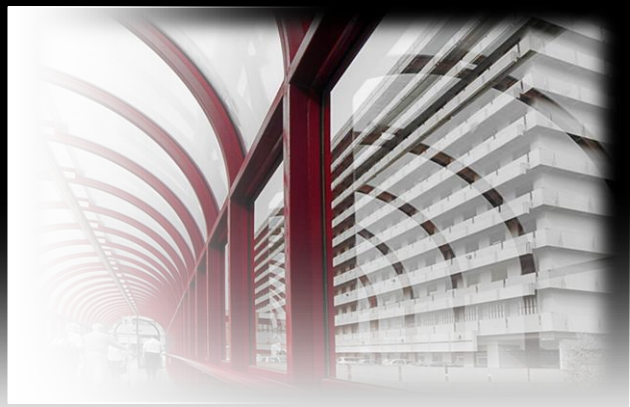
Asma
2017
Bxl



Imagerie et colonne lombaire

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Dpt d'imagerie
Cliniques Universitaires St Luc Bruxelles

Objectifs

- Modalités d'imagerie
- Imagerie de la colonne : Que voit-on ?
- Imagerie de la colonne : que ne voit pas ?
- Lésions discales dégénératives et terminologie
- Discordances radio-cliniques population normale
- Situation particulière : aspects post-opératoires

Ce que nous ne verrons pas

- Rachis cervical et thoracique
- Rachis en croissance
- Pathologies non dégénératives
- Imagerie de la chirurgie et de ses complications

A la fin de cette discussion

- Imagerie : forces et faiblesses
- Concordances radio-cliniques
- Discordances radio-cliniques
- Perspectives

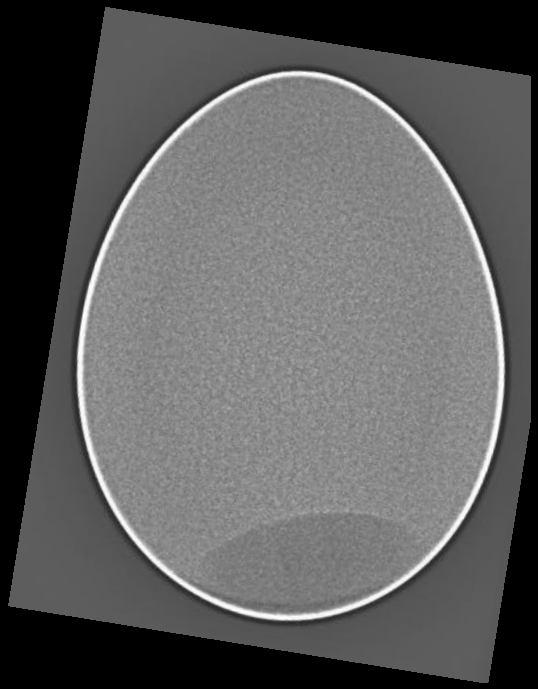
Objectifs

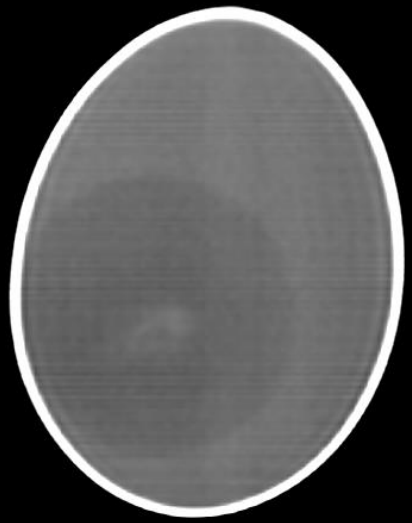
- Modalités d'imagerie
- Informations pratiques
- Imagerie de la colonne : Que voit-on ?
- Imagerie de la colonne : que ne voit pas ?
- Discordances radio-cliniques population normale

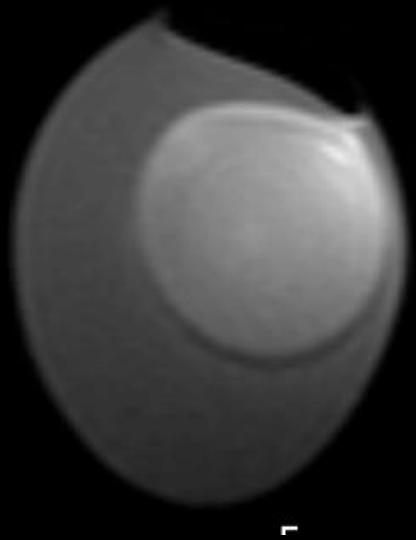
Modalités disponibles

- Radiographie standard
- TDM
- Myélographie(-CT)
- IRM
- Echographie
- Spect- CT
- FDG-Pet
- ….?

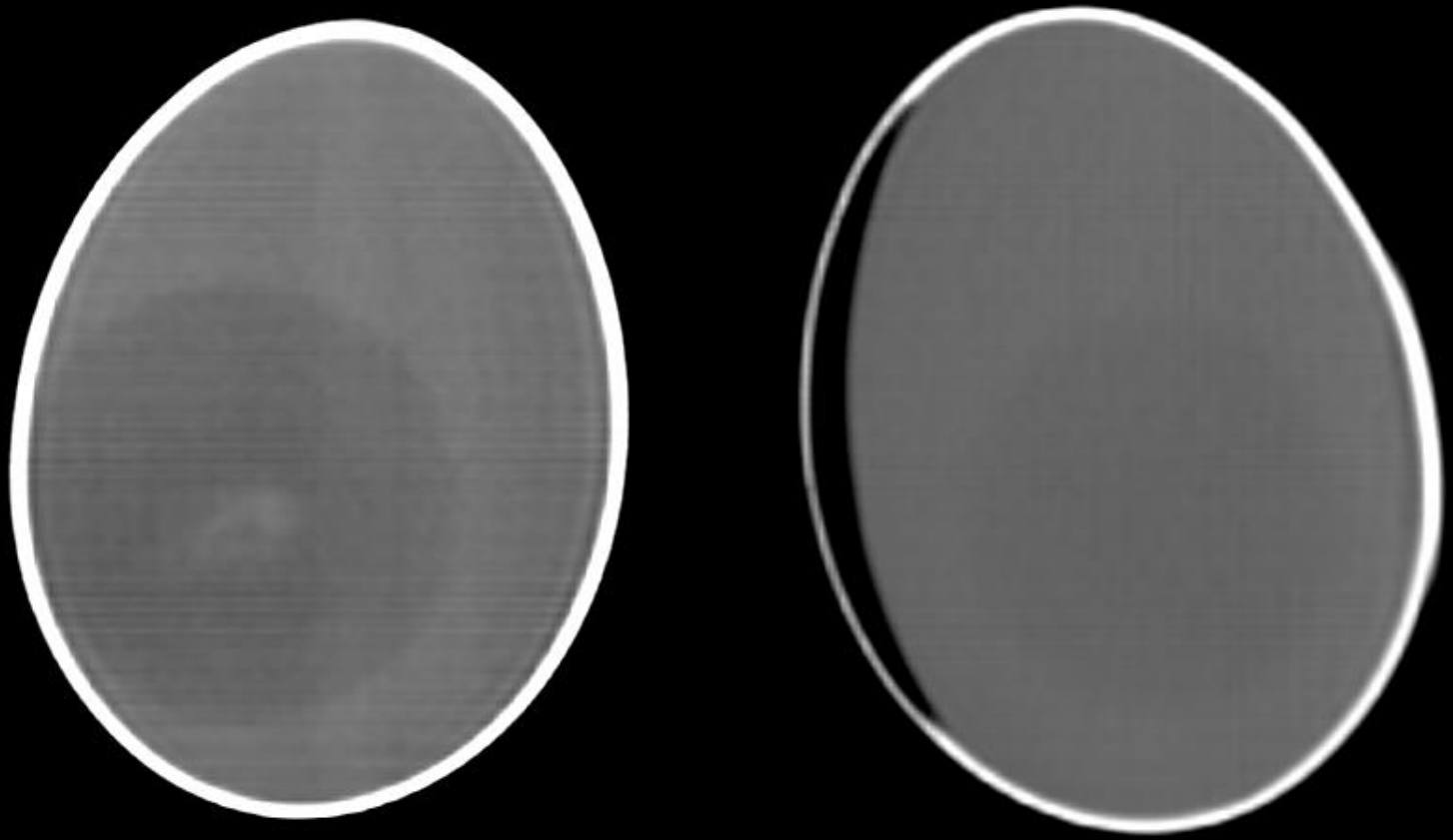
Un objet, plusieurs modalités





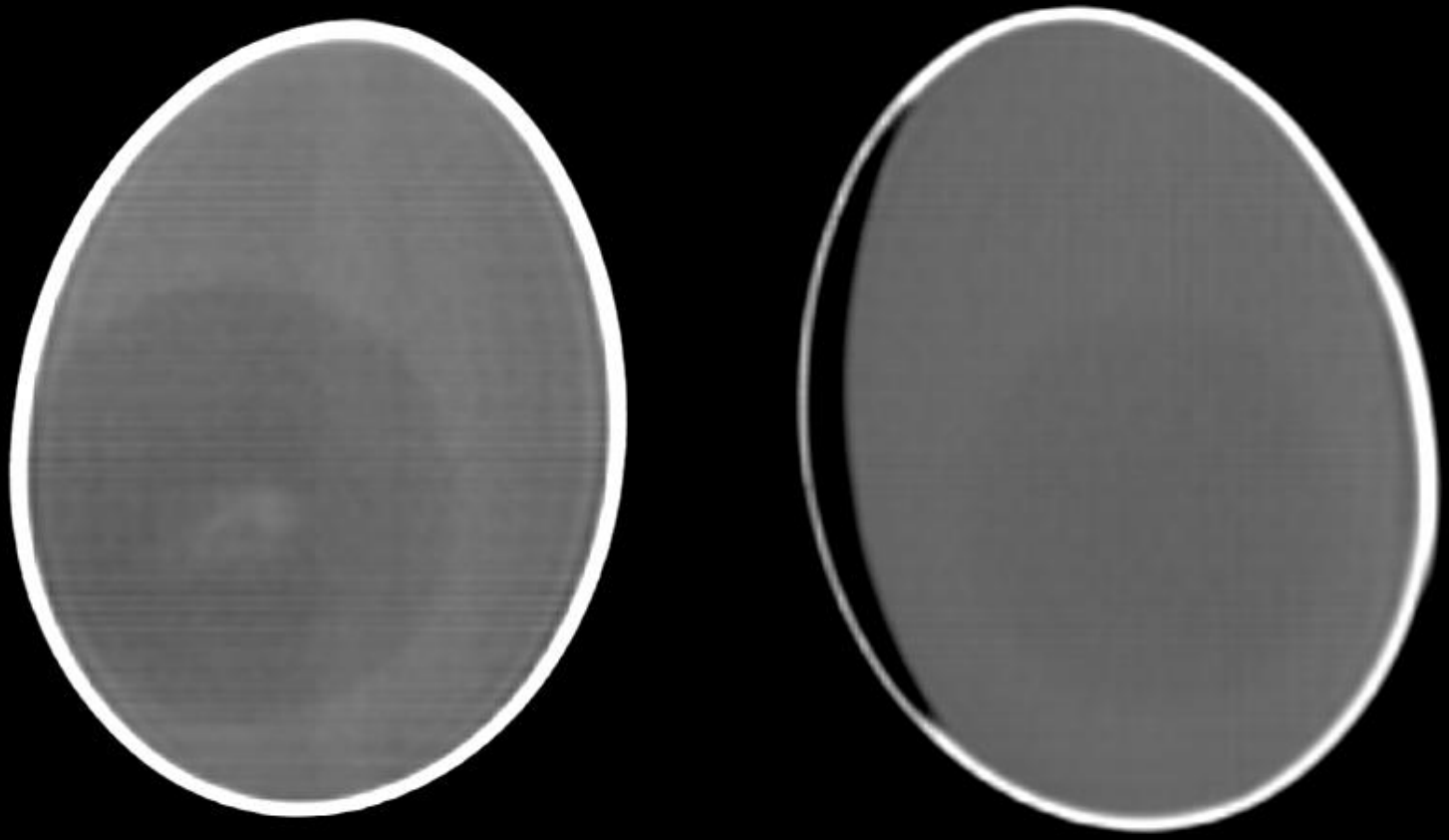


Quelle technique ?
Que reconnaît-on ?

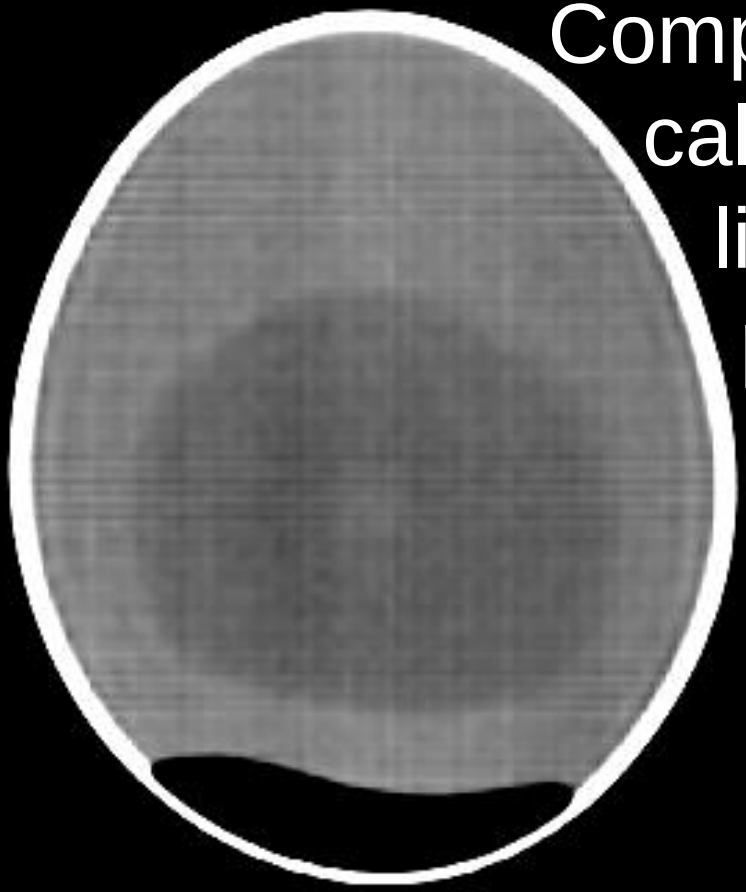


Quelle technique : TDM

Que reconnaît-on: calcium, tissu, air



Coupe sagittale Coupe transversale



Composantes reconnues en CT

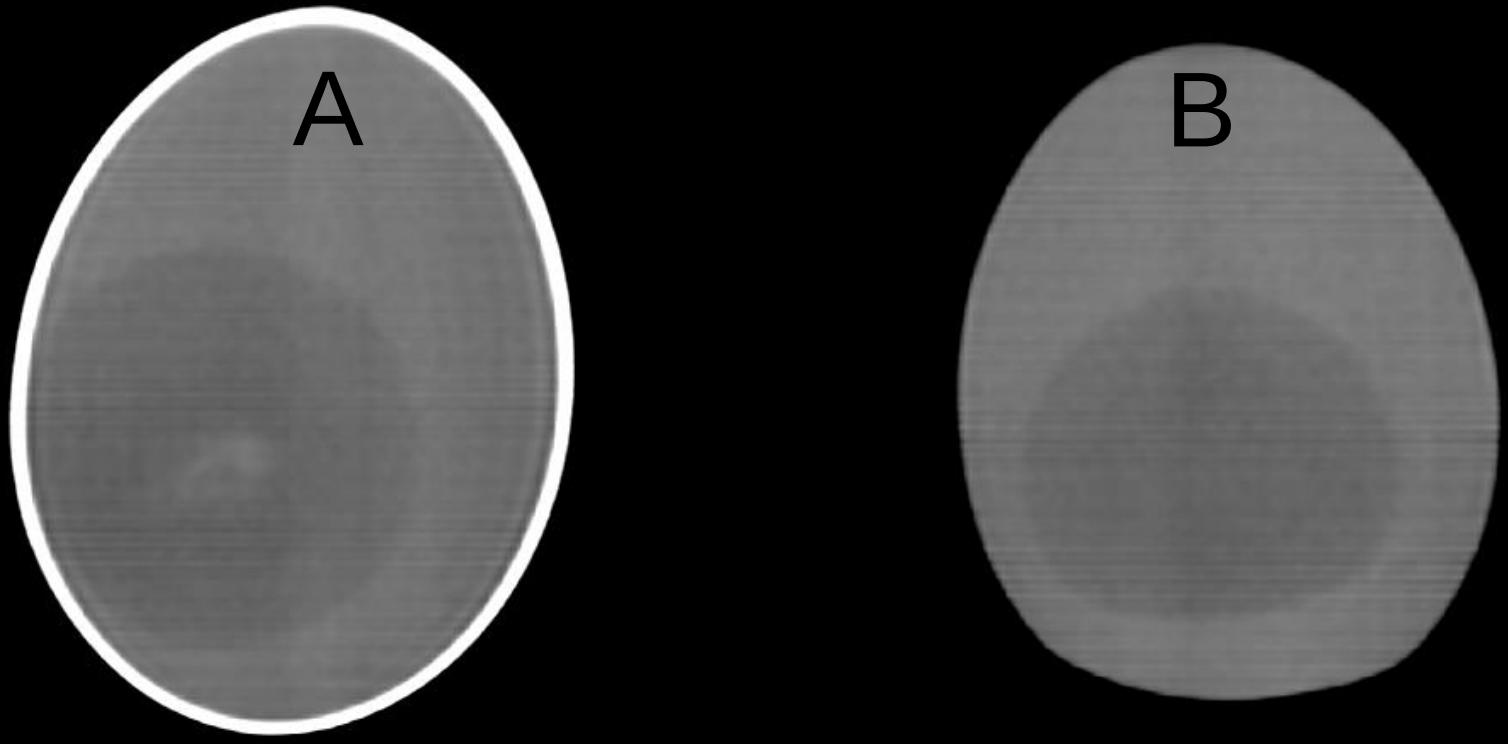
calcium – coquille

lipides (moins dense)- jaune

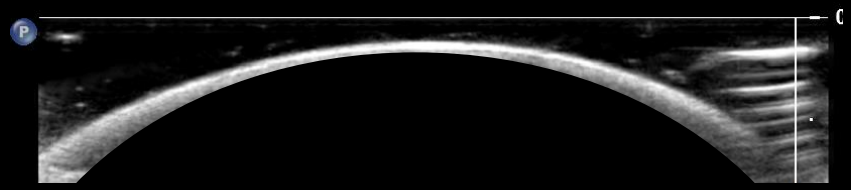
protéines - blanc

air – poche aérique

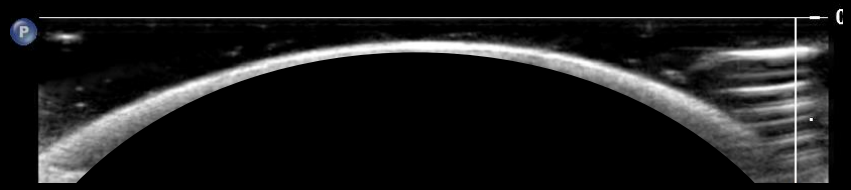
Quelle différence entre A et B ?



Quelle technique ?

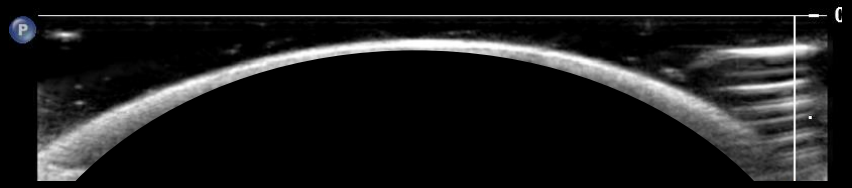


Echographie
Œuf



Echographie d’un œuf:
arrêt complet du faisceau ultrasonore par la coquille calcifiée (ligne blanche)

Images échographique de 2 oeufs
Quelle est la différence ?



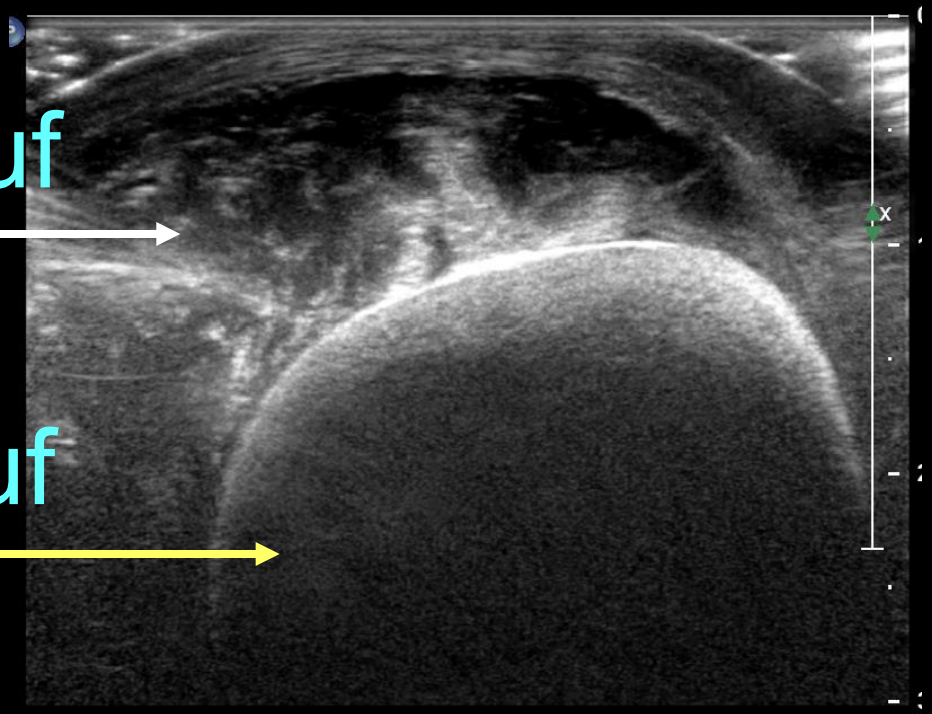
A

B

Echographie d'un oeuf pelé et cuit

Blanc d'oeuf

jaune d'oeuf

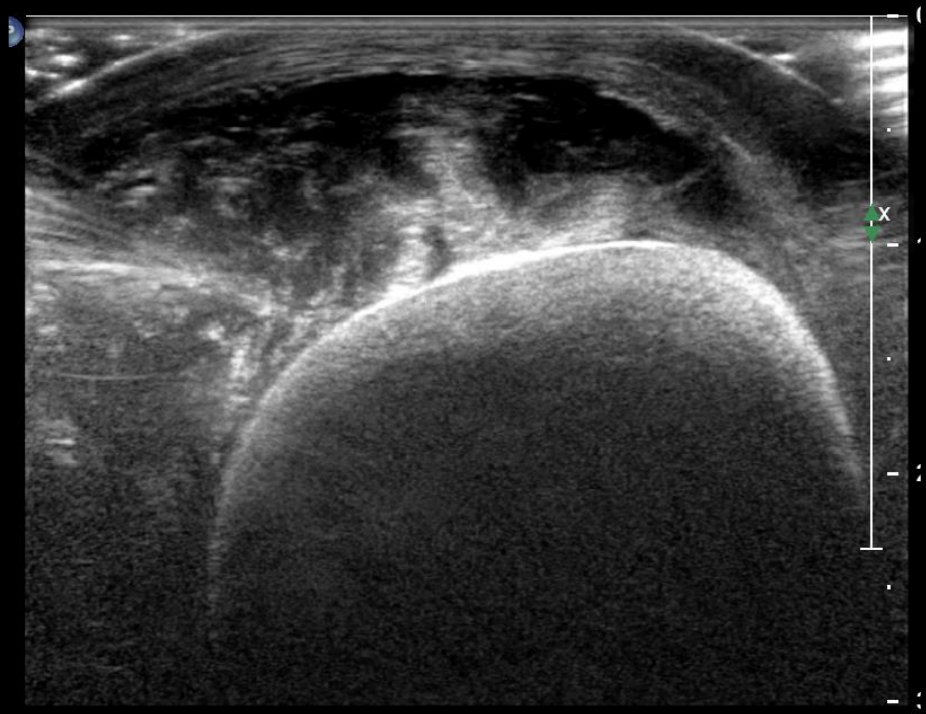


L'échographie perçoit et localise les interfaces entre des structures

Œuf pelé

Cru

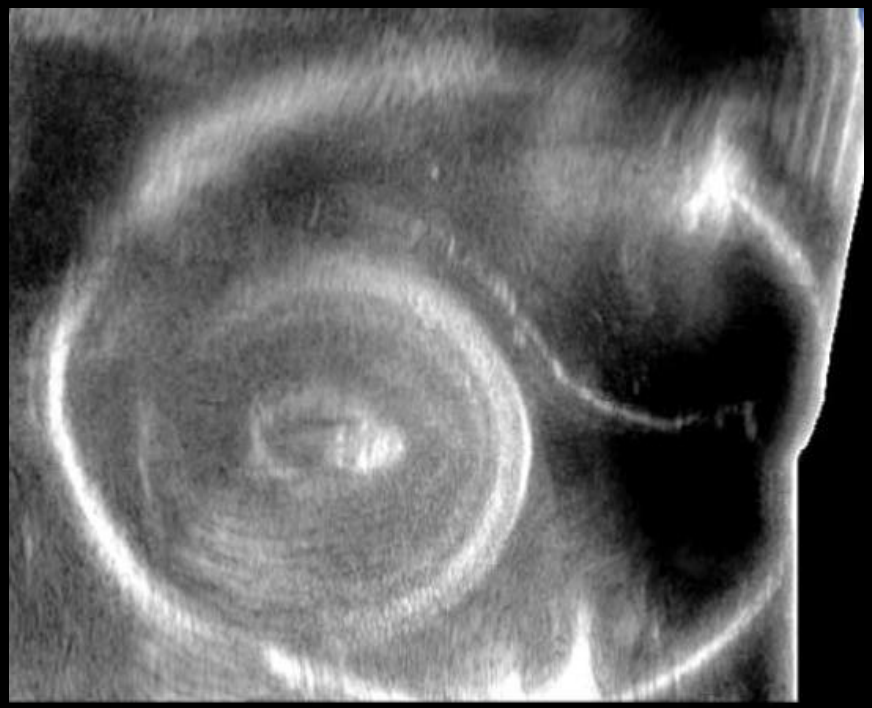
cuit



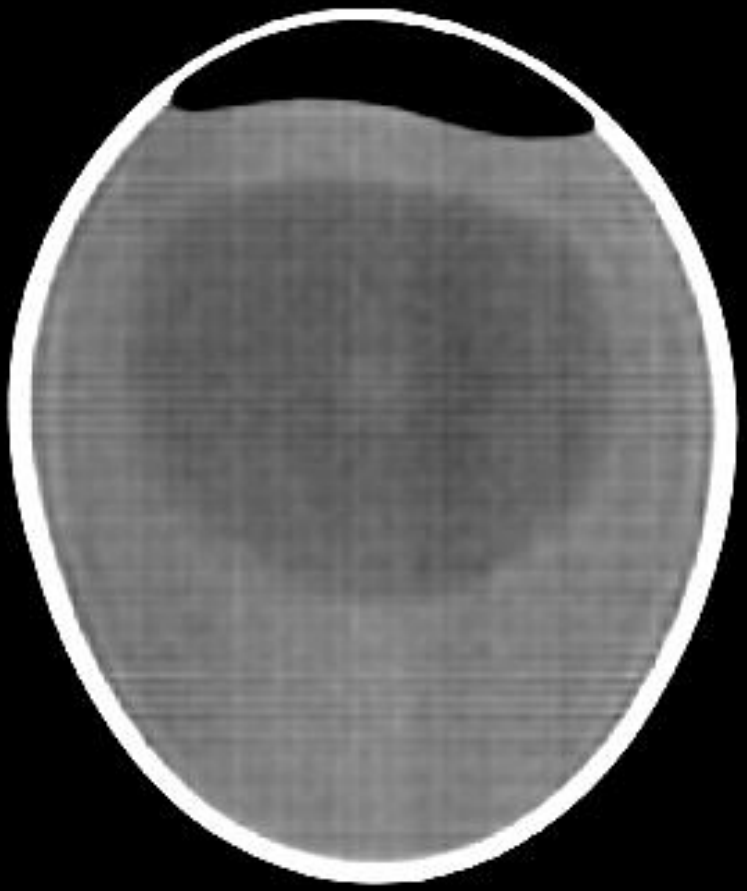
Œuf pelé

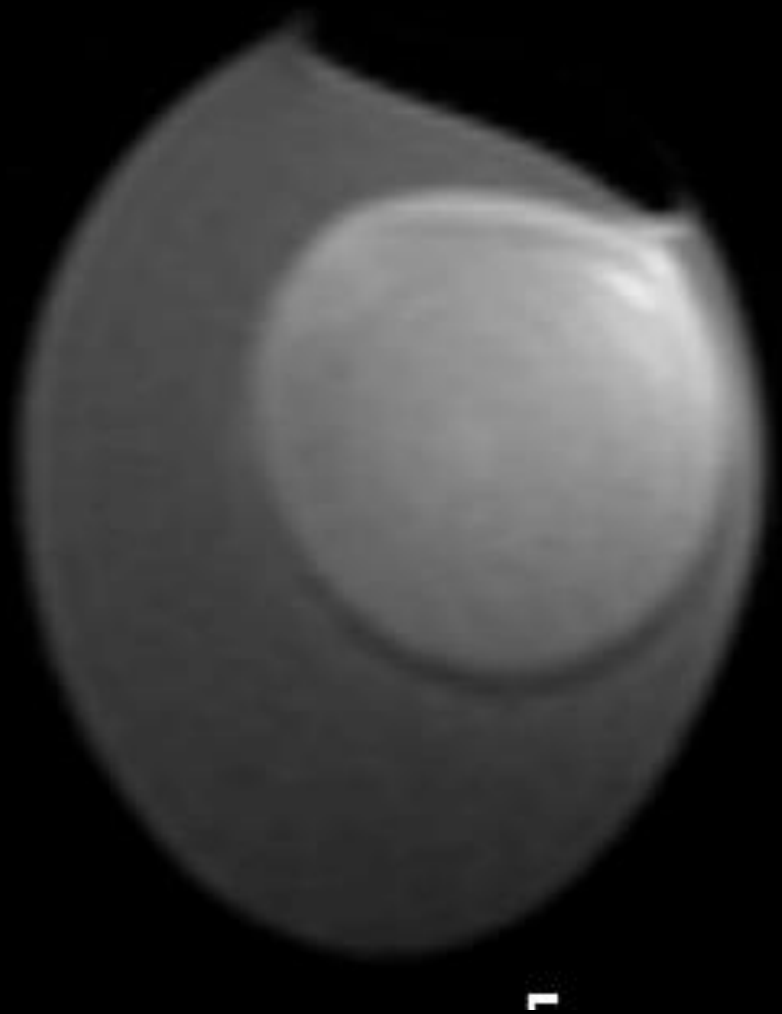
Cuit

cru



TDM

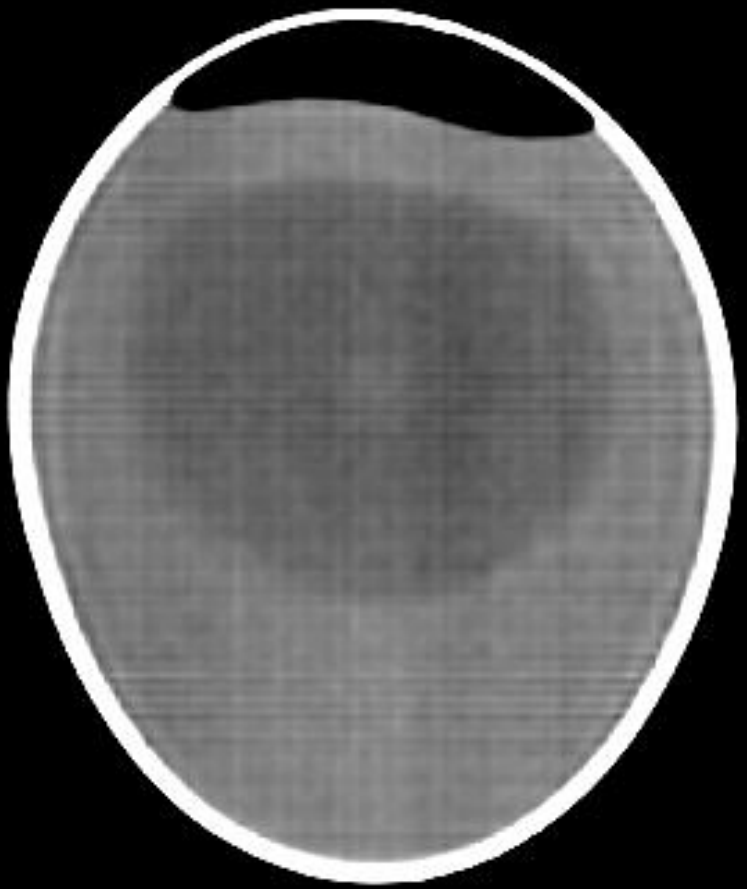




Calcium

Air

Jaune = blanc



~~Calcium~~

~~Air~~

Jaune > < blanc

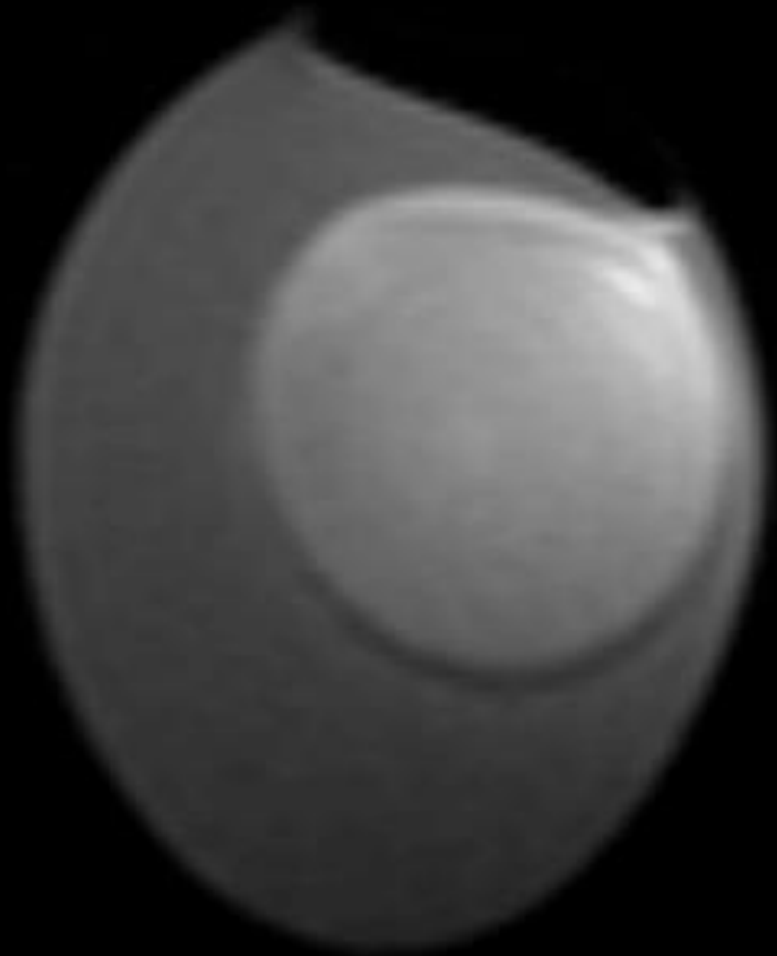
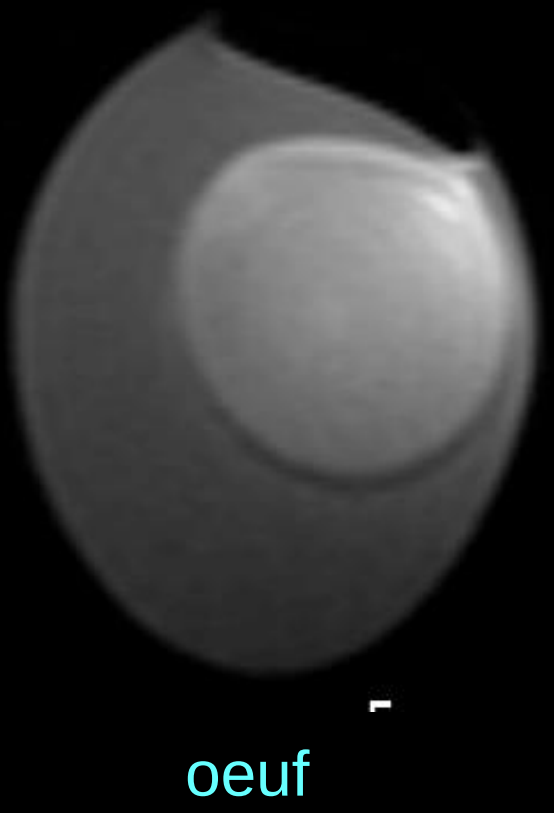
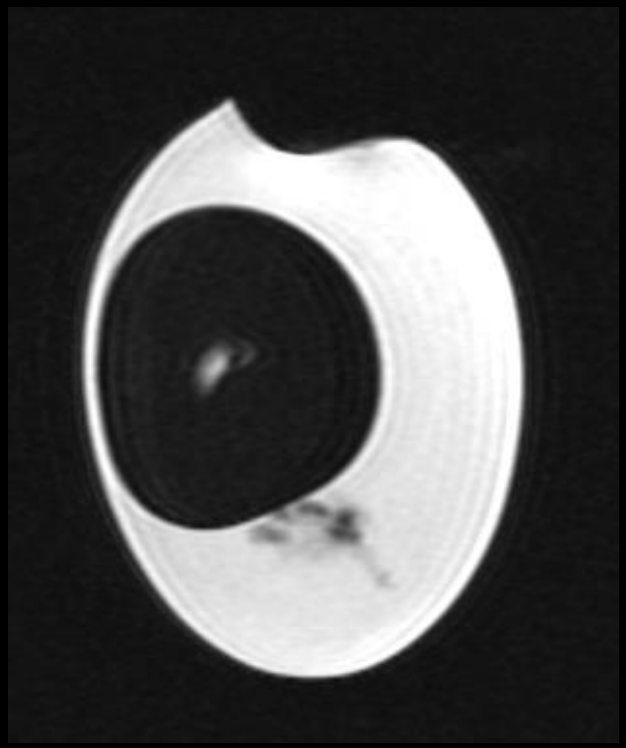


