

## Imagerie de l'épaule



A.Madani



---

---

---

---

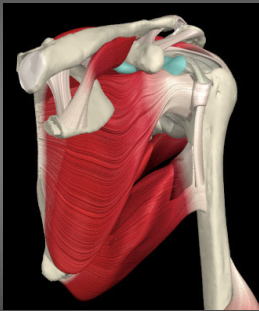
---

---

---

---

## Radio-anatomie



---

---

---

---

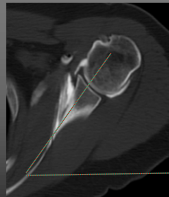
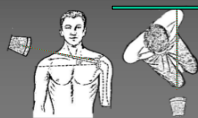
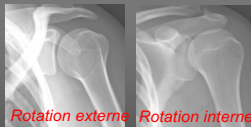
---

---

---

---

## Anatomie: articulation glénohumérale



---

---

---

---

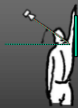
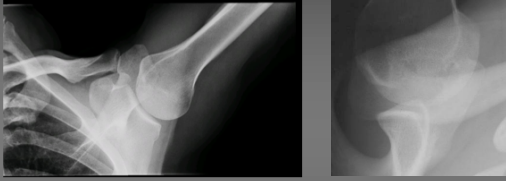
---

---

---

---

*Anatomie: articulation glénohumérale*



---

---

---

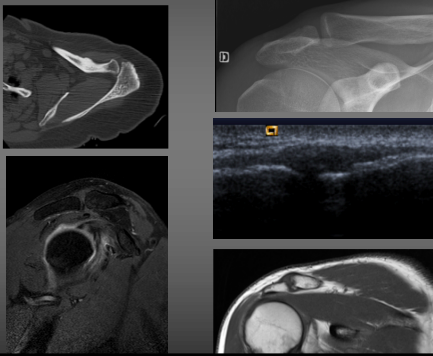
---

---

---

---

*Anatomie: articulation acromio-claviculaire*



---

---

---

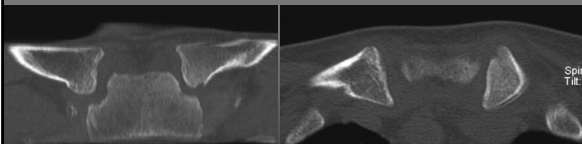
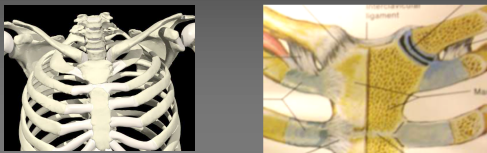
---

---

---

---

*Articulation sterno-claviculaire*



---

---

---

---

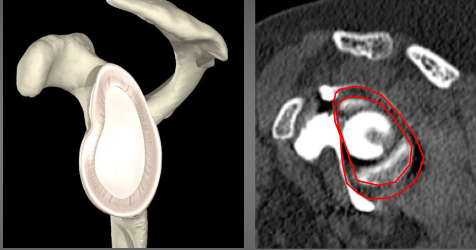
---

---

---



### Anatomie: labrum




---

---

---

---

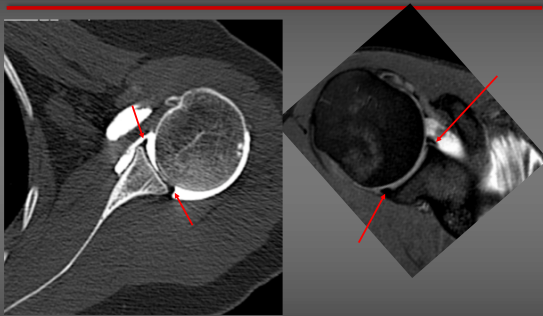
---

---

---

---

### Anatomie: labrum




---

---

---

---

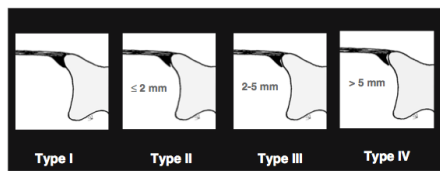
---

---

---

---

### Labrum variante



Macroscopie: 23%    19%    23%    33%

- Attachement du labrum supérieur:  
Arthro-Irm versus macroscopie: 79%  
Arthro-CT versus macroscopie: 84%
- Extension AP du récessus sublabral:  
Arthro-Irm versus macroscopie: 59%  
Arthro-CT versus macroscopie: 81%

Waldt et al. Eur Radiol 2006; 16:451-458

---

---

---

---

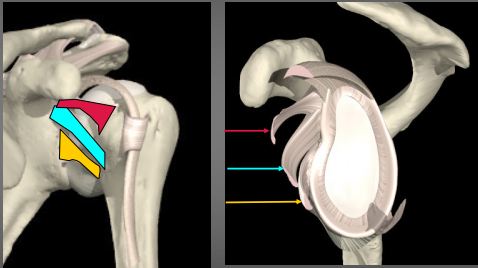
---

---

---

---

### Anatomie: ligaments glénohuméraux



Ligament glénohuméral supérieur  
Ligament glénohuméral moyen  
Ligament glénohuméral inférieur

