

XIX

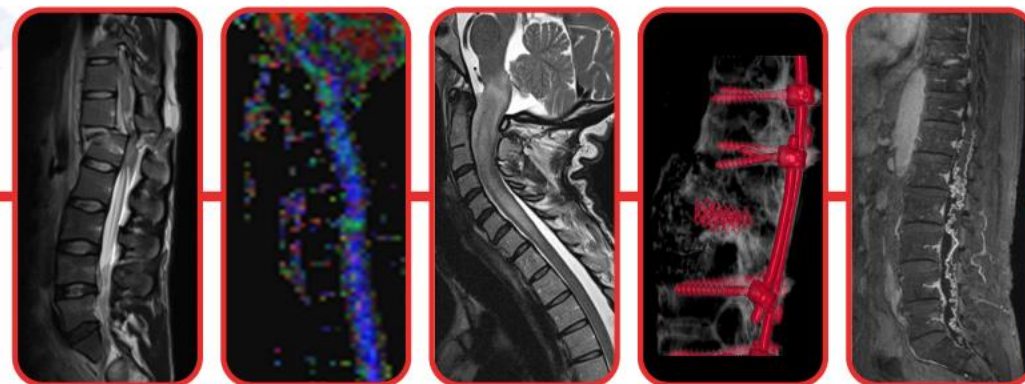
Curso Nacional de
NEURORRADIOLOGÍA

Radiología Raquimedular

**Protocolos básicos y avanzados en
patología raquimedular**

Juan Alvarez-Linera Prado
Hospital Ruber Internacional

20 y 21 de abril de 2023 • MADRID
Sede: CINESA. Calle de Fuencarral, 136



Resumen

Protocolo básico

Recomendaciones ACR, ASNR

Columna cervical, dorsal, lumbar

Opciones

1,5 vs 3T

2D-3D

Supresión grasa (T2,T1)

Metal

Técnicas especiales

Angio-RM

Difusión, FA, Tractografía



Recomendaciones ACR (oct-2022)

Secuencias

T1: (FLAIR es aceptable)

LCR hipointenso con buen contraste con médula /raíces

No señal heterogénea en médula

No supresión grasa, buen contraste con planos grasos/musculares

No señal heterogénea en LCR

T2

No señal heterogénea en médula

LCR hipointenso con buen contraste con médula /raíces

Grasa no isointensa, buen contraste con planos musculares

No señal heterogénea en LCR

Parámetros

Columna cervical

Cortes 3mm o menos

GAP 1mm o menos

Pixel 1mm o menos

Columna dorsal

Cortes 4mm o menos

GAP 1mm o menos

Pixel 1,3 o menos

Columna lumbar

Cortes de 5mm o menos

GAP 1mm o menos

Pixel 1,5 o menos



ASNR practice parameters

Columna lumbar

Sagital T1(o DP) y T2 (o Dixon)

Axial T2 (T1 si hay estudio postcte)

Columna cervical/dorsal

Sagital T1(o DP) y T2 (o Dixon)

Axial T2 y T2*

Axiales: mínimo 3 niveles

Cortes: Cervical 3mm, Dorsal/lumbar 4mm



ASNR practice parameters

The precise details of that performance may vary among equipment, patient body habitus, and the personal preferences of the radiologists who manage and interpret the studies.

T2* or gradient-echo images have a good signal and contrast and are sensitive to magnetic field heterogeneity (eg, greater signal loss at interfaces between bone and CSF or between bone and soft tissue) and are less sensitive to CSF flow–induced artifacts (eg, signal voids due to brisk or pulsatile CSF flow)

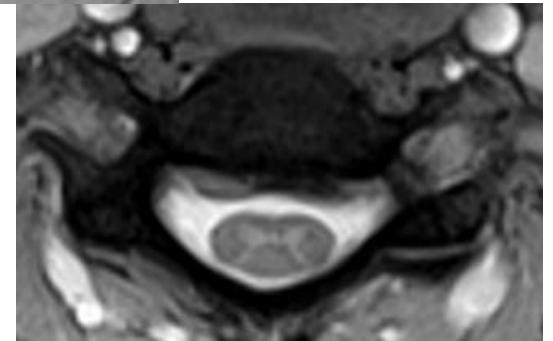
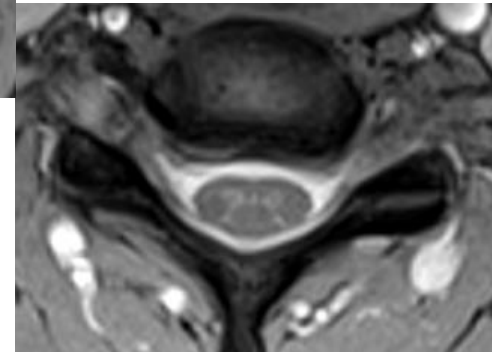
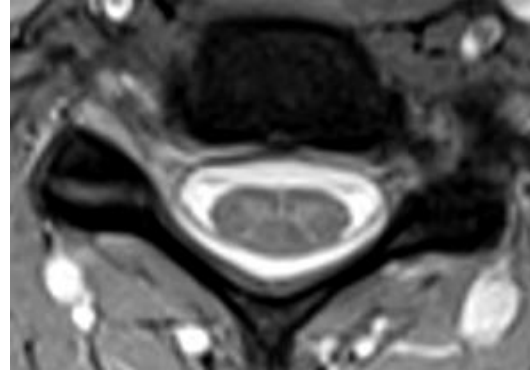
Because of anatomical and physiological differences in three major spinal regions, radiologists may prefer to use different sequences in different regions. In the cervical and thoracic spine, CSF flow rate is greater than in the lumbosacral spine. T2*-weighted images are apt to have less CSF flow–related artifacts than are T2-weighted fast-spin echo images.

The choice of MR pulse sequences is generally standardized for particular studies but can be guided by the clinical history and physical examination (see section III, Indications). Commonly used sequences in MR imaging of the spine include: T1; intermediate TE, proton density, or FLAIR; T2-weighted sequences; T2*; and various fat-suppression techniques. These techniques can be employed as 2-D or 3-D acquisitions. Vascular techniques can be used for angiography. The types of fat suppression include frequency select fat saturation, STIR, and chemical shift techniques (Dixon).

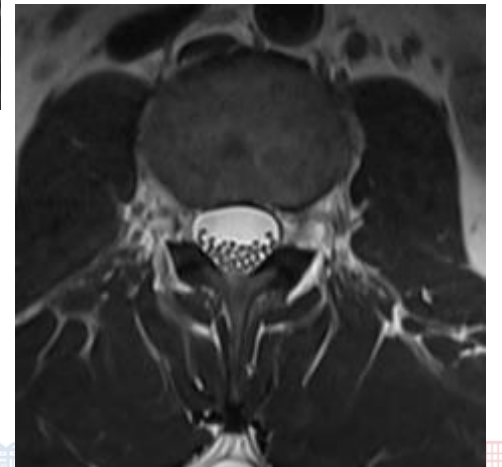
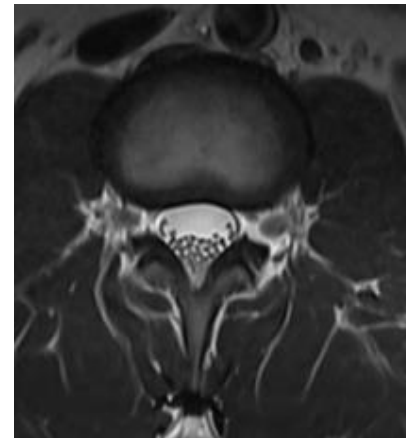
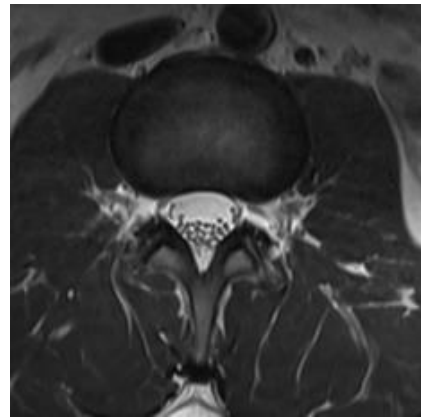
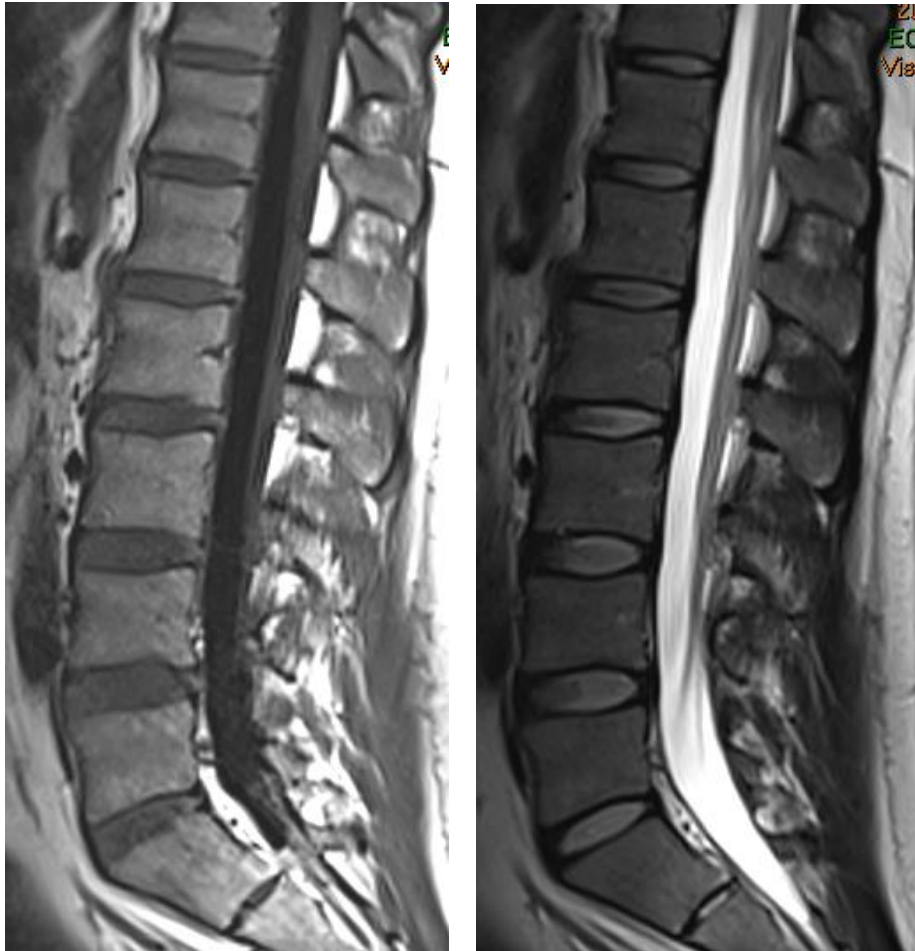
When dealing with imaging around metal, such as fixation devices, short tau inversion recovery (STIR) for fat suppression, high-receiver bandwidth, fat-water separation, or multispectral methods for metal artifact, suppression may be helpful to reduce artifacts



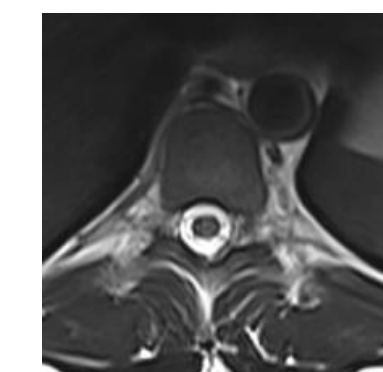
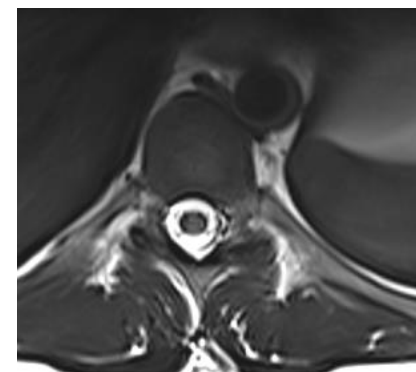
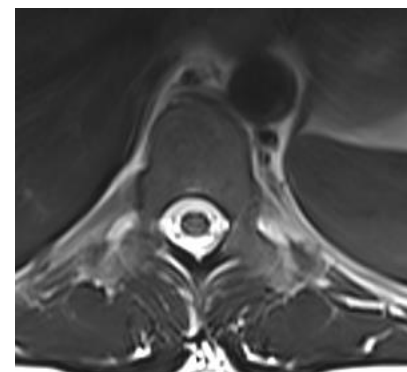
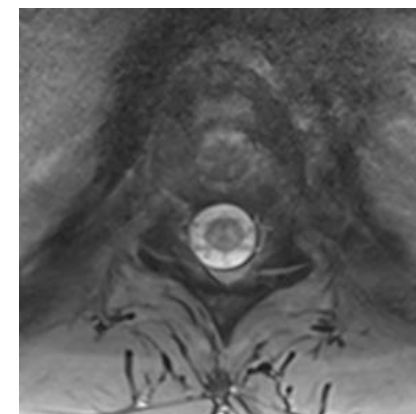
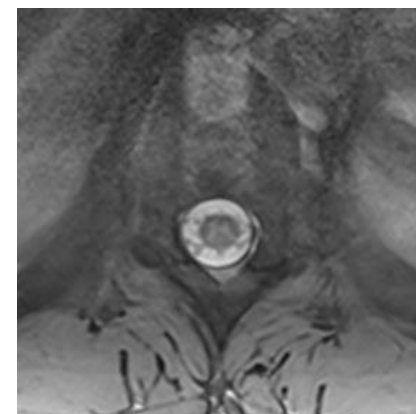
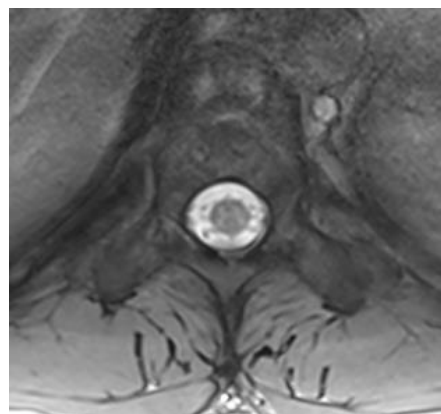
Protocolo básico columna cervical



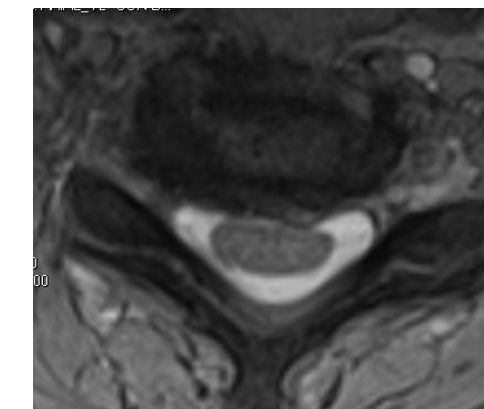
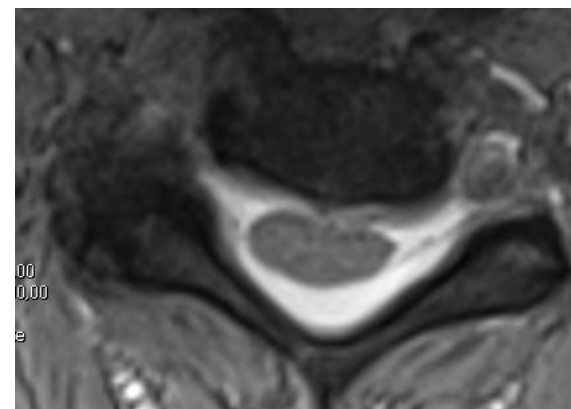
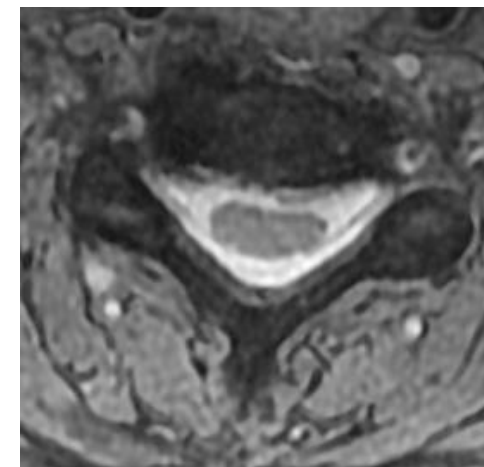
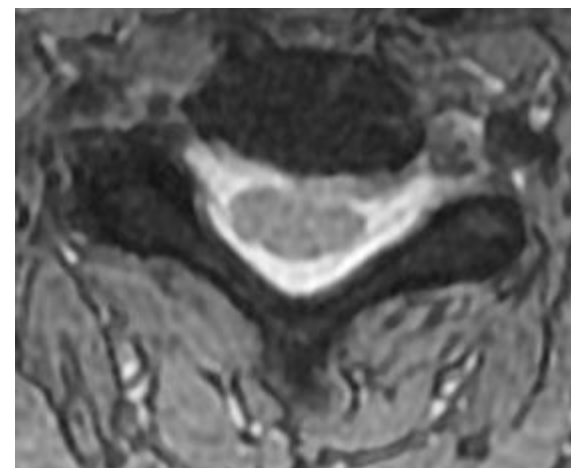
Protocolo básico columna lumbar



