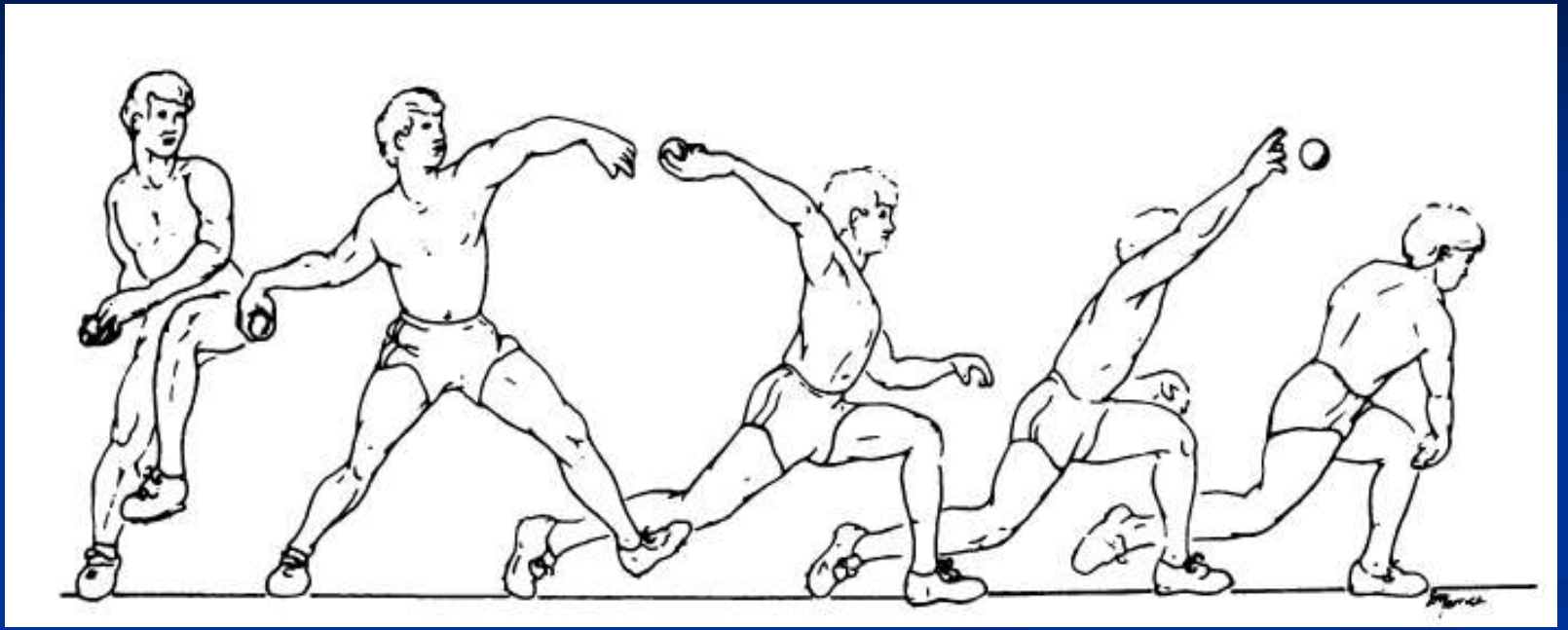
- MR images will show undersurface degeneration and partial tears of the rotator cuff tendons. Labral abnormality is also described in patients with secondary extrinsic impingement.

Posterosuperior glenoid impingement

- Posterosuperior glenoid impingement syndrome was first described by Walch et al in athletes who participate in recurrent overhead activities, such as throwing, tennis playing, and swimming.

Posterosuperior glenoid impingement

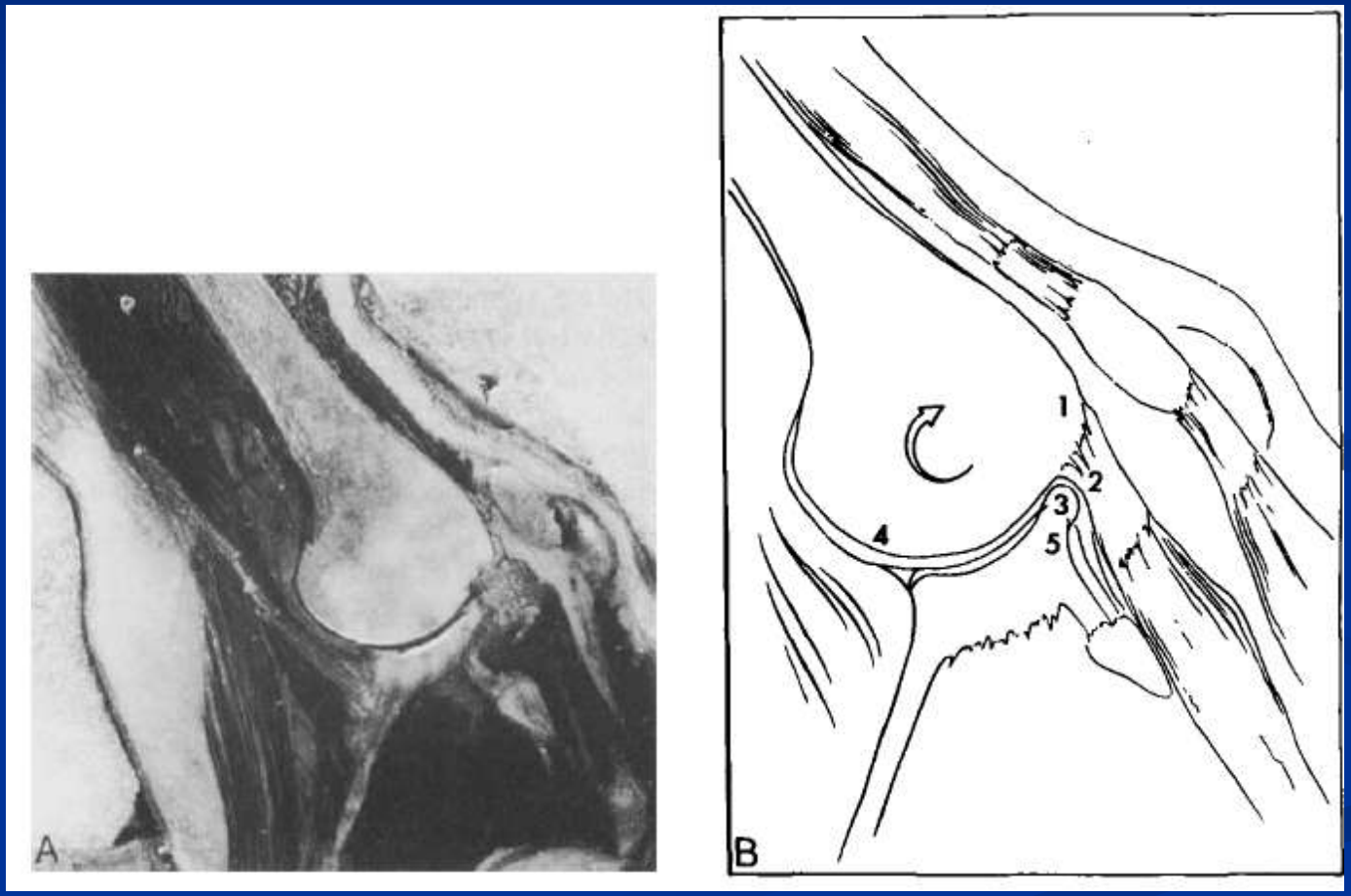
- During the late cocking phase of throwing motion, the arm is maximally abducted and maximally externally rotated.
- This extreme ABER position will cause contact between the undersurface fibers on the supraspinatus and infraspinatus and posterosuperior glenoid rim.