Image IRM pondérée T1



Lipides – jaune –hyperintense
Protéines – blanc – hypointense
Calcium – coquille - pas vu
Air non vu – poche – pas vu

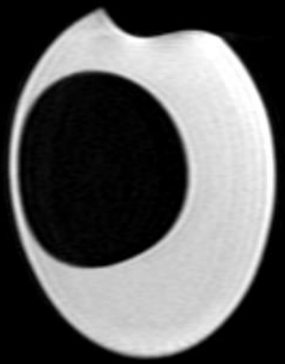
Image IRM pondérée T2 oeuf



Lipides – jaune –hyperintense
Protéines – blanc – hypointense
Calcium – coquille - pas vu
Air non vu – poche – pas vu

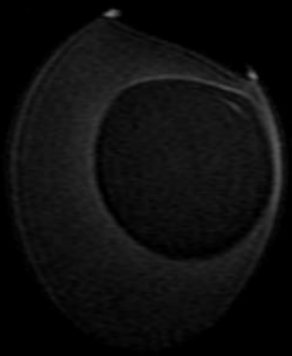
Image IRM pondérée T2

Œuf cru



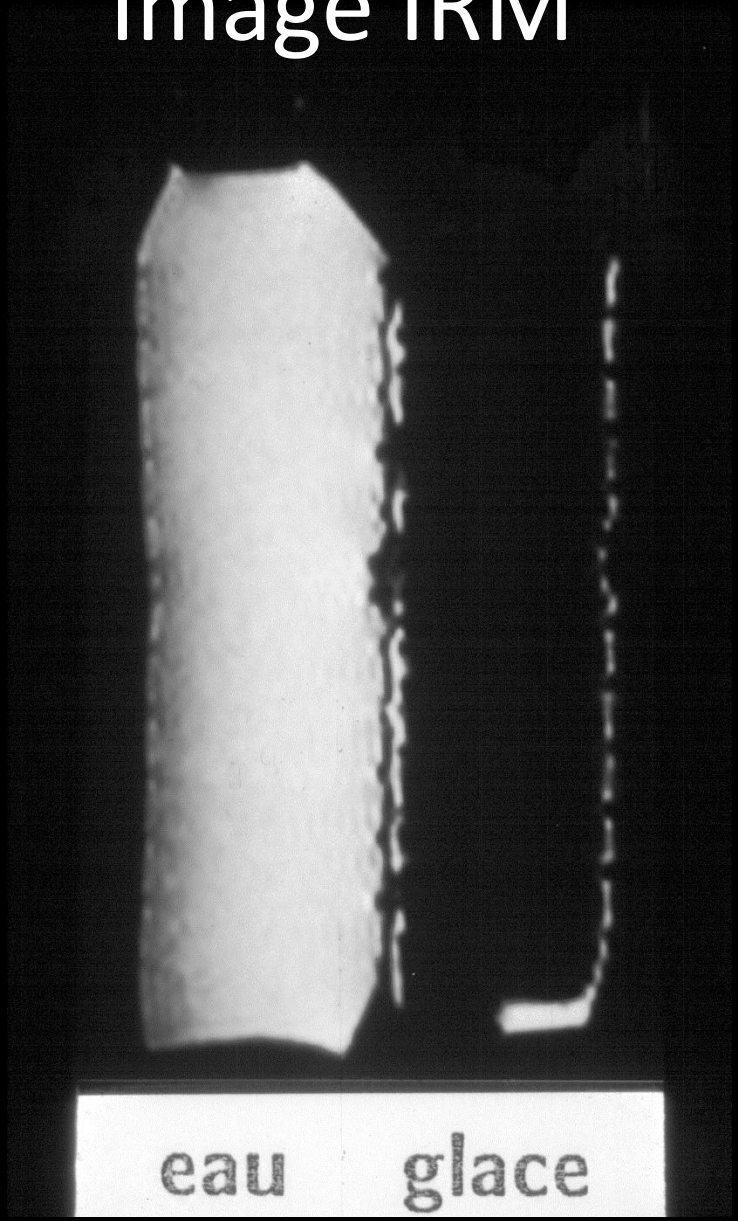
Importance de
* composition chimique
* état physique
sur aspect IRM des tissus

Œuf cuit




SPA
SPA
+20°
-20°

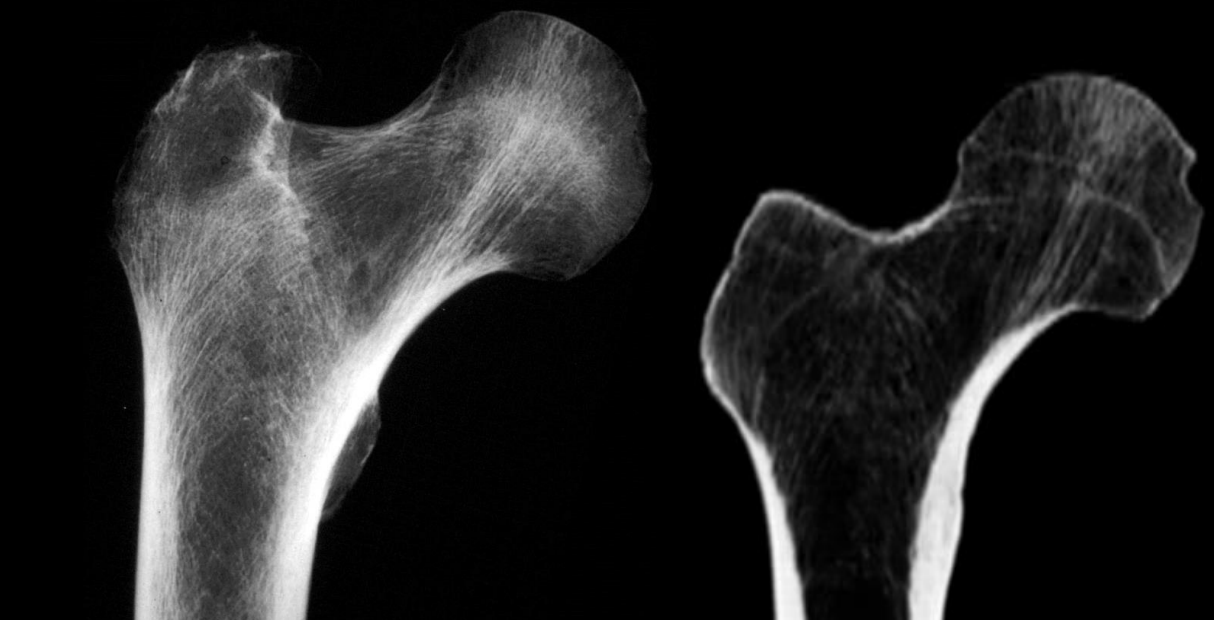
Image IRM

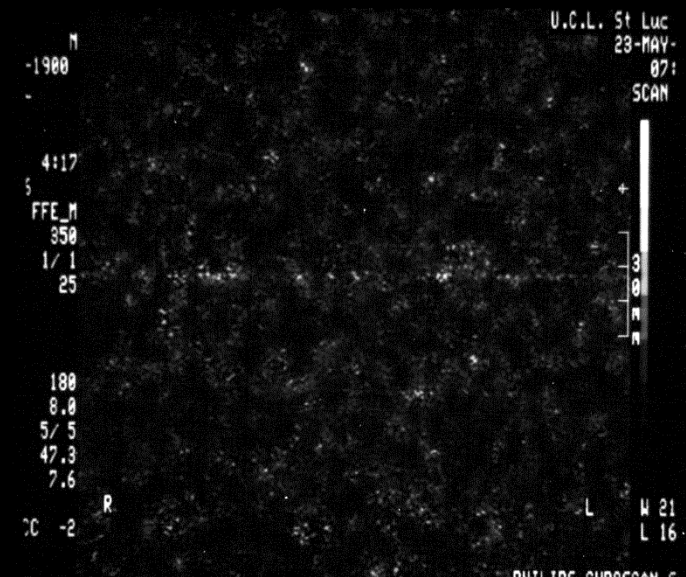


Radiographie

Coupe TDM

Radiographie Coupe TDM IRM





Fémur immergé dans huile
Image IRM pondérée T1

Spécimen sec
Immergé dans huile

Spécimen frais

Moelle osseuse rouge (hypointense en T1)
Moelle osseuse jaune (hyperintense en T1)

Image IRM pondérée T1

Objectifs

- Modalités d'imagerie
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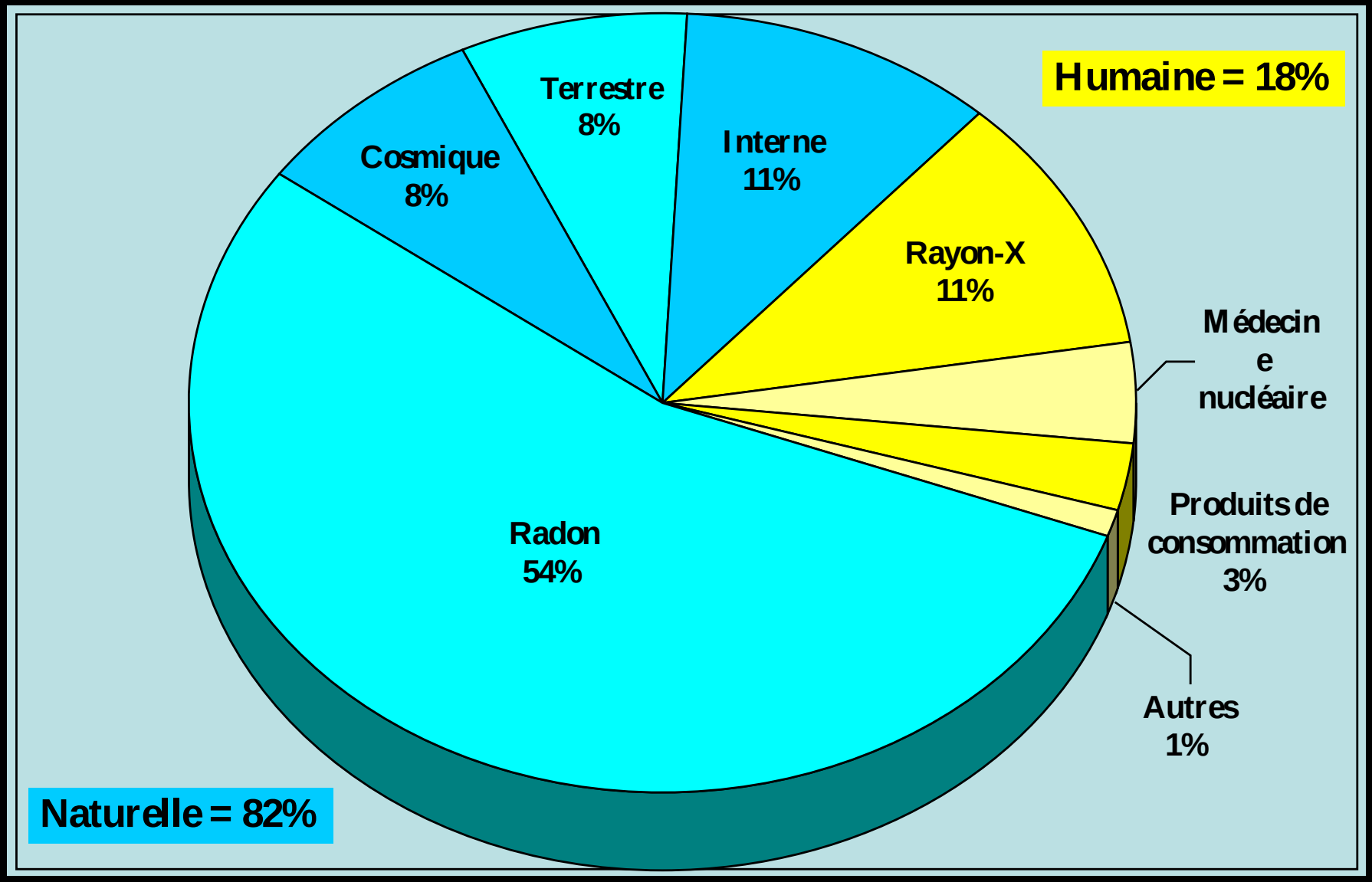
Imagerie / Contre-indications

	Absolues	**Relatives**
Radiographies	Aucune	Grossesse
Echographie	Aucune	Morphotype Plaies, air, gaz, os
TDM	Grossesse	
IRM	Métal dans yeux PCMKR	PCMKR
Med nucl.	Grossesse	

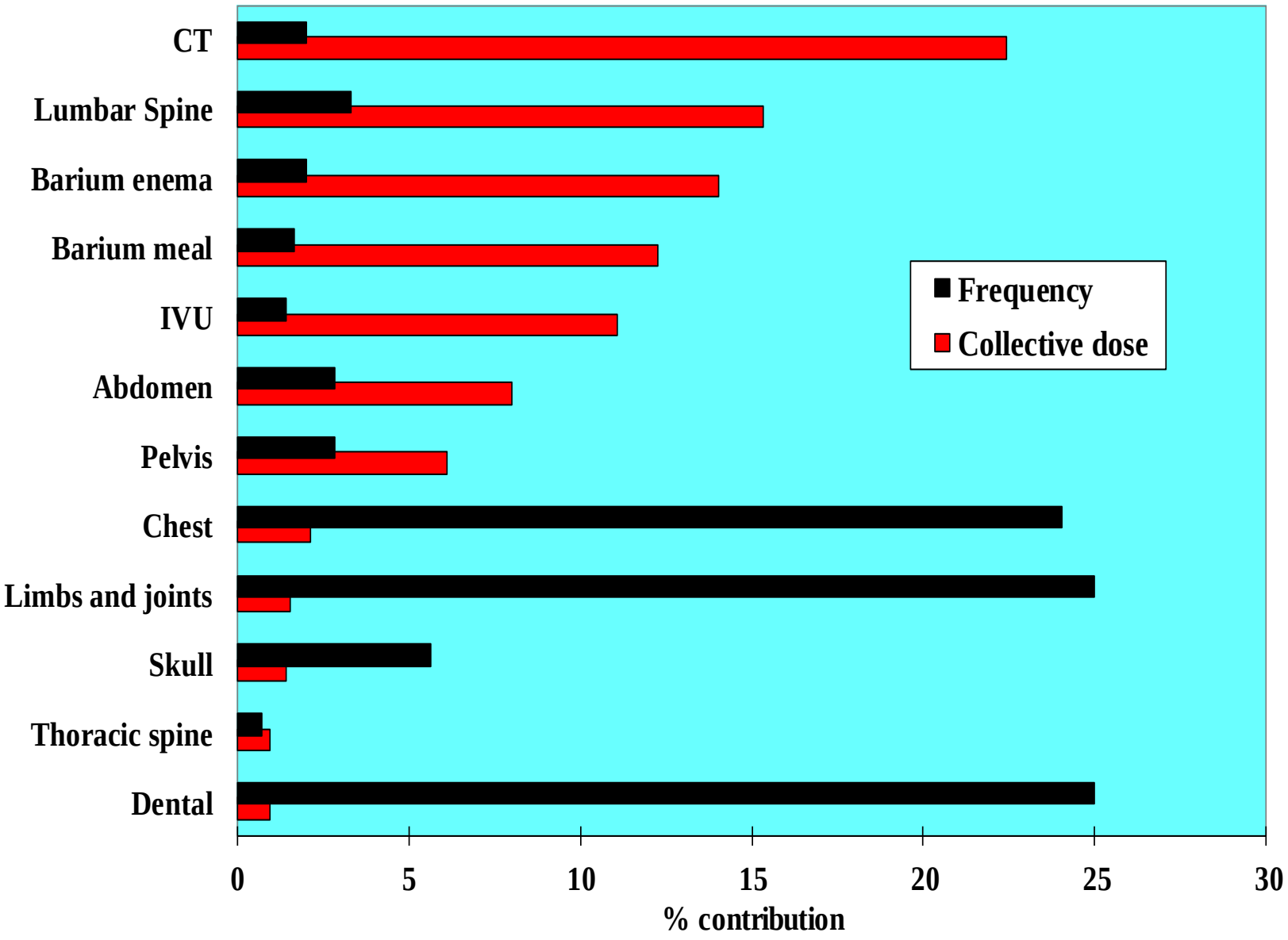
Sources de rayonnements ionisants



Doses délivrées par quelques explorations radiologiques courantes.

Irradiation	mSv	Jours équivalent
Naturelle	2,4	1 an
Rx thorax	0,02	3 jours
CT thorax (**1995**)	8	36 mois
CT thorax (**2010**)	5,3	24 mois
CT Thorax basse dose (2010)	1,3	6 mois
CT Thorax basse dose (2017)	0,8 à 1	4 mois
FDG-Pet	25	120 mois

Frequency of, and collective dose from, different radiological investigations in the UK

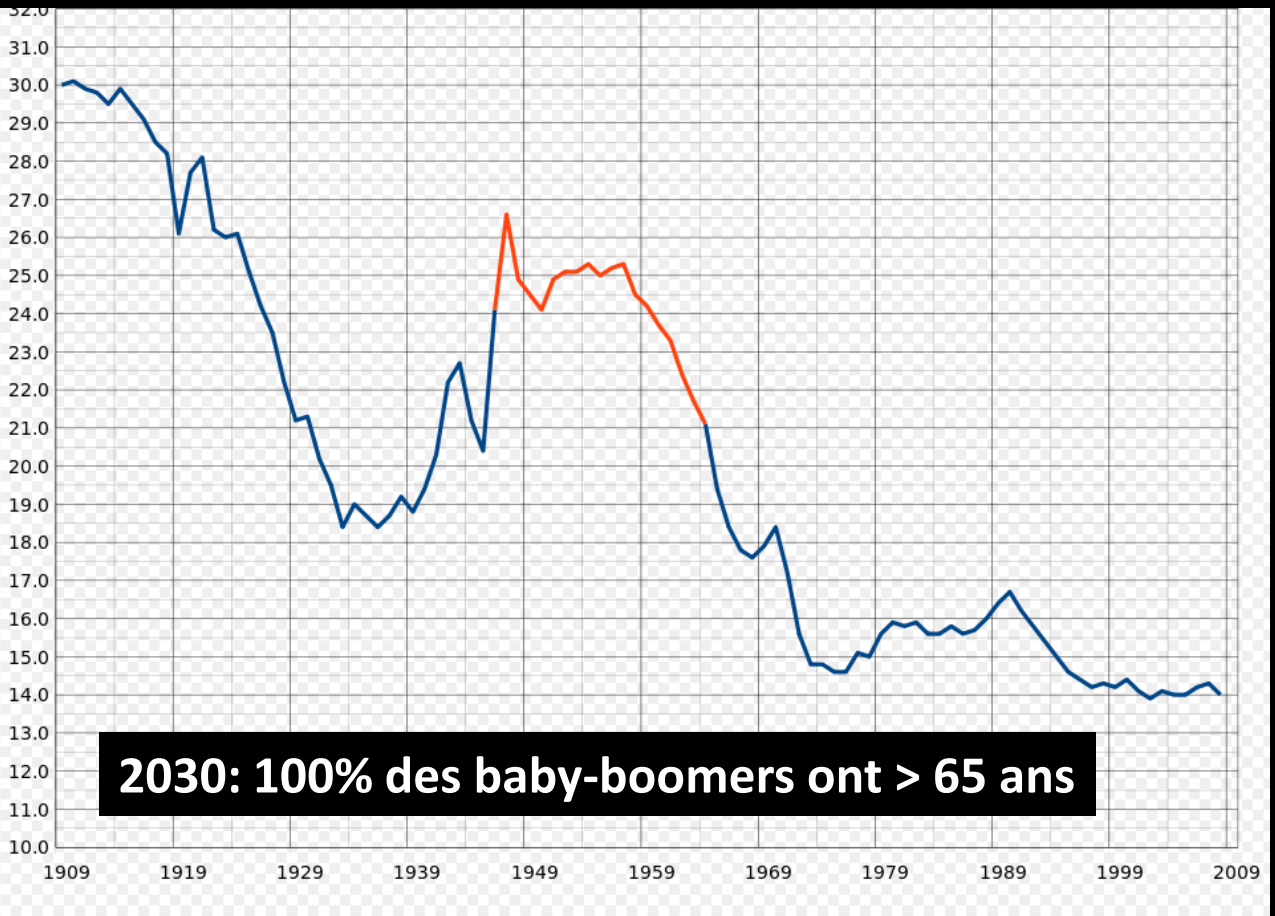


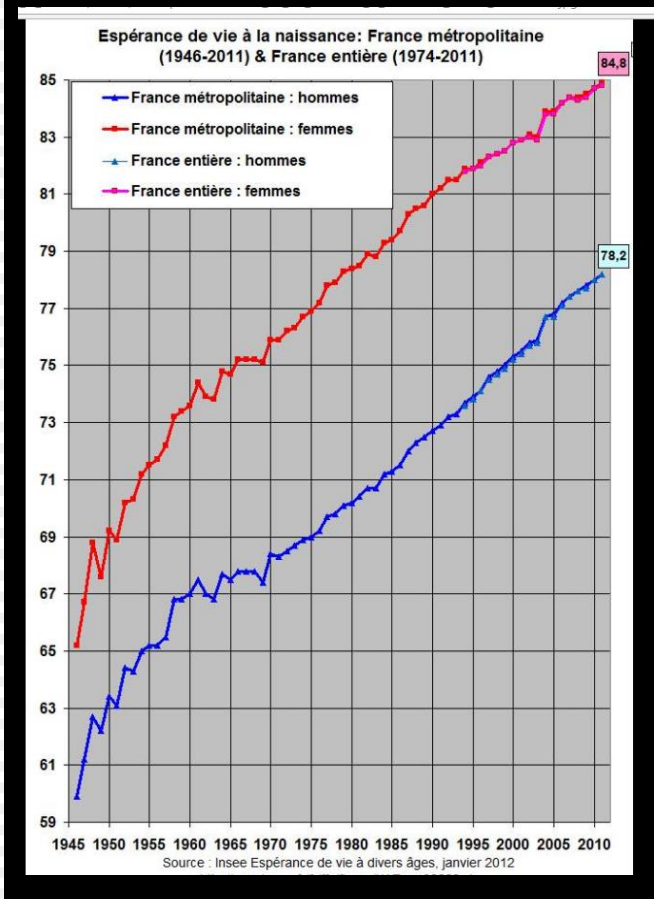
Evolution nombre de CT lombaire à St Luc entre 1995 et 2015

	1995	2005	2015	En 20 ans
0-59 ans	914	1531	1841	101%
60-89 ans	382	882	1447	279%

Menu du jour : Radiologie gériatrique !

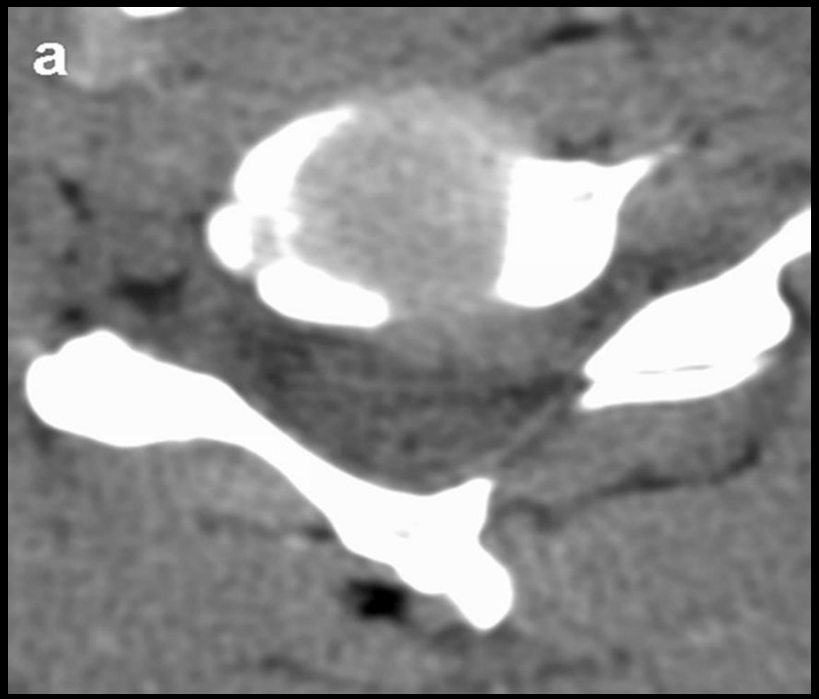
Baby boom (1945-1965) **+** **Life expectancy**

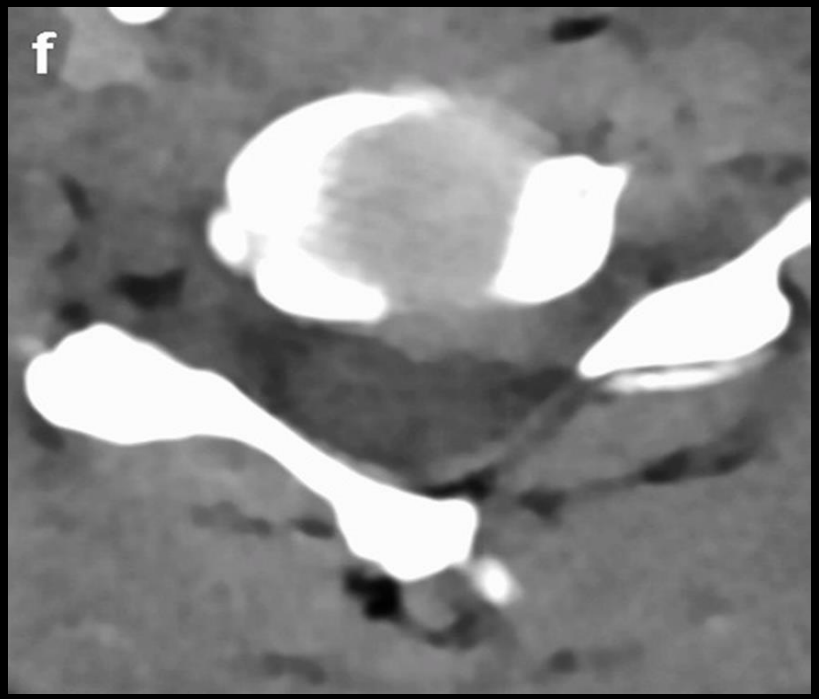




Software de reconstruction
Baisse de dose de 40%
Amélioration du contraste

- 40% d'irradiation





Même patient

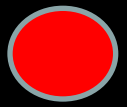
Limitation des examens inutiles
- Justification des examens
- Substitution de la TDM vers IRM
- Réduction de doses

TDM Lombaire

Année	Nb CT	Pt < 30 ans	%
2011	2827	182	6%
2012	2554	210	8%
2013	2587	172	7%
2014	2438	104	4%

IRM Lombaire

Année	Nb IRM	Pt < 30 ans	%
2011	2125	243	11%
2012	2297	300	13%
2013	2580	341	13%
2014	2618	343	13%

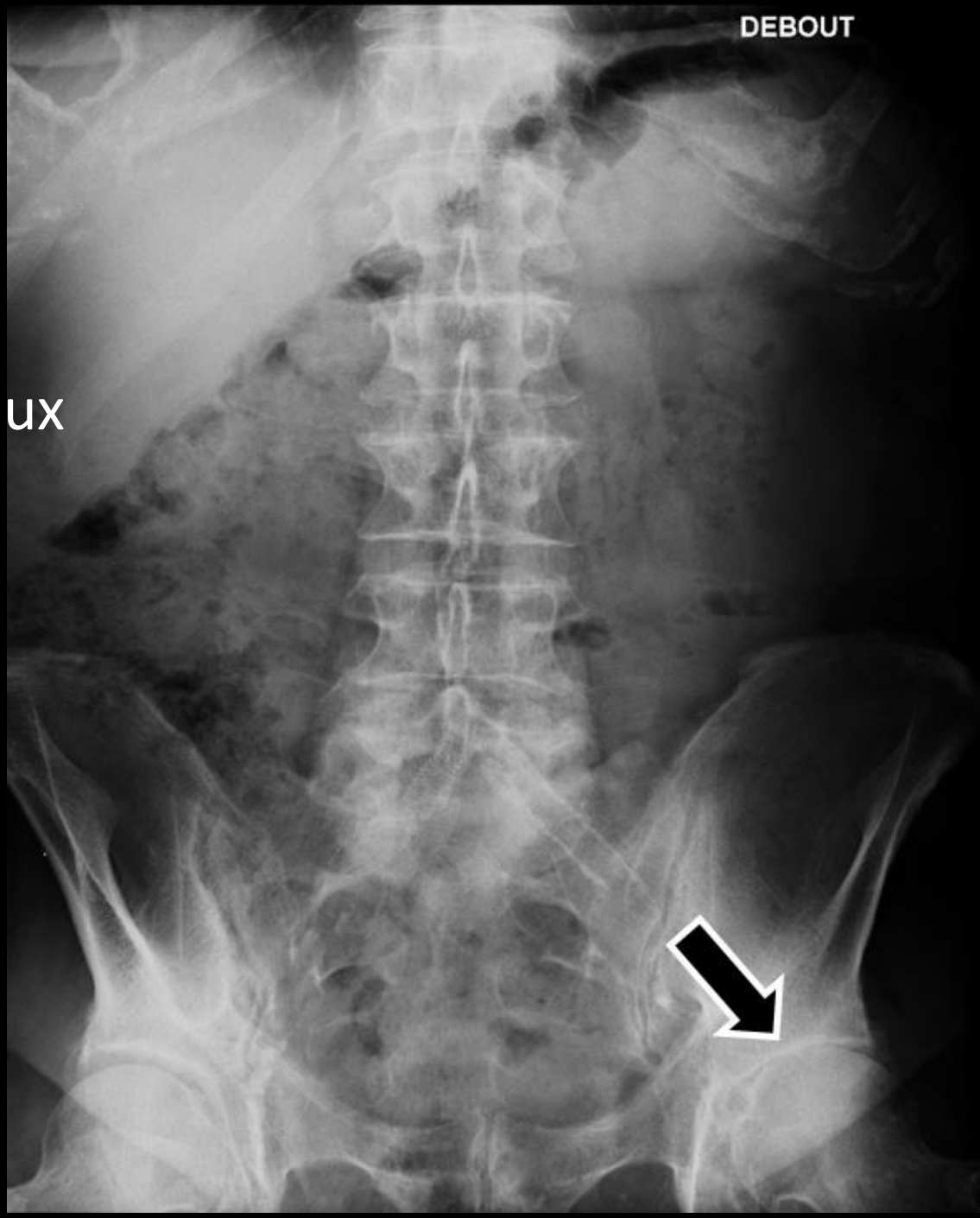


Objectifs

- Modalités d'imagerie
- Informations pratiques
- Imagerie de la colonne : Que voit-on ?
- Terminologie
- Imagerie de la colonne : que ne voit pas ?
- Discordances radio-cliniques population normale