---

---

---

---

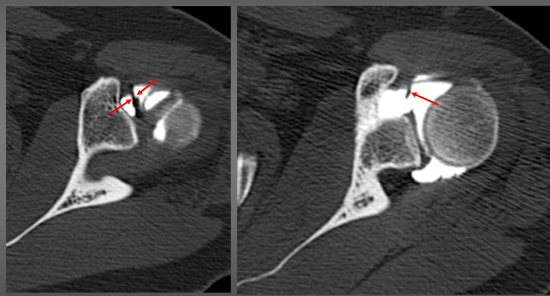
---

---

---

---

### Anatomie: ligaments glénohuméraux



---

---

---

---

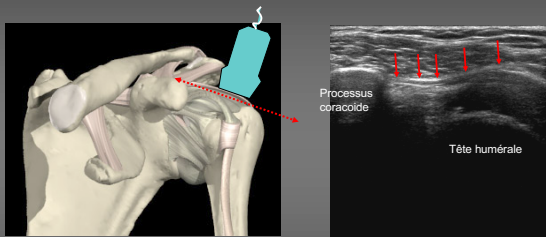
---

---

---

---

### Anatomie: ligament coraco-huméral



---

---

---

---

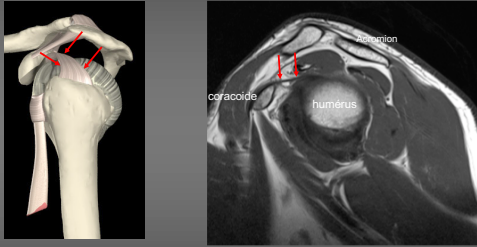
---

---

---

---

**Anatomie: ligament coraco-huméral**



---

---

---

---

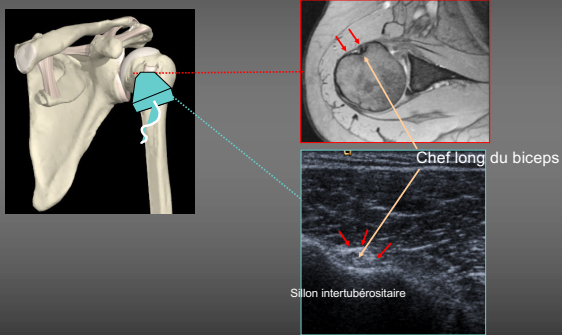
---

---

---

---

**Anatomie: ligament transverse**



---

---

---

---

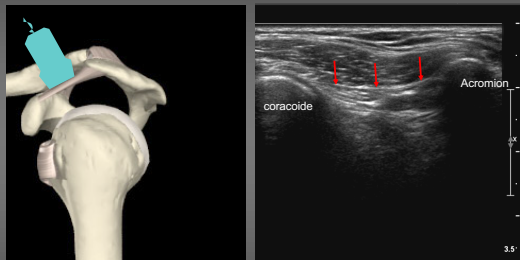
---

---

---

---

**Anatomie: ligament coraco-acromial**



---

---

---

---

---

---

---

---

*Anatomie: ligaments coraco-claviculaires*



---

---

---

---

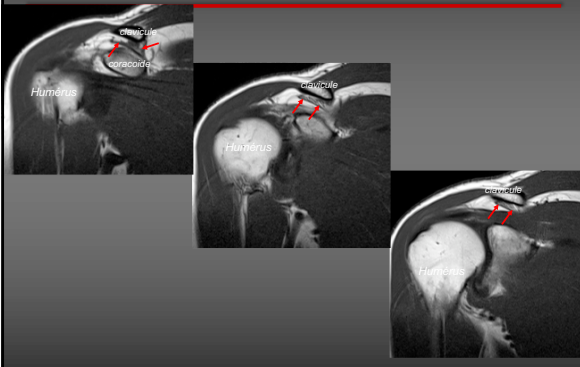
---

---

---

---

*Anatomie: ligaments coraco-claviculaires*



---

---

---

---

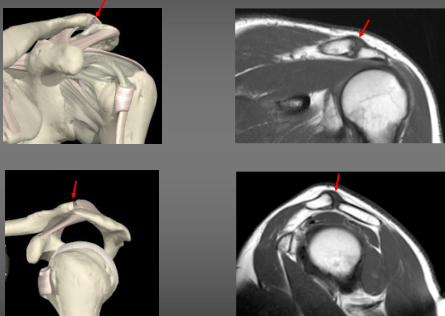
---

---

---

---

*Anatomie: ligament acromio-claviculaire*



---

---

---

---

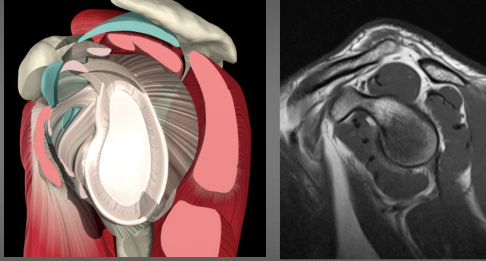
---

---

---

---

*Anatomie: coiffe des rotateurs*



---

---

---

---

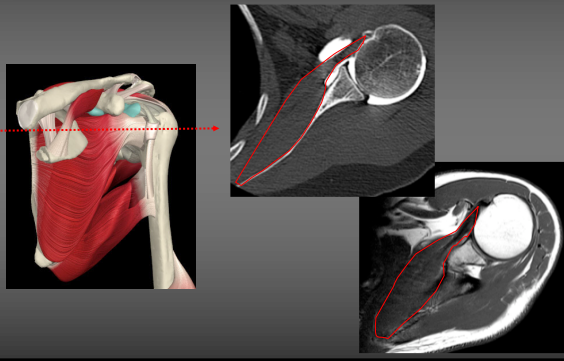
---

---

---

---

*Anatomie: coiffe des rotateurs -  
subscapulaire*



---

---

---

---

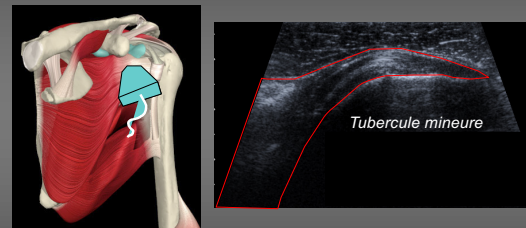
---

---

---

---

*Anatomie: coiffe des rotateurs -  
subscapulaire*



---

---

---

---

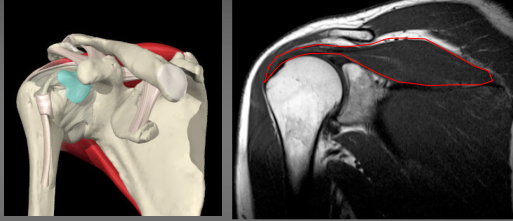
---

---

---

---

Anatomie: coiffe des rotateurs -  
supra-épineux



---

---

---

---

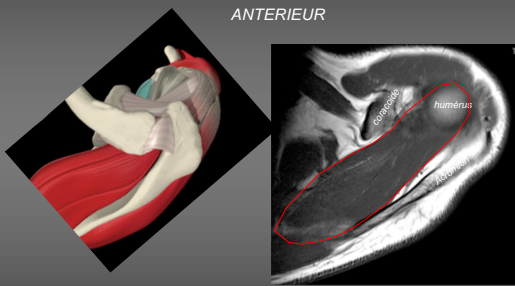
---

---

---

---

Anatomie: coiffe des rotateurs -  
supra-épineux



ANTERIEUR

POSTERIEUR

---

---

---

---

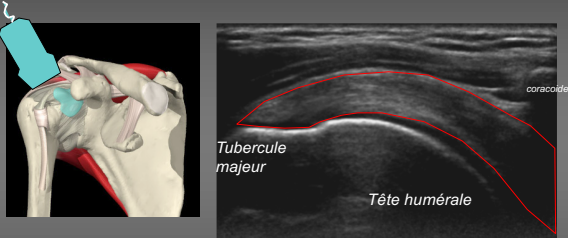
---

---

---

---

Anatomie: coiffe des rotateurs -  
supra-épineux



Tubercule  
majeur

Tête humérale

coracoïde

---

---

---

---

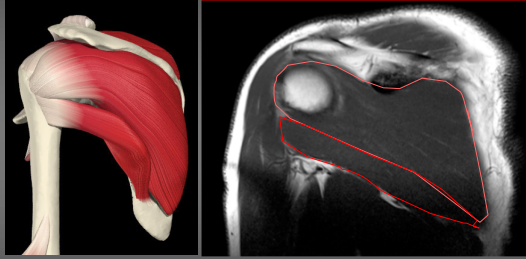
---

---

---

---

Anatomie: coiffe des rotateurs –  
intra-épineux Petit rond



---

---

---

---

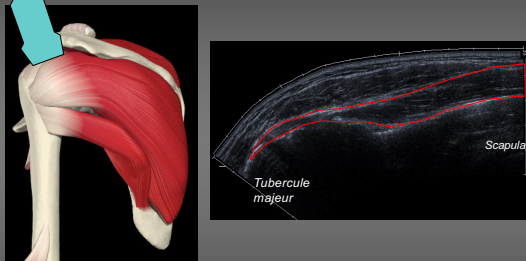
---

---

---

---

Anatomie: coiffe des rotateurs -  
intra-épineux



---

---

---

---

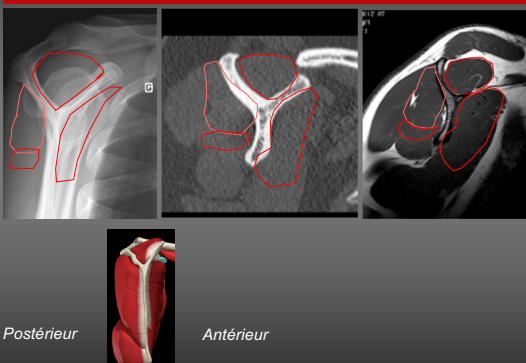
---

---

---

---

Anatomie: coiffe des rotateurs



---

---

---

---

---

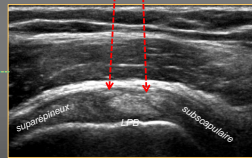
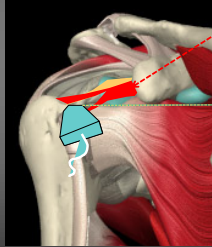
---

---

---

Anatomie:

Intervalle des rotateurs



---

---

---

---

---

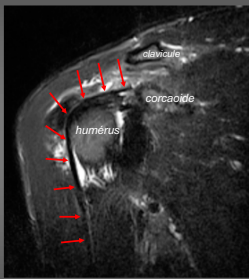
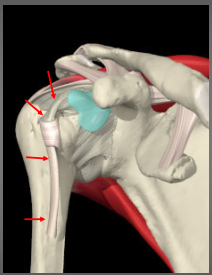
---

---

---

Anatomie:

biceps (chef long)



---

---

---

---

---

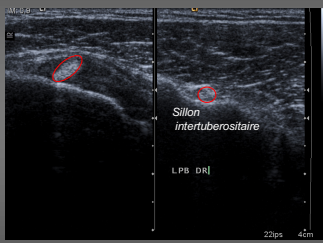
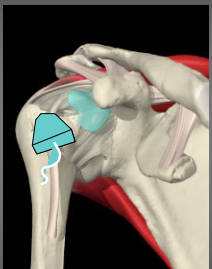
---

---

---

Anatomie:

biceps (chef long)