5 Phases of Pitching:

wind-up, early cocking, late cocking, acceleration, and follow-through.

Posterosuperior glenoid impingement



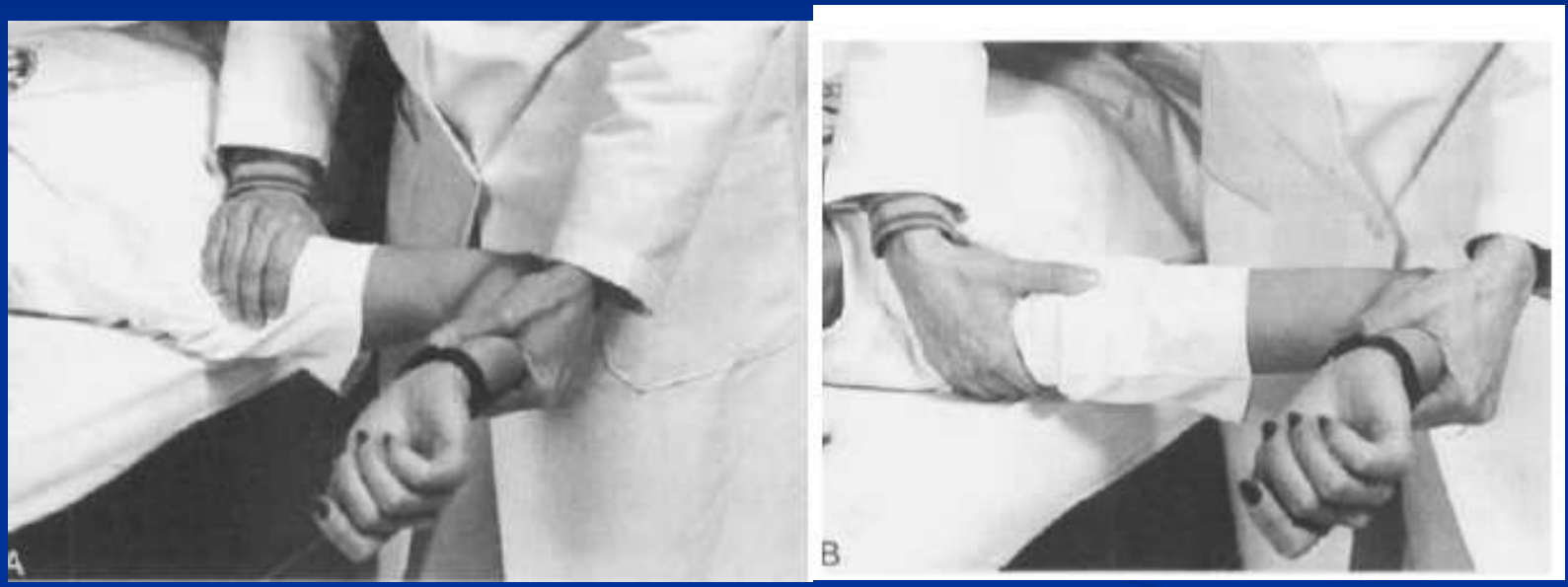
Posterosuperior glenoid impingement

- This contact is commonly seen in asymptomatic individuals and non-throwers during ABER;
- Repetitive impaction of these structures in competitive athletes can lead to degeneration and tearing of the articular surface fibers at the infraspinatus and supraspinatus tendon junction with associated degeneration and tearing of the posterosuperior glenoid labrum.

Posterosuperior glenoid impingement

- The diagnosis of internal impingement can be made on physical examination when abduction and external rotation of the shoulder elicits posterosuperior glenohumeral joint pain.
- Relocation test of Jobe can be done to further confirm this diagnosis, when a posteriorly directed force to the humeral head while shoulder in ABER position relieves the pain.