La statique
La structure osseuse
Les disques intervertébraux

~~Les tissus mous~~
~~Le contenu canalaire~~
~~Le contenu foraminal~~



La statique
La structure osseuse
Les disques intervertébraux

~~Les dimensions canalaires~~
~~Les dimensions foraminales~~
~~Les tissus mous peri-vertebraux~~
~~Le contenu canalaire~~
~~Le contenu foraminal~~

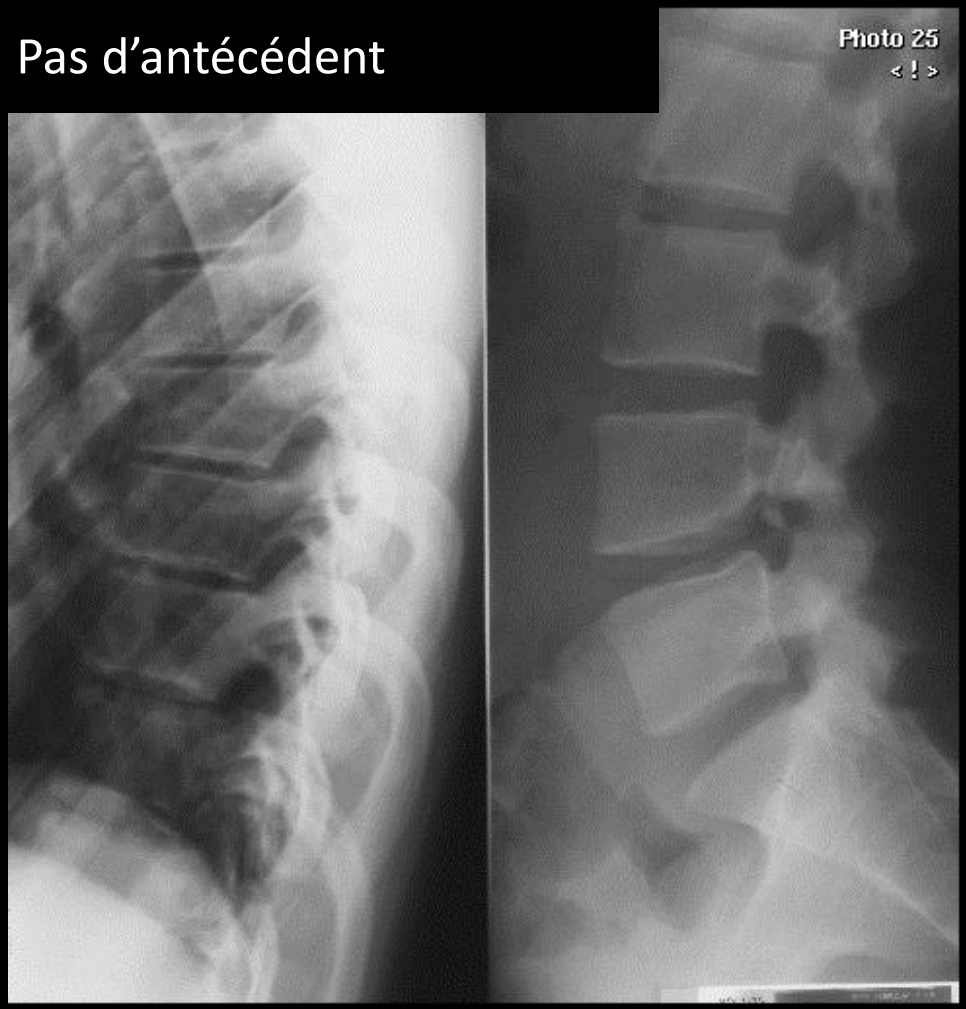
~~x~~

Cas clinique

- H 18 ans
- Lombalgie aigue spontanée, depuis deux semaines
- Pas d’antécédent

Cas clinique

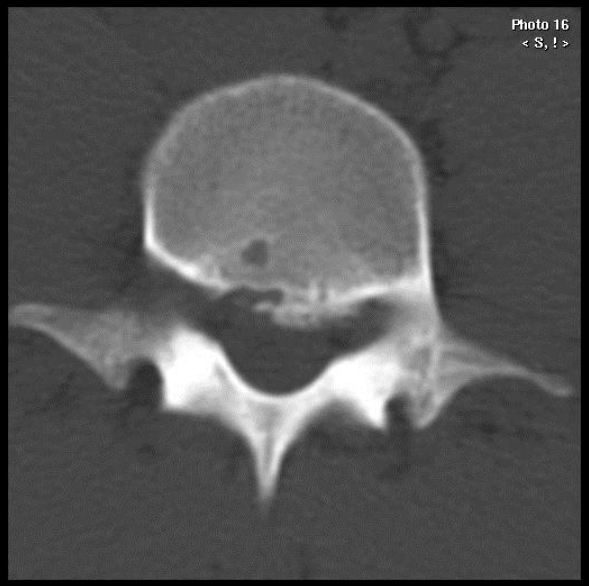
- H 18 ans
- Lombalgie aigue spontanée, deux semaines
- Pas d'antécédent

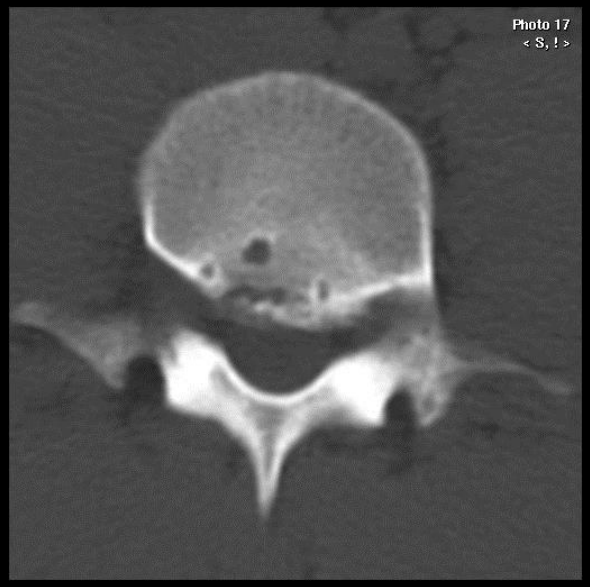


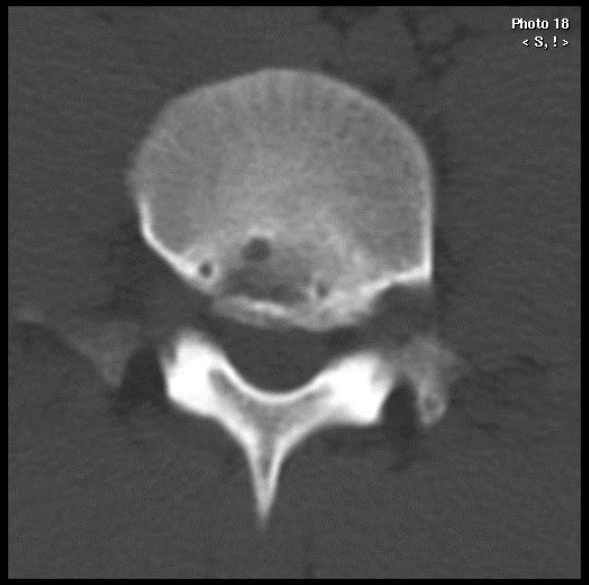
Pincement discal
Fragment ?

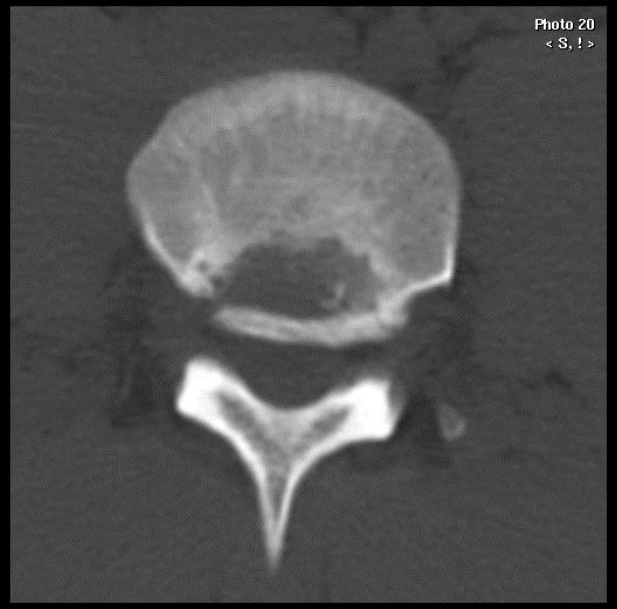
- Lombalgie aigue spontanée, deux semaines
- Pas d’antécédent
- Reconstruction TDM

Coupes TDM transverses







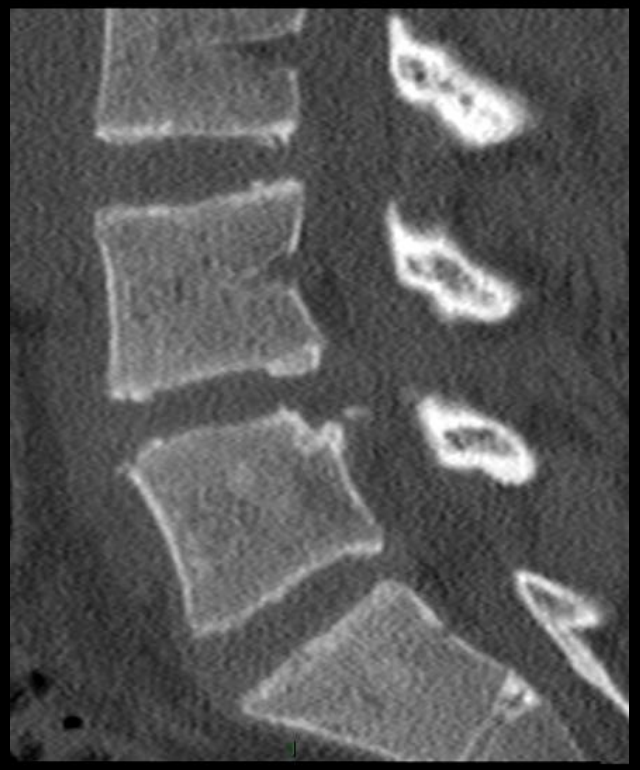



Plateau vertébral
continu
Fragment osseux
Cortical attaché

TDM

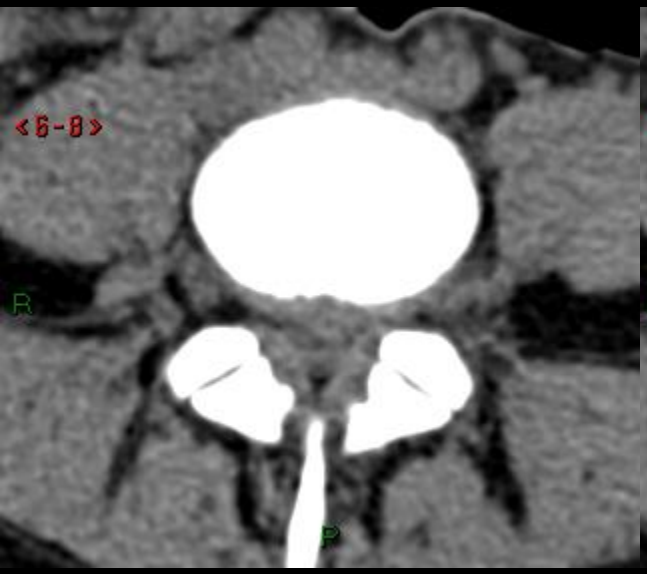
~~La statique~~
La structure osseuse
Les disques intervertébraux
Les dimensions canalaires
Les dimensions foraminales
Les tissus mous peri-vertebraux

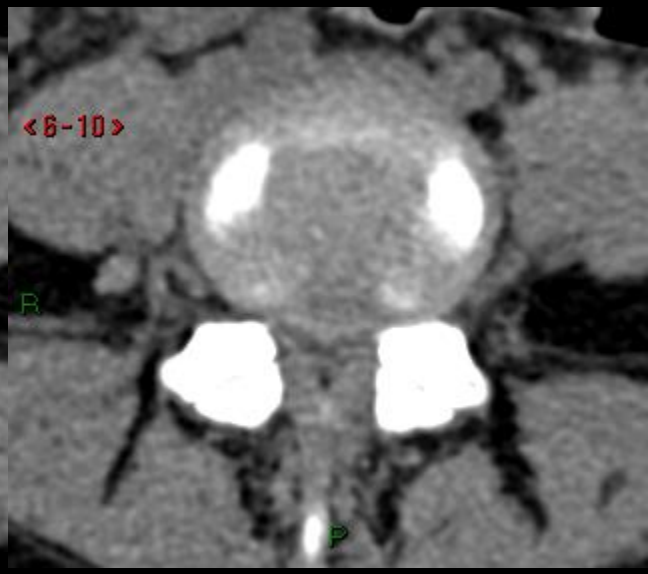
~~Le contenu canalaire~~
~~Le contenu foraminal~~

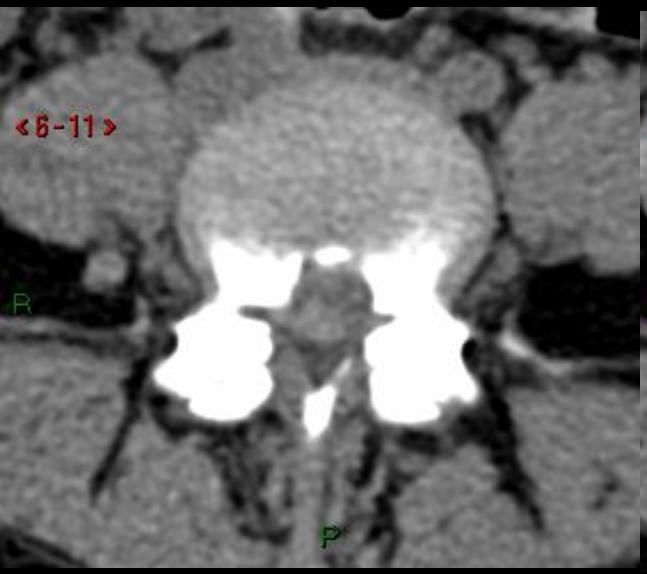


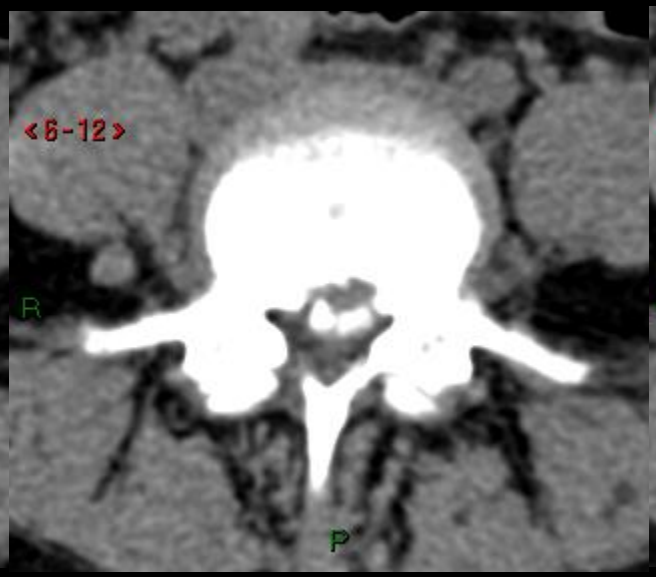
TDM : Les dimensions canalaires

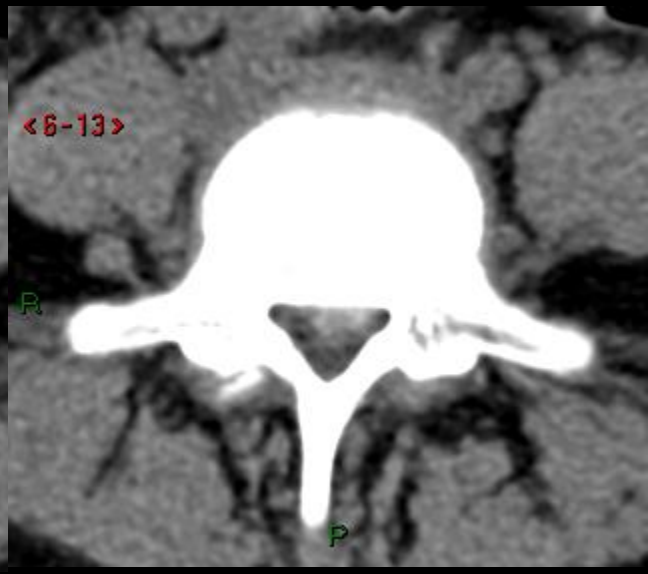
~~Le contenu du sac dural~~











TDM lombaire

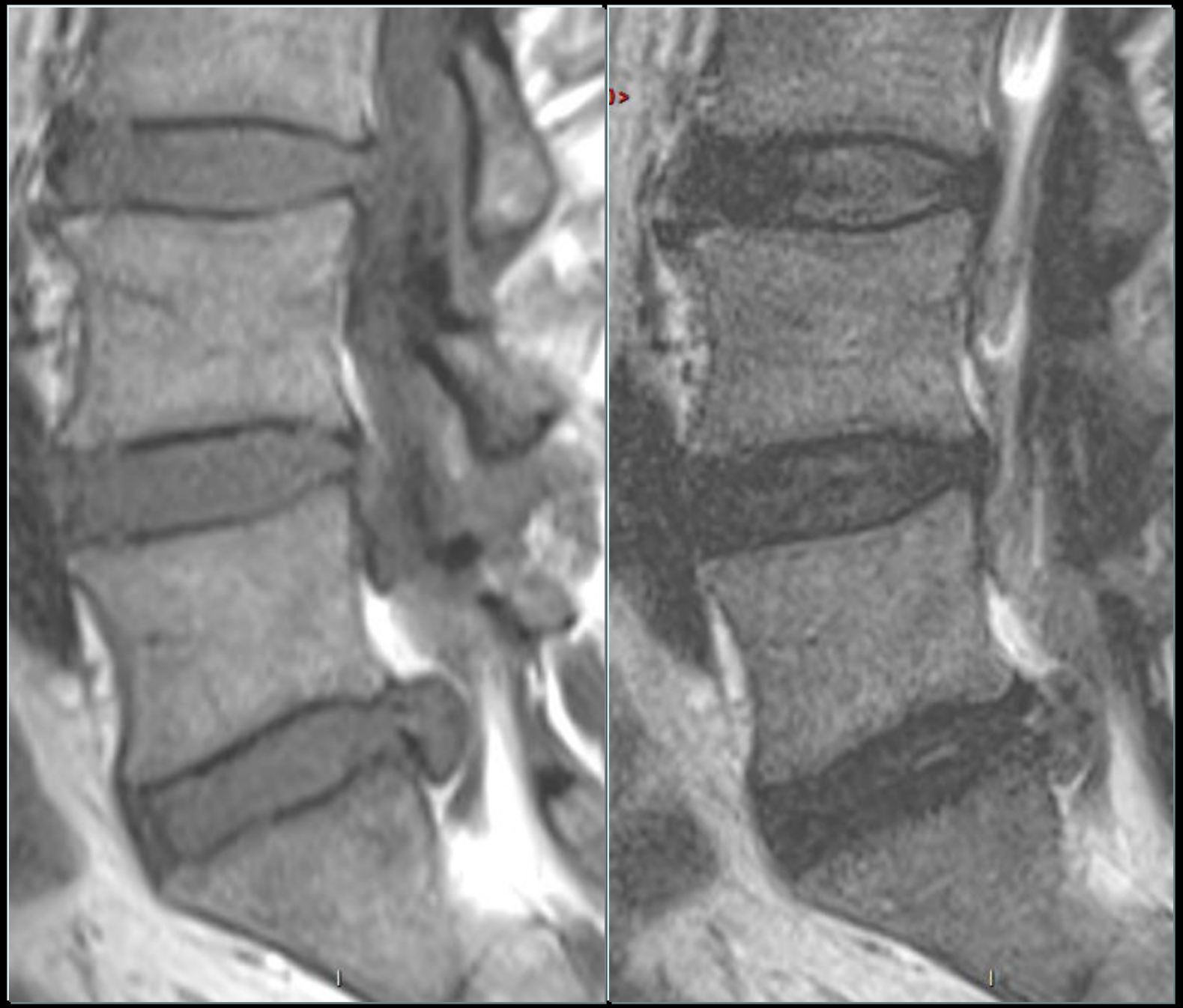
Avantages

- Accessible
- Performant
  - Disques
  - Foramens
  - Os
  - Articulations zygapophysaires
- Résolution spatiale
- Reproductible
  - Entre les services
  - Au cours du temps

Inconvénients

- Irradiant
- Faible résolution en contraste

Cas clinique
Homme 53 ans
Lombosciatalgies droites recentes
Abolition reflexe achiléen (S1)

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R
P


<4 - 22>
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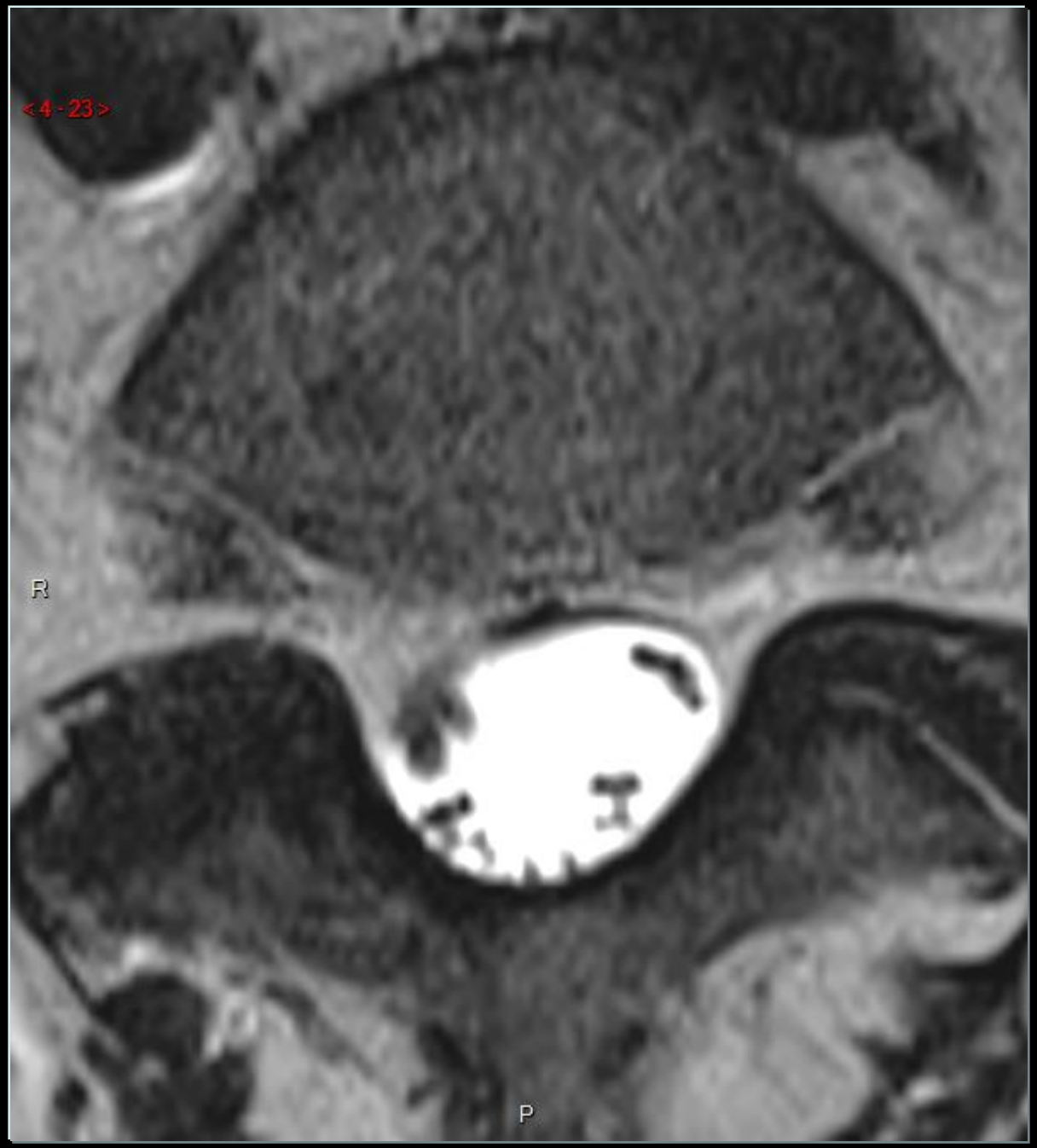
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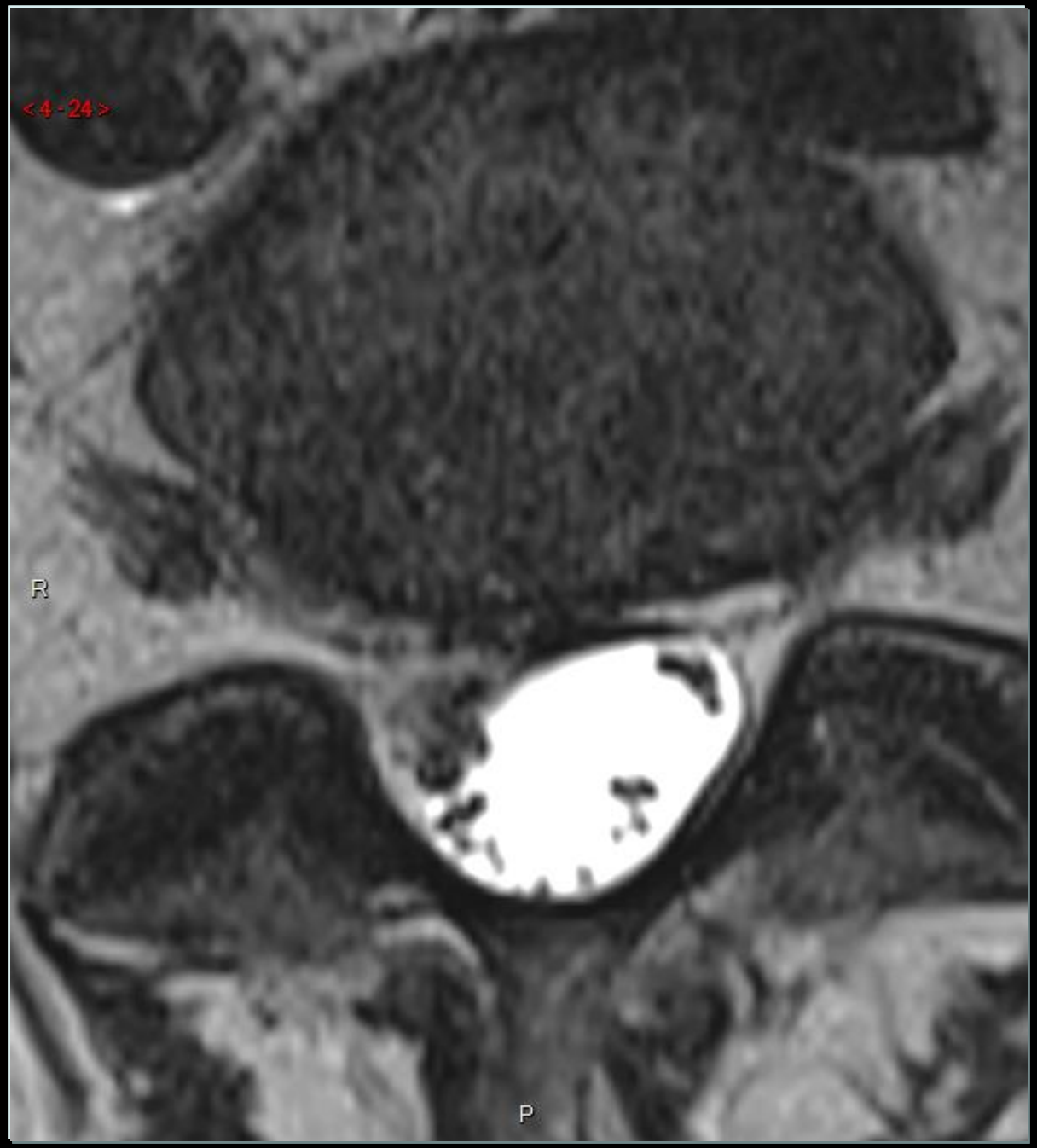
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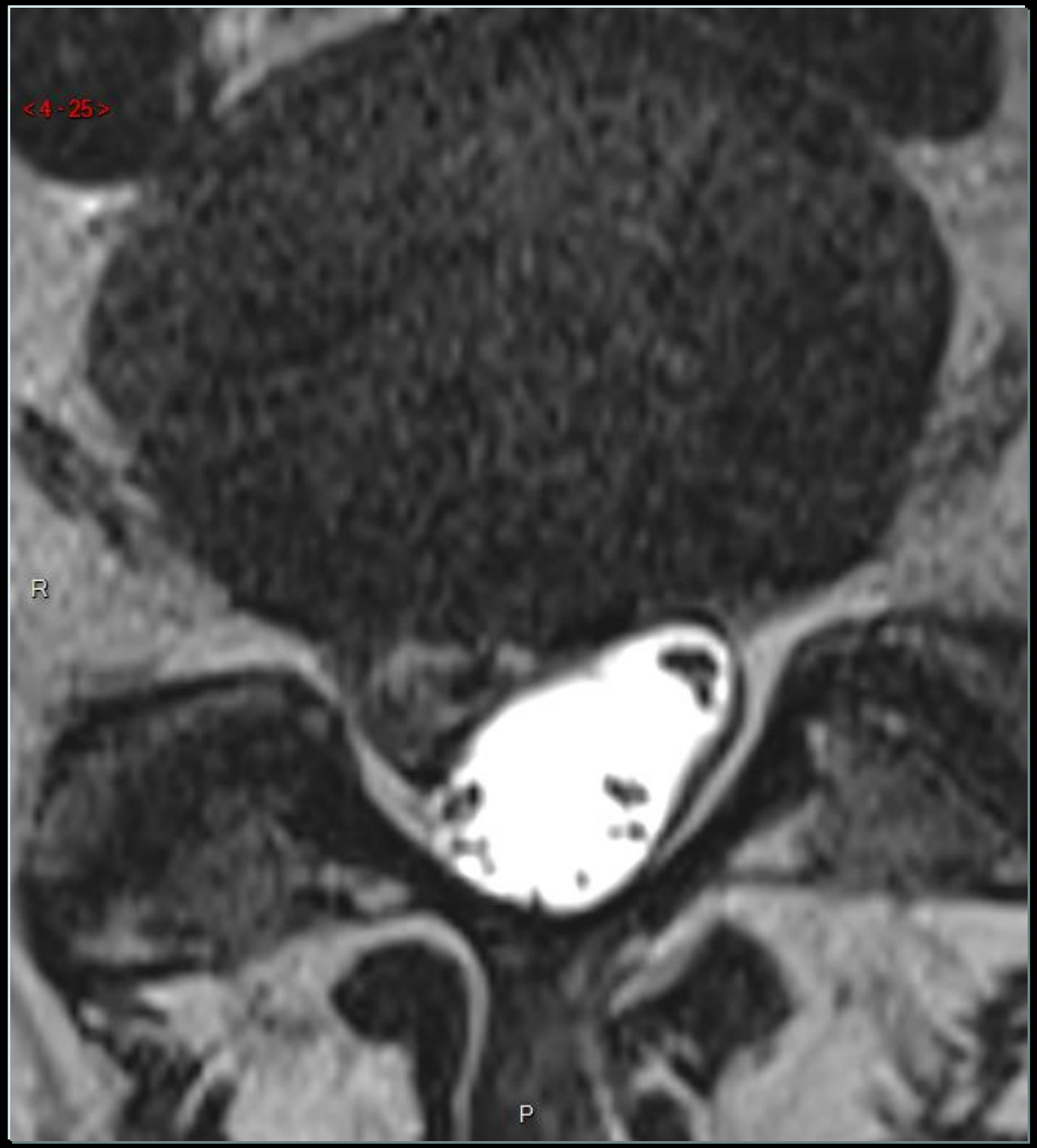
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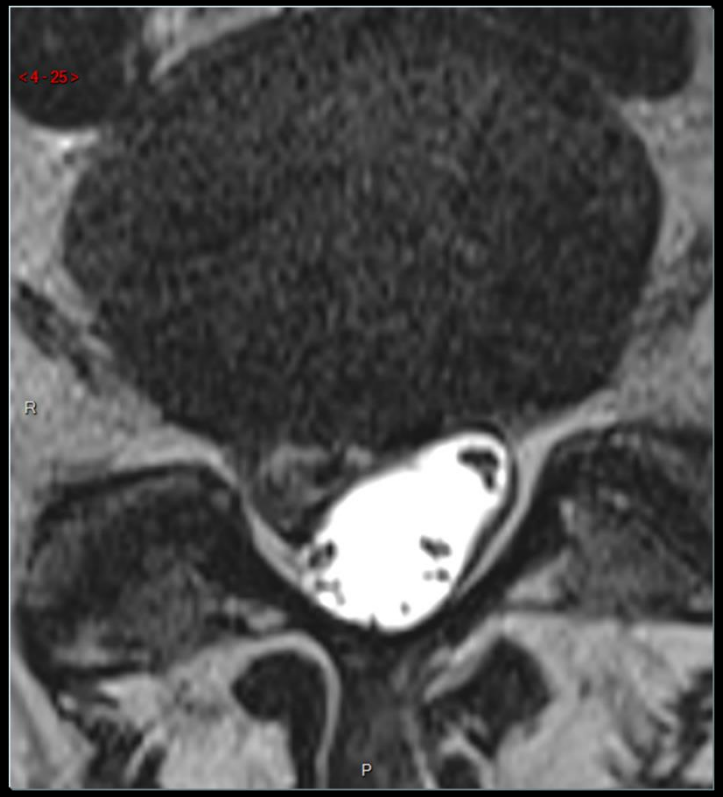
<4 - 26>
R
P