---

---

---

---

---

---

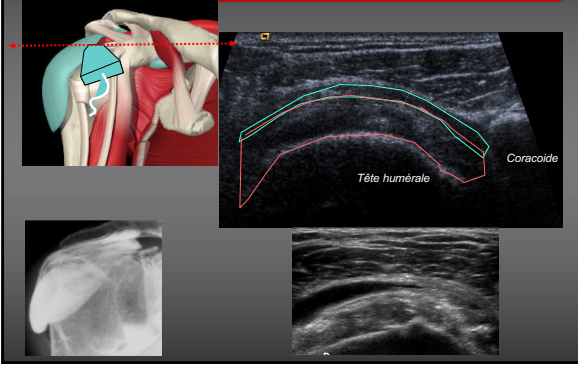
---

---



Anatomie:

bourse subacromiale



---

---

---

---

---

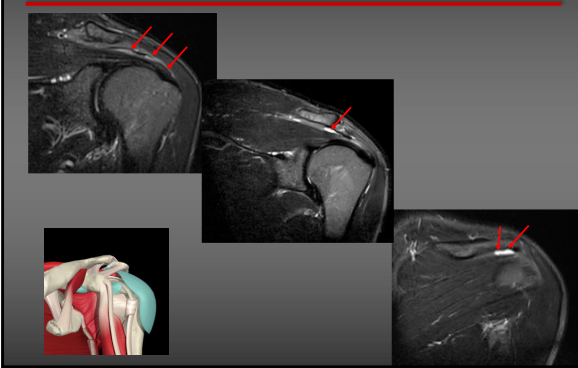
---

---

---

Anatomie:

bourse subacromiale



---

---

---

---

---

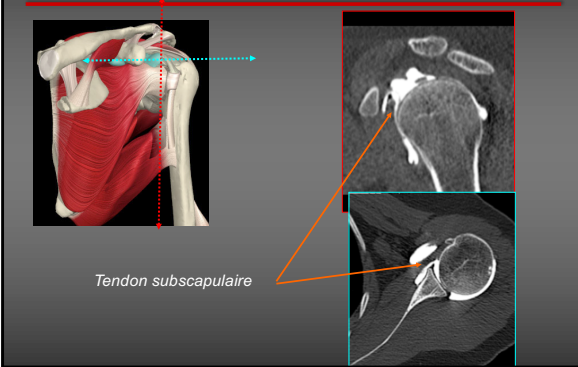
---

---

---

Anatomie:

bourse subscapulaire



---

---

---

---

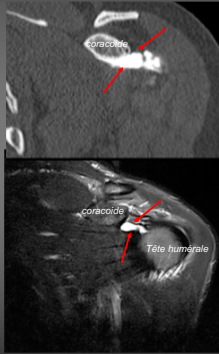
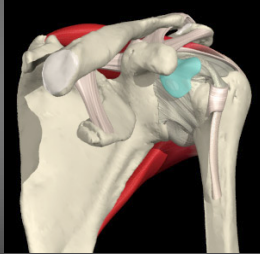
---

---

---

---

Anatomie: *bourse subcoracoïdienne*



---

---

---

---

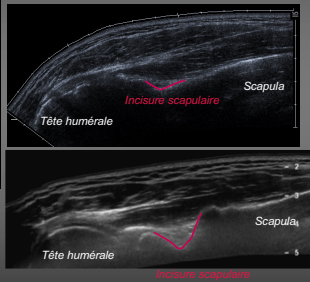
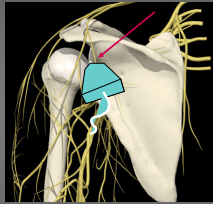
---

---

---

---

Anatomie: *nerf suprascapulaire*



---

---

---

---

---

---

---

---

Anatomie: *nerf suprascapulaire*



---

---

---

---

---

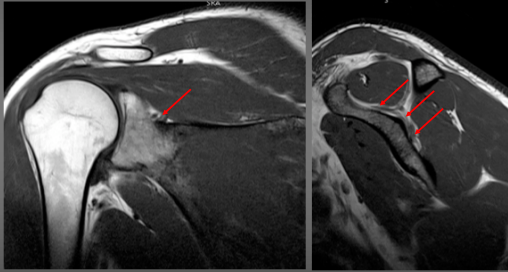
---

---

---

Anatomie:

nerf suprascapulaire



---

---

---

---

---

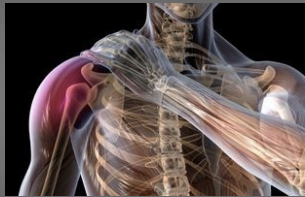
---

---

---

Pathologie

- 1- Coiffe des rotateurs
- 2- Instabilité



---

---

---

---

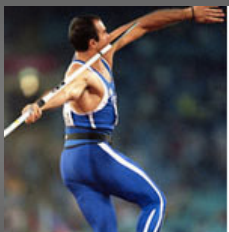
---

---

---

---

Pathologies de la coiffe des rotateurs



QUI EST COUPABLE?

---

---

---

---

---

---

---

---

## Pathologies de la coiffe des rotateurs

### **Tendon:**

- Facteurs structuraux et constitutionnels:
  - (quasi) absence de capacité à la cicatrisation spontanée (mise en tension permanente, face bursale et articulaire empêchant le processus de cicatrisation)
  - Fragilité liée à une anomalie du collagène et/ou de la matrice tendineuse, hyperlaxité diffuse, facteurs métaboliques, ...

---

---

---

---

---

---

---

---

## Pathologies de la coiffe des rotateurs

### **Tendon:**

- Facteur vasculaire:
    - Zone « critique » située à 1 cm de l'insertion osseuse du tendon, siège préférentiel d'inflammation, de dépôts calciques et des ruptures.
    - Micro-vascularisation tendons du supra-épineux < infra-épineux < sub-scapulaire  
⇒ « nécrose » ischémique intra-tendineuse chez le patient âgé
- MAIS ...
- lésions pas nécessairement dans les zones hypovascularisées; les lésions supra-épineuses sont périphériques à l'enthèse et non forcément dans la zone critique.

---

---

---

---

---

---

---

---

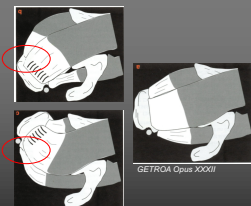
## Pathologies de la coiffe des rotateurs

### **Facteurs biomécaniques:**

- Contractions excentriques sollicitent d'avantage le tendon par rapport aux contractions concentriques et isométriques.
- Contrainte maximale dépend plus de la position de l'articulation que de la partie du tendon sollicitée (maximale à 60° abduction)

### **L'utilisateur:**

- Sports (de lancer- raquette...)
- Port de sac à main (femme)
- Position de sommeil



---

---

---

---

---

---

---

---

## Pathologies de la coiffe des rotateurs

### Facteurs environnementaux:

- Environnements ostéo-articulaire
  - Conflits avec la voûte acromio-coracoïdienne
  - Dysplasie gléno-humérale
- Bourse sous-acromiodeltoïdienne
  - Fréquente++
  - Svt responsable de la douleur



---

---

---

---

---

---

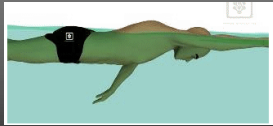
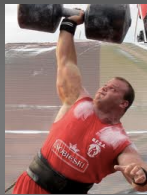
---

---

## Conflits

### Conflit antéro-supérieur

- Acromion crochu
- Os acromial
- Arthrose AC
- Enthésophytes acromiaux
- Épaississement du lig.coraco-acromial
- Autres: bursite, cal,...