Posterosuperior glenoid impingement



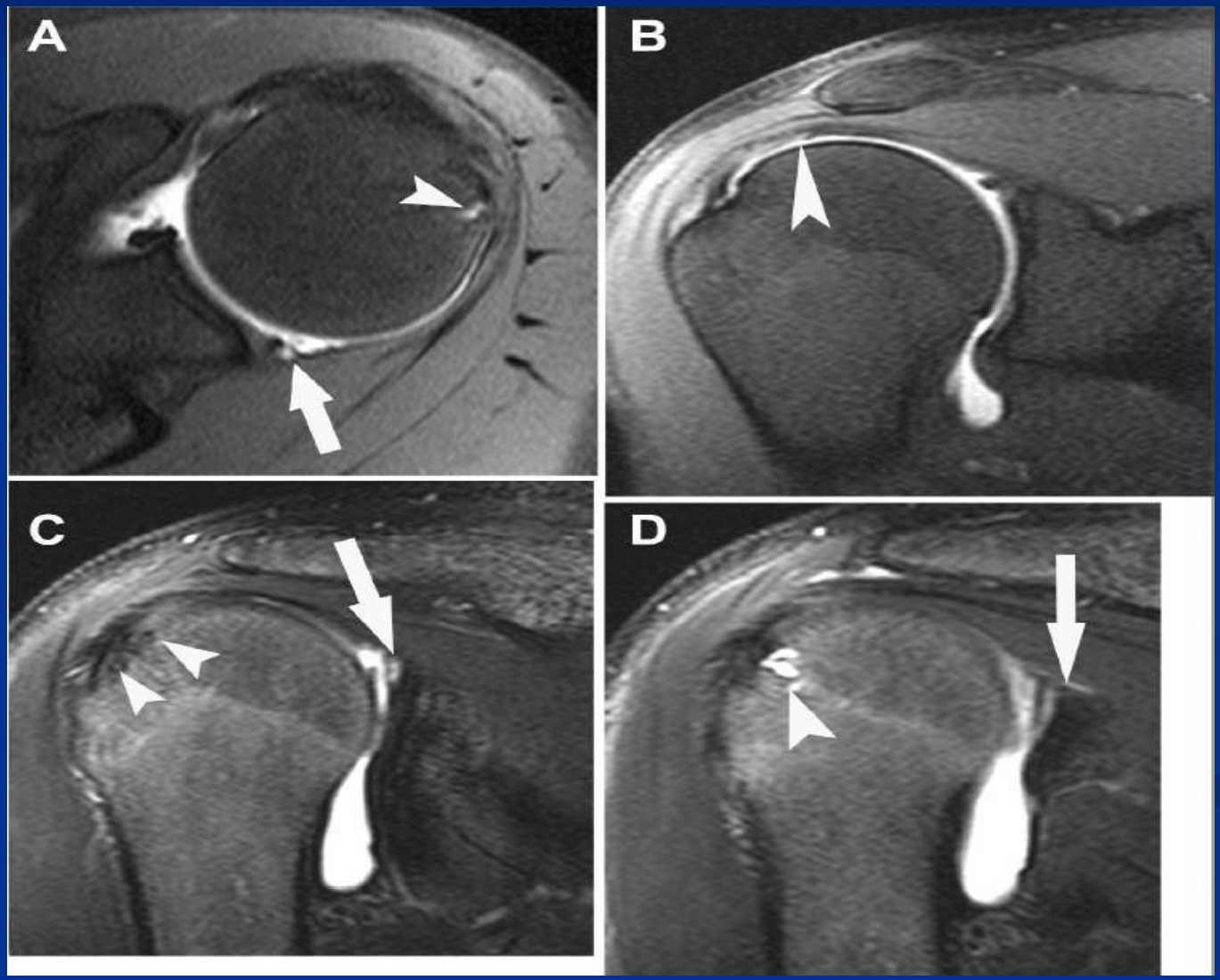
Posterosuperior glenoid impingement

- MR image findings include partial-thickness undersurface tearing of the posterior fibers of the supraspinatus and anterior fibers of the infraspinatus tendons;
- Fraying and tearing of the posterosuperior glenoid labrum;
- Paralabral cyst formation;
- Cystic changes in the greater tuberosity of the humeral head

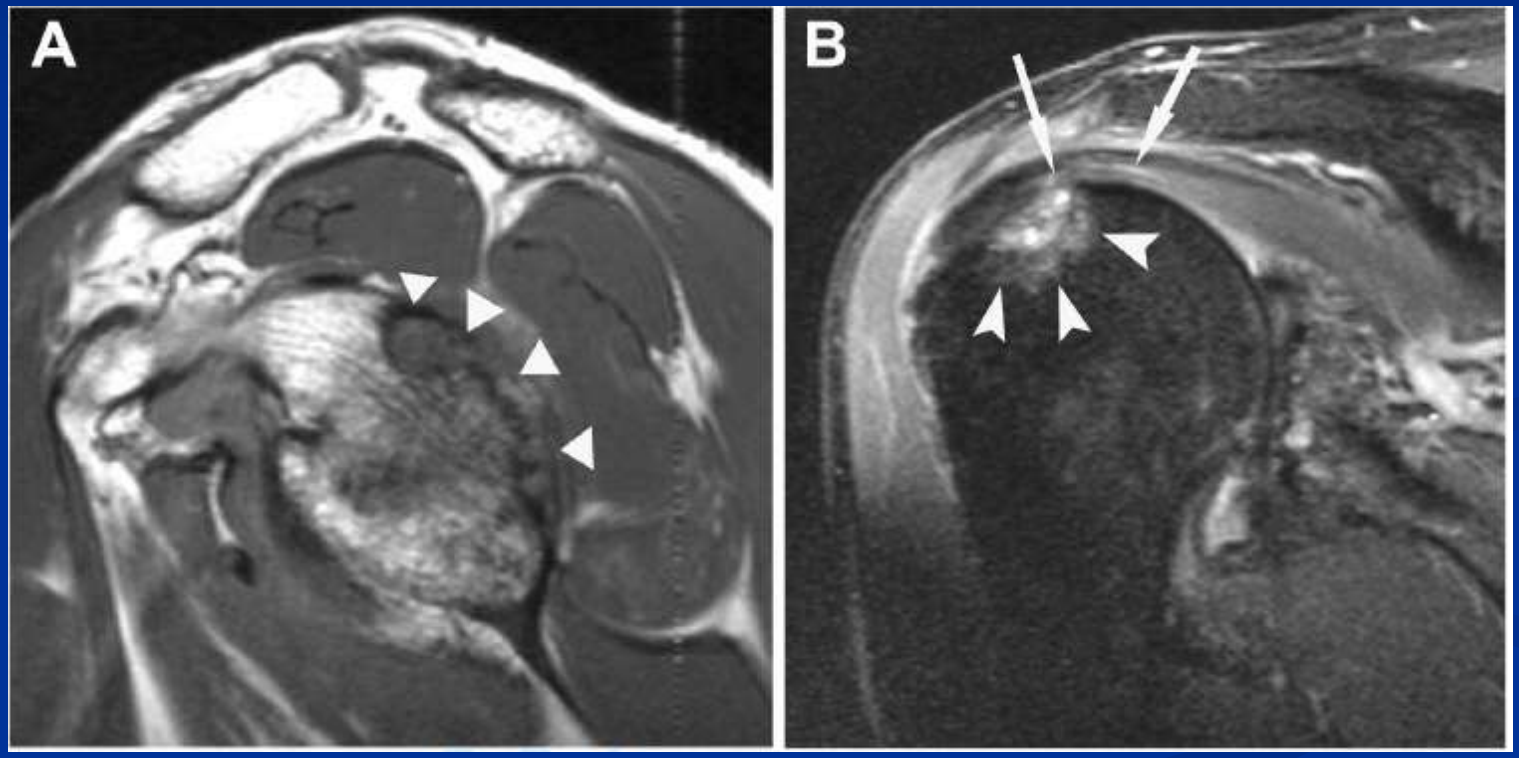
Posterosuperior glenoid impingement

- Some of these findings may simply represent normal adaptive changes from the repetitive motion, however they are considered pathologic in symptomatic patients.
- MR imaging can also demonstrate the contact between the rotator cuff tendons, the greater tuberosity, and the posterosuperior glenoid labrum when arm is placed in ABER position.

