

The normal spine:

Anatomy of the sacroiliac joint



Cliniques universitaires
SAINT-LUC
UCL BRUSSELS

Objectives

- Complex anatomy of the SI interface
- Implications for imaging of SI joints
 - Radiographs
 - CT/MRI
- Implications for analysis of SI joints
 - Radiographic evaluation
 - CT/MRI evaluation

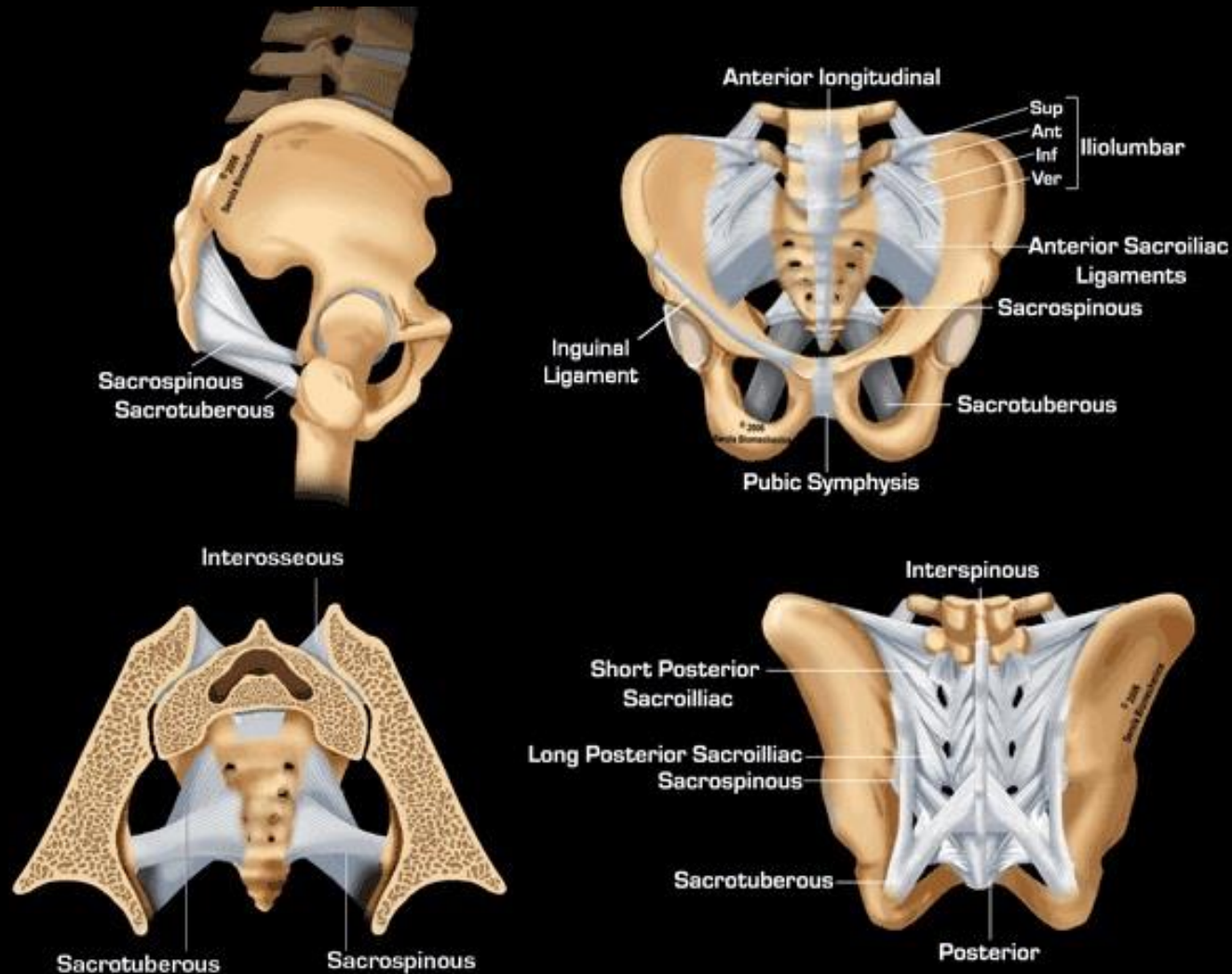
Beyond our scope

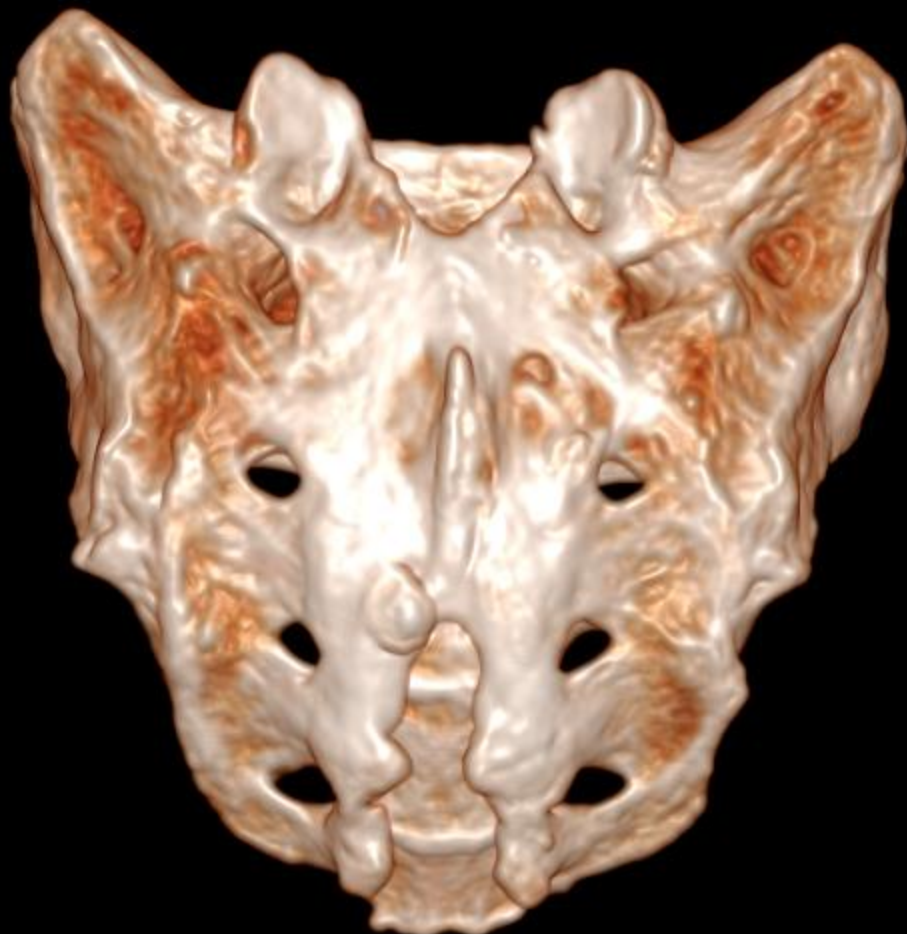
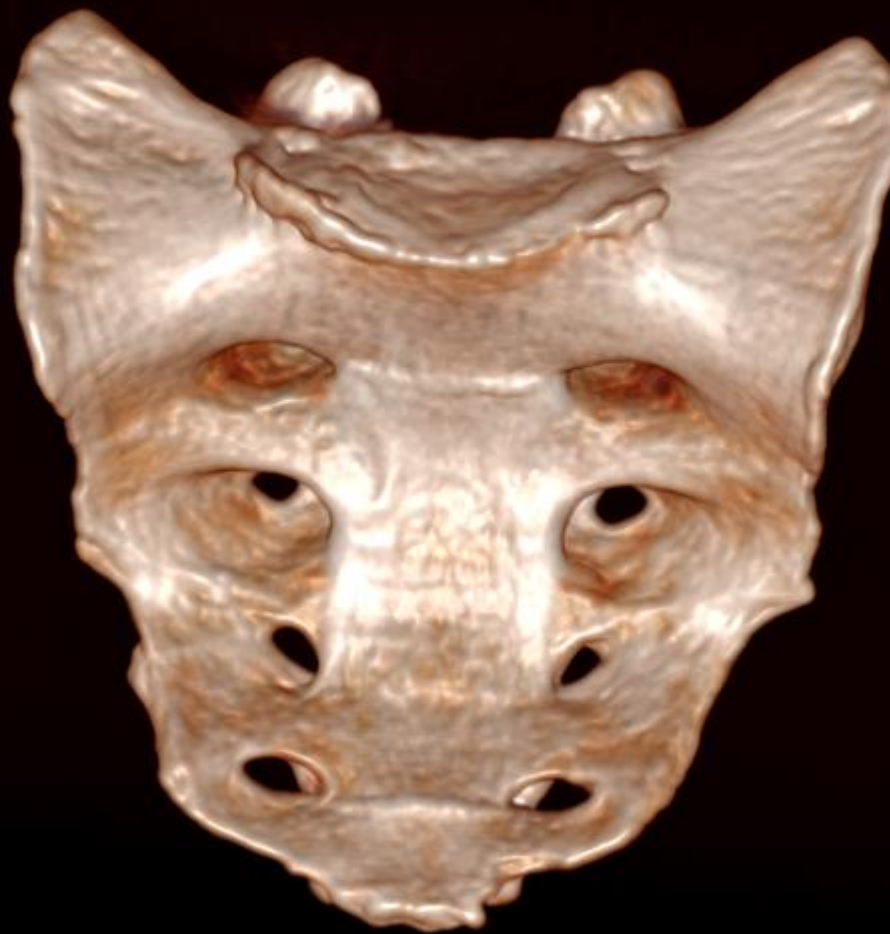
- MRI and CT features of SI joint disorders
- Advanced MR imaging (contrast, diffusion...)
- Treatment monitoring
- Interventional radiology

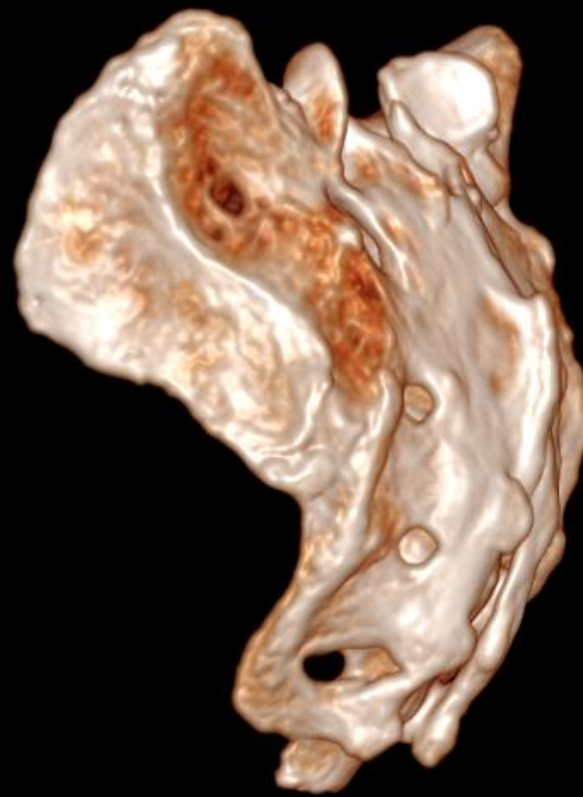
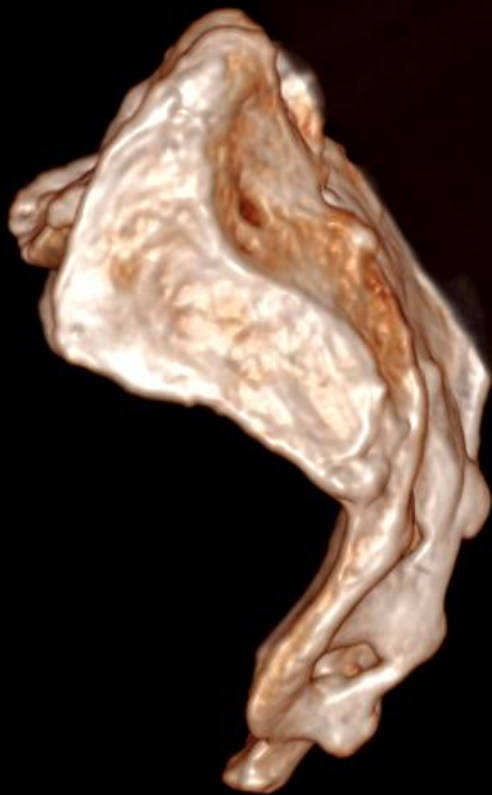
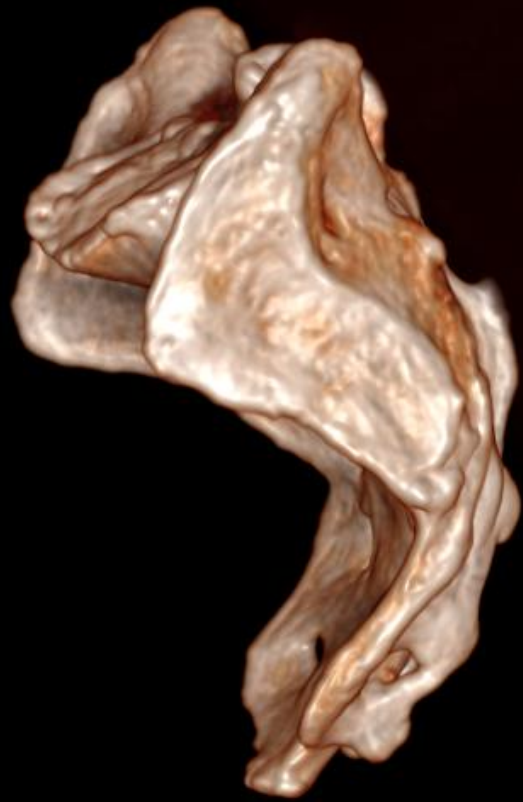
By the end of this presentation, you should

- coop with the anatomy of mature and immature SI joints and variants
- understand implications for imaging techniques
- Be aware of anatomy-related pitfalls

Anatomy of the sacroiliac joint

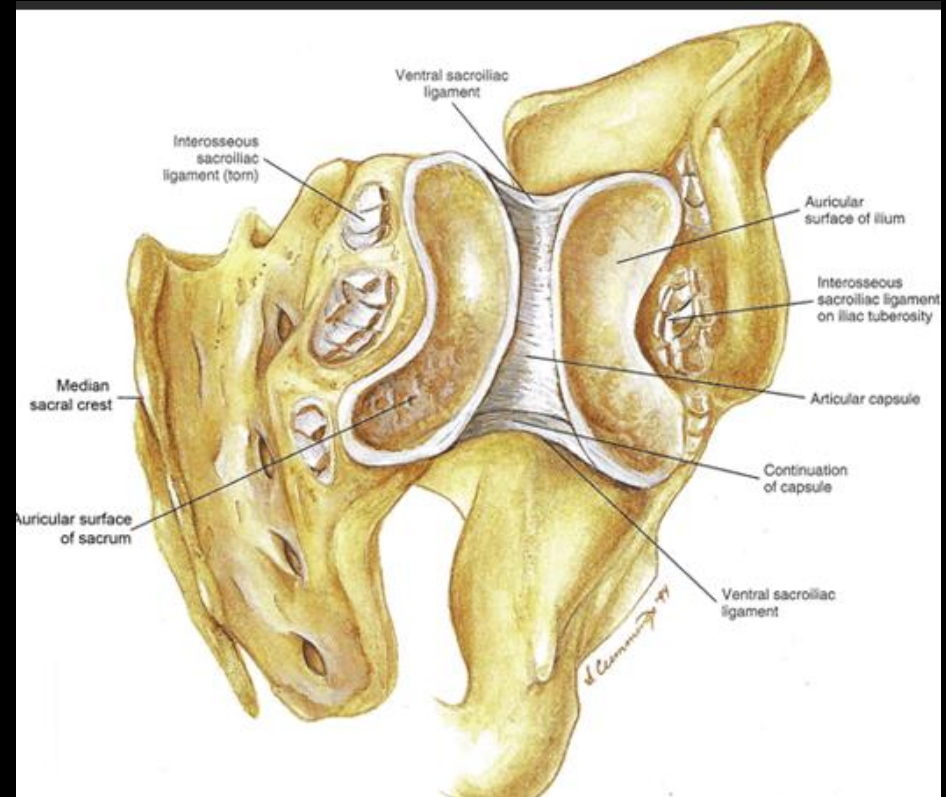






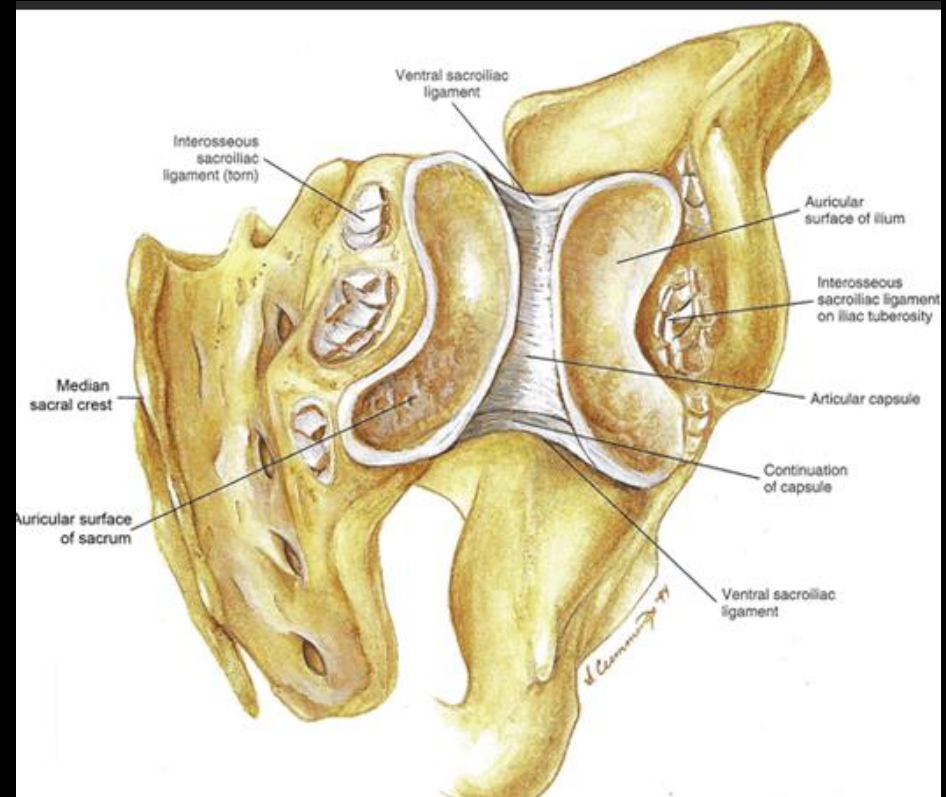
Normal sacro-iliac joint anatomy

- L- or C-shaped articular surfaces (auricular surfaces) on sacrum and iliac bones
- with thick sacral and thin iliac articular cartilage
- covering thin sacral and thick iliac subchondral bone plates
- anterior and inferior segments of SI interface



Normal sacro-iliac joint anatomy

- Fibrous SI joint without cartilage
- with thick ligaments
- Posterior and superior segments of SI interface



Comparative anatomy of intervertebral disc and sacro-iliac joint

Intervertebral disc

Sacro-iliac joint



Central

antero-inferior

thick nucleus pulposus

layer of fluid in articular space

No synovium

synovium



Peripheral

Postero-superior

annulus fibrosus

fibrous interface

fibrous connective tissue

fibrous and fatty connective tissue



Thin cartilaginous end-plate

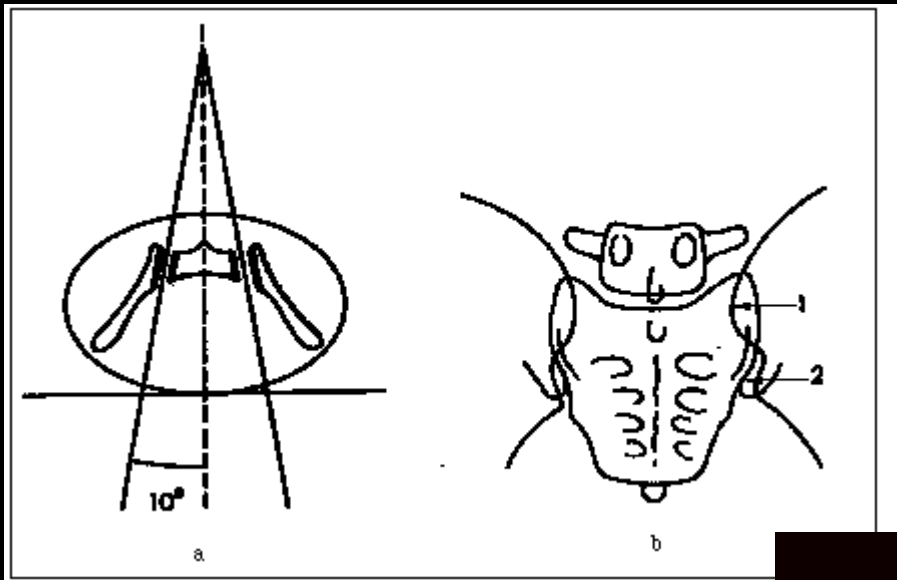
Thick cartilaginous end-plate

Zygapophyseal joints

No zygapophyseal joints

Strong ligaments and muscles

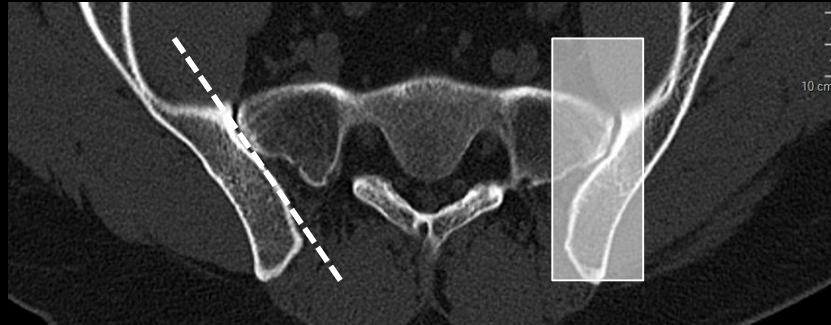
Strong ligaments and muscles



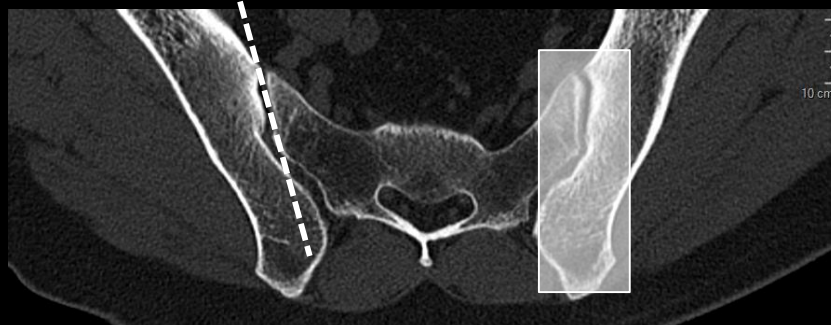
Cross-sectional anatomy

Transverse oblique CT reformats

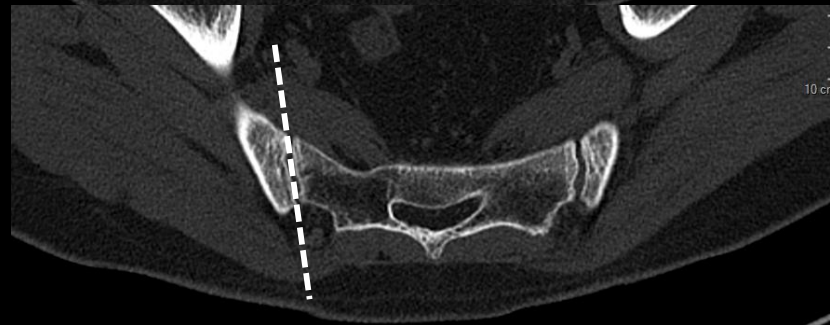
S1



S2



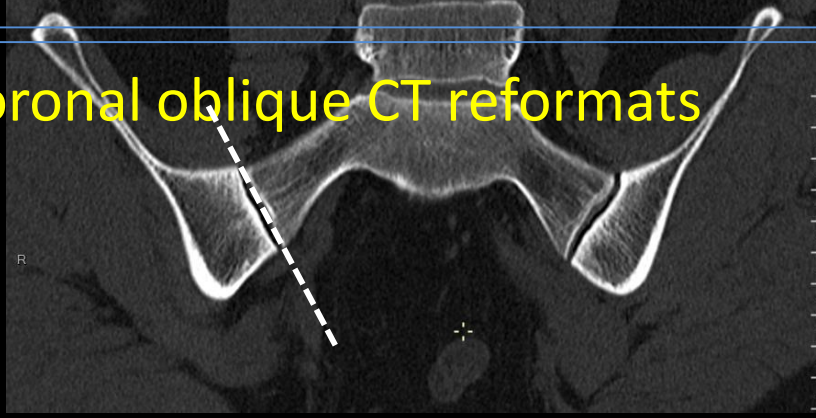
S3



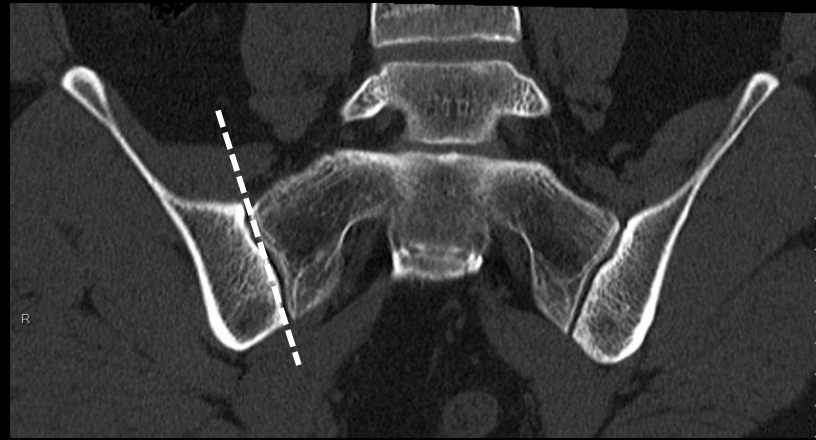
Cross-sectional anatomy

Coronal oblique CT reformats

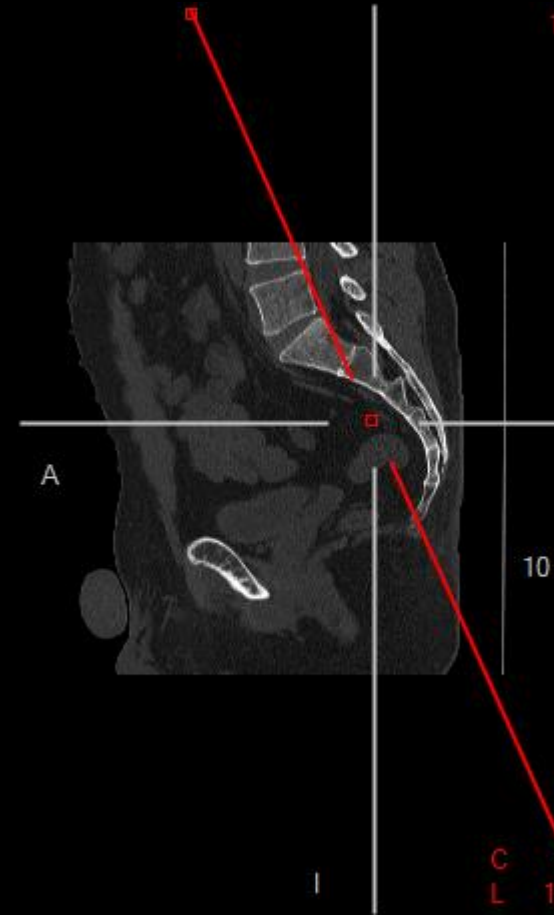
S1



S2



S3



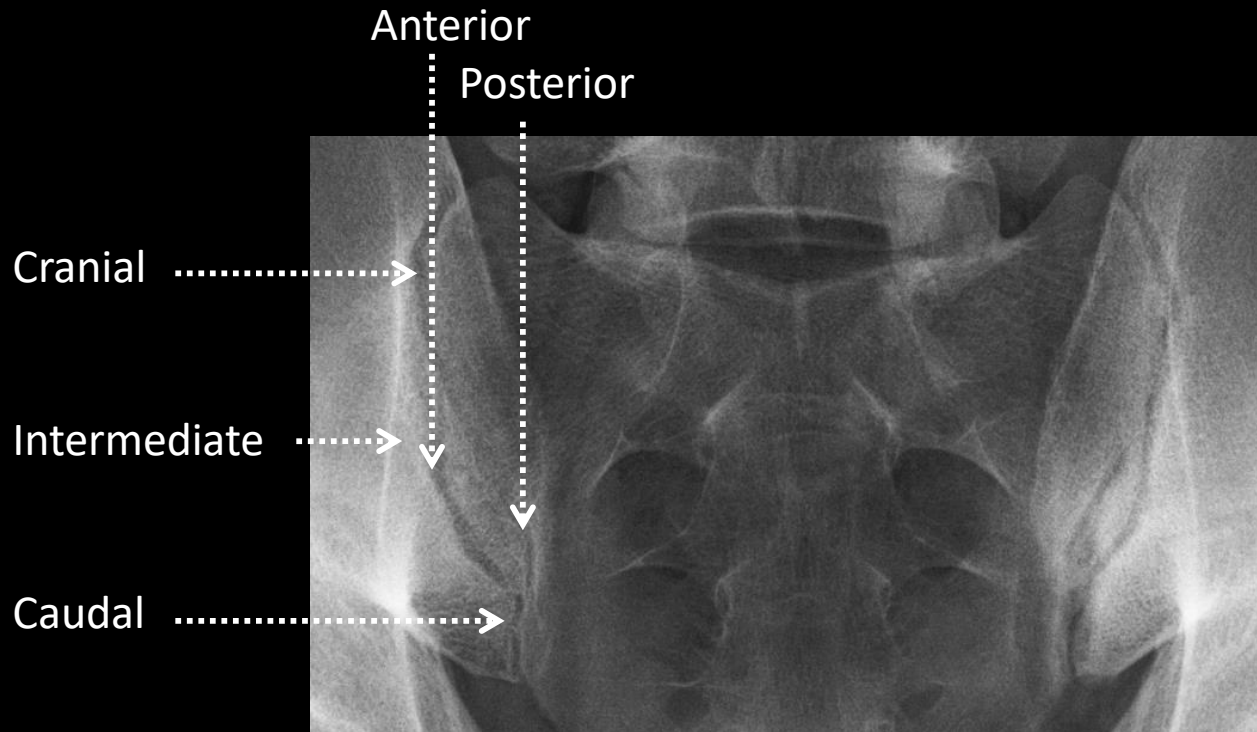
Radiological anatomy



Limitations of radiographic assessment

- No lateral view
- Overlapping soft tissues and bones
- No assessment of articular recesses
- Oblique and serpiginous orientation of articular surfaces
- (poor visibility of subchondral bone)

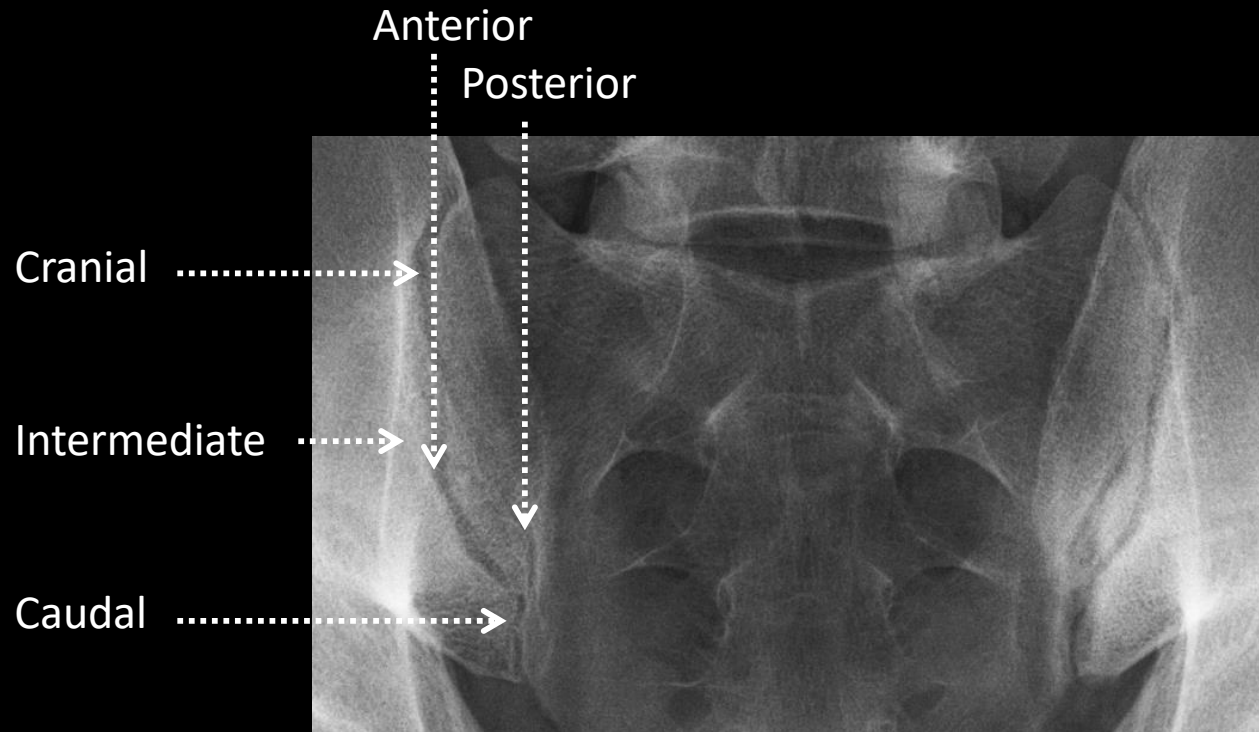
Radiological anatomy



Caudal segment of SI interface

- only cartilaginous interface
 - sagittal orientation
 - No degenerative changes (more specific if involved)
- less bony overlap
conspicuity of subchondral bone

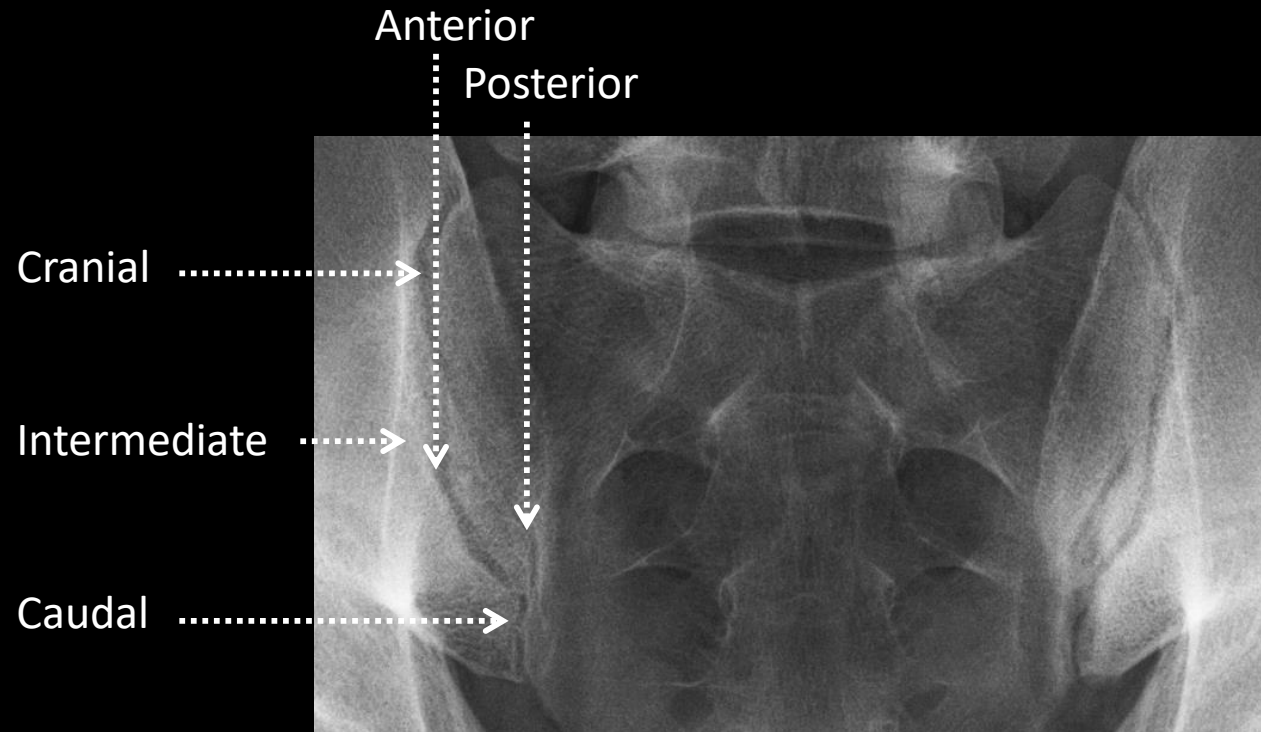
Radiological anatomy



Posterior segment of SI interface

- Cartilaginous and fibrous interface
- Frequent accessory sacro-iliac joints

Radiological anatomy

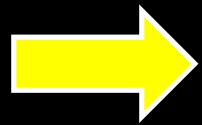


Intermediate segment of SI interface

- Cartilaginous and fibrous interface and posterior aspect of iliac wing
- Frontally orientated (limited conspicuity of subchondral bone)
- Frequent degenerative changes