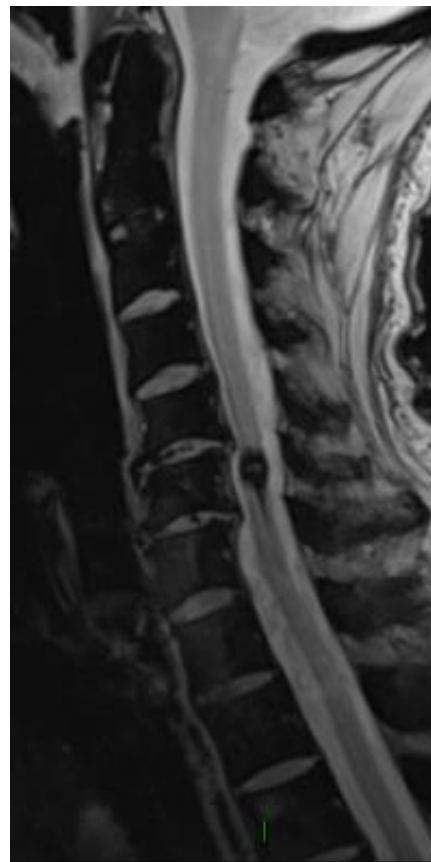
Protocolo básico columna dorsal



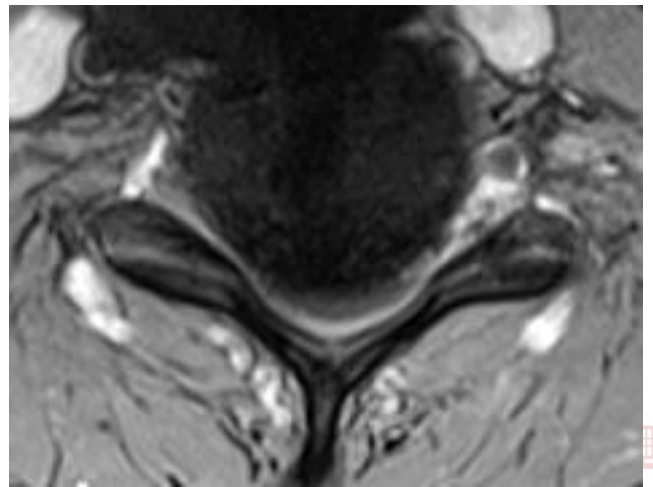
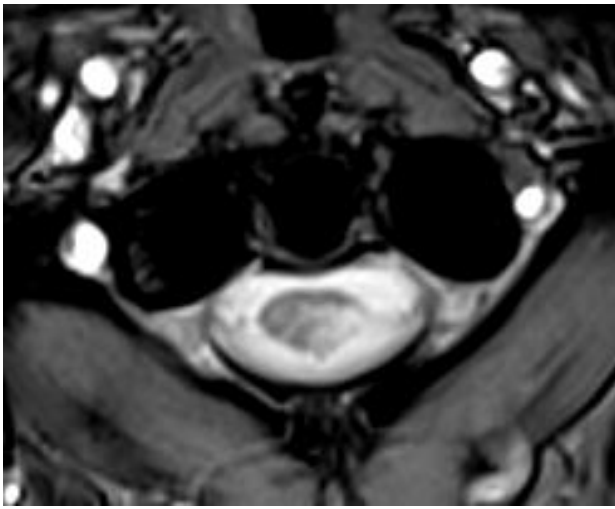
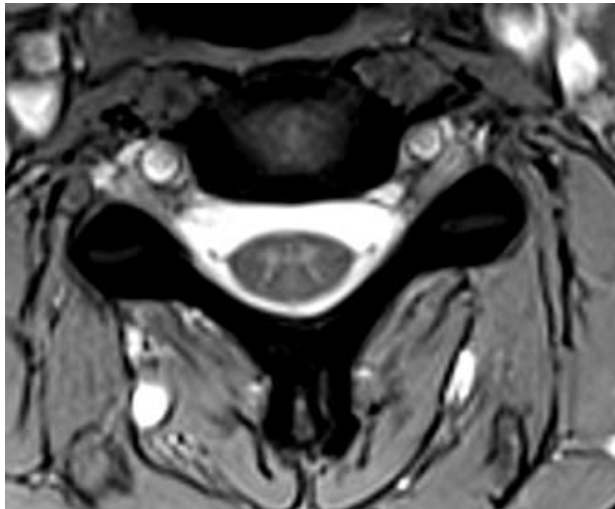
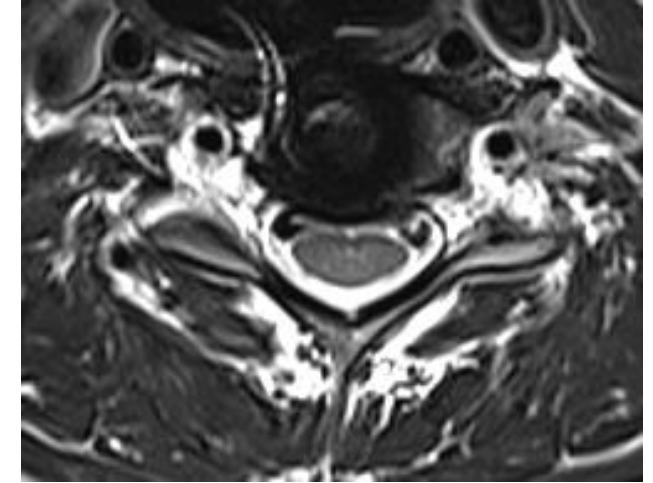
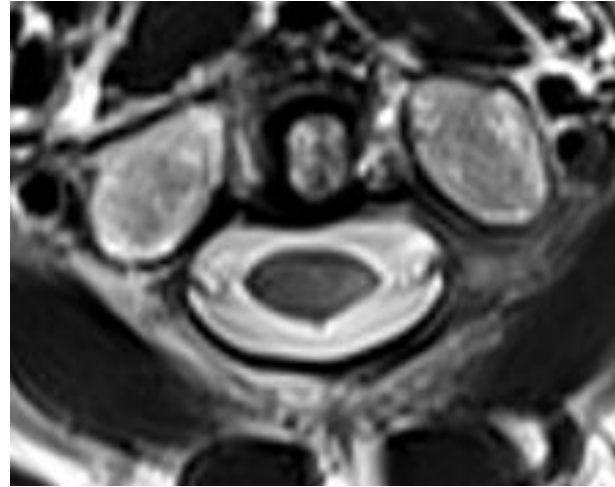
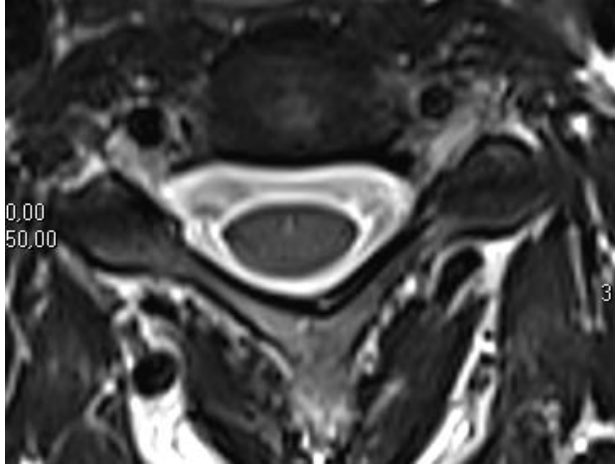
1,5 vs 3T



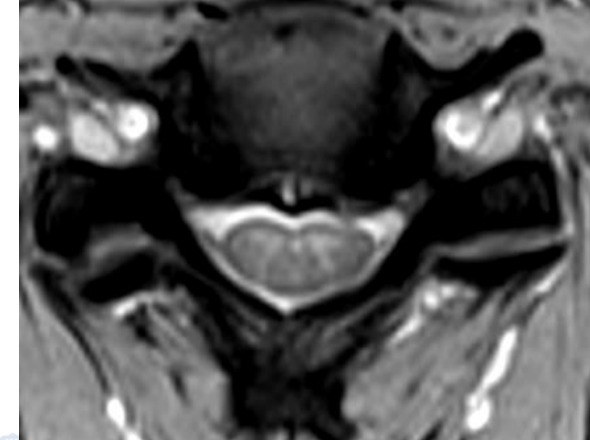
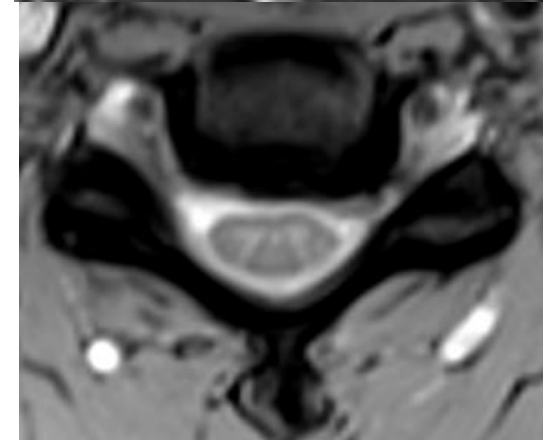
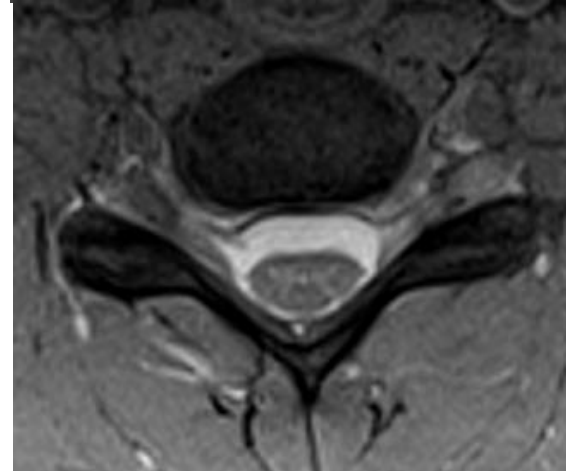
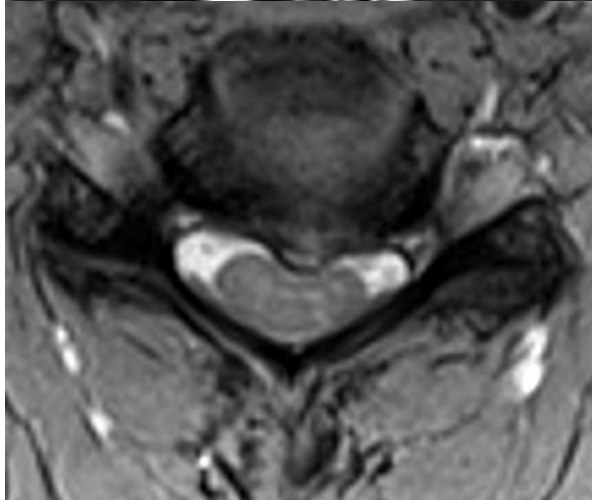
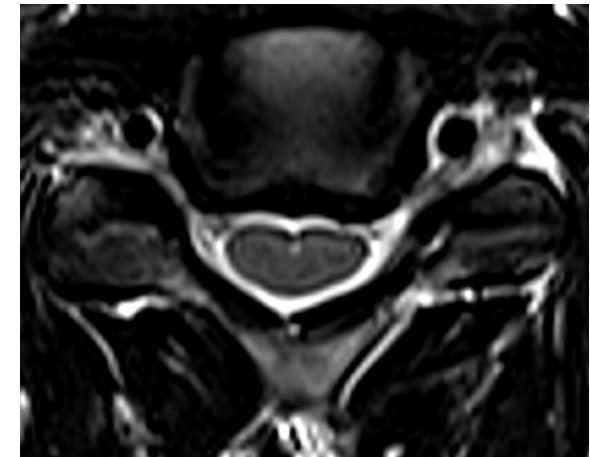
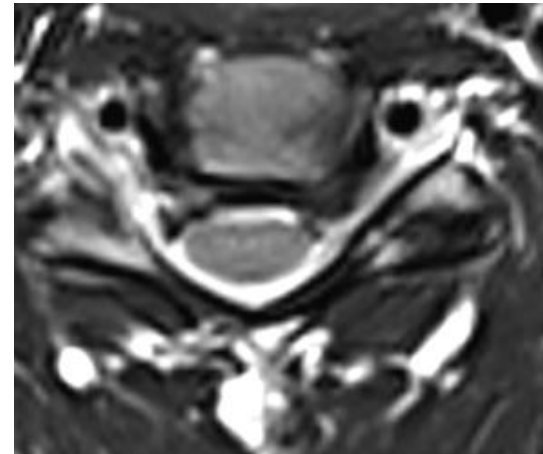
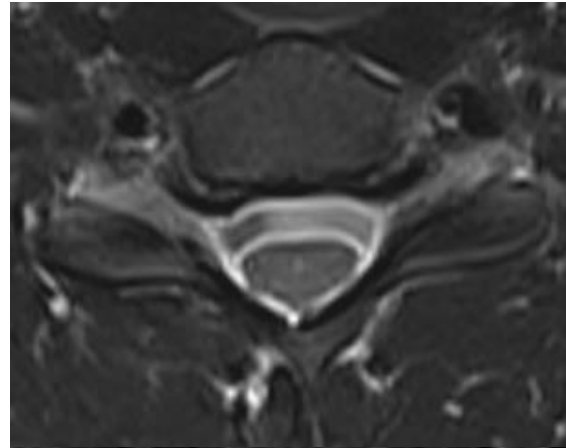
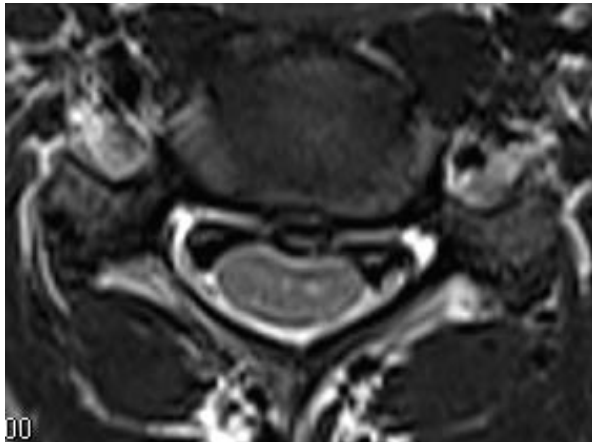
FSE vs GE



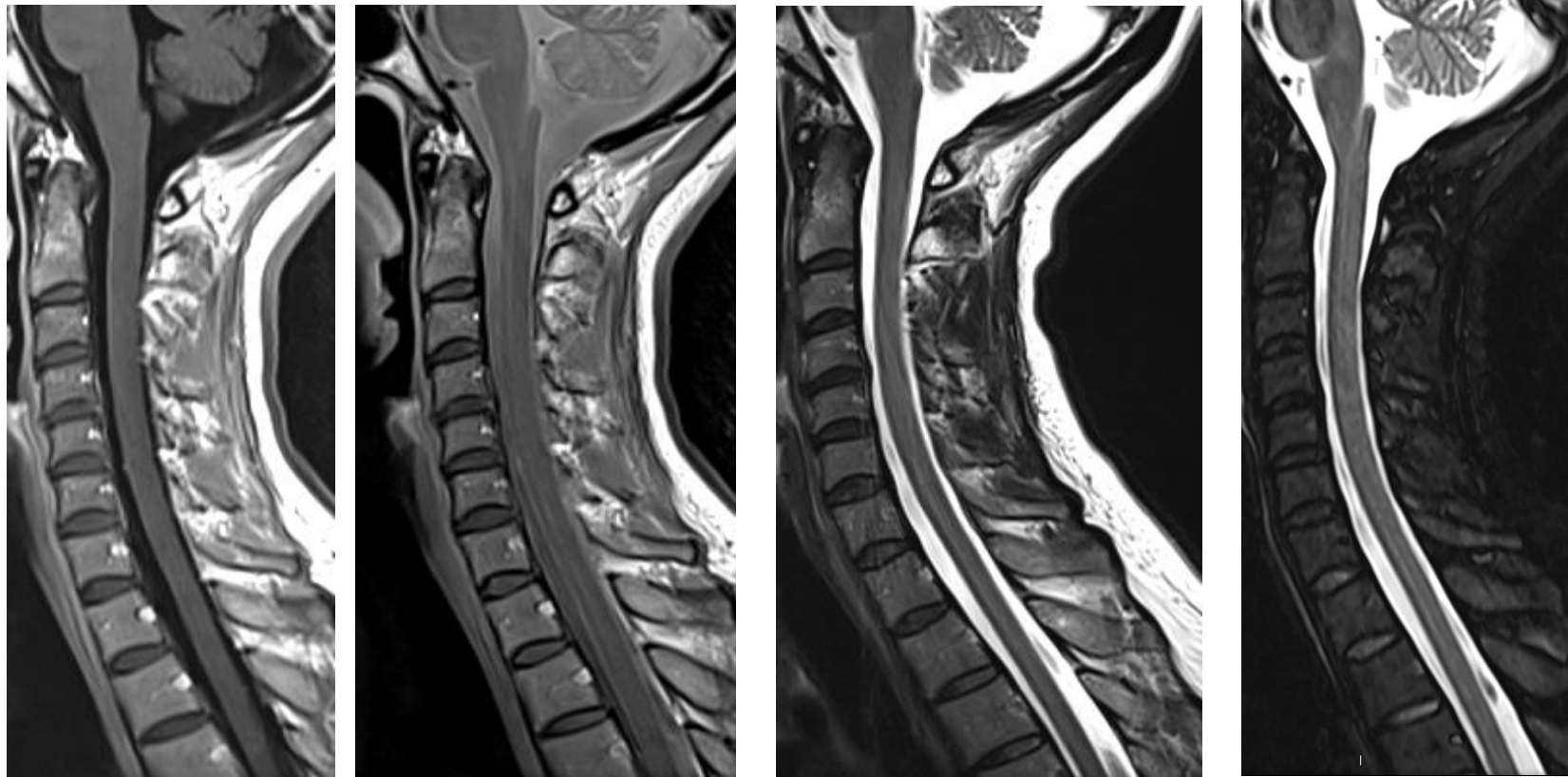
T2 vs T2*



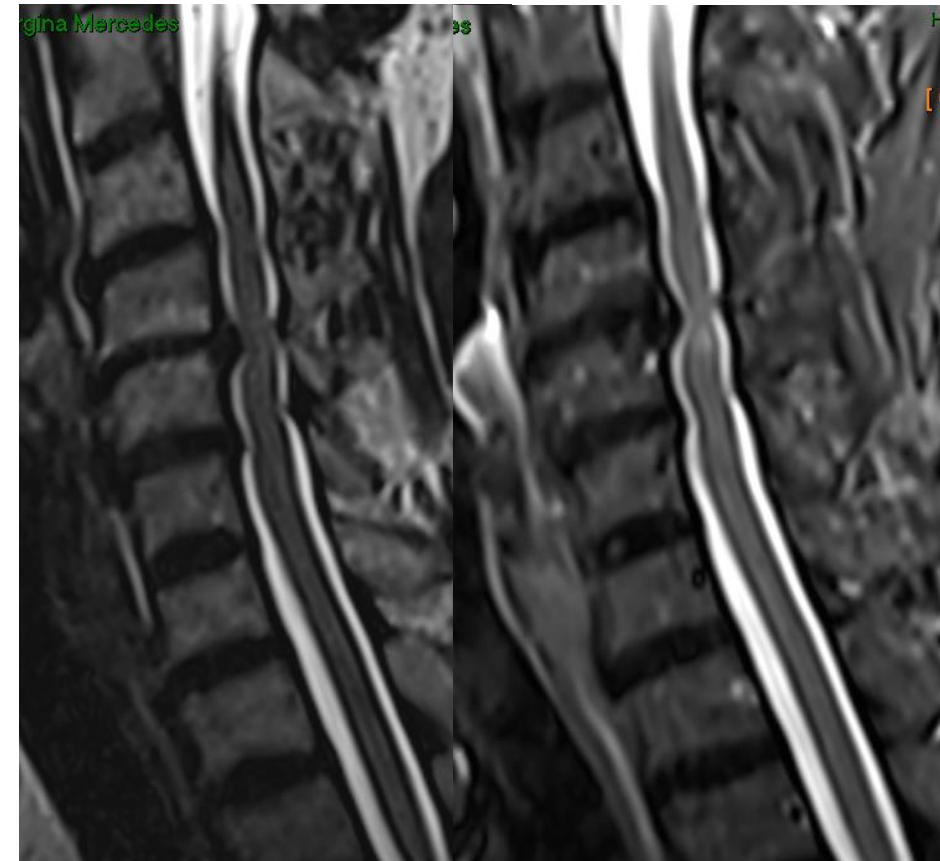
T2 vs T2*



Médula: T2, DP, STIR



Lesión medular T2 vs STIR



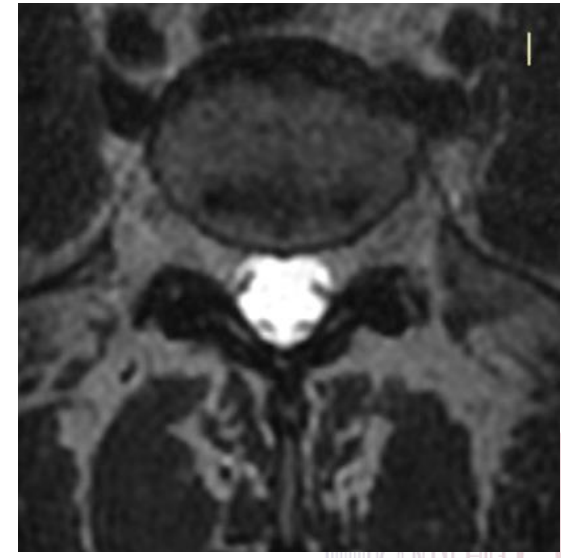
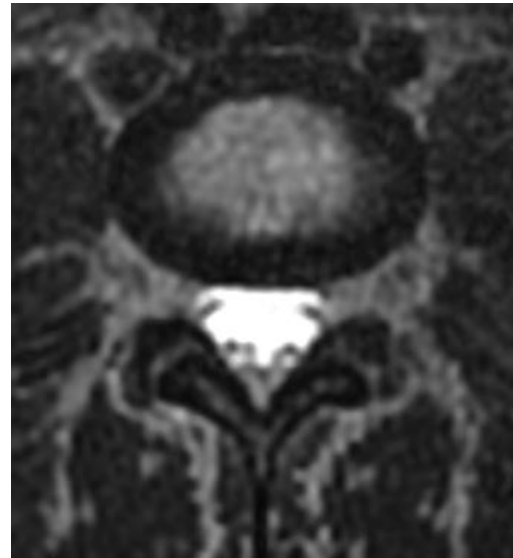
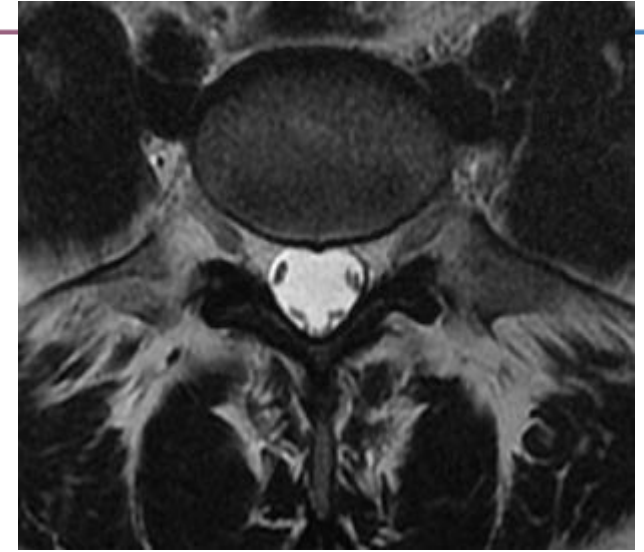
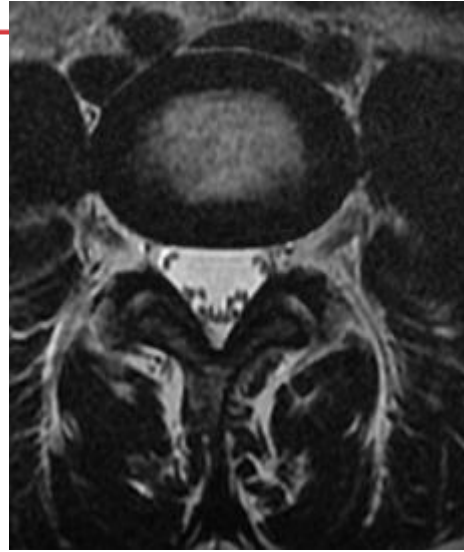
T2 vs STIR: artefactos