Posterosuperior glenoid impingement



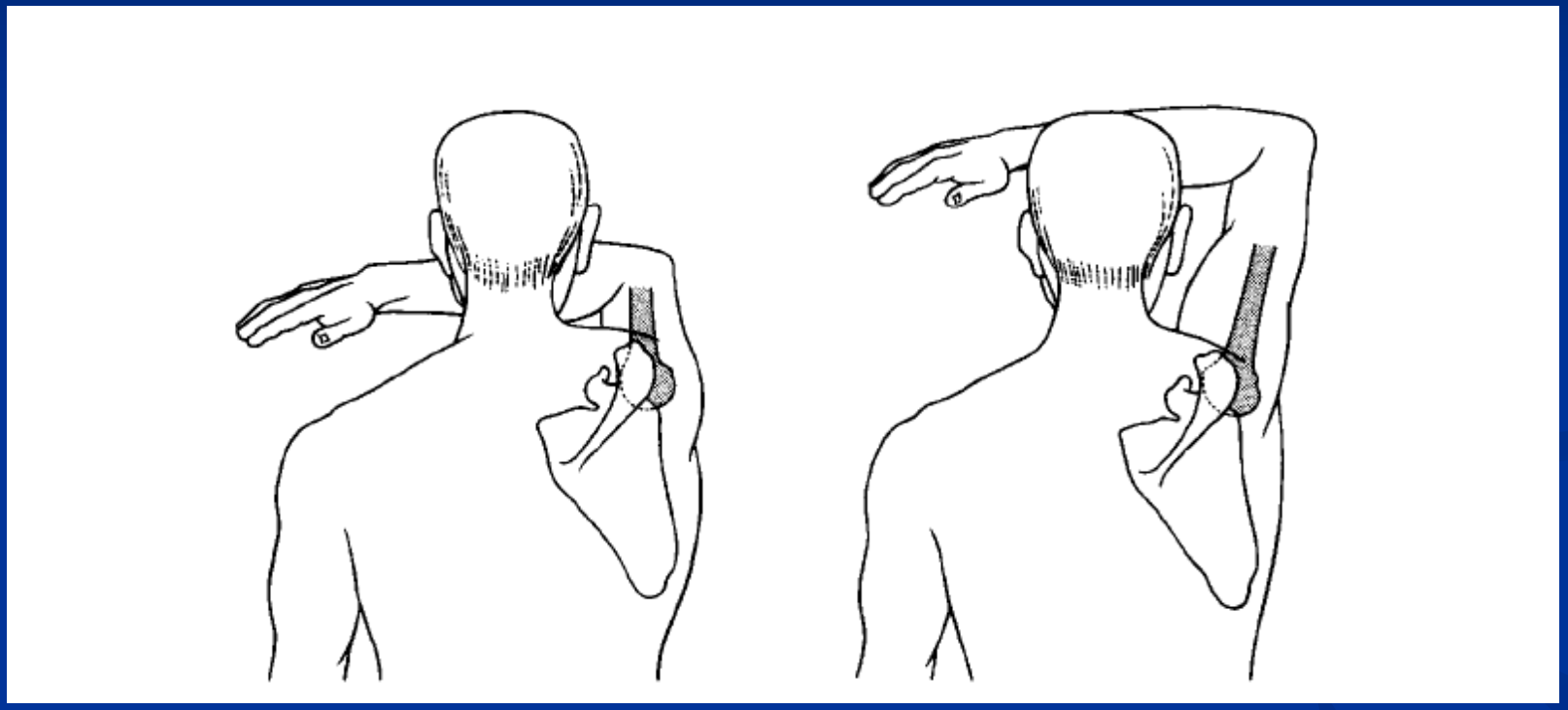
Posterosuperior glenoid impingement



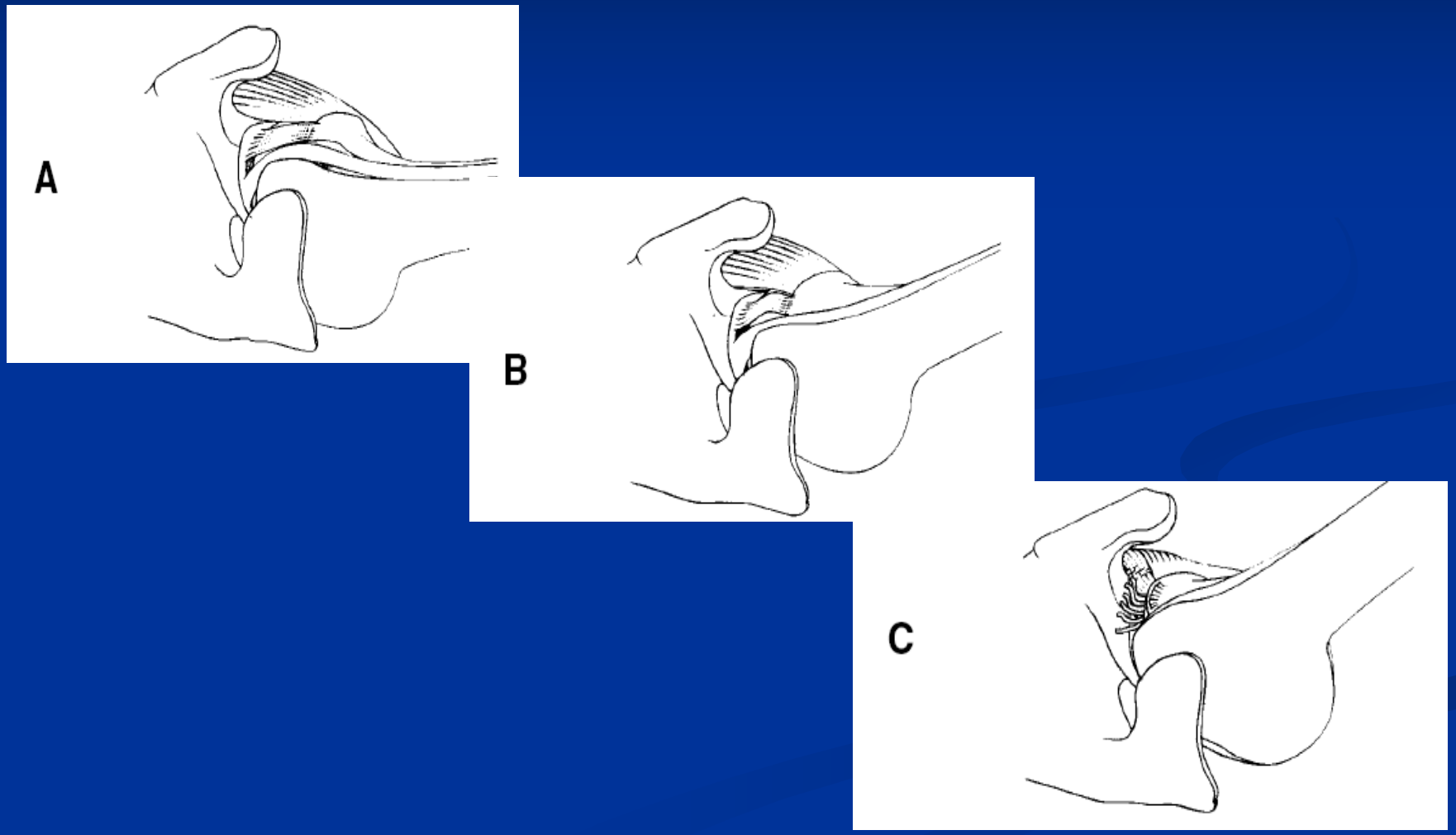
Anterosuperior glenoid impingement

- Impingement of the undersurface of the reflective pulley system and of the subscapularis tendon against the anterosuperior glenoid rim, when the arm is anteriorly elevated, horizontally adducted, and internally rotated.