Normal sacroiliac joint

Variants to be aware of



Anatomical variations of the normal SI joints

Immature sacro-iliac joint

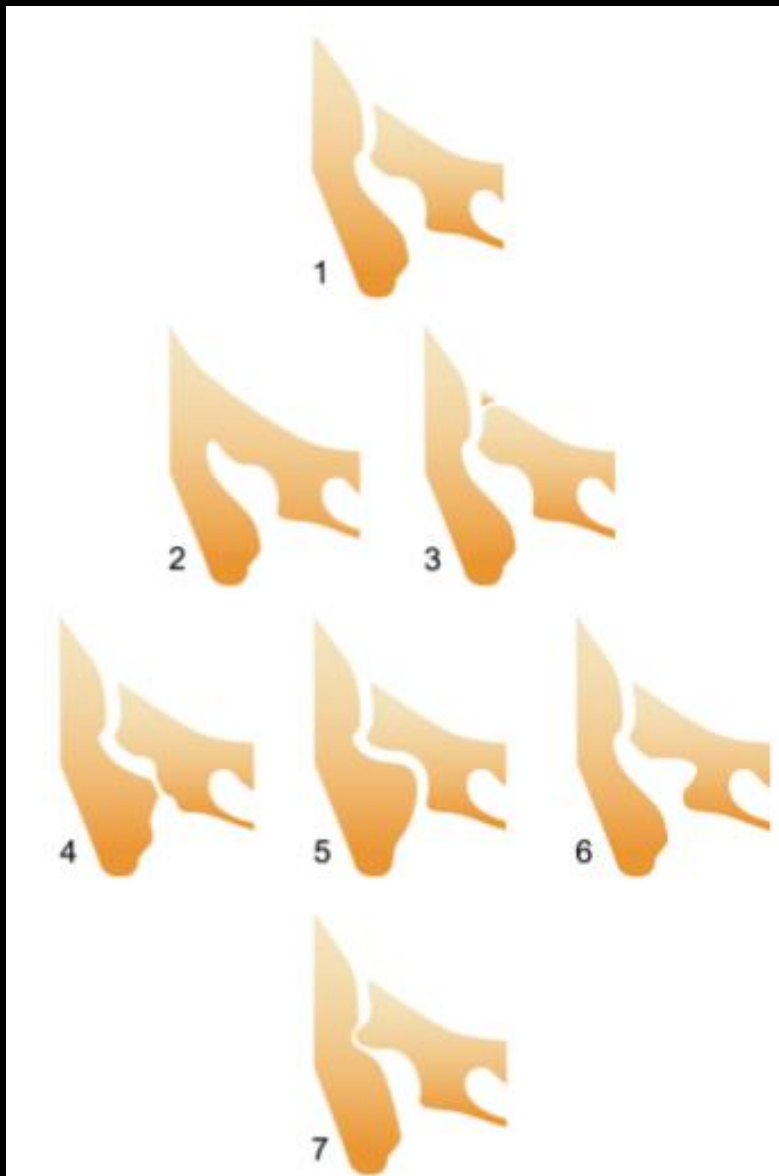
Ligamentous ossifications

Anatomical variations of SI joints

MRI 157 patients

Frequency (pts)

1	Normal sacroiliac joint	68%
2	Isolated SI synostosis	1%
3	Unfused apophysis	0%
4	Accessory SI joint	11%
5	Iliosacral complex	11%
6	Sacral defect	13%
7	Dysmorphic changes	17%



Sacroiliac joints: anatomical variations on MR images
Mazen El Rafei et al Eur Radiology 2018; 28: 5328-5337
<https://doi.org/10.1007/s00330-018-5540-x>

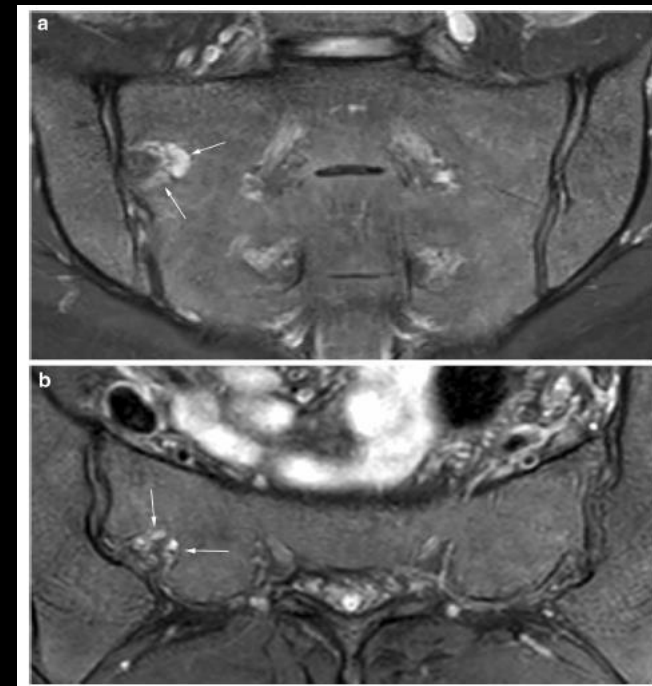
Bilateral ilio-sacral complex

- Prominent ilium
- Depressed sacrum
- Vascular engorgement



Unilateral right sacral defect

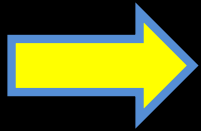
- Flat ilium
- Depressed sacrum
- Vascular engorgement



Normal sacroiliac joint

Variants to be aware of

Anatomical variations of the normal SI joints



Immature sacro-iliac joint

Ligamentous ossifications

Magnetic resonance imaging of sacroiliitis in children: frequency of findings and interobserver reliability

Katharine E. Orr^{1,2} · Savvas Andronikou¹  · Marc James Bramham^{1,2} · Izidora Holjar-Erlic¹ · Flavia Menegotto¹ · Athimalaipet V. Ramanan³

	Reader 1 (panel) and reader 2			Reader 1 (panel) and reader 3		
	Percentage agreement	Cohen κ	95% confidence interval	Percentage agreement	Cohen κ	95% confidence interval
Sacroiliitis	87%	0.51	0.27–0.72	72%	0.31	0.15–0.48
Bone marrow oedema	85%	0.38	0.12–0.61	75%	0.29	0.12–0.45
Erosion	93%	0.5	0.12–0.79	82%	0.33	0.14–0.51
Effusion	96%	0.32	N/A	60%	0.06	–0.02–0.16
Diffusion-weighted signal abnormality	88%	0.2	–0.06–0.50	90%	0.33	–0.02–0.62
Enhancement	86%	0.3	0.01–0.56	82%	0.28	0.05–0.51
Sclerosis	94%	0.24	0.00–0.58	88%	0.19	–0.08–0.48

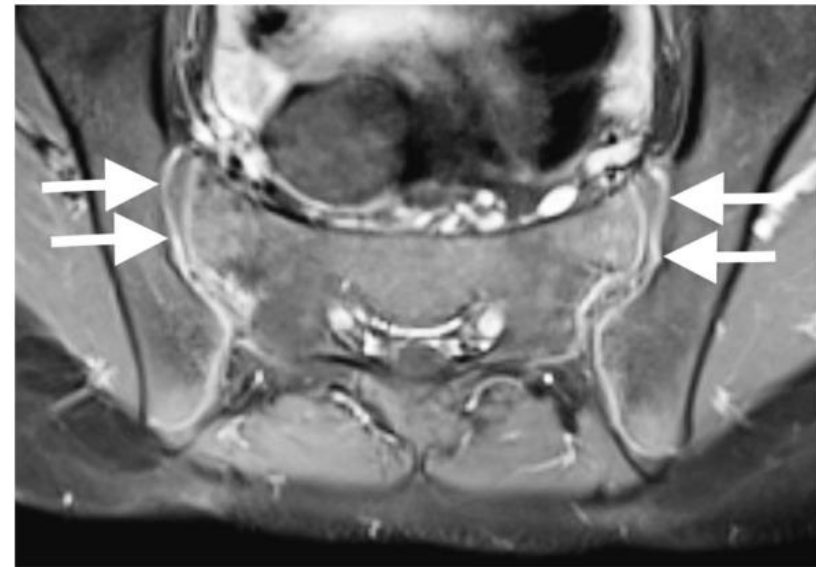


Fig. 4 A 12-year-old girl with mechanical back pain. **a** Contrast-enhanced T1-weighted image (TR 679 ms, TE 12 ms) demonstrates smooth synovial enhancement (*arrows*) of both sacroiliac joints in the absence of other findings. The authors believe this may be a normal finding

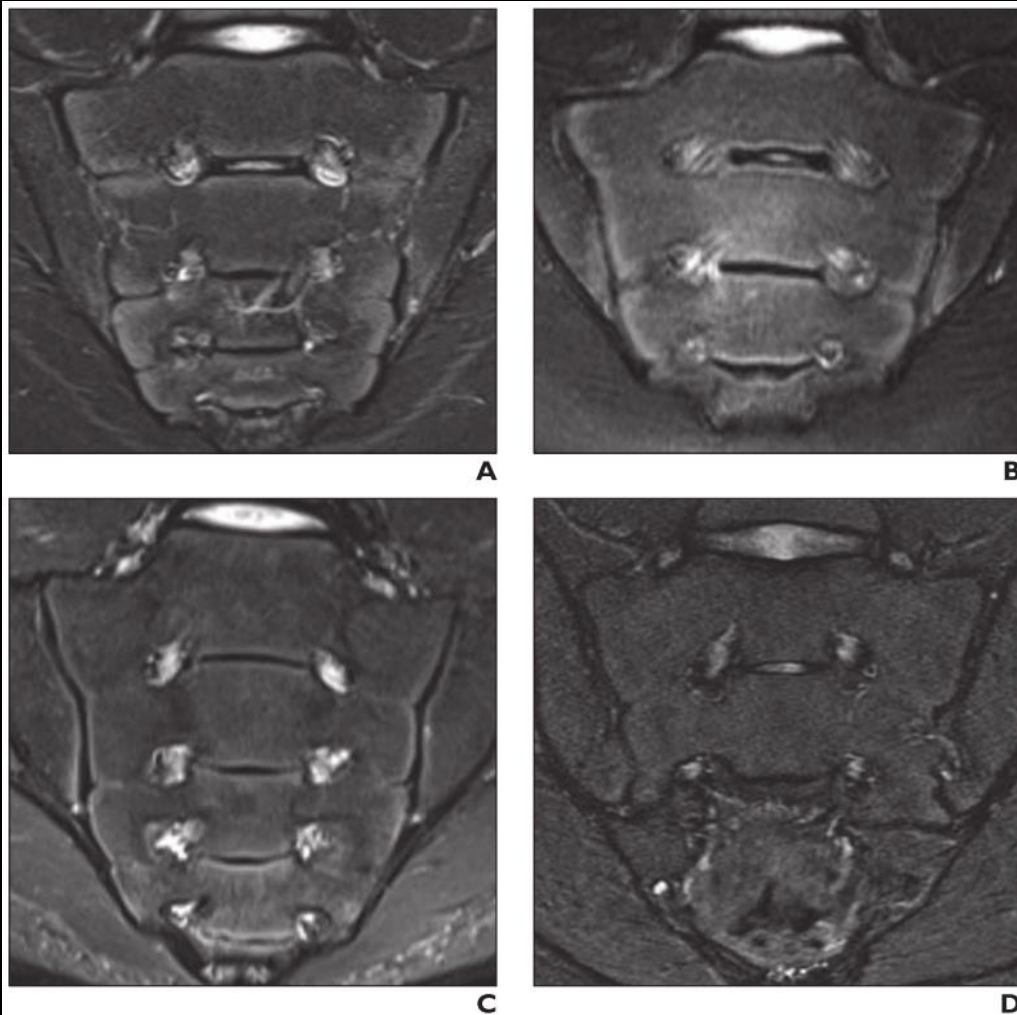
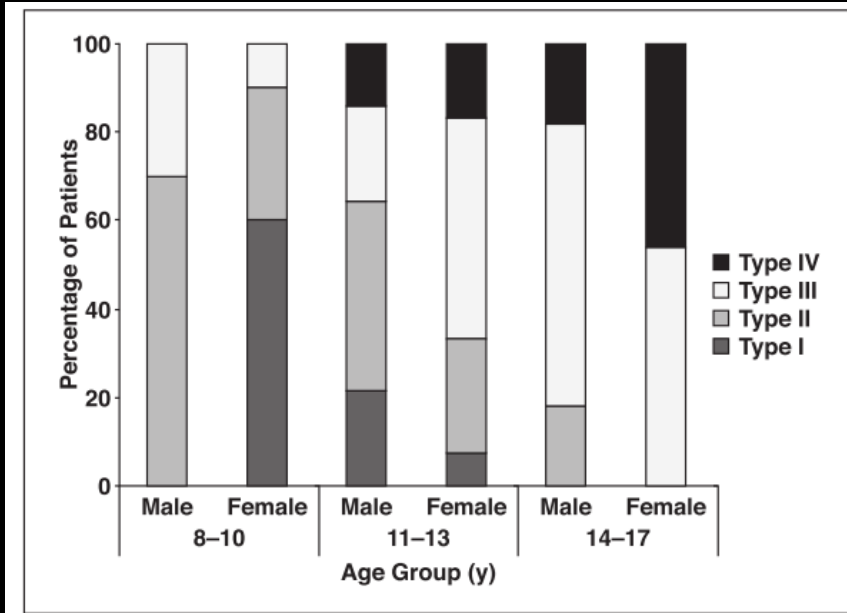


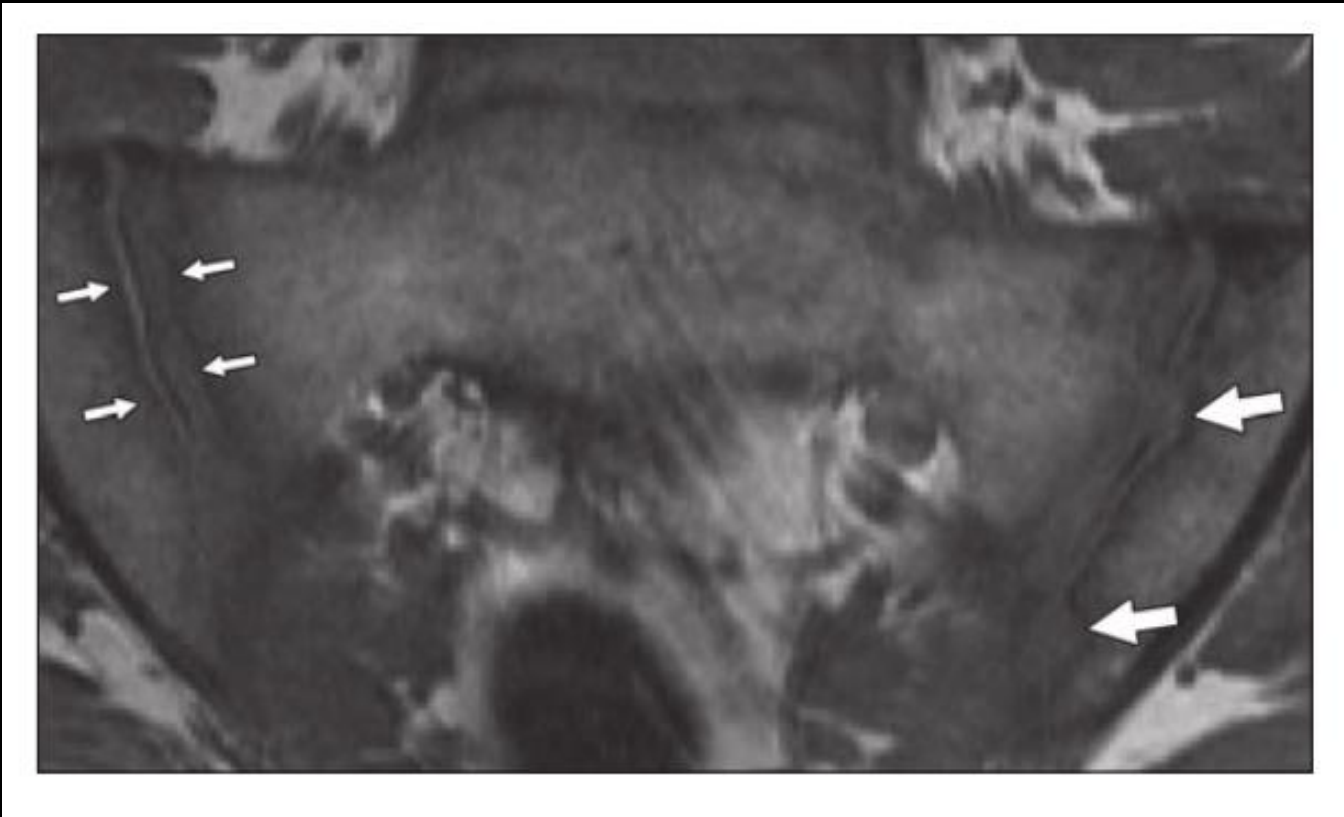
Fig. 1—MR images show classification of metaphyseal-equivalent signal intensity.
A, Type I signal is defined as distinct homogeneously increased metaphyseal-equivalent uniform signal that also extends along unfused sacral apophyses. Patient is 8-year-old boy.
B, Type II signal is defined as homogeneously increased metaphyseal-equivalent signal that is indistinct and only partially extends along partially fused sacral apophyses. Patient is 10-year-old girl.
C, Type III signal is defined as minimally uniform metaphyseal-equivalent increased signal with mostly fused sacral apophyses. Patient is 13-year-old boy.
D, Type IV signal is defined as no metaphyseal-equivalent increased signal identified. Patient is 16-year-old girl.



A-C vs D
 Kappa 0,49

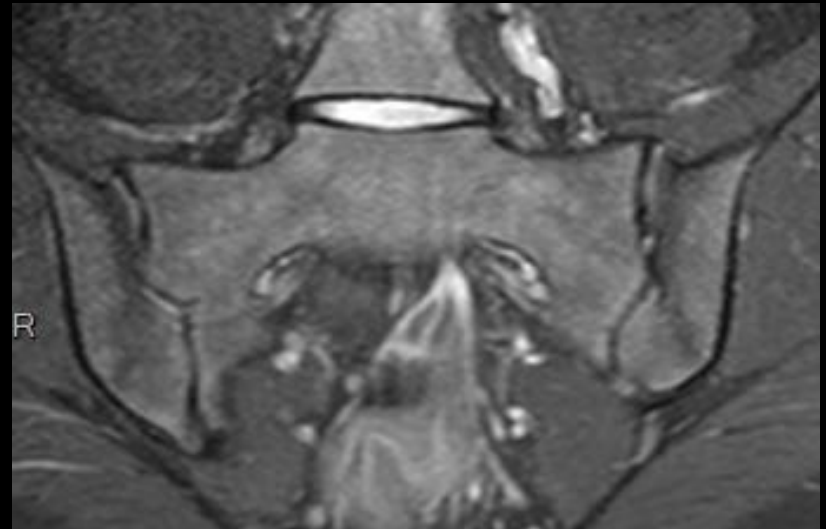
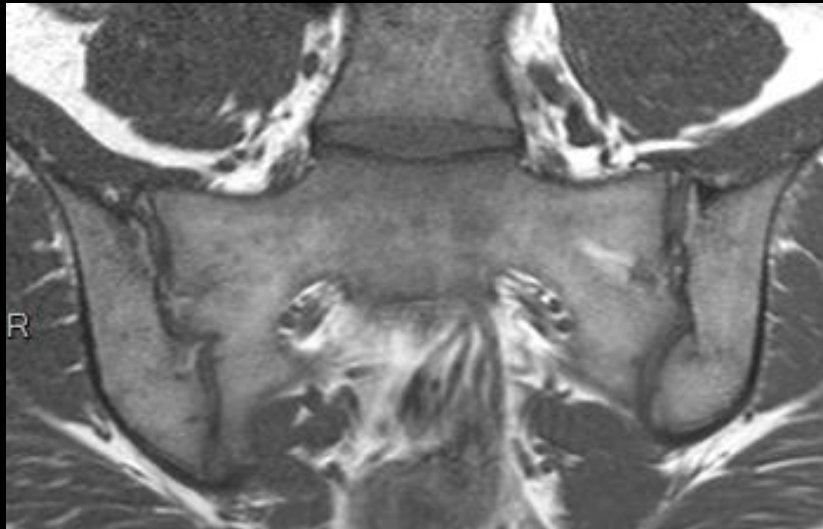
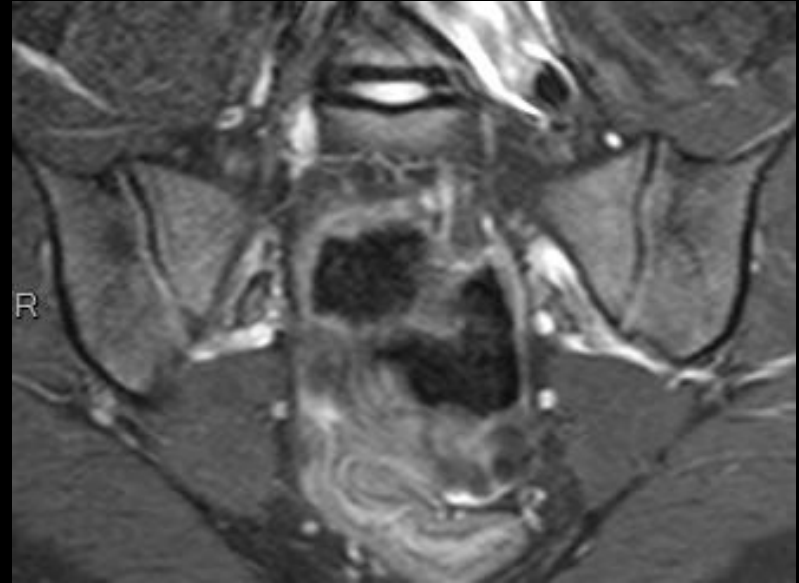
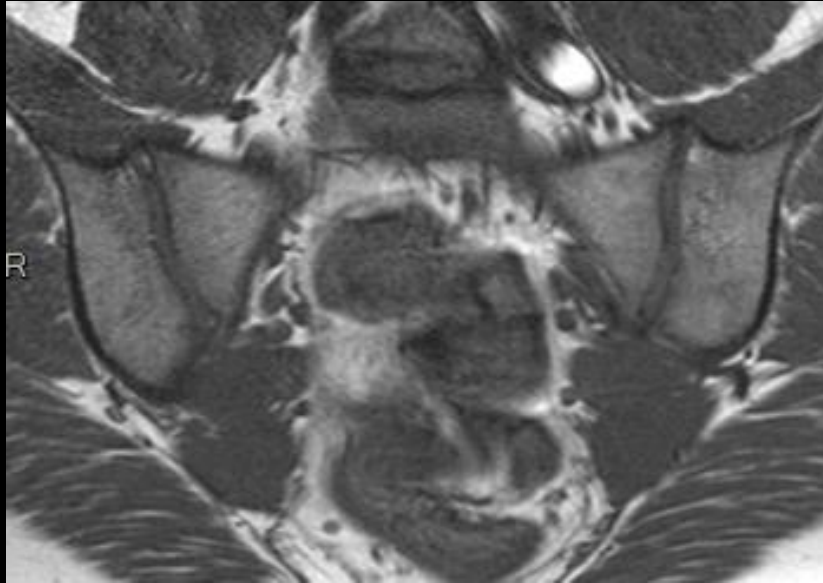
« SI joint cortical irregularities »

- 57% of patient/joints
- Iliac/sacrum: 51%/11%
- Upper/lower : 43%/27%
- No age difference
- Kappa: 0,20

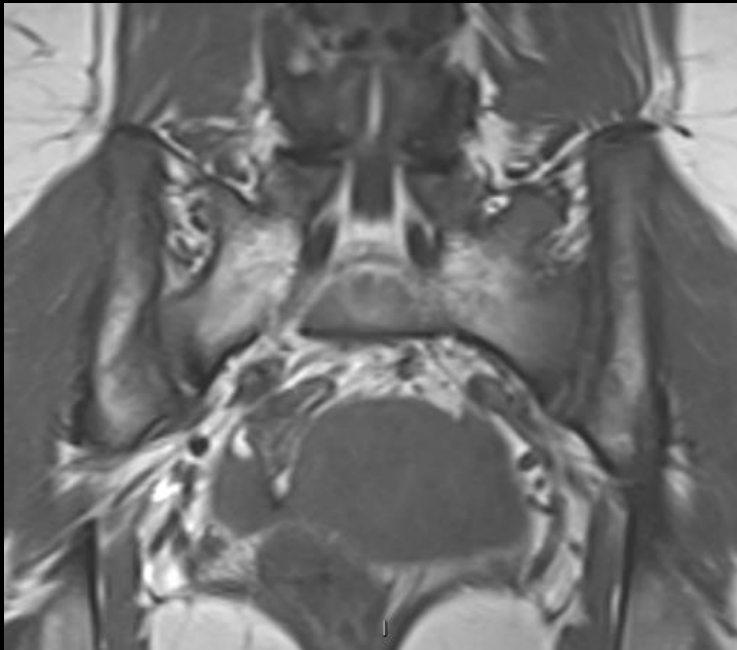


Chauvin NA et al, MRI of the Sacroiliac Joint in Healthy Children.
AJR Am J Roentgenol. 2019 Apr 11:1-7. doi:10.2214/AJR.18.20708.

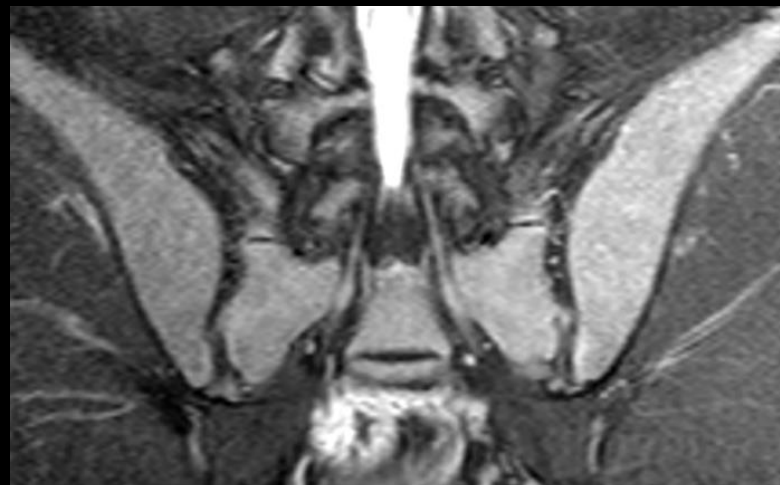
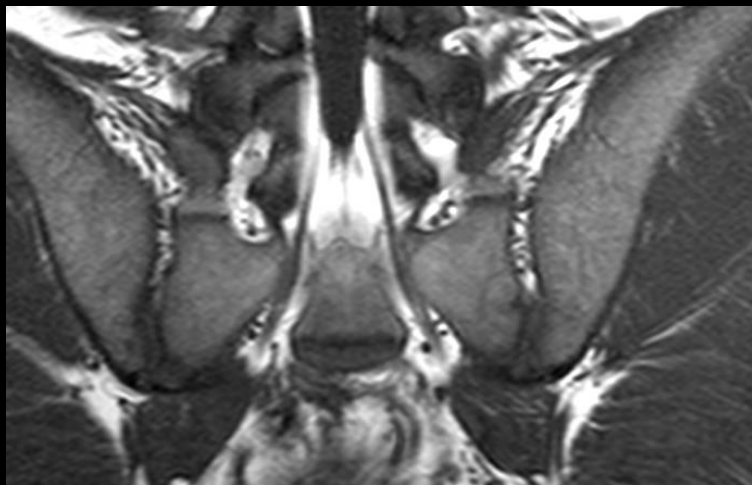
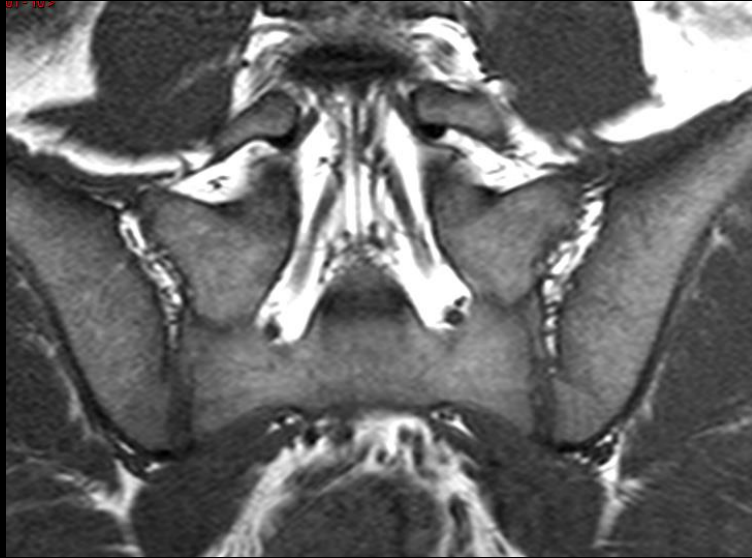
Normal SI joints
15-year-old girl



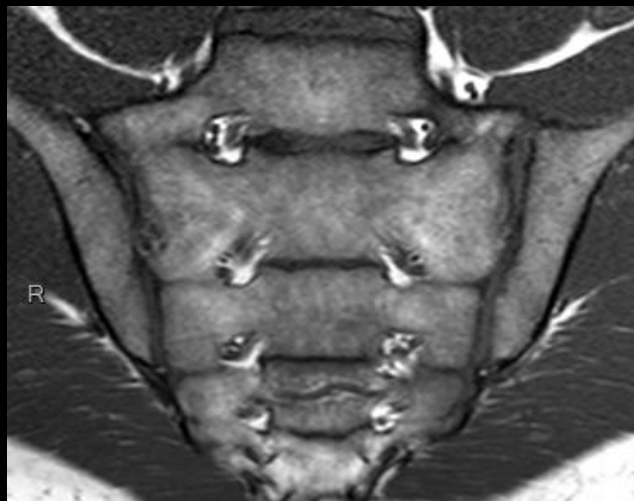
Normal SI joints
17-year-old girl



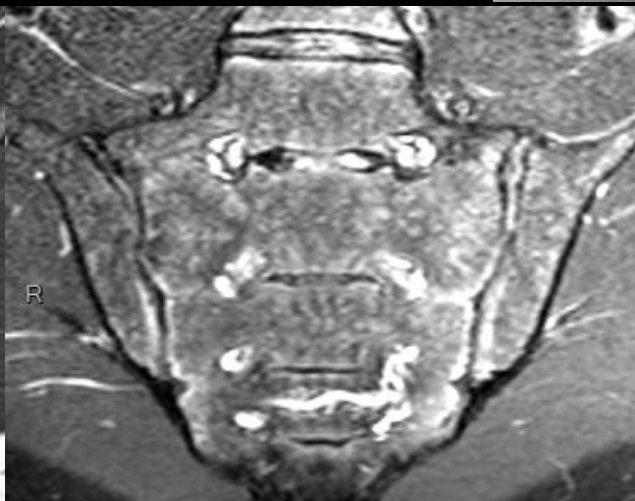
Normal SI joints
20-year-old man



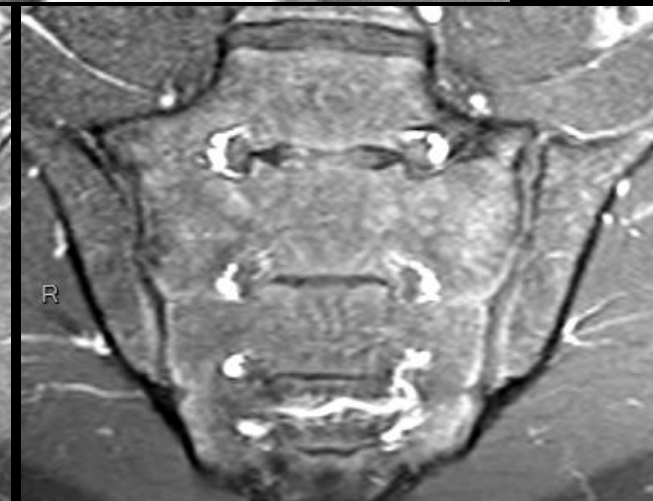
Normal SI joints
23-year-old man



SE T1



fs PD



Gd-enh. fs SE T1

Normal SI joints
23-year-old man

Subtle bilateral and symmetrical changes
Compatible with metaphyseal-equivalent changes