---

---

---

---

---

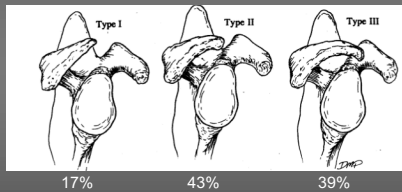
---

---

---

## Conflit antéro-supérieur

- Acromion: type



Bigliani, Morrison, Orthop Trans 1986; 10: 228

---

---

---

---

---

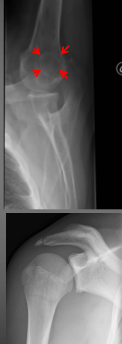
---

---

---

## Conflit antéro-supérieur

- Os acromial
  - < non fusion des noyaux d'ossification de l'acromion (> 22-25 ans).
  - Instabilité par tractions répétées du m.deltoïde
  - Prévalence 1,4- 8,4%
  - Bilatéral > 60% des cas



---

---

---

---

---

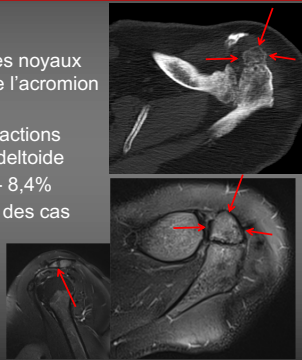
---

---

---

## Conflit antéro-supérieur

- Os acromial
  - < non fusion des noyaux d'ossification de l'acromion (> 22-25 ans).
  - Instabilité par tractions répétées du m.deltoïde
  - Prévalence 1,4- 8,4%
  - Bilatéral > 60% des cas



---

---

---

---

---

---

---

---

## Conflits

### > Conflit antéro-médial:

- = conflit sub-coracoïdien
- antéflexion et rotation interne du bras
- Prévalence plus élevée quand rupture de coiffe (50% vs 9%)



---

---

---

---

---

---

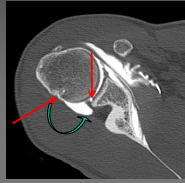
---

---



## Conflits

- Exostose glénoïdienne postérieure (lésion de Bennett)
- Ostéocondensation du tubercule majeur
- « Géode-kyste » ostéochondral huméral postérieur
- Erousement glénoïdien postérieur




---

---

---

---

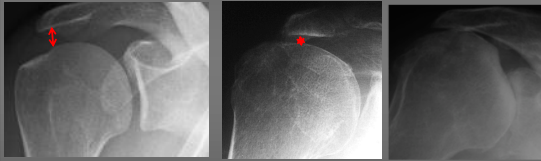
---

---

---

---

## Pathologies de la coiffe des rotateurs




---

---

---

---

---

---

---

---

## Calcifications

- 1-stade précalfifié: métaplasie du tendon en fibrocartilage
- 2-stade calcifié: phases de formation et de résorption
- 3-stade post calcifié: reconstitution du tendon



De Palma and Kruper classification. <sup>5</sup>		
Type	Radiological appearance	Correspondence to Uthoff's pathological stages
I	Fluffy, fleecy with ill-defined periphery	Resorptive phase
II	Homogeneous with clearly defined periphery	Formation phase

Patte and Goutallier classification based on morphology. <sup>2</sup>	
I	Sharp and dense
II	Blunt and dense
III	Sharp and translucent
IV	Blunt and translucent

<sup>5</sup>Uthoff et al. In: Gazielly et al Paris: Elsevier, 1997, p. 144-146  
<sup>2</sup>DePalma et al. Clin Orthop 1961;20:61-72  
<sup>3</sup>Patte CF, Goutallier D. Rev Chir Orthop 1988;74: 277-278