Anterosuperior glenoid impingement

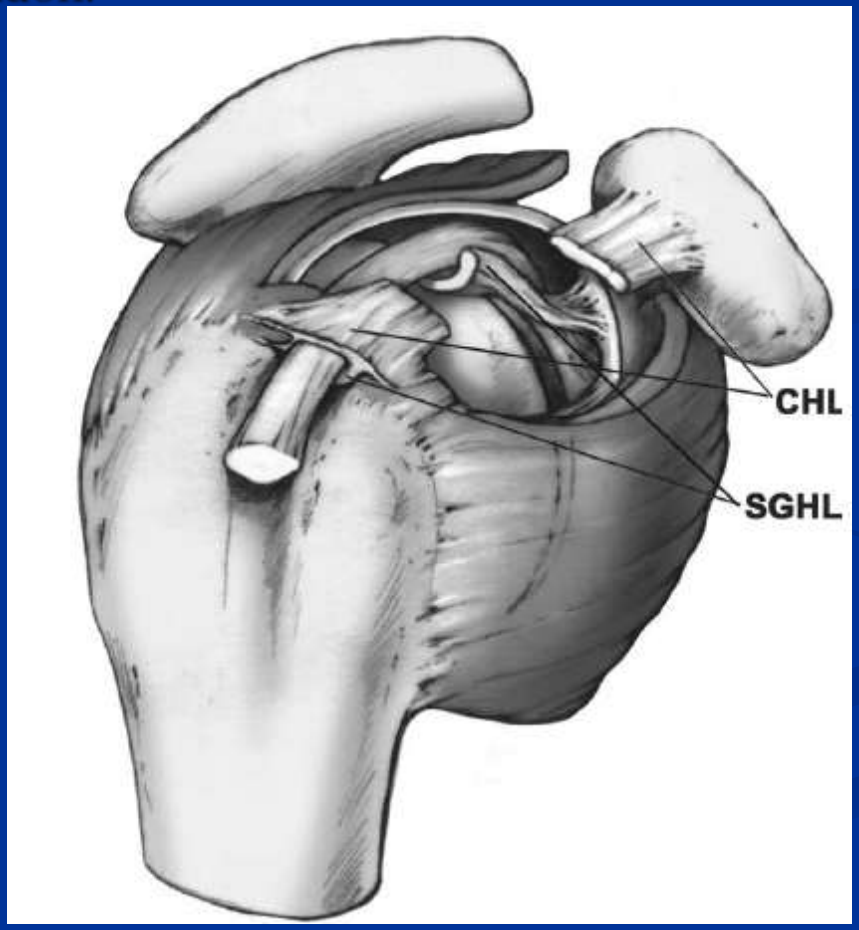


Anterosuperior glenoid impingement



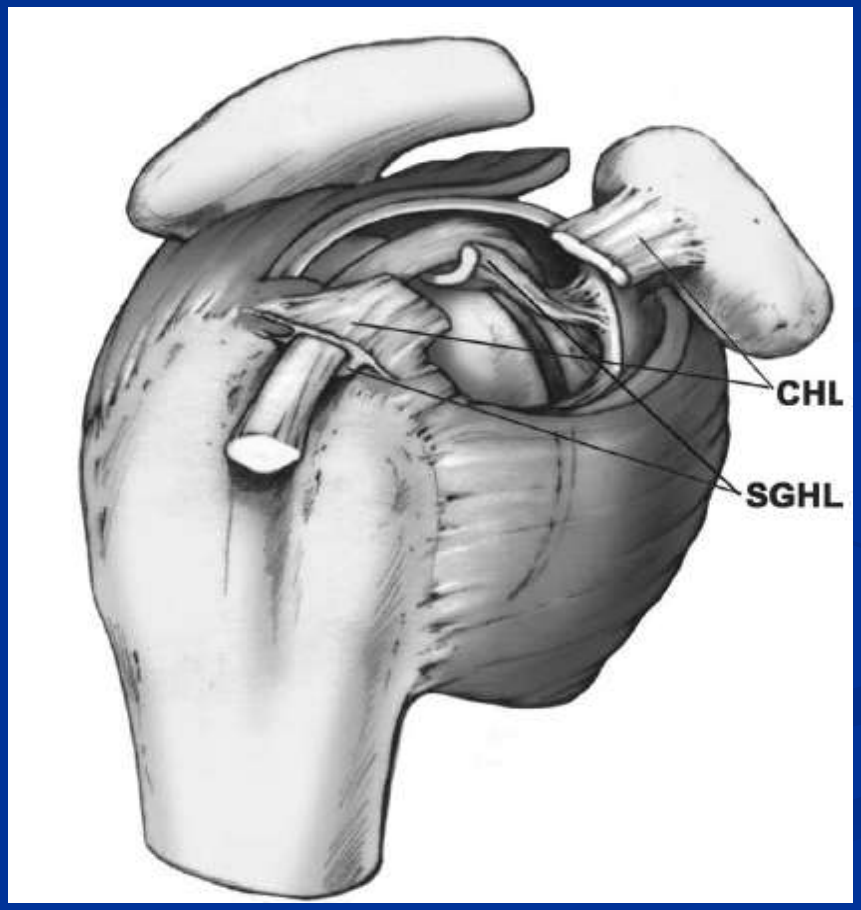
Anterosuperior glenoid impingement

- The shoulder pulley system is composed of coracohumeral ligament (CHL), the superior glenohumeral ligament, and fibers of the spupraspinatus and subscapularis tendon.