SE T1

fs PD

Gd-enh. fs SE T1



SE T1

fs PD

Gd-enh. fs SE T1



fs PD



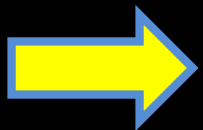
Gd-enh. fs SE T1

Normal sacroiliac joint

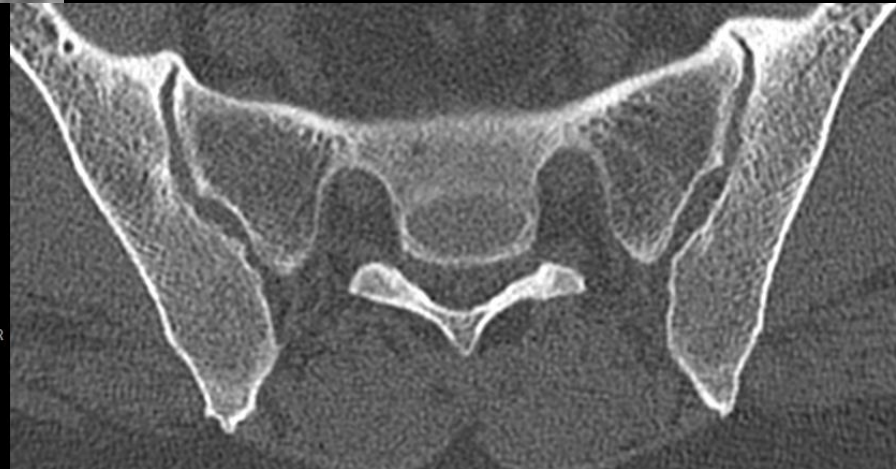
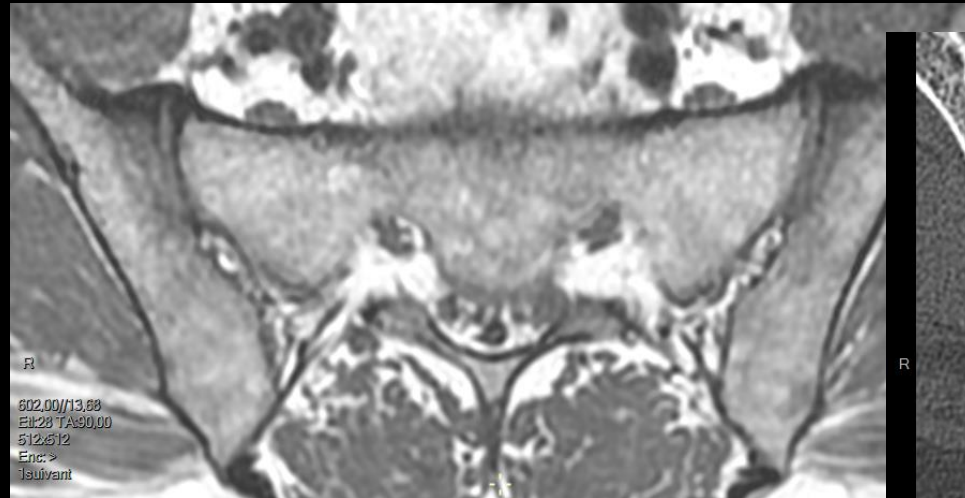
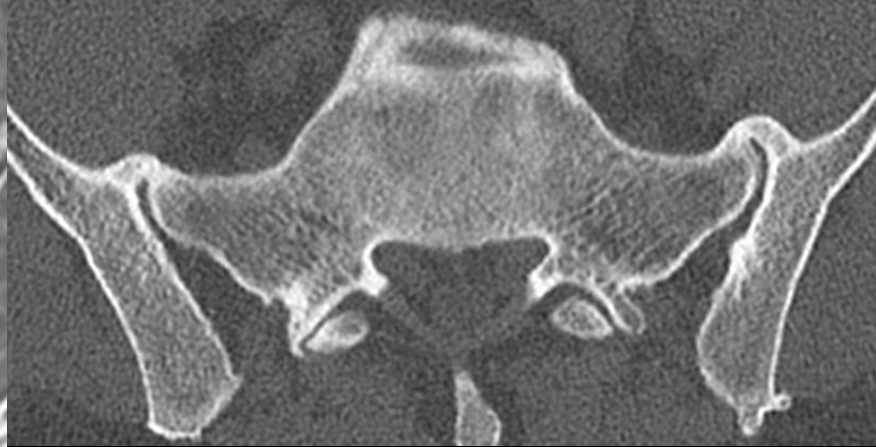
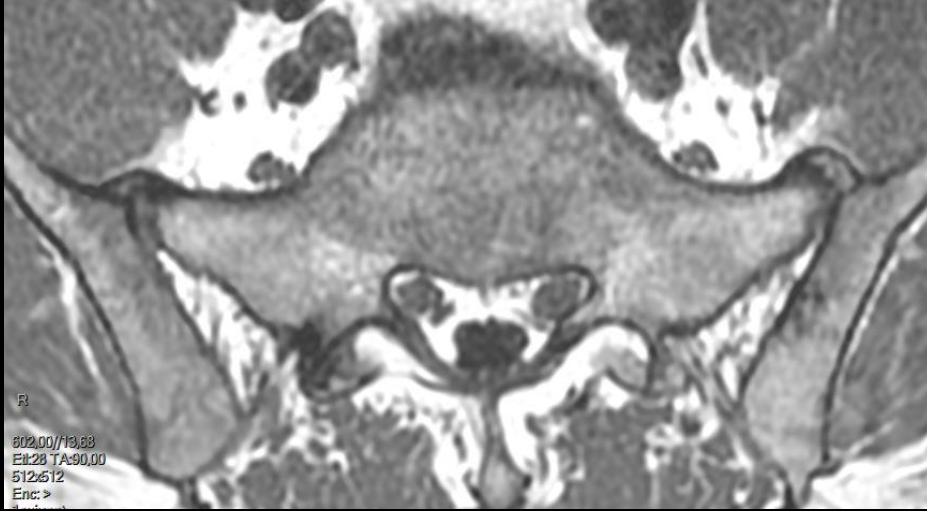
Variants to be aware of

Anatomical variations of the normal SI joints

Immature sacro-iliac joint



Ligamentous ossifications



Anatomy-related pitfalls at SI imaging

Soft tissue involvement in SI diseases

Trans-articular extent by bone tumors

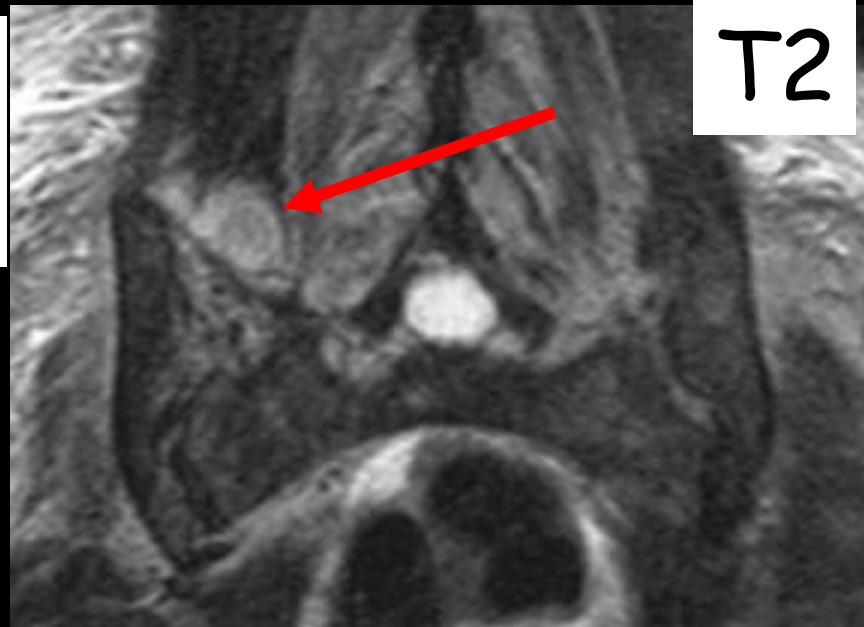
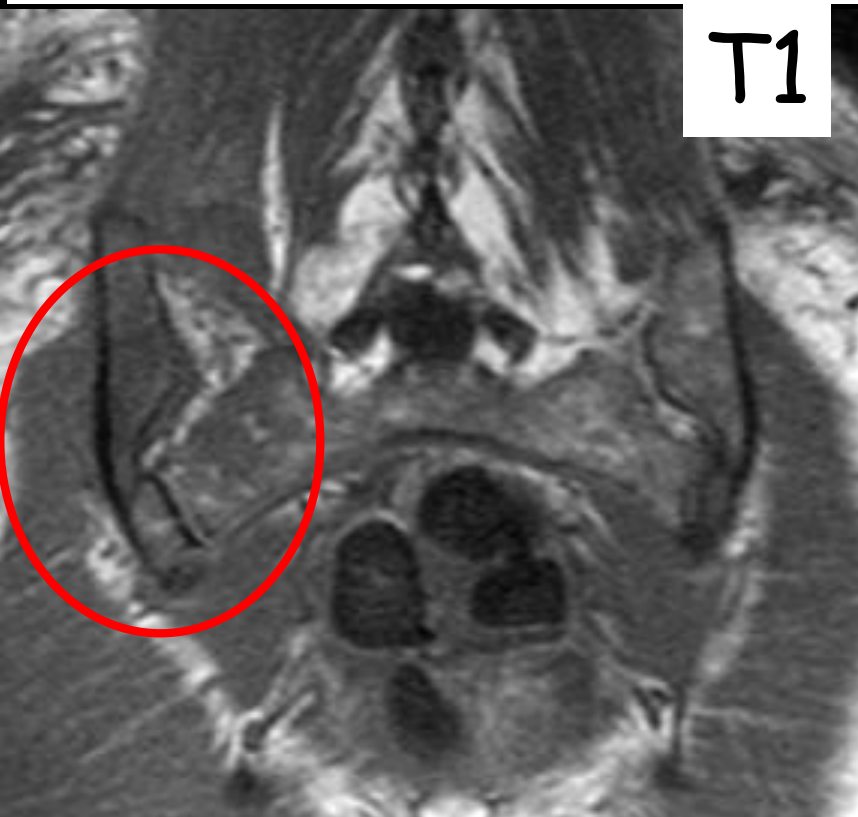
Anatomy-related pitfalls at SI imaging

Soft tissue involvement in SI diseases

- very limited articular space
tight capsule

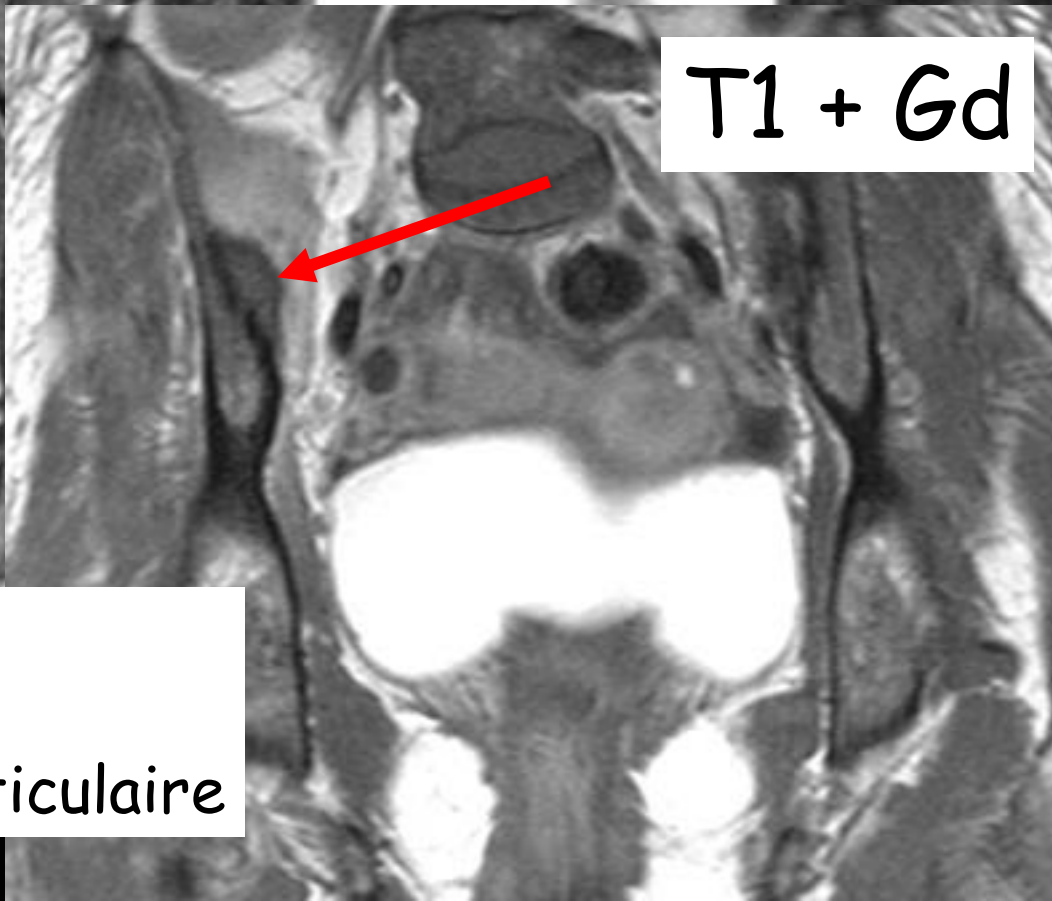
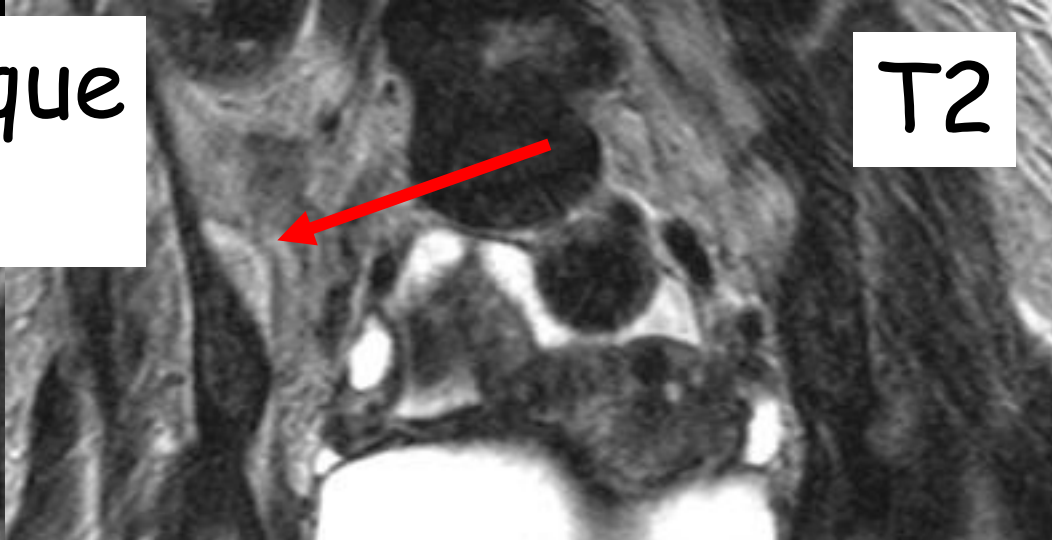
Abcess at distance from the joint

Sacro-iliite septique IRM



Altérations **spécifiques**
abcès tissus mous
atteinte espace articulaire

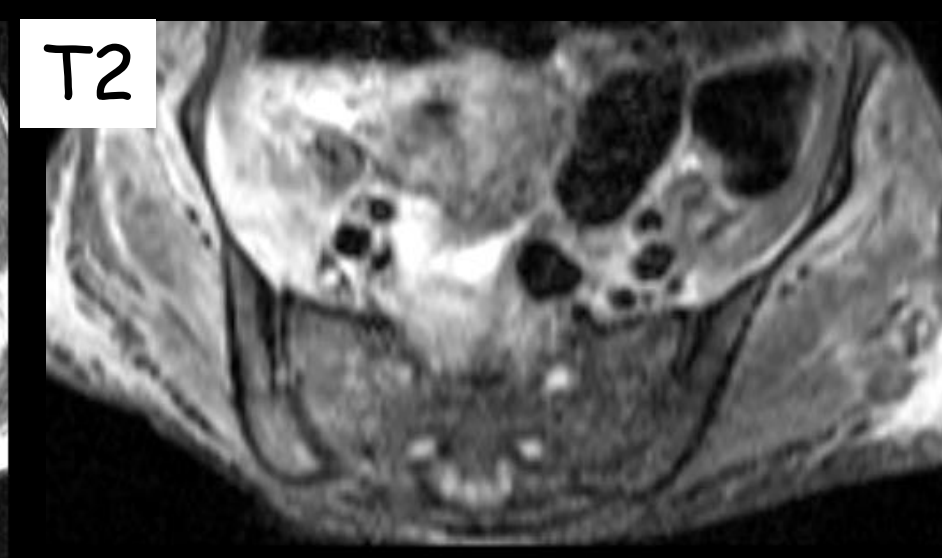
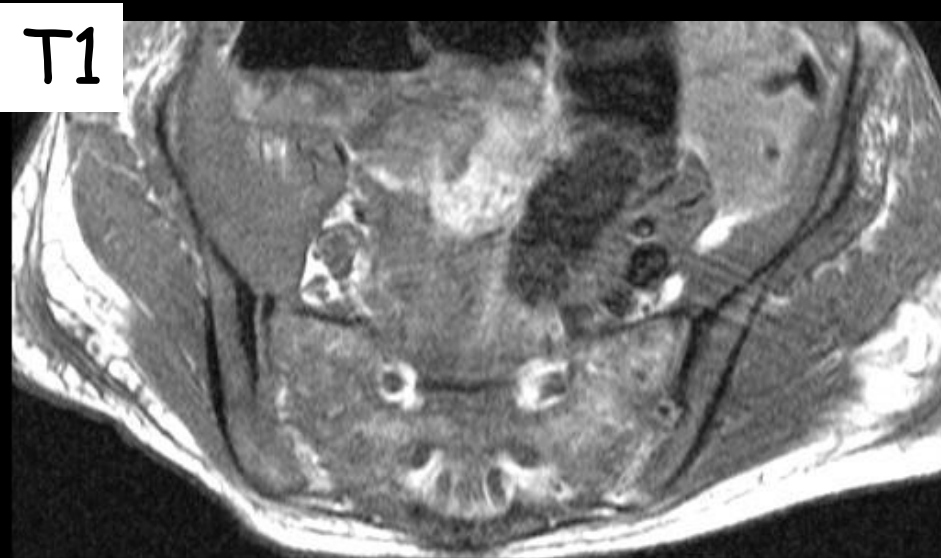
Sacro-iliite septique IRM

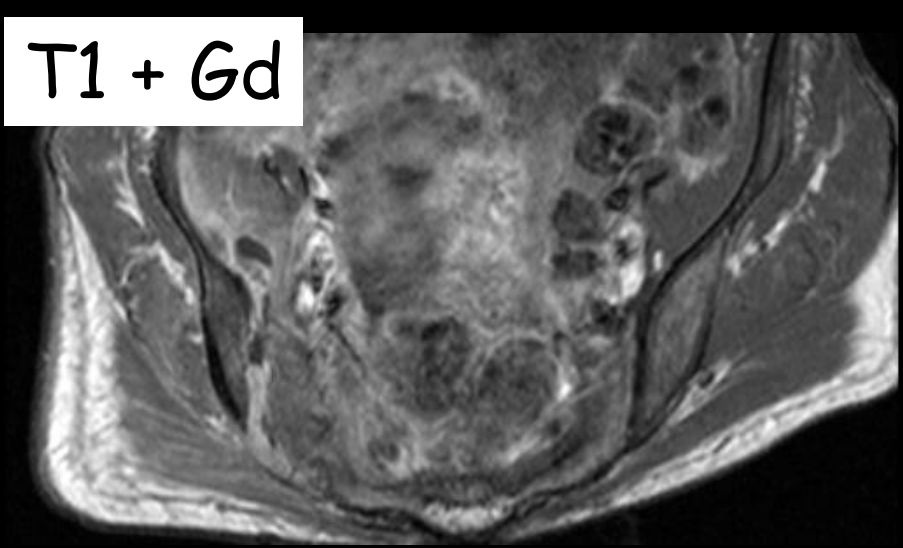
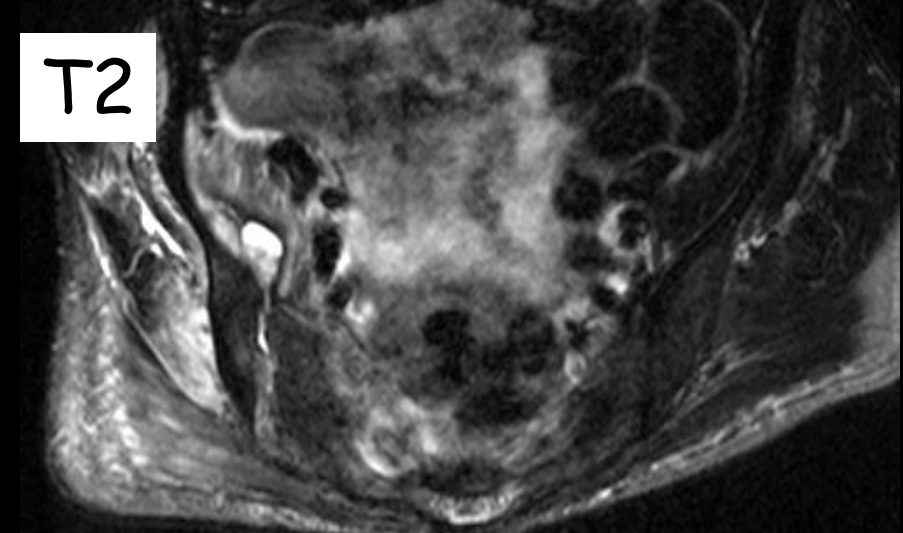
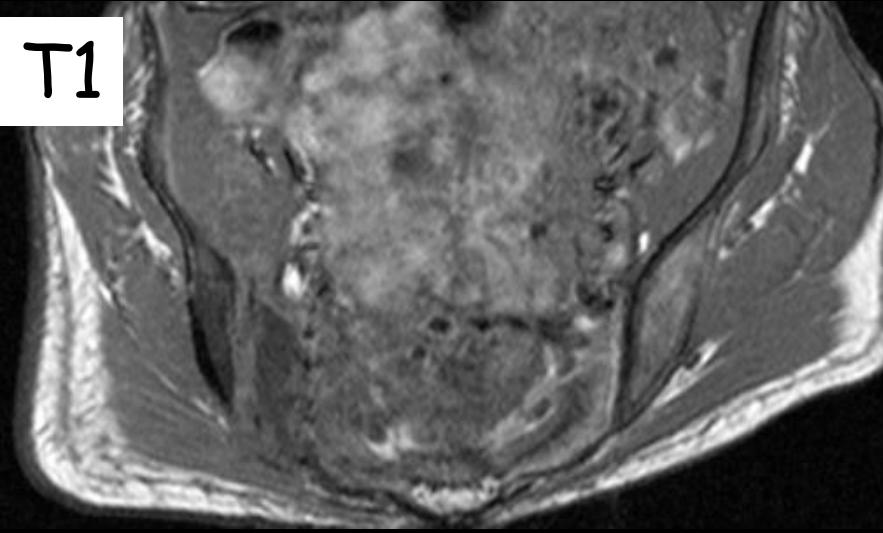


Altérations **spécifiques**
abcès tissus mous
atteinte espace articulaire

IRM - difficulté diagnostique

Atteinte articulaire à l'arrière-plan





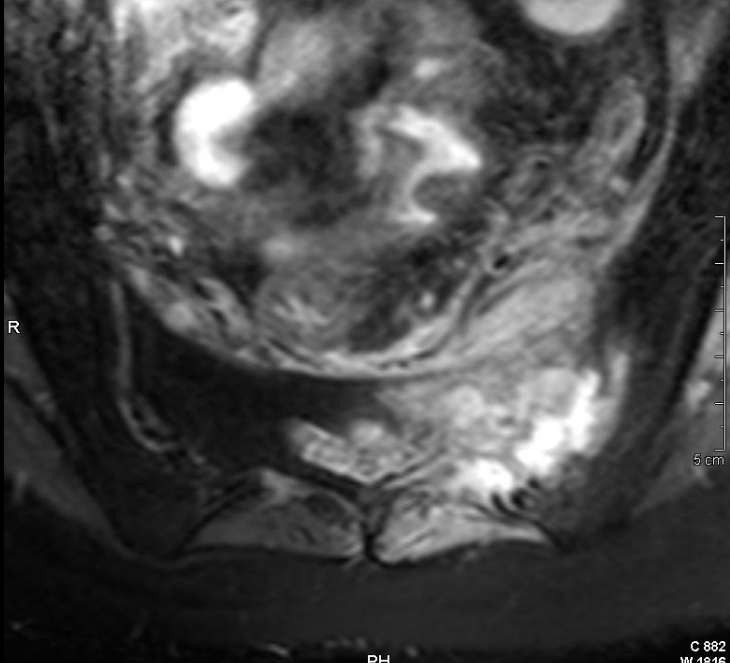
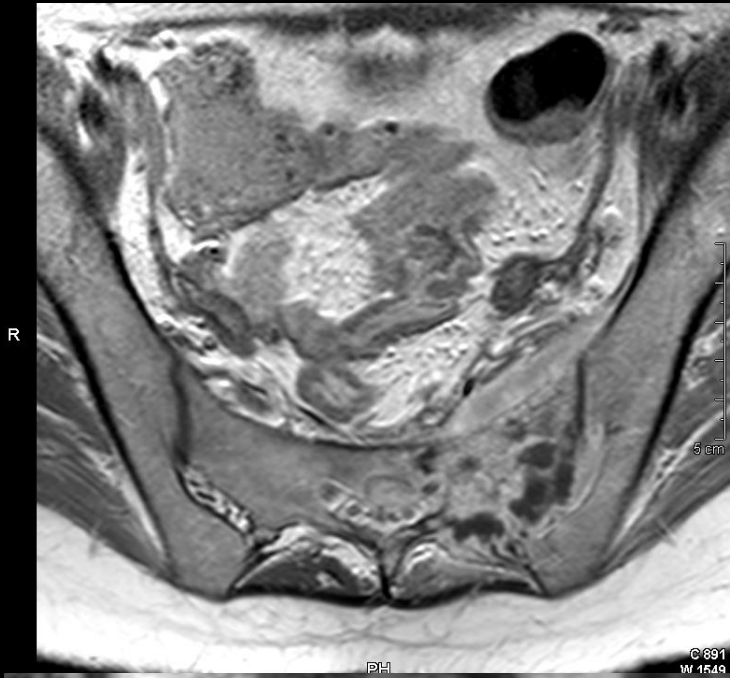
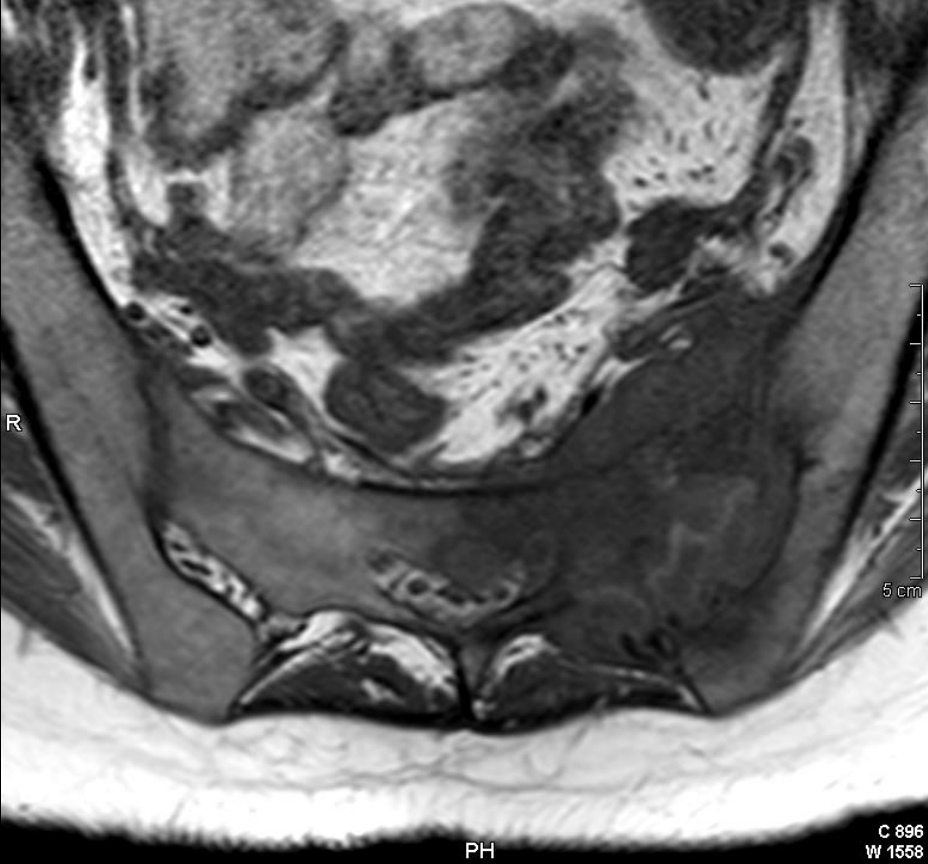
Anatomy-related pitfalls at SI imaging

Trans-articular extent by bone tumors

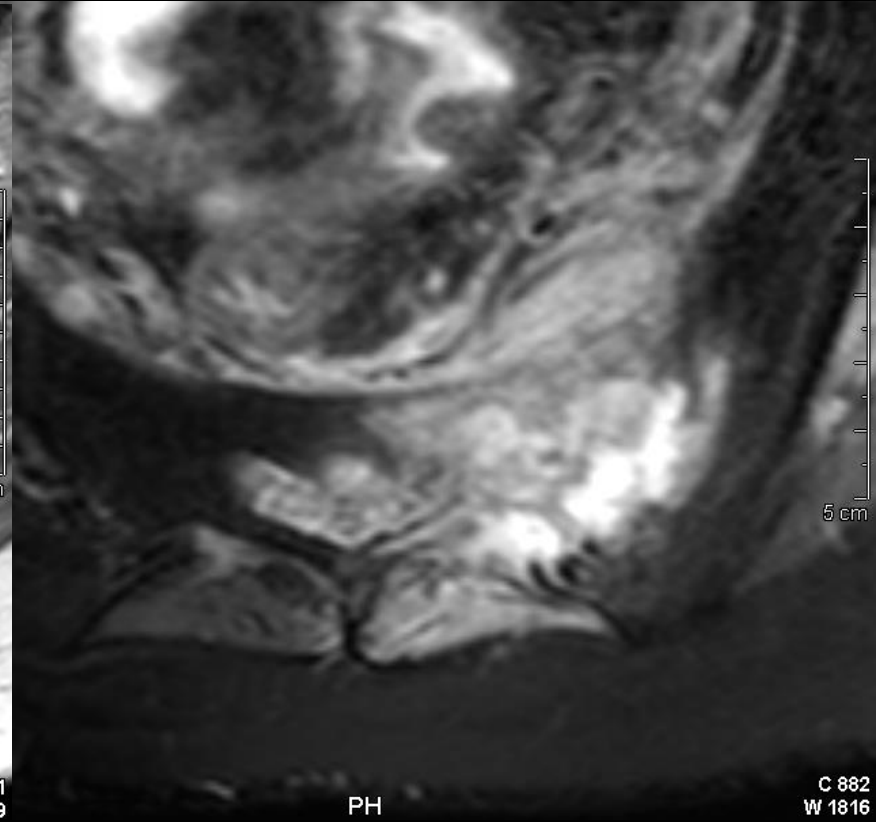
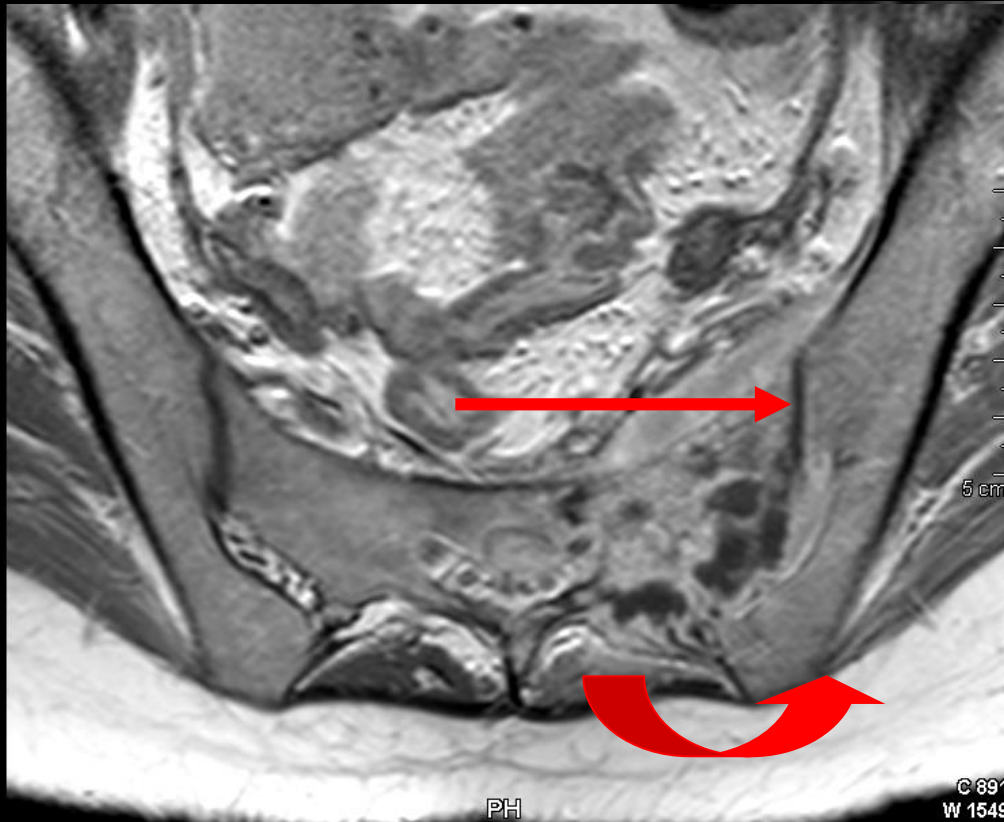
If involvement of both sides,
check the articular part of the joint

- **Inflammatory diseases** may involve the cartilage
- **Neoplastic diseases** spare the cartilage

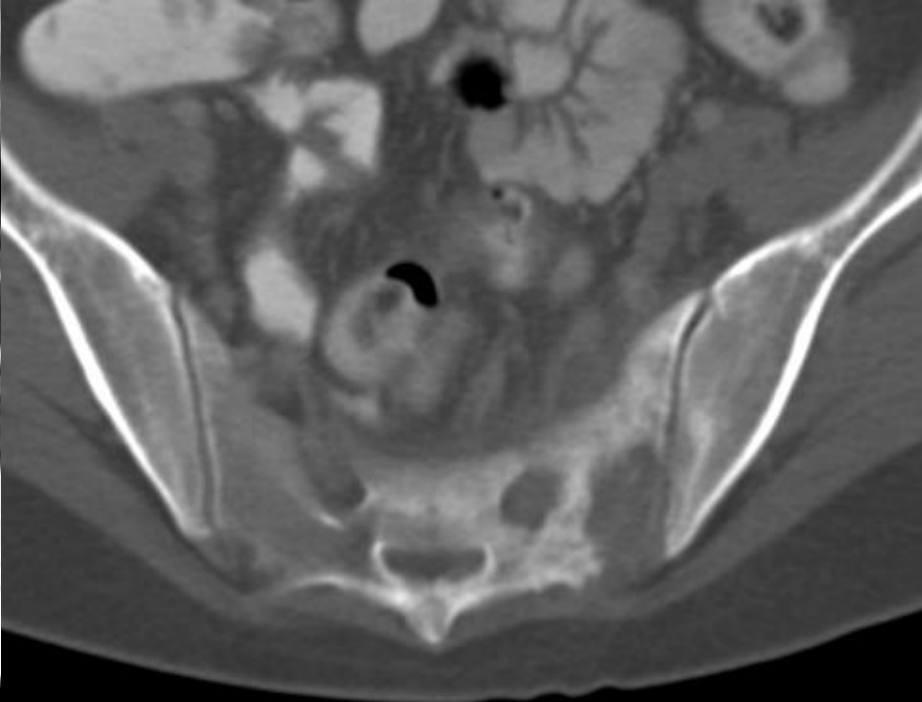
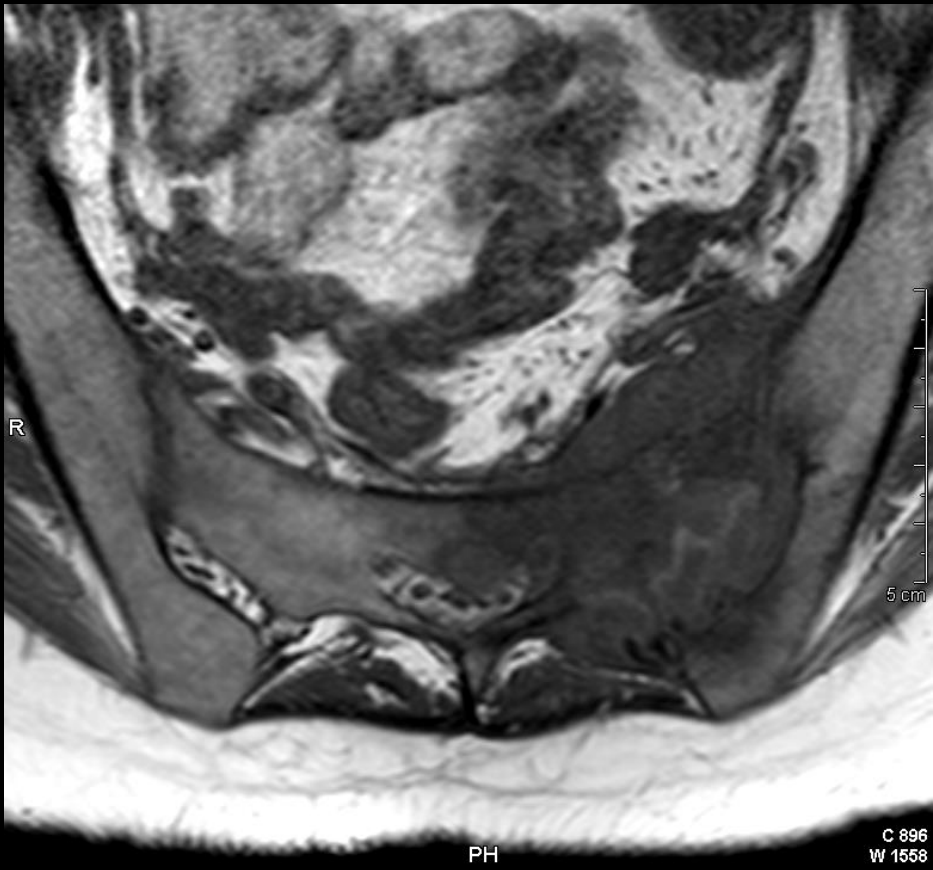
Inflammatory vs neoplastic ?