T2 vs STIR hernia emigrada



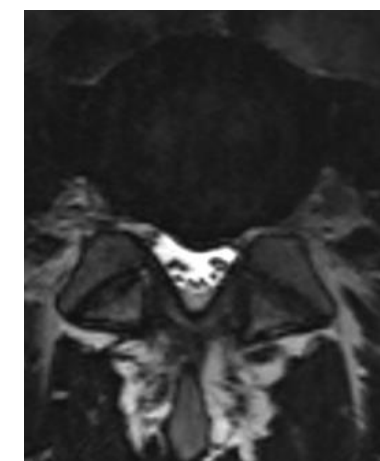
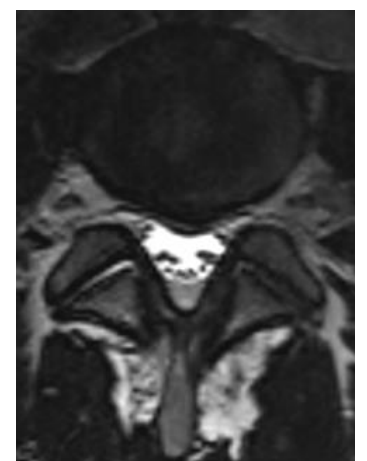
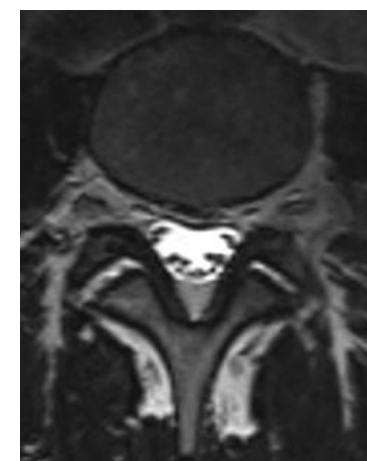
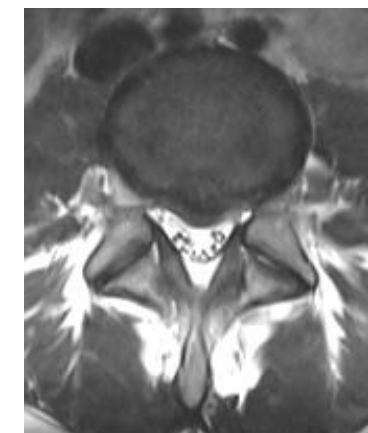
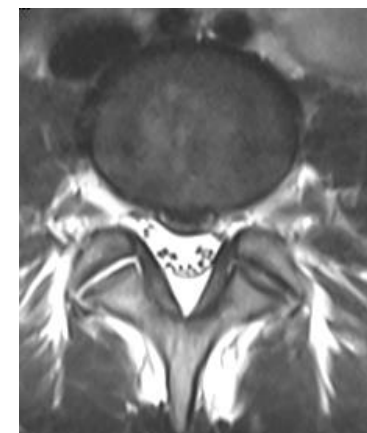
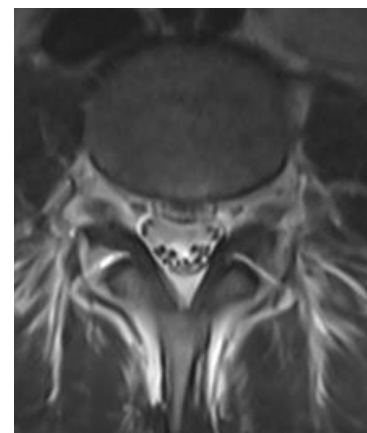
2D vs 3DT2 en 1,5T



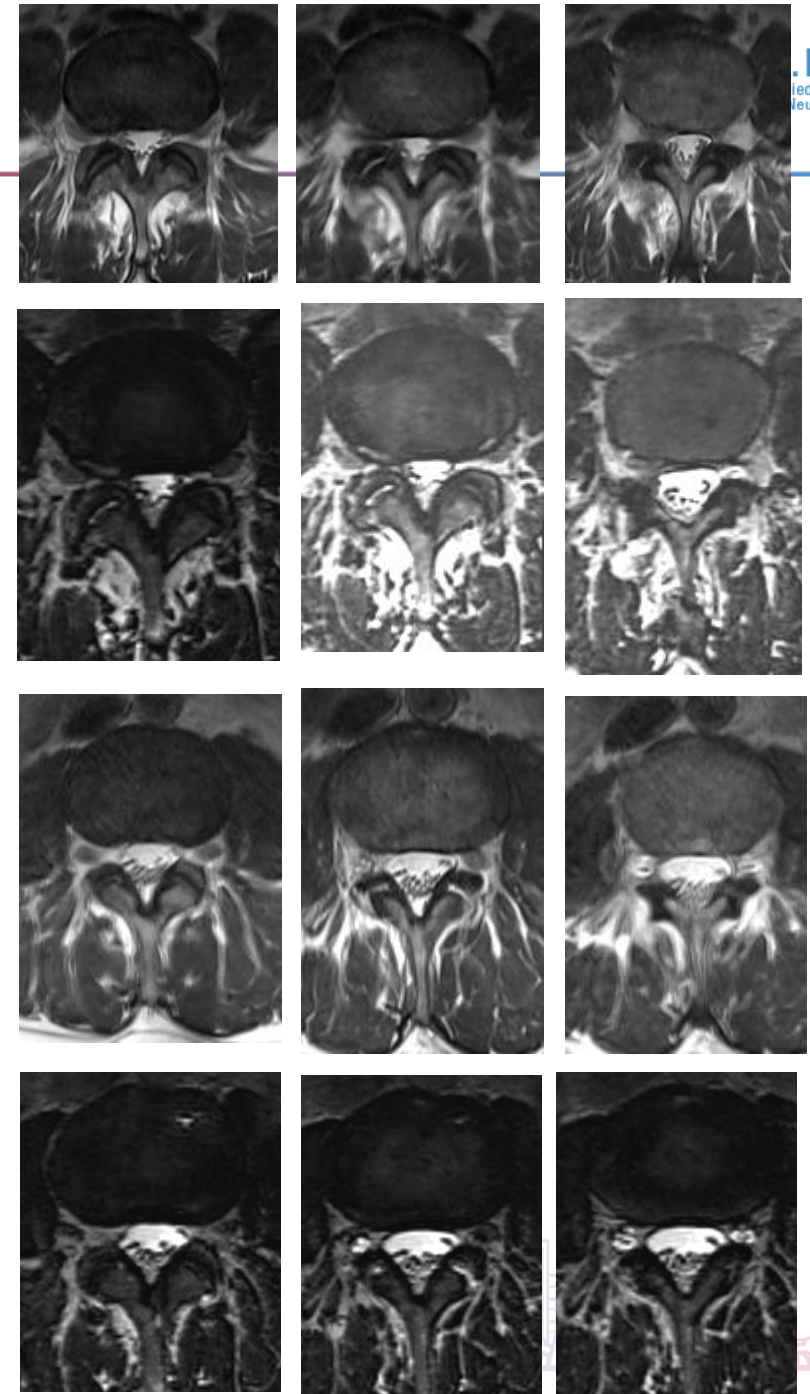
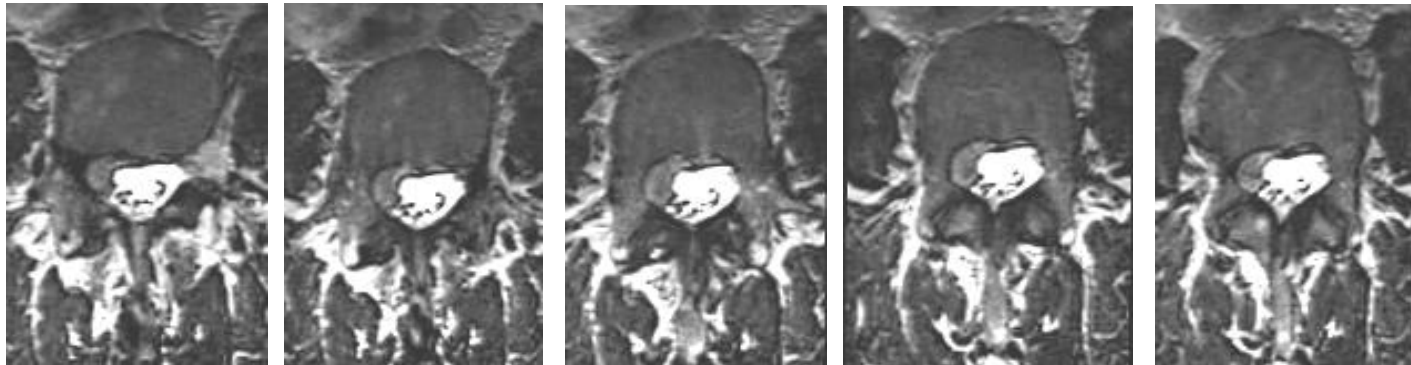
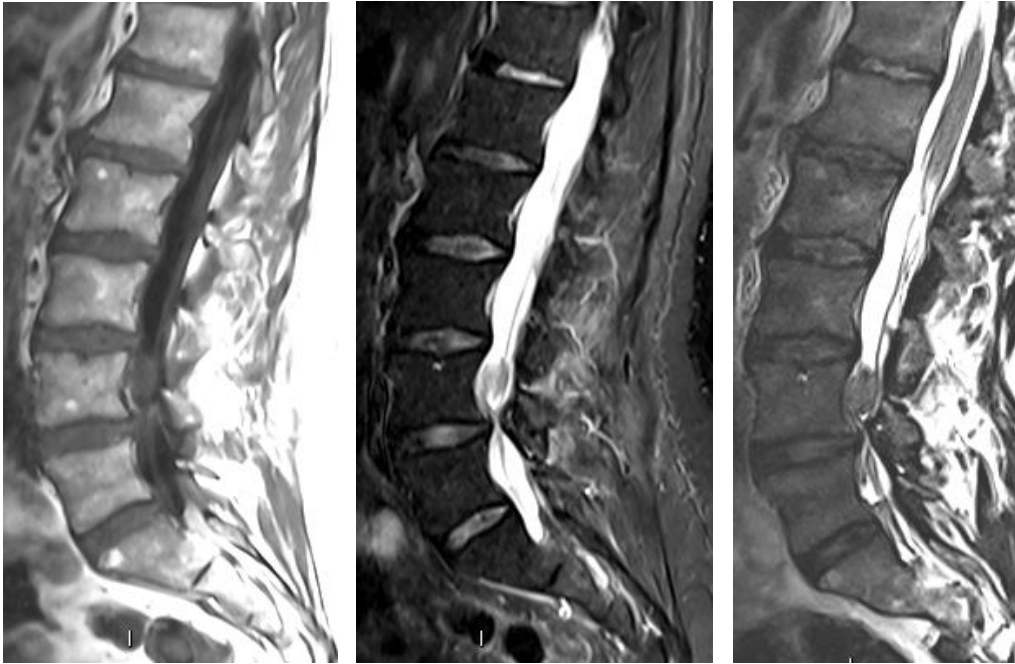
3DT2: resolución en el corte(1mm)



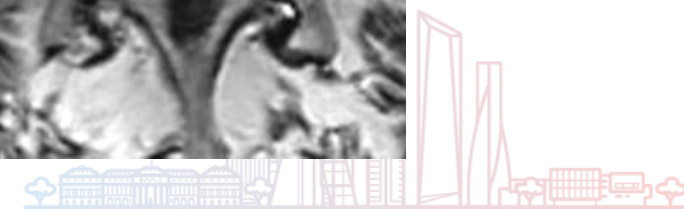
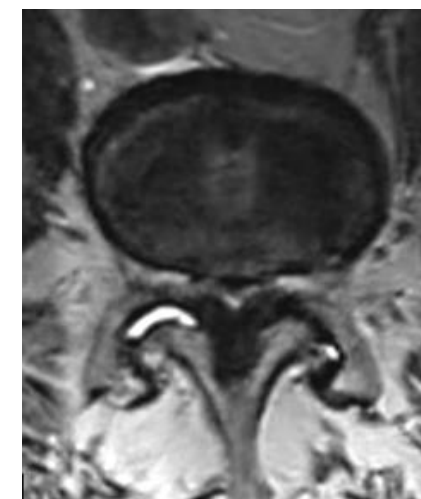
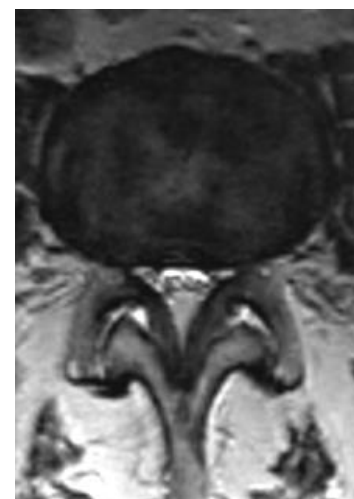
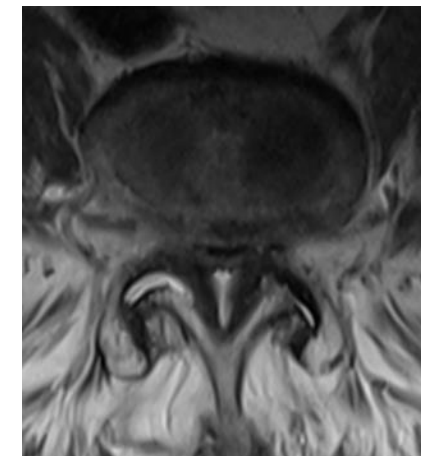
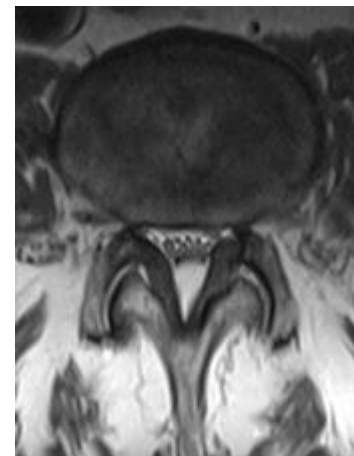
3DT2 en 3T



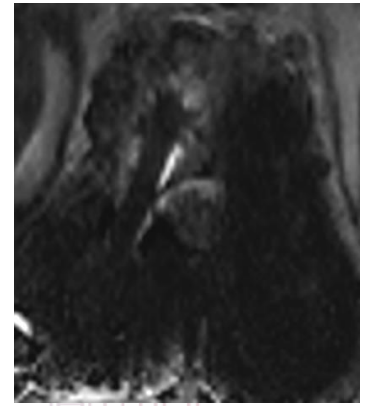
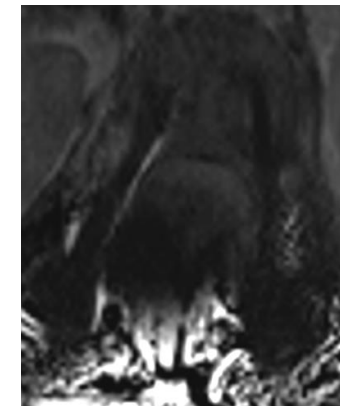
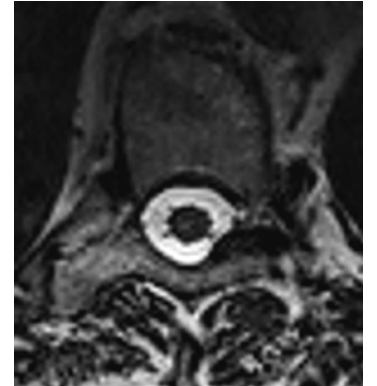
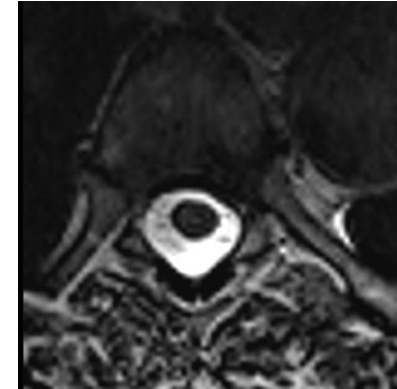
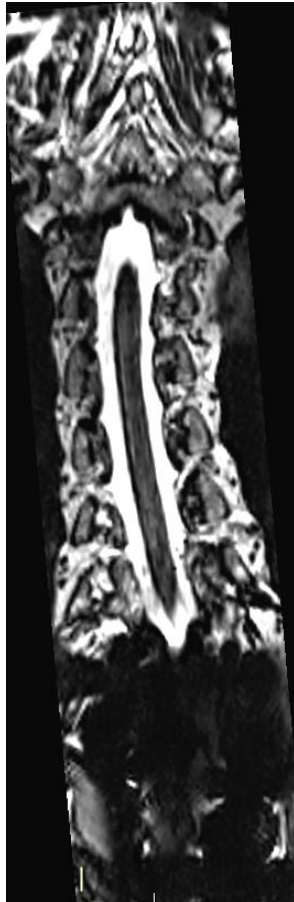
Hernia emigrada