Anterosuperior glenoid impingement

- This system represents an important part of the rotator interval. It is suggested that the function of the pulley system is to protect the long head of the biceps tendon against anterior shearing stress, and stabilize this tendon in its intraarticular position.

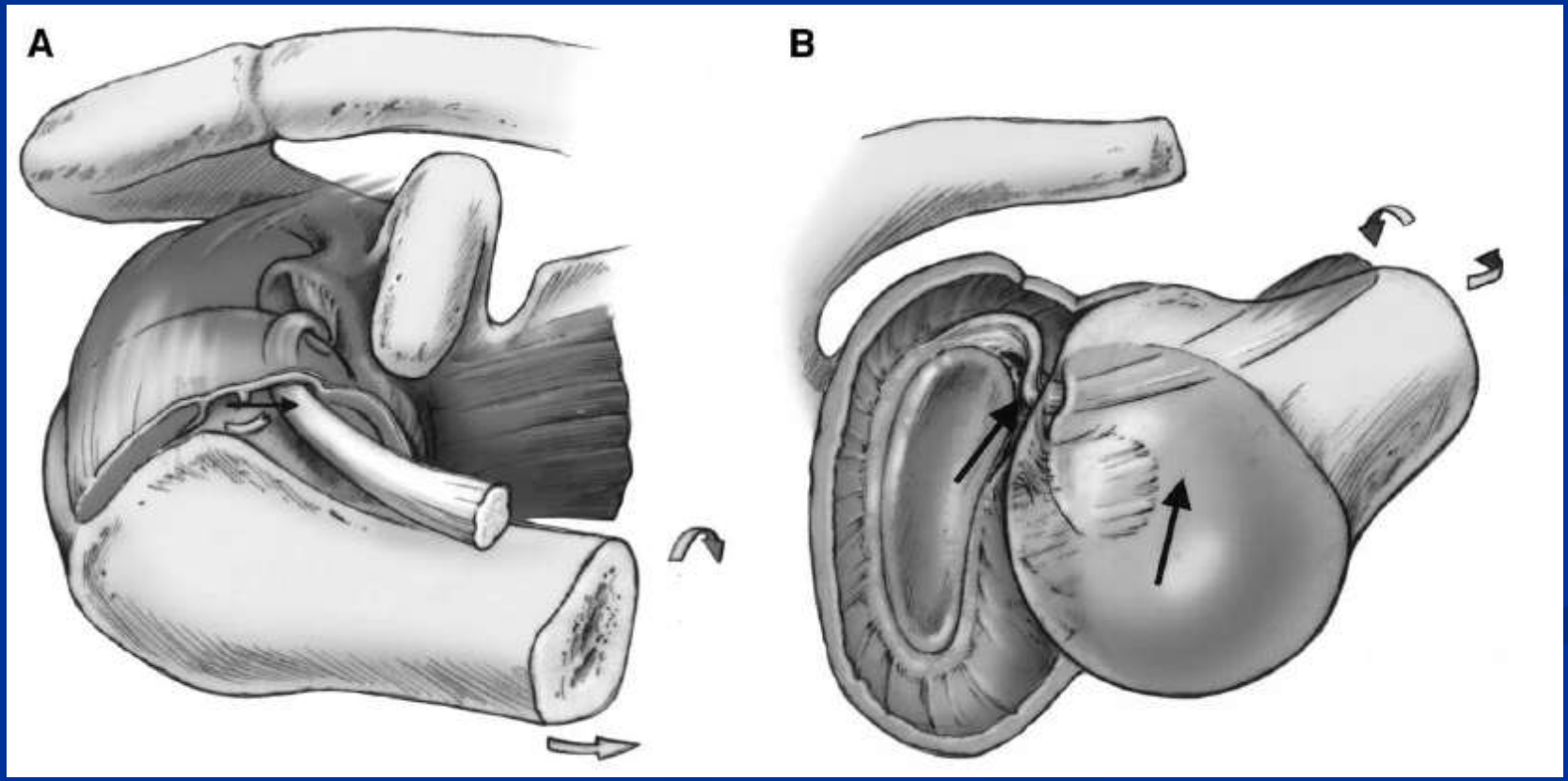


Anterosuperior glenoid impingement

- Gerber and Sebesta proposed that in patients with anterosuperior impingement syndrome, repetitive and forceful anterior elevation, horizontal adduction and internal rotation of the arm will cause impingement of the reflective pulley between the articular surface of the subscpularis tendon and the anterosuperior glenoid rim, and leads to frictional damages in these structures.