Inflammatory vs neoplastic ?



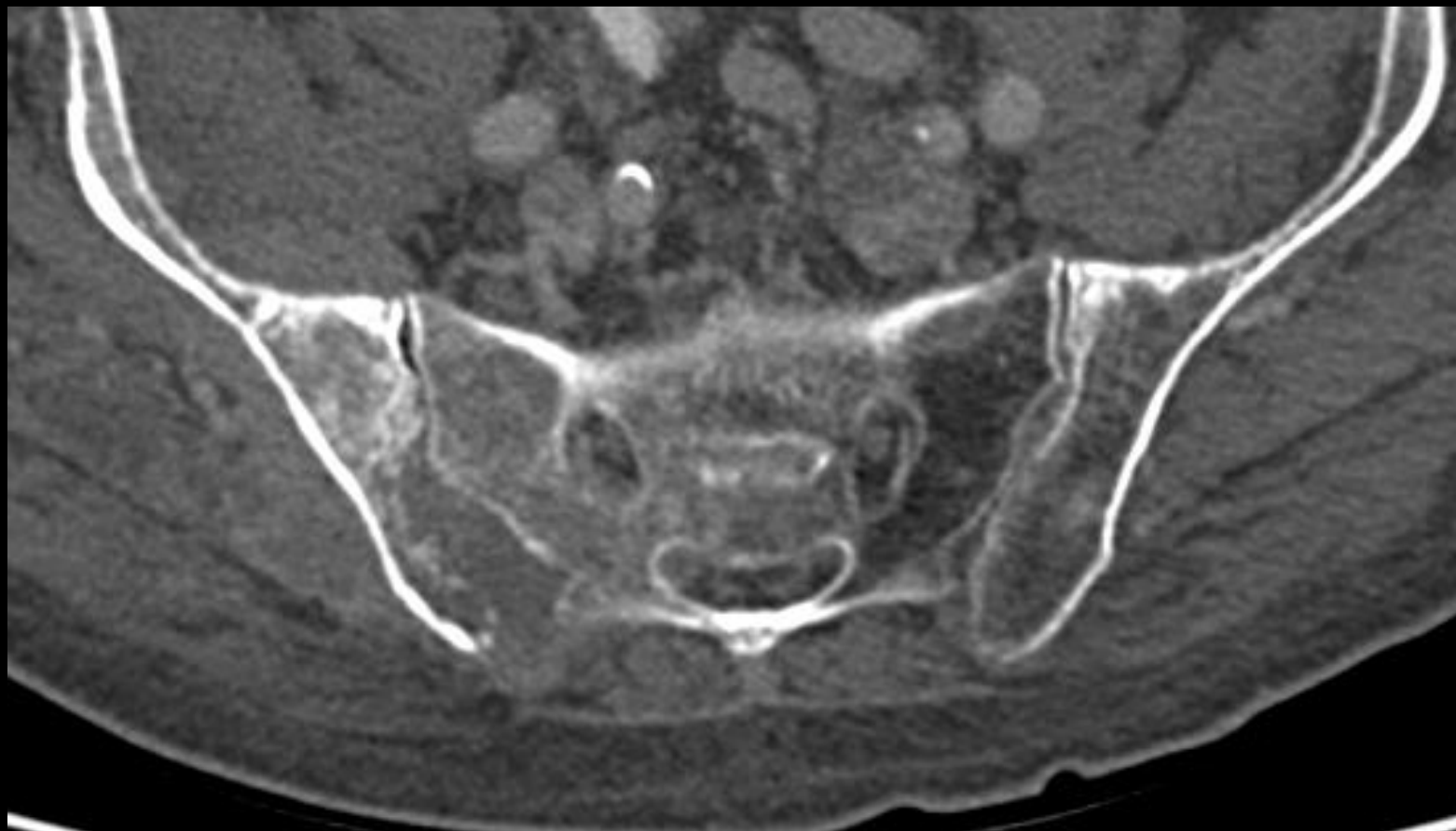
Articular component of SI interface is preserved
Interosseous extension through fibrous joint



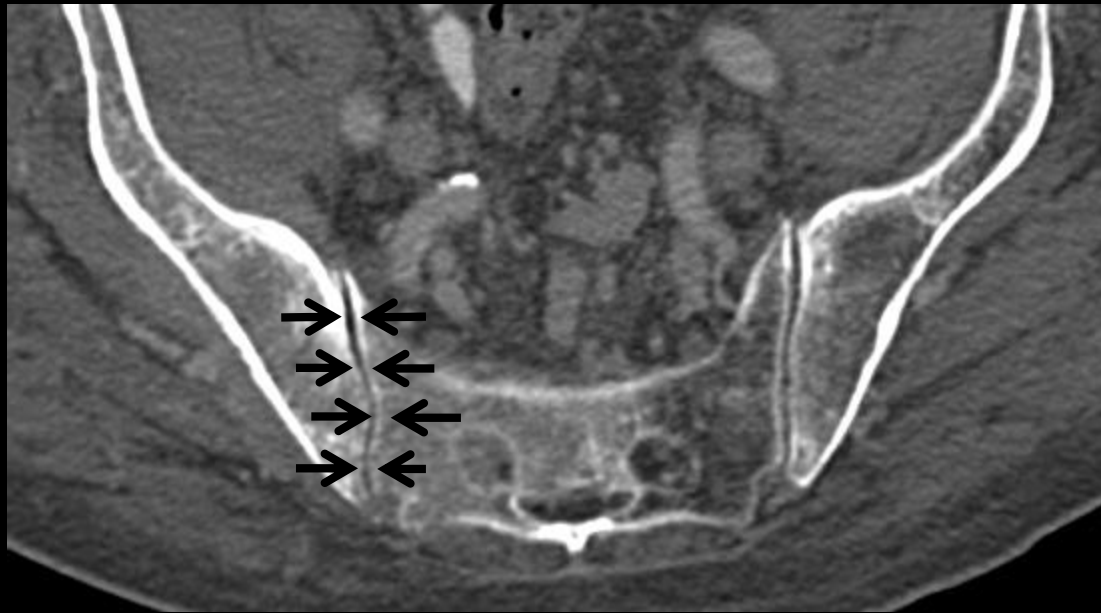
Lymphoma

Articular component of SI interface is preserved
Interosseous extension through fibrous joint

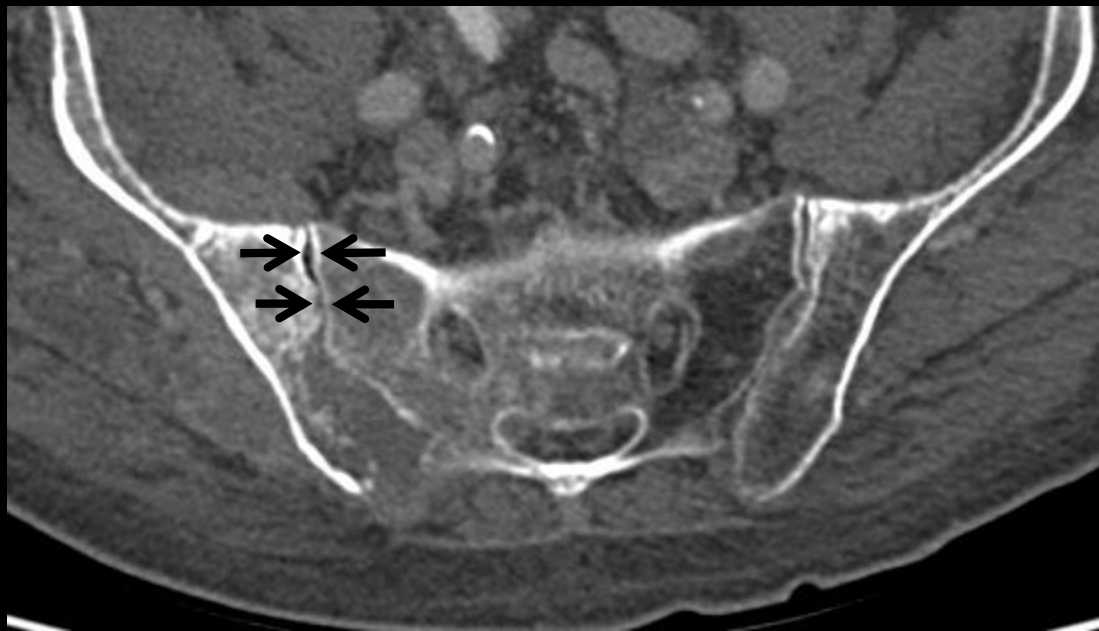
Inflammatory vs neoplastic ?



Preserved of inferior aspect of SI interface (cartilage)



Involvement of posterior aspect of superior segment of SI interface (fibrous)



Hypernephroma
metastasis

Take home messages

- Complex anatomy of the SI interface
- Frequent variations with age and among individuals
- Cartilaginous / fibrous components

The normal spine:

Anatomy of the sacroiliac joint

Part 1



Cliniques universitaires
SAINT-LUC
UCL BRUSSELS

Spondylo-arthropathies

Imagerie sacro-iliaque

Partie 2



Cliniques universitaires
SAINT-LUC
UCL BRUSSELS

Objectifs

- Cadre clinique
- Séméiologie
- Techniques

Importance

- Imagerie : place dans diagnostic Rhu (-)
- Thérapies efficace pour Rhu(-)
- Thérapie ciblée: la bonne drogue sur la bonne cible

Pathologies sacro-iliaques : difficile

- Clinique torpide
- Examen clinique difficile
- Anatomie radiologique complexe
 - Orientation triple oblique
 - Superpositions tissus mous

Critères de classification de l' ASAS

HLA B27

CRP élevée

Arthrite périphérique

Enthésite achille

Uvéite

Dactylite

Psoriasis

Pathologie inflammatoire Tdig

Histoire clinique SpA

Bonne réponse aux AINS

Lombalgie inflammatoire (< 40 ans, 3 mois, nocturne, diminuée

Critères ASAS de sacro-iliite IRM

Œdème médullaire sous-chondral

2 foyers sur une coupe

1 foyer sur deux coupes

Associations Between Spondyloarthritis Features and Magnetic Resonance Imaging Findings

A Cross-Sectional Analysis of 1,020 Patients With Persistent Low Back Pain

Bodil Arnbak,¹ Anne Grethe Jurik,² Kim Hørslev-Petersen,³ Oliver Hendricks,³
Louise Thuesen Hermansen,³ Anne Gitte Loft,⁴ Mikkel Østergaard,⁵ Susanne Juhl Pedersen,⁵
Anna Zejden,⁶ Niels Egund,⁶ René Holst,⁷ Claus Manniche,¹ and Tue Secher Jensen¹

Constitution série de pts
2011-2013

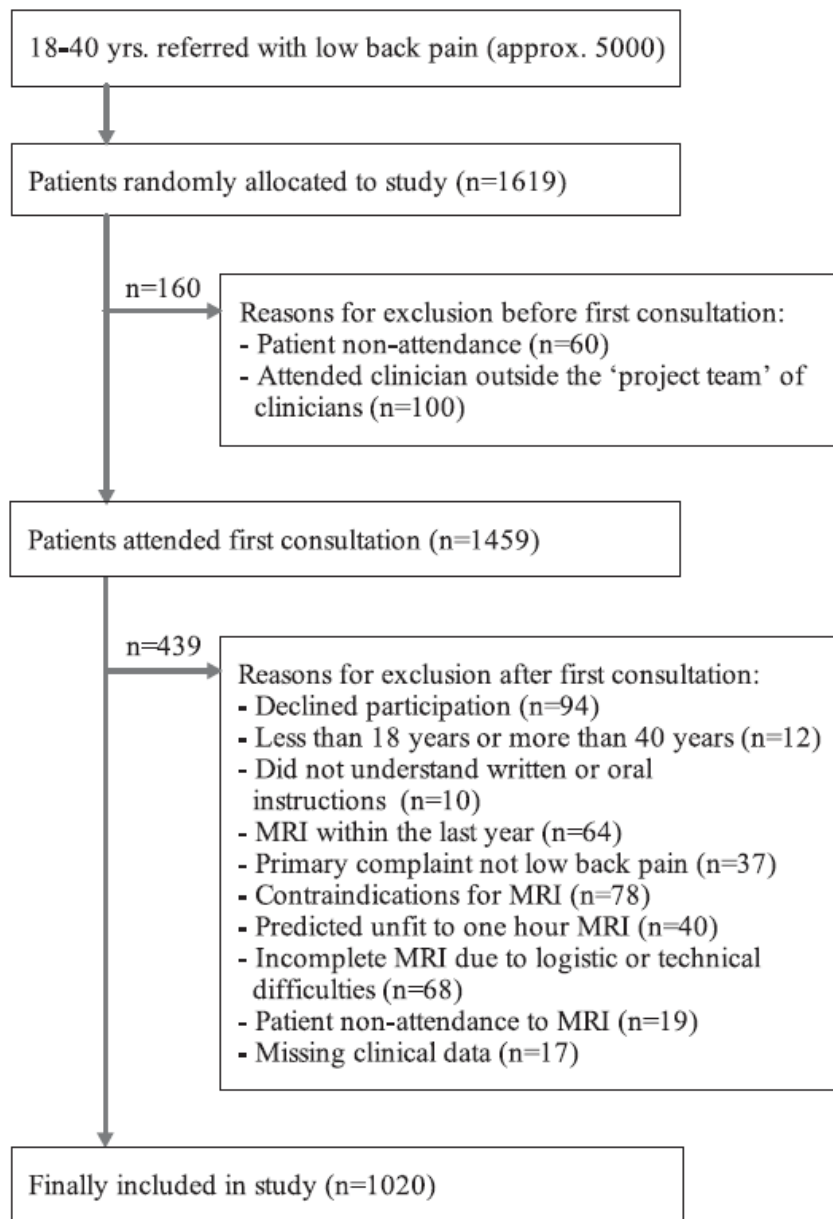


Figure 1. Flow chart showing path for inclusion of the patients in the study. MRI = magnetic resonance imaging.

Table 1. Definitions of the categorical sacroiliac joint magnetic resonance imaging variables used in the multiple regression analysis*

Category	Definition
Bone marrow edema	
Absent	No bone marrow edema
Low score	Bone marrow edema in <25% of the subcortical bone area
Medium score	Two regions with bone marrow edema in <25% of the subcortical bone area or 1 region with bone marrow edema in 25–50% of the subcortical bone area
High score	Greater than medium score
Fatty marrow deposition	
Absent	No fatty marrow deposition
Low/medium score	One or 2 regions with fatty marrow deposition in <25% of the subcortical bone area or 1 region with fatty marrow deposition in 25–50% of the subcortical bone area
High score	Greater than low/medium score
Erosions	
Absent	No erosions
Present	Erosions in at least 1 region
Sclerosis	
Absent	No sclerosis
Present	Sclerosis in at least 1 region

* The presence of a given finding was defined by a minimum of 2 lesions seen on a single sacroiliac (SI) joint slice or 1 lesion seen on at least 2 consecutive slices. Each finding in each of the 8 SI joint regions was graded as follows: absent, <25% of the subcortical bone area, 25–50% of the subcortical bone area, or >50% of the subcortical bone area. The categorical variables were based on the cumulative grading in all SI joint regions as indicated above. The number of categories was determined by the prevalence of the relevant finding, in order for each category to include at least 5% of the patients, so that sufficient power could be obtained for logistic regression analyses.

Oedeme pris en considération si 2 foyers/1coupe ou 1 foyer/2coupes

Résultats - Prévalence

Parmi 1020 patients qui n'ont probablement pas la SpA

21% ont critères IRM de sacro-iliite

2% ont signe IRM d'atteinte inflammatoire

Coin vertébral œdème (2%), graisse (1%) mixte (1%)
œdème zygapophysaire (1%)

53% ont au moins un signe clinique +

19% ont au moins deux signes cliniques +

15%-17% 3 signes les plus fréquents (Lomb. Inflam., reponse AINS, hist. fam.)

10% HLAB27

8% CRP

Objectifs

- Cadre clinique
- Séméiologie
- Techniques

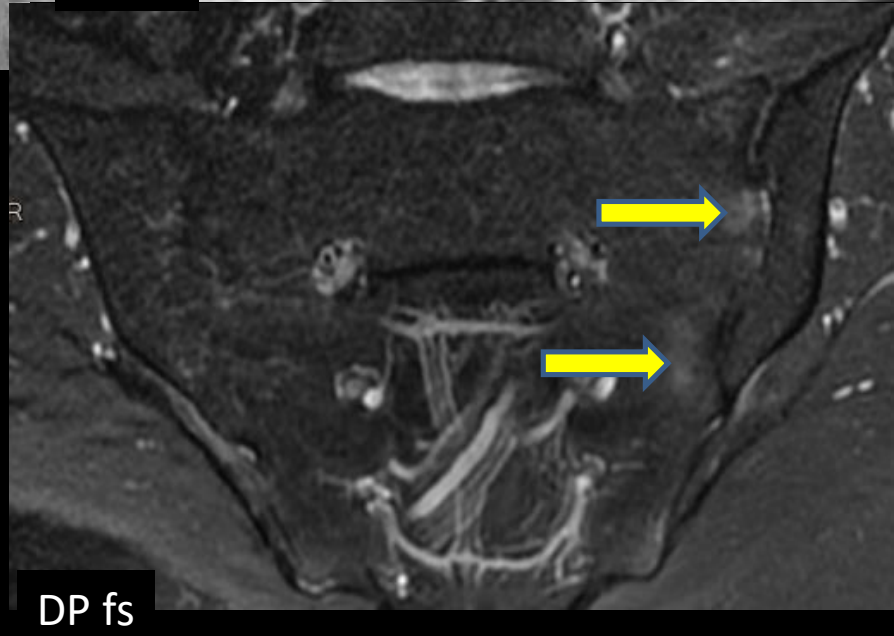
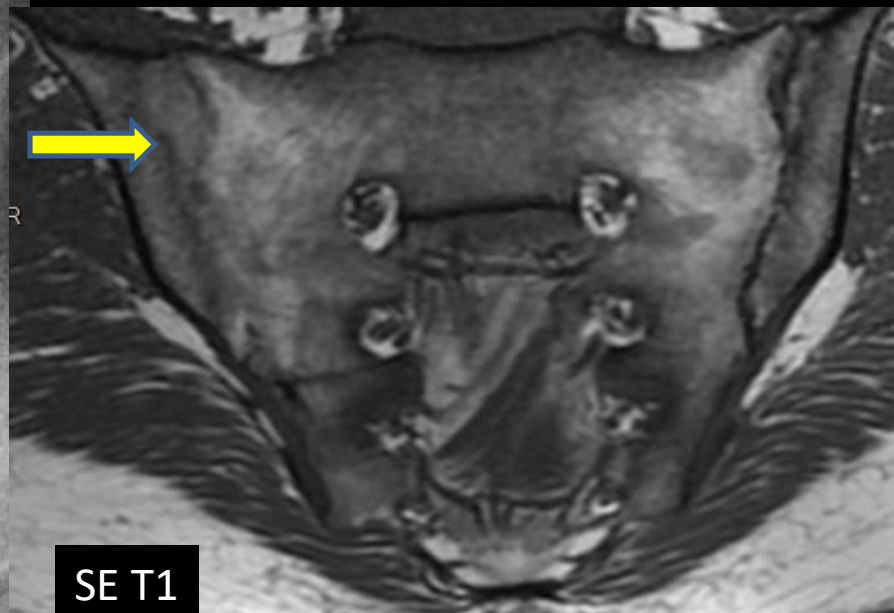
Buts imagerie

- Détecter lésions
 - Actives
 - Quiescentes
- Explorer tous les territoires cibles
 - Enthèses (insertions tendons, ligaments aponévroses)
 - Os sous chondral
 - Synoviales
 - Capsules articulaires

Femme 49 ans , SpA

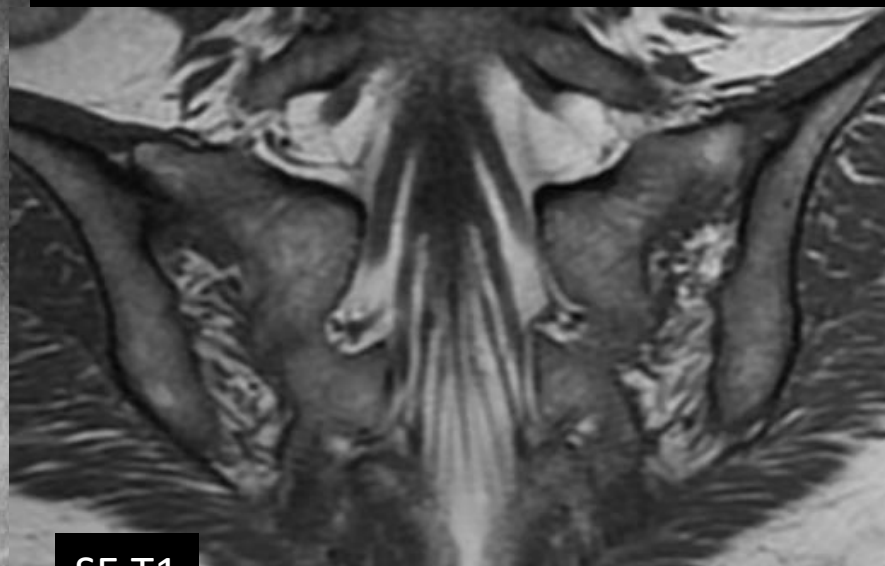
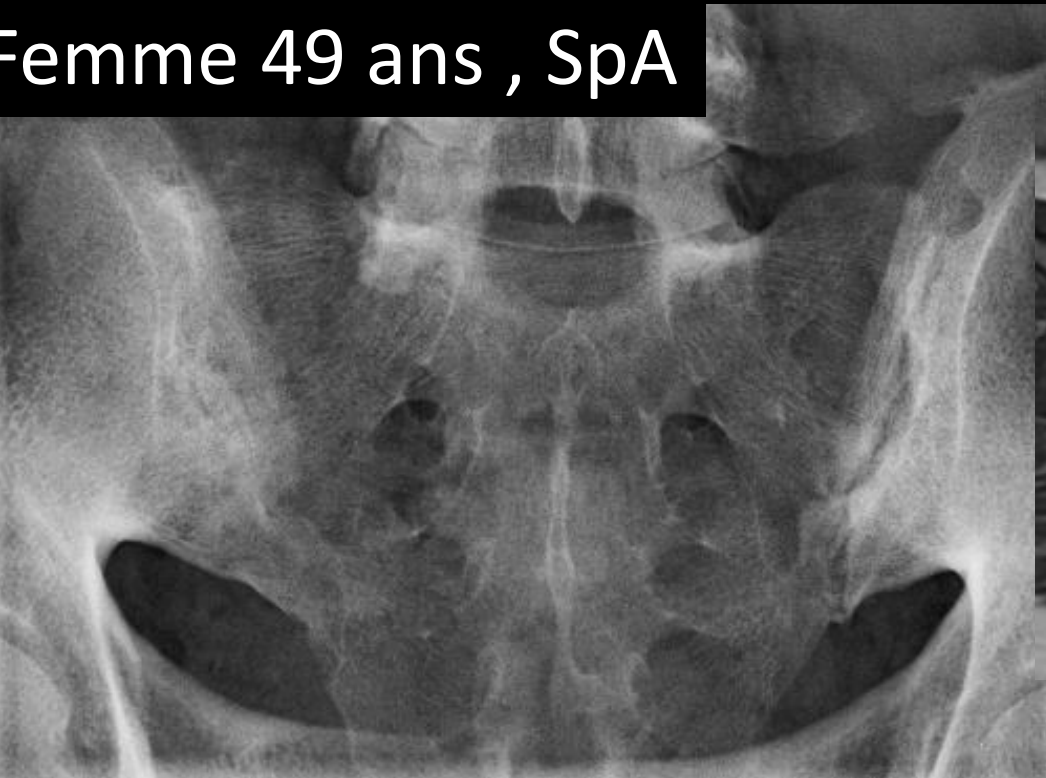


Femme 49 ans , SpA

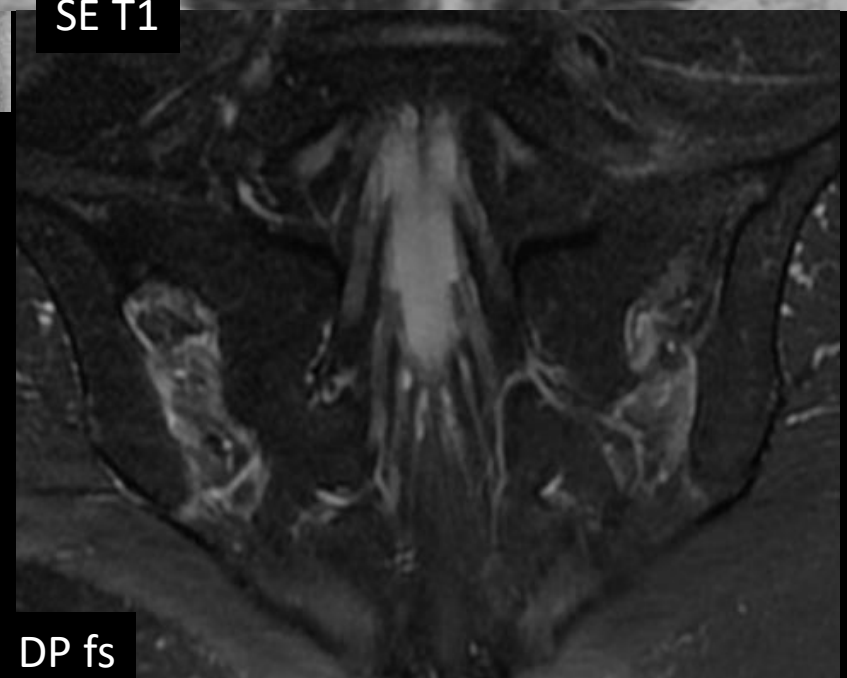


Atteinte articulaire
ankylose
« oedème) »

Femme 49 ans , SpA



SE T1



DP fs

Atteinte postérieure (enthèses)
oedème

Femme 34 ans, SpA

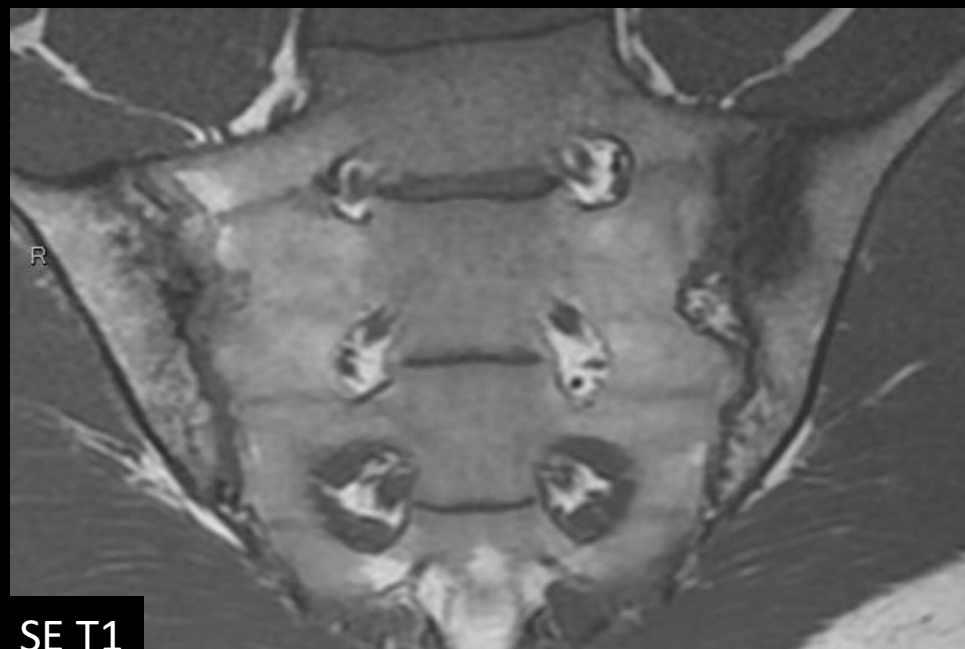


Femme 34 ans, SpA



Homme 30 ans, SpA





SE T1



Water T2 dixon

Séméiologie

Anomalies précoces

Inflammation

- IRM

Anomalies tardives

Lésions structurales

- Rx
- CT

Séméiologie IRM

Inflammation

- Ostéite (œdème médullaire)
- Synovite
- Capsulite
- Enthésite

Lésions structurales

- Ostéo-sclérose
- Érosions
- Involution graisseuse
- Ossifications péri-osseuses

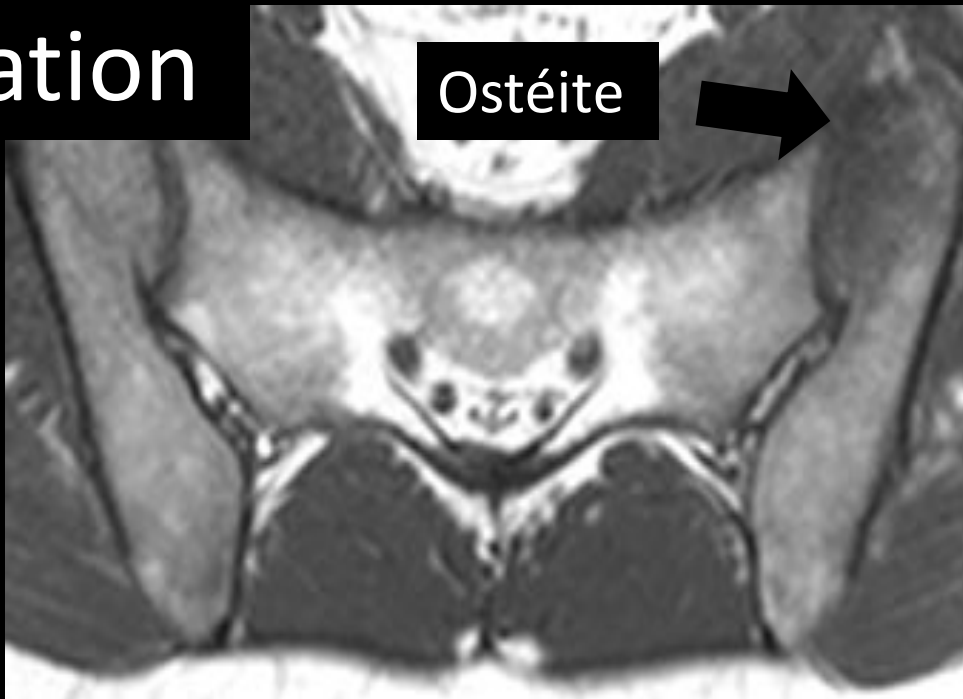
Inflammation



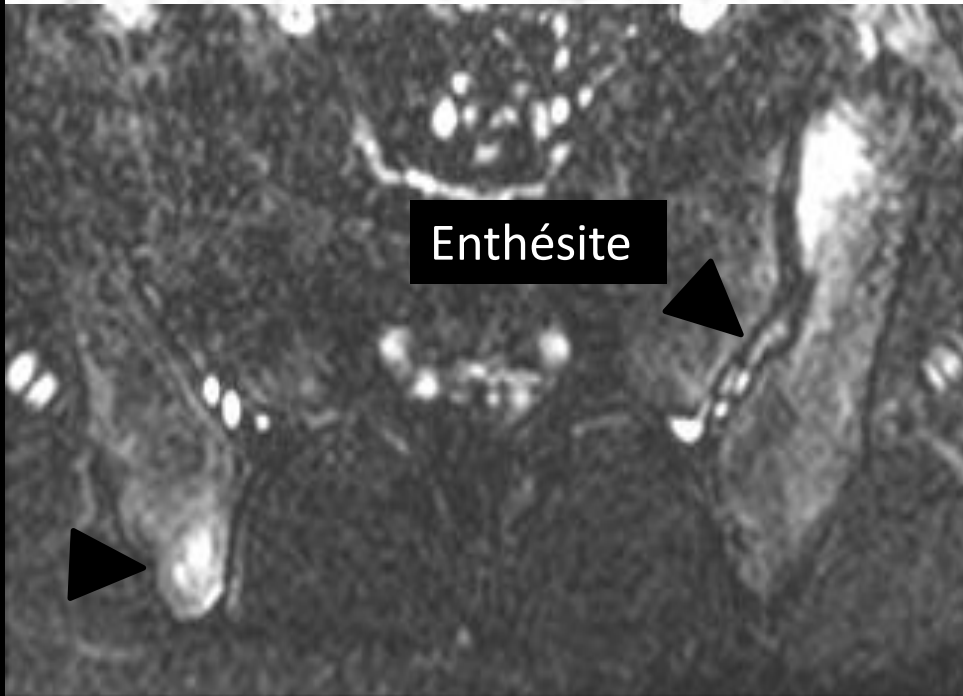
Ostéite : signal élevé en T2 fs
dans deux secteurs différents sur une coupe
dans un secteur sur deux coupes

Inflammation

Ostéite



Enthésite

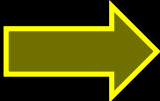


Enthésite



Technique IRM

- Lésions actives – inflammation - Œdème

 séquence sensible à eau : Dixon T2 / fs T2 / DP fs / STIR

- Lésions quiescentes - Involution graisseuse

 séquence sensible à graisse : SE T1 / Dixon T2 (image fat)

- Plan coronal oblique T1 (graisse blanche)
- Plan coronal oblique fat-sat T2 (eau blanche et graisse noire)
- Plan transverse oblique T1 ou T2

Suppression signal de la graisse

Terminologie

- STIR
- T2 fs
- DP fs
- Dixon, Ideal, mDixon
- Grappa, Blade...
- Dans séquence
- Avant séquence
- Après séquence

Technique IRM

- Lésions actives – inflammation - Œdème
➔ séquence pondérée T2 avec fat-sat
- Lésions quiescentes - Involution graisseuse
➔ séquence pondérée T1 avec graisse
- SE T1 fat-sat avec contraste ?

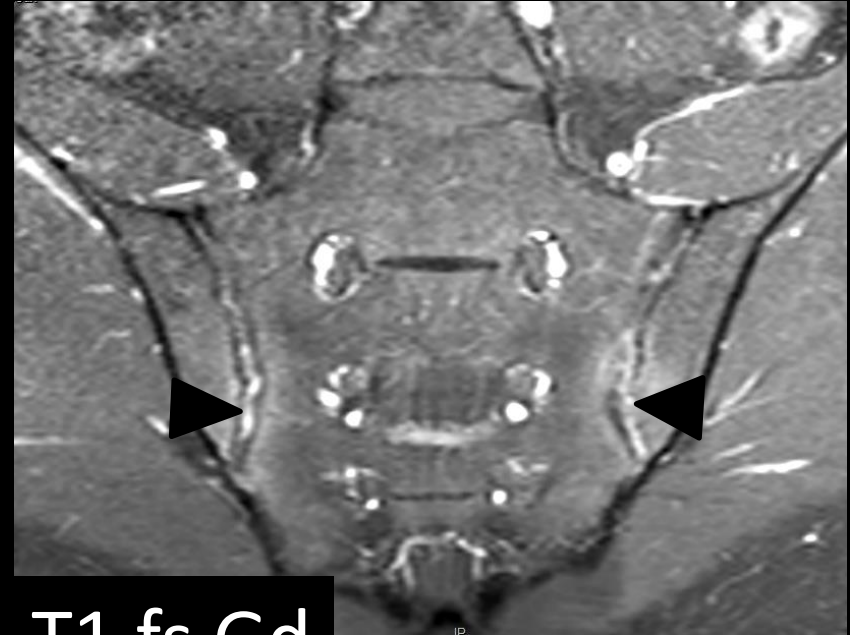
Injection *iv* de Gd ?