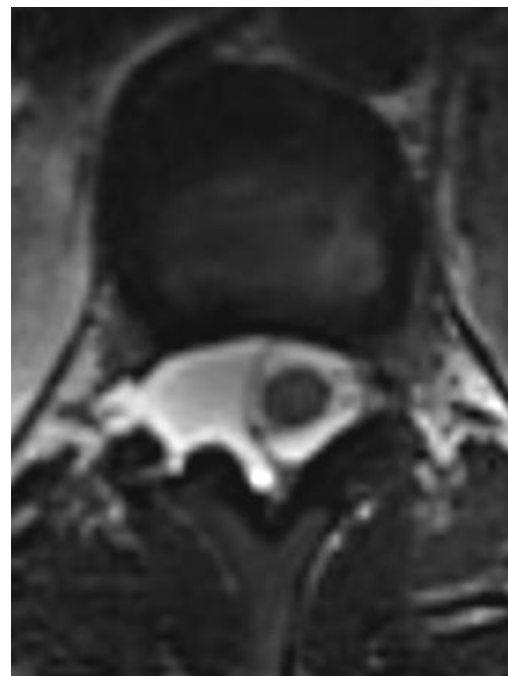
Estenosis del canal: 3DT2 vs 2DT2



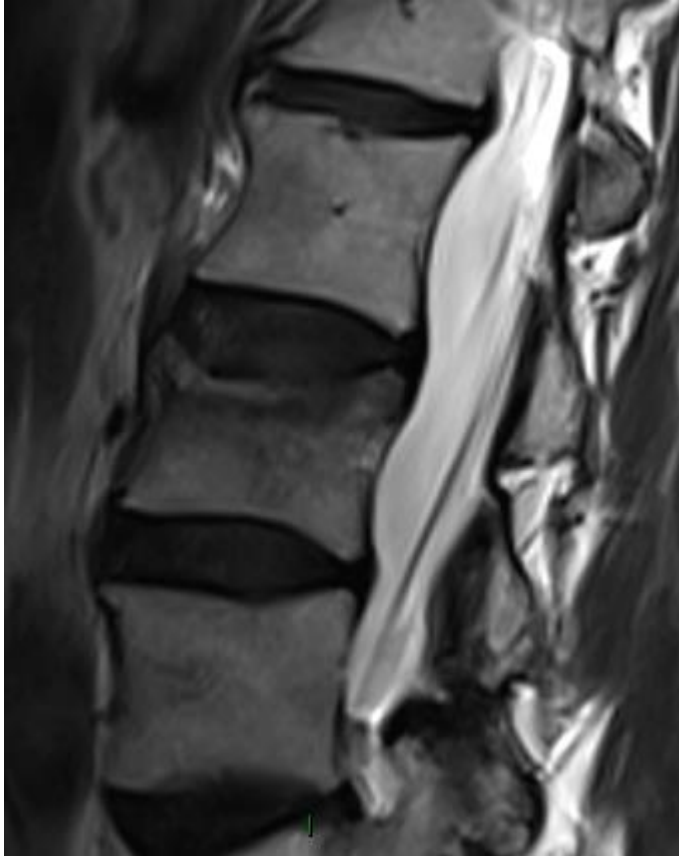
Escoliosis



Mielo-RM



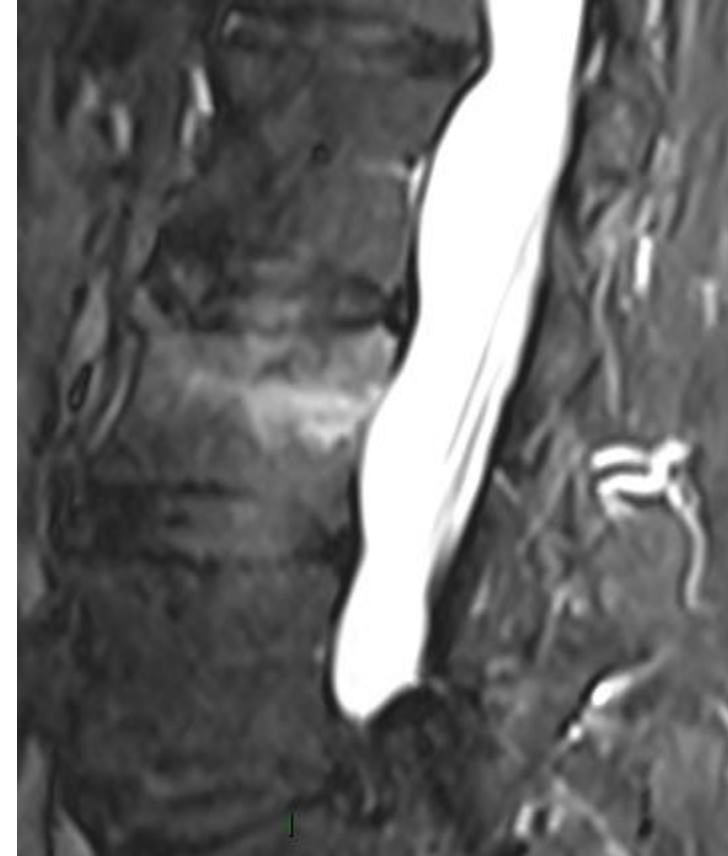
Fractura aguda: T2 vs STIR



2D-T2



3D-T2



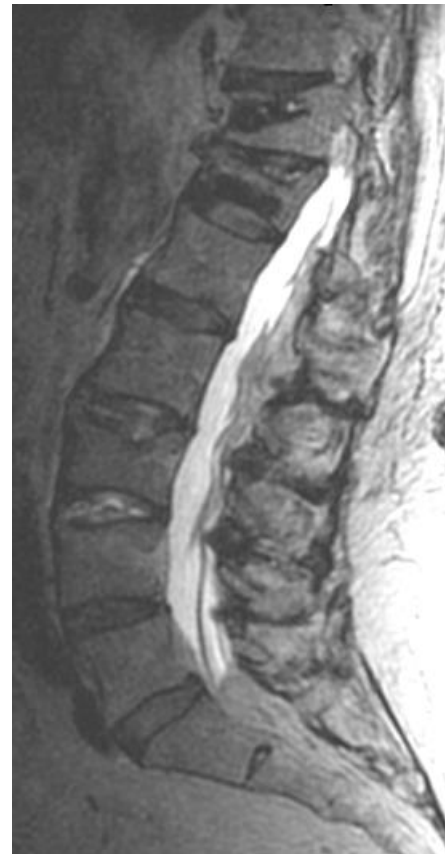
STIR



Fracturas por osteoporosis



2D-T2



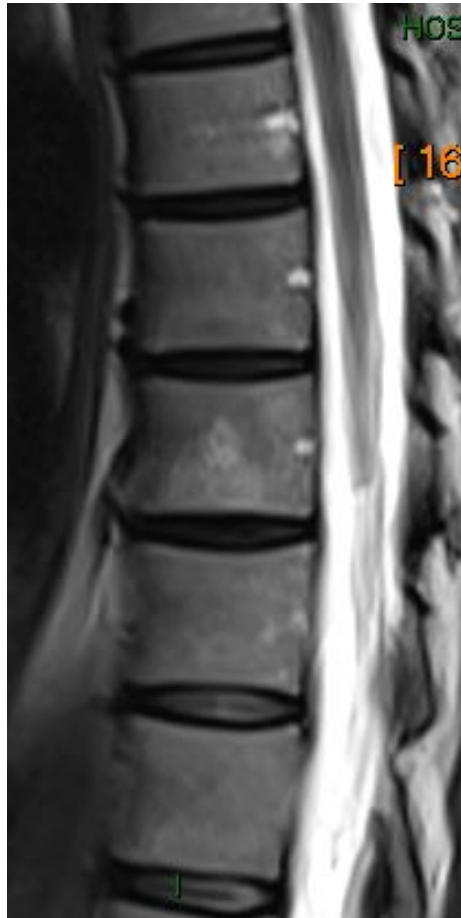
3D-T2



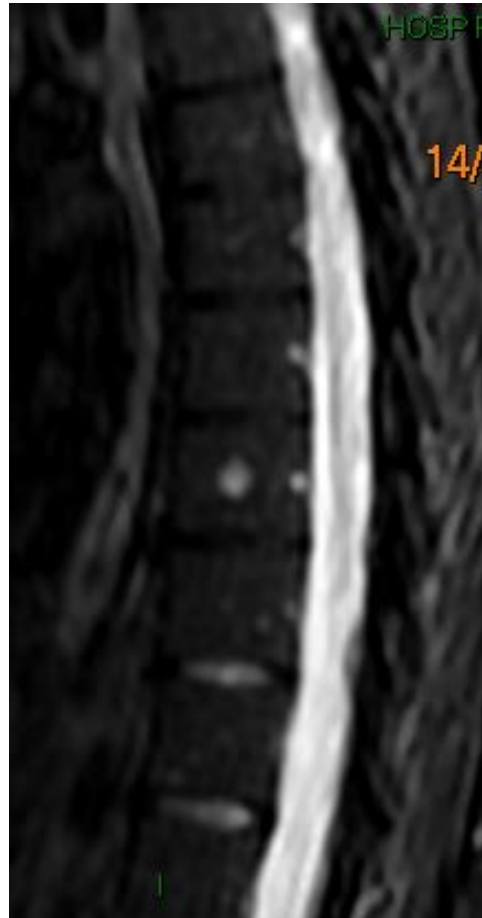
STIR



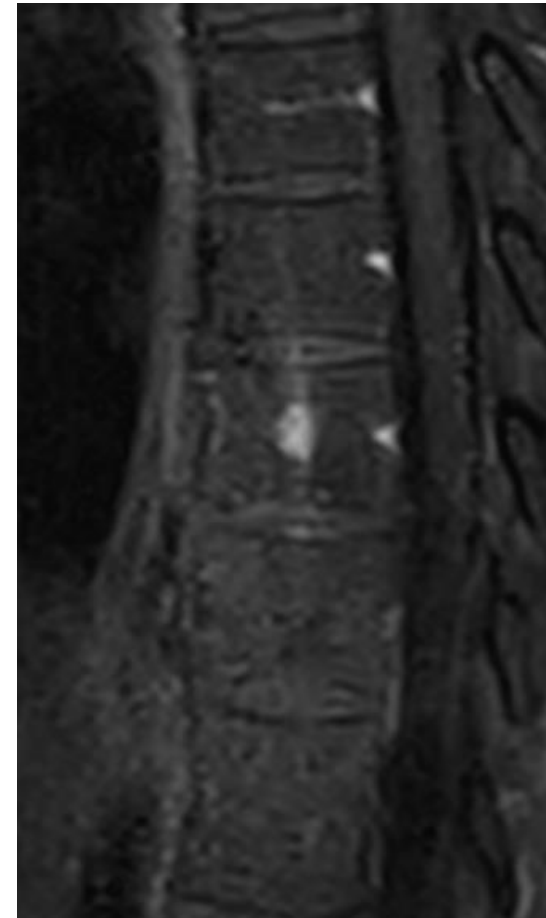
Metastasis T2 vs STIR



T2



STIR



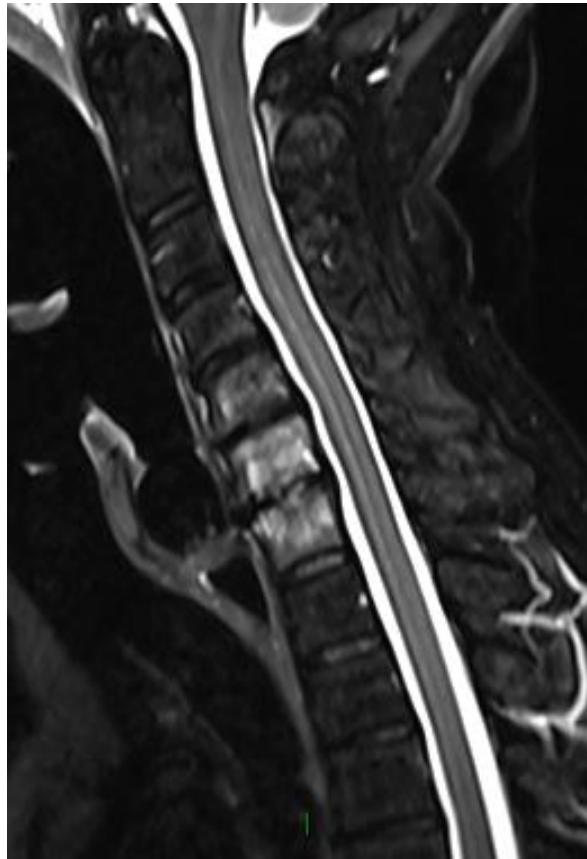
T1-SG + Gd



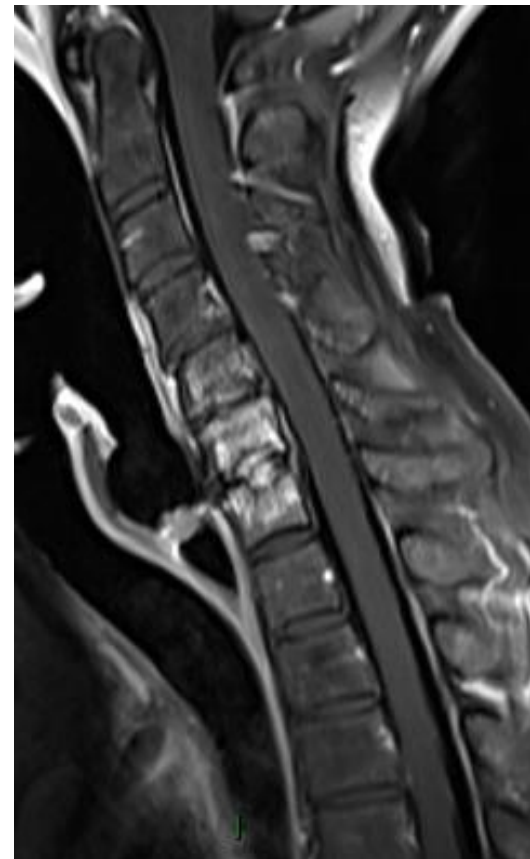
T1-SG: FSE vs GE



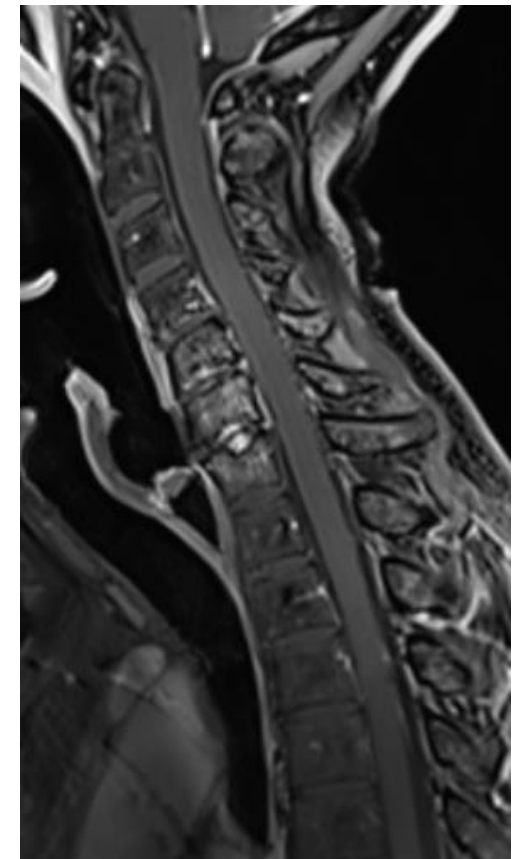
T2



STIR



T1-FSE-SG



T1-GE-SG

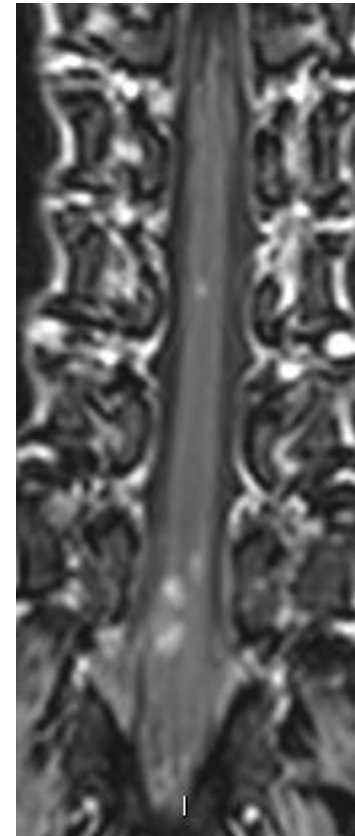
3D GE-SG vs 3D-FSE-SG



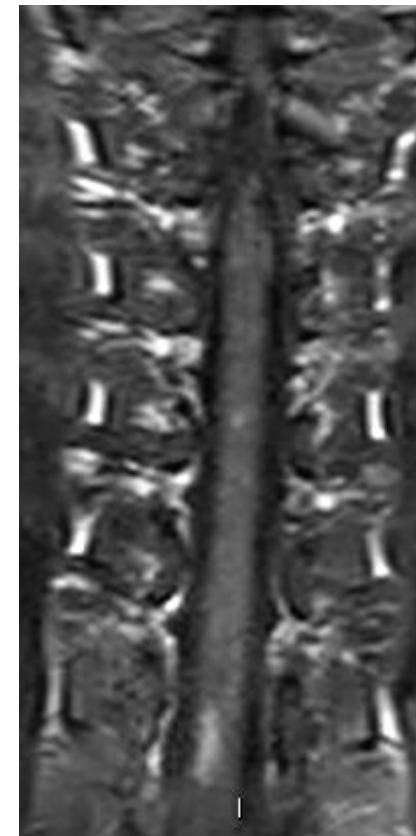
3D-T1-GE-SG



3D-T1-FSE-SG



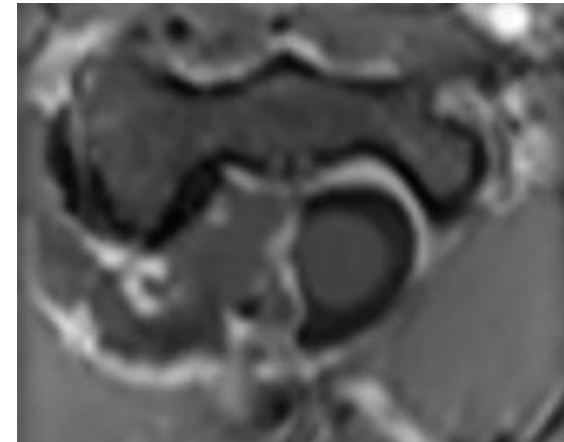
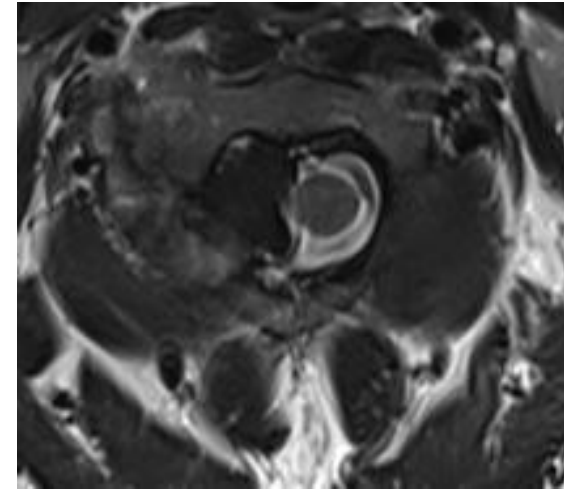
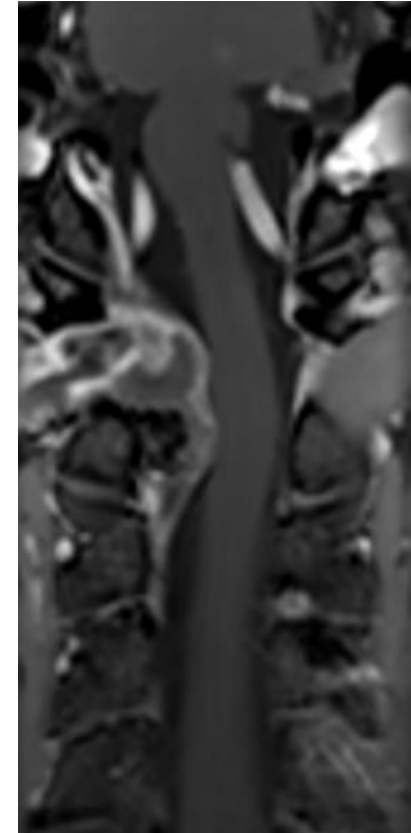
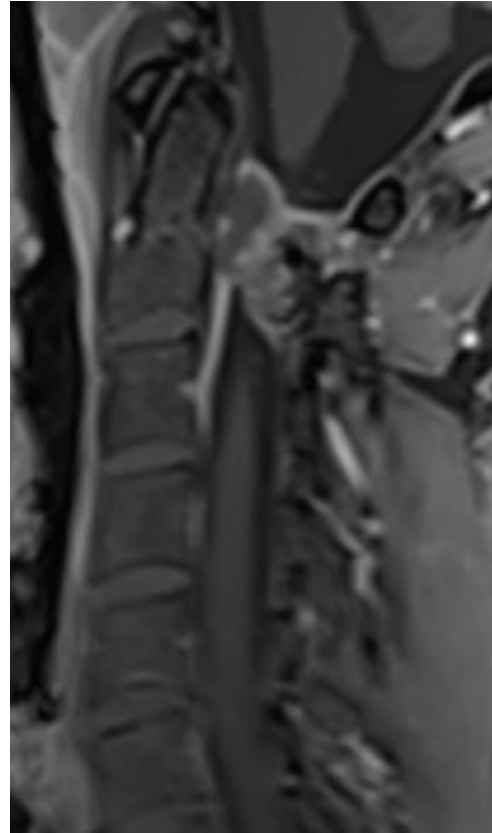
3D-T1-GE-SG