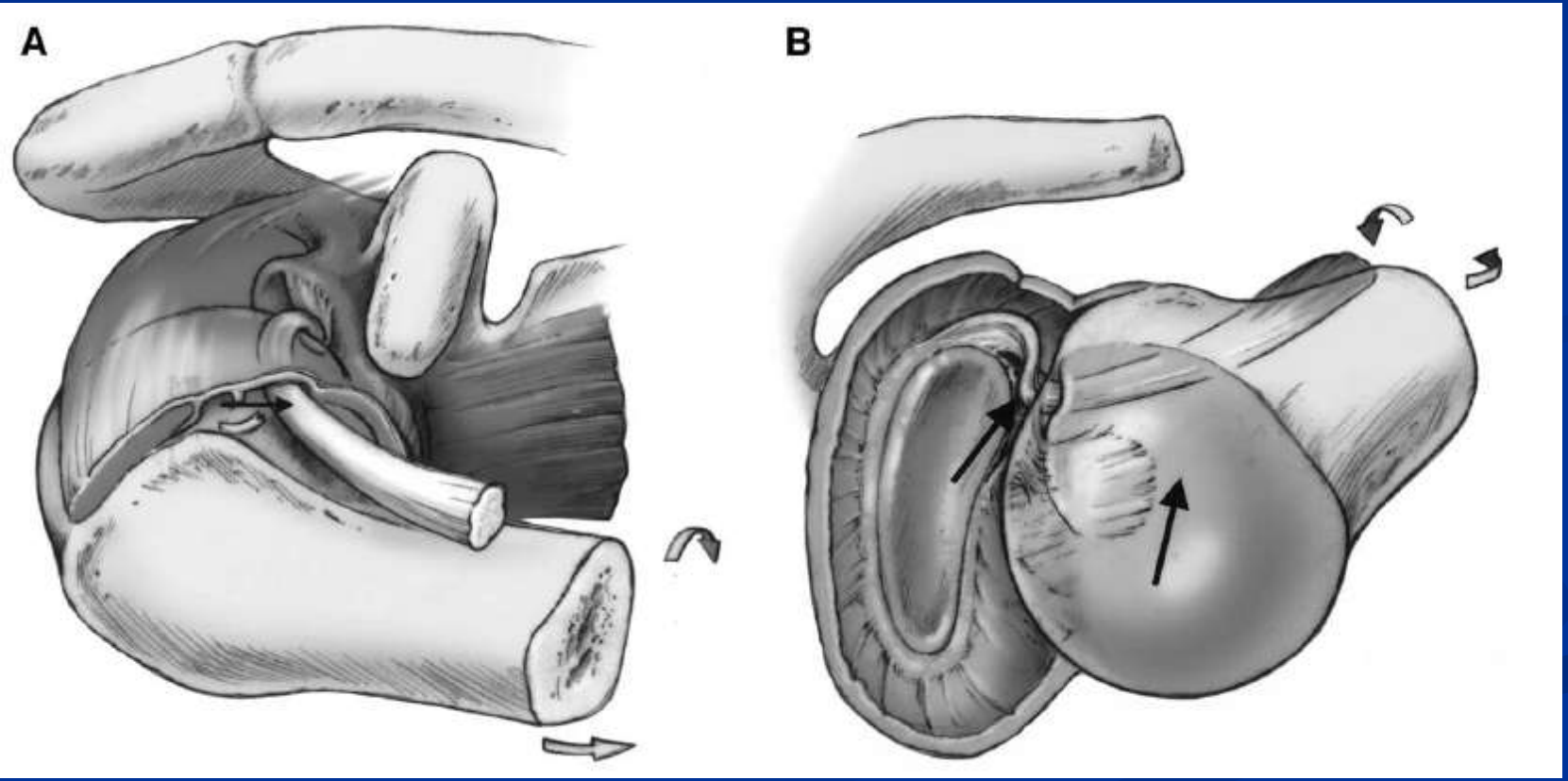
Anterosuperior glenoid impingement

- A torn reflective pulley, either secondary to trauma or degenerative process, can cause instability of the long head of the biceps (LHB) in its intraarticular course, results in medial subluxation of LHB.



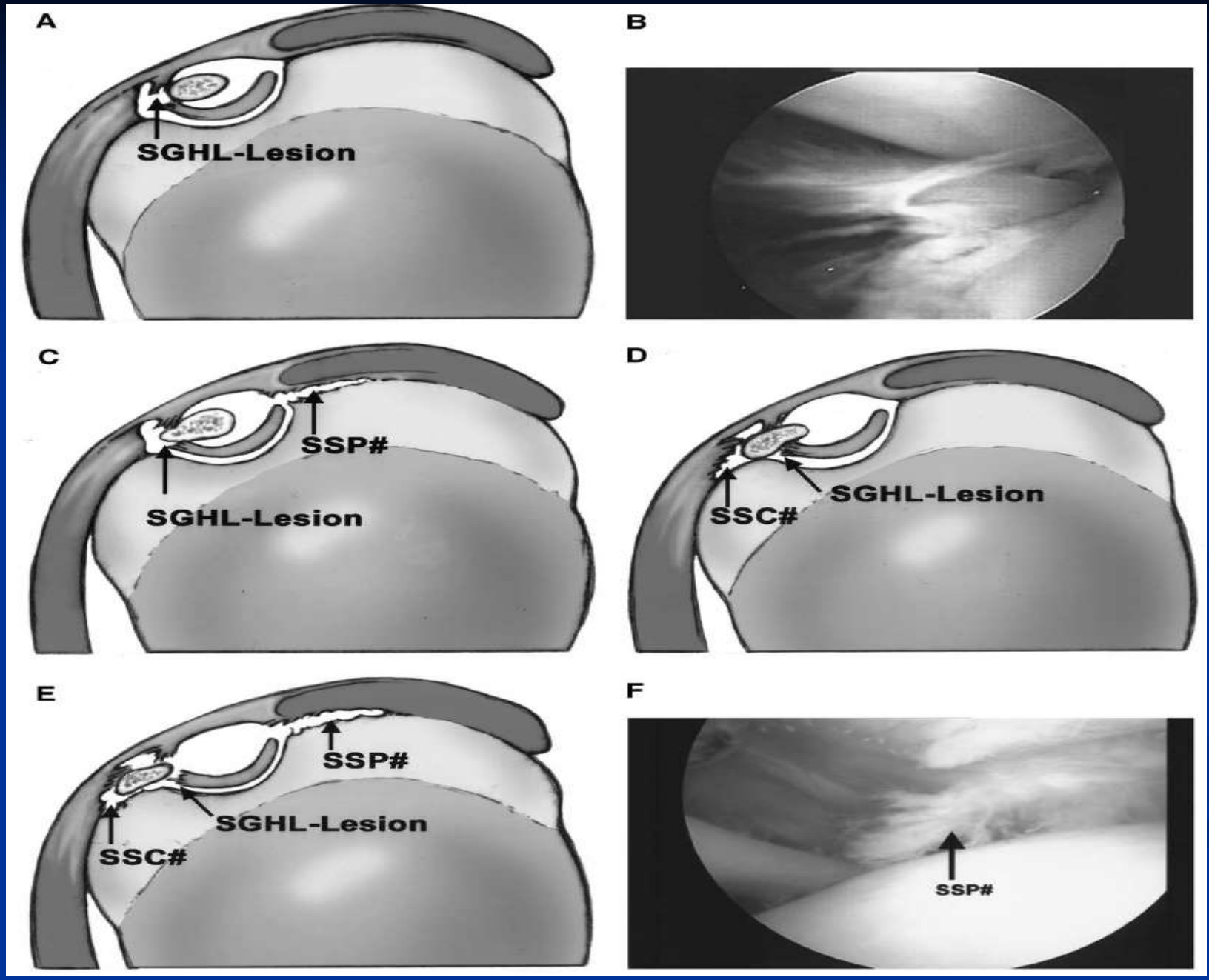
Anterosuperior glenoid impingement

•The medially subluxed LHB will lead to anterior translation and superior migration of the humeral head, which will cause anterosuperior impingement.