- Injection de Gd **améliore la détection** de
 - Synovite (différence liquide articulaire (avasculaire) de la synoviale épaisse (vascularisée)
 - Enthésites
 - capsulite
- Injection de Gd **n'améliore pas la détection** de
 - Ostéite
 - Érosion
- Injection de contraste n'augmente pas la détection des patients atteints car atteinte isolée de la synoviale (sans ostéite) est très rare.
- NB En recherche, quantification de la perfusion ? Monitoring ?
- NB interet Gado pourrait être différent au rachis !

Inflammation



DP fs



T1 fs Gd

Erosion et synovite

Bone Inflammation (osteitis)

- Appears as bone marrow edema
- occurs early in disease course
- correlates with symptoms
- is detected exclusively at MRI
- presents as high signal intensity on fat-saturated fluid-sensitive sequences
- needs to be visible at least on 2 consecutive slices or 2 foci on same slice for a definite diagnosis in sacro-iliac joints.

Messages

Inflammation (IRM)

- Ostéite (œdème médullaire)
- Synovite
- Capsulite
- Enthésite

Lésions organisées (Rx CT)

- Ostéo-sclérose
- Érosions
- Involution graisseuse
- Ankylose
- Ossifications péri-osseuses

SPA

- Pathologie articulaire et enthèse
- Distribution bigarrée au sein d'une même articulation

Uncommon degenerative involvement of the Sacro-iliac joints Part 3



Cliniques universitaires
SAINT-LUC
UCL BRUSSELS

Ostéose iliaque condensante



Femme, 25 ans

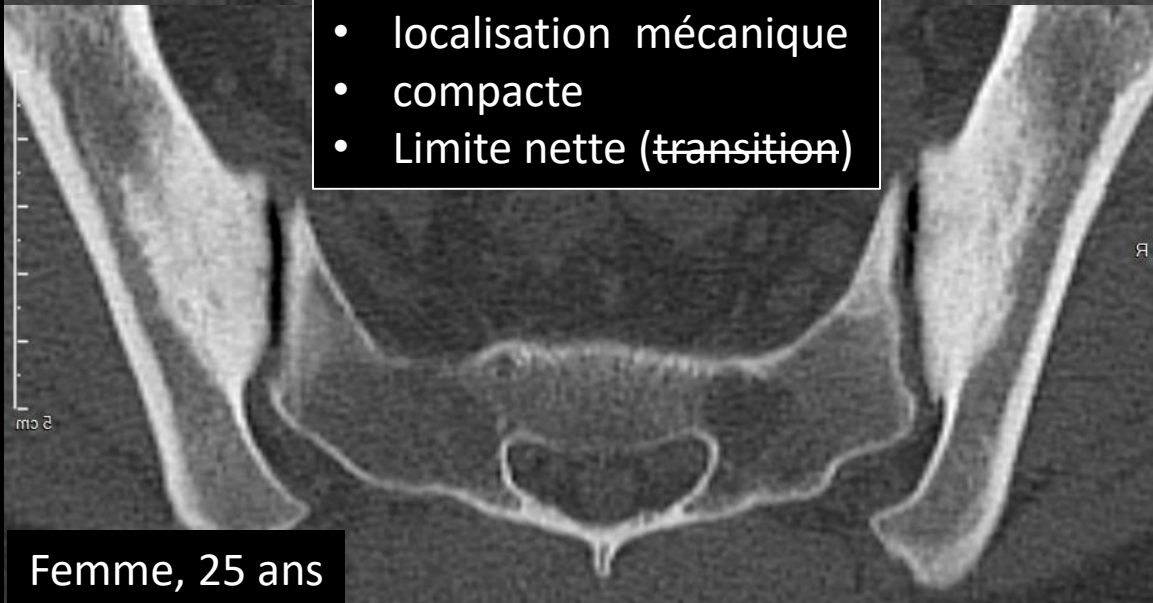
- Atteinte quasi exclusive du sexe féminin
- 25 - 50 ans
- Symptômes variables parfois inflammatoires
- Biologie normale
- évolution lente vers guérison clinique (rare > 55 ans).

Ostéose iliaque condensante



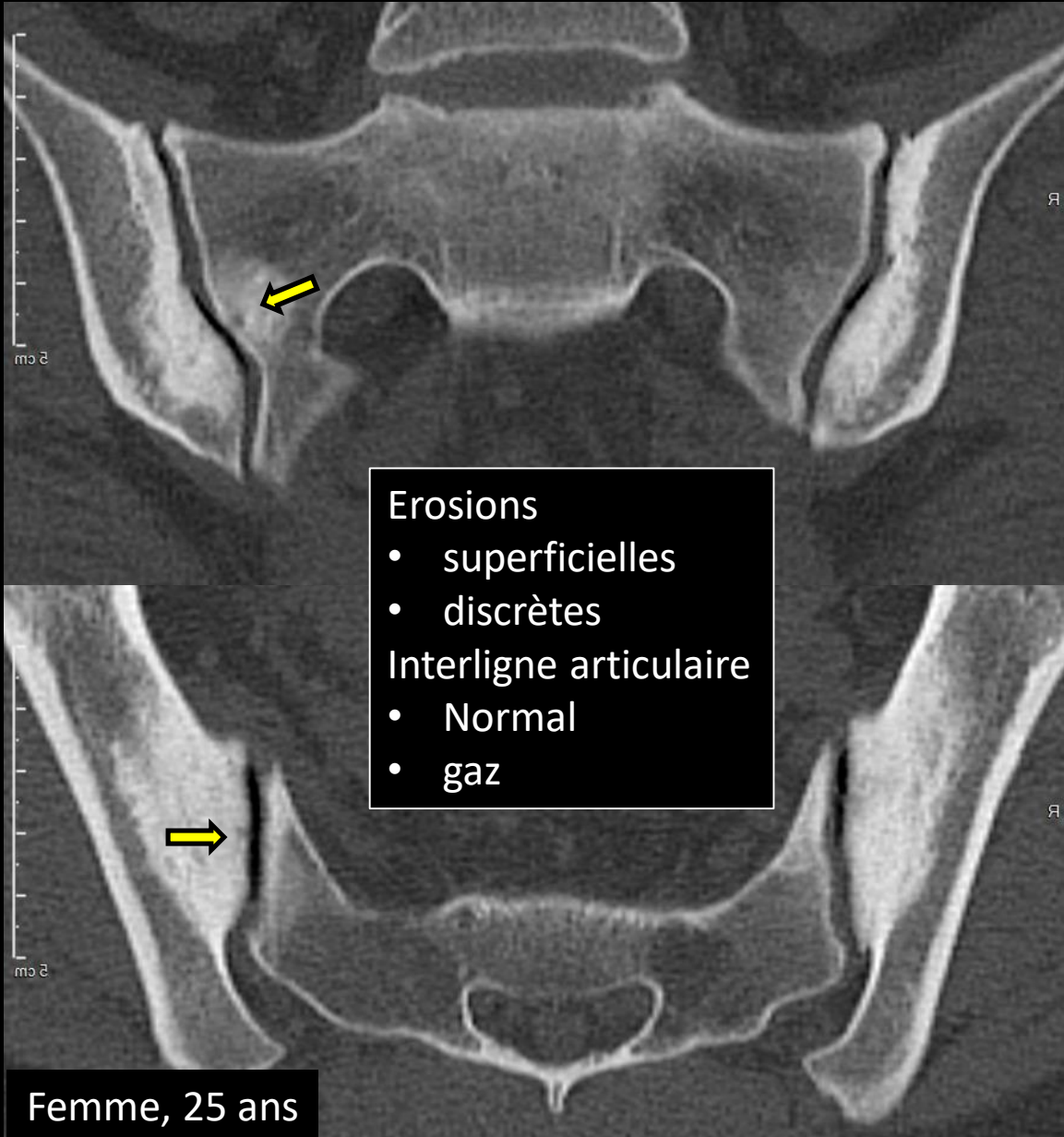
Hyperostose

- Iliaque >> sacrée
- localisation mécanique
- compacte
- Limite nette (transition)

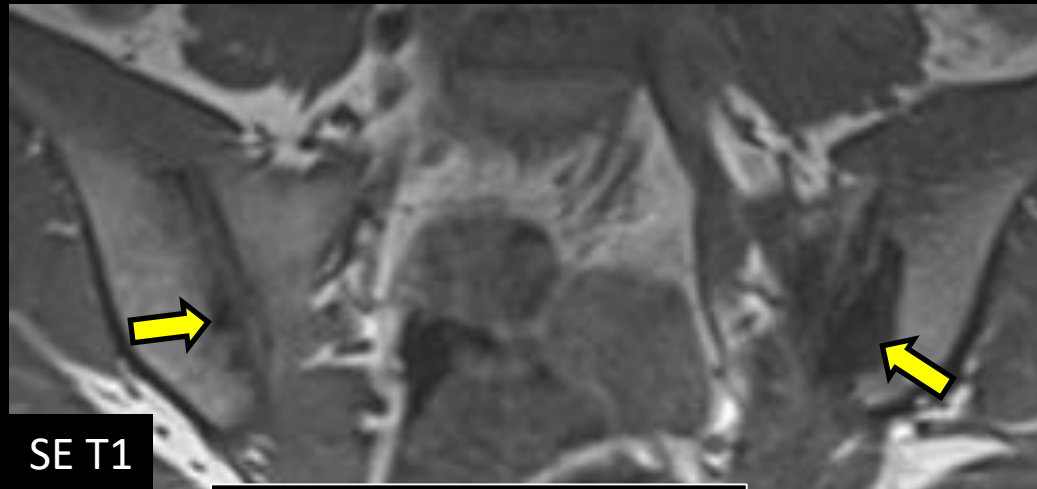


Femme, 25 ans

Ostéose iliaque condensante



Ostéose iliaque condensante - IRM

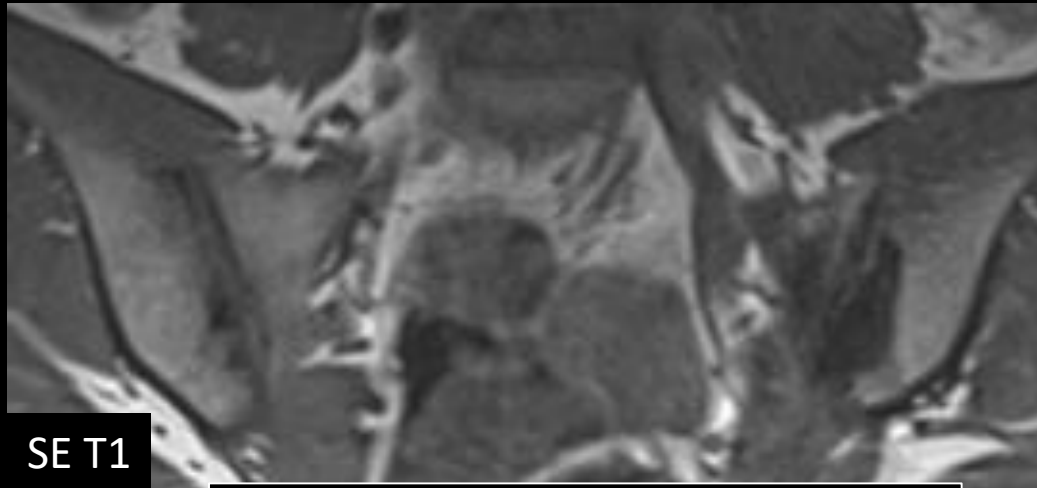


Sclérose

- Hyposignal T1 et DPFS
- Bordure hypo/hyper
- Limite nette



Ostéose iliaque condensante - IRM



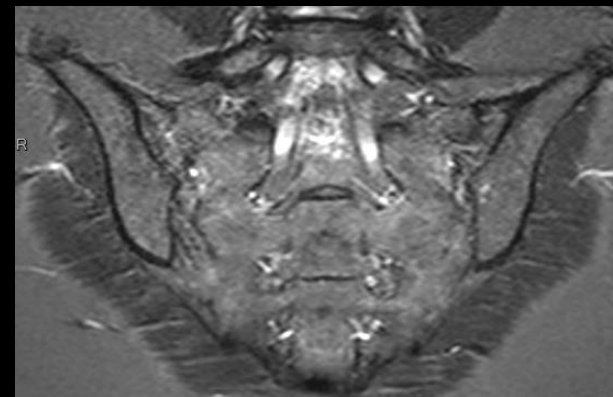
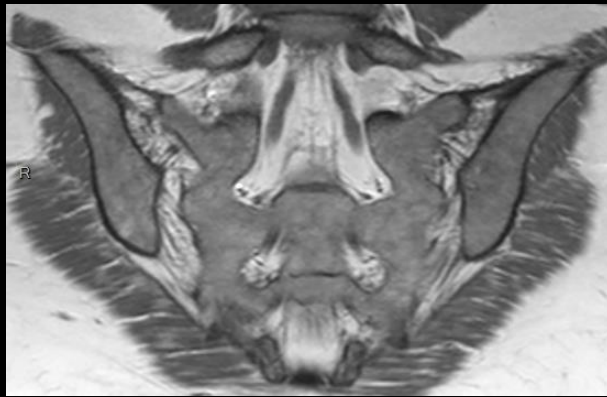
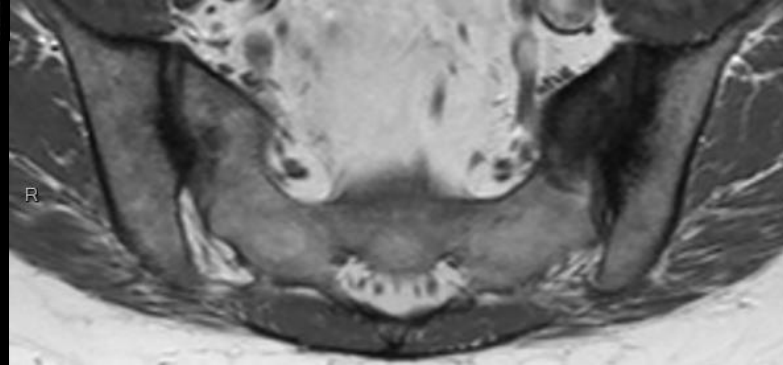
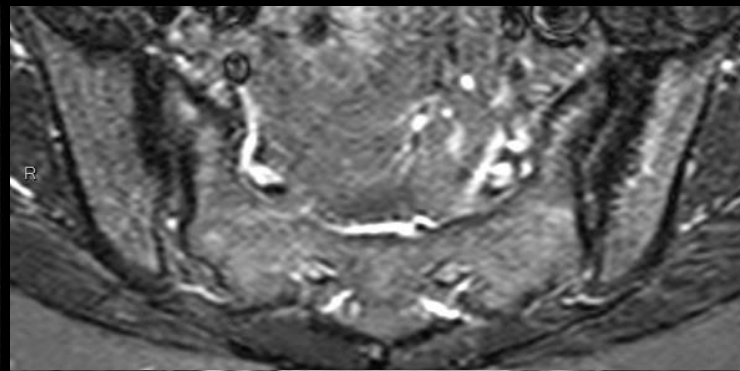
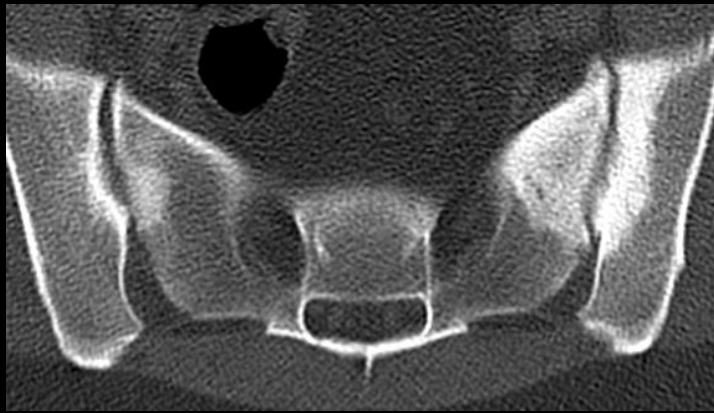
SE T1

Oedème

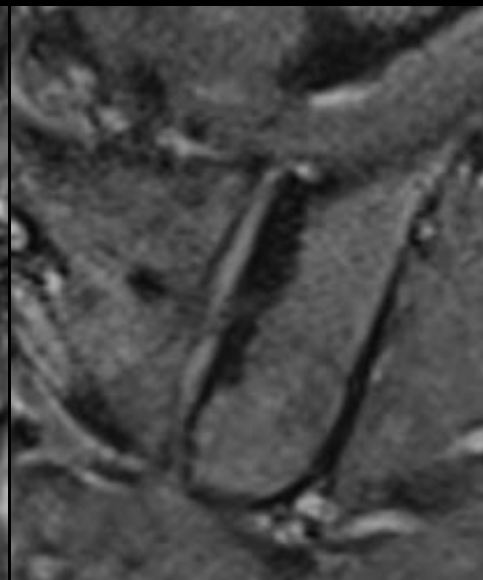
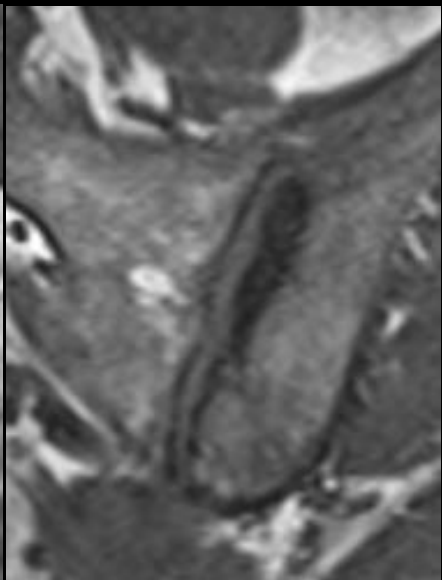
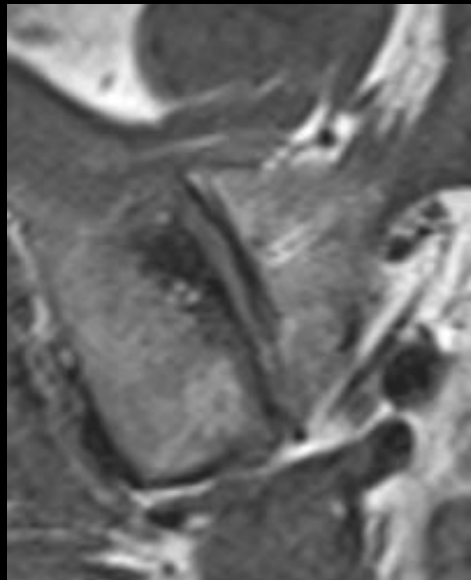
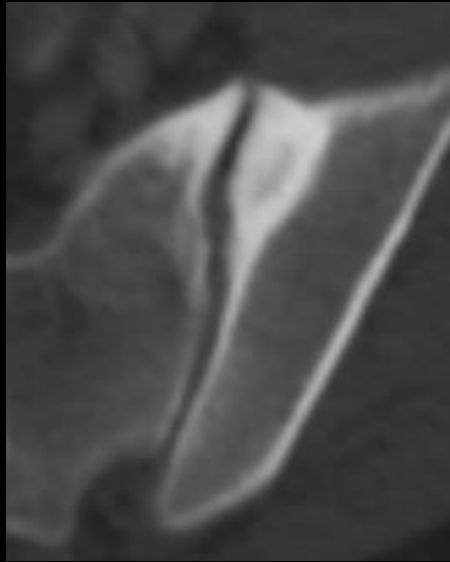
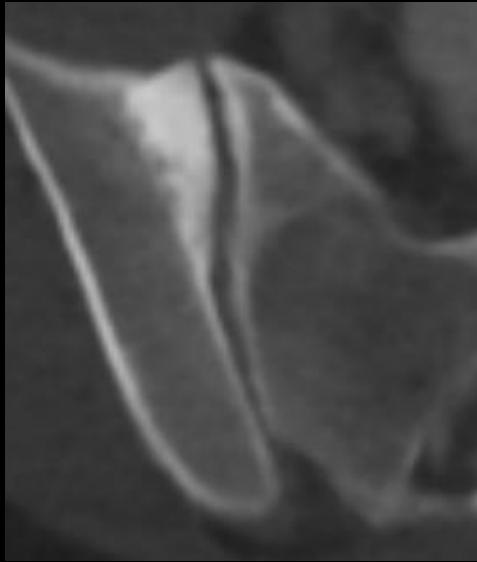
- Limité
- Périphérique
- Osseux (ligamentaire, articulaire)



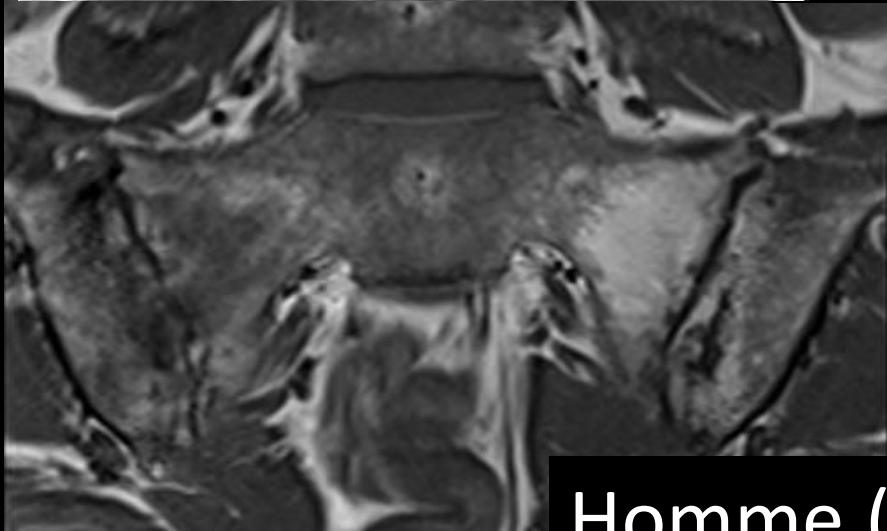
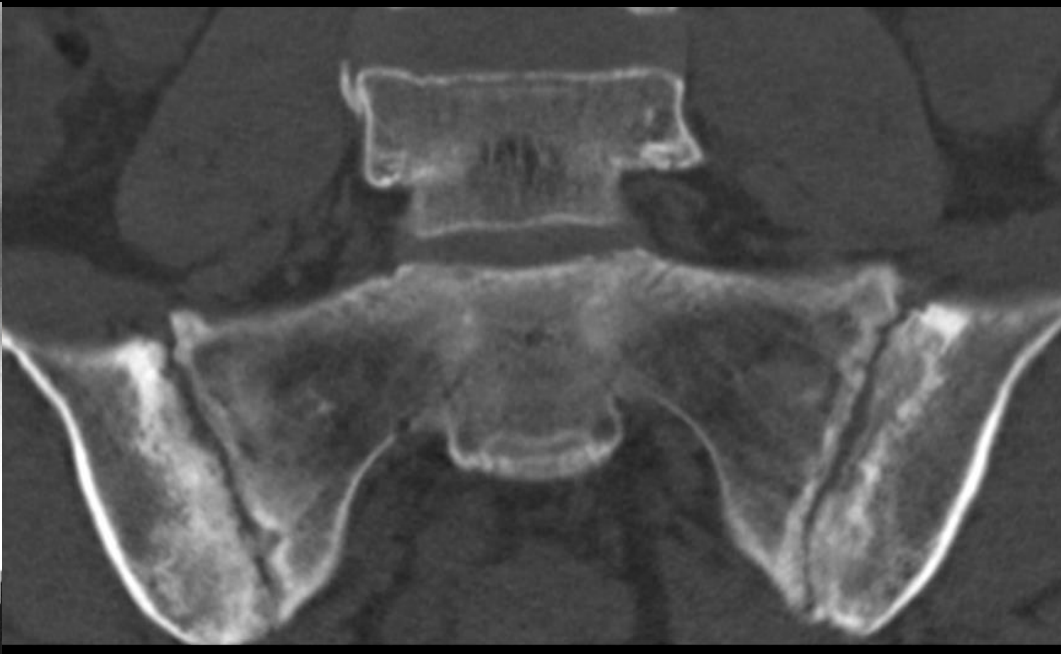
DP fs



Respect du secteur ligamentaire des articulations SI



DD : Rhumatisme axial séro-négatif



Homme (31 ans) SpA

Spondylarthrite ankylosante

Ostéose iliaque condensante

Sclérose

Pas compacte

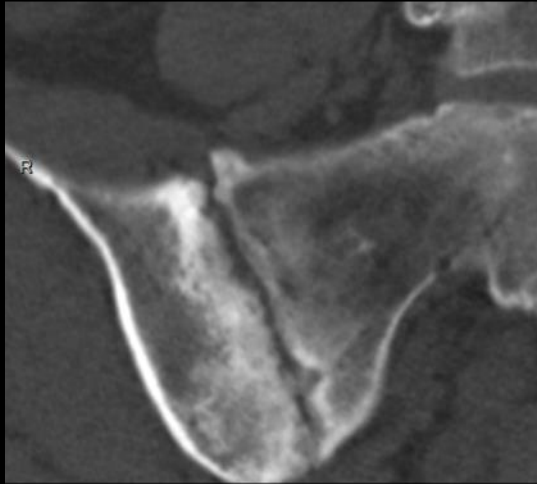
Limite floue

Érosions

Nombreuses

Interligne

élargi



Sclérose

compacte

Limite nette

Érosions

absente

Interligne

normal

Spondylarthrite ankylosante

Ostéose iliaque condensante

Sclérose

Pas compacte

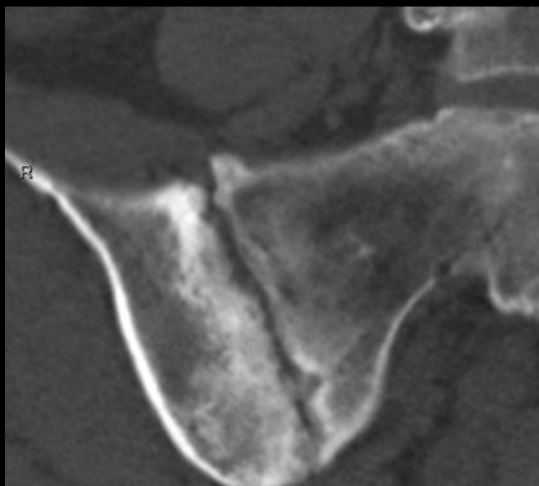
Limite floue

Érosions

Nombreuses

Interligne

élargi



Sclérose

compacte

Limite nette

Érosions

absente

Interligne

normal



moelle

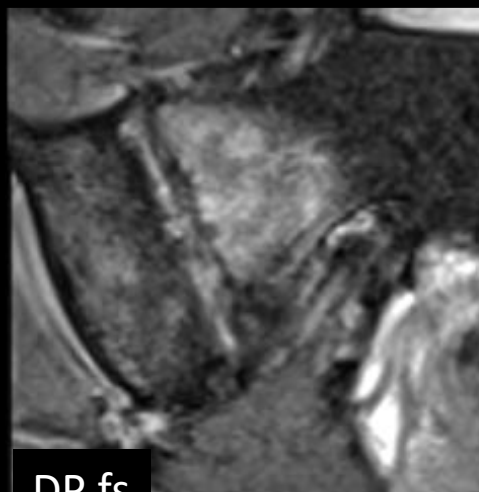
Hypo/hyper
disparate

Érosions

nombreuses

Interligne

Hypo/hyper



moelle

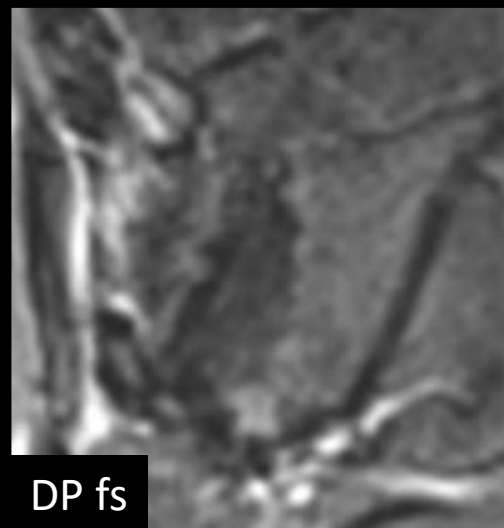
Hypo/hypo
homogène

Érosions

absentes

Interligne

Hypo/hypo



	Ostéo iliaque condensante	Arthrose sacro-iliaque	SpA
Atteinte articulaire	Focale (Tiers moyen et antérieur)	Focale (Tiers moyen et antérieur)	Diffuse
Atteinte ligamentaire	Non	Non	Oui
Distribution	Bilatérale, symétrique Iliaque >> sacré	Variable, asymétrique Iliaque > sacré	Bilatérale, asymétrique Iliaque = sacré
Espace articulaire	Normal	Diminué	Élargi
Sclérose	Compacte, marquée	Compacte, modérée	Floue
Erosions	Superficielles, marquées	Peu marquées	Nombreuses, floues
	Aspect monomorphe	variable	Aspect bigarré
Oedème	Subtil, périphérique	limité	important, multifocal
Synovite, capsulite	Non	Non	Oui

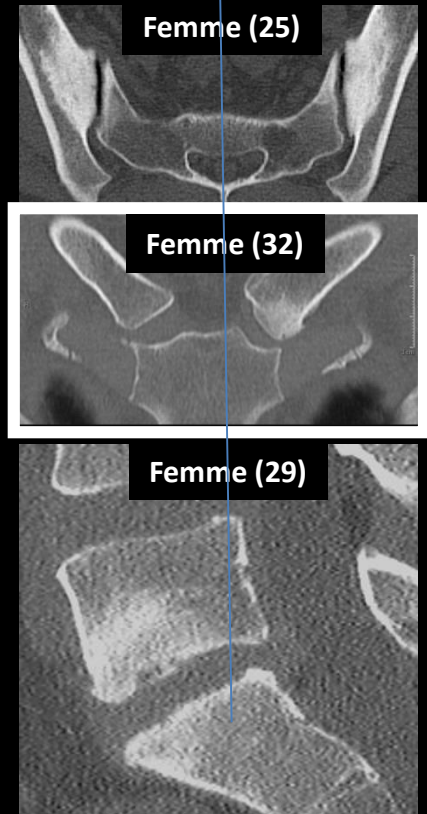
Uncommon degenerative involvement of the Sacro-iliac joints Part 3



Cliniques universitaires
SAINT-LUC
UCL BRUSSELS

Objectifs

- Arthropathies mécaniques atypiques
 - Localisations
 - Sacro-iliaque
 - **Sterno-claviculaire**
 - Disque lombaire
 - Imagerie
 - Diagnostic différentiel





Coll. J. Malghem

- Jeune femme
- Sclérose inféro-médiale de la clavicule
- Ostéophyte inférieur
- Interligne relativement respecté
- Manubrium normal
- Unilatéral

femme de 27 ans

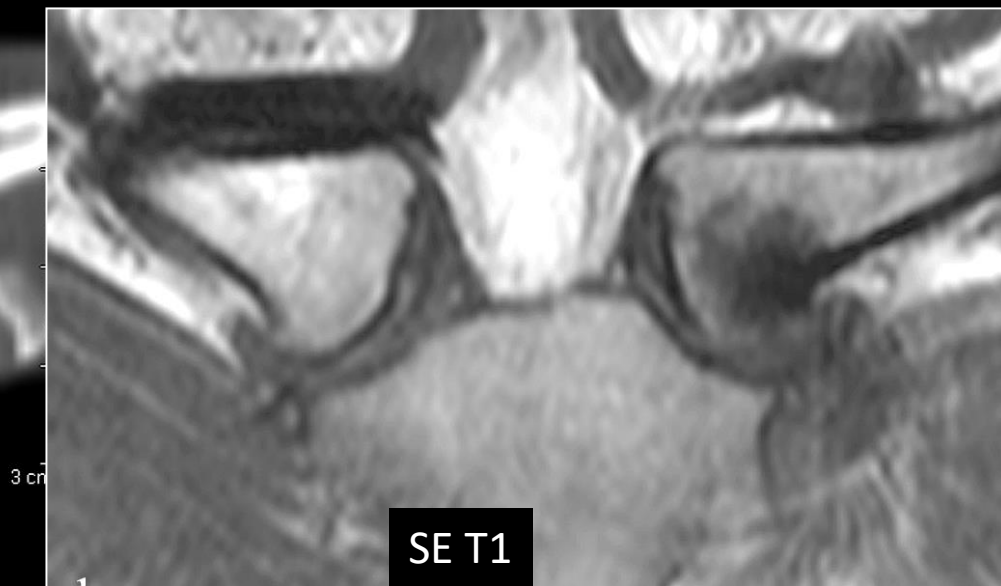
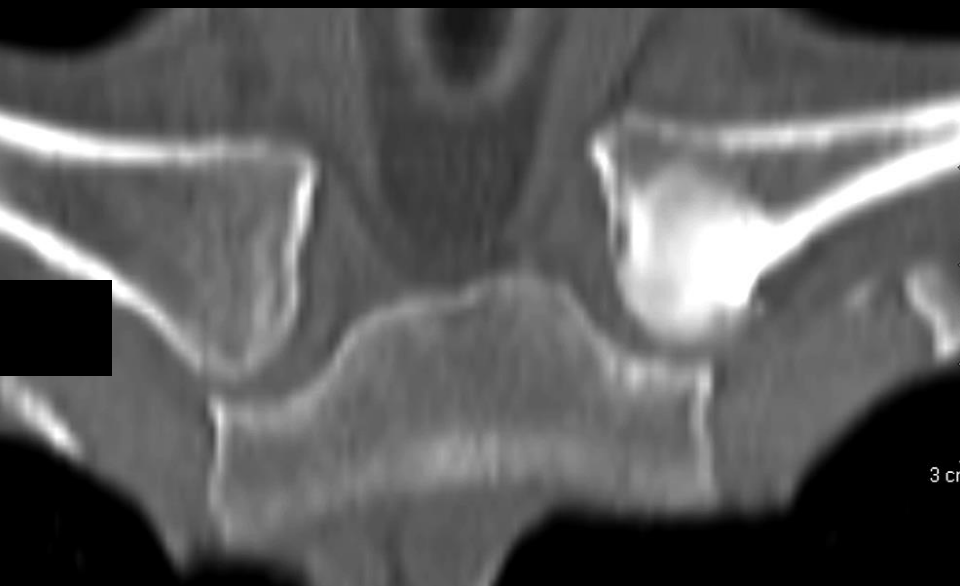


Femme, 32 ans



- Sclérose inféro-médiale de la clavicule
- Ostéophyte inférieur
- Interligne relativement respecté
- Manubrium normal
- Souvent unilatéral