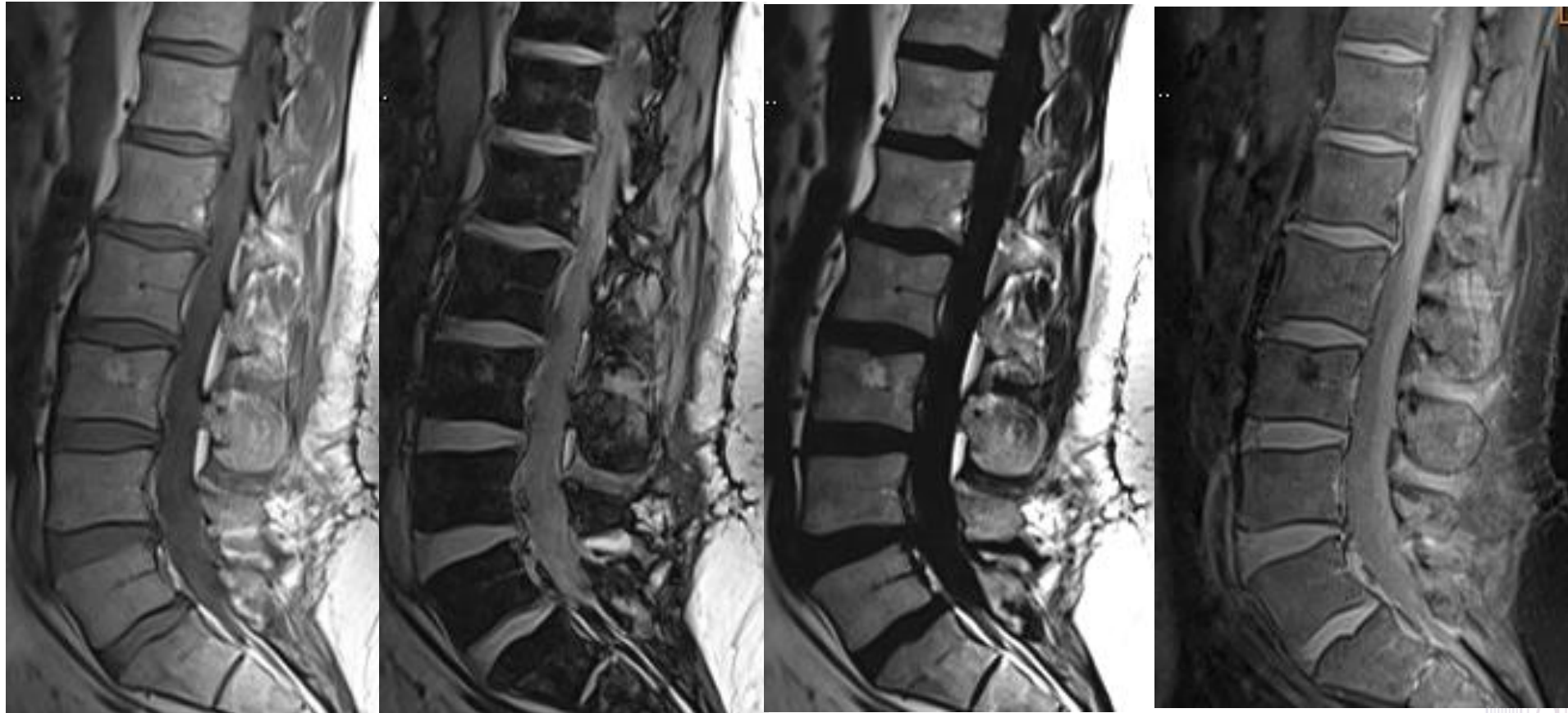
3D-T1-FSE-SG



Planificación quirúrgica: 3D-GE-SG



Dixon T1-FSE



In-Ph

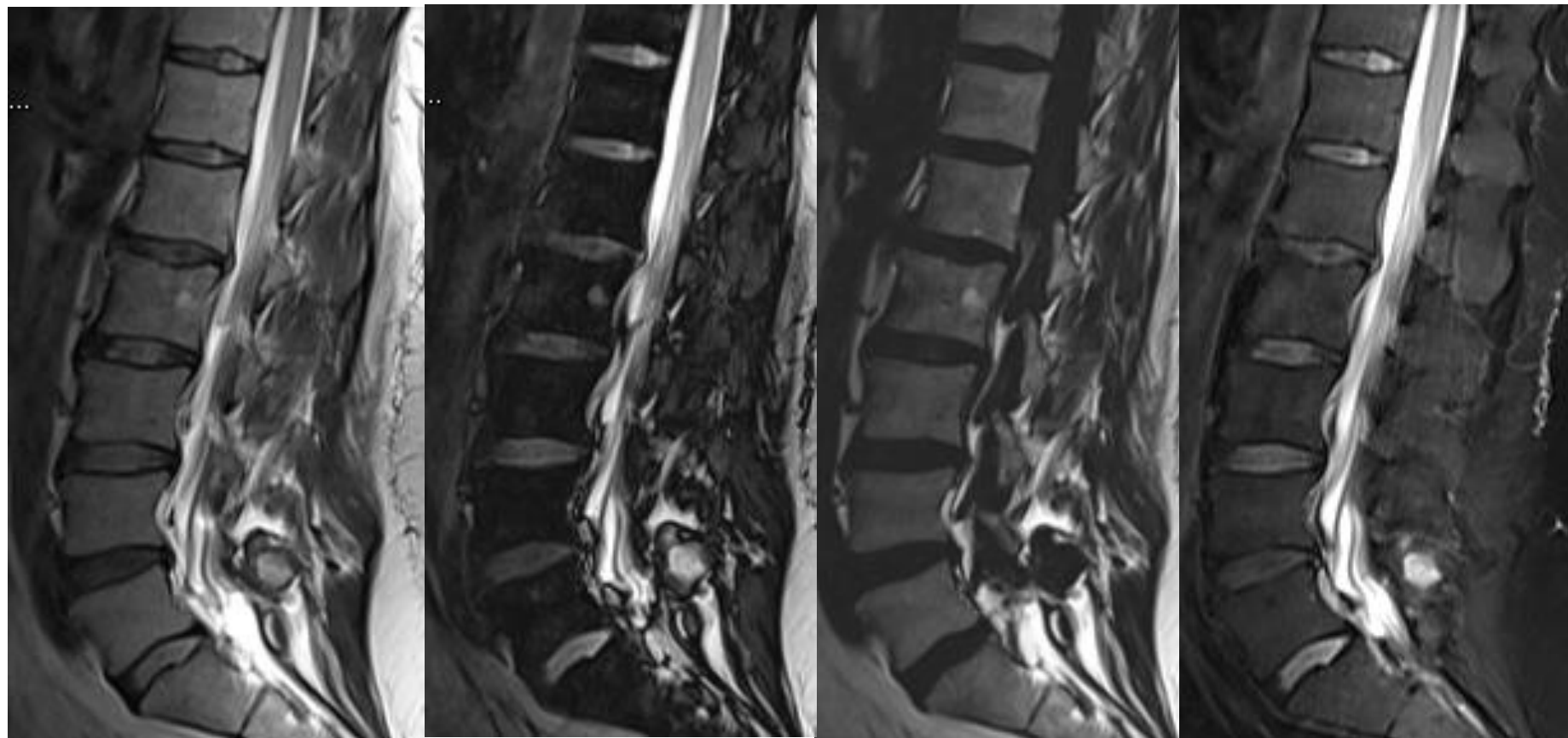
Opp-Ph

Fat

Water



Dixon T2



In-Ph

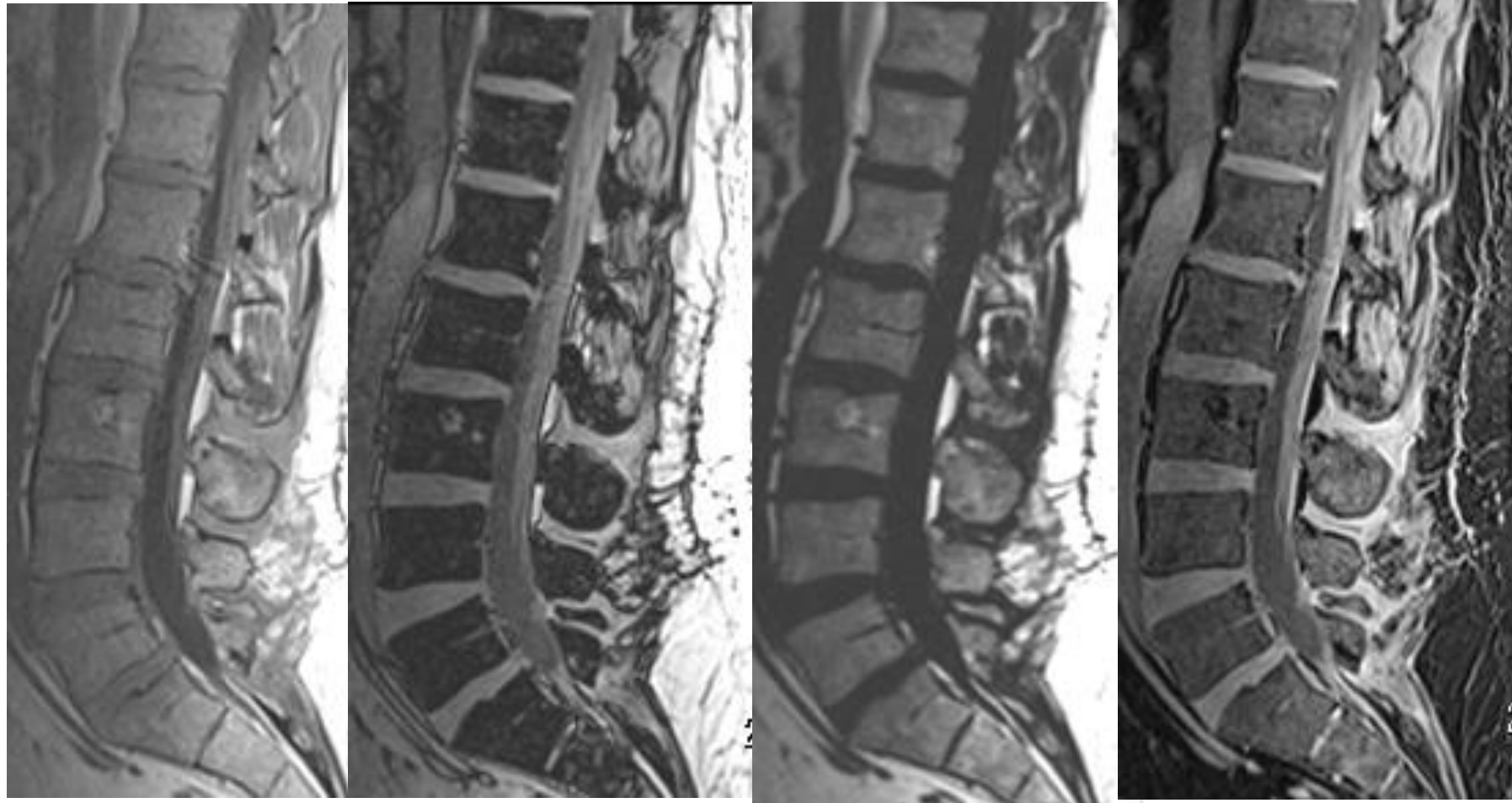
Out-Ph

Fat

Water



Dixon 3D-GE



In-Ph

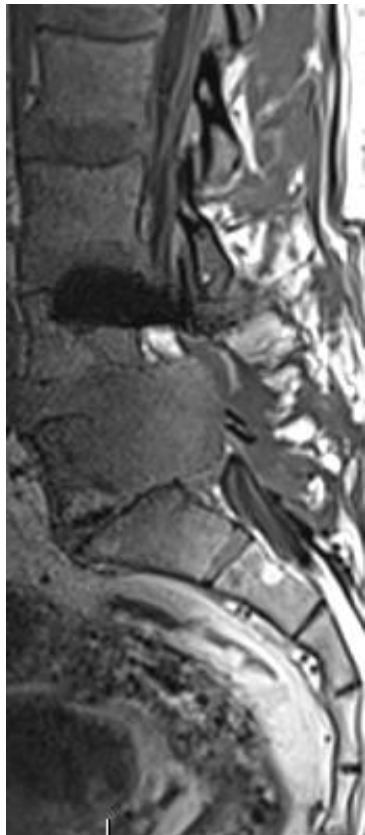
Out-Ph

Fat

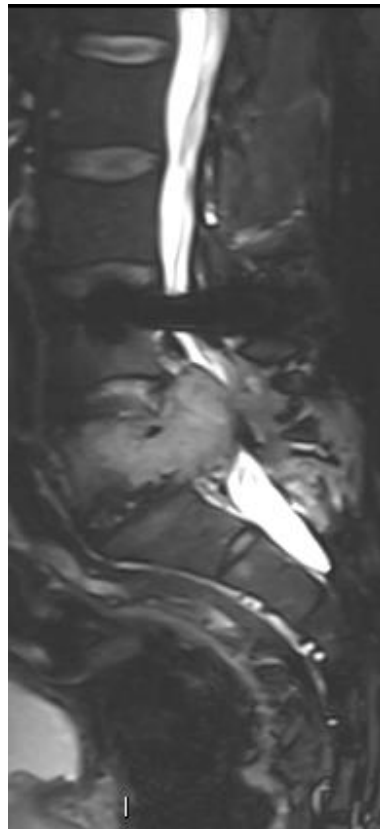
Water



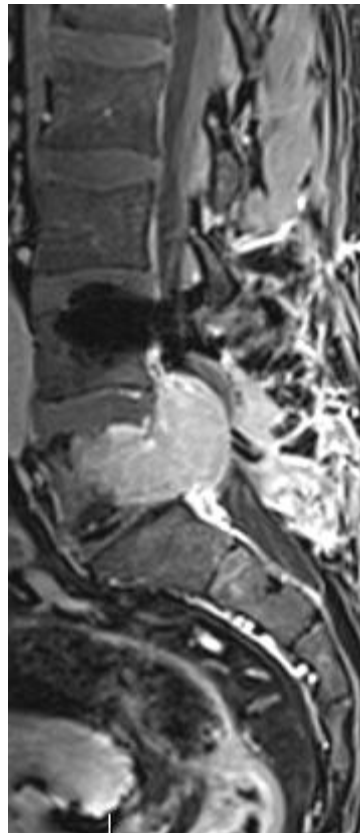
Dixon 3D, STIR 3D: Protonterapia



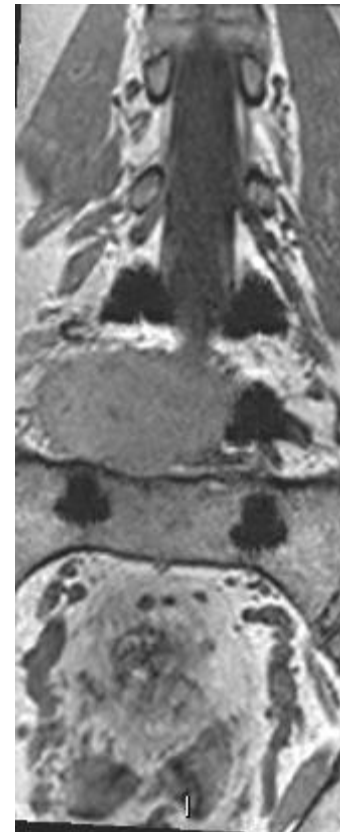
3D-Dx-in Ph



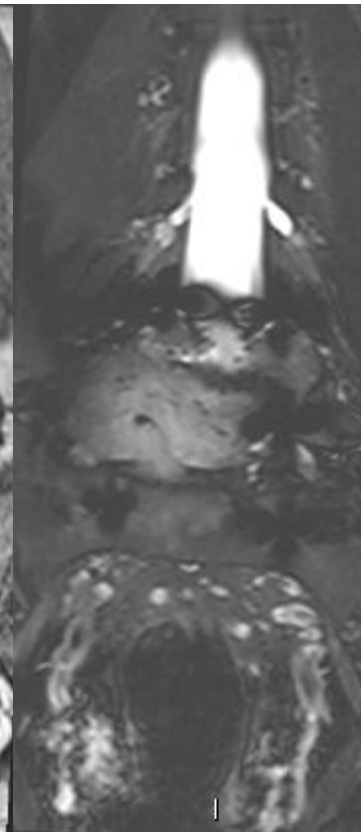
3D-STIR



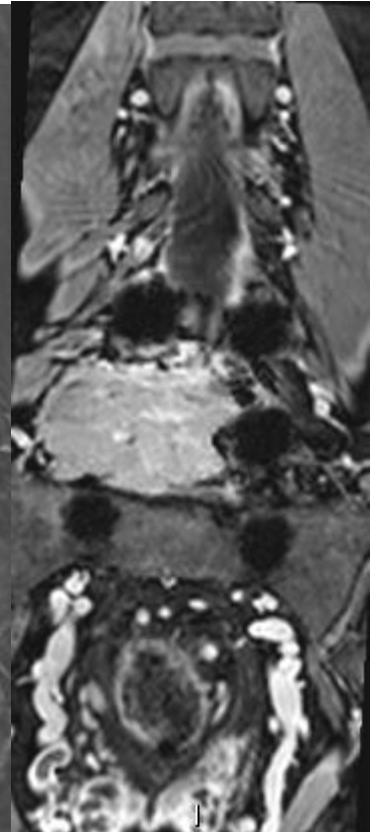
3D-Dx-W



3D-Dx-in Ph

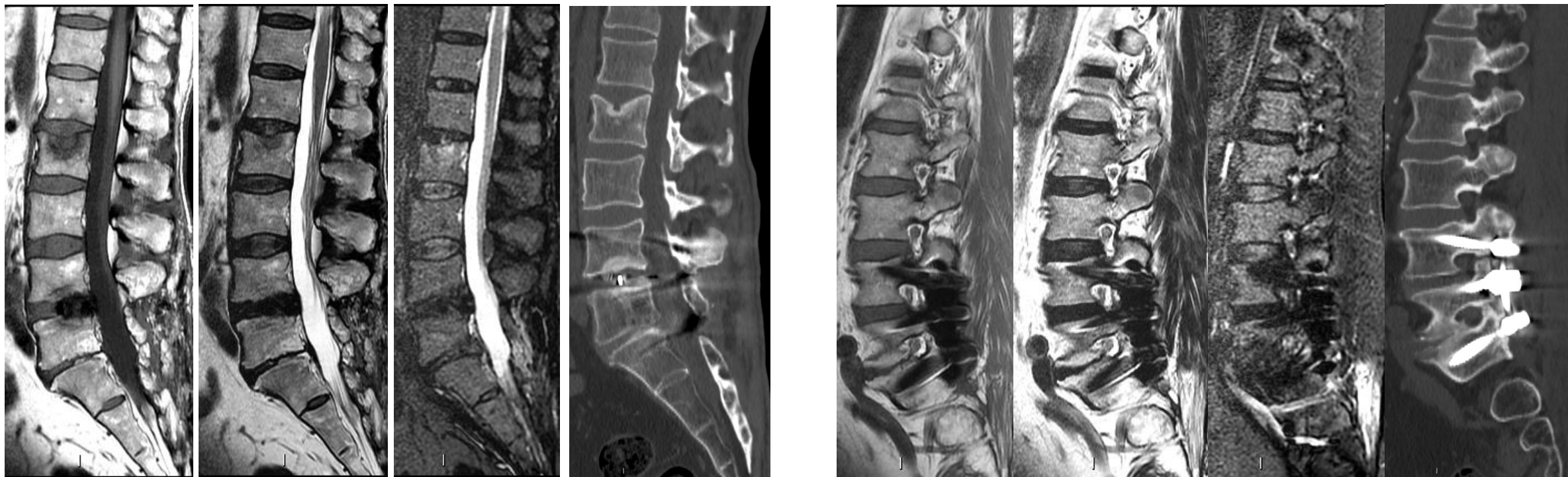


3D-STIR

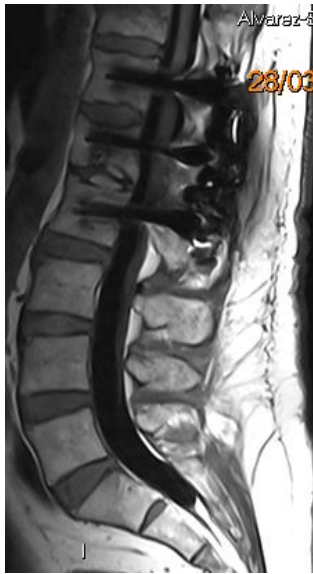


3D-Dx-W

RM VS TC



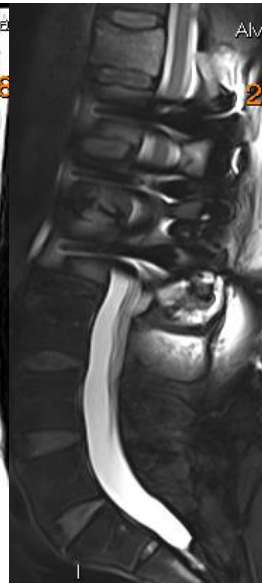
Artrodesis transpedicular y fractura



T1-FLAIR



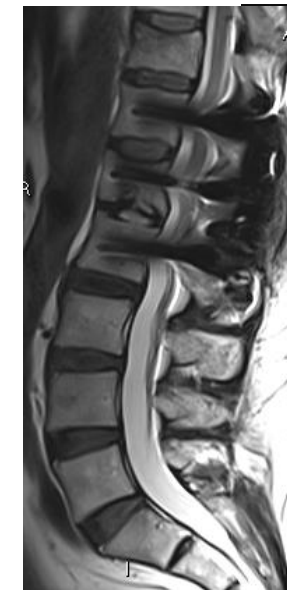
T2



T2-SG



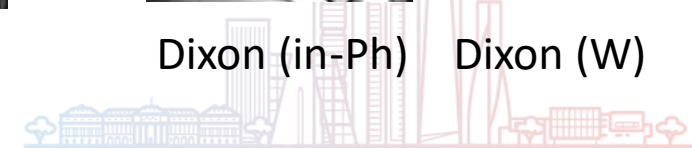
STIR



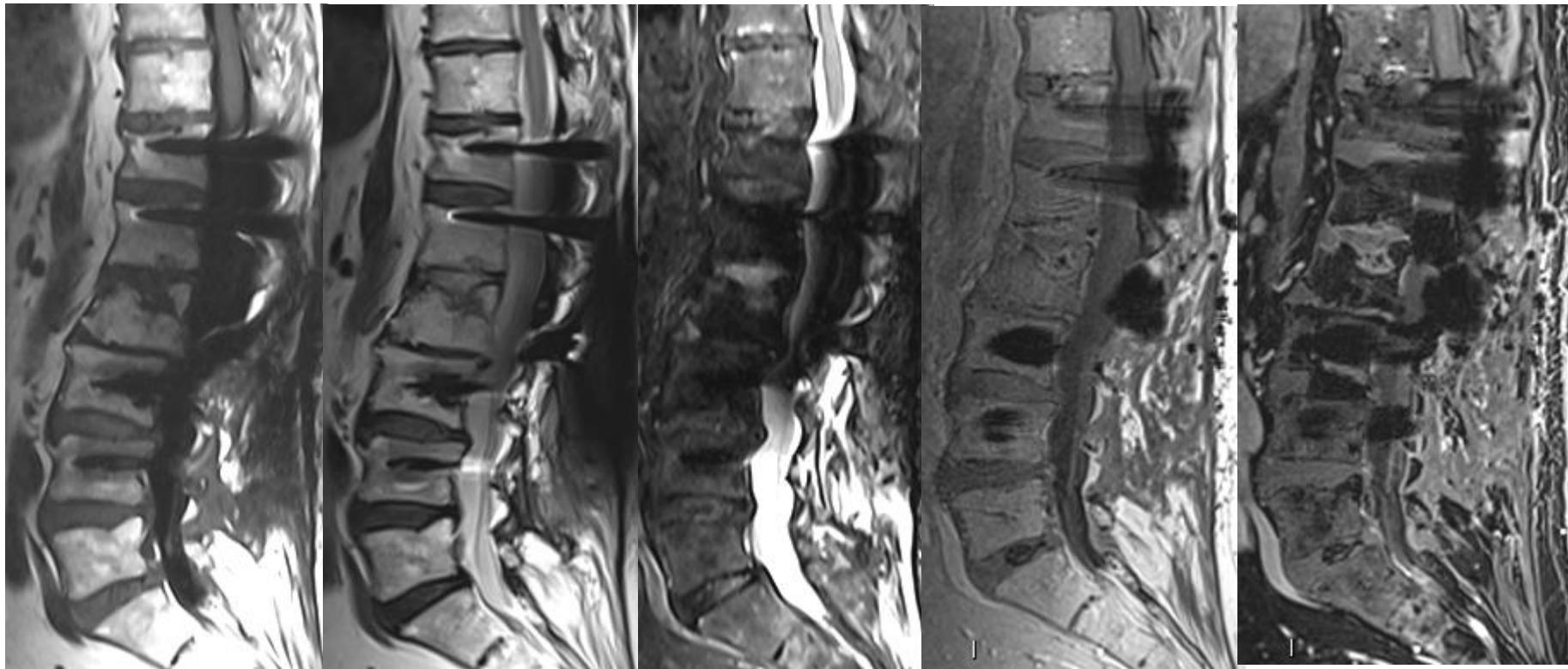
Dixon (in-Ph)