<4-27>
R
P

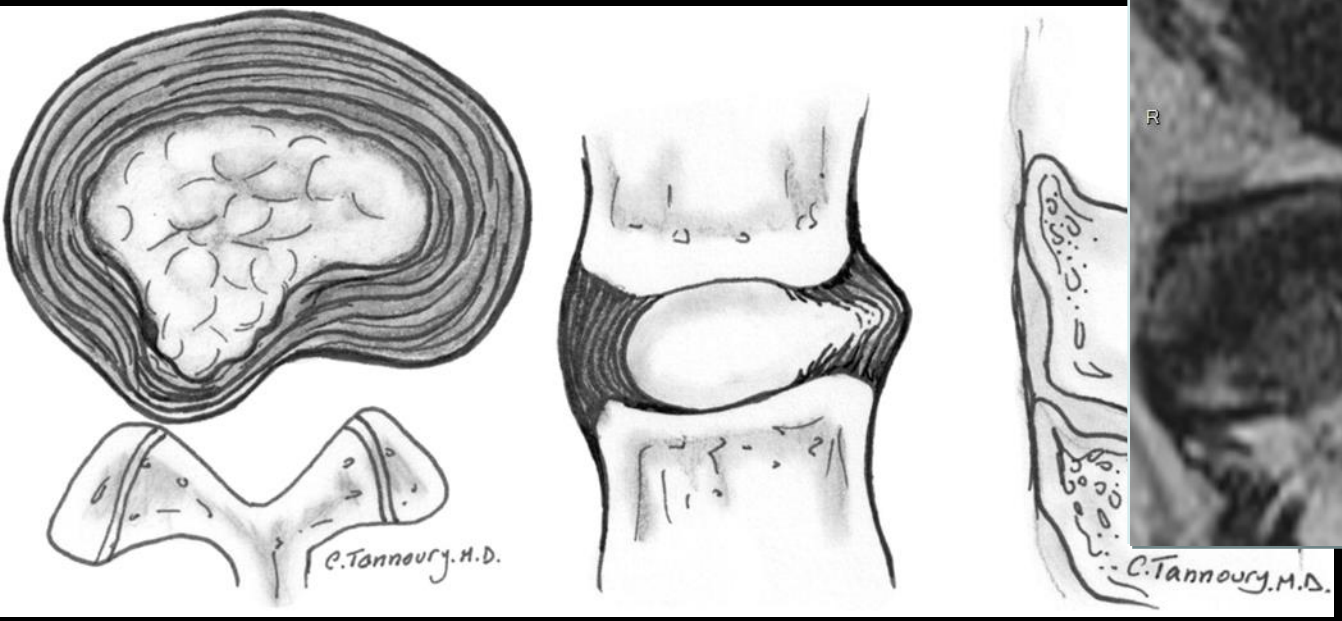

<4 -28>
R
P



Cas clinique
Homme 53 ans
Lombosciatalgies droites recentes
Abolition reflexe achiléen (S1)

Hernie discale
Infiltration péridurale

Hernie/protrusion discale



Lumbar disc nomenclature: version 2.0 David F. Fardon, MD, Alan L. Williams, MD, Edward J. Dohring, MD, F. Reed Murtagh, MD, Stephen L. Gabriel Rothman, MD, Gordon K. Sze, MD The Spine Journal Volume 14, Issue 11, Pages 2525-2545 (November 2014) DOI: 10.1016/j.spinee.2014.04.022

Cas clinique
Homme 63 ans
Lombalgies après avoir aidé son fils à déménager
Apparition progressive démangeaisons cuisse droite
Puis douleur cuisse droite
Diminution des lombalgies

SE T1

SE T1

SE T1

SE T1

SE T1

SE T2

SE T2

SE T2

SE T2

SE T2

SE T1
+ C

SE T1
+ C

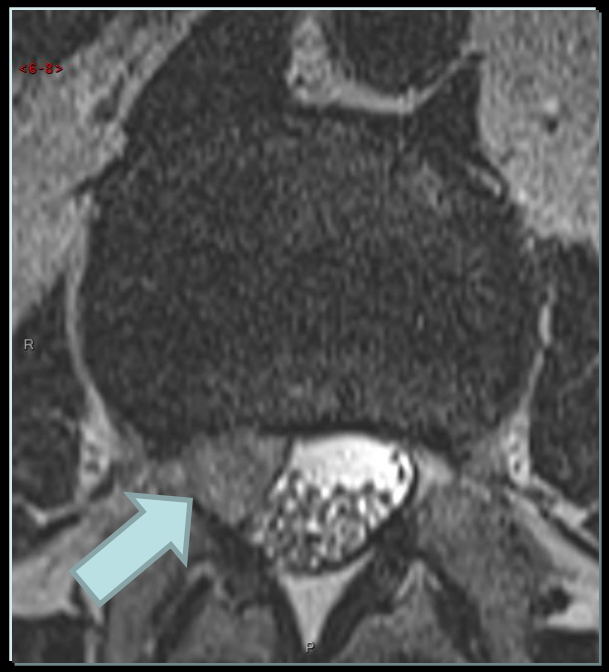
SE T1
+ C

SE T1
+ C

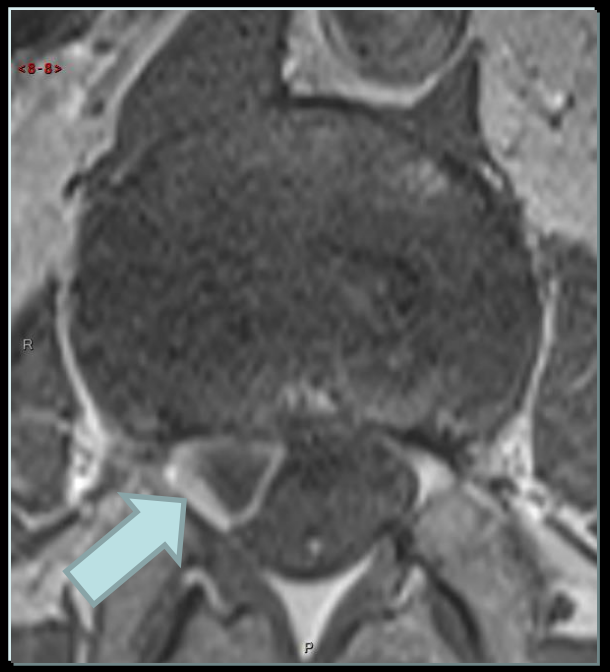
SE T1
+ C

Hernie discale exclue
Abstention thérapeutique (amélioration spontanée)

SE T1

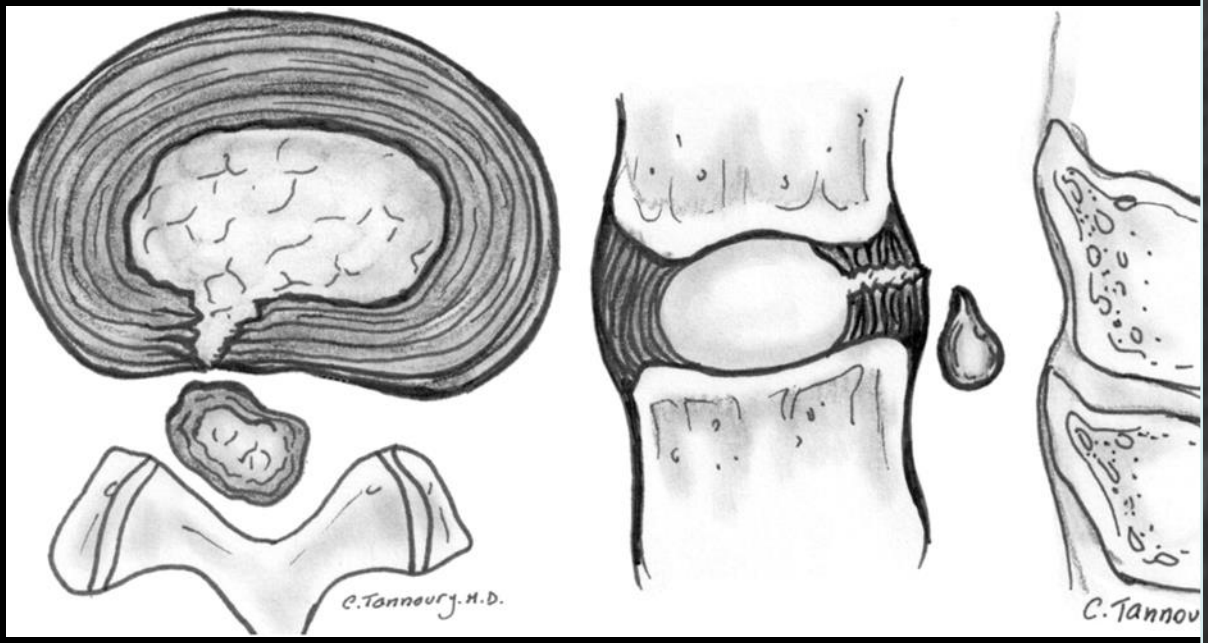


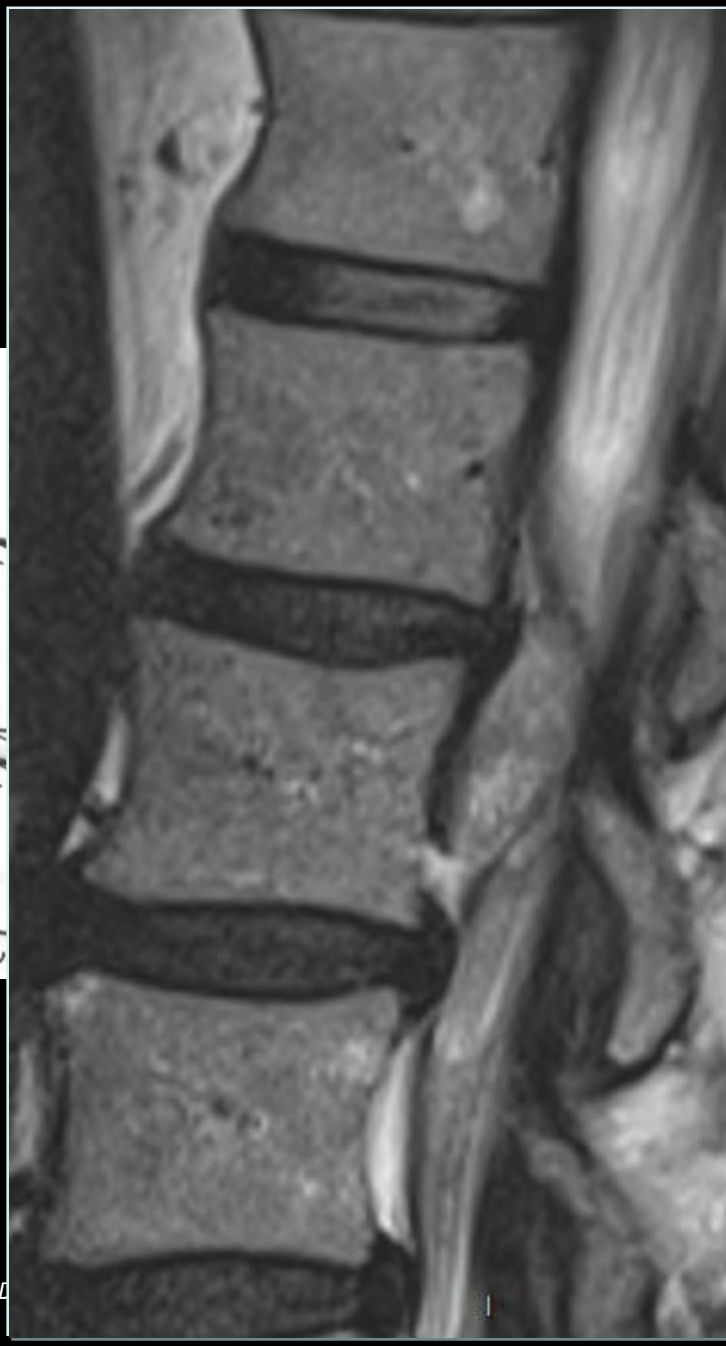
SE T2



SE T1+Gado

Hernie exclue
Hernie migrée





Lumbar disc nomenclature: version 2.0 David F. Fardon, MD, Alan L. Williams, MD, Edward J. Dohring, MD Gordon K. Sze, MD The Spine Journal Volume 14, Issue 11, Pages 2525-2545 (November

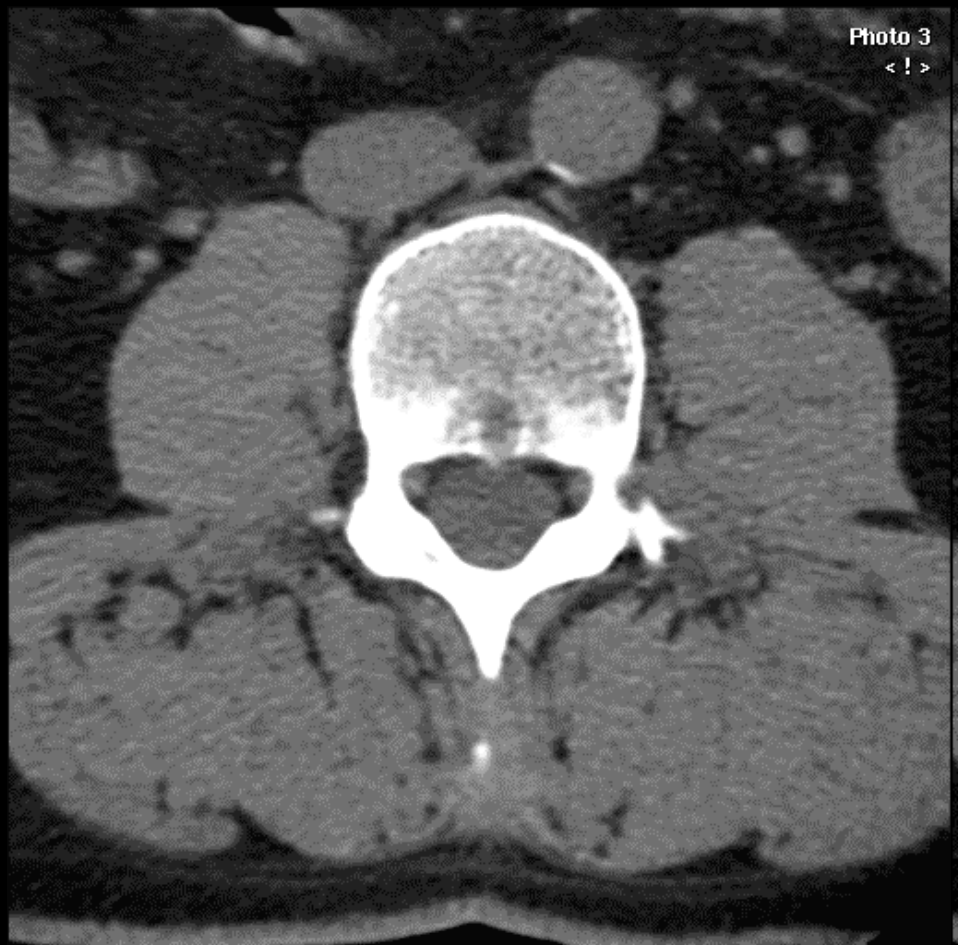
Cas clinique
H, 52 ans
Radiculopathie droite
Lasègue négatif
Exploration TDM

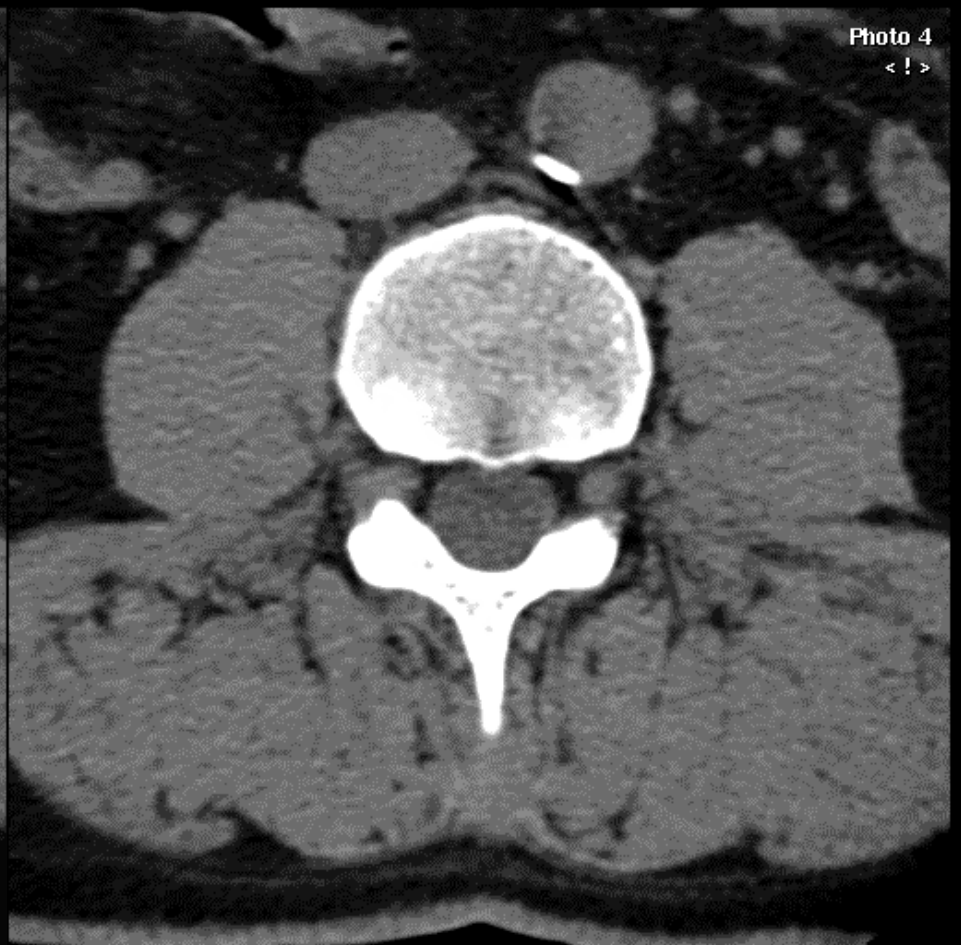
Cas

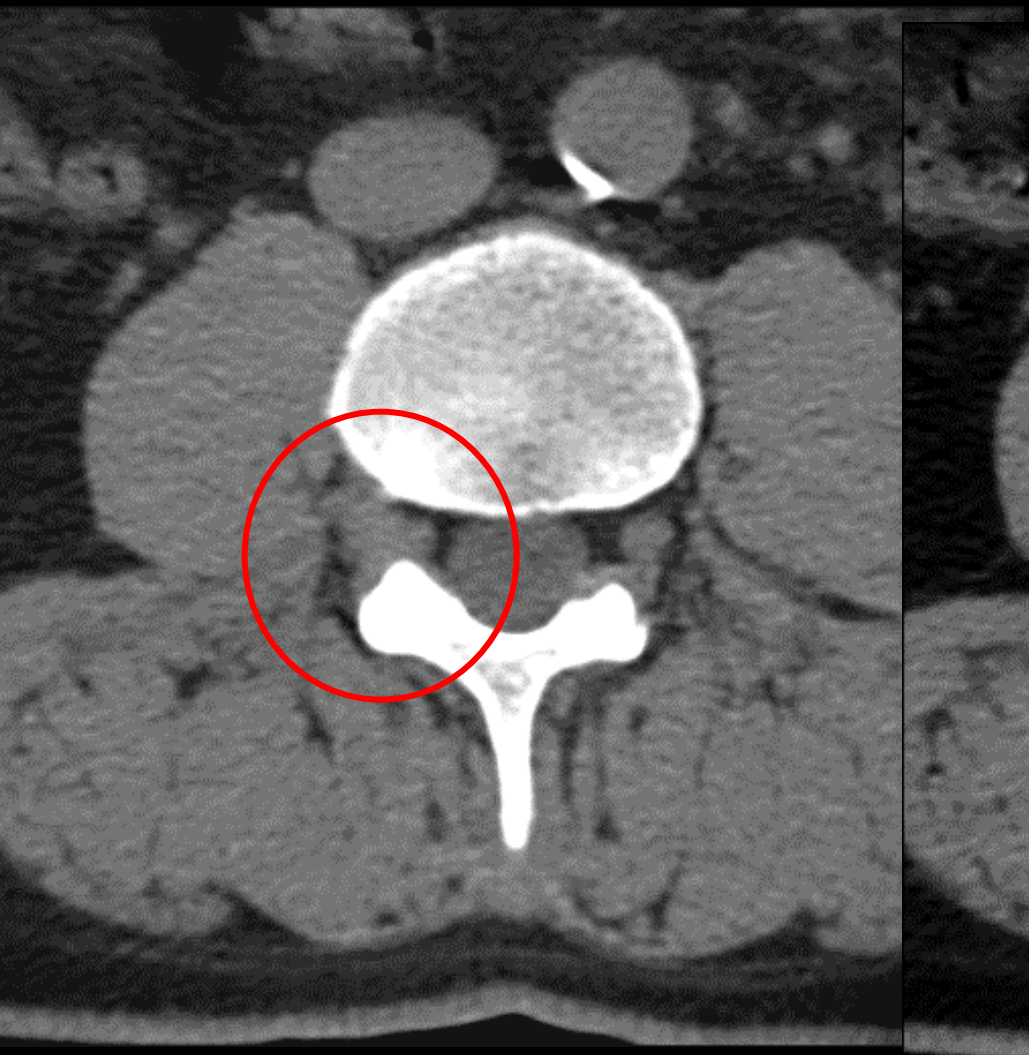
H, 52 ans

Radiculopathie droite

Lasègue négatif







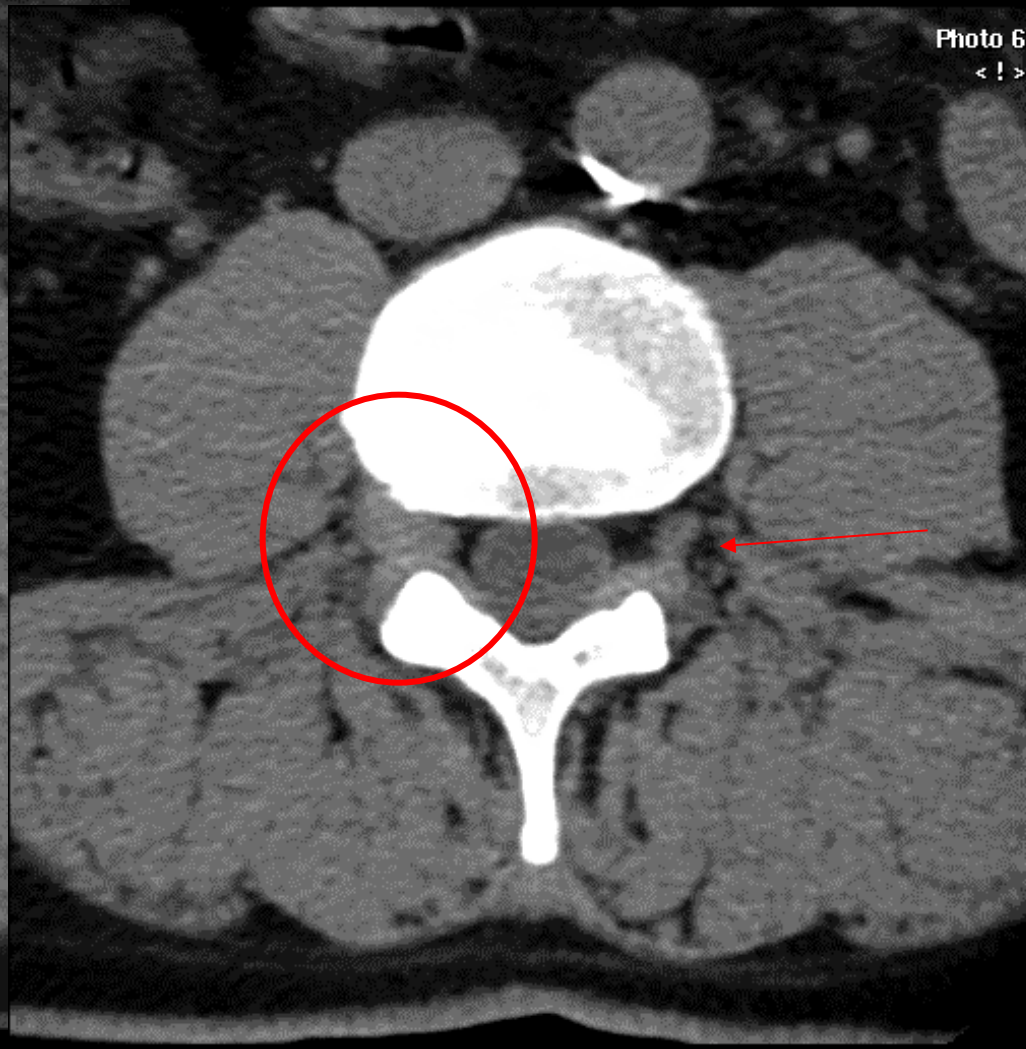


Photo 6
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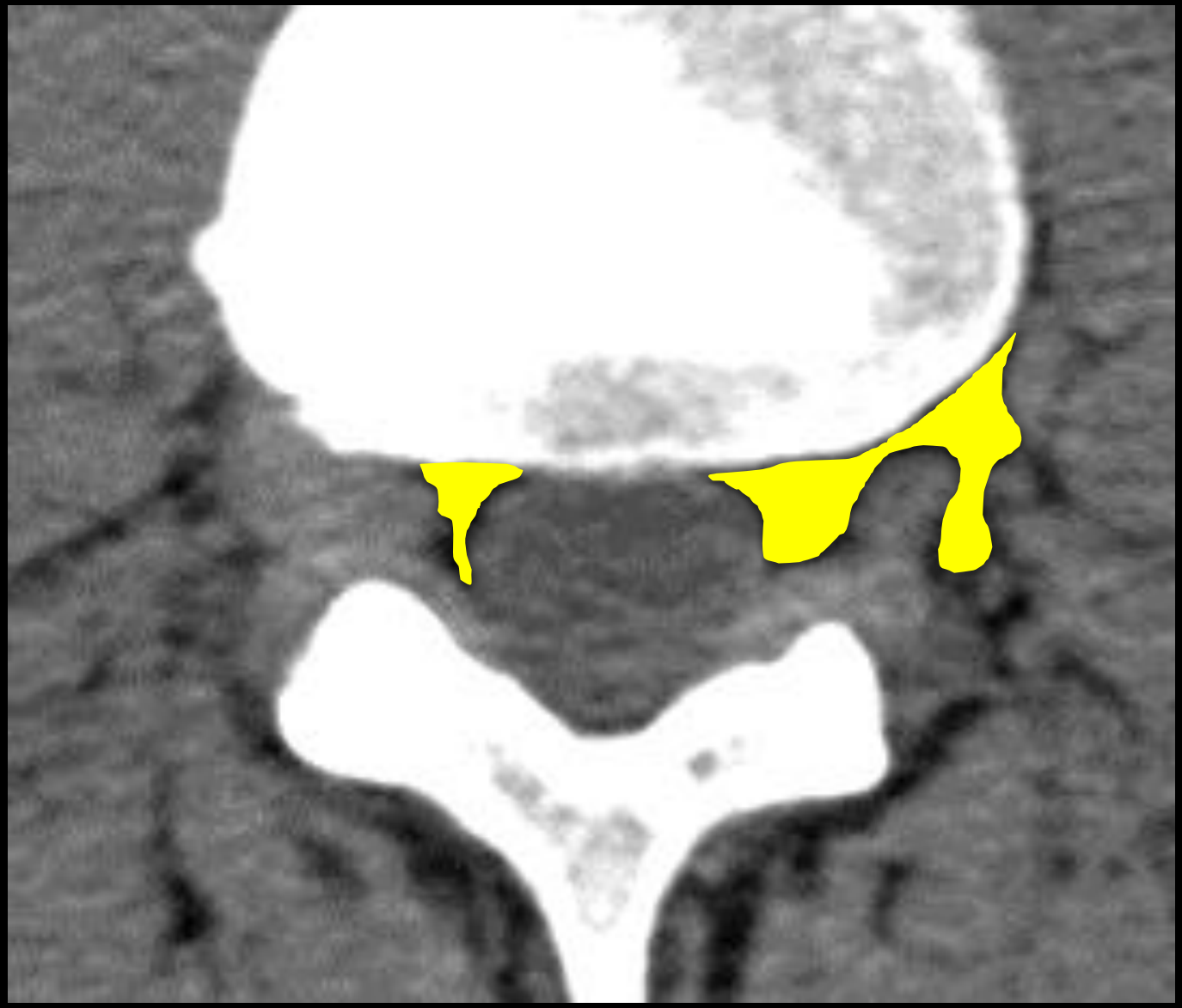
Liseré graisseux péri-radiculaire

Liseré graisseux péri-radiculaire

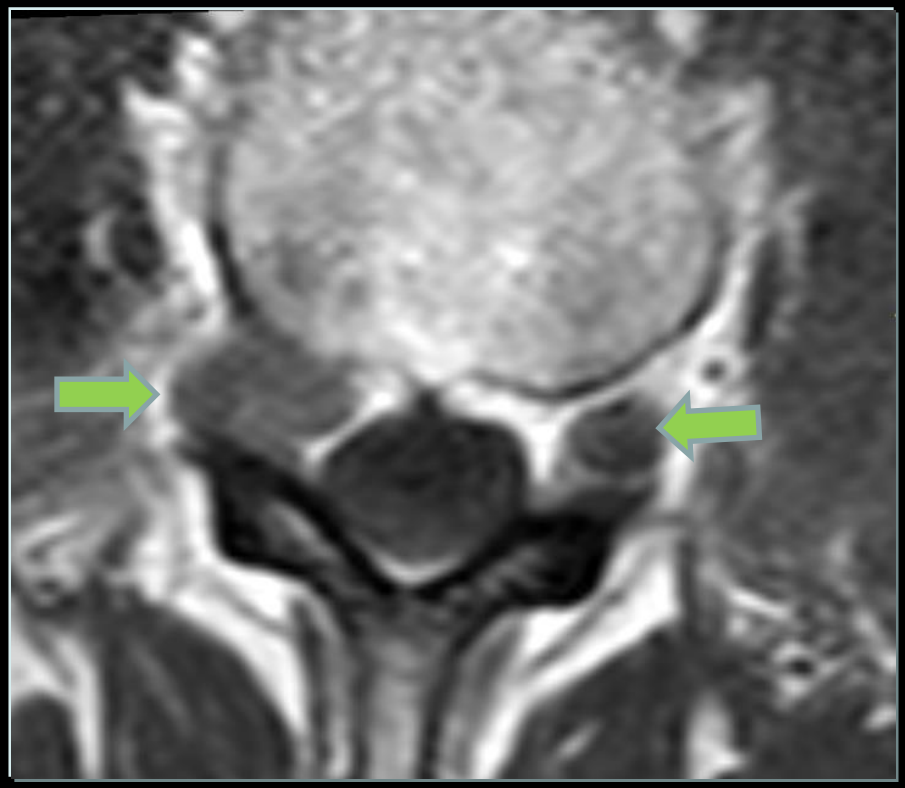


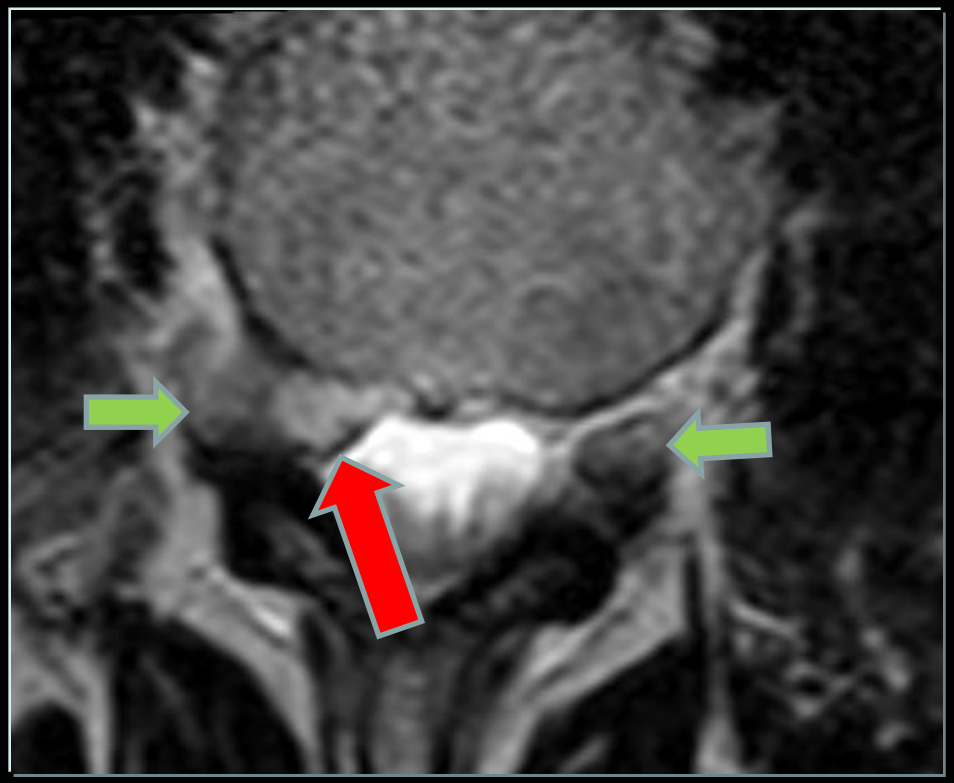
Hernie foraminale

Migration de matériel discal
dans le secteur postéro-latéral

Formation dense
de taille variable
déborde très rarement en dehors du foramen

Hernie foraminale (IRM)
Meilleure distinction racine>< hernie

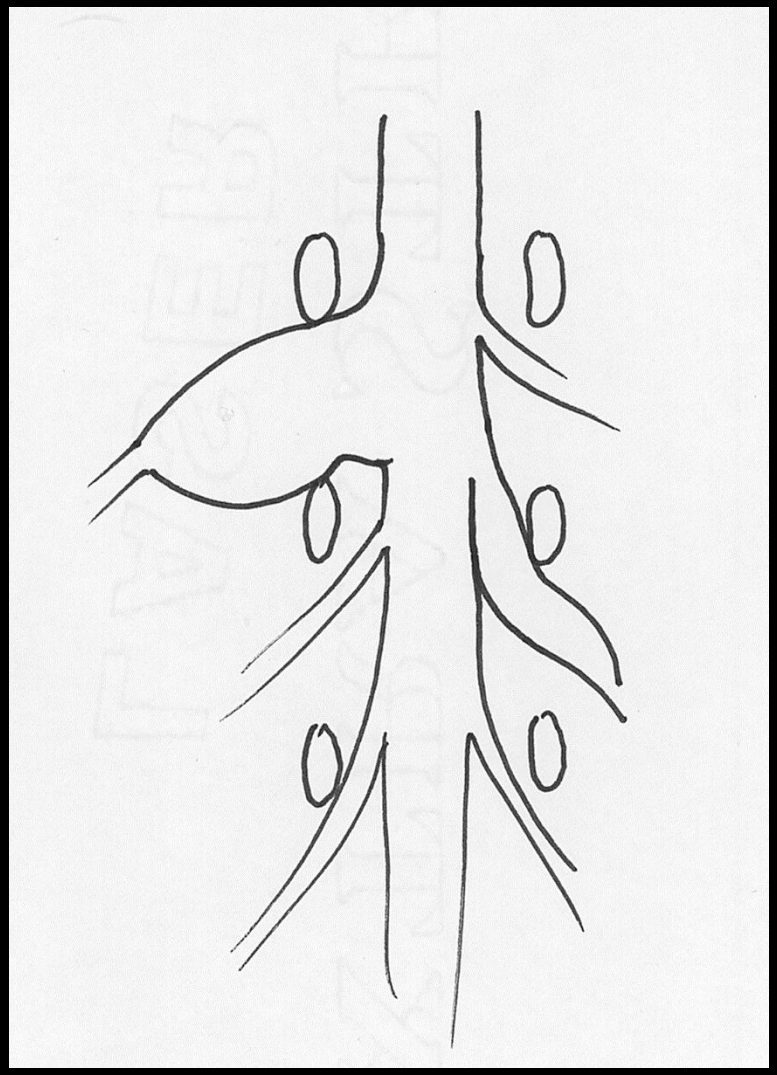


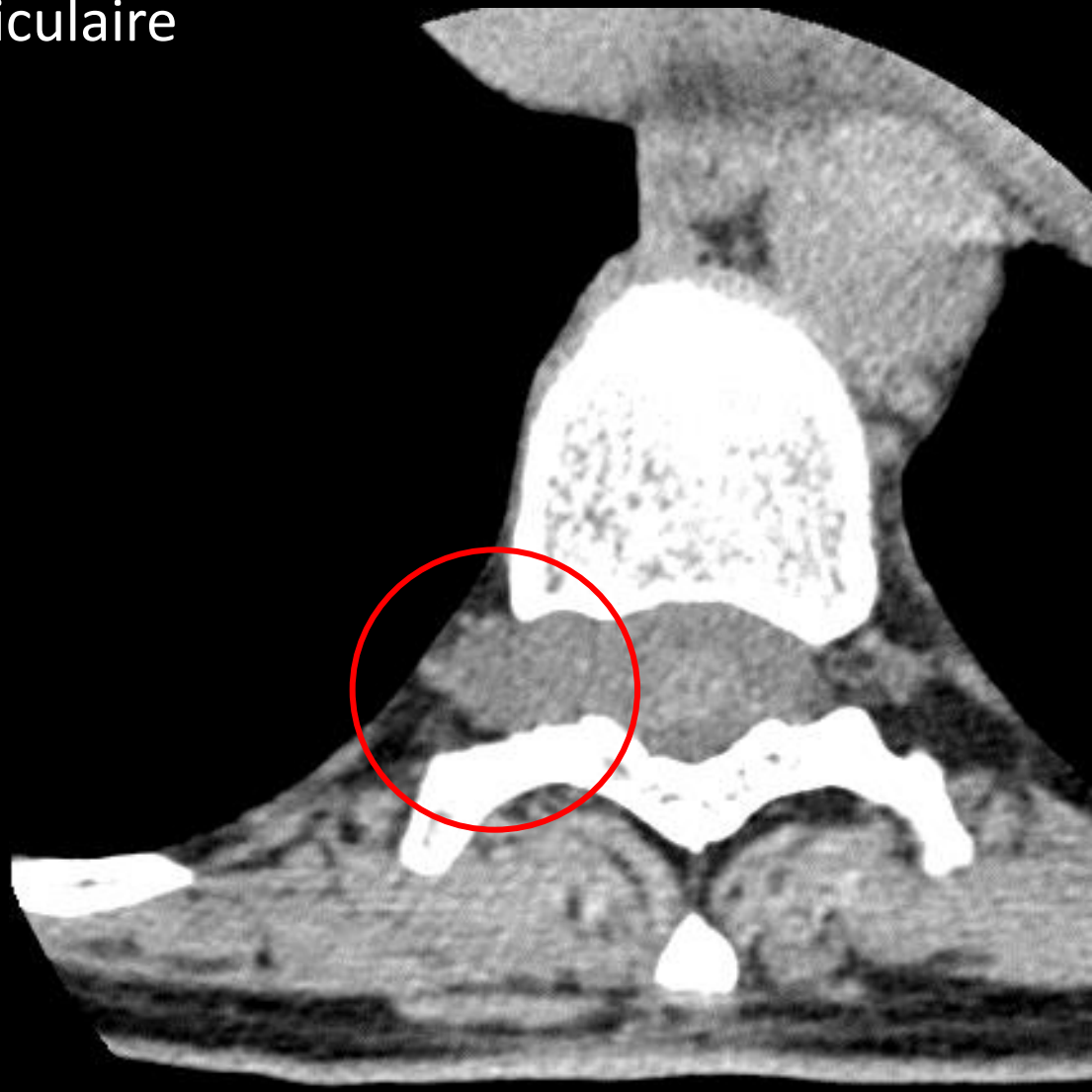


Diagnostic différentiel de « masse foraminale »