Femme, 43 ans

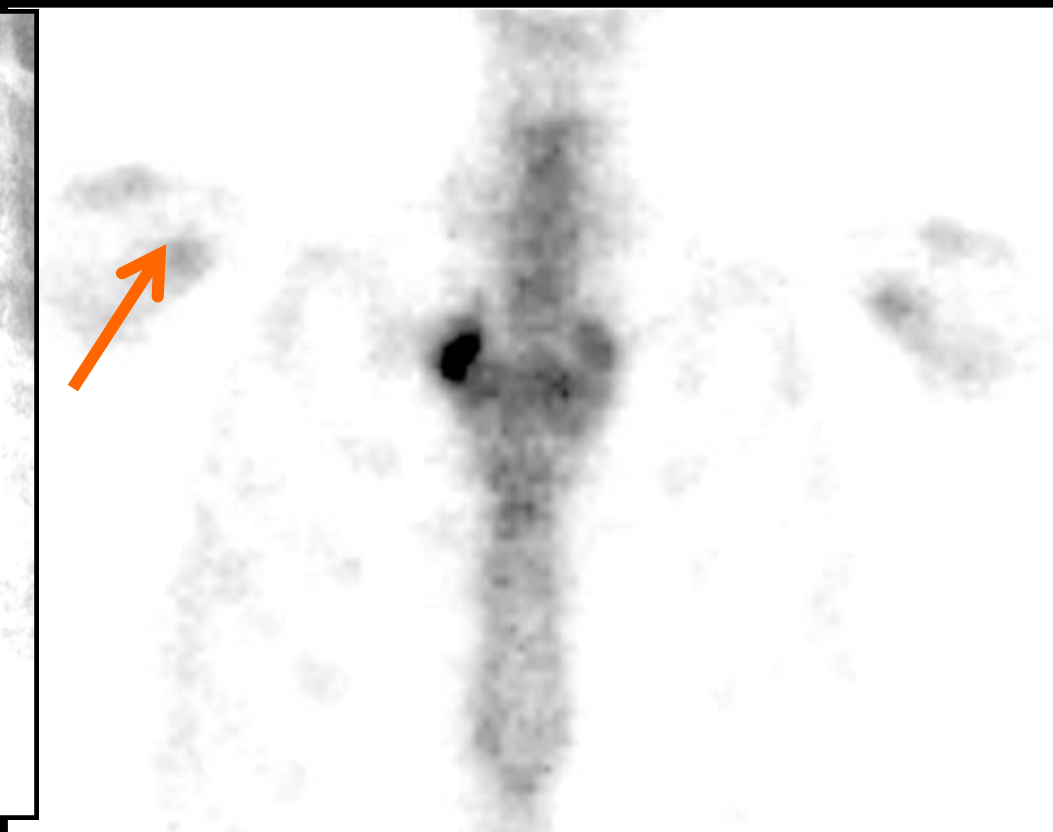


Femme, 25-50 ans

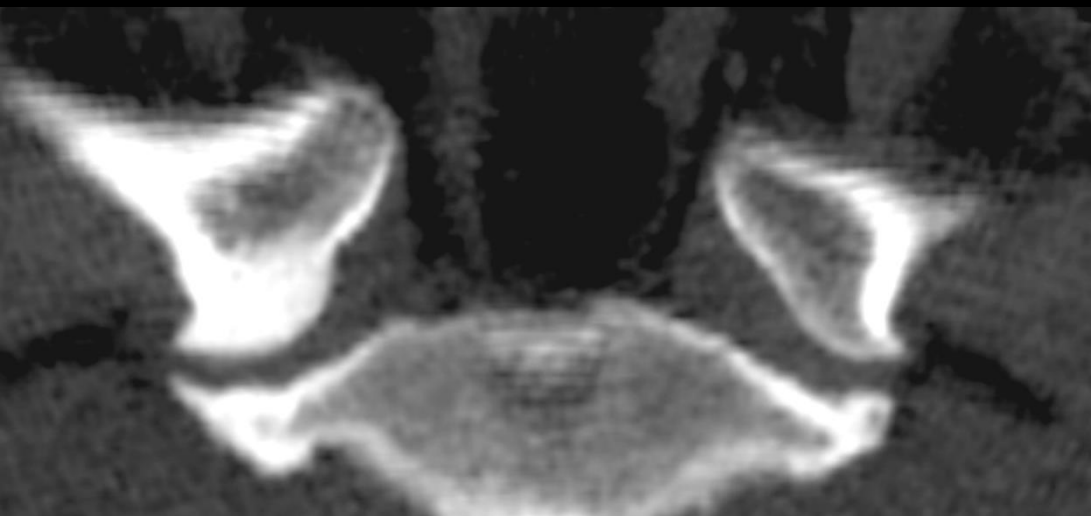
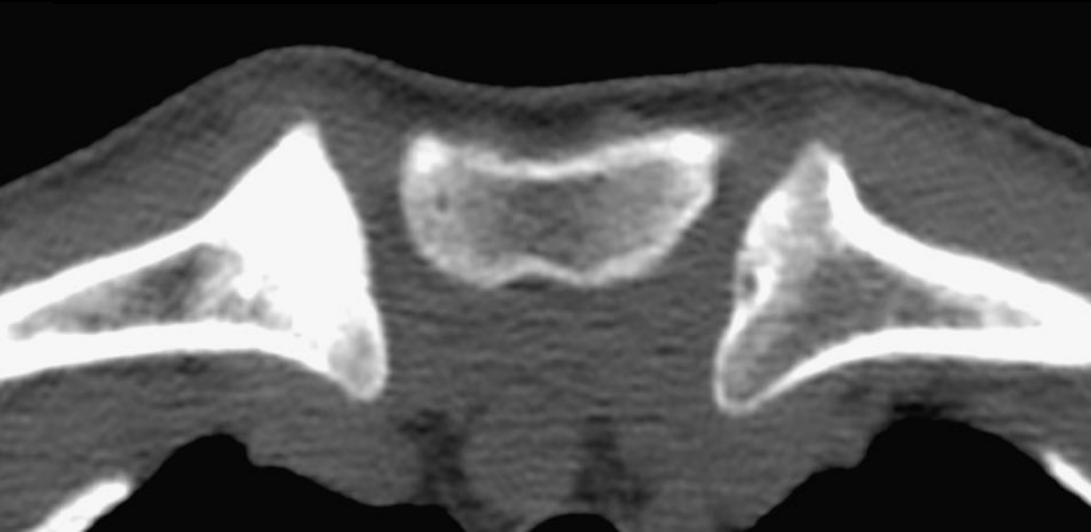
A-/pausi-symptomatique (*Condensing osteitis*)

Unilatéral

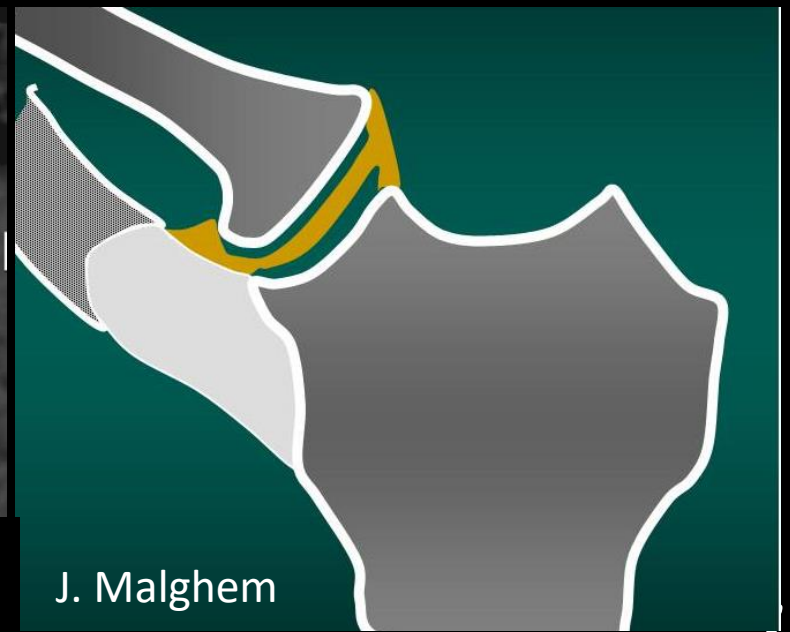
Biologie normale



Interligne normal



Articulation costo-claviculaire



J. Malghem

Condensing Osteitis of the Medial Clavicle – An Intermediate-term Follow-up

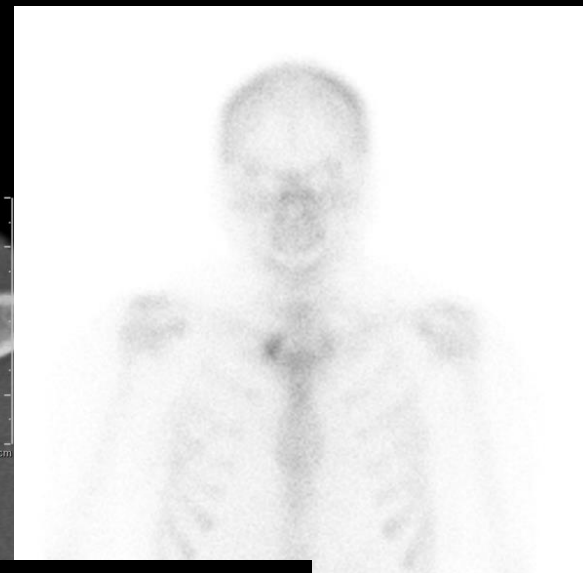
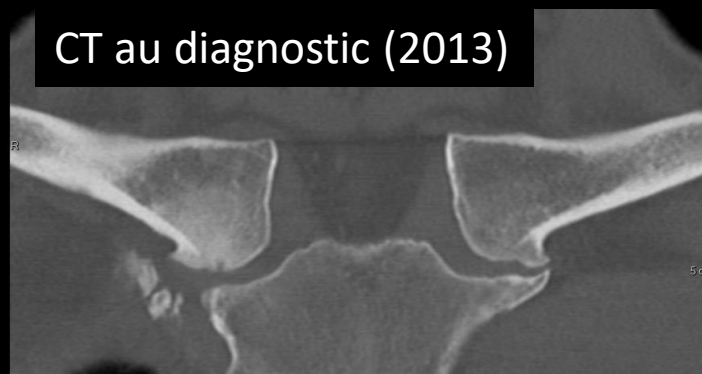
KK Sng,¹MBBS, BK Chan,¹FRCS (Glas), FRCS (Edin), FAMS, AJ Chakrabarti,²MBBS, FRCS (Orth), SN Bell,²MBBS, FRACS, FA (Orth),
CO Low,¹MBBS, FRCS (Glas), FAMS

Table 1. Clinical and Radiological Features of our 9 Patients with Condensing Osteitis

Case number	Sex	Age	Affected side	Dominance	Visual Analogue Scale (Pain)	American Shoulder and Elbow Surgeons Pain Score	Total duration of symptoms (months)	Length of follow-up (months)
1	Male	65	Right	Dominant	0	Slight	24	24
2	Female	34	Right	Dominant	3	Slight	41	77
3	Female	36	Right	Dominant	1	Slight	49	55
4	Female	32	Right	Dominant	7	Moderate	32	70
5	Female	39	Left	Non-dominant	4	Moderate	8	24
6	Female	40	Right	Dominant	3	Slight	26	40
7	Female	35	Left	Non-dominant	3	Slight	18	22
8	Female	34	Right	Dominant	0	Slight	8	9
9	Female	22	Right	Dominant	2	Slight	20	20

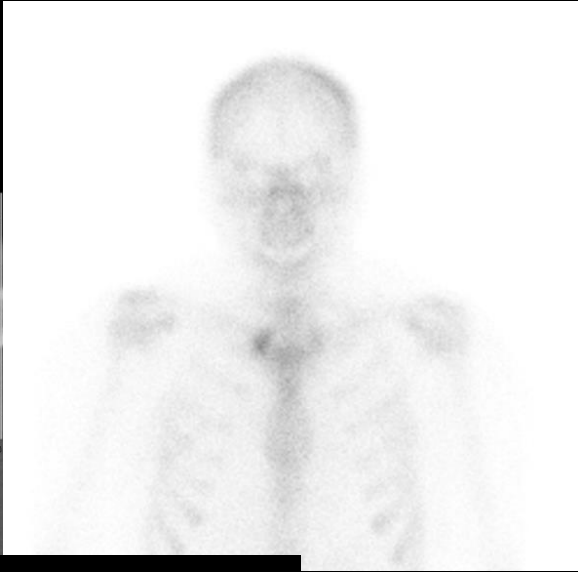
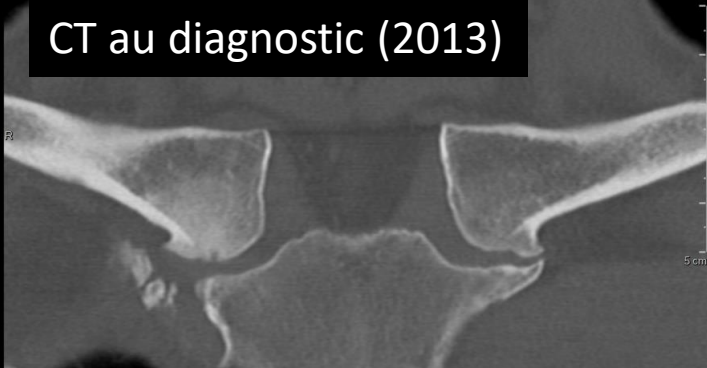
Suivi CT à 2 ans : régression hyperostose (80% cas)

Ostéose claviculaire condensante
Femme (39)



2013 (39 ans)

Ostéose claviculaire condensante
Femme (39)



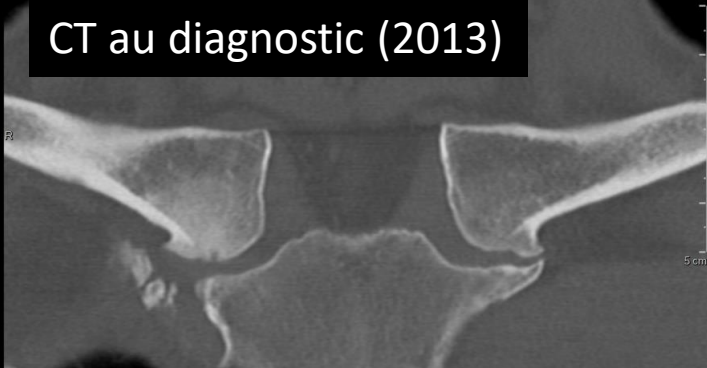
2013 (39 ans)

CT thorax (suivi onco)



2011

Ostéose claviculaire condensante
Femme (39)



CT au diagnostic (2013)

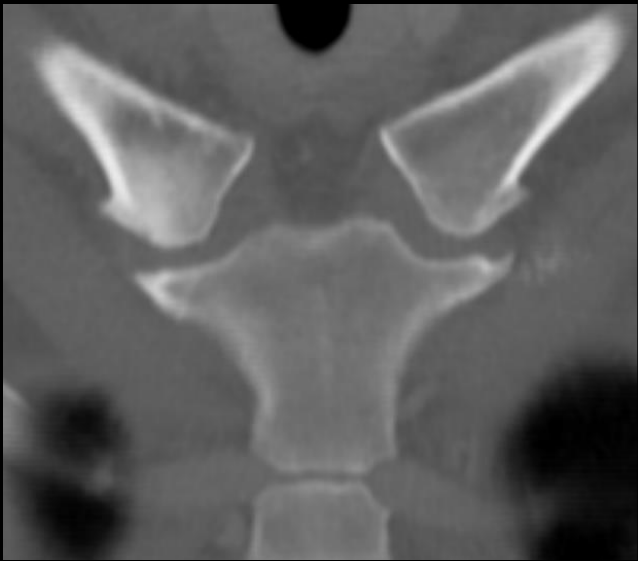


2013 (39 ans)

CT thorax (suivi onco)



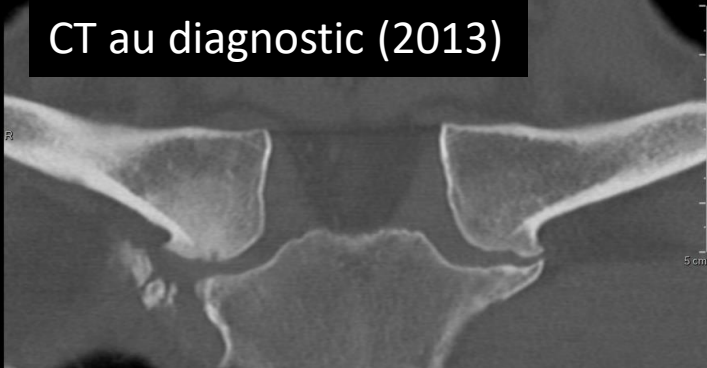
2011



2013

Ostéose claviculaire condensante
Femme (39)

CT au diagnostic (2013)

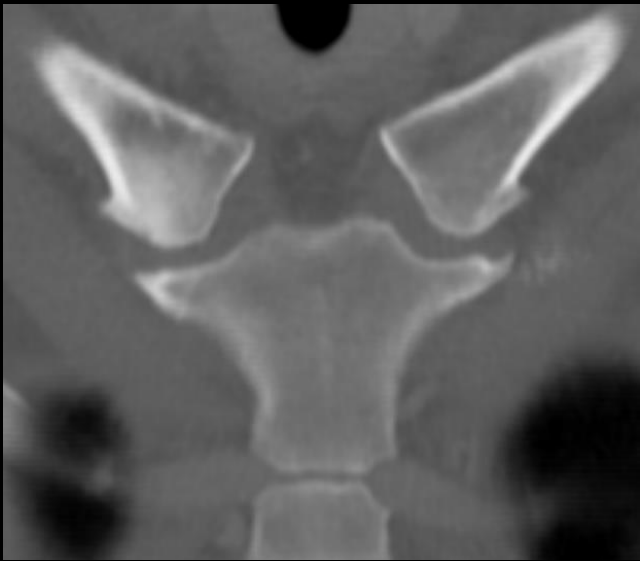


2013 (39 ans)

CT thorax (suivi onco)



2011

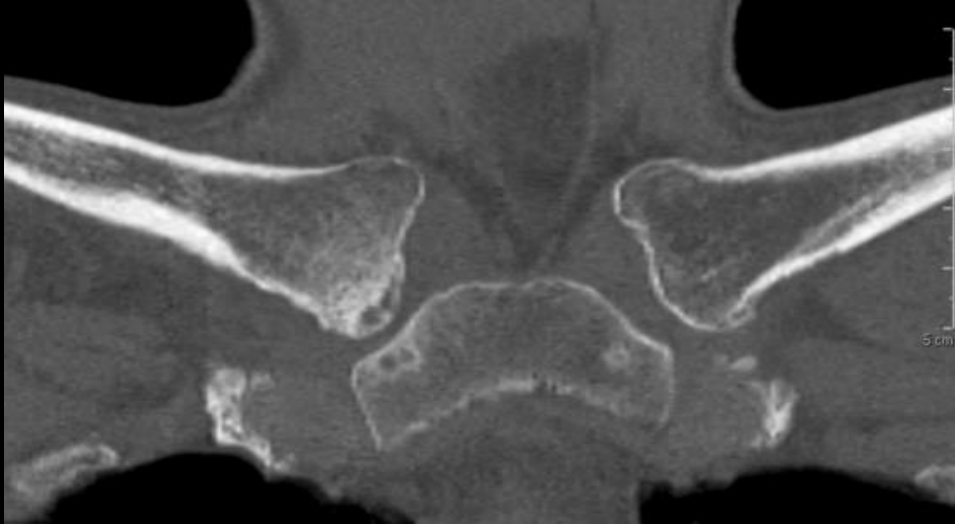


2013



2017

DD Ostéose claviculaire condensante



ARTHROSE

Cohérence

anomalie osseuse ss-chondrale

// pincement interligne



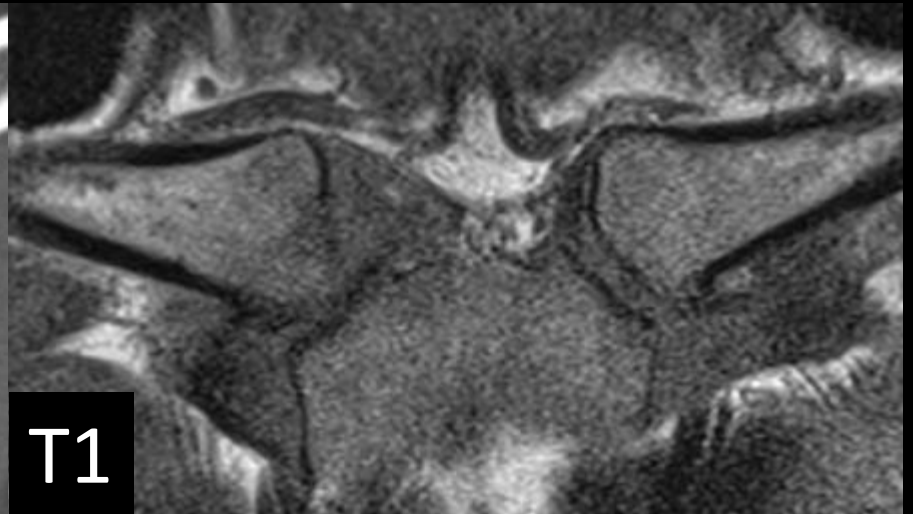
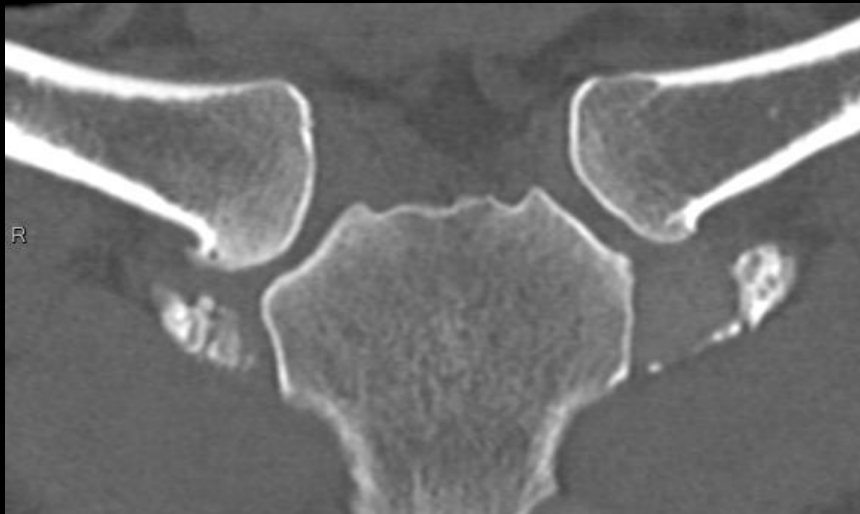
SAPHO

Discordance

Atteinte osseuse +++

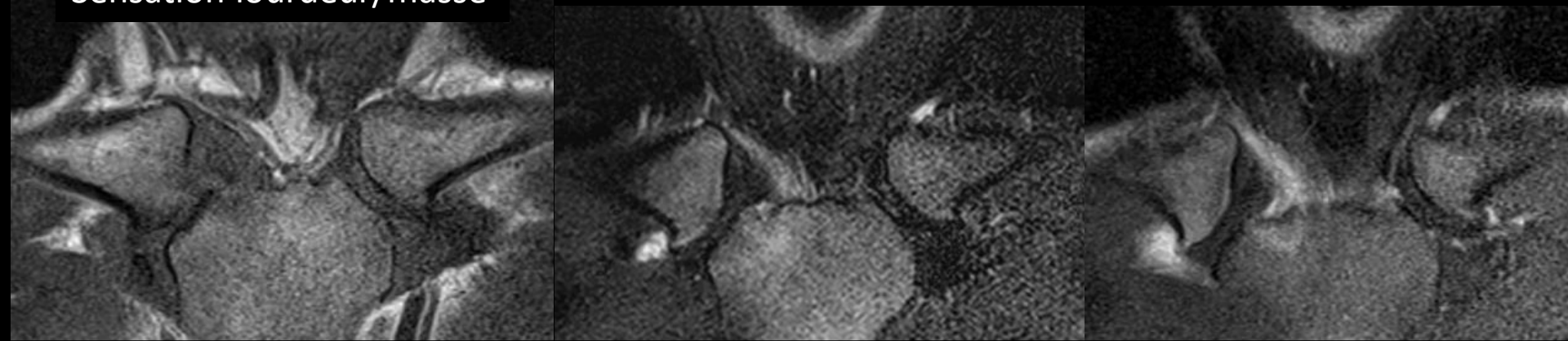
// arthropathie

DD :
Femme, 39 ans
Sterno-clav droite
Sensation lourdeur/masse



Ostéose claviculaire condensante débutante ?

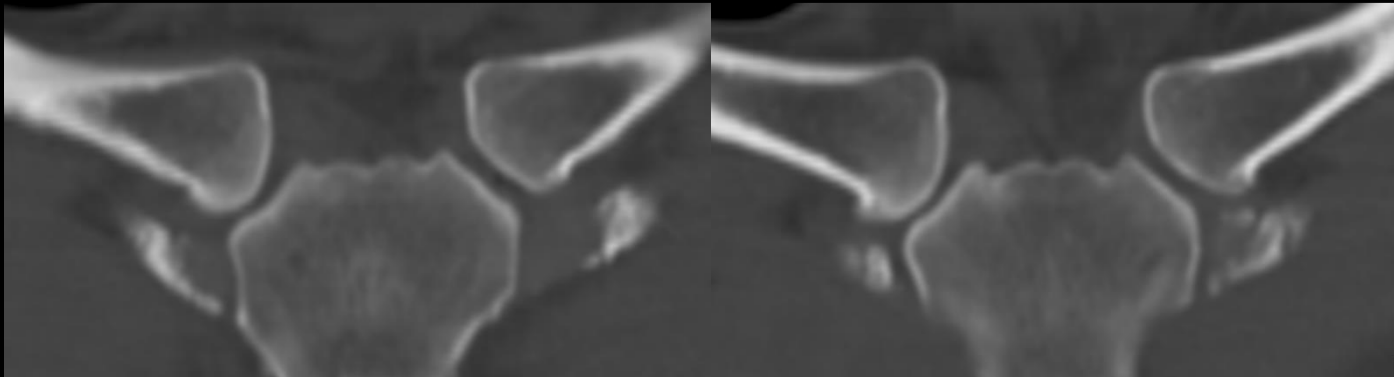
Femme, 39 ans
Sterno-clav droite
Sensation lourdeur/masse



T1

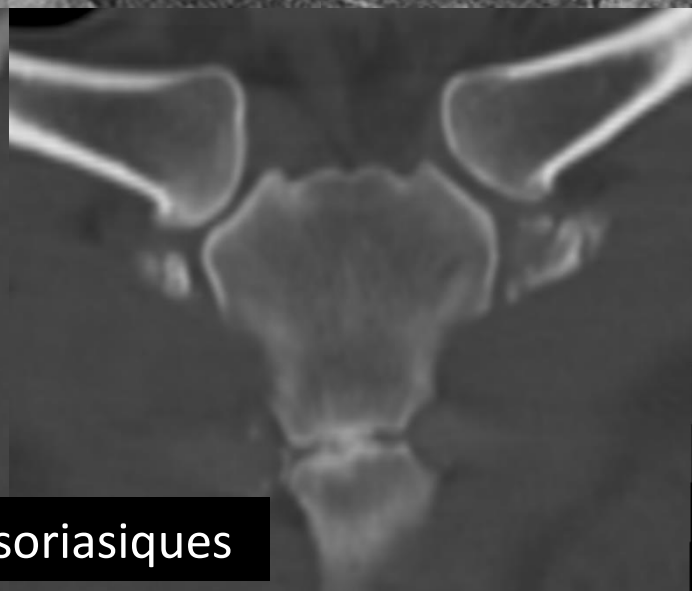
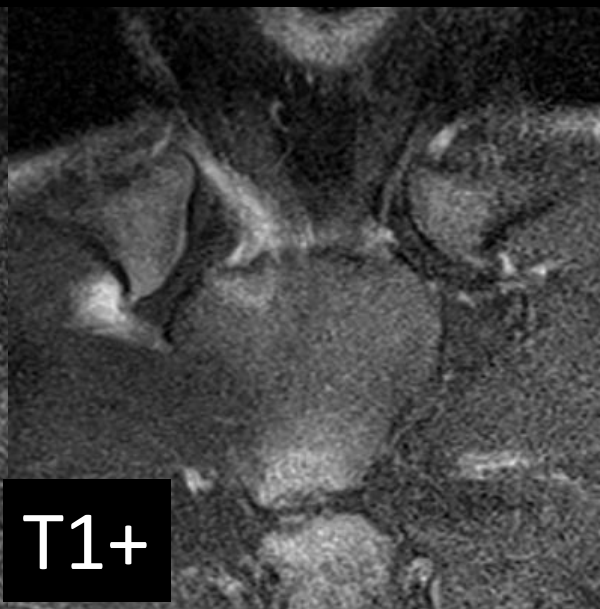
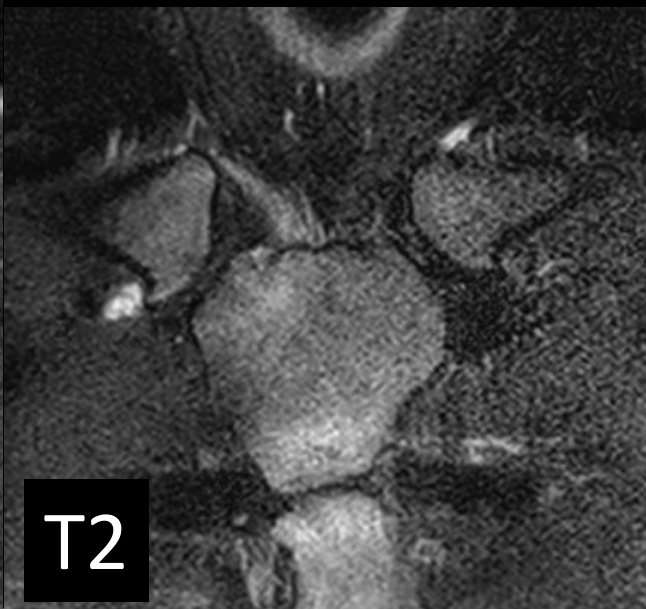
T2

T1+



Ostéose claviculaire condensante débutante ?

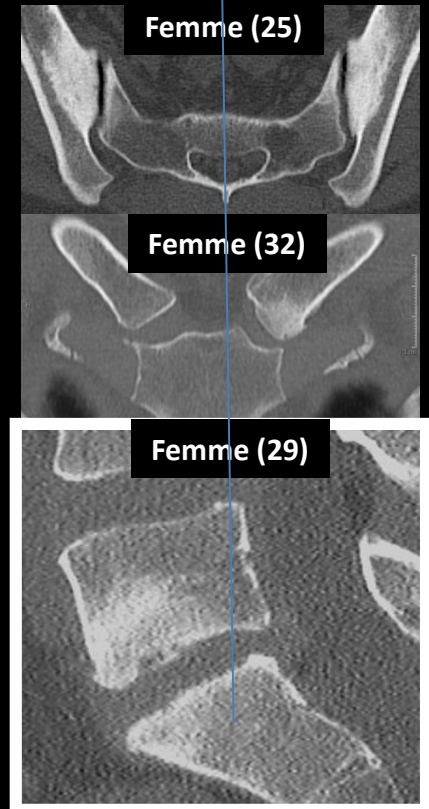
Femme, 39 ans
Sterno-clav droite
Sensation lourdeur/masse



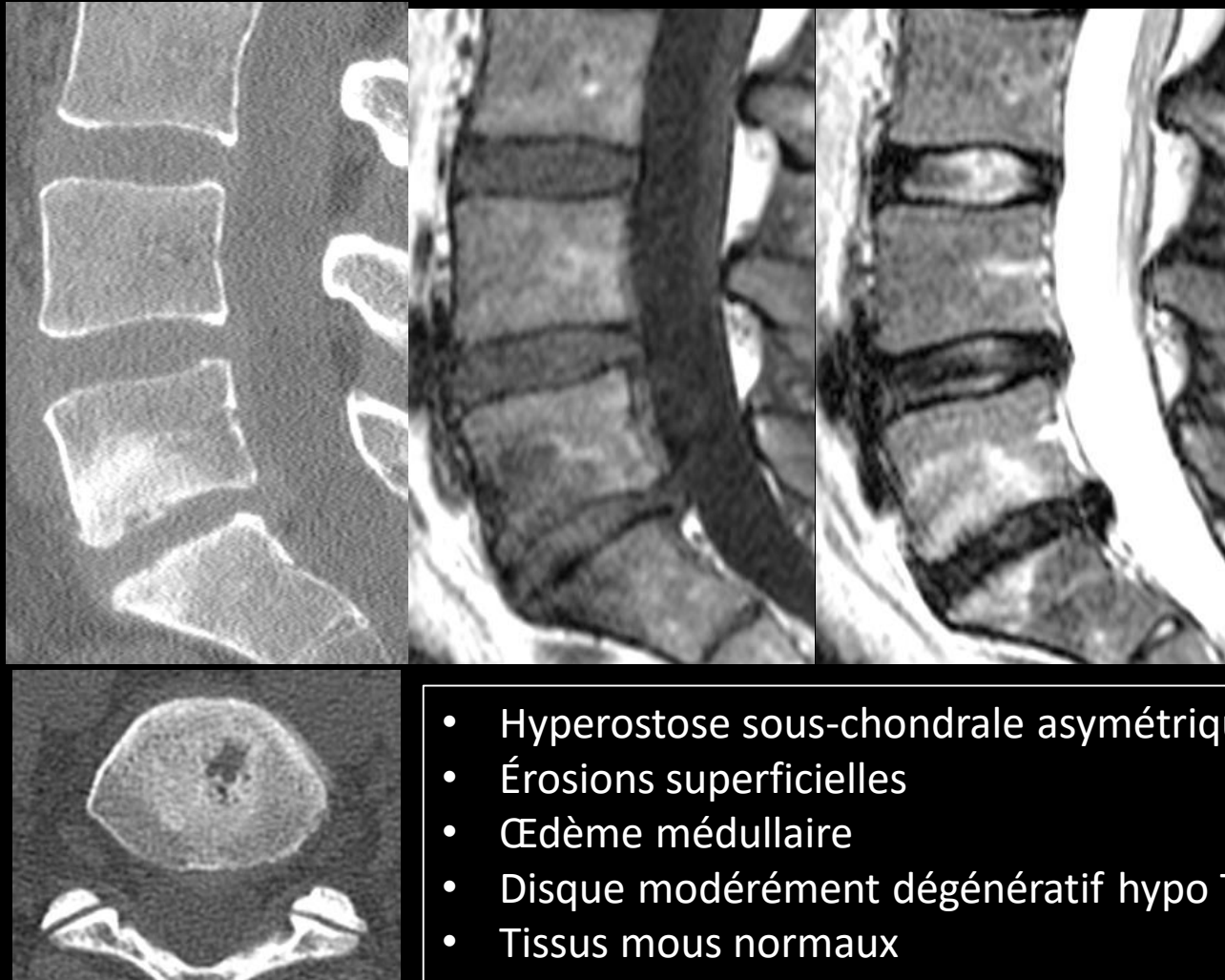
Arthrites psoriasiques

Objectifs

- Arthropathies mécaniques atypiques
 - Localisations
 - Sacro-iliaque
 - Sterno-claviculaire
 - **Disque lombaire**
 - Imagerie
 - Diagnostic différentiel

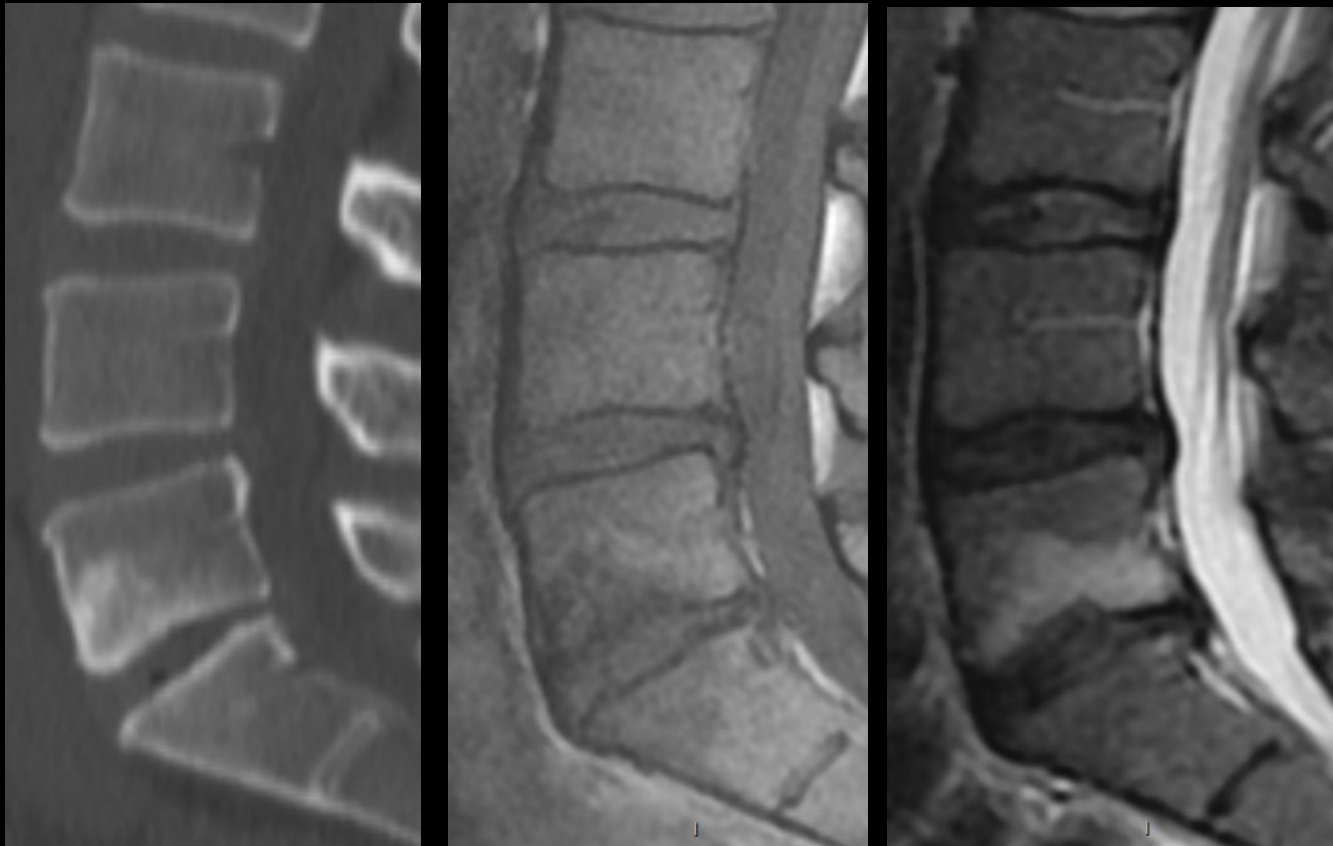


Femme (29 ans)



- Hyperostose sous-chondrale asymétrique
- Érosions superficielles
- Œdème médullaire
- Disque modérément dégénératif hypo T2
- Tissus mous normaux

Femme (39 ans)



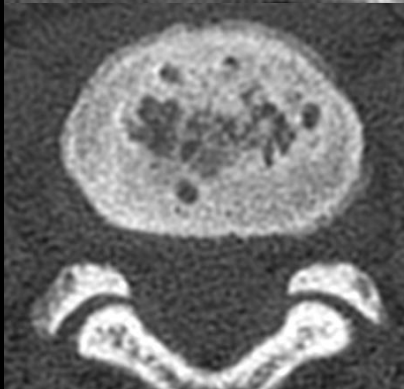
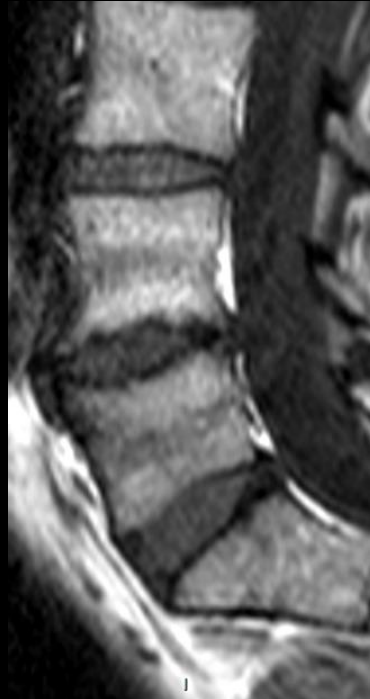
Discordance

sclérose osseuse / œdème médullaire



pincement / ostéophytes

Femme (52 ans)



- Hyperostose sous-chondrale
- Érosions superficielles
- Œdème/lipomatose médullaire
- Absence d'ostéophytes
- Tissus mous normaux

DD
Arthrose typique
Discite inflammatoire
Discite métabolique

.....