Dixon (W)



Artrodesis, discitis



T1-FLAIR

T2

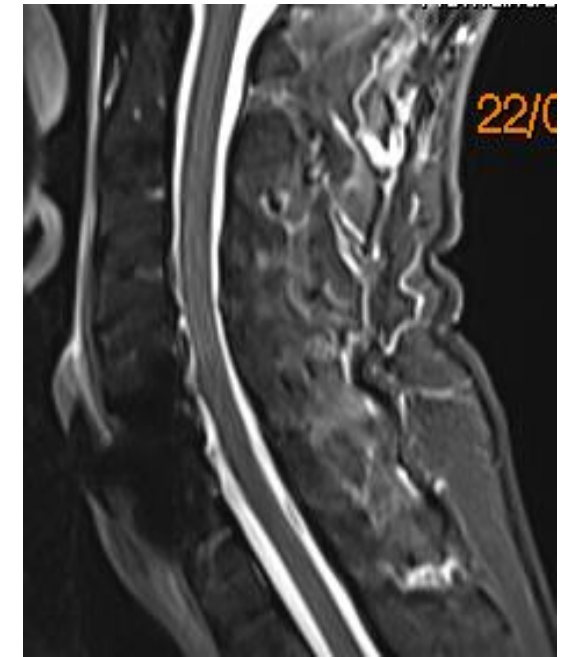
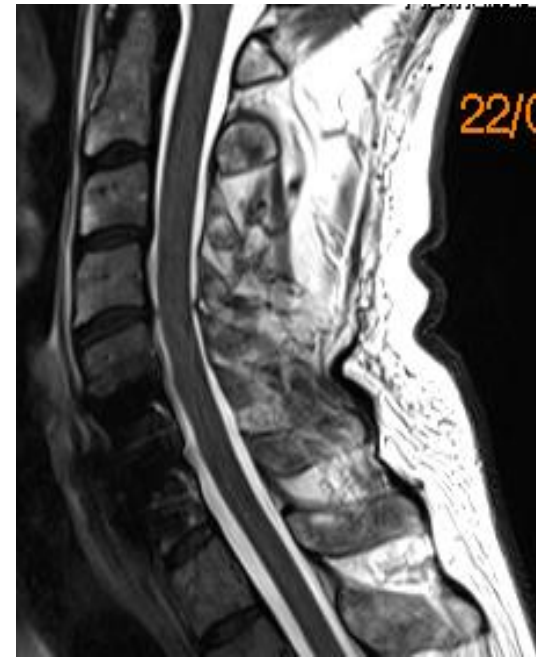
STIR

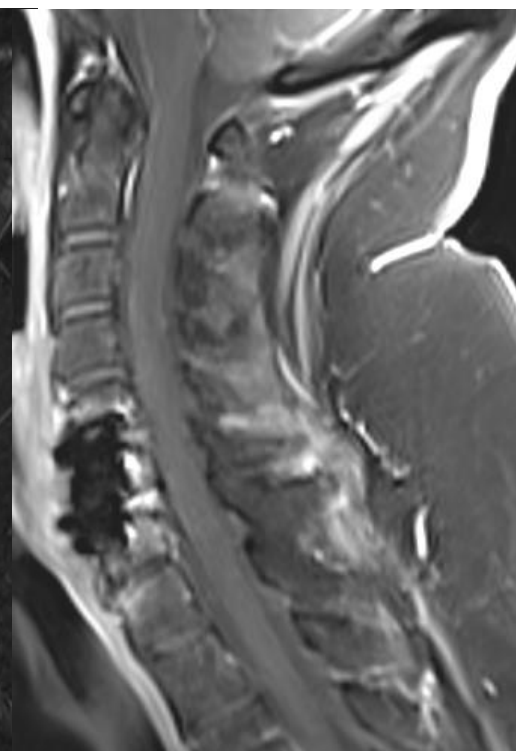
Dx in-Ph

Dx W



Fijación intersomática





Angio-RM/Angio-TC Medular

Anatomía vascular más compleja

Sistemas A/V paralelos

FOV muy extenso

Vasos muy pequeños

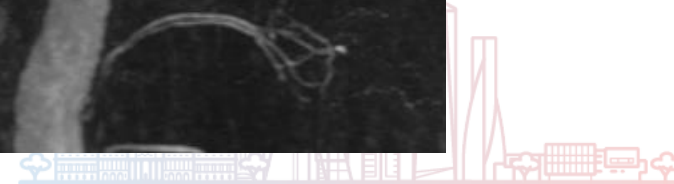
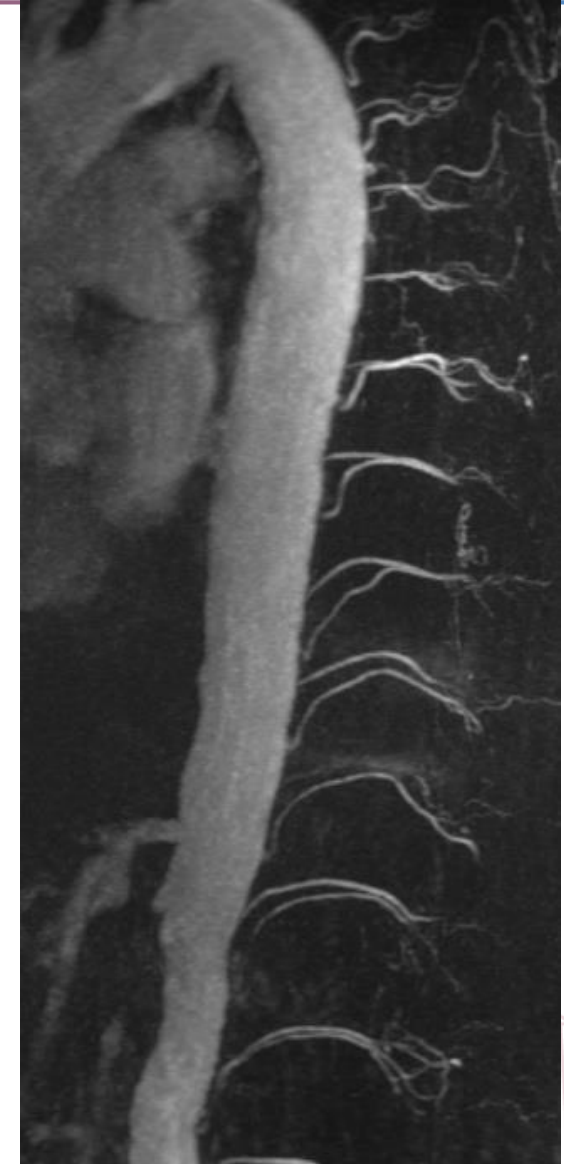
Flujo más distal: mayor solapamiento Arterio-Venoso

Más frecuente: fístulas durales

Artefactos:

Movimiento

Pulsación



AngioRM vs AngioTC

Angio-RM

Alta dosis de Gd

Resolución

Espacial: “baja”

Temporal: alta...

Adquisición múltiple

Substracción

“Bolus test” / TR-MRA

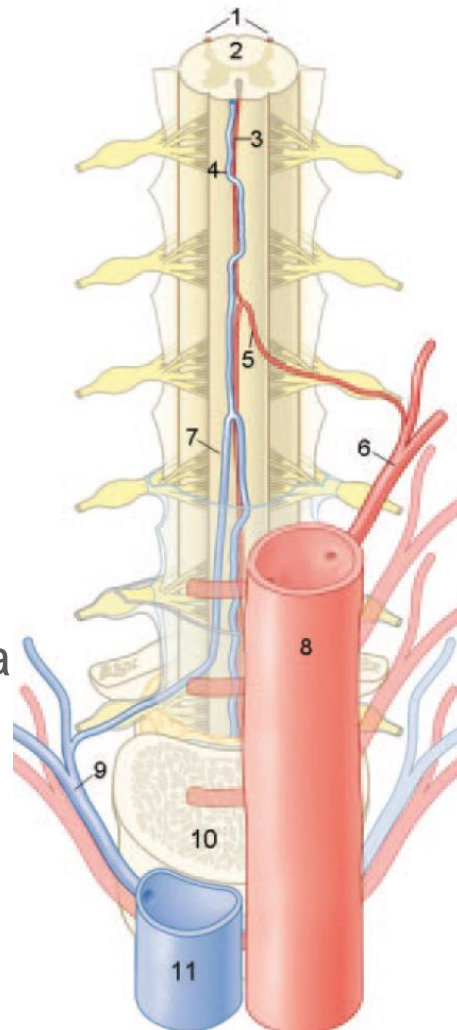
Fases arterial y venosa

Post-proceso rápido

FOV limitado

Artefactos

Posibilidad de
completar/repetir



Angio-TC

Alta dosis de Yodo

Resolución

Espacial: alta

Temporal “baja”

Adquisición única

No substracción

“Bolus test” complejo

Fase única

Post-proceso laborioso

Cobertura “ilimitada”

Alta radiación

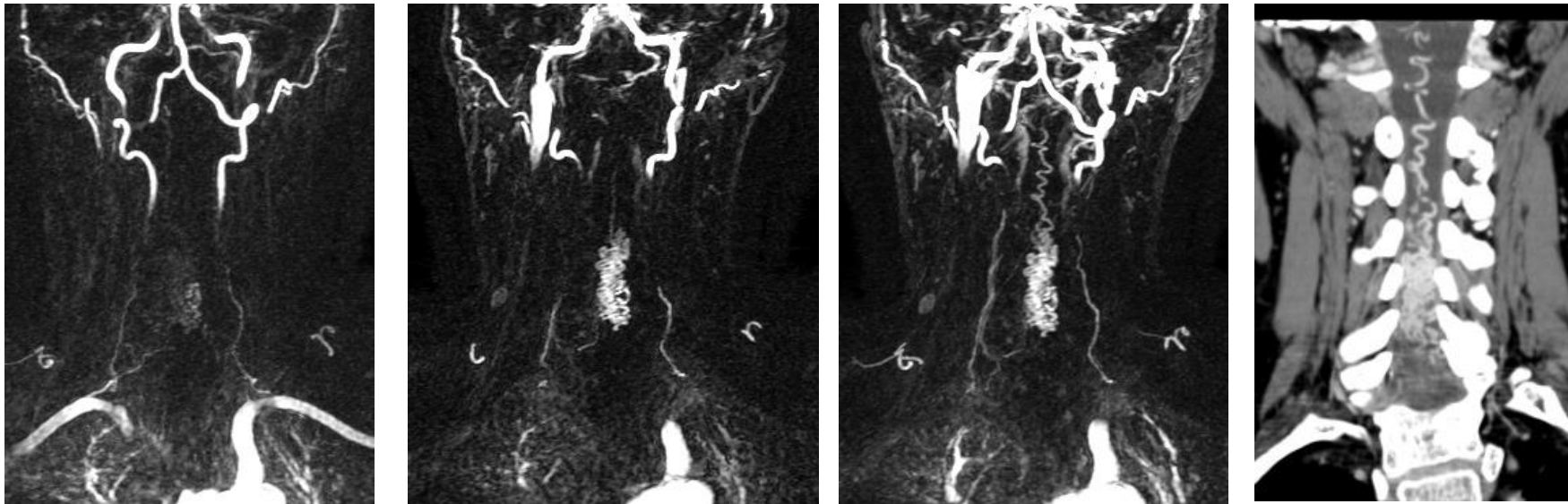
800 cortes axiales

15-20 mSV



TR-MRA: combina el espacio K

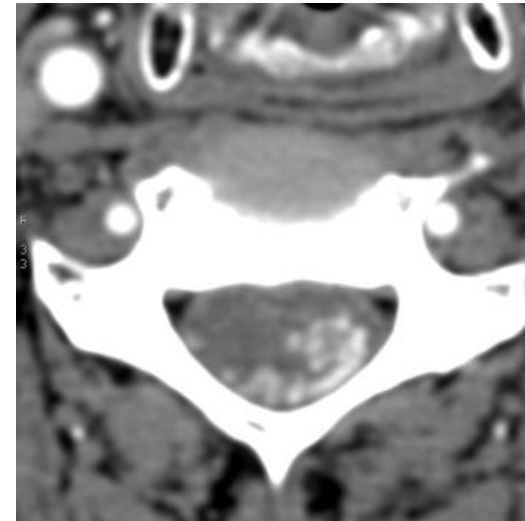
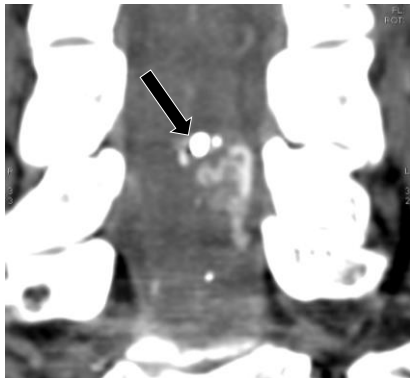
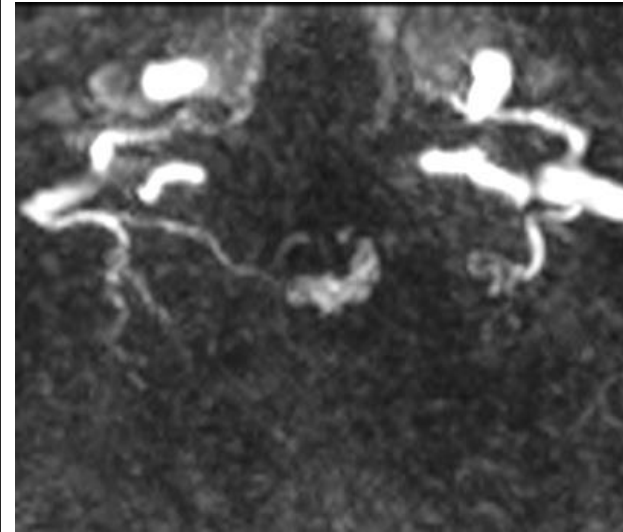
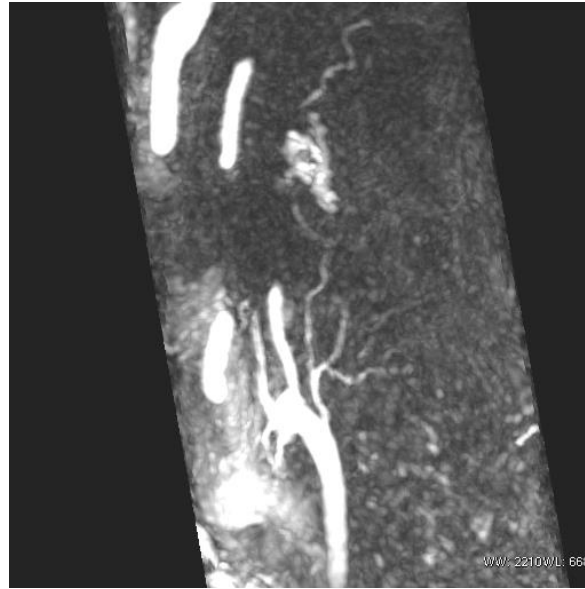
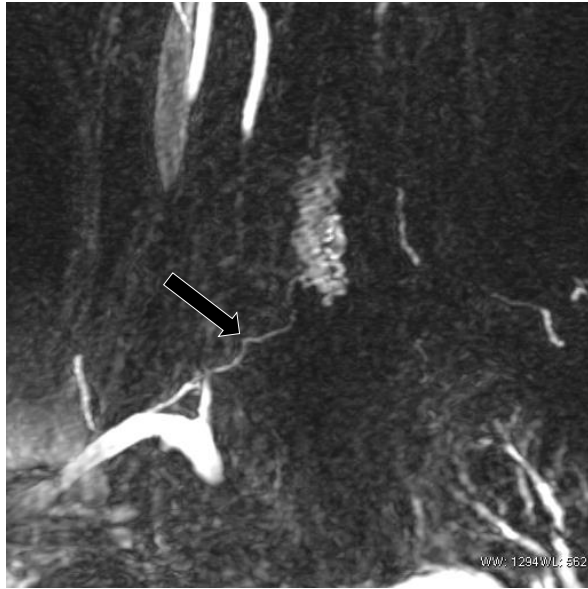
- Buena resolución temporal pero menor resolución espacial
- No requiere “bolus test”
- Substracción automática



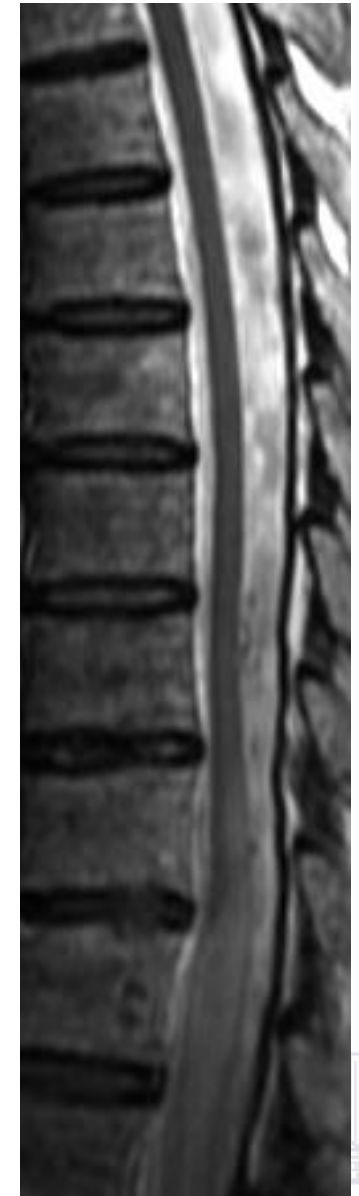
La secuencias “Time-Resolved”-MRA pueden separar la fase venosa y la arterial (resolución “efectiva” de 1-3 seg)



Post-proceso: ARM vs ATC

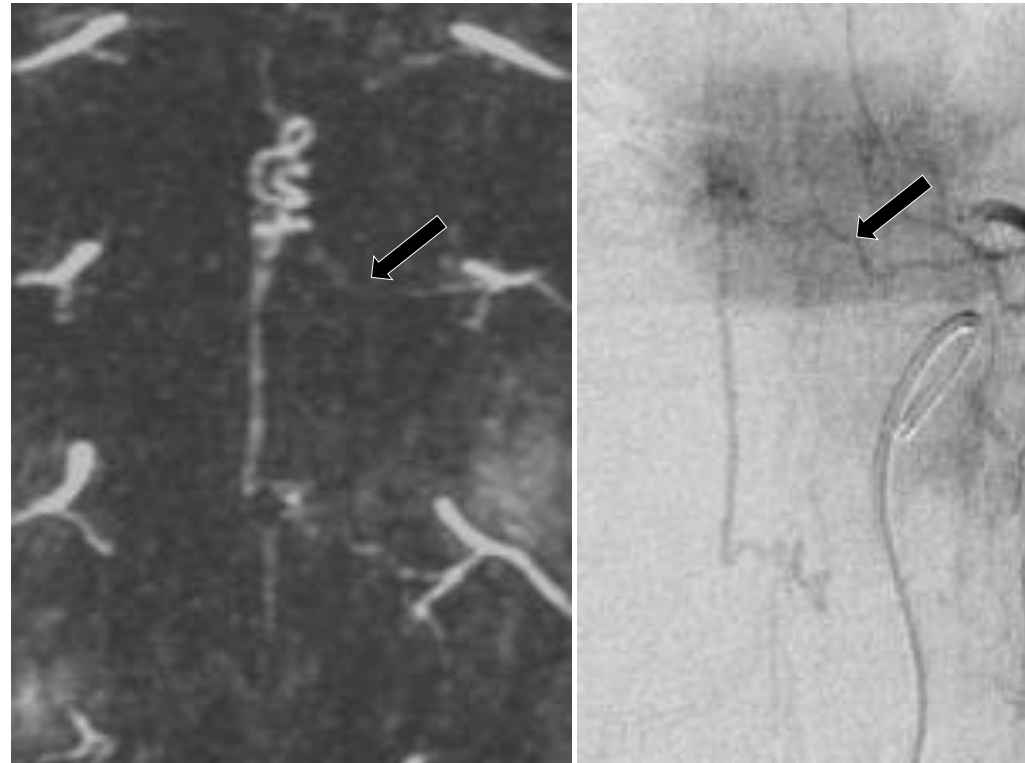
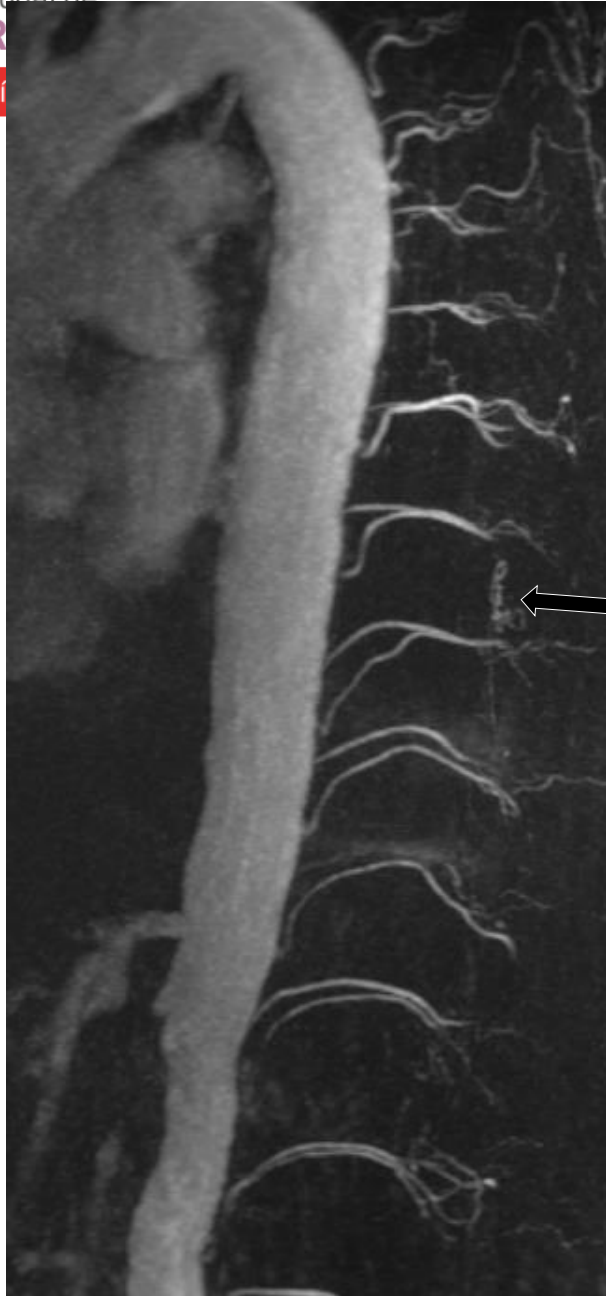