1. Hernie foraminale
2. Dilatation / kyste des gaines périradiculaires
3. Variante anatomique (émergence conjointe des racines
4. Kyste arthrosynovial
5. Neurinome
6. Lésion osseuse infiltrative

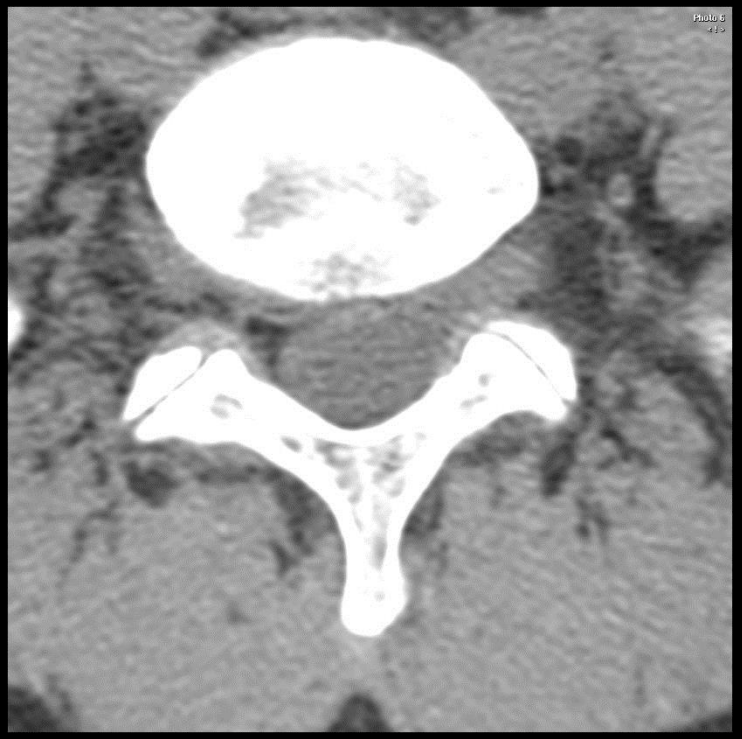
Dilatation de la gaine périradiculaire

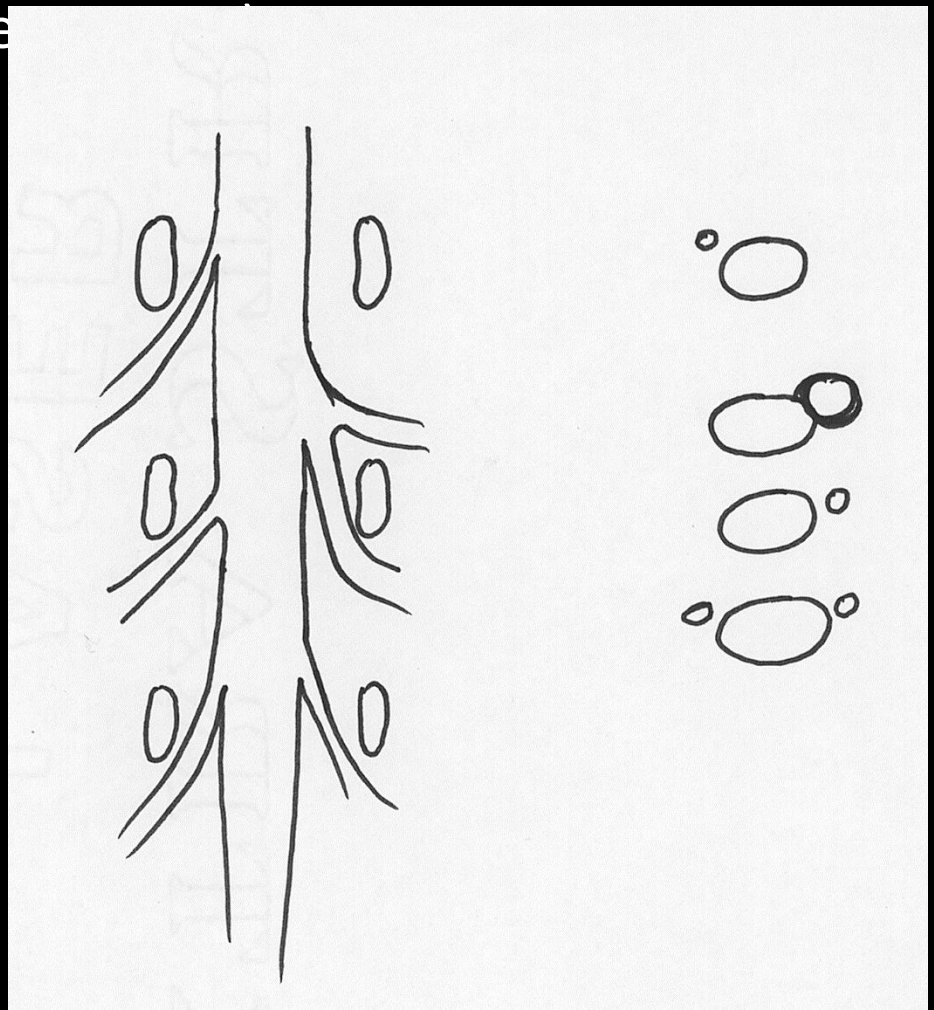




Emergence conjointe des racines

1. Dense par rapport au contenu du sac dural
2. Sans élargissement du foramen,
   mais parfois asymétrie de dimension
3. Analyser séquentiellement les coupes
   (apparition non synchrone de

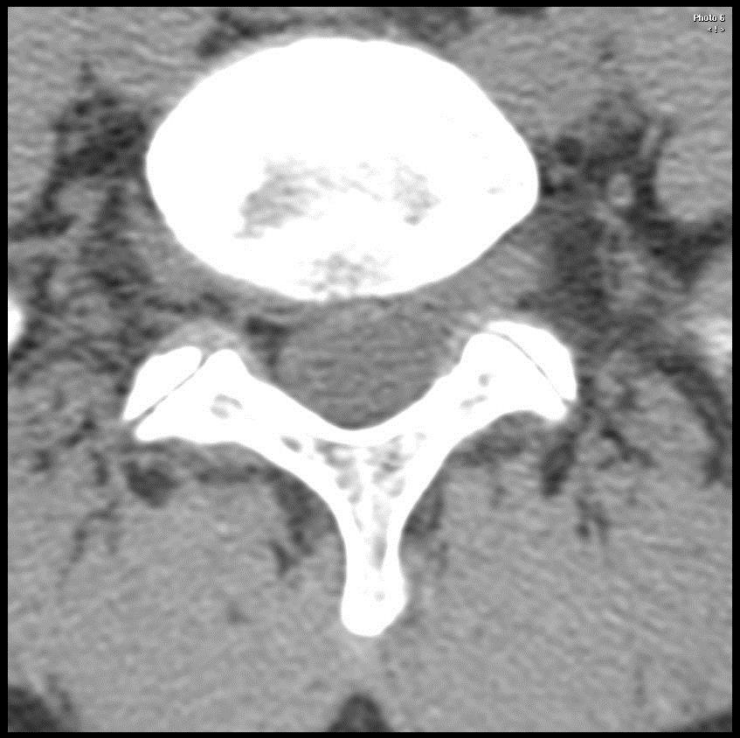




TDM

Résolution en contraste limitée

- Calcium
- Tissu/eau
- Graisse
- Air



Cas clinique
Femme, 29 ans (BA8955x)

Depuis 2 mois, lombalgie gauche
Depuis 2 semaines, sciatique gauche

Pas de déficit neurologique
Rx, TDM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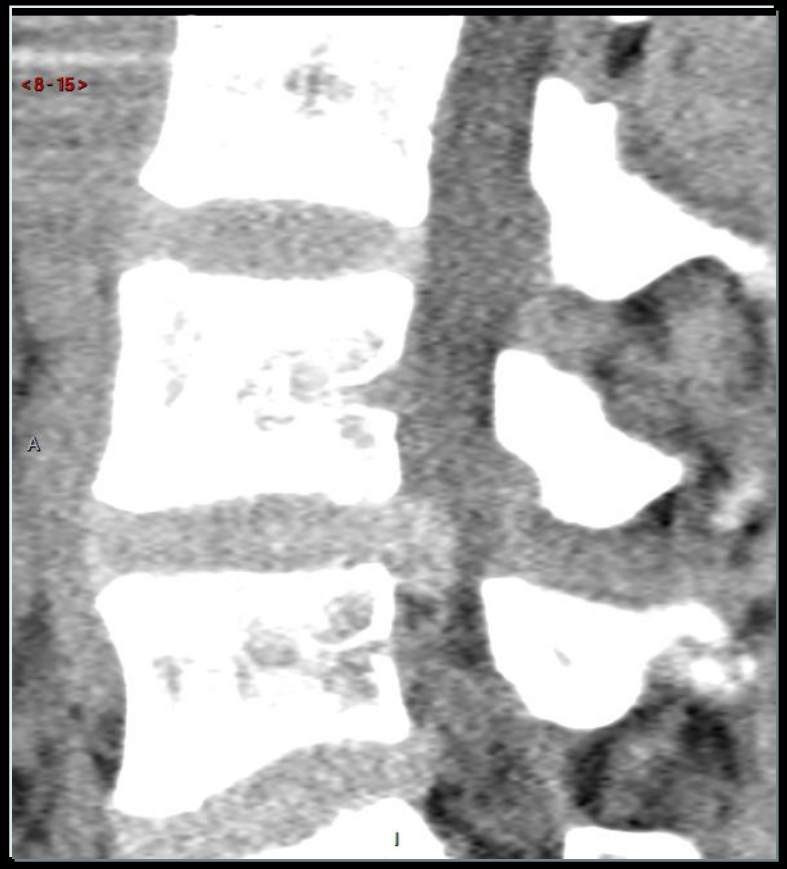
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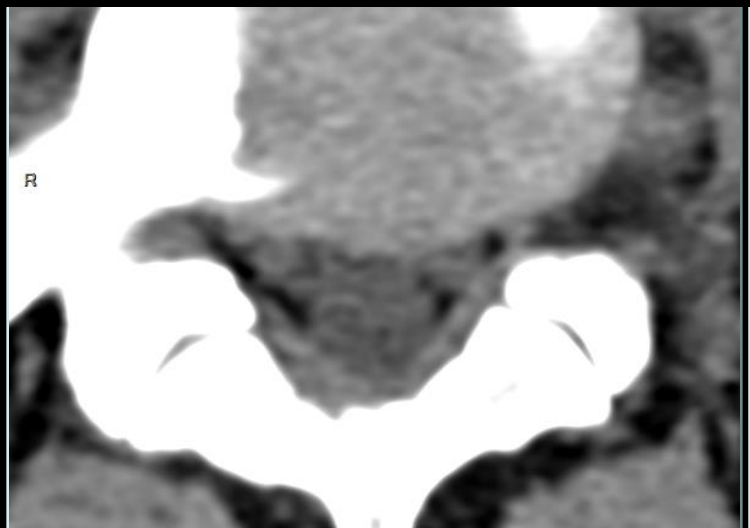
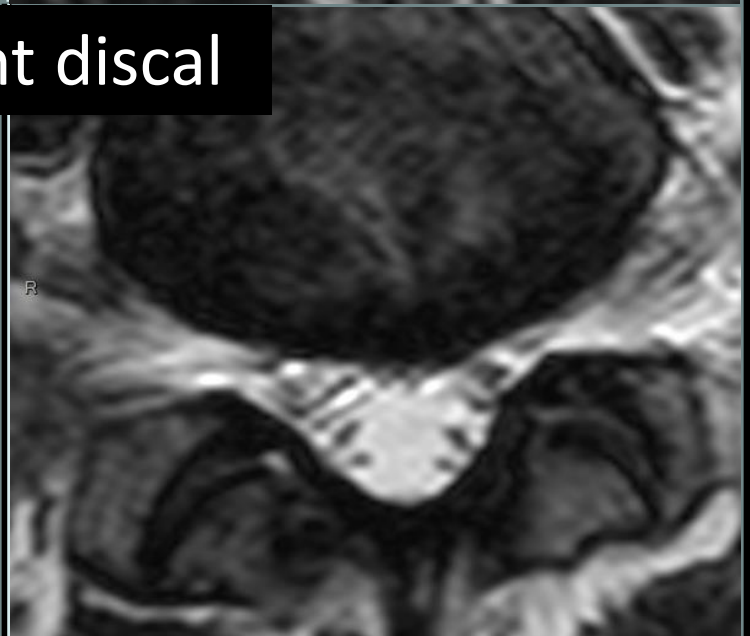
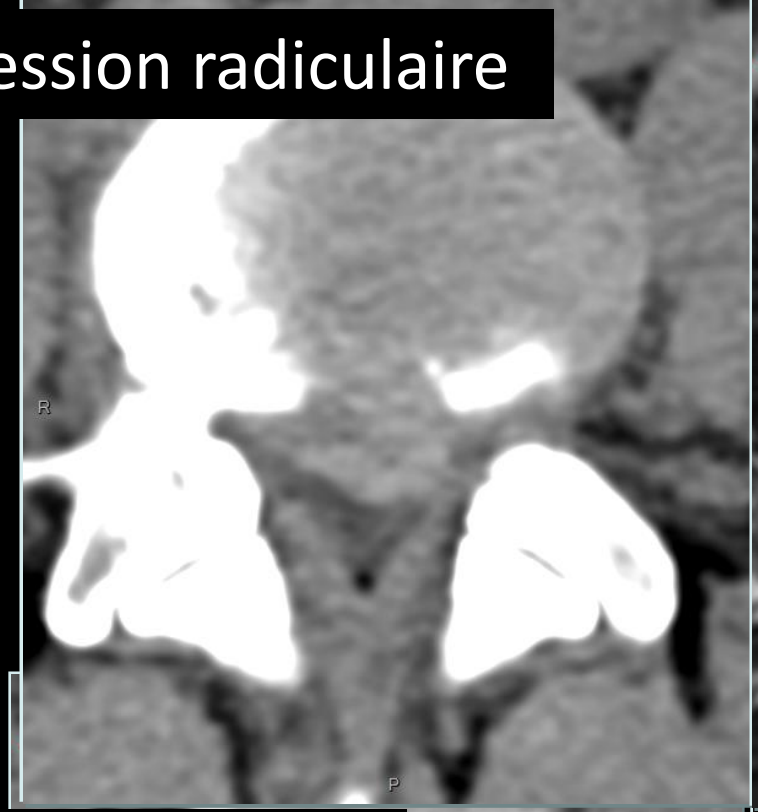
Hernie discale

Débord/bombement/étalement discal

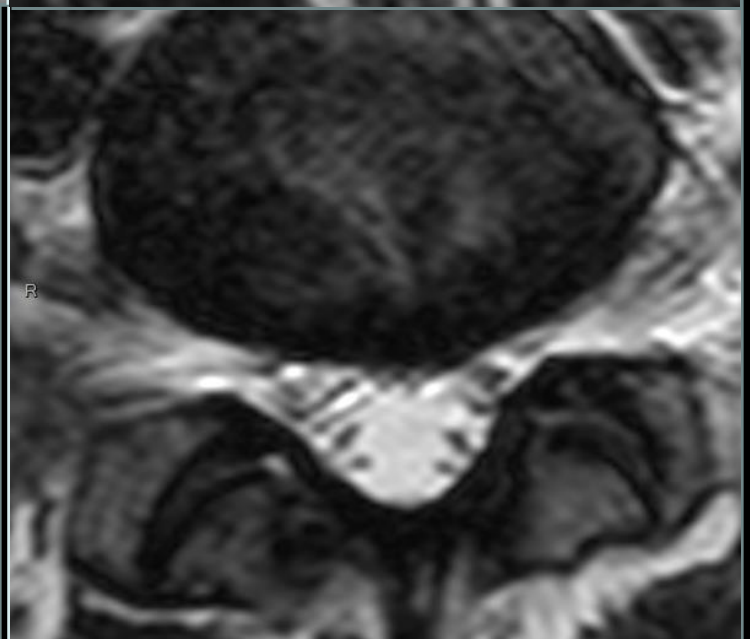




Compression radiculaire



Contact radiculaire



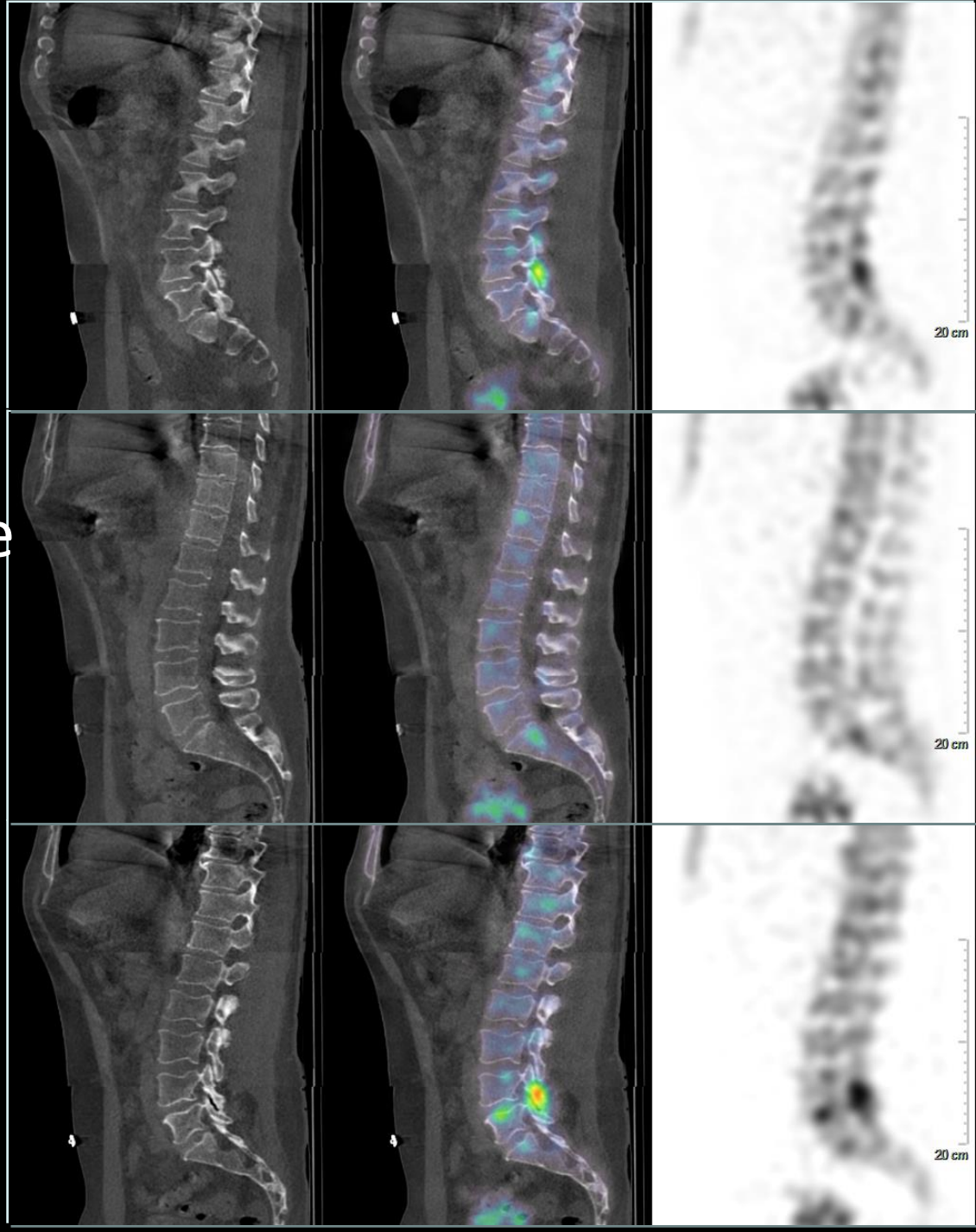
Cas clinique
Femme, 29 ans

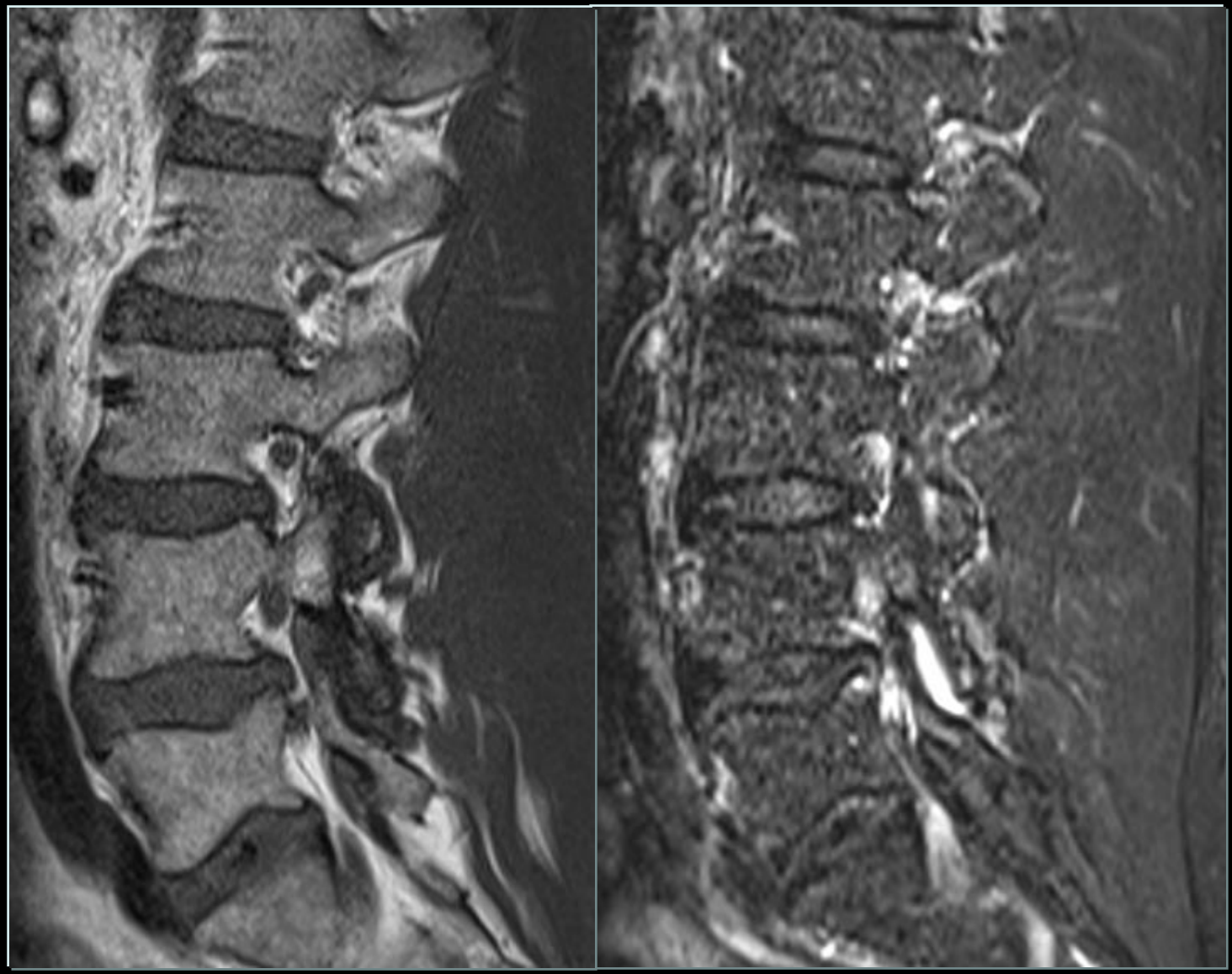
Depuis 2 mois, lombalgie gauche
Depuis 2 semaines, sciatique gauche

Pas de déficit neurologique
Rx, TDM
Traitement medicamenteux et 2 peridurales
Retour au travail deux mois plus tard.

Cas clinique
Homme 53 ans

Spect-CT
Imagerie multimodale
Fusion scinti os et CT





Cas clinique
Homme 53 ans

Spect-CT

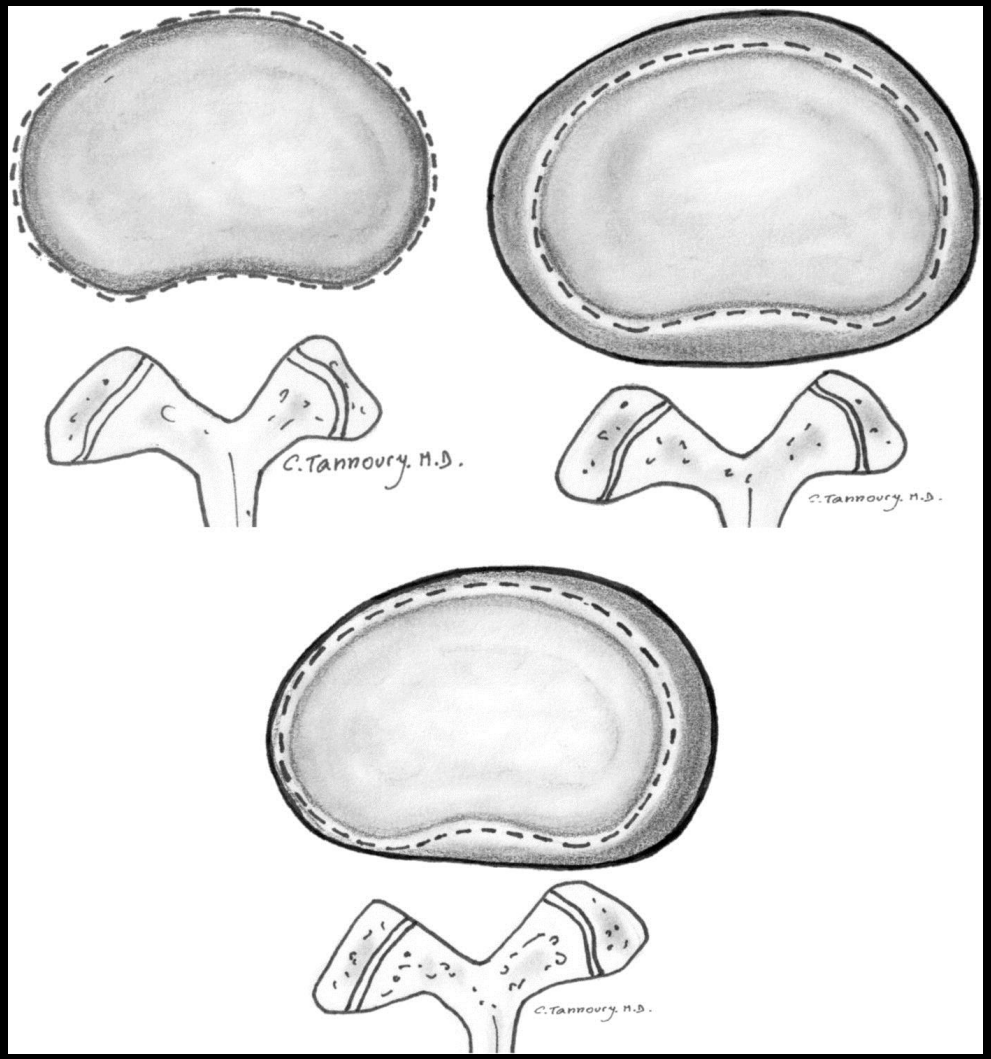

FLEXION


EXTENSION

Objectifs

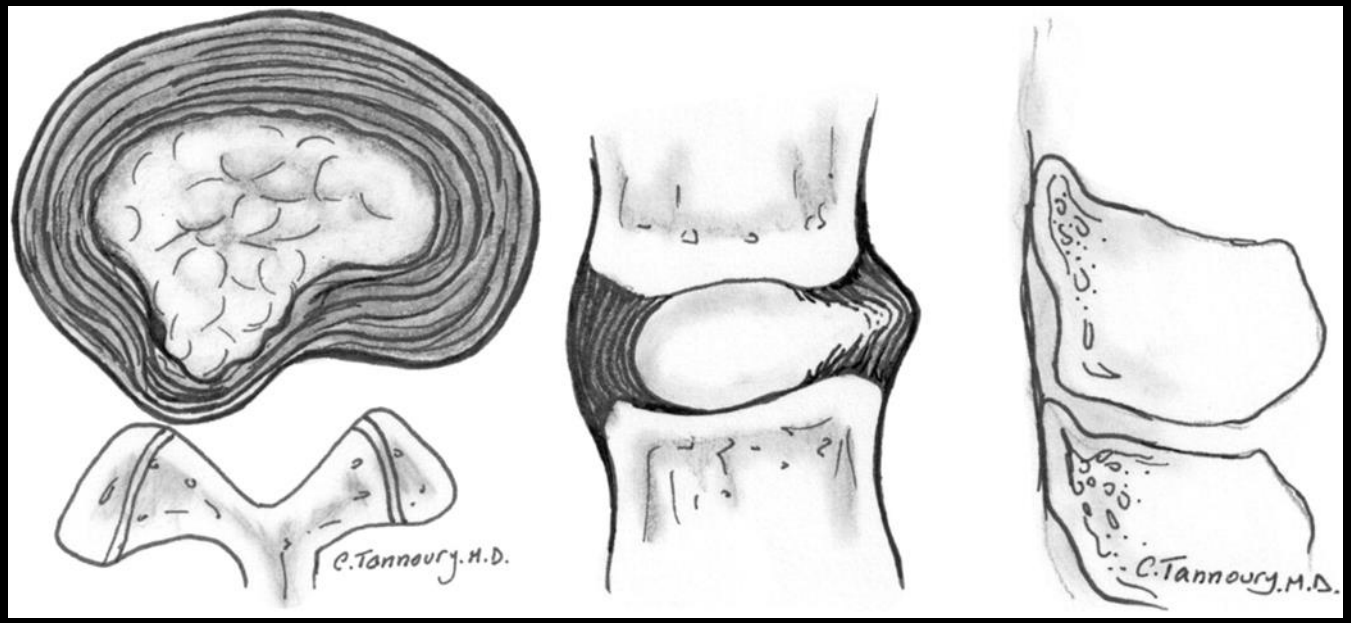
- Modalités d'imagerie
- Informations pratiques
- Imagerie de la colonne : Que voit-on ?
- Terminologie
- Imagerie de la colonne : que ne voit pas ?
- Discordances radio-cliniques population normale