Anterosuperior glenoid impingement

- The combination of a partial articular-side subscapularis and supraspinatus tendon tear in addition to the pulley lesion increases the risk of the incidence of ASI;
- Age and gender are not influencing factors for the development of the ASI.


A
SGHL-Lesion
B
C
SSP#
SGHL-Lesion
D
SSC#
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E
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SGHL-Lesion
SSC#
F
SSP#

Anterosuperior glenoid impingement

Table Arm position, observed structural contact and lesions

Position of arm	Observed structural contact	Observed structural lesions
• Anterior elevation > 120 degrees • Full internal rotation • Horizontal flexion > 90 degrees (arm across sagittal plane)	Intraarticular LHB with cuff superiorly and anterior biceps anchor region inferiorly	• Anterosuperior labral fraying and detachment • Inflammatory changes and/or (rarer) fraying of LHB • Discrete fraying of humeral insertion of SGHL
• Anterior elevation > 80 degrees and < 120 degrees • Full internal rotation • Horizontal flexion > 90 degrees (arm across sagittal plane)	Humeral insertion of SGHL and inferior LHB at entrance into bicipital groove with anterosuperior and anterior glenoid labrum and MGHL (acting like a "plica")	• Fraying of humeral insertion of SGHL • Bulging, fraying of superiormost insertion of subscapularis tendon (see Figure 4) • Fretting lesion of tendon of LHB immediately adjacent to insertion (see Figure 2) • Subluxation, subluxability of tendon of LHBl (see Figure 3) • Fraying and/or instability of anterosuperior labrum
• Anterior elevation > 50 degrees and < 80 degrees • Full internal rotation • Horizontal flexion > 90 degrees (arm across sagittal plane)	Insertion of subscapularis tendon with anterior (anterosuperior) glenoid rim, labrum, and MGHL	• Fraying of undersurface of subscapularis tendon (see Figure 5) • Fraying and/or instability of anterosuperior labrum

SGHL, Superior glenohumeral ligament; *MGHL*, middle glenohumeral ligament; *LHB*, tendon of the long head of the biceps.

Anterosuperior glenoid impingement

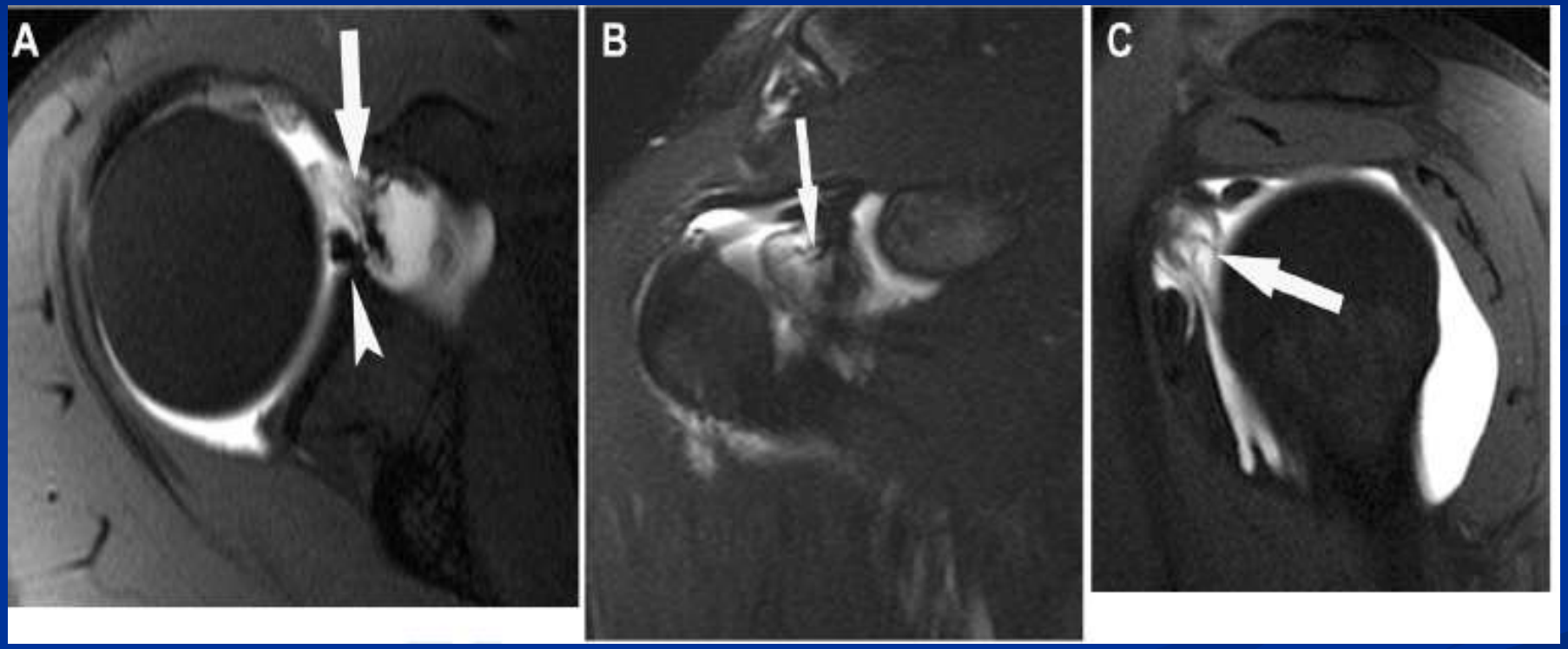

Table 2. Treatment Variations in Addition to a General Glenohumeral and Scapulothoracic Program (Avoiding Overhead and Cross-Body Motions)

Entity	Conservative Treatment	Operative Treatment
Acromioclavicular joint degenerative disease	Corticosteroid injection	Arthroscopic subacromial decompression, distal clavicle resection
Hooked acromion	Rotator cuff strengthening	Arthroscopic subacromial decompression, distal clavicle resection
Ossification of coracoacromial ligament	–	Release, arthroscopic subacromial decompression
Os acromiale	–	Resection/open reduction, internal fixation
Coracoid spurs	–	Resection?
Weak muscles	Rotator cuff strengthening	–
Tight posterior capsule	Stretching	–
Glenoid (internal) impingement	Rotator cuff strengthening	Anterior capsular ligament repair, osteotomy with subscapularis shortening

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