Fistula sin evidencia de vasos



RM típica pero sin clara alteración vascular





Fase arterial:

- Confirma lesión vascular
- Localiza el nivel de la fístula



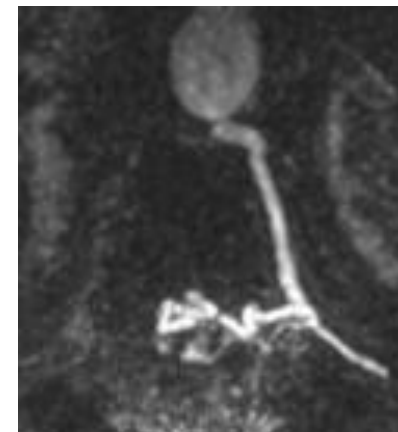
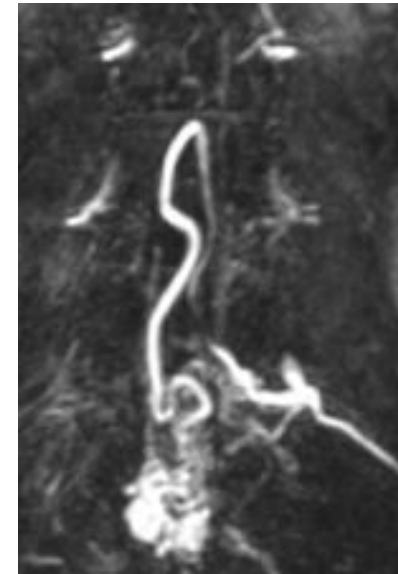
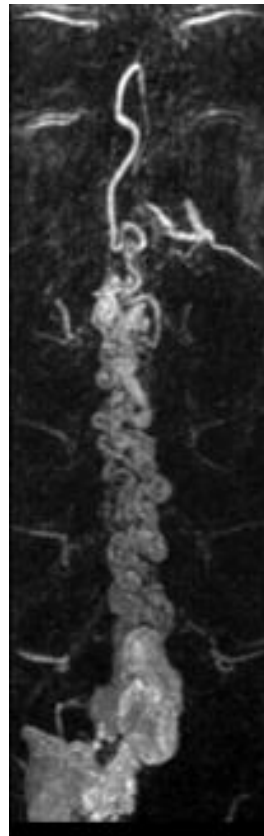
Utilidad de fases tardías

Permiten usar referencias anatómicas
para localizar el nivel



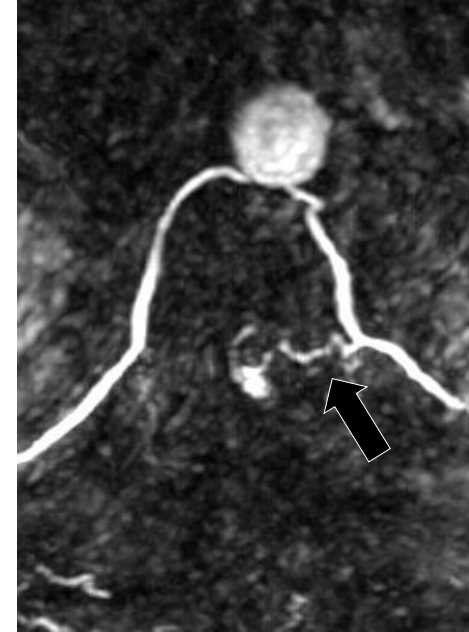
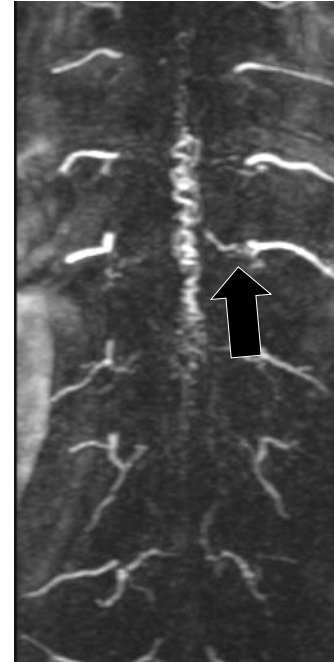
Angio-TC vs Angio-RM

- Mayor resolución espacial
- Menor resolución temporal
- Menos artefactos por movimiento
- Post-proceso más difícil



Malformación de alto flujo





Confirmación de sospecha en RM
Localización de la fístula (Rad-Med)
Optimiza la Arterio:
Menor radiación (50%)
Menor dosis de contraste (50%)



Difusión Isotrópica

Cortes sag/axial

Imagen Paralela

Bajo valor b (500-800)

Limitaciones

T2-shinining: valorar ADC siempre

Susceptibilidad/Distorsión

Movimiento

Pulsación

Respiración

Semiología particular?

Aplicaciones

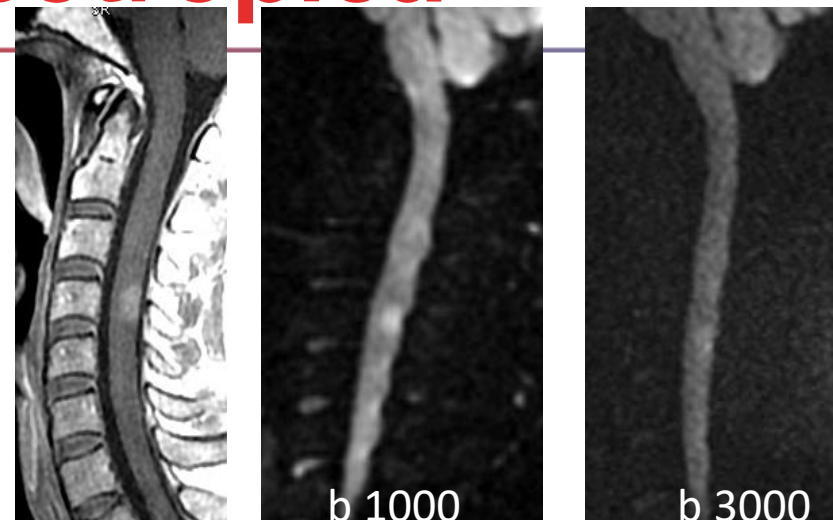
Detección de lesión aguda

DDx? (Inflamación-Isquemia-Tumor)

Lesión no visible en T2

Trauma

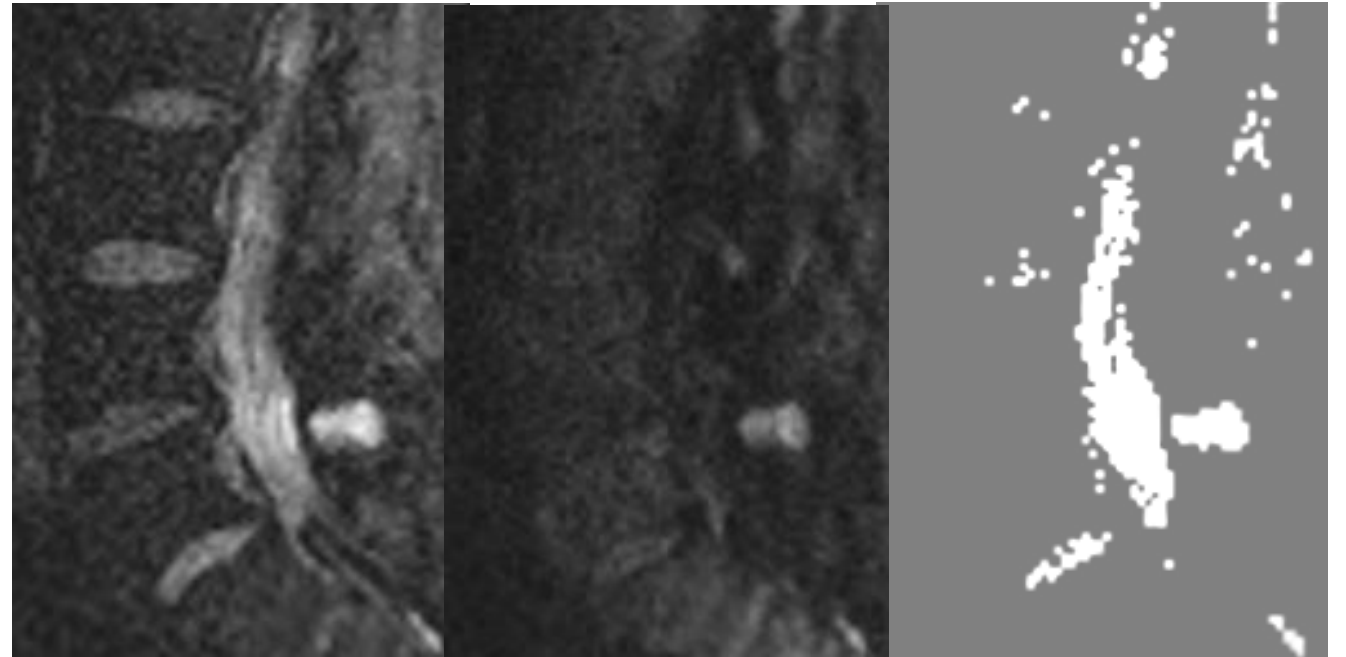
Mielopatía espondilótica?



Con valores b altos hay poca SNR y disminuye la sensibilidad en lesiones pequeñas



Influencia del valor b



b 0

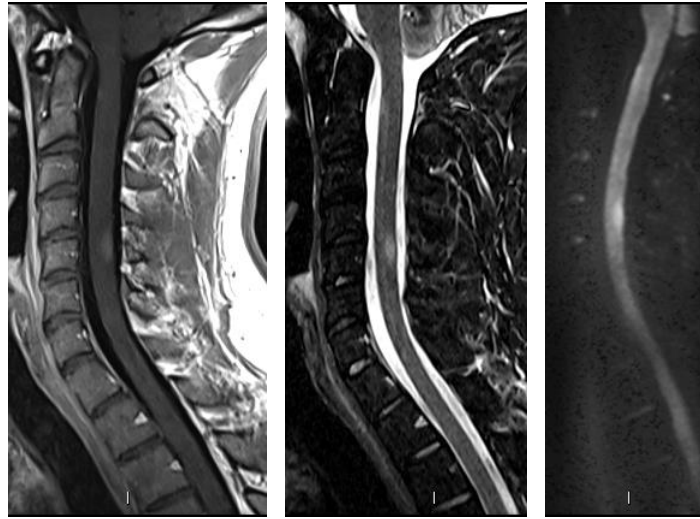
b 800

ADC

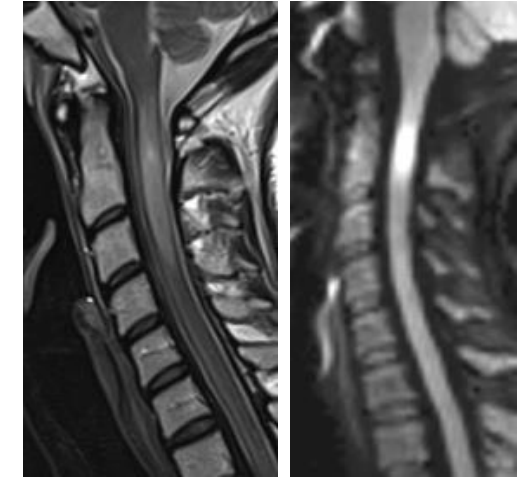


Lesiones agudas

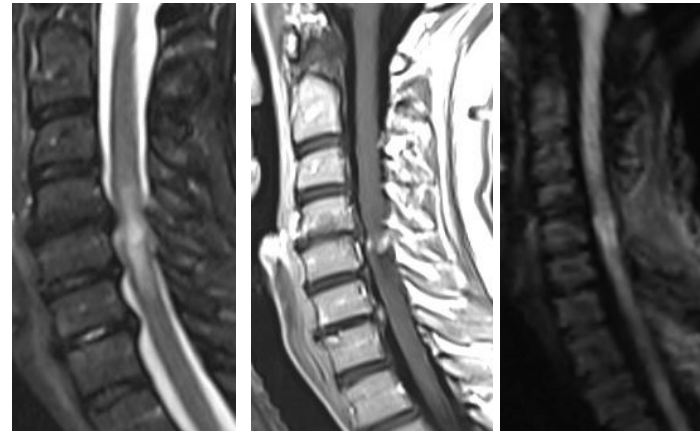
- Infarto
- Traumatismo
- Placa aguda
- Mielitis
- Absceso