---

---

---

---

---

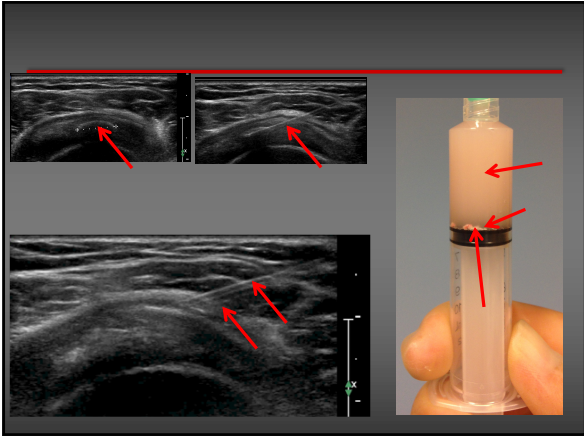
---

---

---








---

---

---

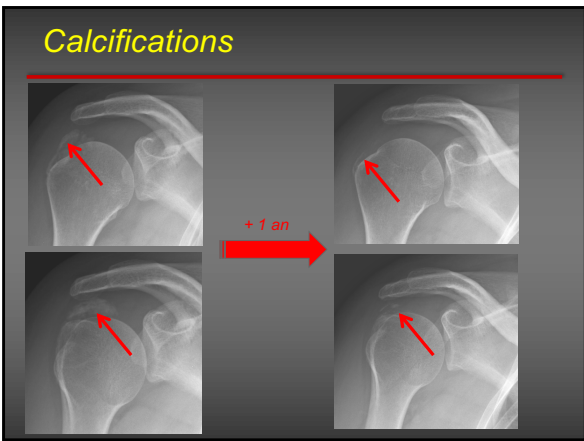
---

---

---

---

---




---

---

---

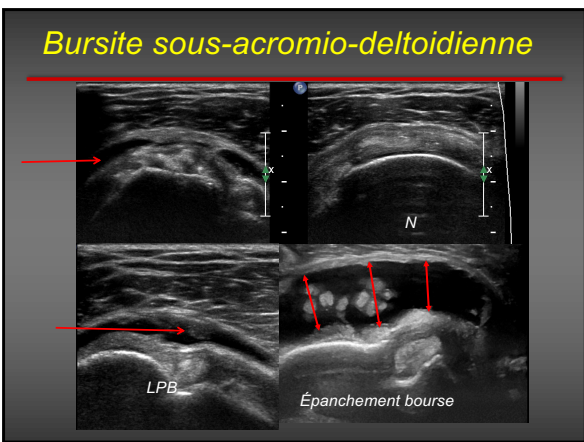
---

---

---

---

---




---

---

---

---

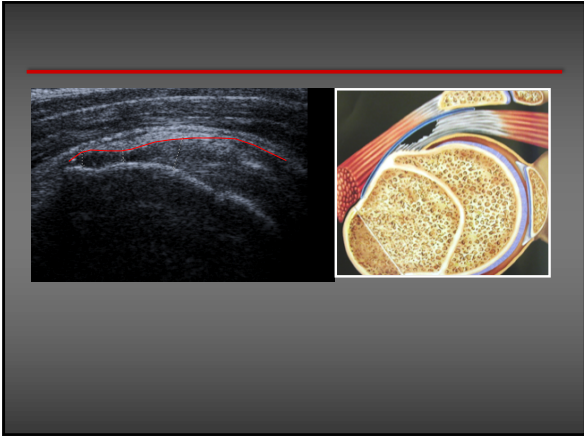
---

---

---

---





---

---

---

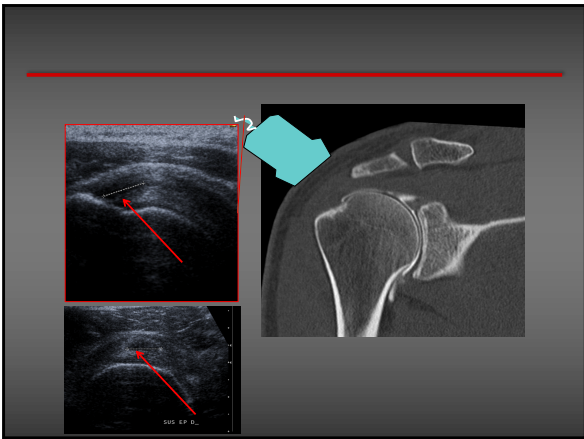
---

---

---

---

---



---

---

---

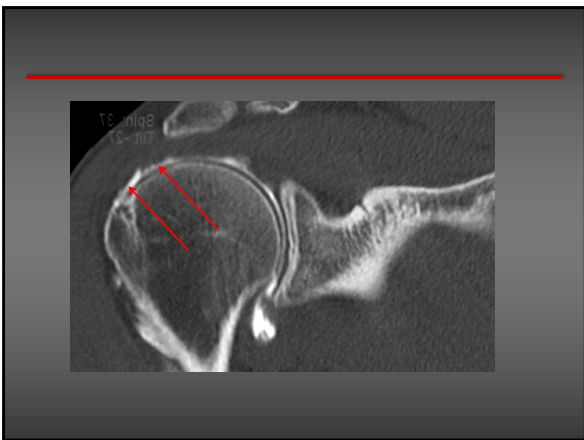
---

---

---

---

---



---

---

---

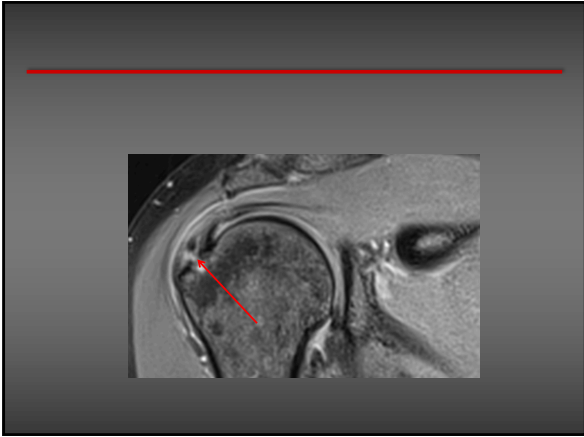
---

---

---

---

---



---

---

---

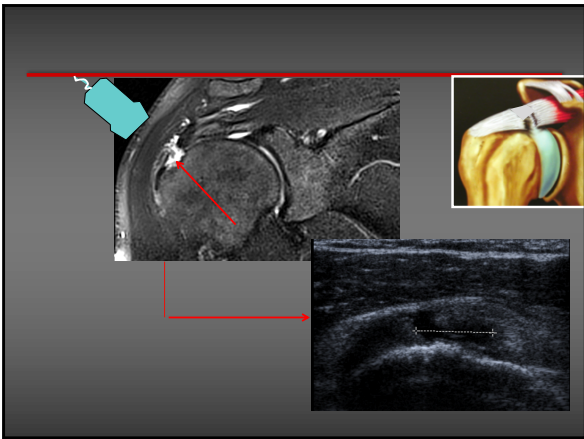
---

---

---

---

---



---

---

---

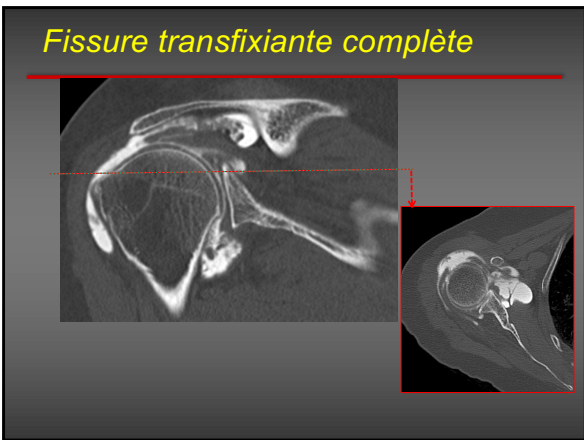
---

---

---

---

---



---

---

---

---

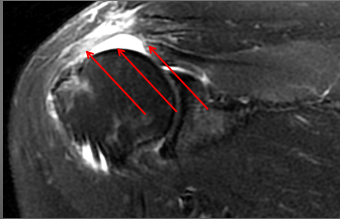
---

---

---

---

## Fissure transfixiante complète




---

---

---

---

---

---

---

---

## Pathologies de la coiffe des rotateurs

- Amyotrophie  $R = \frac{\text{muscle}}{\text{os}}$
- Corrélation entre amyotrophie et dégénérescence graisseuse



Stade 1:  $R > 0.6$

Stade 2:  $0.4 < R < 0.6$

Stade 3:  $R < 0.4$

---

---

---

---

---

---

---

---

## Pathologies de la coiffe des rotateurs

- Dégénérescence graisseuse

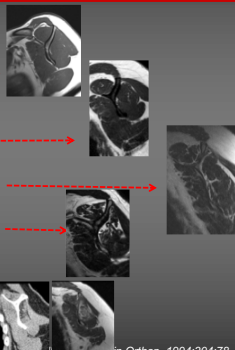
Stade 0: absence de graisse dans le muscle

Stade 1: Présence de quelques fines lignes graisseuses

Stade 2: présence de graisse < muscle

Stade 3: Présence de graisse = muscle

Stade 4: Présence de graisse > muscle



Scullian et al. Clin Orthop. 1994;304:78-83.

---

---

---

---

---

---

---

---

## Pathologies de la coiffe des rotateurs

- Dégénérescence graisseuse
  - Liée vraisemblablement à l'ancienneté de la rupture tendineuse
  - Dépend de l'étendue de la rupture.
  - Dépend du tendon rompu:
    - *Supra-épineux*: rupture isolée sans DG
    - *Infra-épineux*: très sensible. DG même si tendon non rompu
    - *Subscapulaire*: limitée à la partie du muscle qui correspond à la zone de rupture tendineuse

---

---

---

---

---

---

---

---

## Pathologies de la coiffe des rotateurs

- Dégénérescence graisseuse
  - L'absence de dégénérescence graisseuse d'un muscle ne permet pas d'éliminer une rupture de son tendon.
  - Corrélation entre la fréquence de rupture itérative du tendon du supra-épineux en post-op et le grade de dégénérescence adipeuse.

=>D'où l'intérêt de suturer les larges ruptures de coiffe avant l'apparition de la DG trop importante et irréversible.

---

---

---

---

---

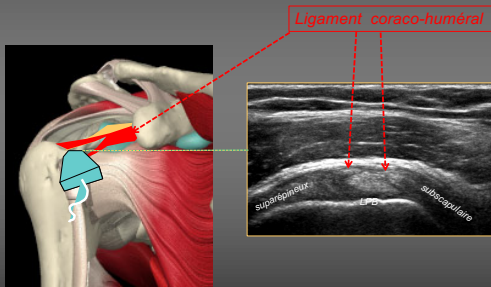
---

---

---

## Pathologies de l'intervalle des rotateurs

Intervalle des rotateurs



---

---

---

---

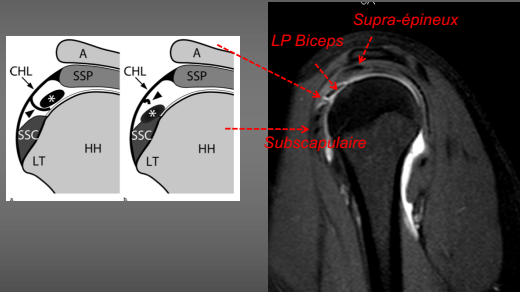
---

---

---

---

**Pathologies de l'intervalle des rotateurs**




---

---

---

---

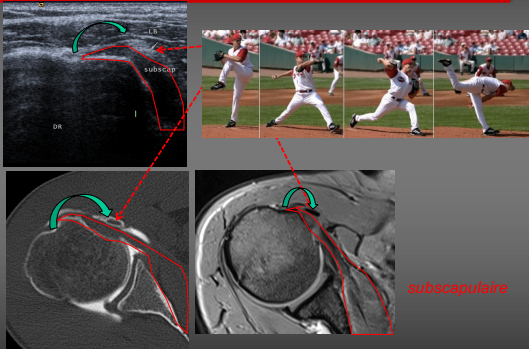
---

---

---

---

**Pathologies de l'intervalle des rotateurs**




---

---

---

---

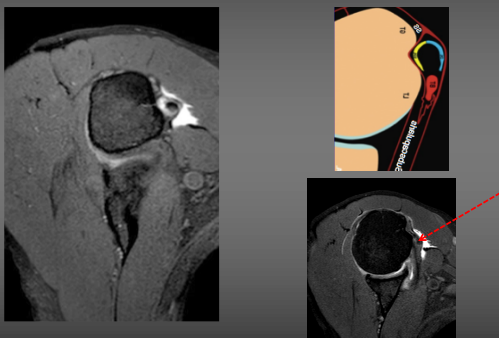
---

---

---

---

**Pathologies de la coiffe des rotateurs Intervalle des rotateurs**




---

---

---

---

---

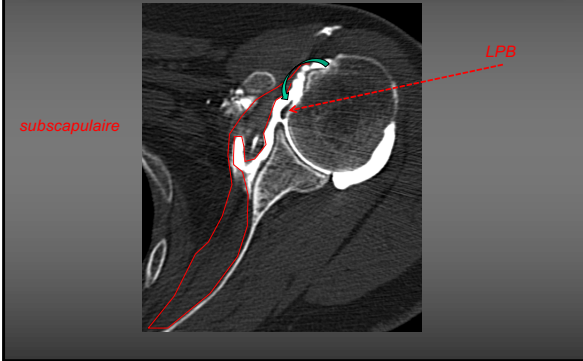
---

---

---



## Pathologies de l'intervalle des rotateurs



---

---

---

---

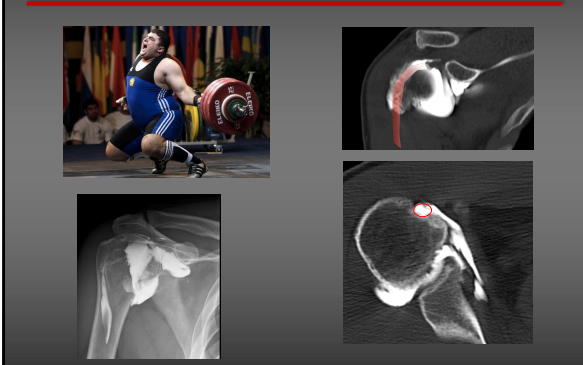
---

---

---

---

## Pathologies de l'intervalle des rotateurs



---

---

---

---

---

---

---

---

## Pathologies de l'épaule

### Capsulose rétractile

Arthrographie: capacité < 10 ml  
US: épaissement capsulaire et hyperhémie  
\*IRM:

- Epaissement du ligament coraco-huméral (>4mm):  
spécificité 95% Sensibilité 59%
- Epaissement capsulaire (>7mm)  
spécificité 86% Sensibilité 64%



\*Mengiardi et al. Radiology 2004;233:486-492

---

---

---

---

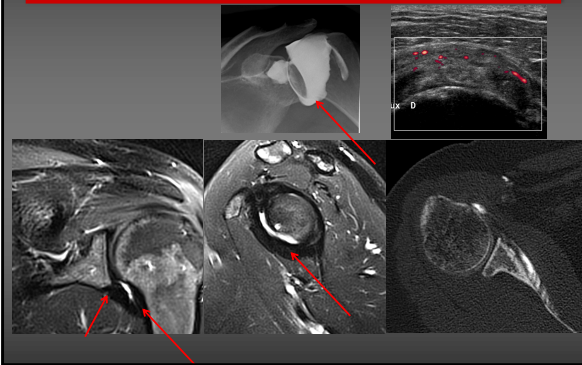
---

---

---

---

Pathologies de la coiffe des rotateurs Capsulose rétractile



---

---

---

---

---

---

---

---

Pathologie

- 1- Coiffe des rotateurs
- 2- Instabilité



---

---

---

---

---

---

---

---

Instabilité

• = perte de contact partielle (subluxation) ou complète (luxation) entre la tête humérale et la cavité glénoïdienne

- Antérieure (>90%)
- Postérieure (2-10%)
- Multidirectionnelle



---

---

---

---

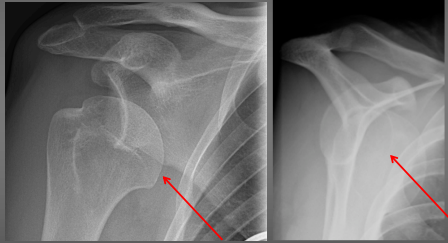
---

---

---

---

*Instabilité gléno-humérale antérieure*



---

---

---

---

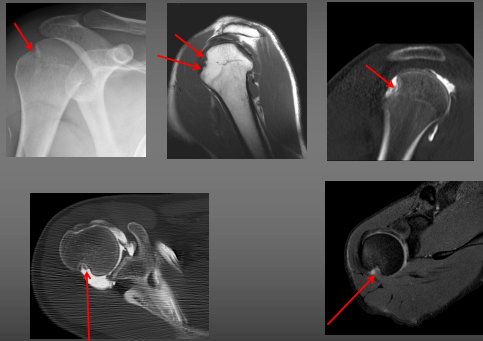
---

---

---

---

*Instabilité gléno-humérale antérieure*  
*Encoche de Hill Sachs*



---

---

---

---

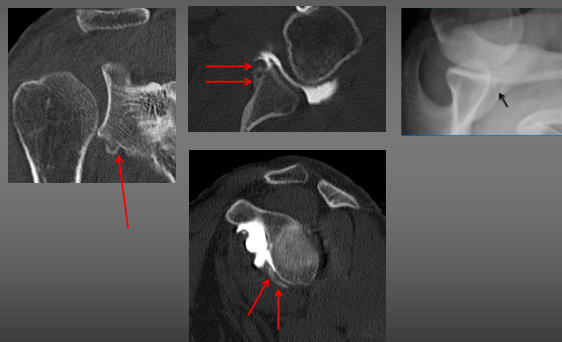
---

---

---

---

*Instabilité gléno-humérale antérieure*  
*Bankart osseuse*



---

---

---

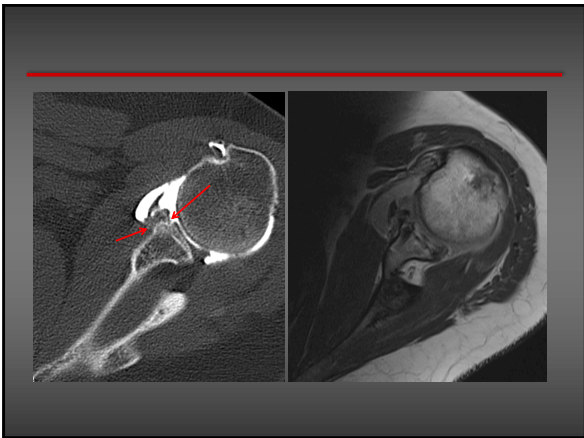
---

---

---

---

---




---

---

---

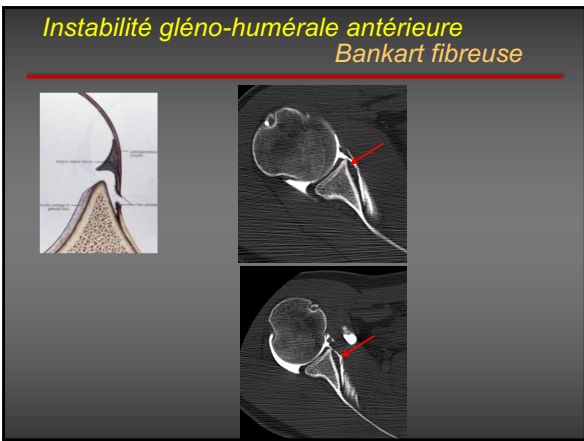
---

---

---

---

---




---

---

---

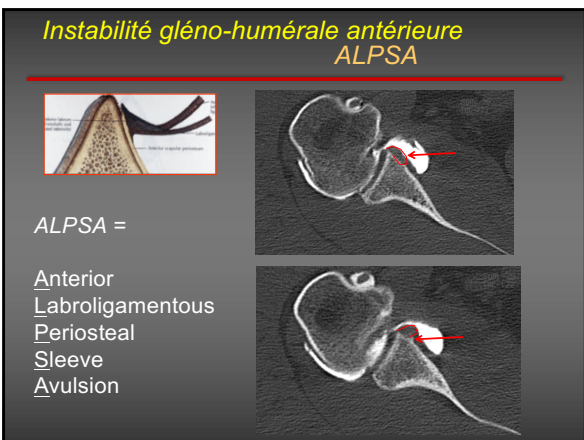
---

---

---

---

---




---

---

---

---

---

---

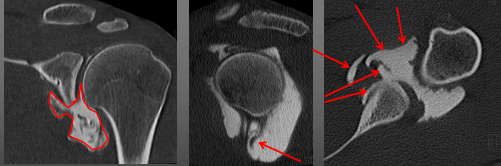
---

---

*Instabilité gléno-humérale antérieure*  
*HAGL*

HAGL =

Humeral  
Avulsion of the  
Glenohumeral  
Ligament



---

---

---

---

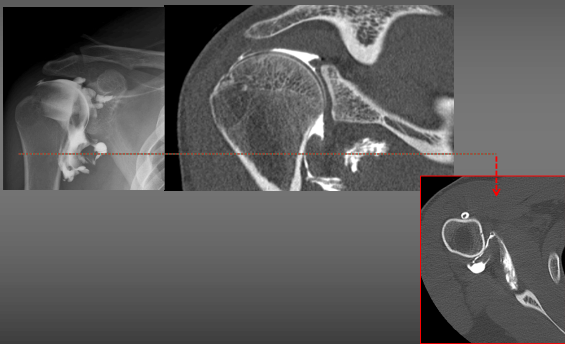
---

---

---

---

*Instabilité gléno-humérale antérieure*  
*HAGL*



---

---

---

---

---

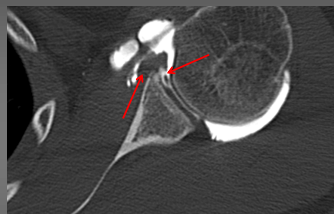
---

---

---

*Instabilité gléno-humérale antérieure*  
*GLAD*

GLAD:  
Gleno  
Labral  
Articular  
Disruption



---

---

---

---

---

---

---

---

### Instabilité gléno-humérale postérieure

- 2-10%
- Sport ( rugby ,haltérophilie, escalade, ...)
- Épilepsie, électrocution...