Débord/bombement/étalement discal



Lumbar disc nomenclature: version 2.0 David F. Fardon, MD, Alan L. Williams, MD, Edward J. Dohring, MD, F. Reed Murtagh, MD, Stephen L. Gabriel Rothman, MD, Gordon K. Sze, MD The Spine Journal Volume 14, Issue 11, Pages 2525-2545 (November 2014) DOI: 10.1016/j.spinee.2014.04.022

Hernie/protrusion discale



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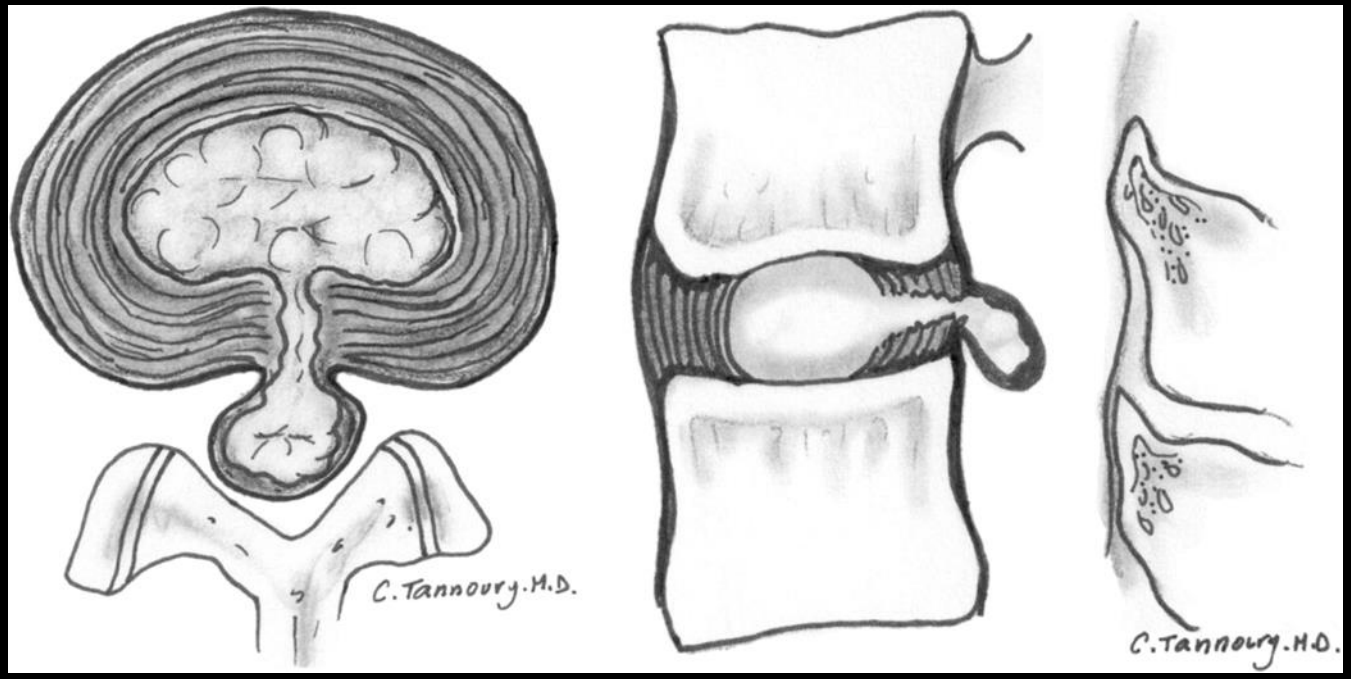
Extrusion discale



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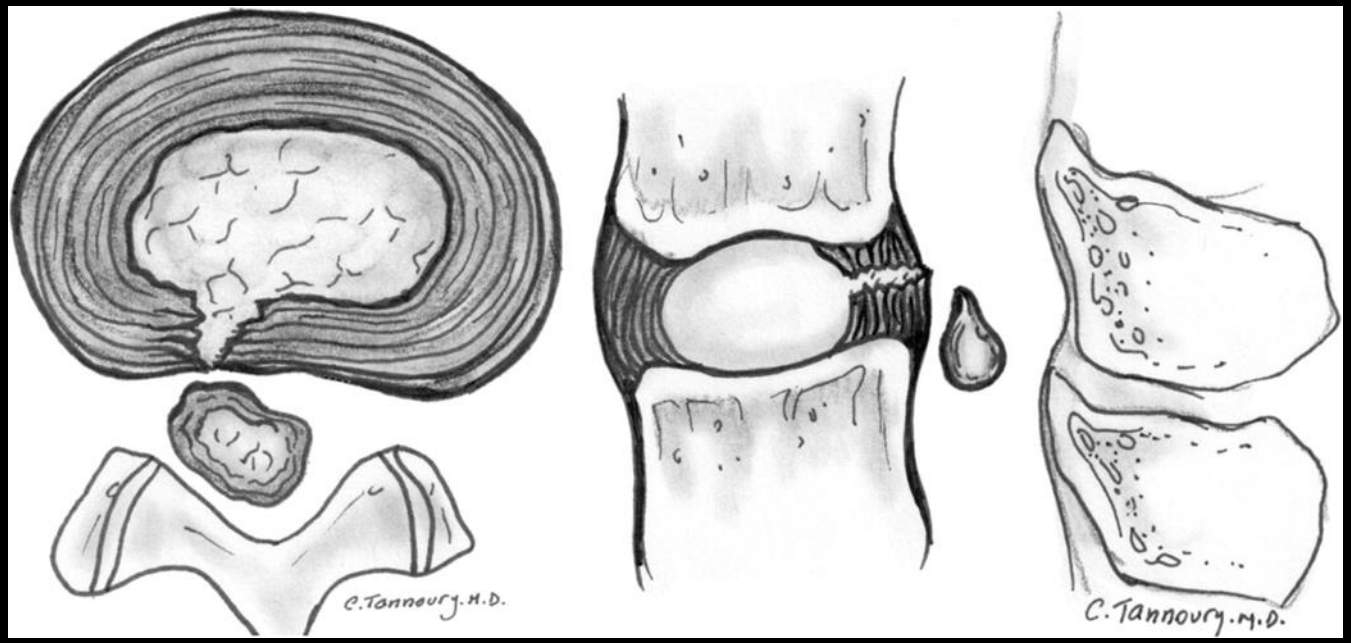
Séquestration discale



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Objectifs

- Modalités d'imagerie
- Informations pratiques
- Imagerie de la colonne : Que voit-on ?
- Terminologie
- Imagerie de la colonne : que ne voit pas ?
- Discordances radio-cliniques population normale

CAS CLINIQUE

Homme, 82 ans,

IR, diabete type 2, HTA, cholecystectomie

Motif: lombosciatalgies bilaterales, demarche à petit pas, difficulté pour se lever

Périmetre de marche : 100 m

Soulagement en position assise

Blocage des pieds et paresthésies plantaires

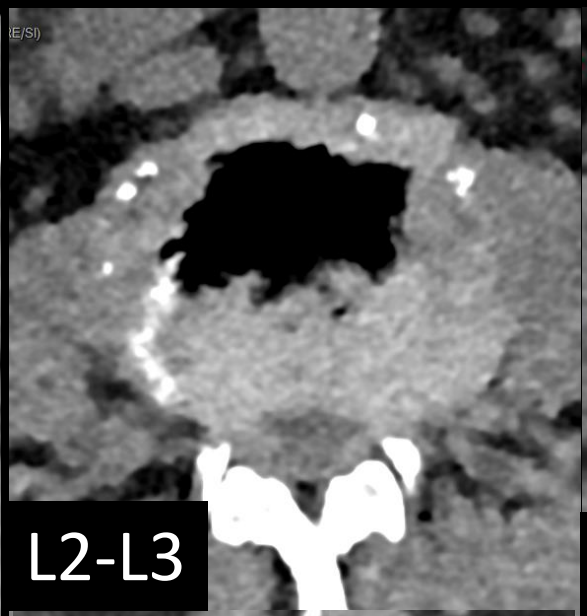
Appui pointe et talon OK

Abolition ROT Minf

EMG: polyneuropathie sensitivo-motrice Mb Sup et Mb Inf

Atteinte L5 D peu évolutive chronique

CT:


L2-L3


L3-L4


L4-L5

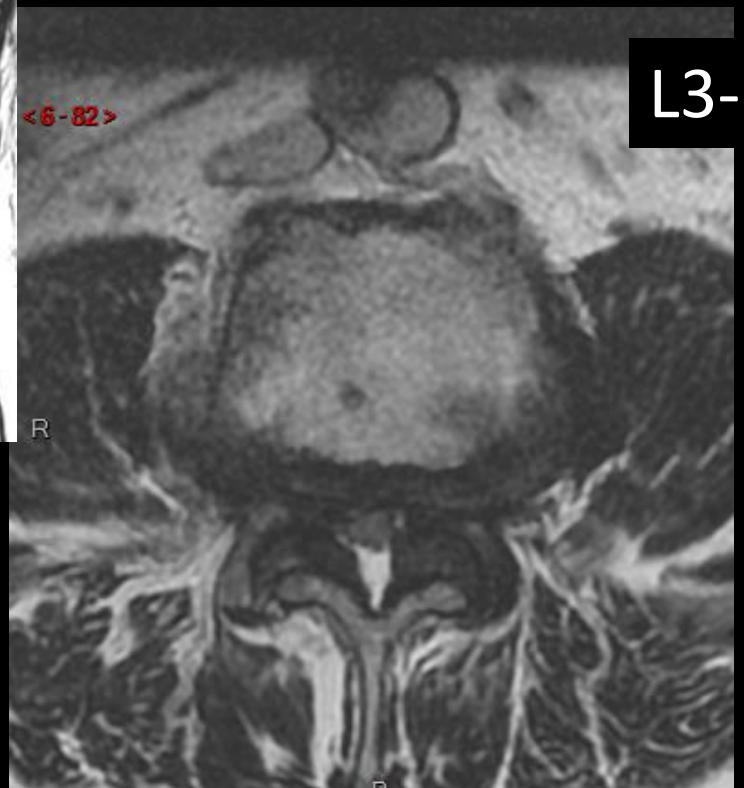

L5-S1

TDM

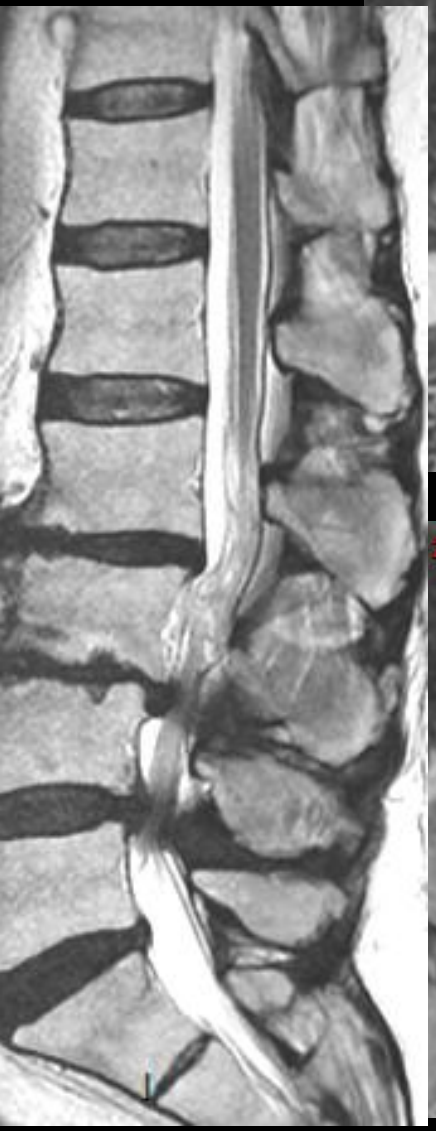
SE T1

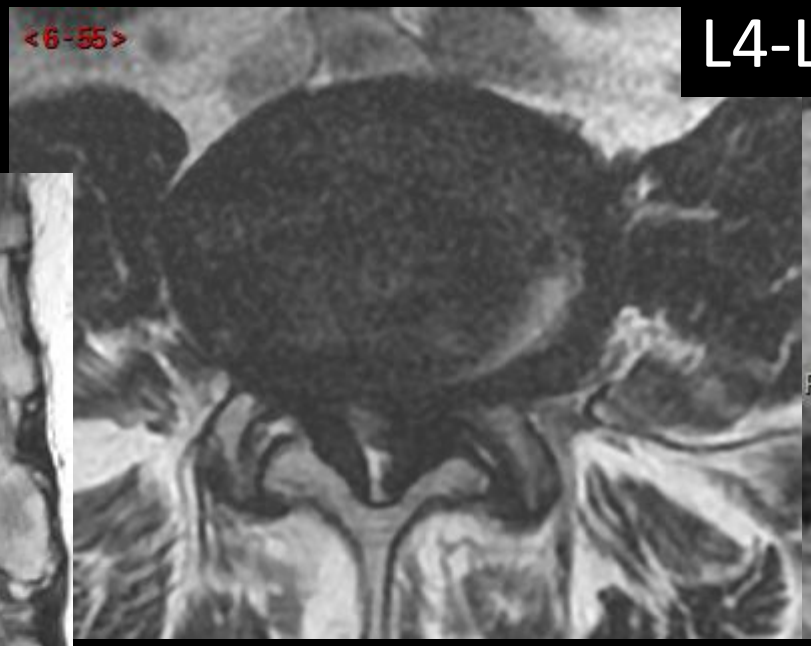
SE T2

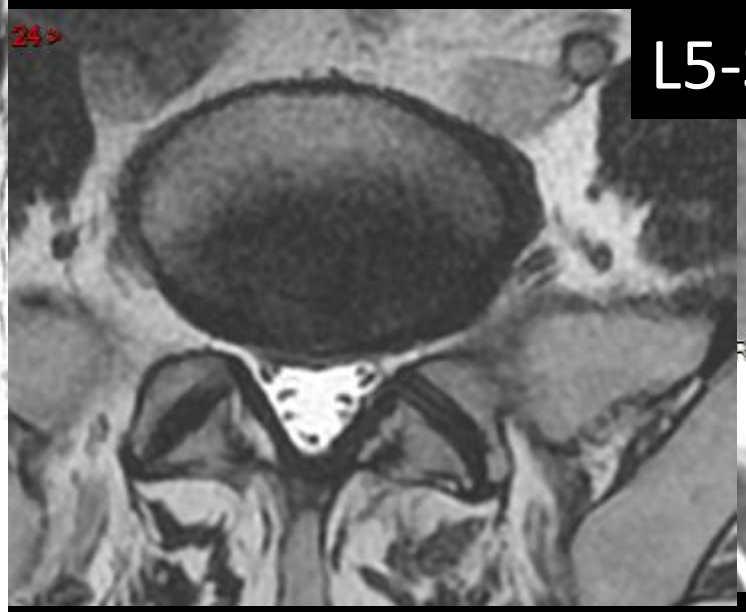
L2-L3

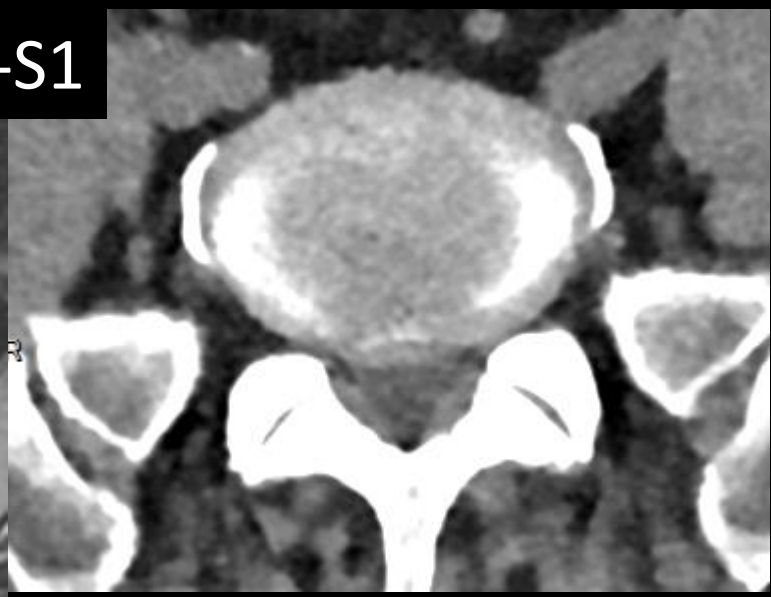


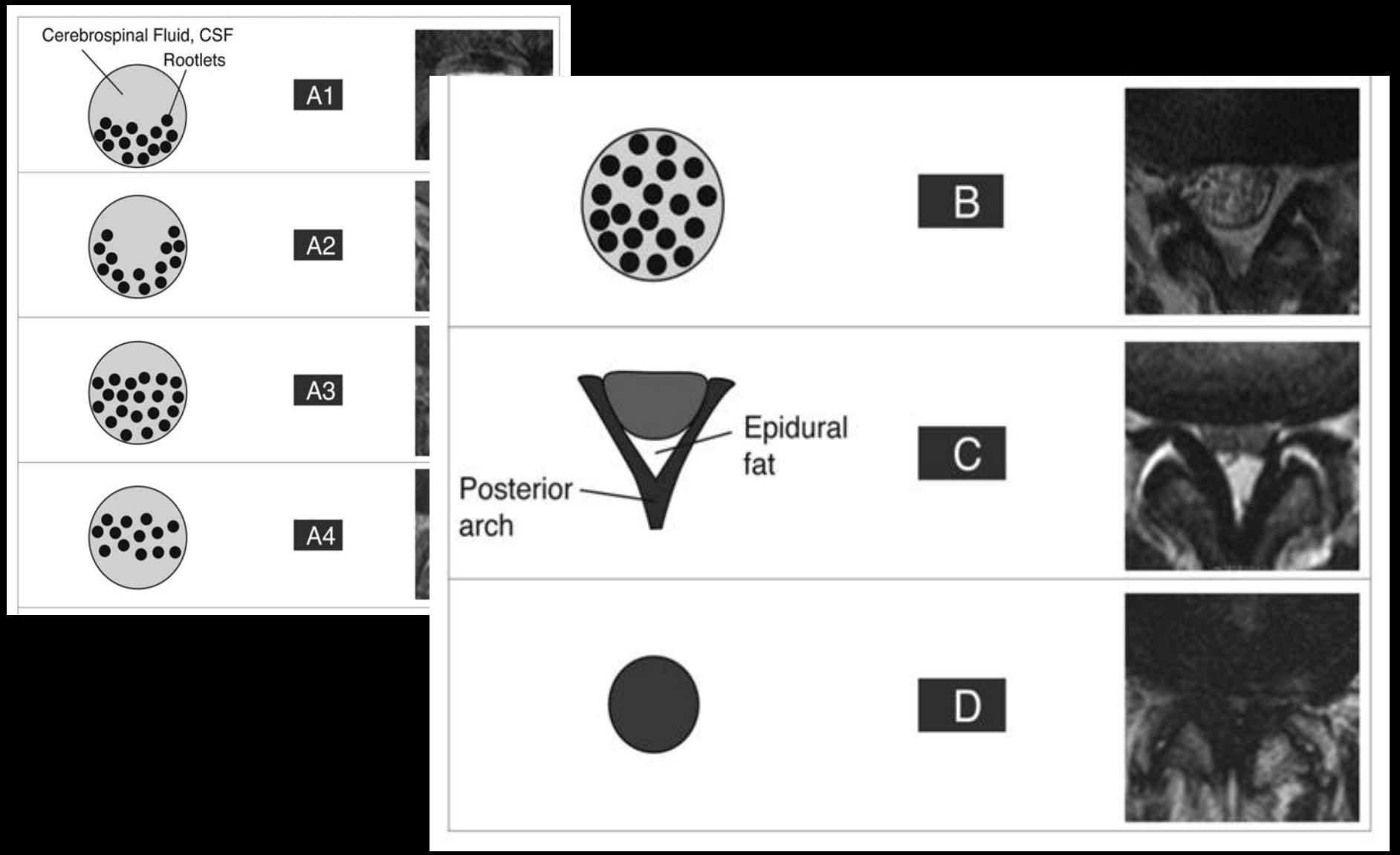
L3-L4




L4-L5


L5-S1





Schizas et al. Qualitative Grading of Severity of Lumbar Spinal Stenosis Based on the Morphology of the Dural Sac on Magnetic Resonance Images. Spine 2010;35:1919–1924

TDM fenetre osseuse

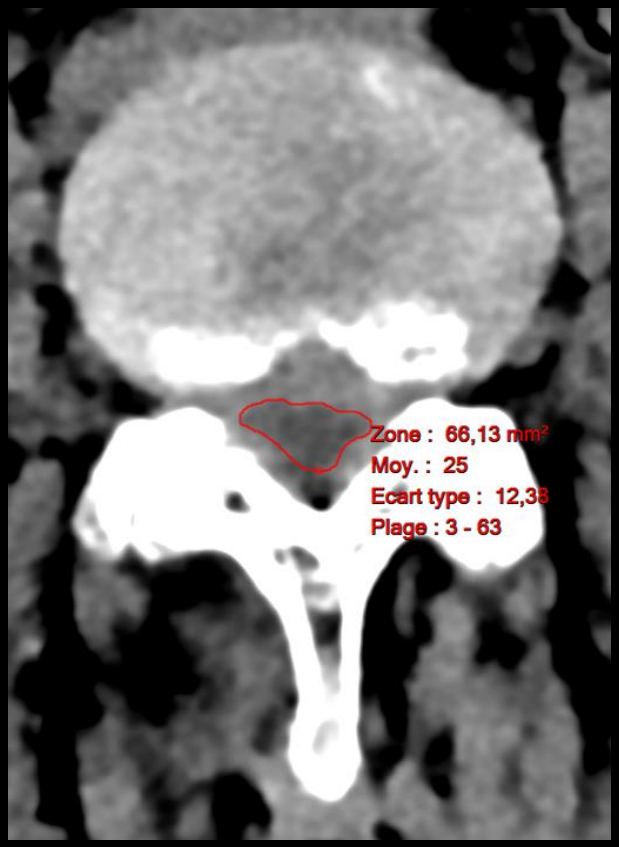
fenetre molle

IRM SE T2

TDM

- rétrécissement relatif < **100 mm2**
- rétrécissement significatif < **75 mm2**
- rétrécissement significatif "sévère" < **60 mm2**

L4-L5



L4-L5

Grade A selon
La classification
de Lausanne

Discordance TDM/IRM

TDM

SE T2

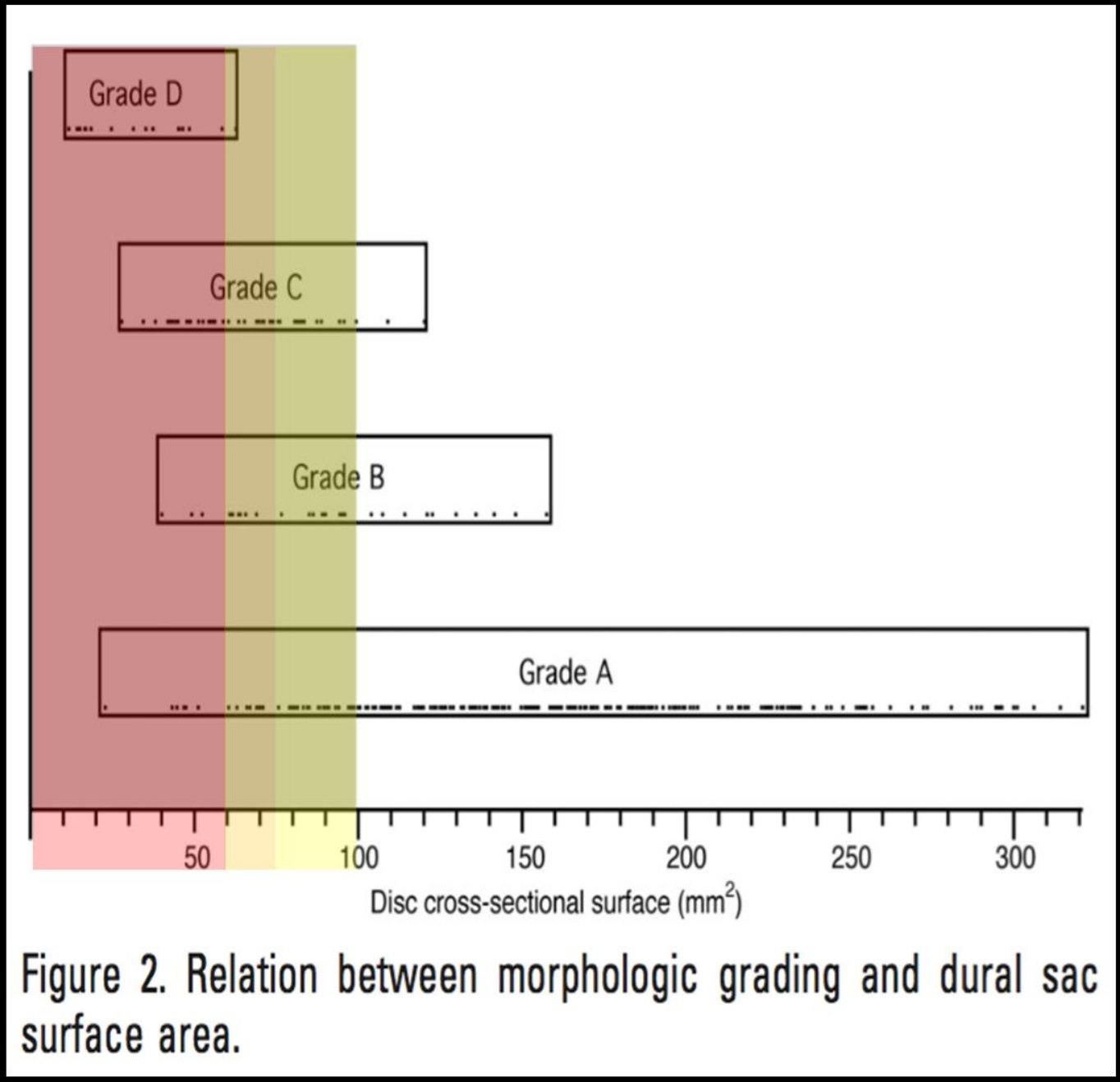


Figure 2. Relation between morphologic grading and dural sac surface area.

Schizas C et al. Spine 35;21: 1919-1924

Objectifs

- Modalités d'imagerie
- Informations pratiques
- Imagerie de la colonne : Que voit-on ?
- Terminologie
- Imagerie de la colonne : que ne voit pas ?
- Discordances radio-cliniques population normale

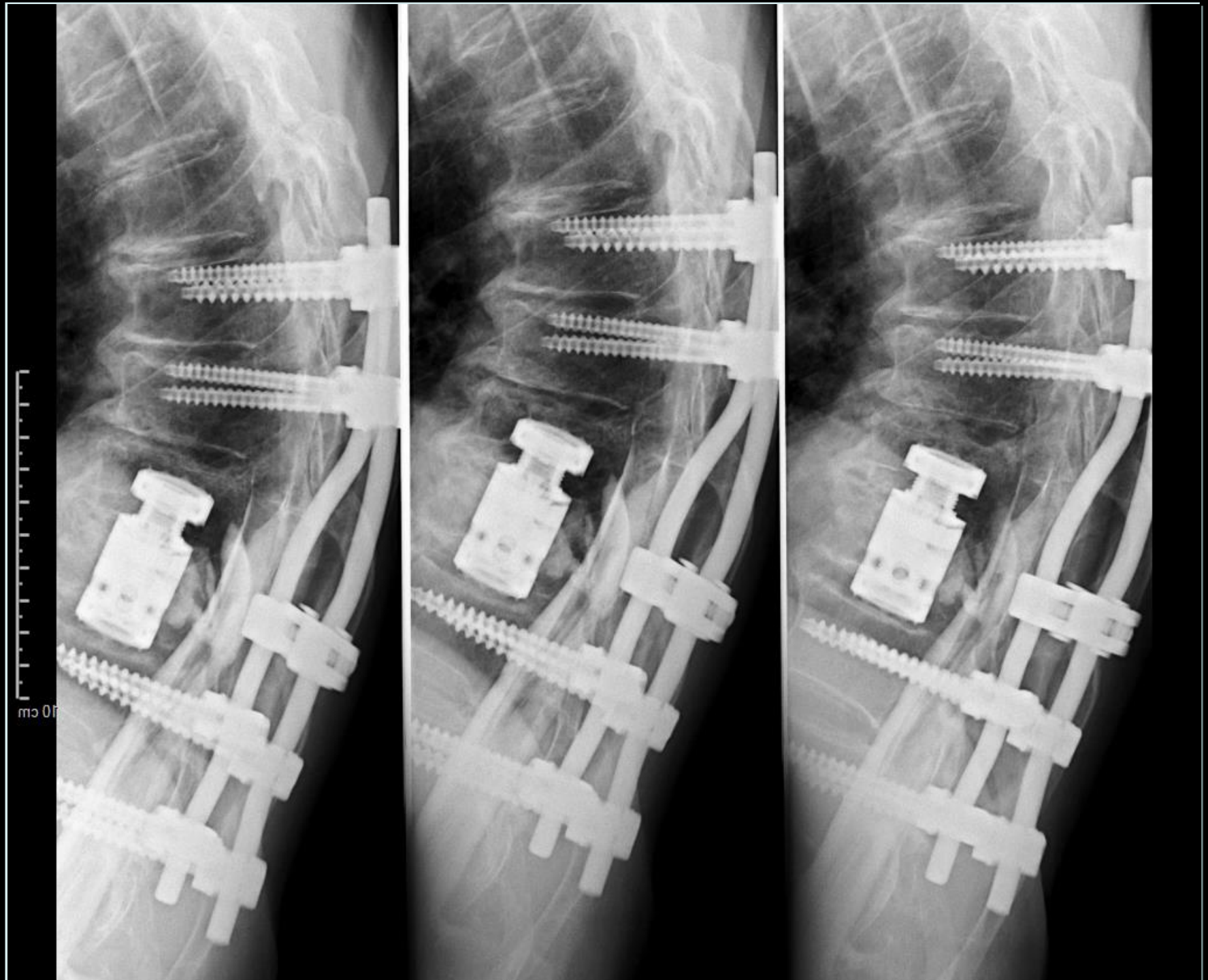
Objectifs

- Modalités d'imagerie
- Imagerie de la colonne : Que voit-on ?
- Imagerie de la colonne : que ne voit pas ?
- Lésions discales dégénératives et terminologie
- Discordances radio-cliniques population normale
- Situation particulière : aspects post-opératoires

Que ne voit-on pas ?

A. La dynamique

Variations des répercussions radiculaires/canalaire en fonction de la position ?



Que ne voit-on pas ?

B. La souffrance radiculaire

Aucune corrélation entre souffrance radiculaire et

- diametre
- signal
- vascularisation
- …… de la racine

Objectifs

- Modalités d'imagerie
- Informations pratiques
- Imagerie de la colonne : Que voit-on ?
- Terminologie
- Imagerie de la colonne : que ne voit pas ?
- Discordances radio-cliniques population normale

Objectives

1997 (Getroa-Sims multicentric study)
To assess the frequency of lumbar disc changes in a strictly selected asymptomatic population

2007 (UCL)
To assess the outcome of known disc changes in a previously asymptomatic population.