QUE RETENIR ?



Cliniques universitaires
SAINT-LUC
UCL BRUSSELS

Que retenir ?

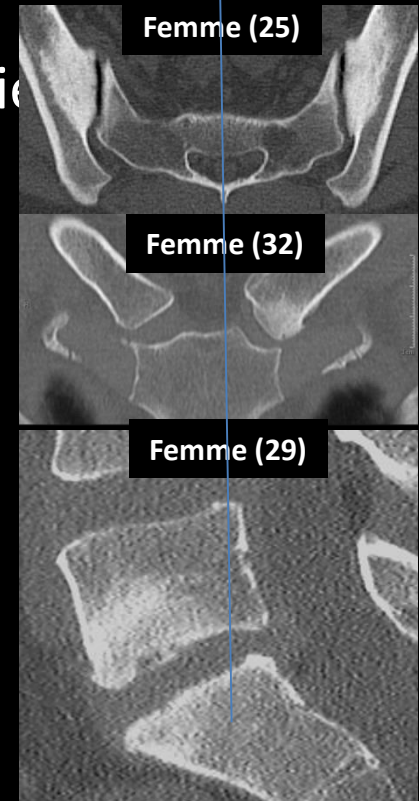
- 25-50 ans
- Arthropathies mécaniques atypiques
- Sacro-iliaques, sternoclaviculaire, lombaire inférieure
- Symptômes variables parfois inflammatoires
- Biologie normale
- évolution lente vers guérison clinique
- CT plus spécifique que IRM

Discordance

hyperostose et érosions superficielles

> <

interligne quasi normal



Que retenir ?

- > 50 ans
- Arthropathies mécaniques
- Oestrogènes assouplissement conjonctif
- RX typique

Uncommon degenerative involvement of the lombo-sacral segment



Cliniques universitaires
SAINT-LUC
UCL BRUSSELS

Buts IRM

- Détecter lésions
 - Actives
 - Quiescentes
- Explorer tous les territoires cibles
 - Enthèses (insertions tendons, ligaments aponévroses)
 - Os sous chondral
 - Synoviales
 - Capsules articulaires

Technique IRM

- Lésions actives – inflammation - Œdème

 séquence pondérée **T2 avec fat-sat**

- Lésions quiescentes - Involution graisseuse

 séquence pondérée **T1 avec graisse**

Suppression signal de la graisse

Terminologie

- STIR
- T2 fs
- DP fs
- Dixon, Ideal, mDixon
- Grappa, Blade...
- Dans séquence
- Avant séquence
- Après séquence

Comment suis-je certain d'avoir un bon examen ?

- Plan coronal oblique T1 (graisse blanche)
- Plan coronal oblique T2 avec fat sat (eau blanche et graisse noire)
- Plan transverse oblique T1 ou T2

Technique IRM

- Lésions actives – inflammation - Œdème
➔ séquence pondérée T2 avec fat-sat
- Lésions quiescentes - Involution graisseuse
➔ séquence pondérée T1 avec graisse
- SE T1 fat-sat avec contraste ?

Injection *iv* de Gd ?

- Injection de Gd **améliore la détection** de
 - Synovite (différence liquide articulaire (avasculaire) de la synoviale épaisse (vascularisée)
 - Enthésites
 - capsulite
- Injection de Gd **n'améliore pas la détection** de
 - Ostéite
 - Érosion
- Injection de contraste n'augmente pas la détection des patients atteints car atteinte isolée de la synoviale (sans ostéite) est très rare.
- NB En recherche, quantification de la perfusion ? Monitoring ?
- NB attention pourrait être différent au rachis !

Mandatory MRI sequences for SI imaging

- T1-weighted SE coronal oblique sequence
- Fat-saturated intermediate-weighted SE coronal oblique sequence

Optional MRI sequences for SI imaging

- T1-weighted and fat-suppressed intermediate-weighted SE transverse oblique sequences (optional).
- Gadolinium enhanced fat-saturated T1-weighted sequence (optional)
- Fat-saturated T1-weighted sequence or gradient-echo T2*-weighted sequence (optional)

Séméiologie

Anomalies tardives

Lésions structurales

- Rx
- CT

Anomalies précoces

Inflammation

- IRM

Séméiologie IRM

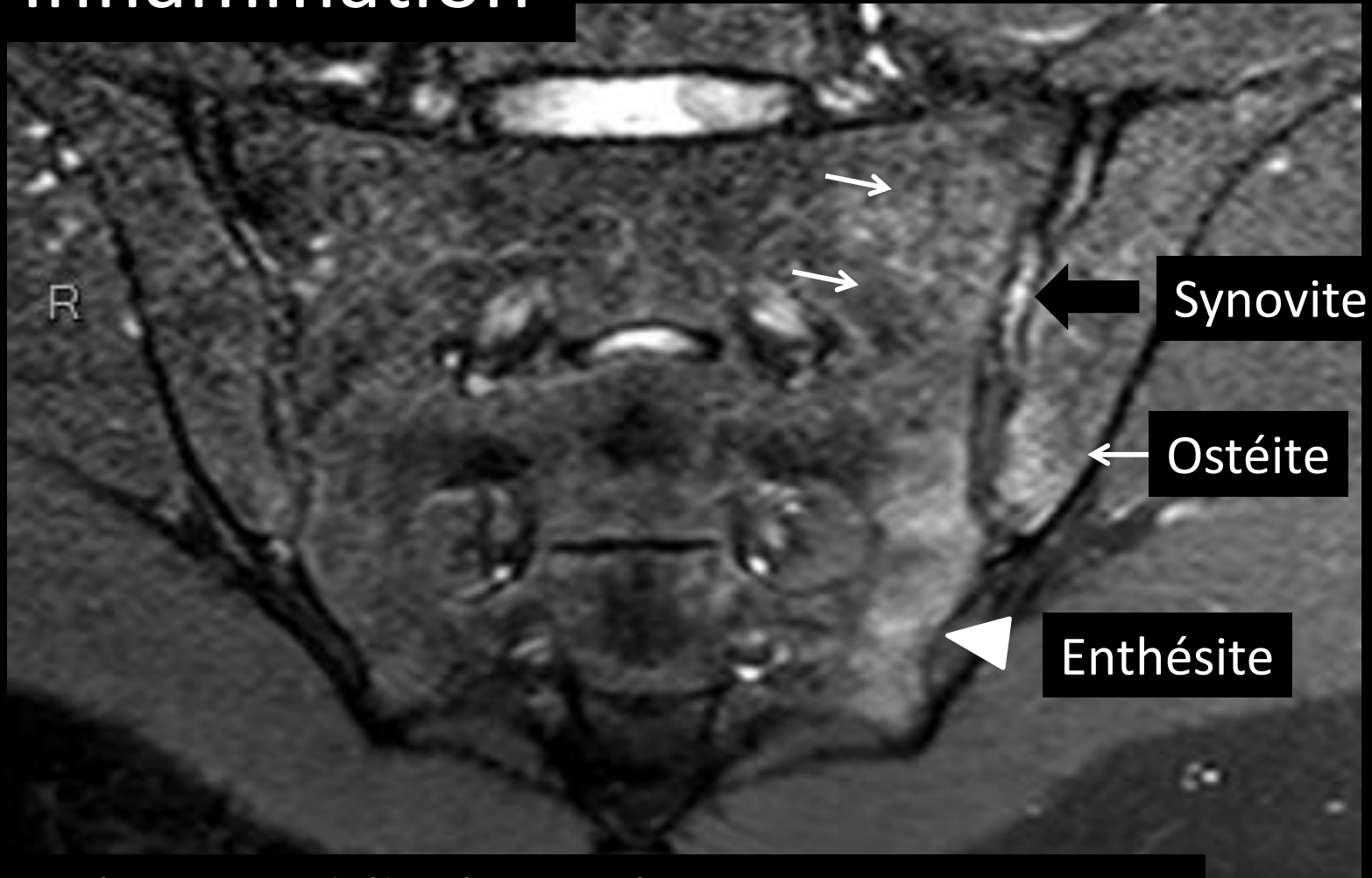
Inflammation

- Ostéite (œdème médullaire)
- Synovite
- Capsulite
- Enthésite

Lésions organisées

- Ostéo-sclérose
- Érosions
- Involution graisseuse
- Ossifications péri-osseuses

Inflammation

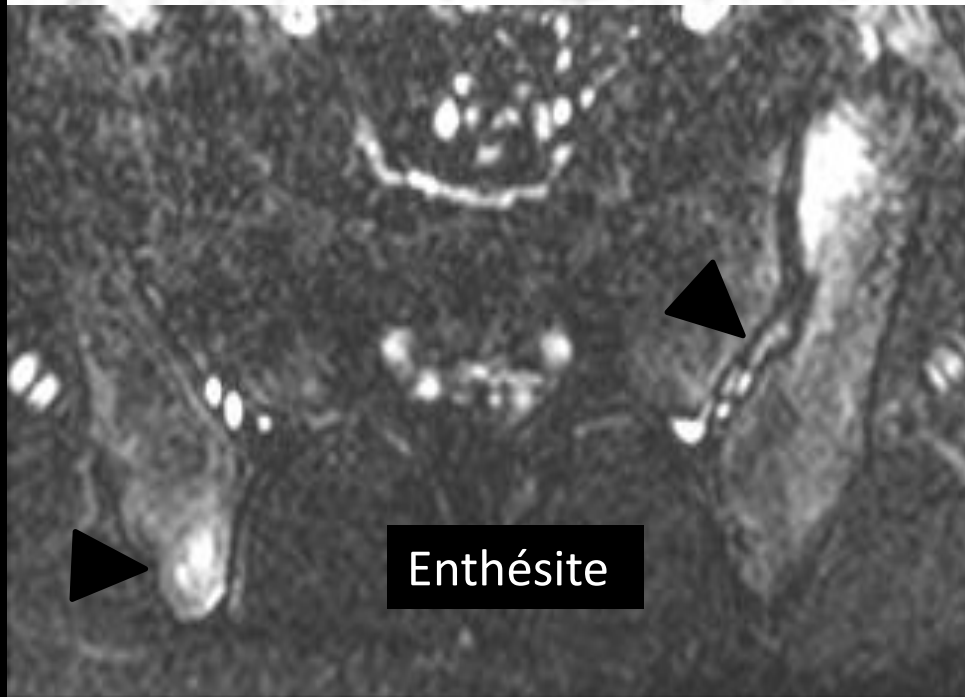


Ostéite : signal élevé en T2 fs
dans deux secteurs différents sur une coupe
dans un secteur sur deux coupes

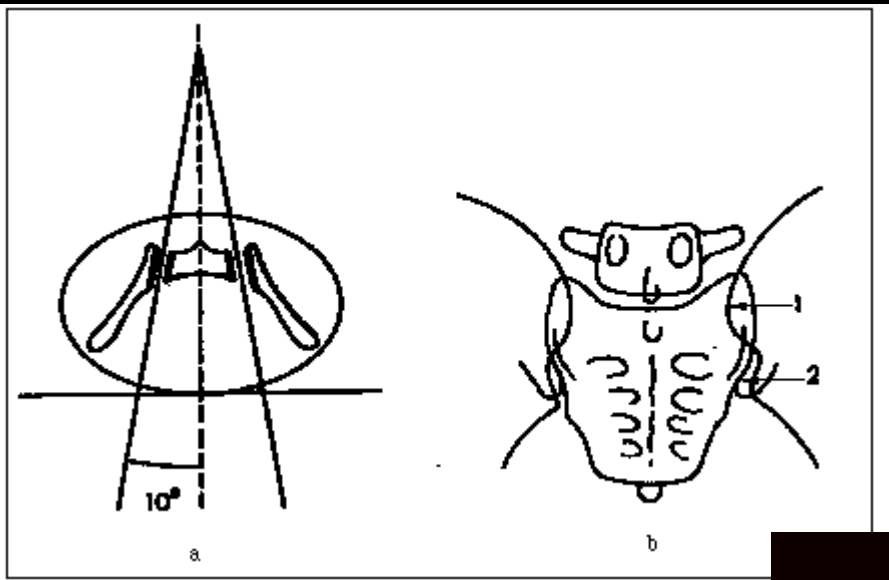
Inflammation



Ostéite



Enthésite

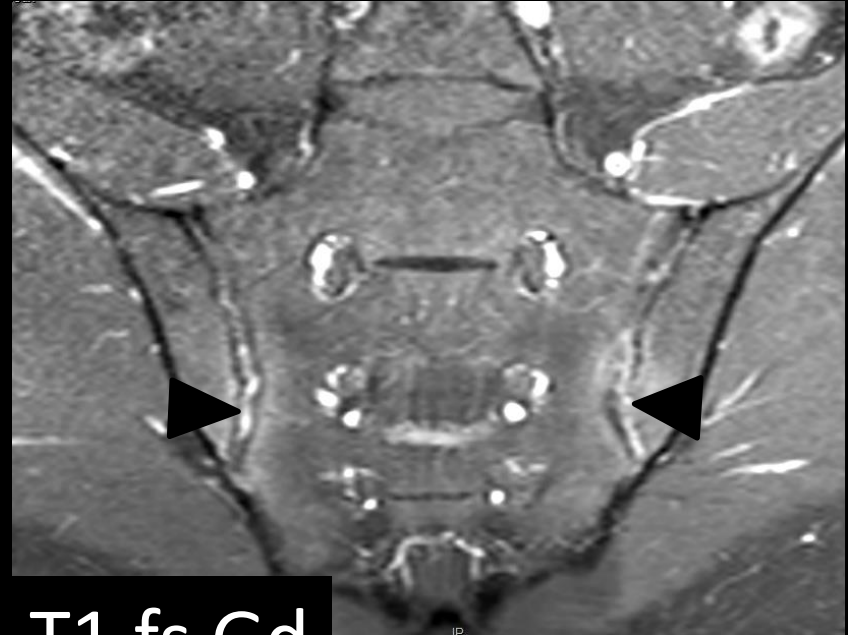


Inflammation



DP fs

Synovite



T1 fs Gd

Erosion et synovite

Bone Inflammation (osteitis)

- Appears as bone marrow edema
- occurs early in disease course
- correlates with symptoms
- is detected exclusively at MRI
- presents as high signal intensity on fat-saturated fluid-sensitive sequences
- needs to be visible at least on 2 consecutive slices or 2 foci on same slice for a definite diagnosis in sacro-iliac joints.

Séméiologie

Inflammation

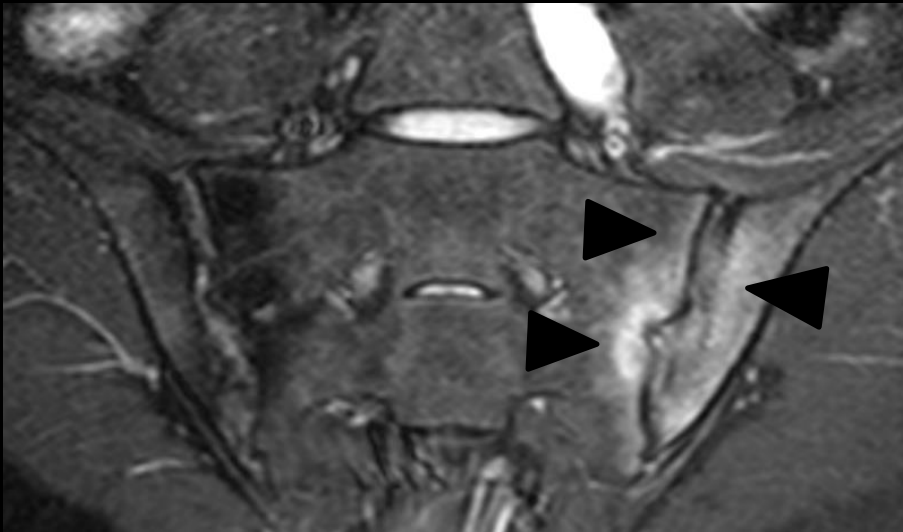
- Ostéite (œdème médullaire)
- Synovite
- Capsulite
- Enthésite

Lésions organisées

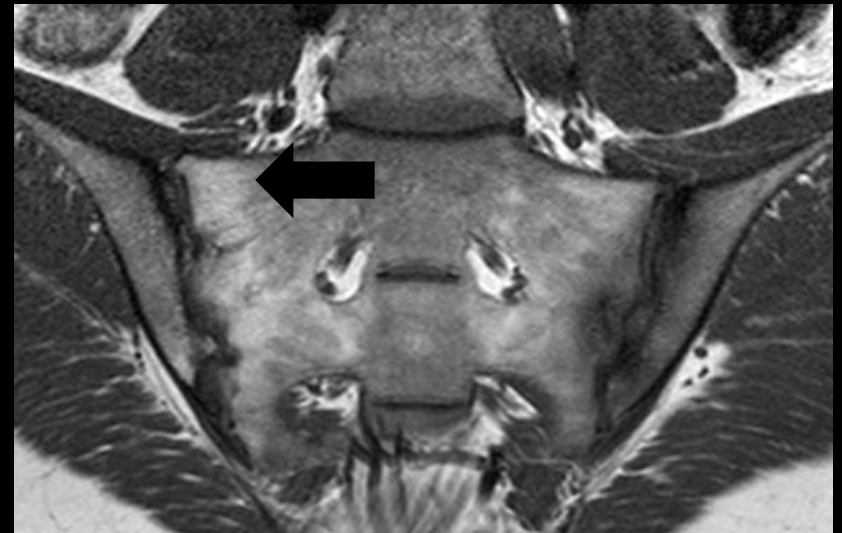
- Ostéo-sclérose
- Érosions
- Involution graisseuse
- Ankylose
- Ossifications péri-osseuses

Lésions avérées (structural)

Actif !



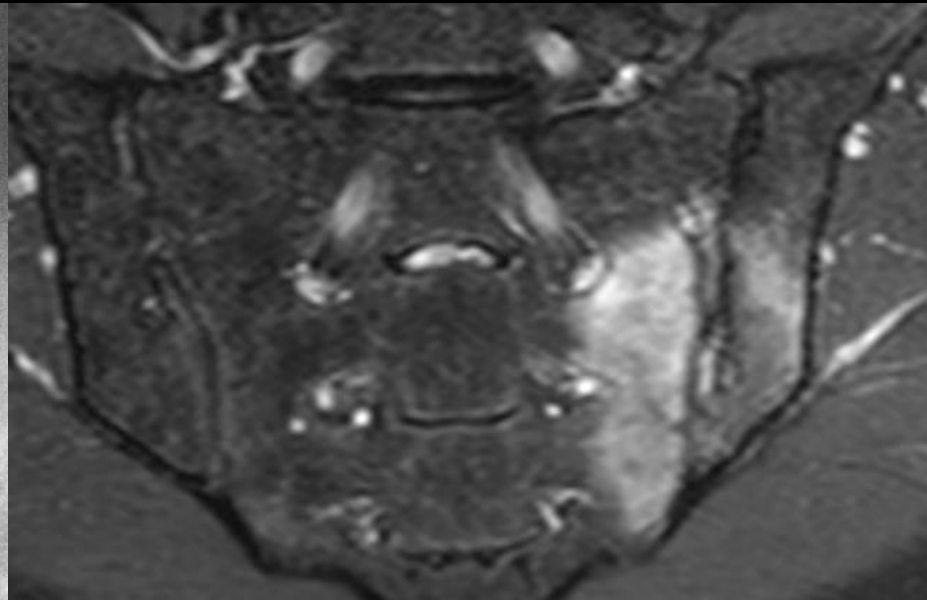
Quiescent !



Lésions avérées (structural)

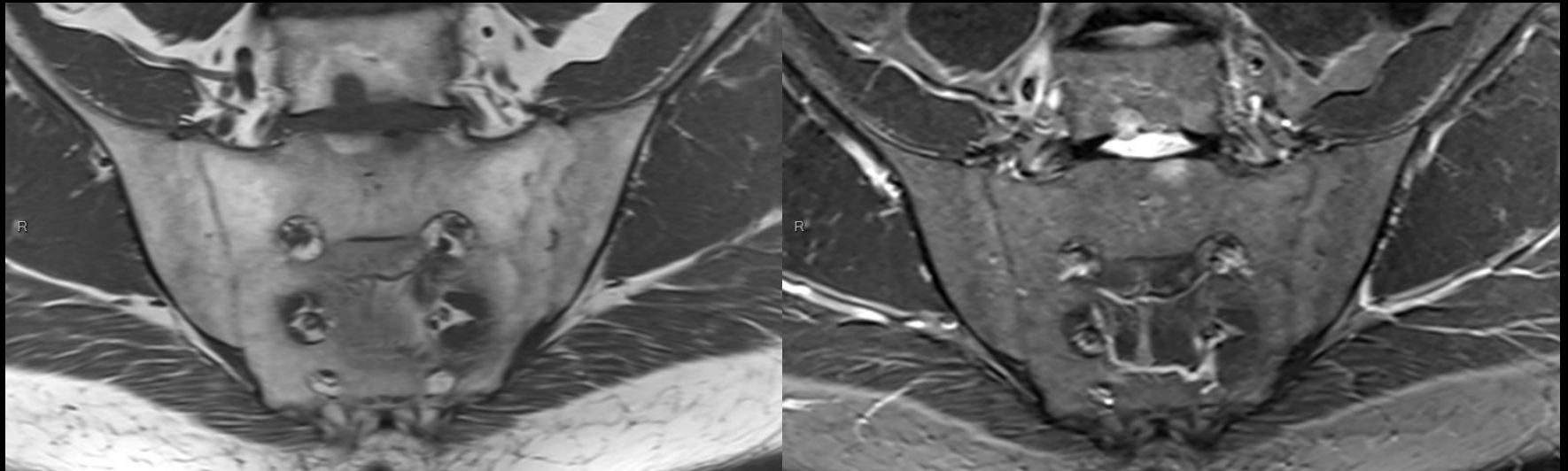


Erosion
Sclérose



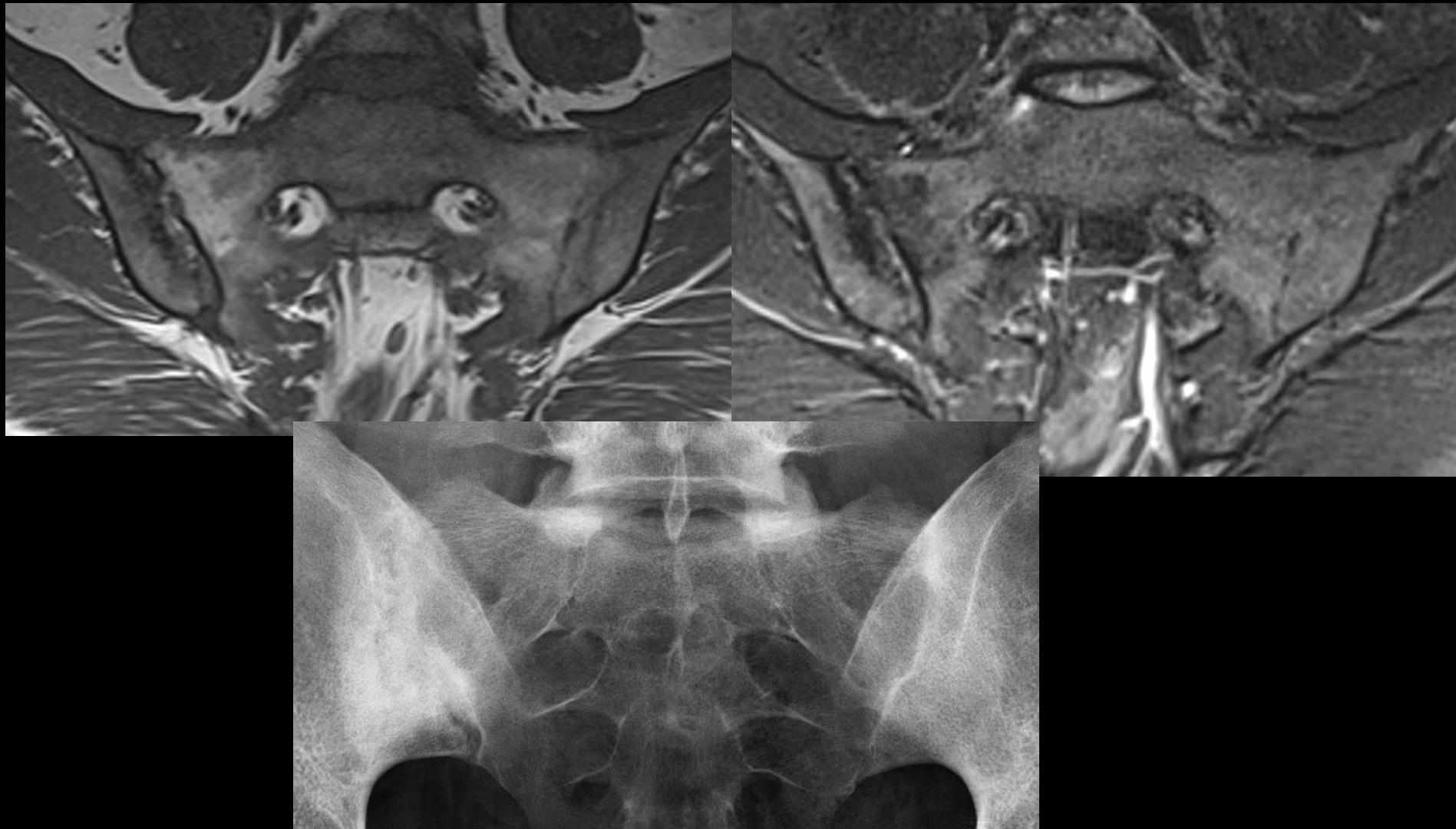
Erosion

Lésions avérées (structural)



Ankylose

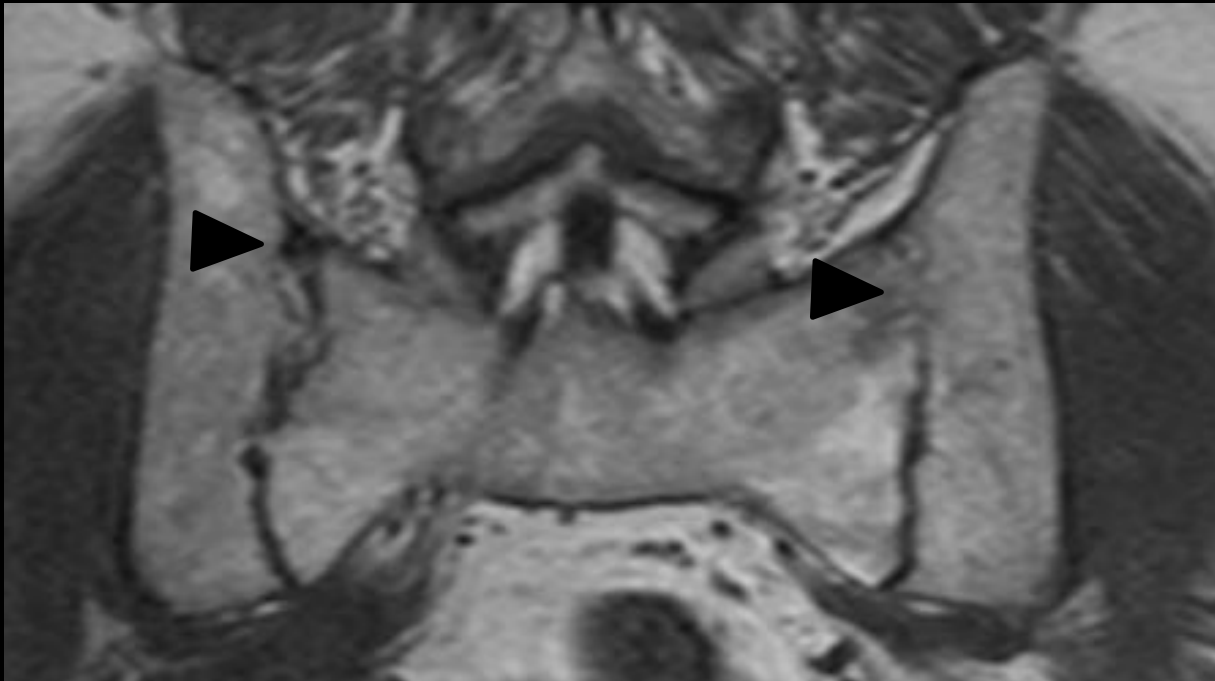
Lésions avérées (structural)



Structural changes

- propensity to produce bone
- fatty deposition/erosion/ossification near entheses and ankylosis
- occur late in disease course
- correlate poorly with symptoms
- are better seen on radiographs/CT than MRI (except for fatty deposition)
- remain poorly understood but could partly represent a healed or quiescent stage of inflammation.
- do not suffice for the definition of a positive MRI if without inflammatory changes

DISH – Forestier Ankylose



Performance diagnostique IRM

Table I. — The sensitivity, specificity, positive and negative likelihood ratios of MRI features of sacroiliitis for the diagnosis of SpA.

	N	Sensitivity %	Specificity %	LR+	LR-
ACTIVE					
BMO	215	65.2	74.6	2.56	0.47
Enthesitis	13	3.8	98.4	2.38	0.98
Capsulitis	17	6.7	99.0	6.7	0.94
STRUCTURAL					
Sclerosis	167	43.3	75.6	1.77	0.75
Fat infiltration	164	54.8	84.0	3.42	0.54
Erosion	130	54.3	94.8	10.4	0.48
Ankylosis	39	14.8	97.4	5.7	0.87

(N = number of patients; LR+ = positive likelihood ratio; LR- = negative likelihood ratio; BMO = bone marrow oedema).

Combinaison BME et autres signes

Table II. — The sensitivity, specificity, positive and negative likelihood ratios of BMO concomitant with other MRI features of sacroiliitis for the diagnosis of SpA.

	N	Sensitivity %	Specificity %	LR+	LR-
BMO	215				
+ Enthesitis	10	5.1	96.1	1.31	0.99
+ Capsulitis	17	10.2	96.1	2.67	0.93
+ Sclerosis	109	57.0	60.3	1.43	0.71
+ Fat infiltration	112	67.9	75.6	2.78	0.42
+ Erosion	120	76.6	80.8	3.99	0.29
+ Ankylosis	26	16.8	96.1	4.31	0.87

(N = number of patients; BMO = bone marrow oedema; LR+ = positive likelihood ratio; LR- = negative likelihood ratio).