Type	Description
Type I	Incomplete detachment
Type II	Incomplete and ossified avulsion (Kim lesion)
Type III	Chondrolabral erosion
Type IV	Flap tear

Provencher et al Am J Sports Med 2011 39: 874-886

---

---

---

---

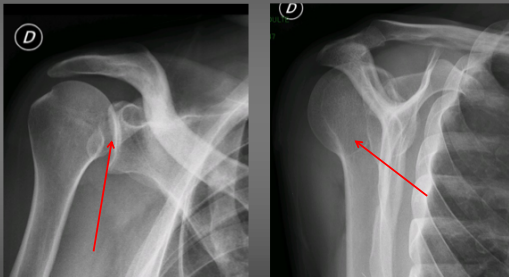
---

---

---

---

### Instabilité gléno-humérale postérieure



---

---

---

---

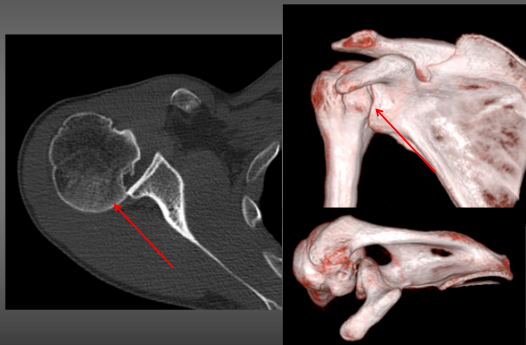
---

---

---

---

### Instabilité gléno-humérale postérieure



---

---

---

---

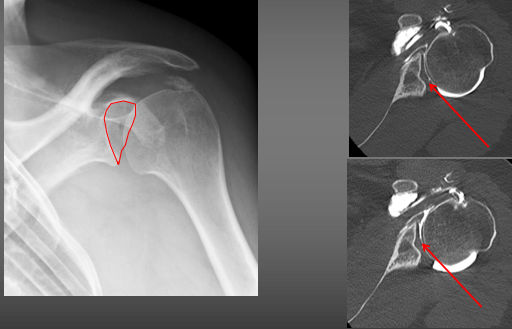
---

---

---

---

*Instabilité gléno-humérale postérieure  
Dysplasie glénoïdienne*



---

---

---

---

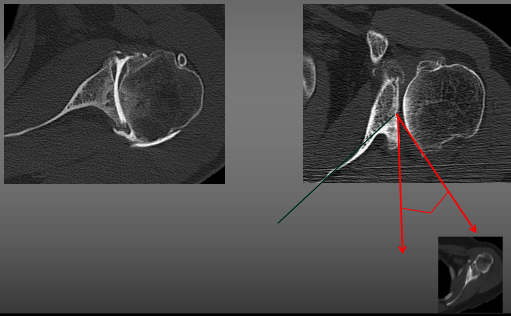
---

---

---

---

*Instabilité gléno-humérale postérieure*



---

---

---

---

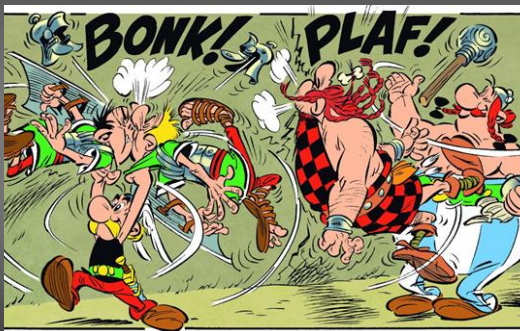
---

---

---

---

*SLAP :  
Superior Labrum from Anterior to Posterior*



---

---

---

---

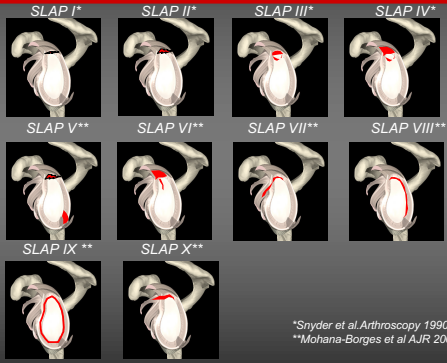
---

---

---

---

**SLAP :**  
Superior Labrum from Anterior to Posterior



\*Snyder et al Arthroscopy 1990;6:274-279  
 \*\*Mohana-Borges et al AJR 2003; 181:1449-1462

---

---

---

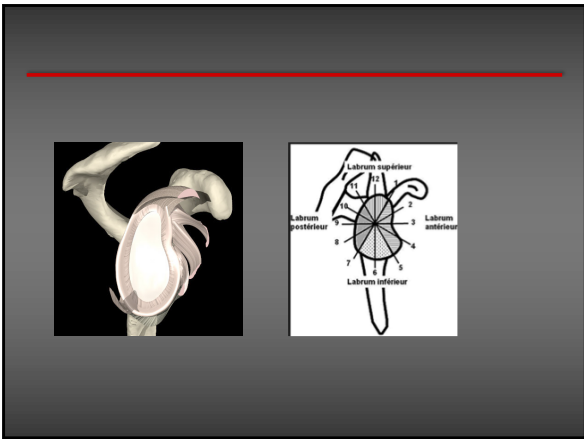
---

---

---

---

---




---

---

---

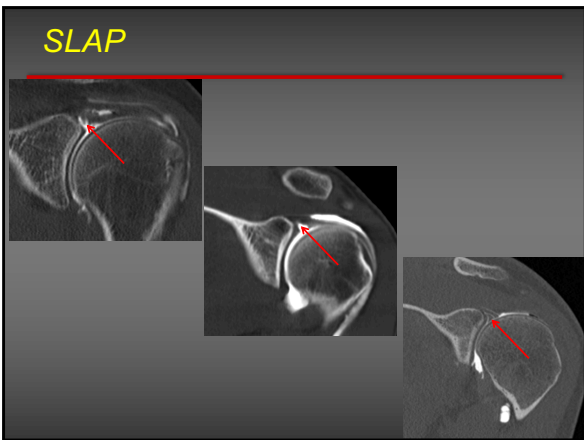
---

---

---

---

---




---

---

---

---

---

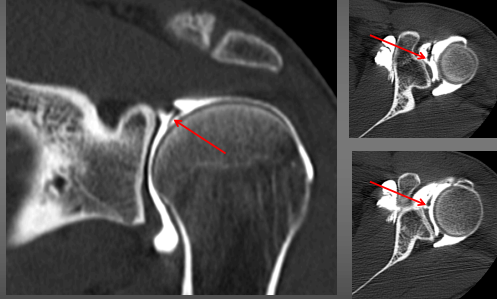
---

---

---



## SLAP




---

---

---

---

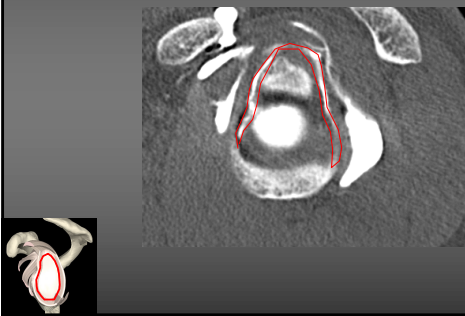
---

---

---

---

## SLAP




---

---

---

---

---

---

---

---

## SLAP



\*Arthro CT:

**Superior Labral Anteroposterior Tears: Accuracy and Interobserver Reliability of Multidetector CT Arthrography for Diagnosis**

Table 3  
Effectiveness of Multidetector CT Arthrography for Each Reader in Diagnosis of SLAP Lesions

Reader	Sensitivity	Specificity	Accuracy	PPV	NPV	FN	FP
1	84.3 (33/39)	74.7 (36/77)	80.3 (33/101)	83.8 (33/39)	81.5 (46/61)	0.7 (6/8)	23.3 (17/2)
2	87.7 (34/39)	77.0 (31/77)	82.3 (33/101)	81.1 (36/39)	86.6 (47/55)	2.2 (2/8)	27.4 (2/2)

Note.—Data are percentages. Percentages were rounded. Numbers in parentheses were used to calculate the percentages. FN = false-negative cases, FP = false-positive cases, NPV = negative predictive value, PPV = positive predictive value.