2017 (etude Sims à refaire)

Subjects - 1997

- Multicentric prospective Getroa study
- 68 subjects
- Recruited by involved radiologists
- Based on a written questionnaire (48 items)
- Sagittal SE T1, SE T2 and transverse SE T2 sequences

- Inclusion criteria
  - Completely asymptomatic
  - Never had any symptoms or disability

Selected MRI features

- Disc alteration
- Disc contours
- Vertebral marrow changes

Disc alteration (signal – height)

Stage 0 : normal signal on T2, normal disc height

Stage 1: slight decrease in signal, normal disc height

Stage 2 : slight decrease in disc signal and height

Stage 3: low signal, disc height loss < 50%

Stage 4: low signal, disc height los > 50%

Disc contour (disc contour)

Stage 0 : Normal disc contour (no buldging)

Stage 1: slight disc buldging, large radius

Stage 2 : protrusion (focal disc buldging)

Stage 3: extrusion (narrow base or migration)

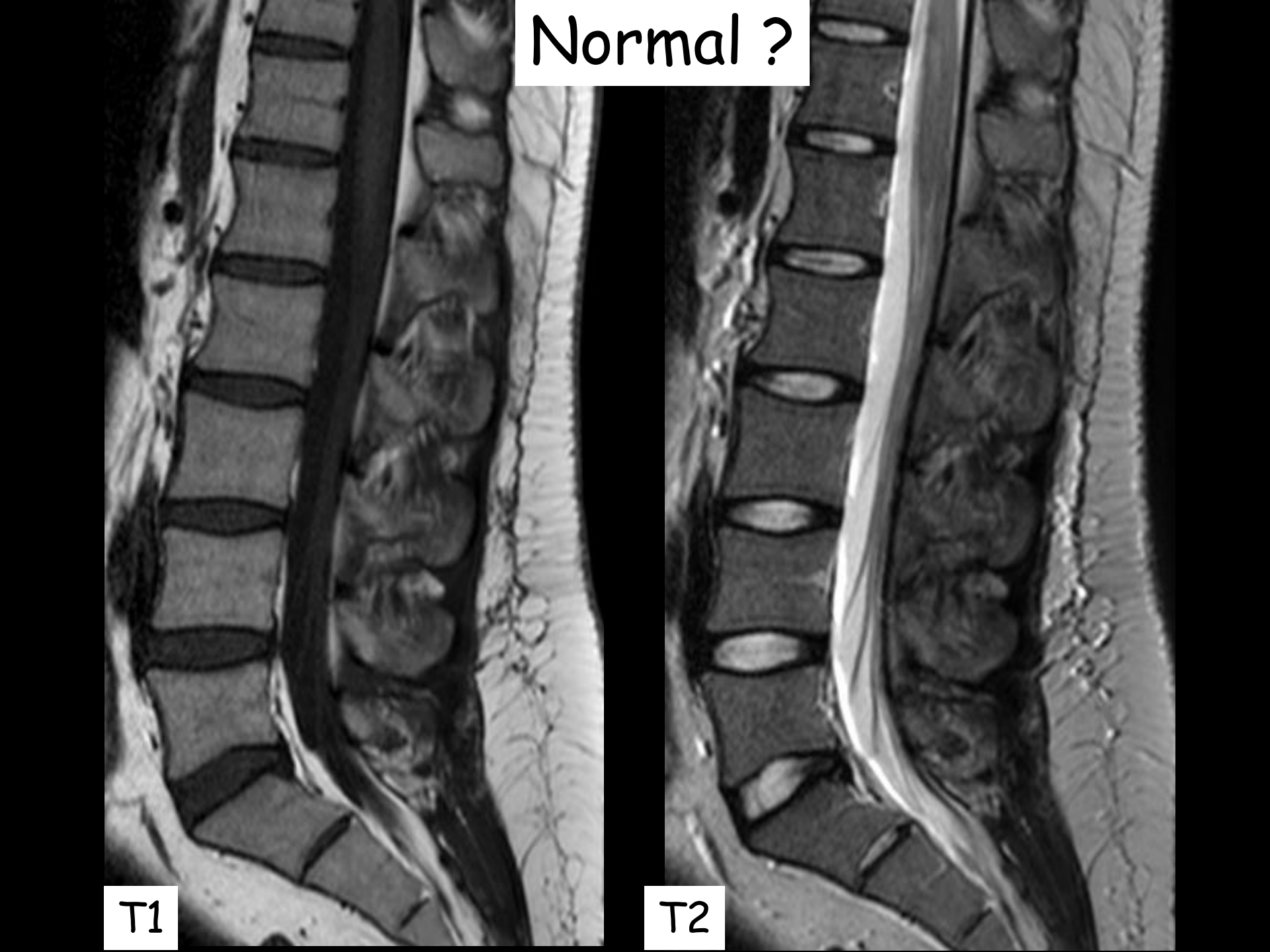
Subchondral bone marrow changes

Stage 0 : No signal change

Stage 1: Modic 1 (oedema-like changes)

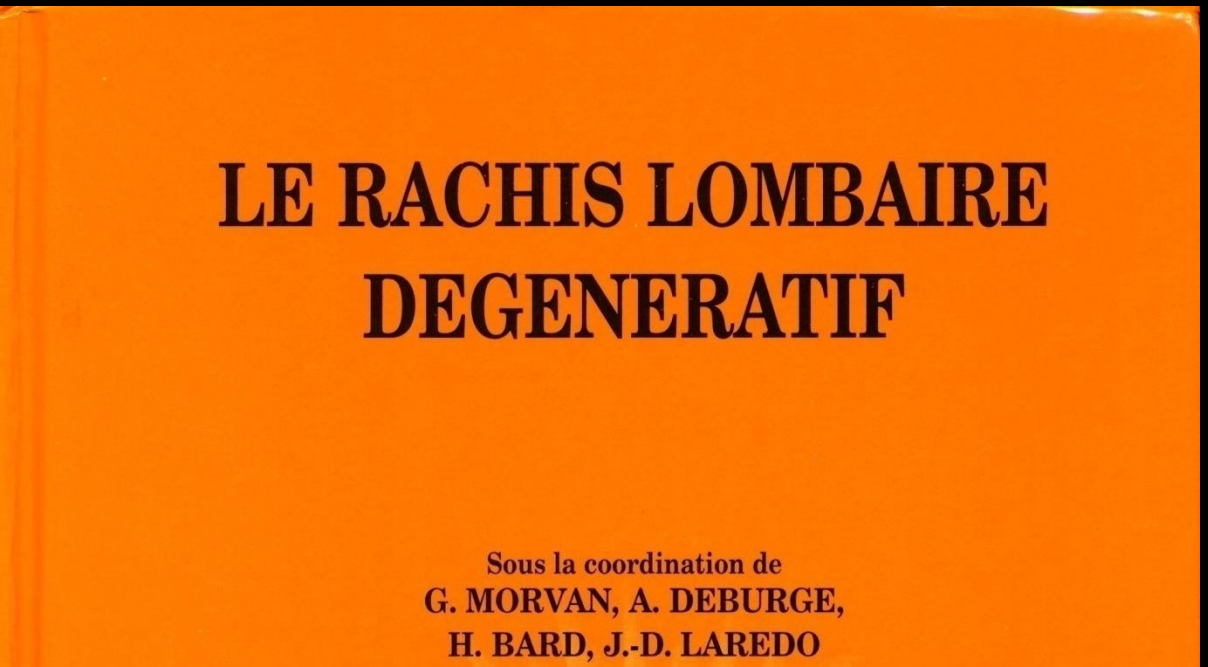
Stage 2 : Modic 2 (fat-like changes)

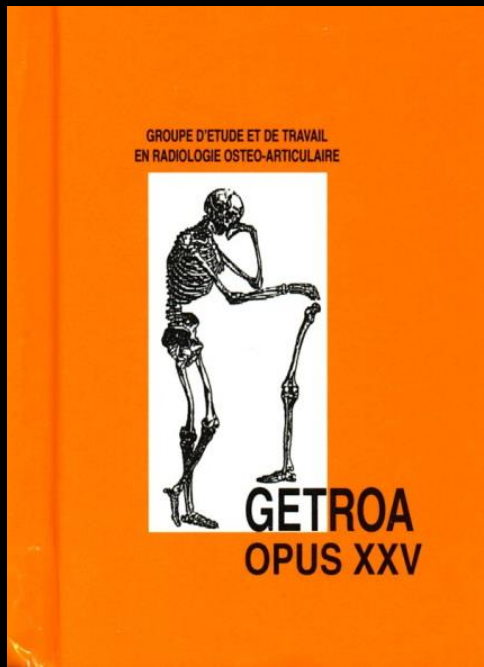
Stage 3: Modic 3 (low signal)


Normal ?
T1
T2

Etude multicentrique

- IRM colonne lombaire (9 centres d'imagerie)
- 68 sujets
  - sans symptôme lombaire actuel
  - sans antécédent lombo(radicul)algique
  - entre 20 – 75 ans

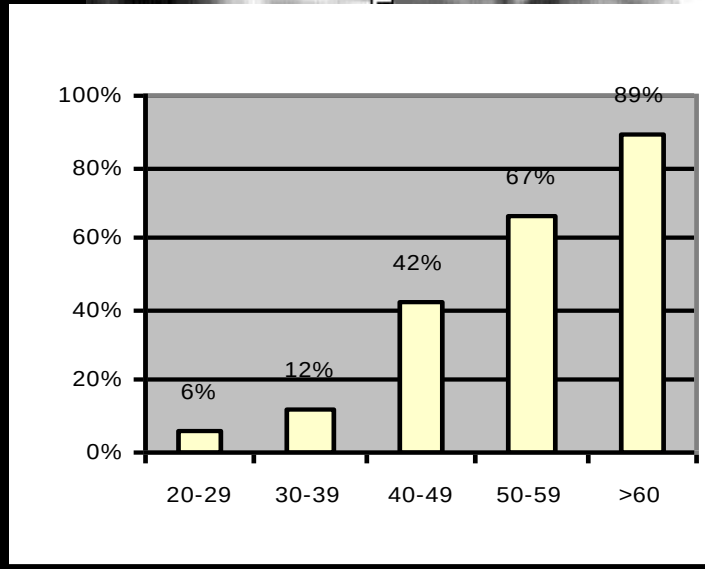


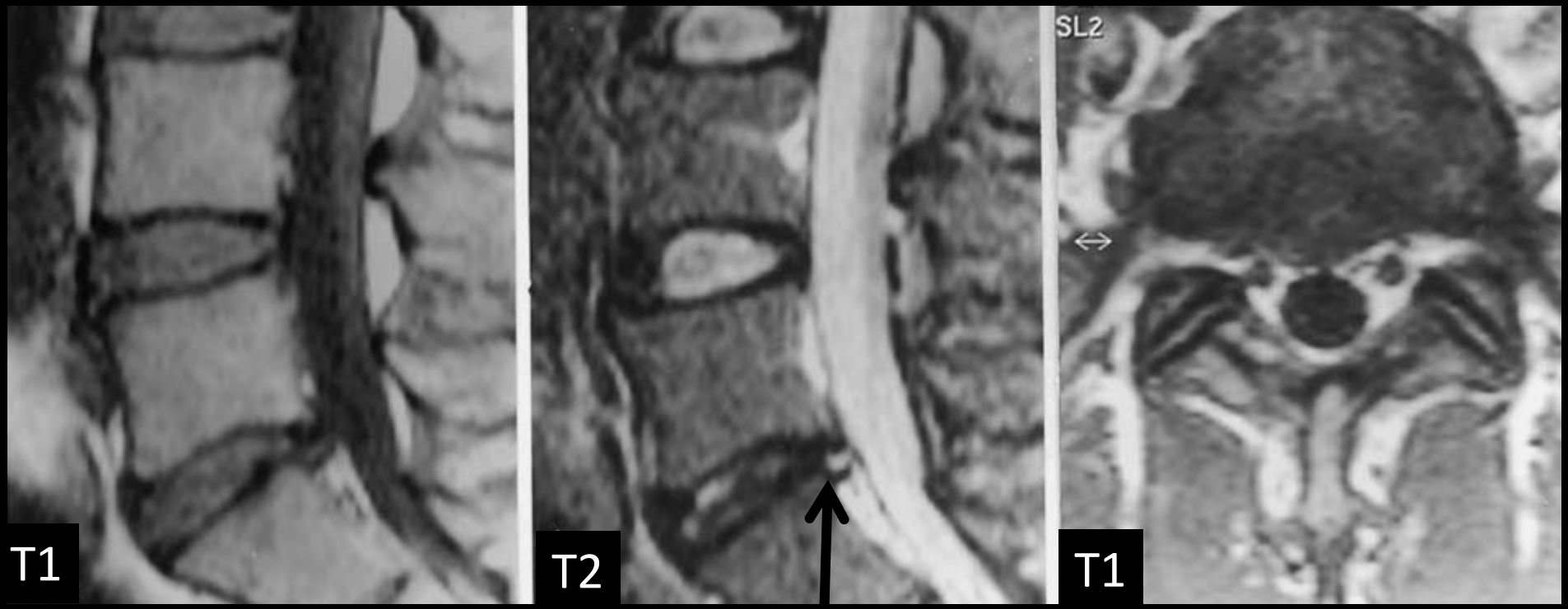


Normal : 37 % population

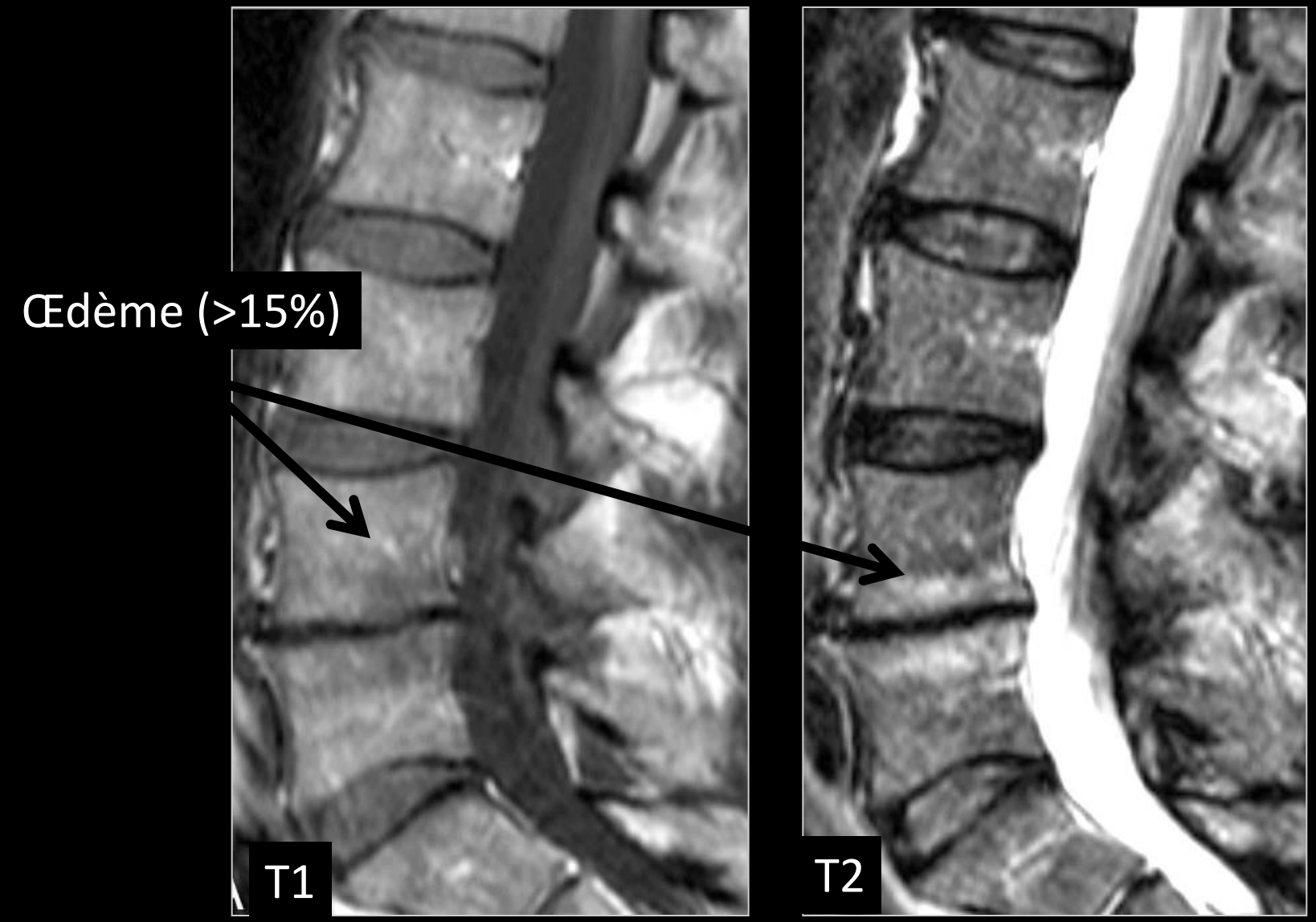
0% > 50 ans

Dégénérescence discale
Hyposignal et pincement
(25%)

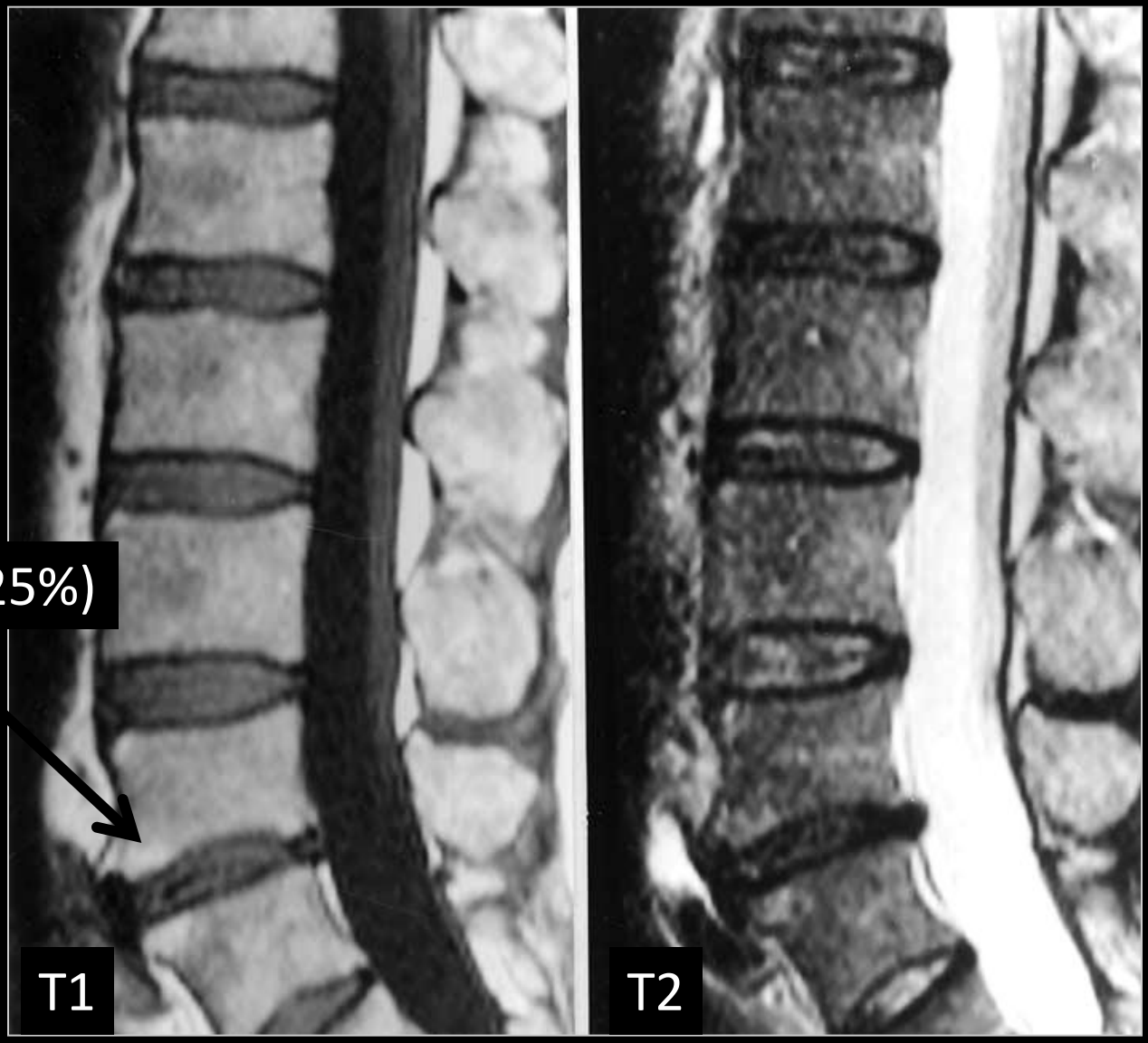




Fissure annulus (25%)
(13% < 50 ans, 50% > 50 ans)


Œdème (>15%)
T1
T2

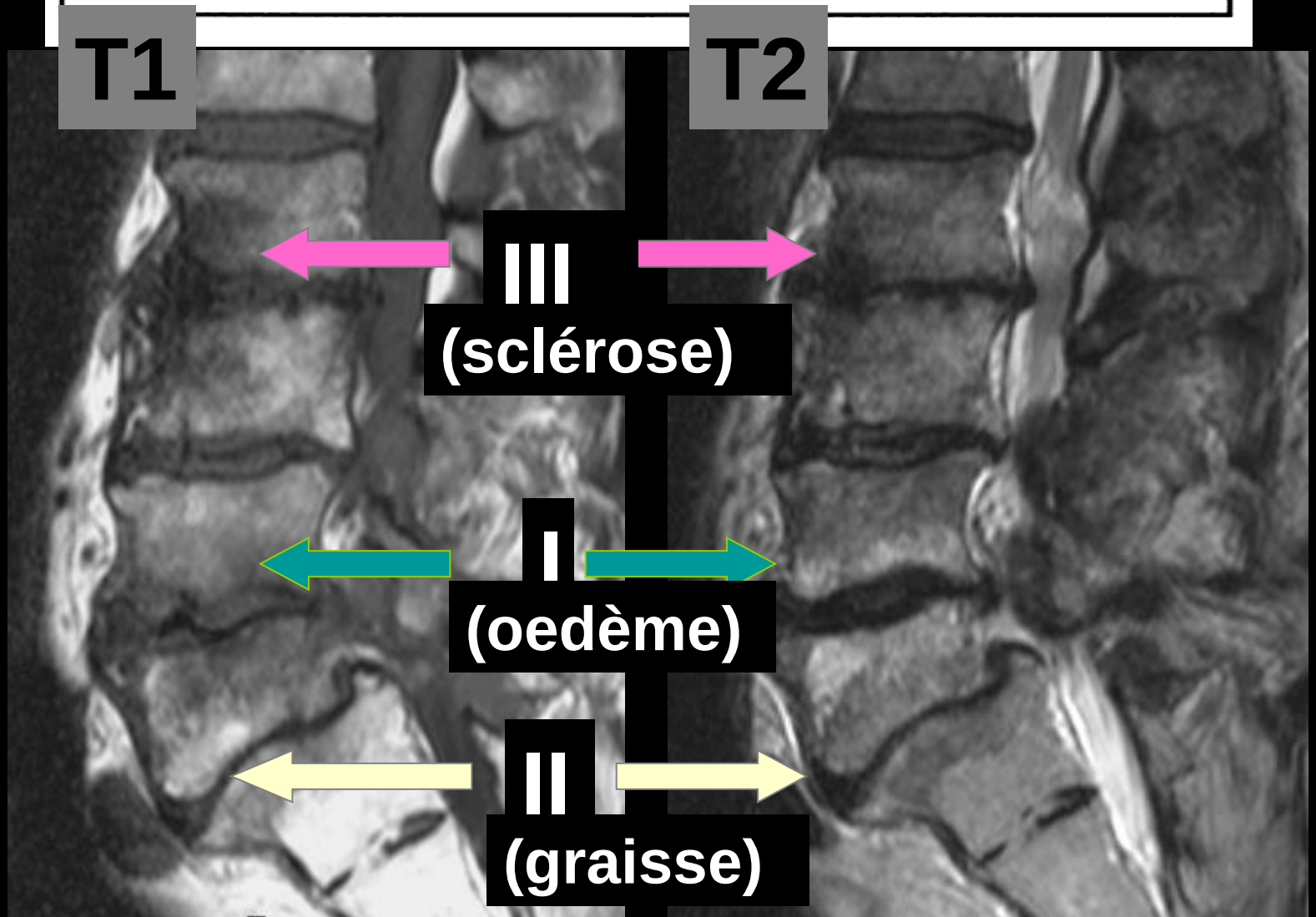
Graisse (>25%)

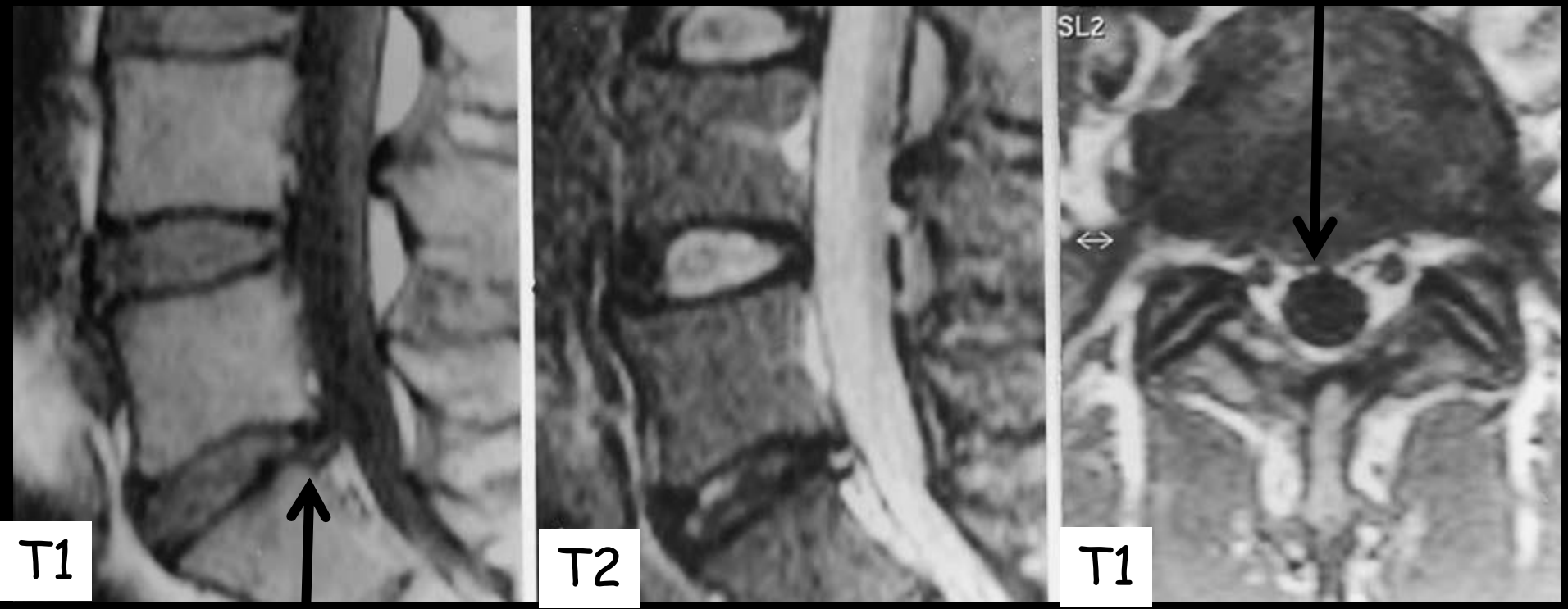


State of the Art

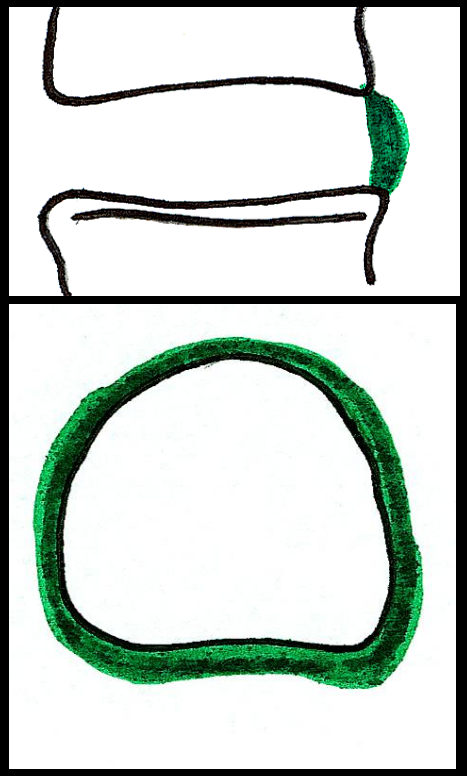
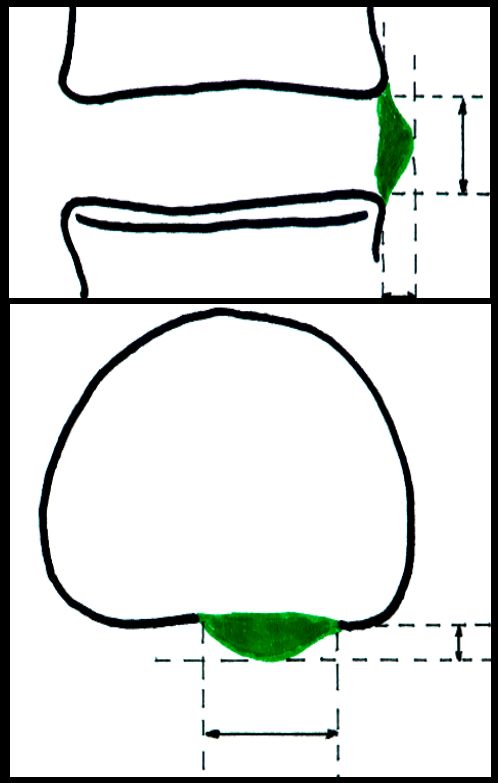
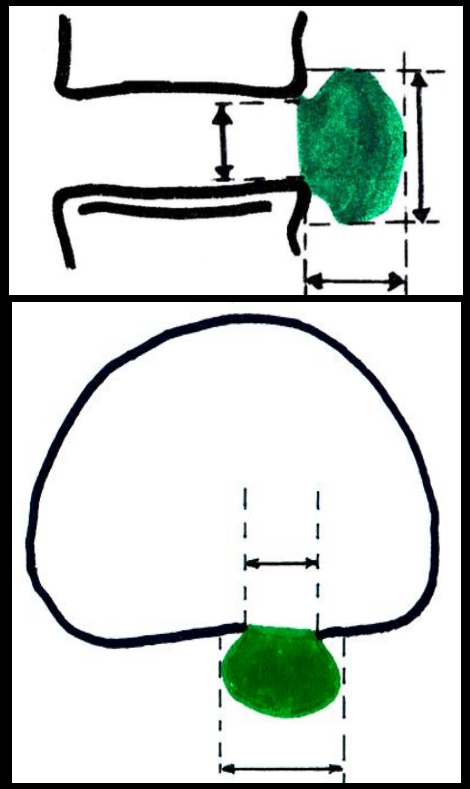
Michael T. Modic, MD • Thomas J. Masaryk, MD • Jeffrey S. Ross, MD • John R. Carter, MD

Imaging of Degenerative Disk Disease[1]





Protrusion discale (21%)

Bombement	Protrusion	Extrusion
		
40 %	21%	0%
52 %	27%	1%

Malghem J, et al. IRM de rachis lombaires asymptomatiques. Etude du GETROA. In: Le Rachis Lombaire dégénératif. Getroa Opus XXV. Sauramps,1998.

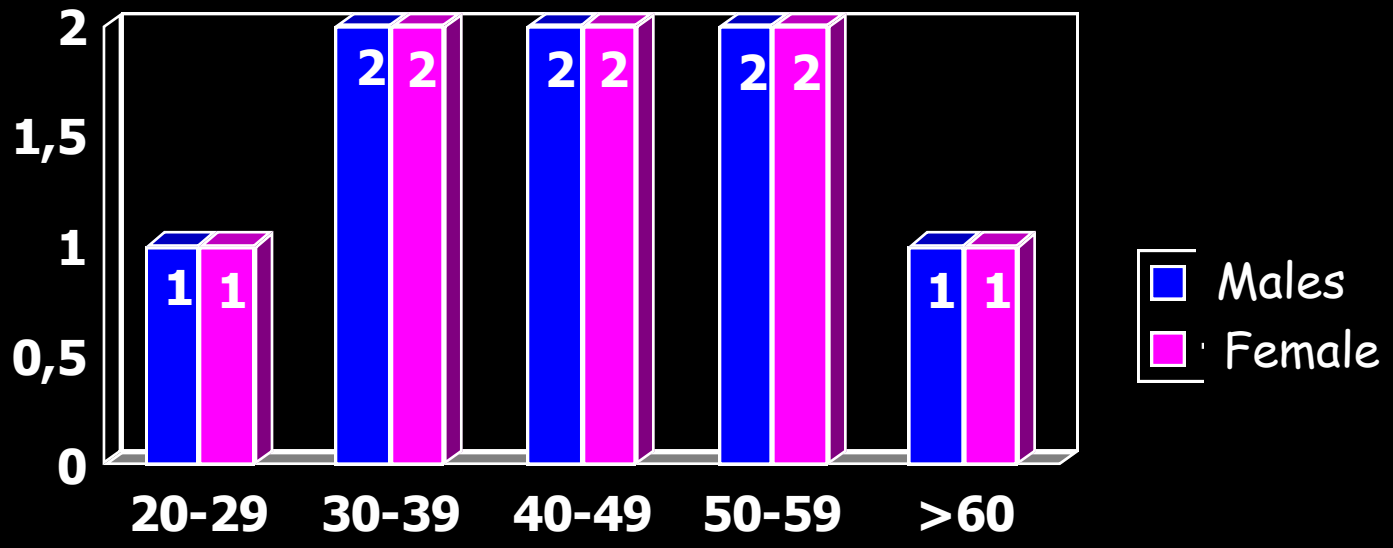
Jensen MC, et al. MRI of the lumbar spine in people without back pain. NEJM 1994;331:69-73

Subjects - 2007

- Longitudinal study
- 16 subjects out of the 21 UCL-recruited subjects in 1997
- Recruited by 2 radiologists
- Written questionnaire to assess clinical changes

Subjects - 2007

Clinical data of follow-up population



1997

2007

1997

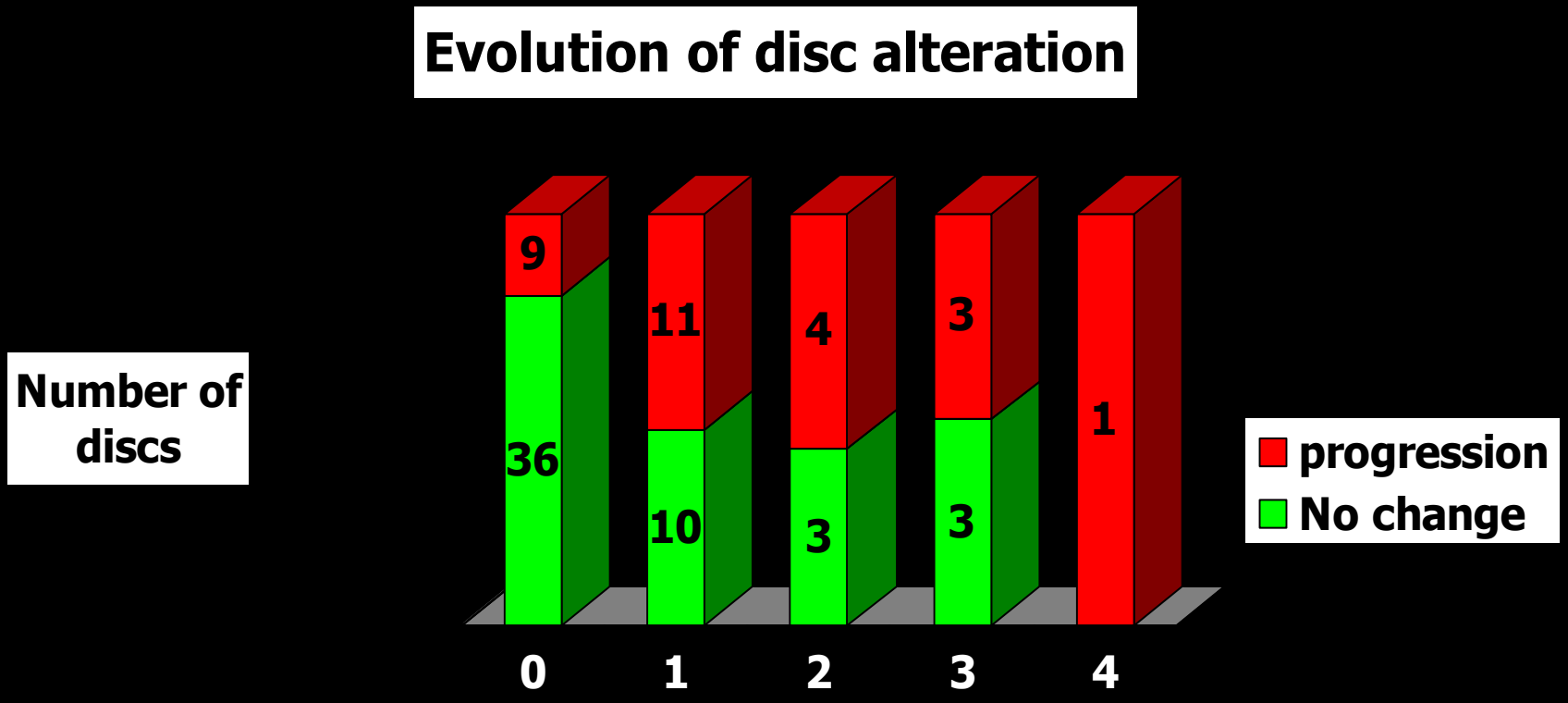
2007

Analysis of follow-up MR studies

- Separate analysis of images
- Comparative analysis 1997-2007 (side-by-side)
  - Unchanged
  - Progressive
  - Regressive
- Two MSK radiologists blinded to clinical data