Conclusion

IRM performante pour détection lésions sacro-iliaques

Séquence minimum: SE DP fs (œdème ?) et SE T1 (graisse ?) plan coronal oblique

Approche holistique :

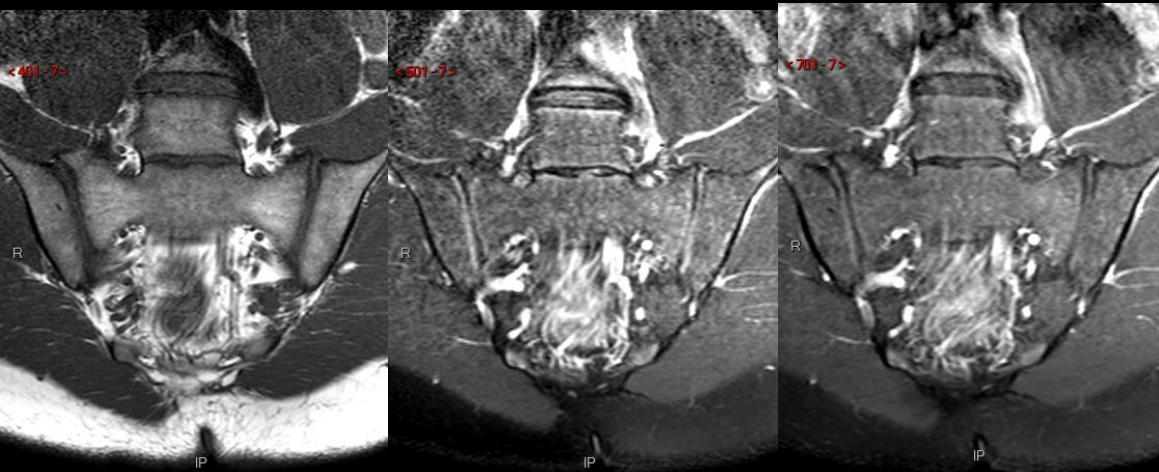
Espace: Os sous-chondral, synoviale, capsule, enthèse

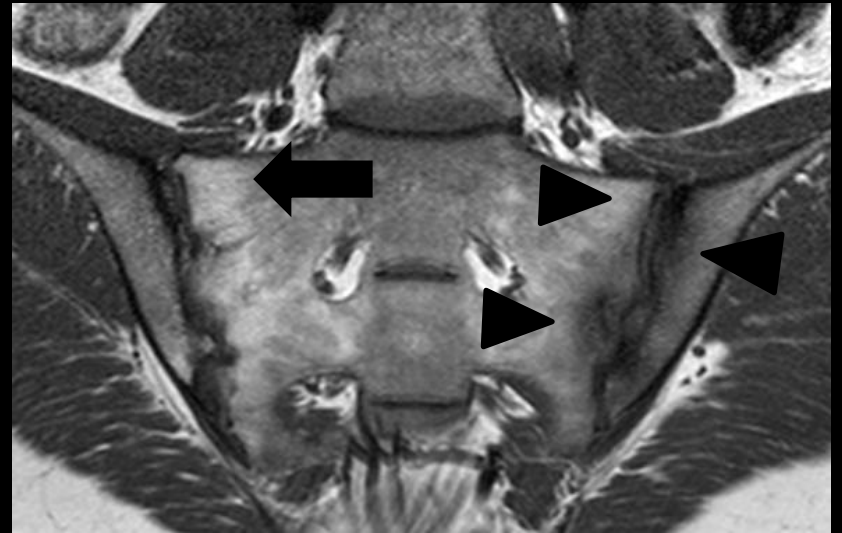
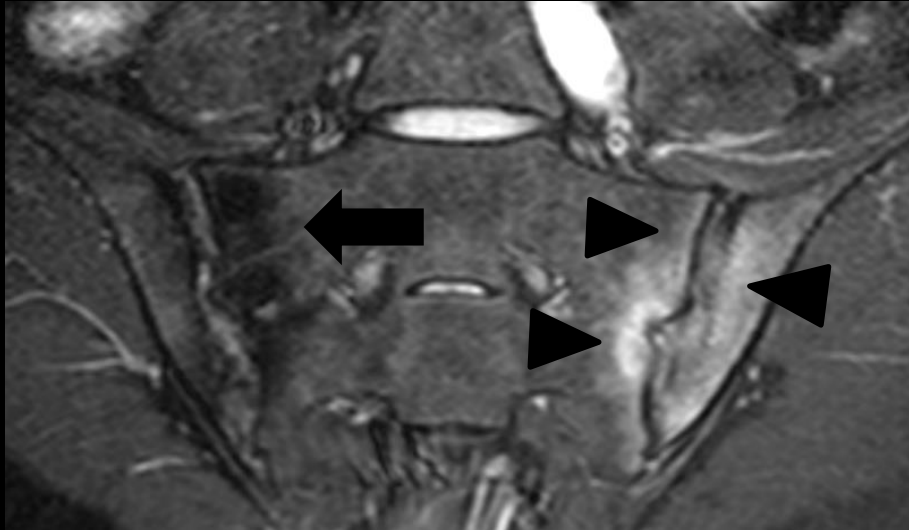
Temps : phase active, phase quiescente

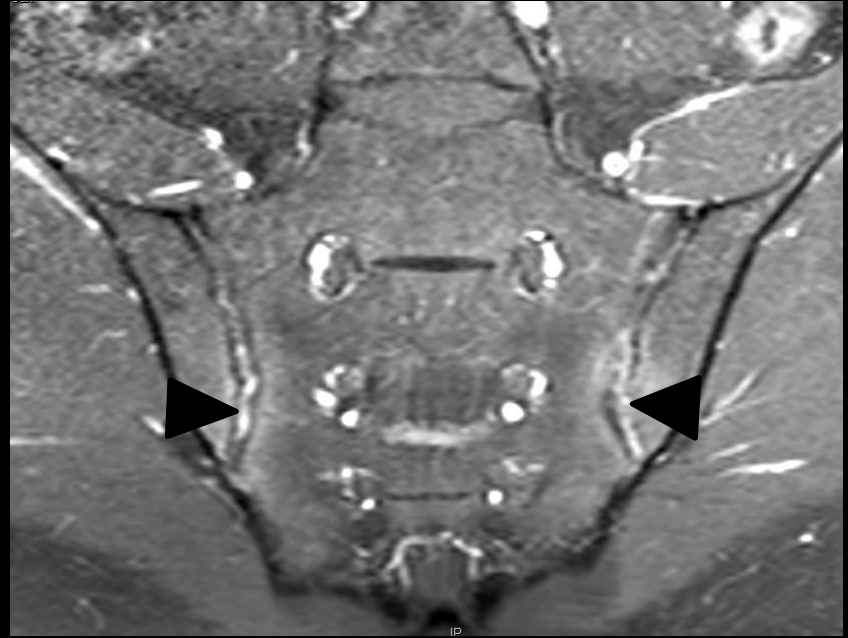
Sémiologie IRM

- Topographie articulaire
 - Tiers moyen et antérieur
 - Autres territoires
 - Variantes
- Association simultanée de plusieurs phases
 - Active aigue
 - Active chronique
 - Quiescente

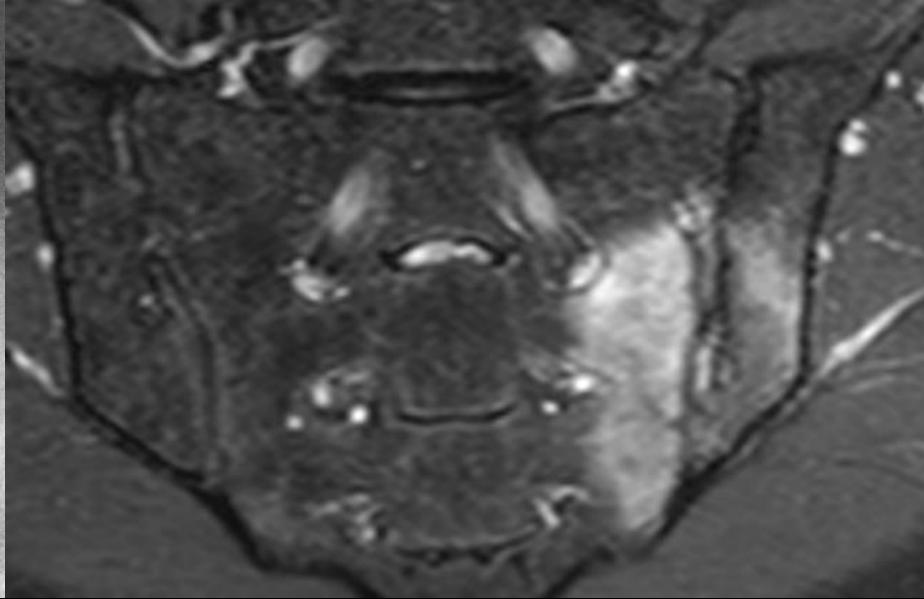


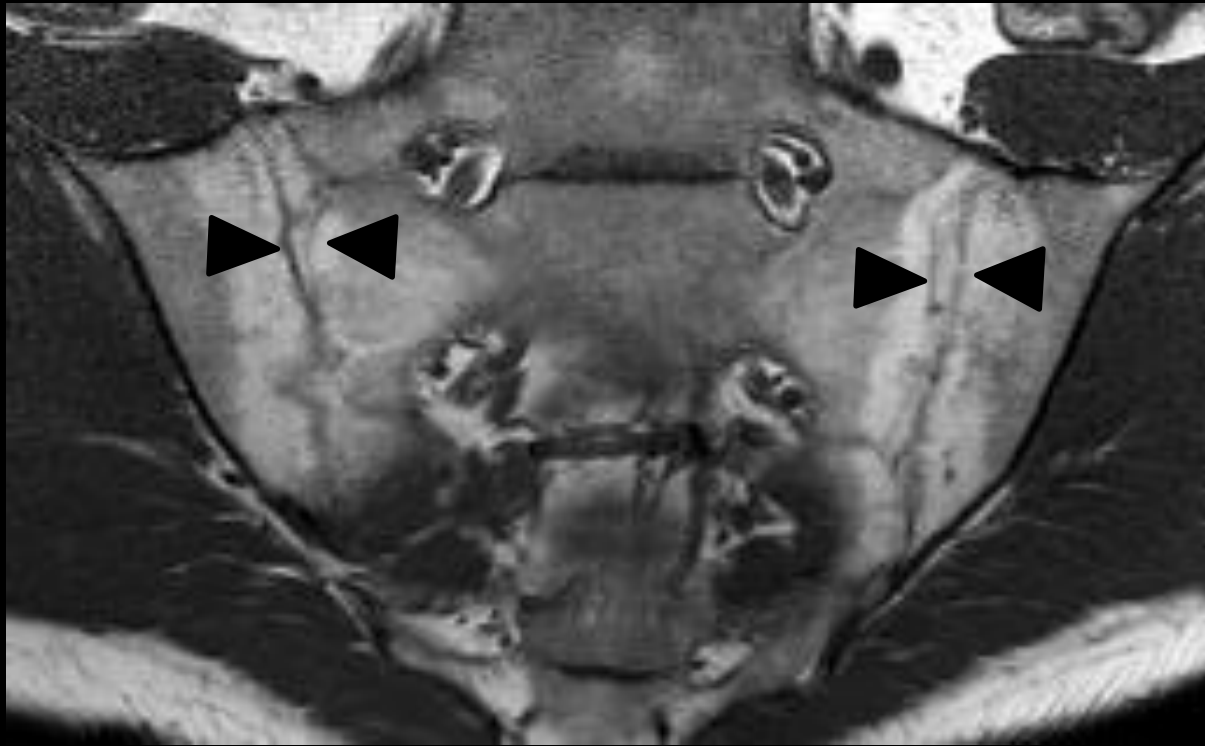


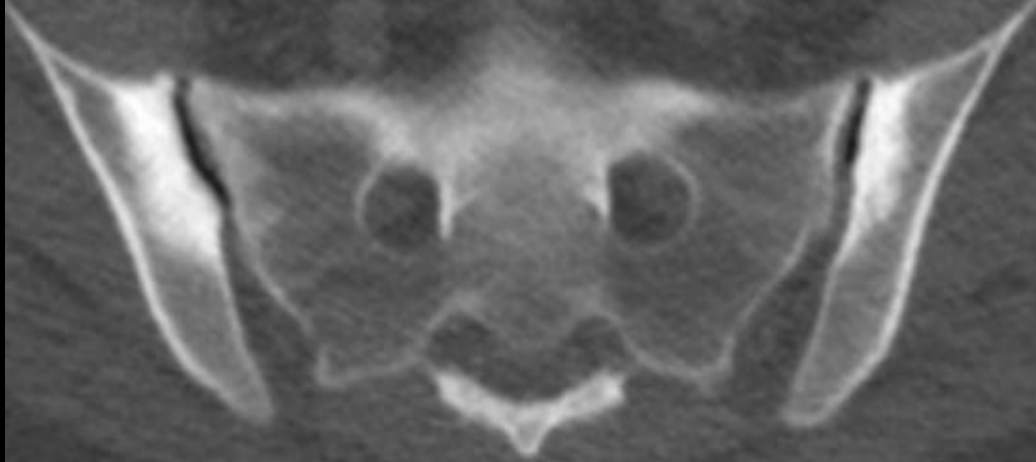


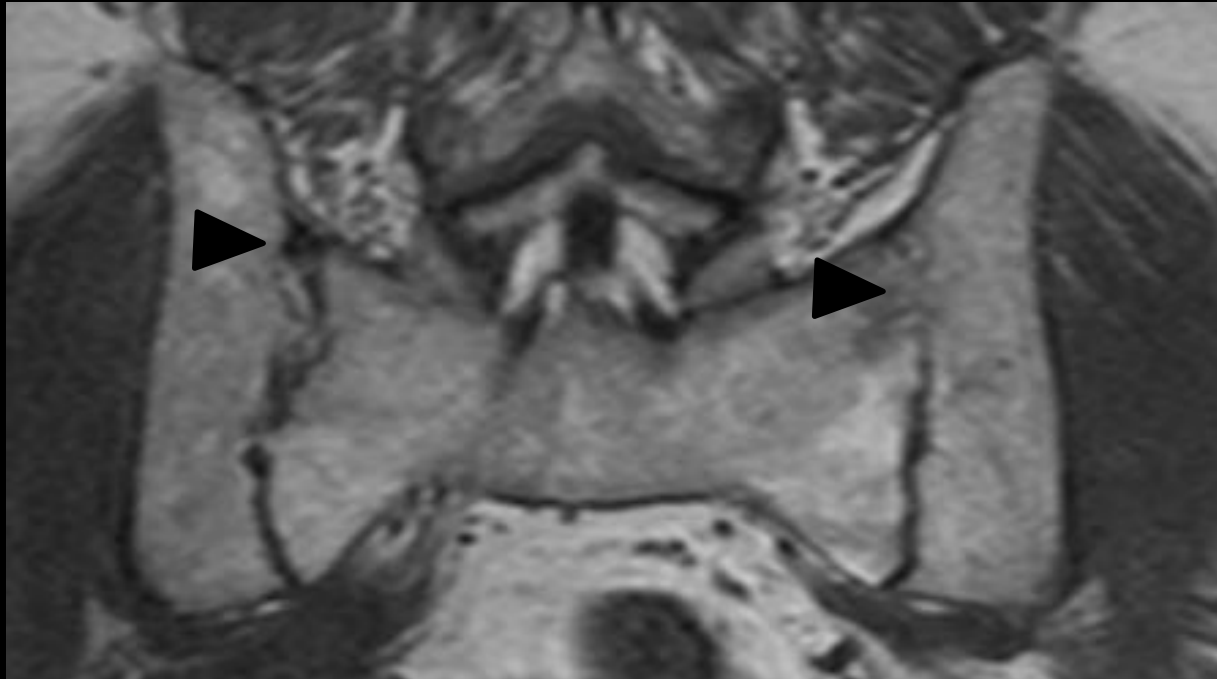


Synovite









Sacro-iliite septique:

Pathologie relativement rare

Diagnostic clinique difficile

Population à risque

Grossesse

Immunodéprimé

Utilisation de drogue

Sacro-iliite septique

Généralement affection aiguë (mais diagnostic tardif)

Radiographies peu contributives

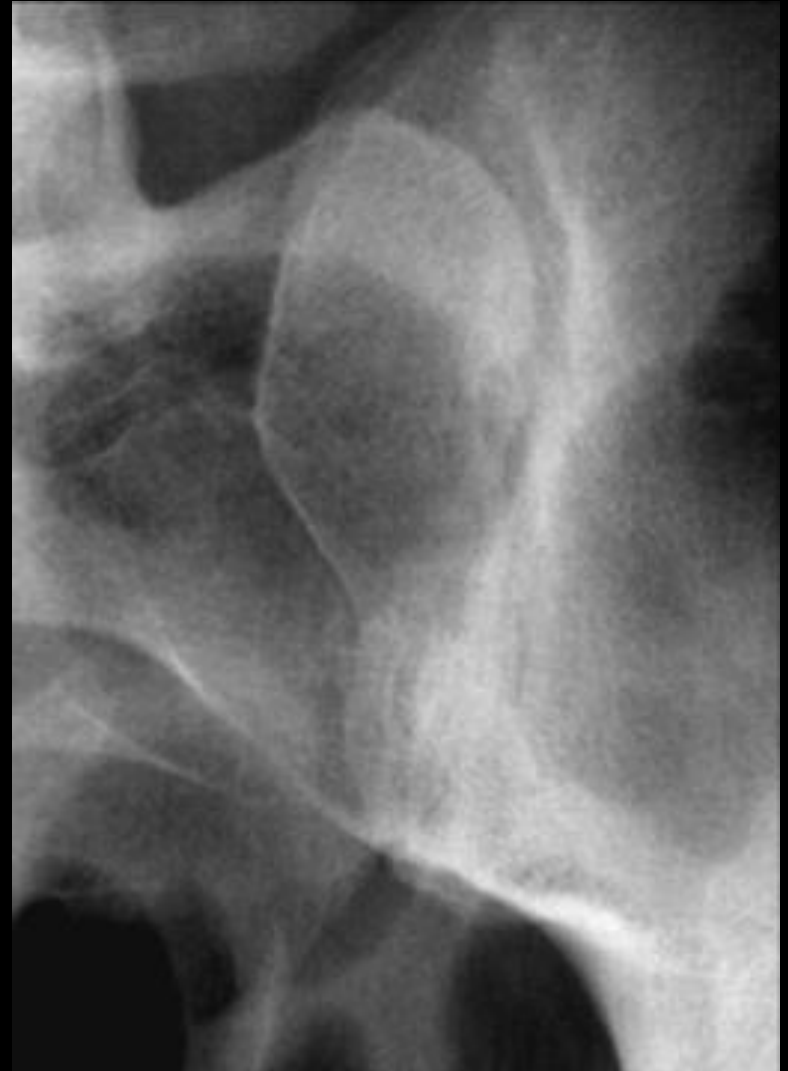


Atteinte unilatérale,
Prévalence destruction sur reconstruction
érosions floues et peu/pas de sclérose trabéculaire.

Sacro-iliite septique

Généralement affection aiguë (mais diagnostic tardif)

Radiographies peu contributives (ou d'interprétation délicate)



Comparison of STIR, Selective fat-saturation and Dixon

	STIR	Spectral	Reconstruction
Fat-saturation	Inversion time in pulse sequence	Selective saturation of fat signal	Data at different TE (in and out)
Signal-to-noise ratio	Limited	High	High
Field inhomogeneities	Low sensitivity	High sensitivity	Low sensitivity
T1 contrast	Very limited	Compatible	Compatible
T2 contrast	dominant	Compatible	Compatible
3D combination	No	Yes	Yes

Fat suppression in MR imaging : Techniques and Pitfalls. Delfaut et al Radiographics 1999; 19 :372-382

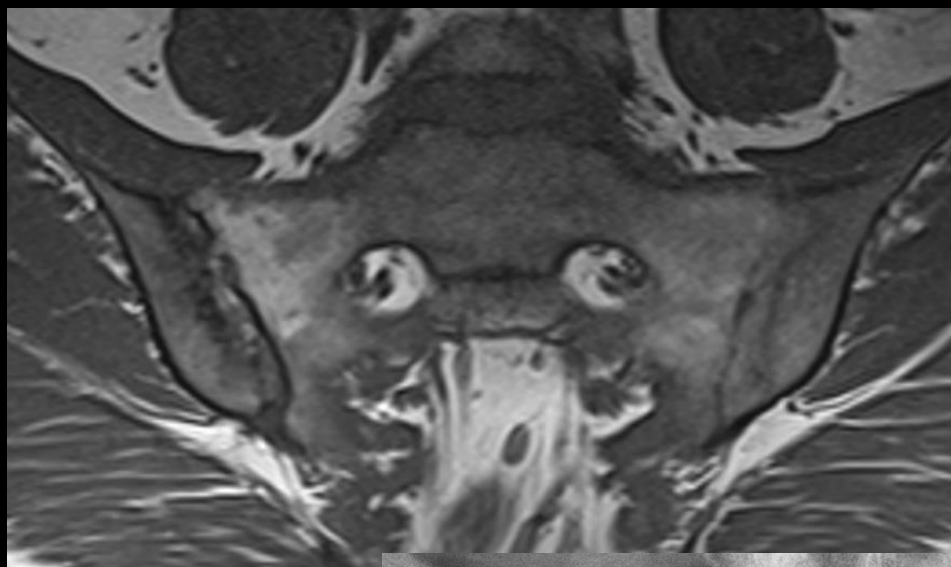
Fat suppression techniques for 3-T MR imaging of the musculo-skeletal system. Filippo Del Grande et al Radiographics 2014; 34: 217-233

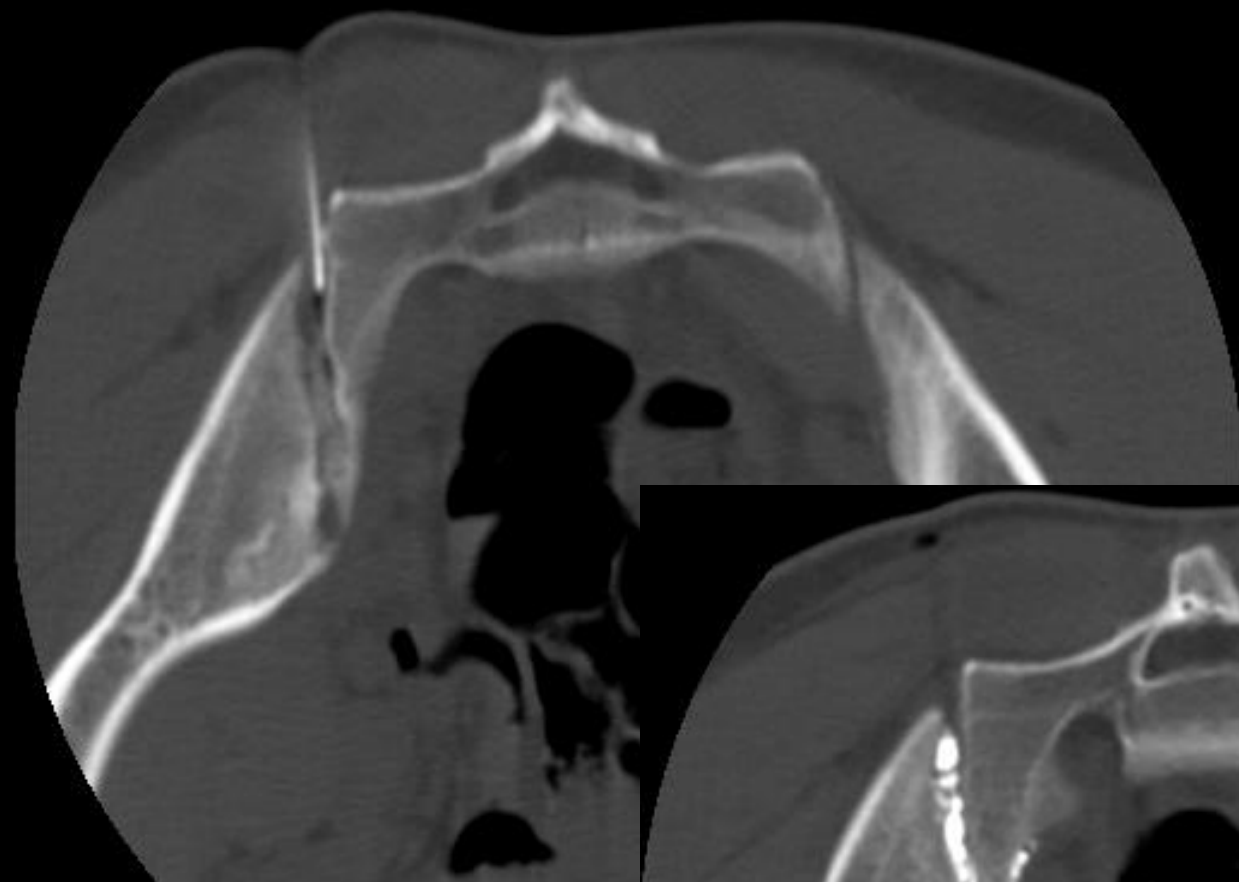
How/when to select STIR, Spectral or Reconstruction ?

	STIR	Spectral	Reconstruction
Thin section	No	Yes	Yes
Large FOV	Yes	No	Yes
Metal artefacts	No	Yes	Variable
T1 contrast	No	Yes	Yes
Gd-enh. imaging	No	Yes	Yes
T2 contrast	dominant	Yes	Yes

Fat suppression in MR imaging : Techniques and Pitfalls. Delfaut et al Radiographics 1999; 19 : 372-382

Fat suppression techniques for 3-T MR imaging of the musculo-skeletal system. Filippo Del Grande et al Radiographics 2014; 34: 217-233



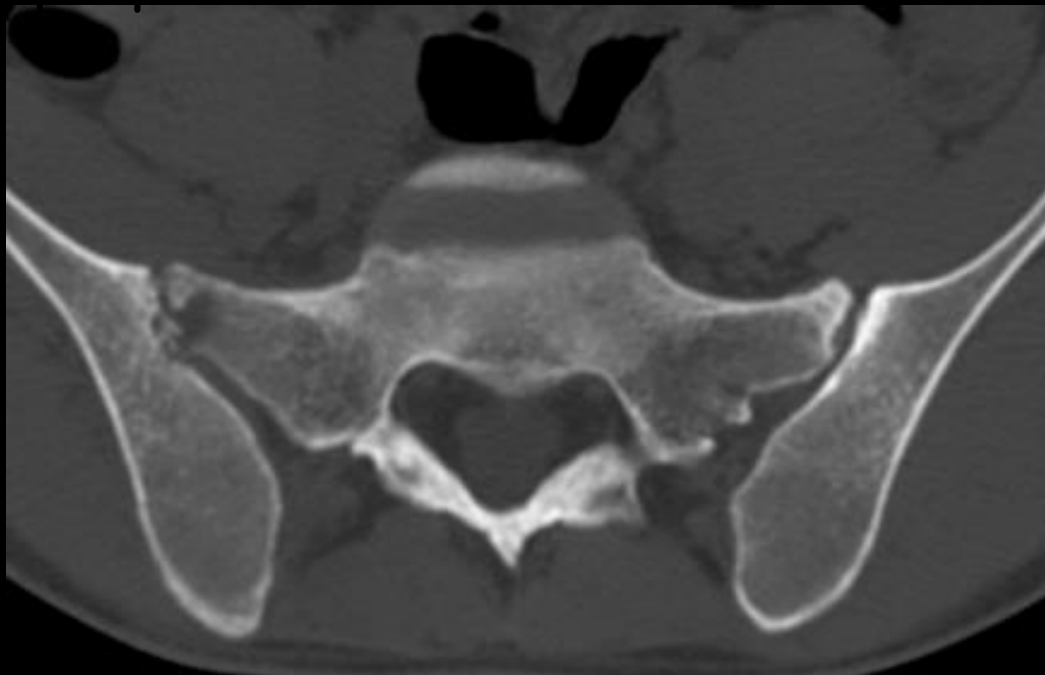


Limited articular recesses
Strong capsule/ligament

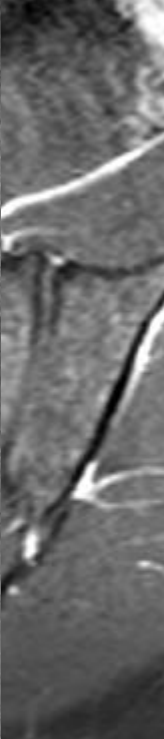
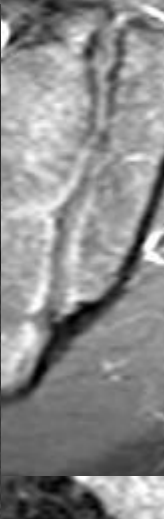
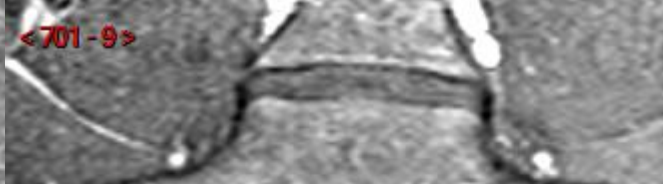
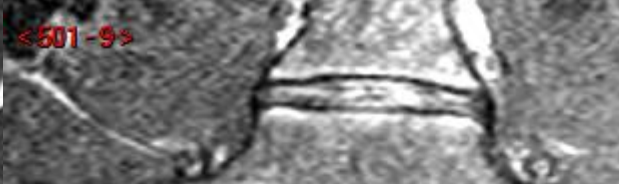
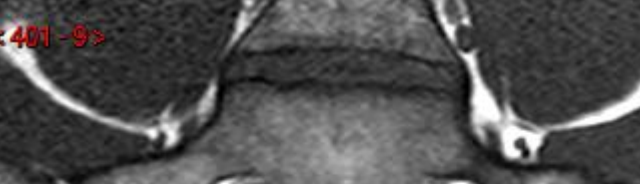
Look at distance for fluid/abcesses !





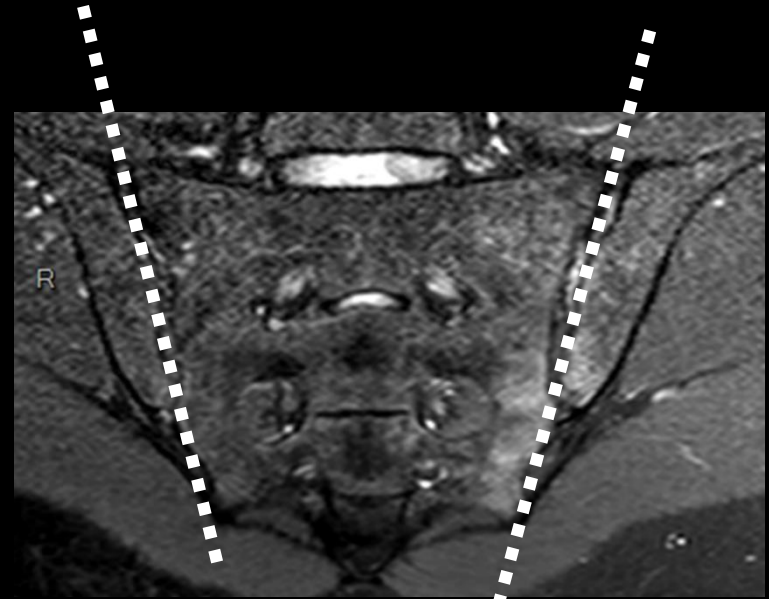


Anatomy of the immature SI interface

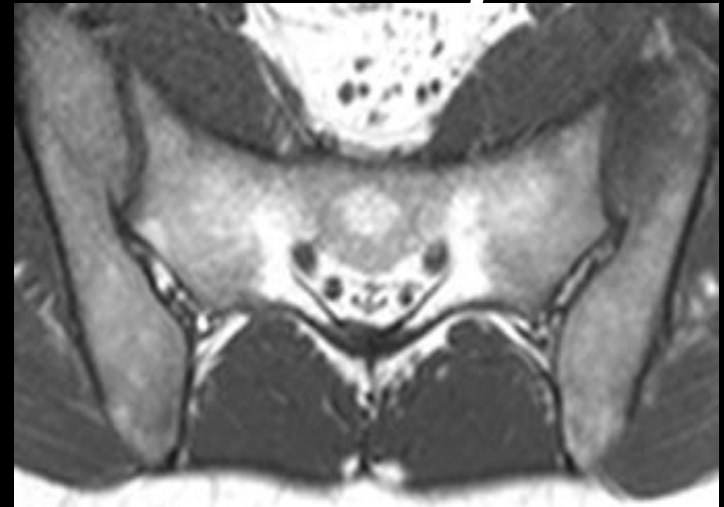


Spatial orientation of SI interface

Frontale plane



Transverse plane



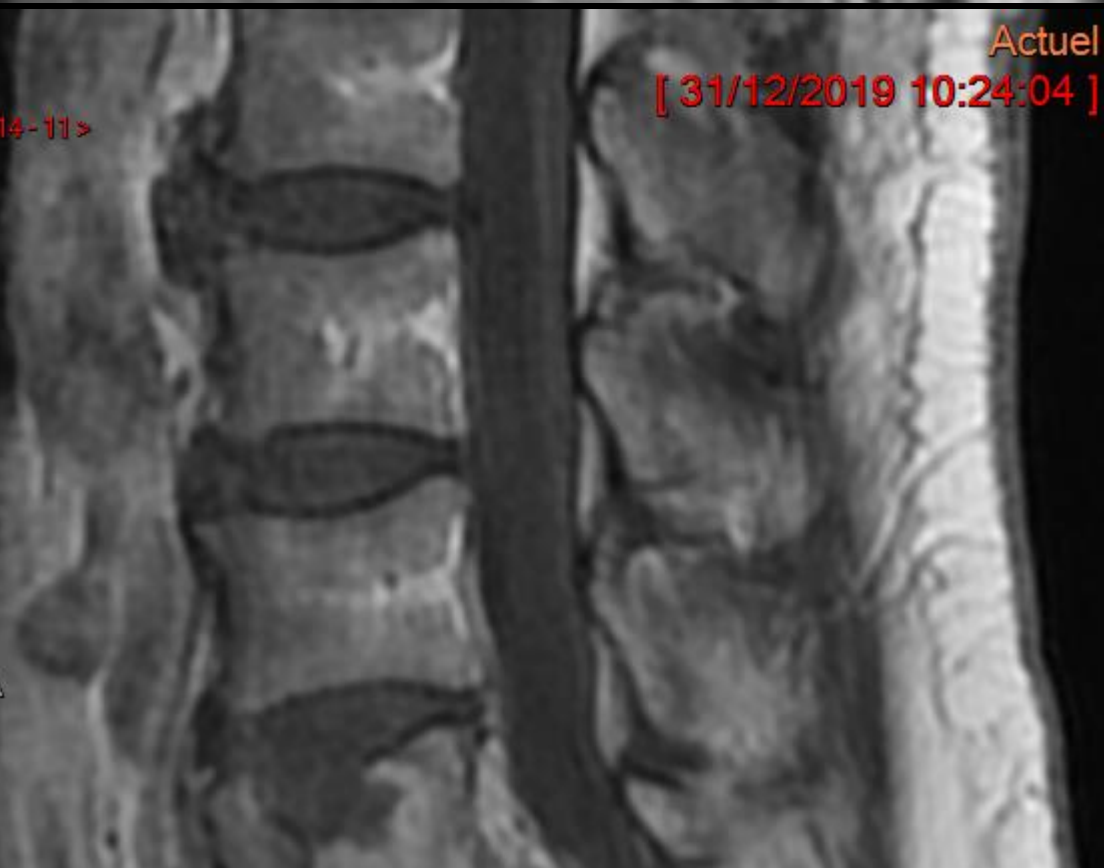
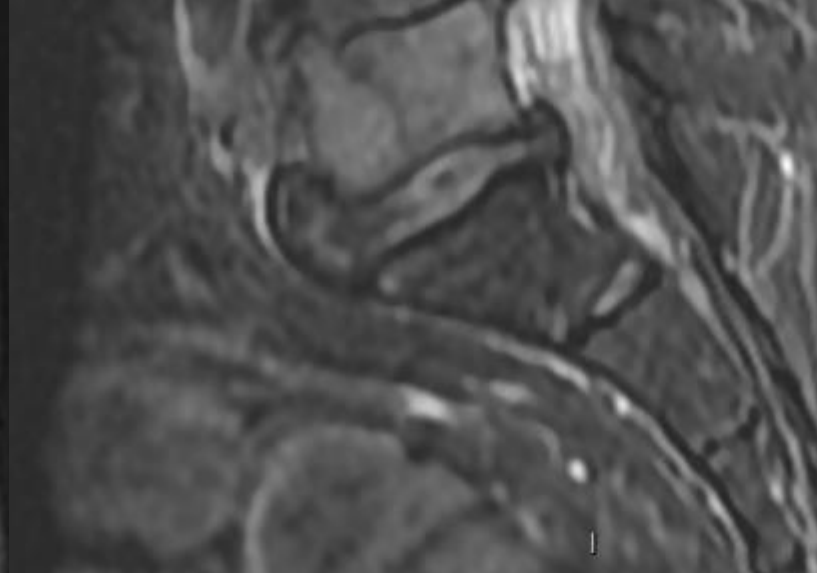
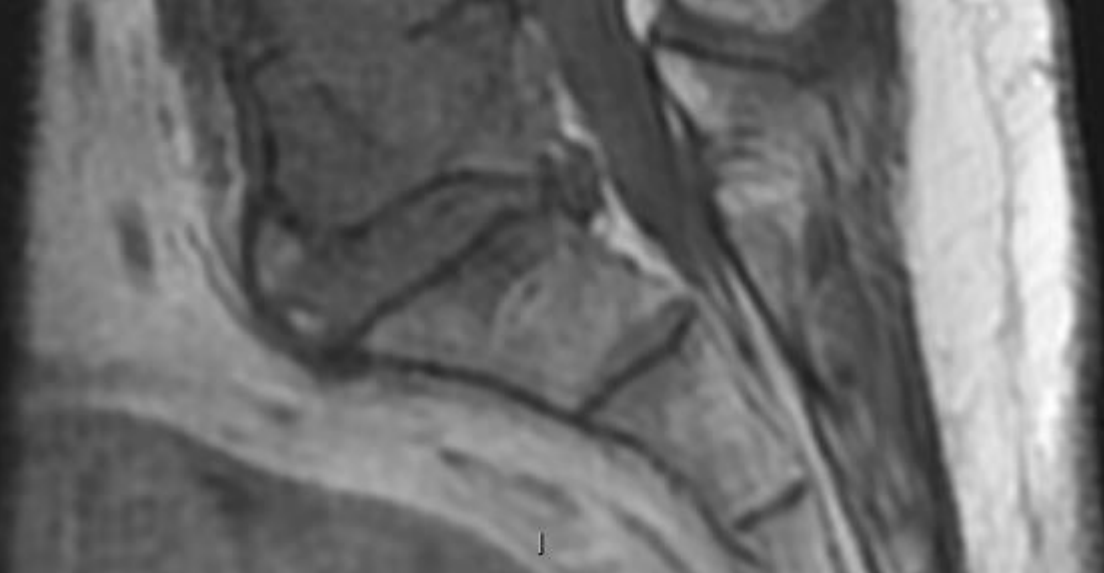
Variations observed in sacro-iliac joint anatomy

Fused joint

Sacro-iliac joint complex

Sacral defect

Accessory sacro-iliac joint



Actuel
[31/12/2019 10:24:04]

< 6 - 40 >

31/

14-11 >

A