L'accord inter-observateur (diagnostic):  $\kappa = 0.87$   
 L'accord inter-observateur (classification):  $\kappa = 0.72$

\*\*Amélioré par ERAS (External Rotation Active Supination)

\*Kim et al. Radiology 2011; 25: 207-215  
 \*\*Choi et al Radiology 2012; 263:199-205

---

---

---

---

---

---

---

---



## Entorse acromio-claviculaire Classification de Rockwood

0 medical

- **Type I:** entorse sans rupture ligamentaire (AC <6mm)
- **Type II:** Rupture isolée des ligaments AC (> 7mm)
- **Type III:** Rupture ligaments AC (distance 25-100%) + CC (> 11-13 mm) - touche de piano
- **Type IV:** déchirure ligament + chape delto-trapézienne => luxation postérieure de la clavicule (RX peut être N. => CT scan)
- **Type V:** type III + rupture chape delto-trapézienne => bascule de la clavicule > 100%
- **Type VI:** dislocation complète + luxation inférieure, sous-coracoïdienne de la clavicule.

0 chirurgical

---

---

---

---

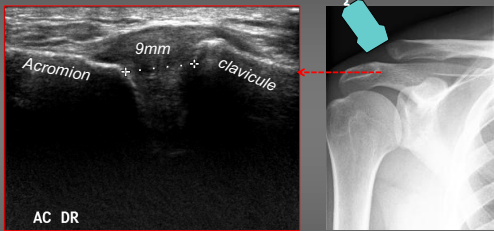
---

---

---

---

## Entorse acromio-claviculaire




---

---

---

---

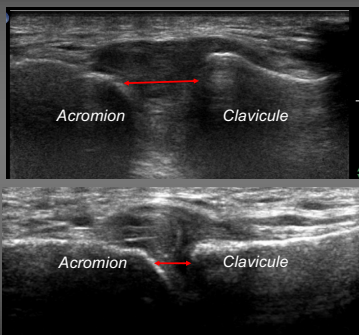
---

---

---

---

## Entorse acromio-claviculaire




---

---

---

---

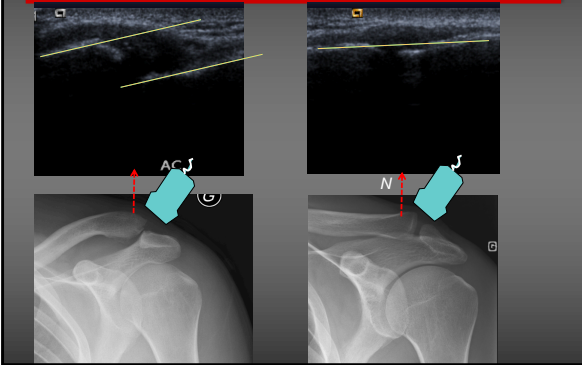
---

---

---

---

*Entorse acromio-claviculaire*



---

---

---

---

---

---

---

---

*Entorse acromio-claviculaire*



---

---

---

---

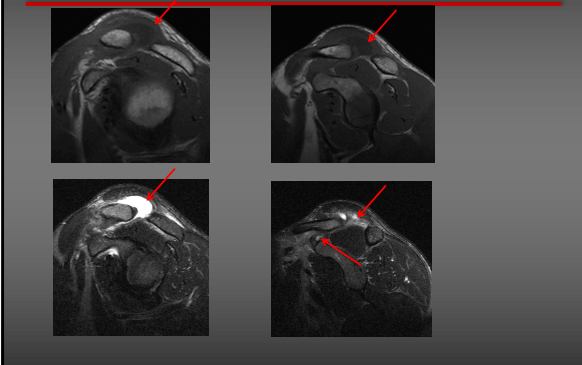
---

---

---

---

*Entorse acromio-claviculaire*



---

---

---

---

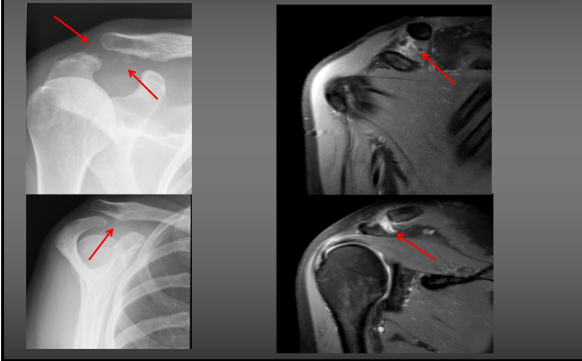
---

---

---

---

### Entorse acromio-claviculaire



---

---

---

---

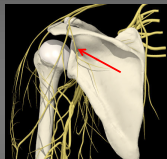
---

---

---

### Atteinte du n. supra-scapulaire

- Kyste mucoïde
- Varices supra-scapulaires
- Microtraumatismes répétés
- Morphologie de l'échancrure supra-scapulaire
- Trajet aberrant de l'a. supra-scapulaire
- Hypertrophie du m. subscapulaire
- Tumeurs
- Hématome-fibrose post-traumatique



---

---

---

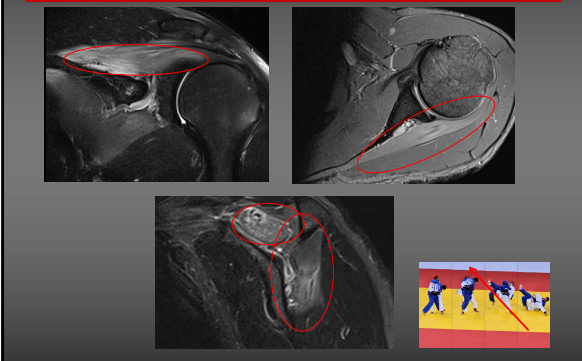
---

---

---

---

### Conflit du nerf supra-scapulaire



---

---

---

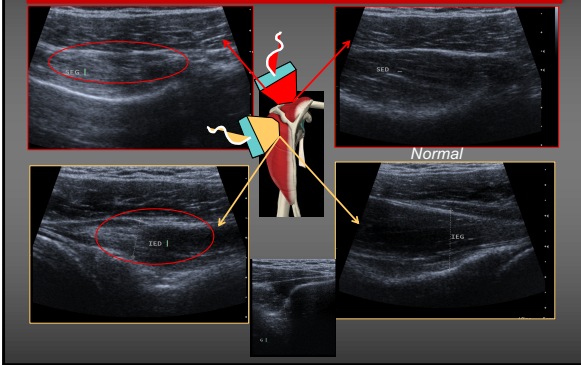
---

---

---

---

### Conflit du nerf supra-scapulaire



---

---

---

---

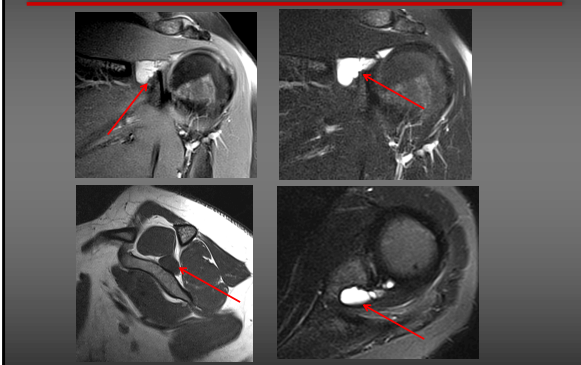
---

---

---

---

### Conflit du nerf supra-scapulaire



---

---

---

---

---

---

---

---

### Take Home message

- Douleur de l'épaule:
  - RX + US
  - en seconde intention: ACT-AIRM
- Entorse acromioclaviculaire:
  - RX + US
- Instabilité glénohumérale:
  - RX (+CT)
  - ACT-AIRM

---

---

---

---

---

---

---

---