Results of follow-up study

Evolution of disc alteration at 10 year follow-up (1997-2007)



Stage 0 : normal signal on T2, normal disc height
Stage 1 : decreased signal, normal height
Stage 2: slight decrease in signal and height
Stage 3: height loss < 50%
Stage 4: height loss > 50%

No change at follow-up MRI

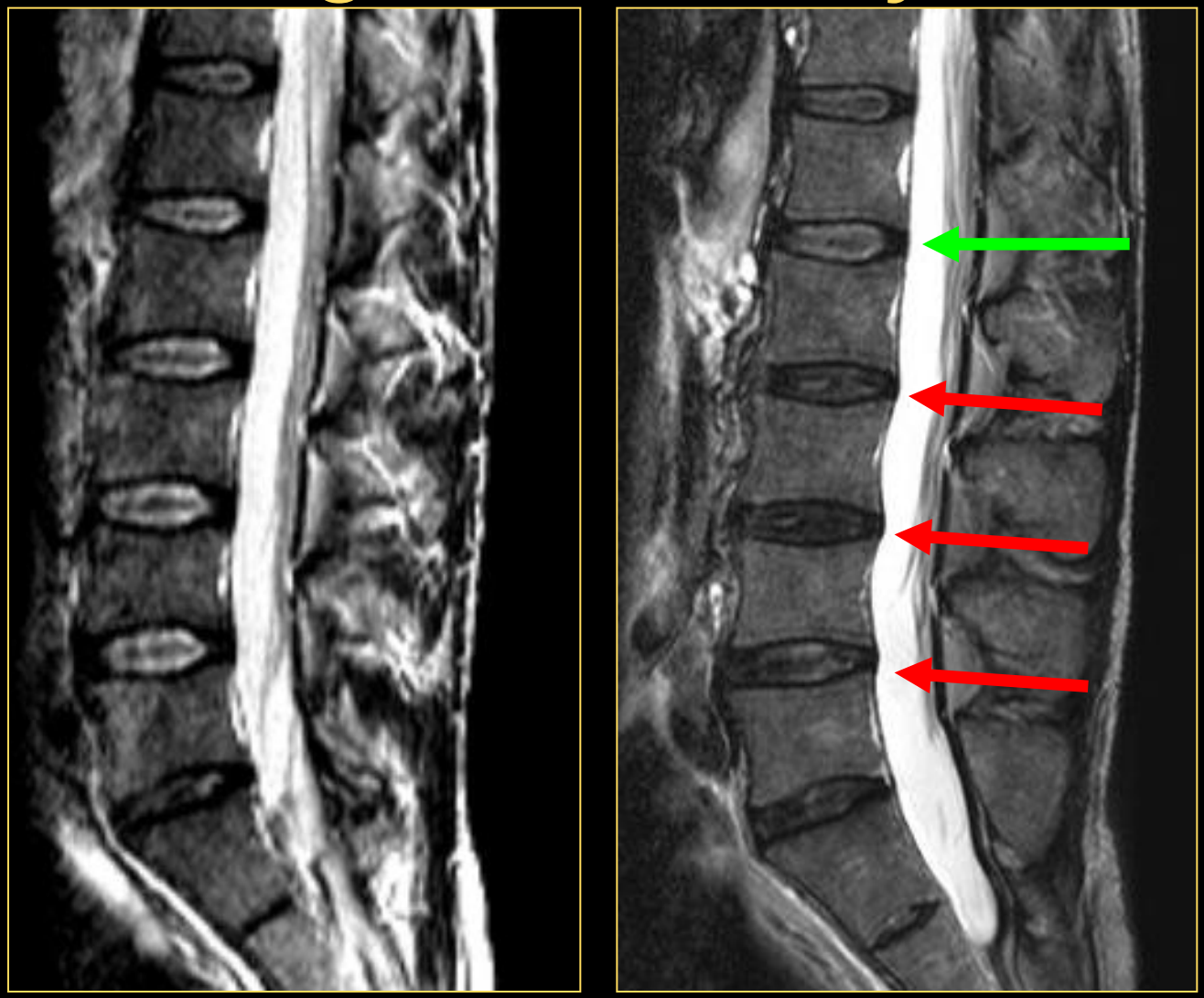
1997

2007

28-yr-old female

Progressive disc alteration
Signal intensity

1997



2007

53-yr-old male

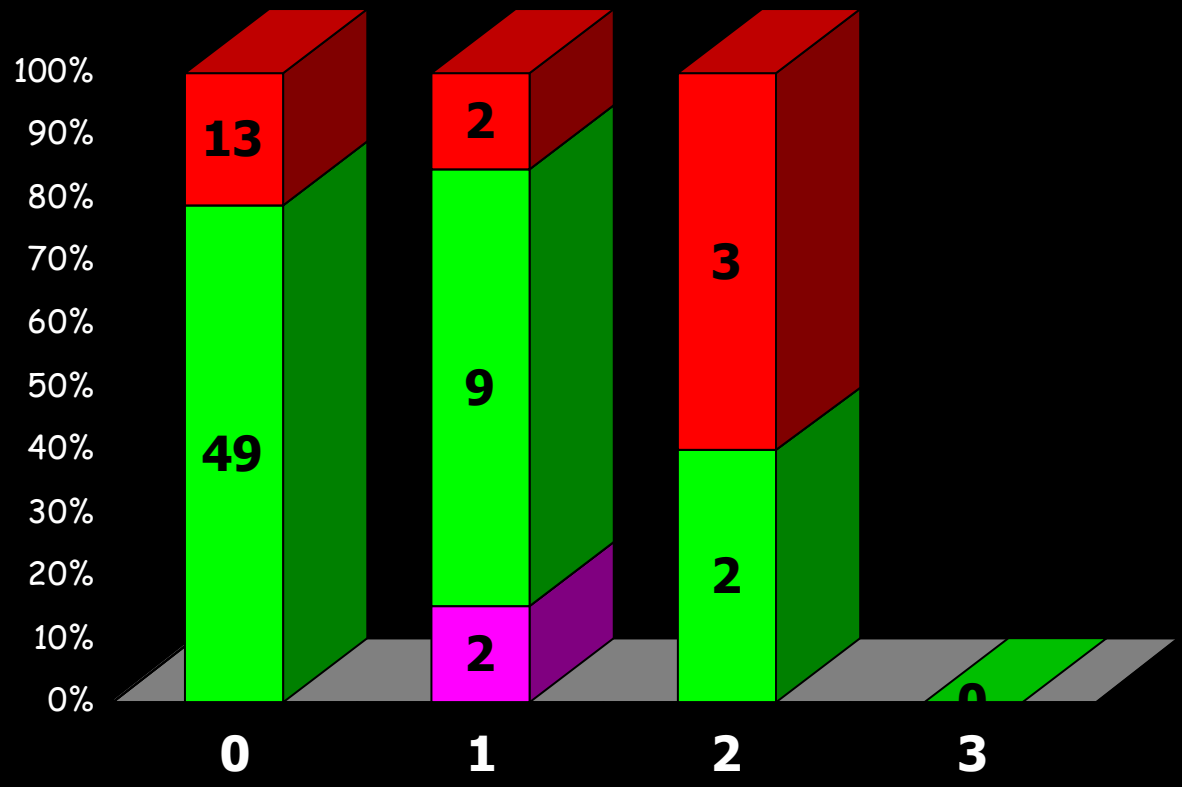
Progressive disc alteration
Disc height

1997

2007

58-yr-old female

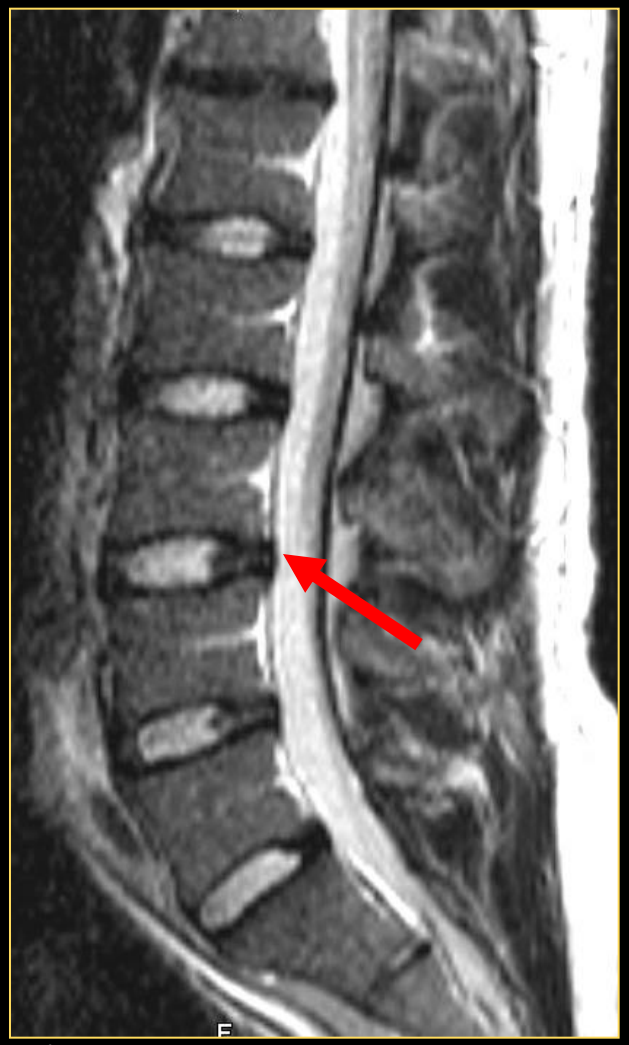
Evolution of disc protrusion at 10 years follow-up MR

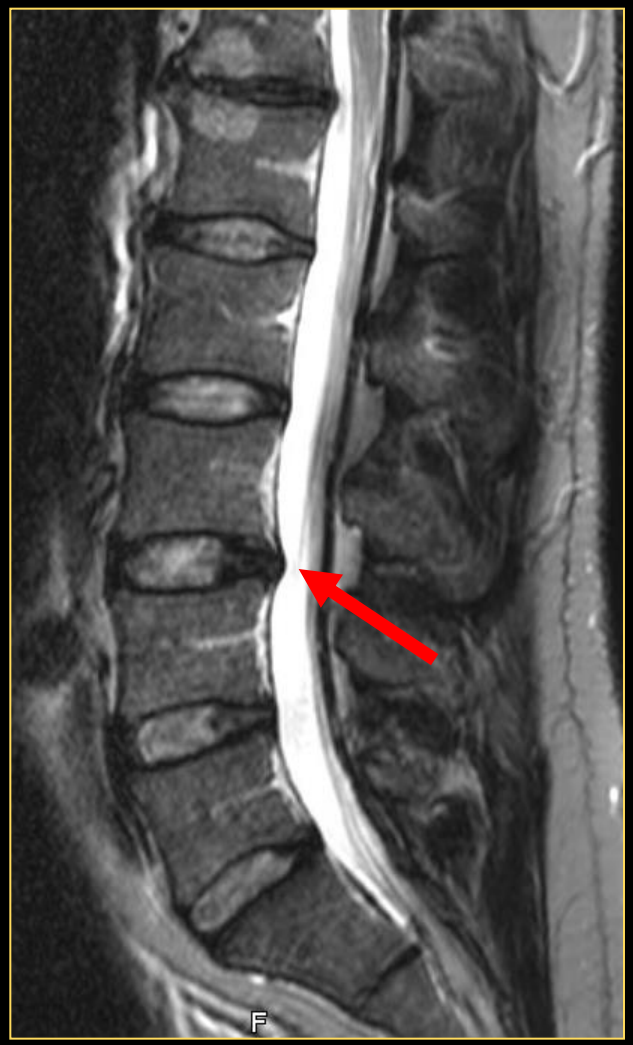


Stage 0 : normal contour
Stage 1 : buldging
Stage 2: protrusion
Stage 3: extrusion

Progressive disc buldging

1997



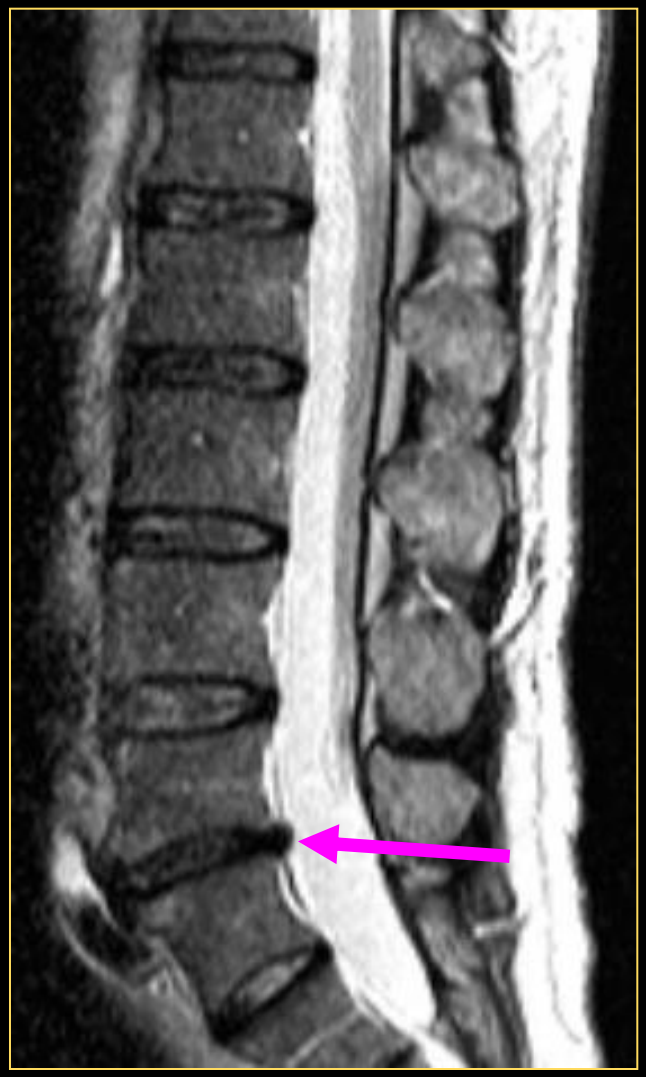


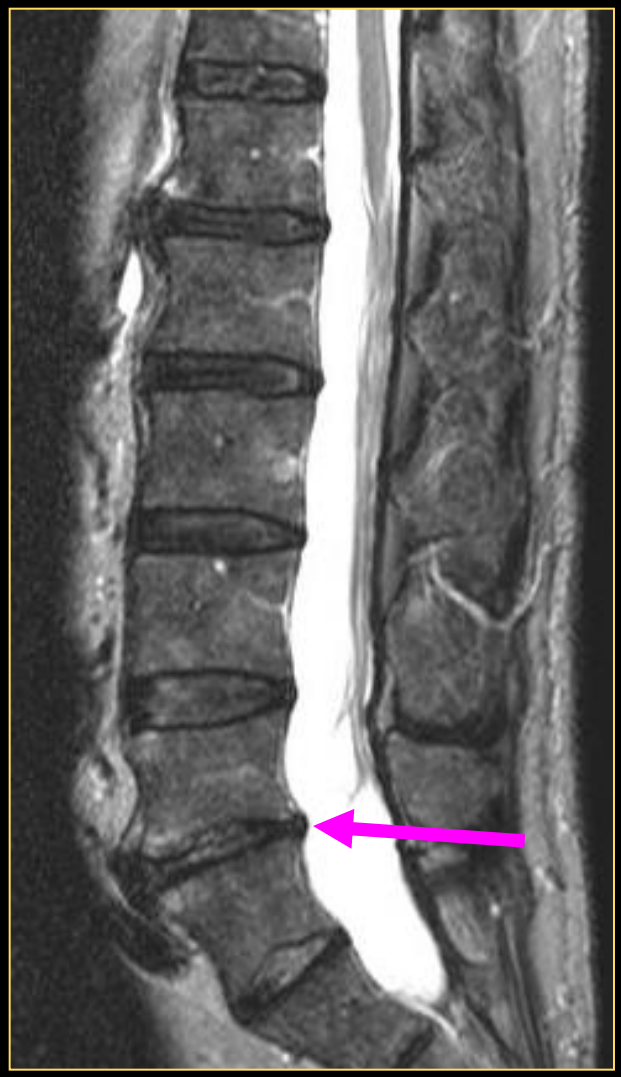
2007

35-yr-old male

Regression fo disc buldge

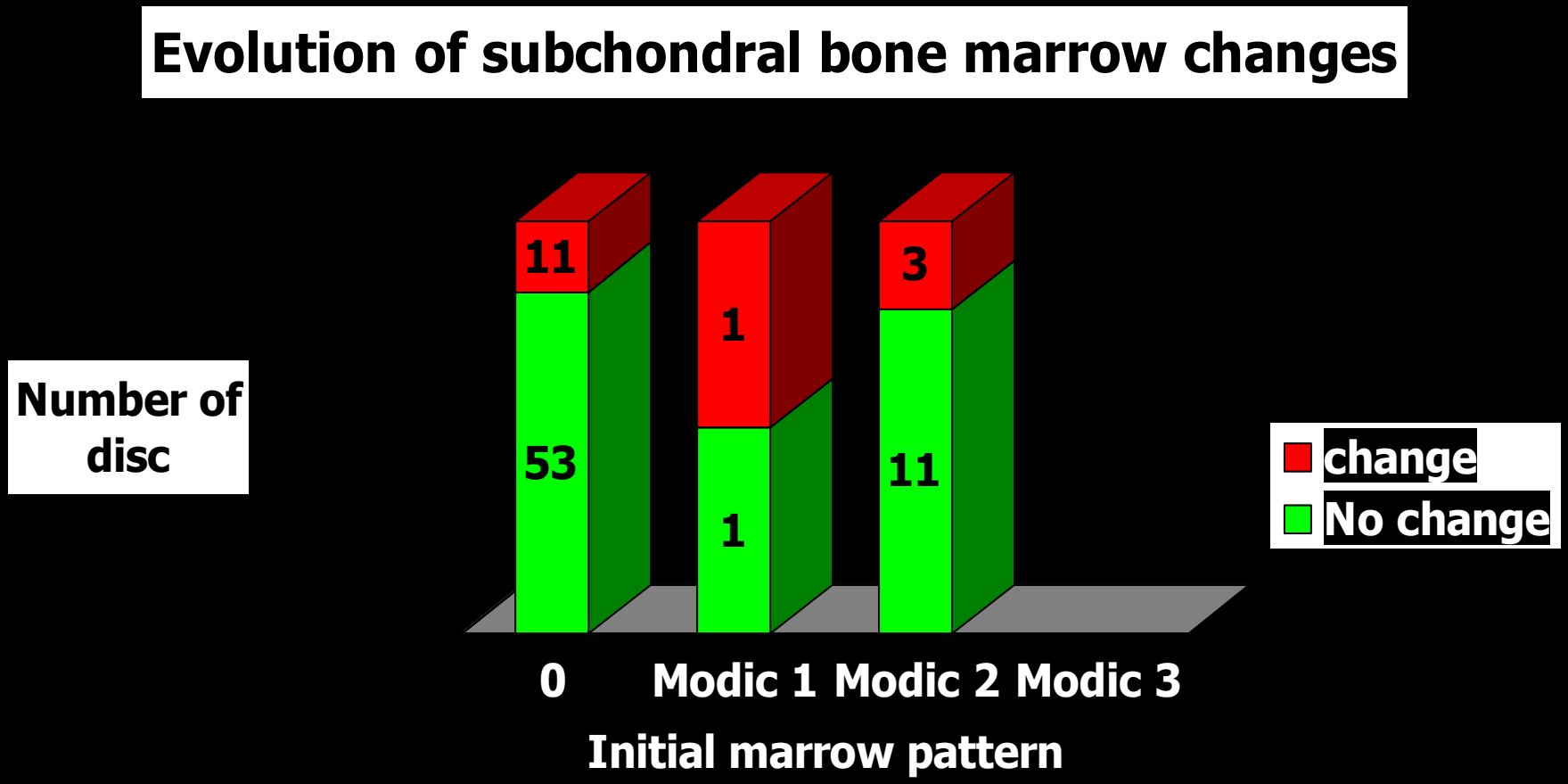
1997





2007

Evolution of subchondral marrow changes



No change in Modic 2 changes

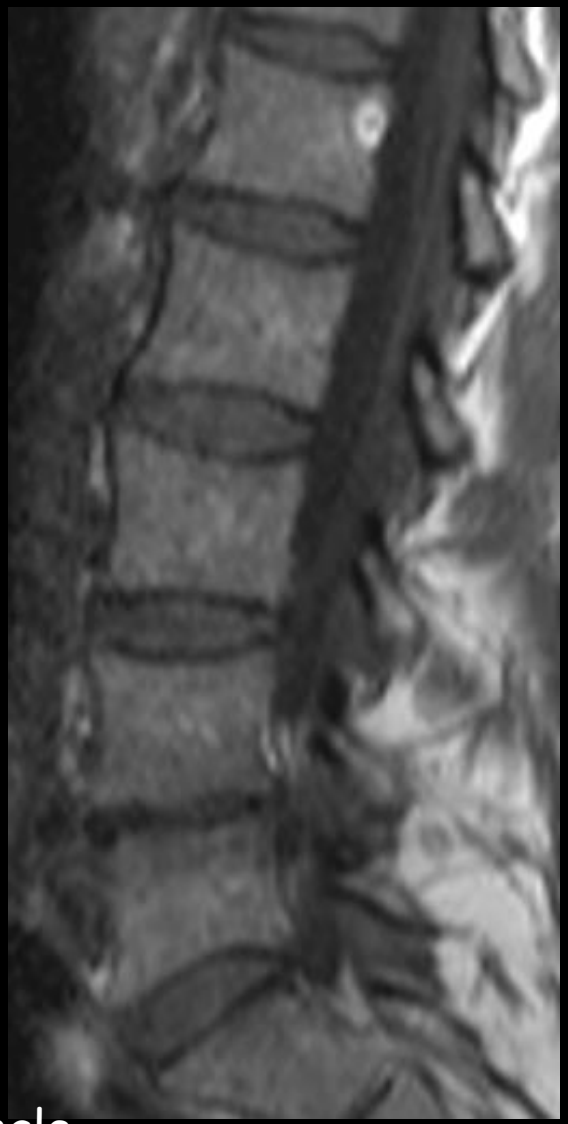
1997

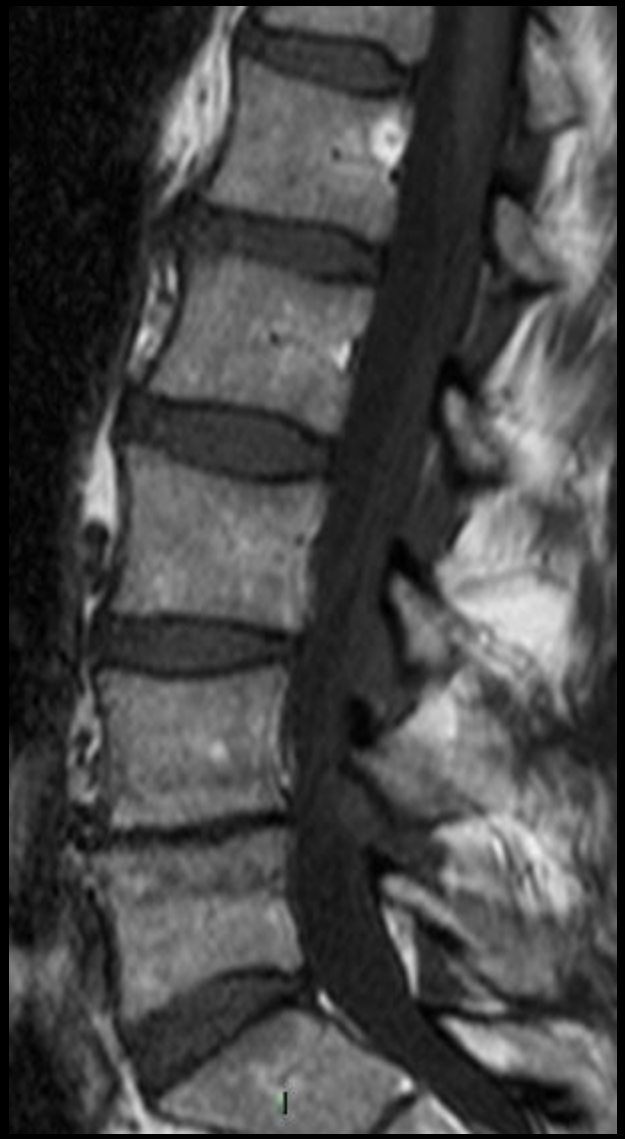
2007

69-yr-old male

From Modic 1 to Modic 2

1997

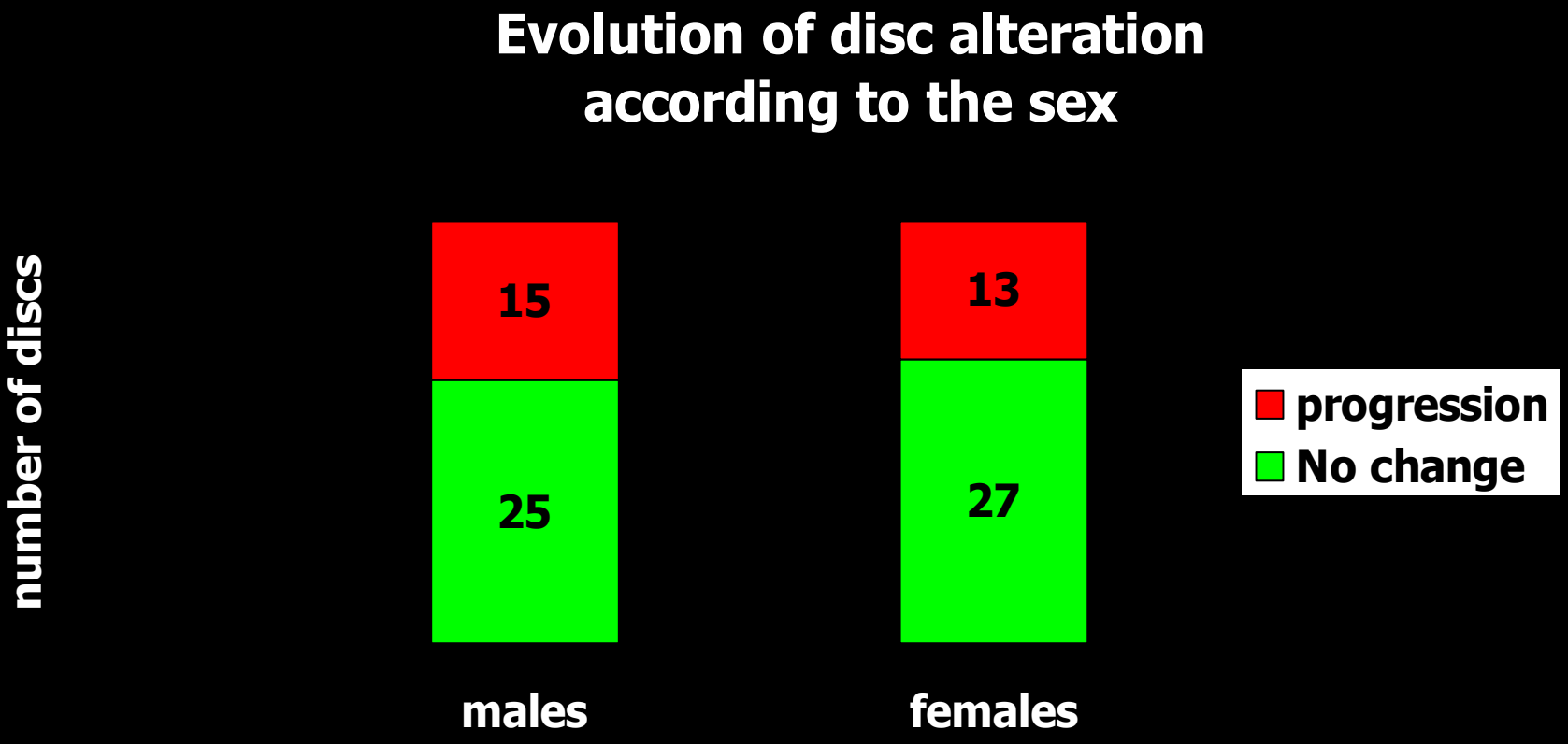




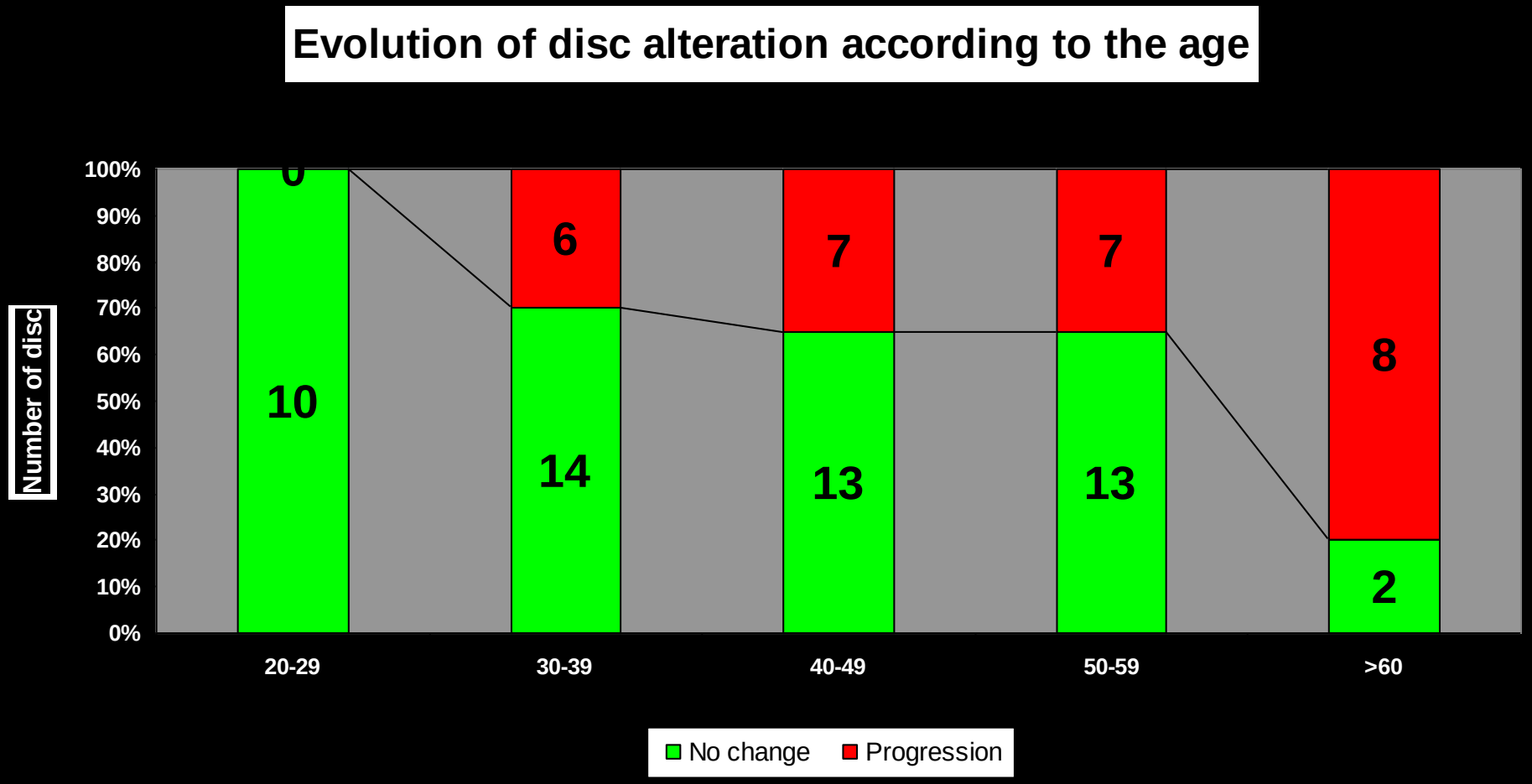
2007

42-yr-old female

Evolution of disc alteration according to the sex



Evolution of disc alteration according to the age



Conclusion – initial study

- Disc changes are frequent in carefully selected asymptomatic subjects.

- Even disc protrusion and subchondral fatty marrow are observed in asymptomatic subjects.

Conclusion – follow-up

- Disc changes after 10 years are limited in the young population but not in the elderly.

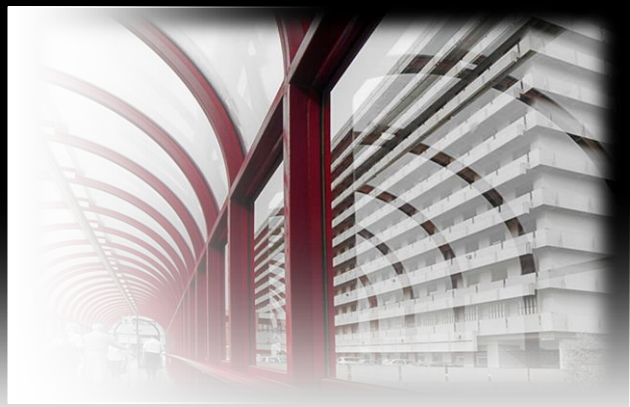
- Abnormal disc contour and subchondral marrow changes may evoluate in any direction (“better” or “worse”).

Take-home messages

- Face à un problème de population
- Performances élevées imagerie
- Limites
  - Dynamique
  - Souffrance radiculaire
- Fréquence élevée des anomalies dans la population asymptomatique et « normale »
- Place de l'imagerie dans la prise en charge ?

Avec les salutations de Rosa, 86 ans

Asma
2017
Bxl



Imagerie et colonne lombaire

Pr Bruno Vande Berg
Dpt d'imagerie
Cliniques Universitaires St Luc Bruxelles