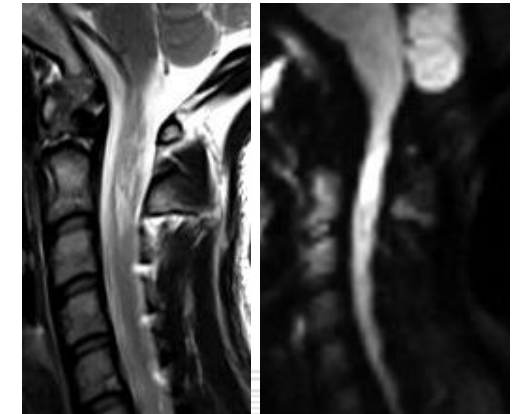
EM



NMO



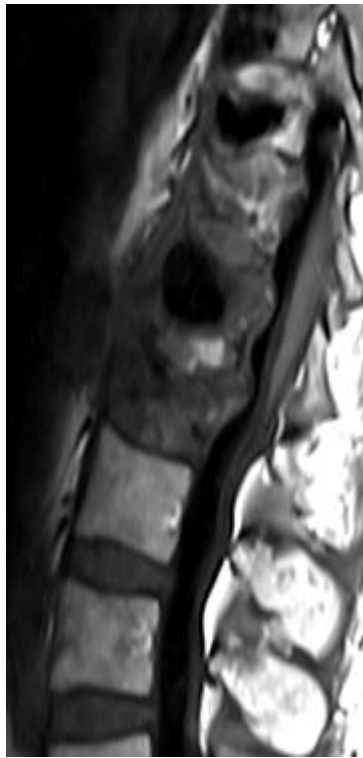
Mielopatía Compresiva



Infarto



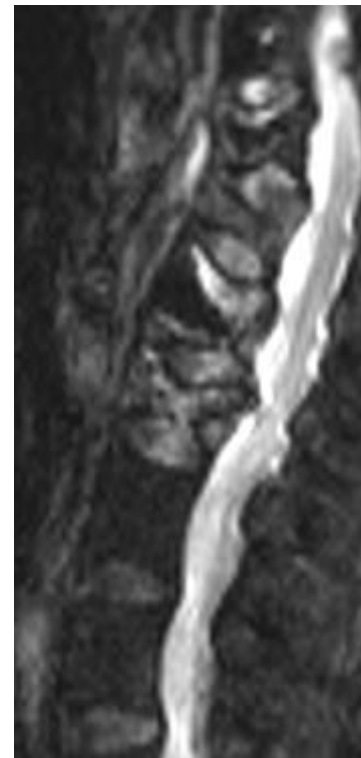
Fractura difusión



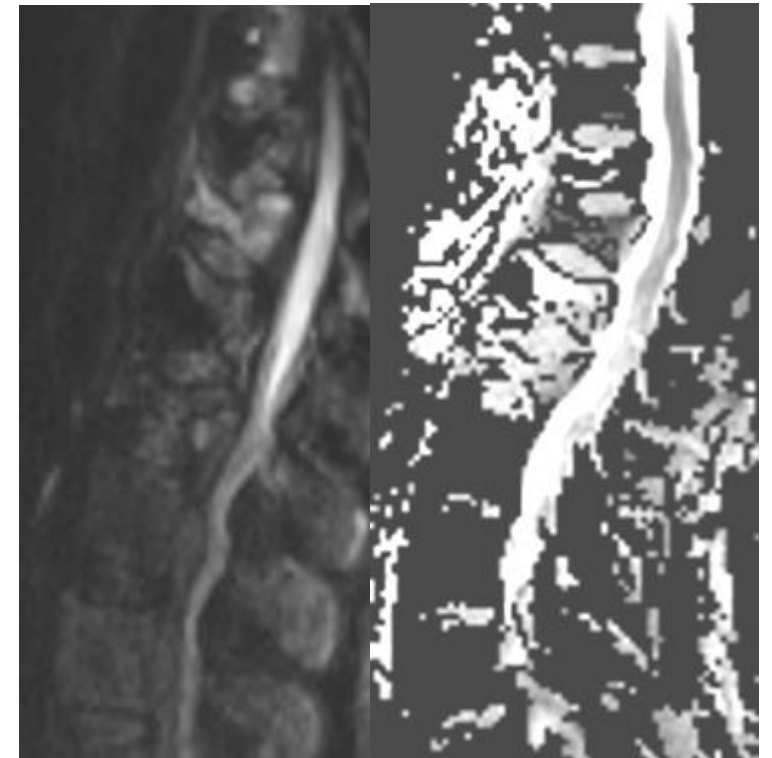
T1



STIR



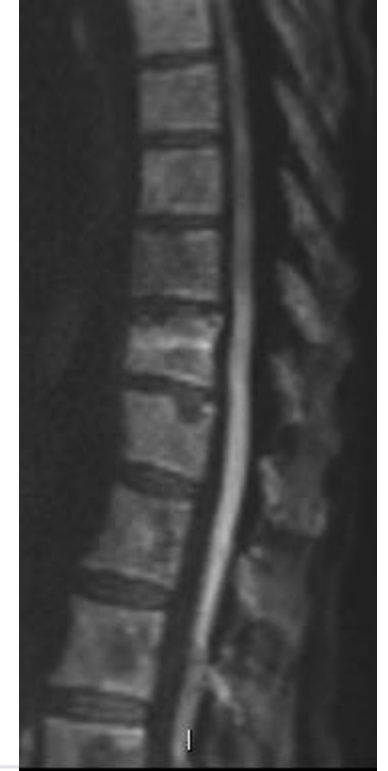
b 0



b 800

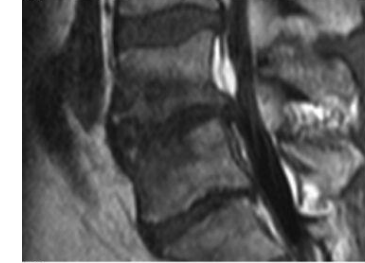
ADC



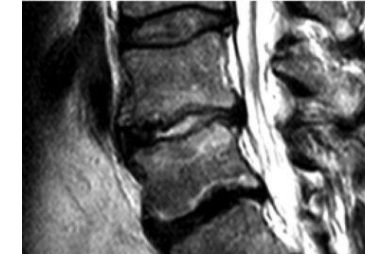




Degeneration
T1



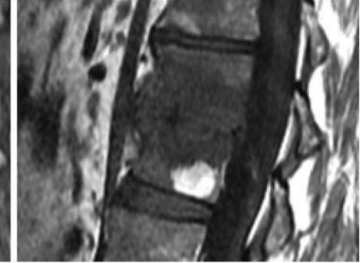
T2



DWI



Infection
T1



T2

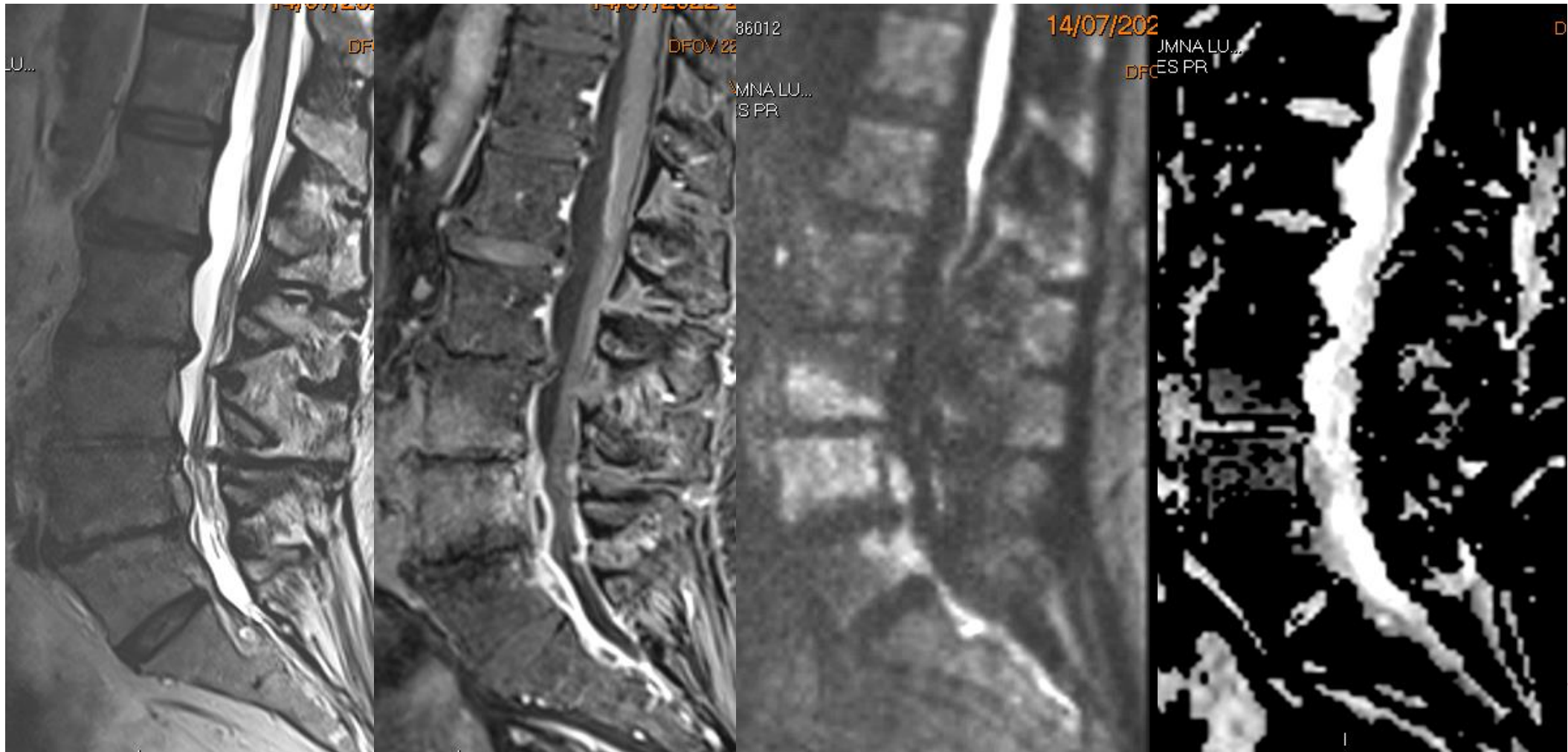


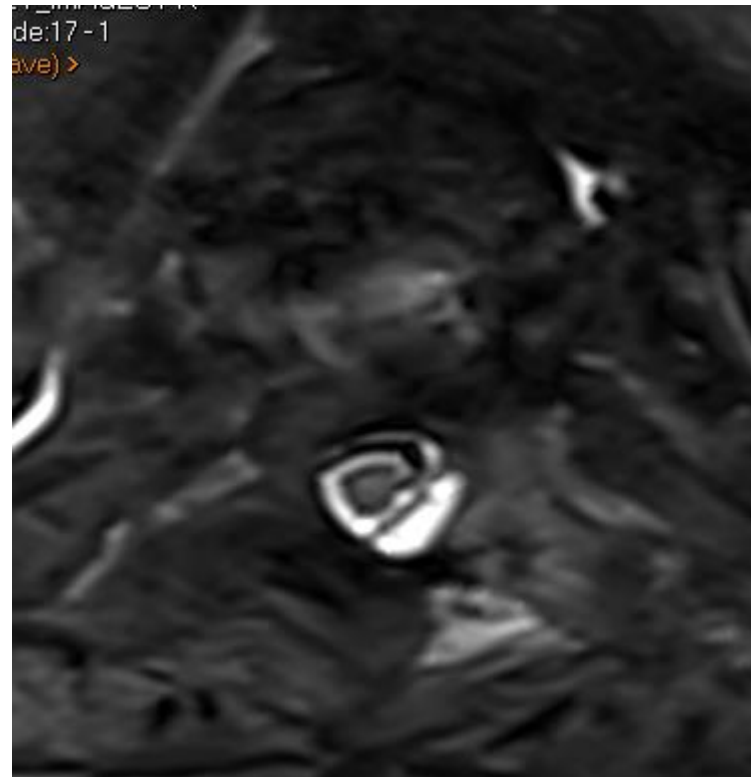
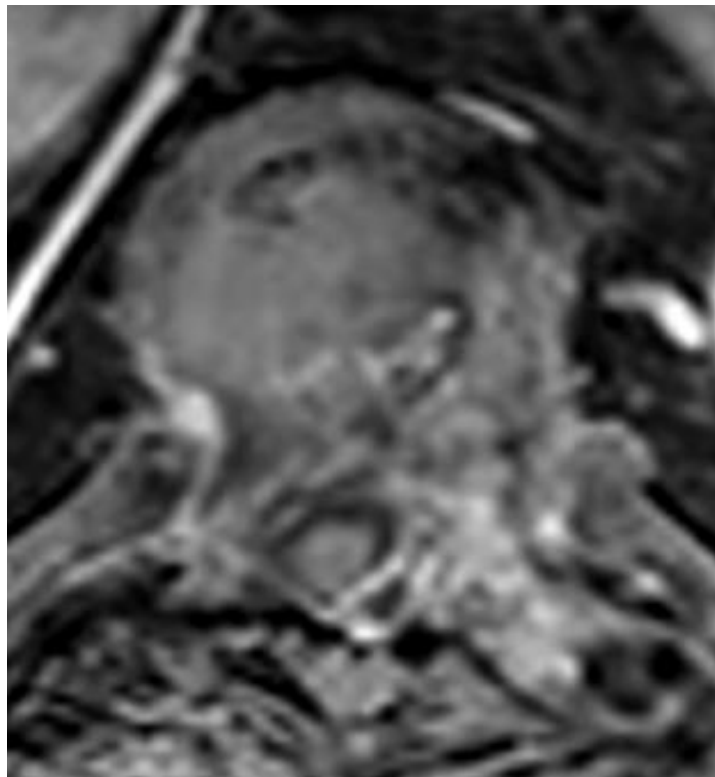
DWI



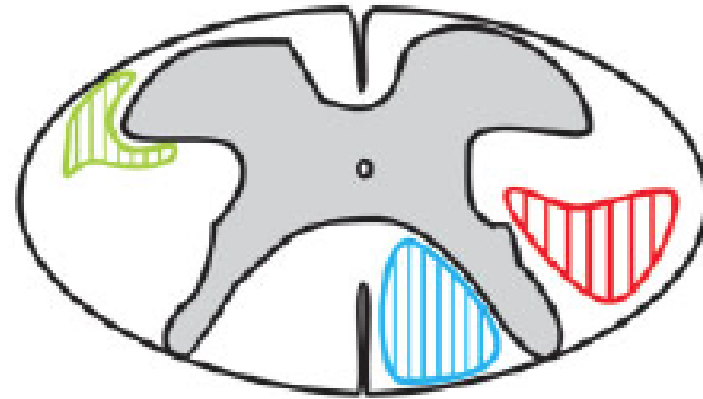
Diffusion-weighted MRI "claw sign" improves differentiation of infectious from degenerative modic type 1 signal changes of the spine
AJNR 2014




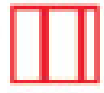
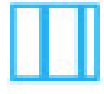


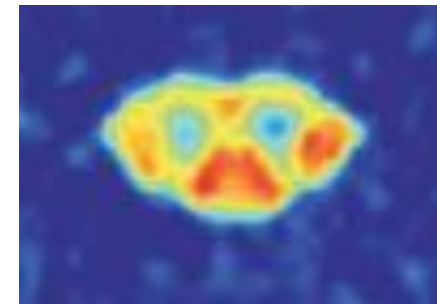
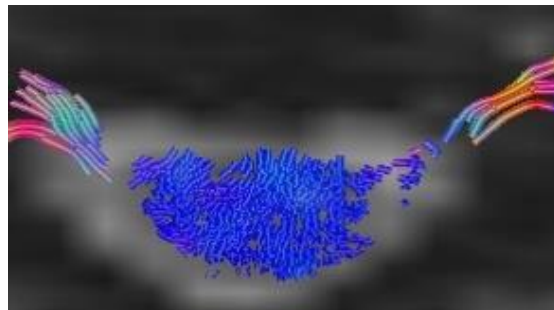


Tensor de Difusión



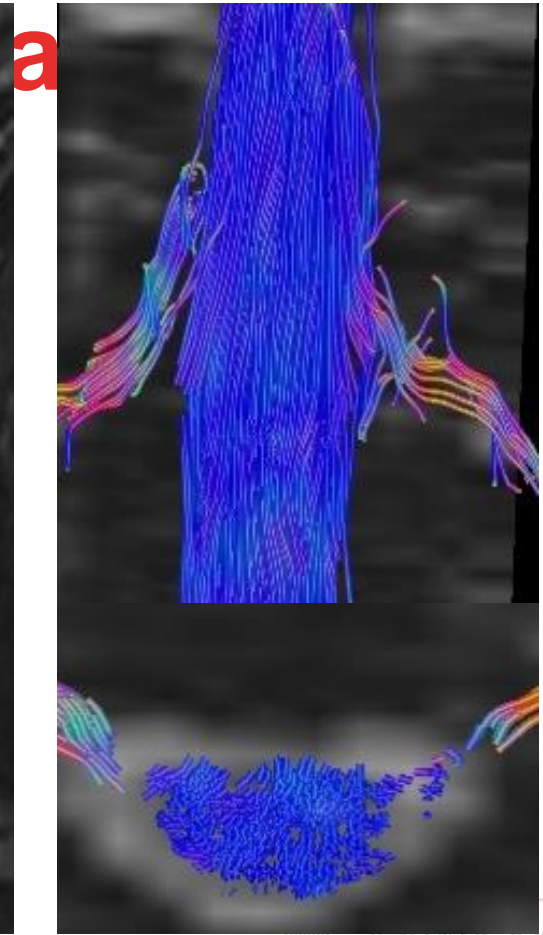
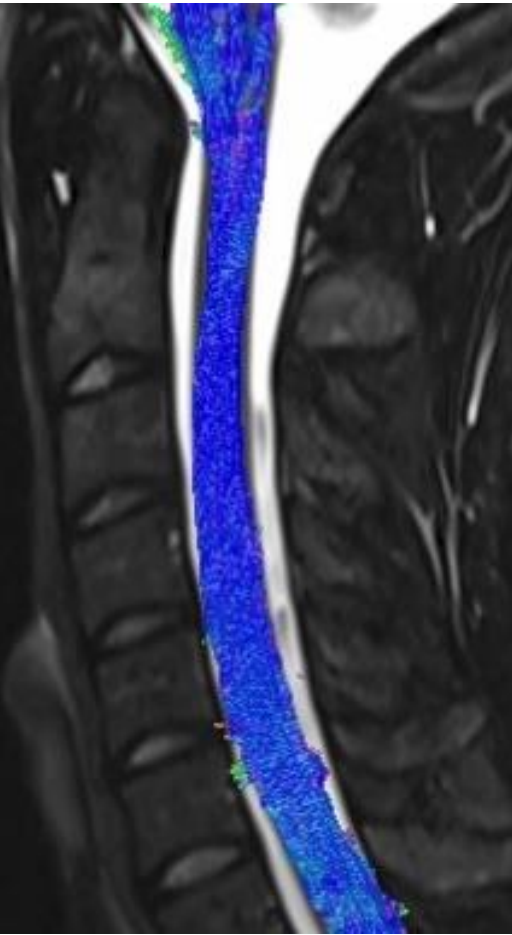
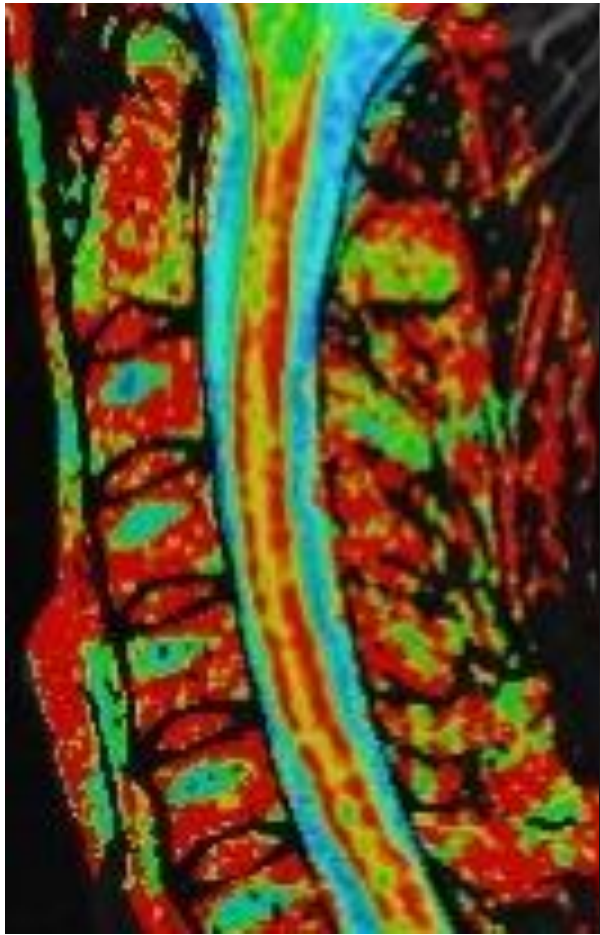
1 mm

-  Lateral spino-thalamic tract
(sensory ascending tracts)
-  Lateral cortico-spinal tract
(motor descending tracts)
-  Dorsal funicoli
(sensory ascending tracts)

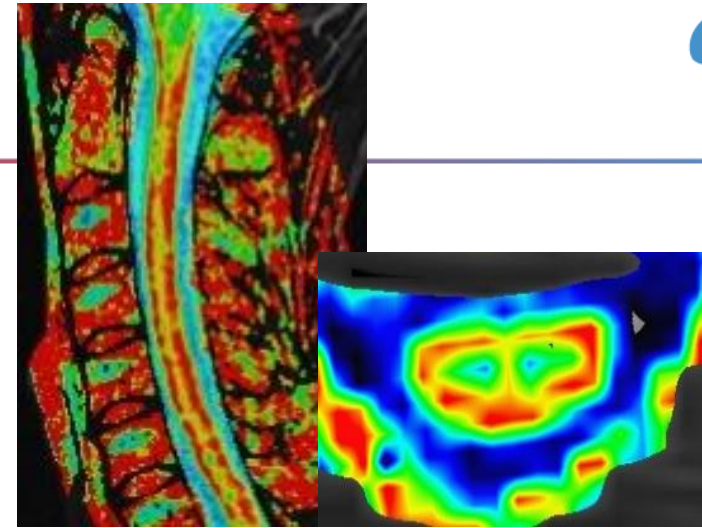
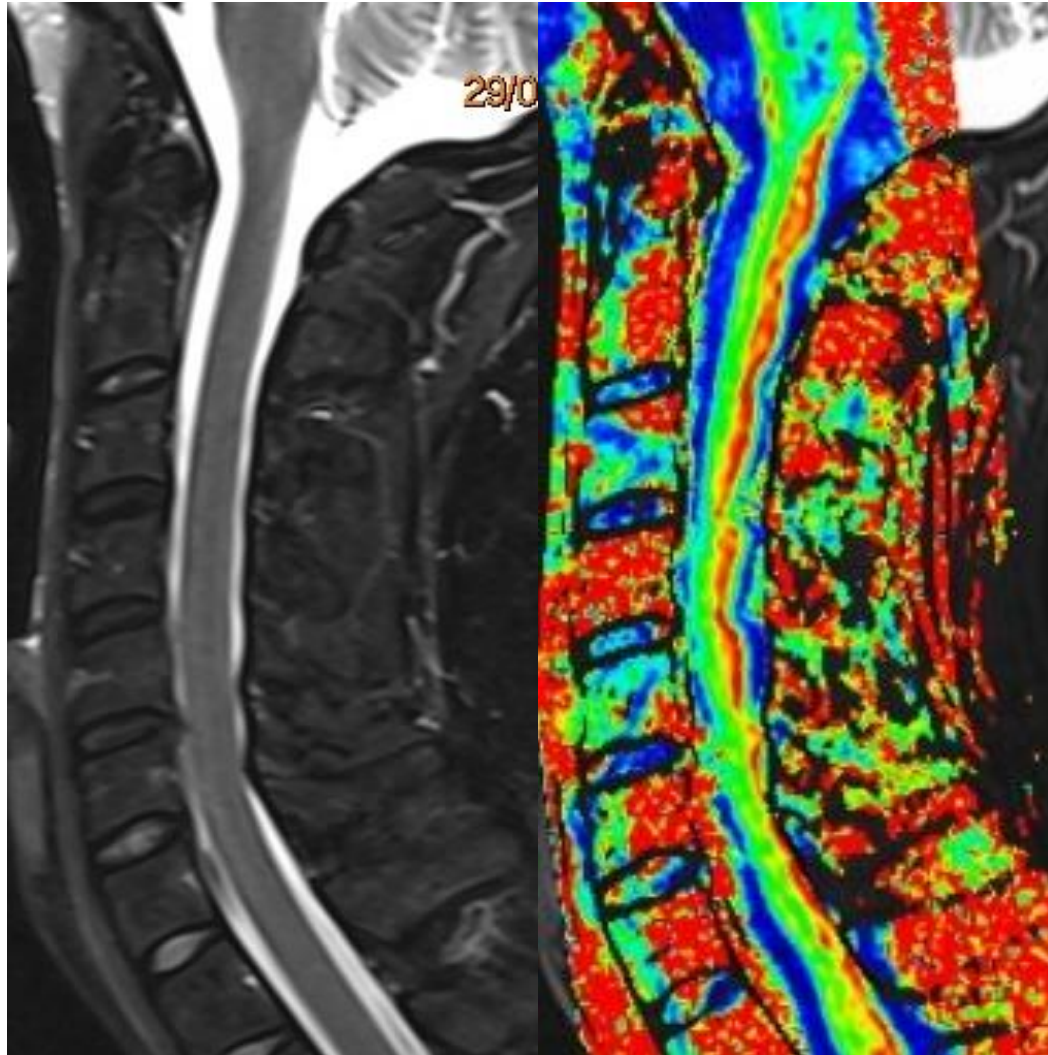


La AF puede detectar lesiones no visibles con otras técnicas
Actualmente no hay aplicaciones clínicas definidas

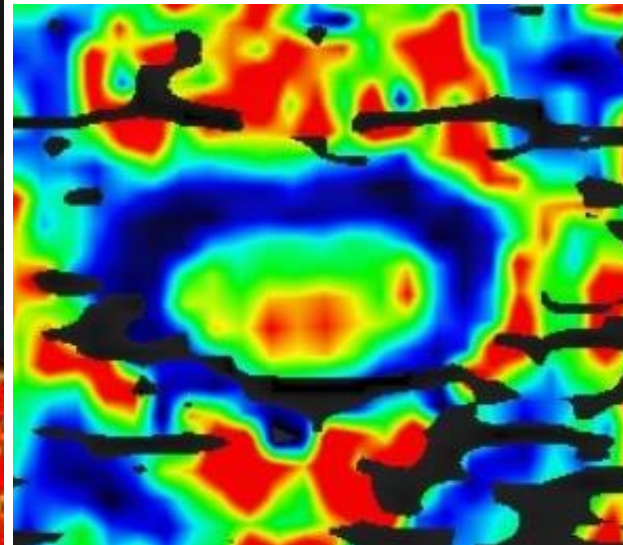




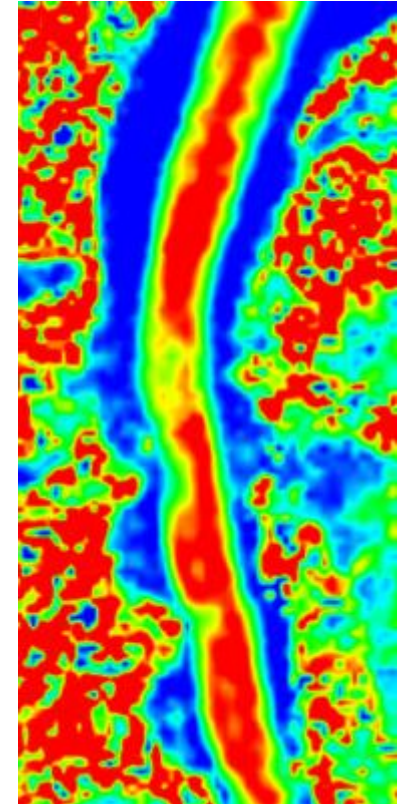
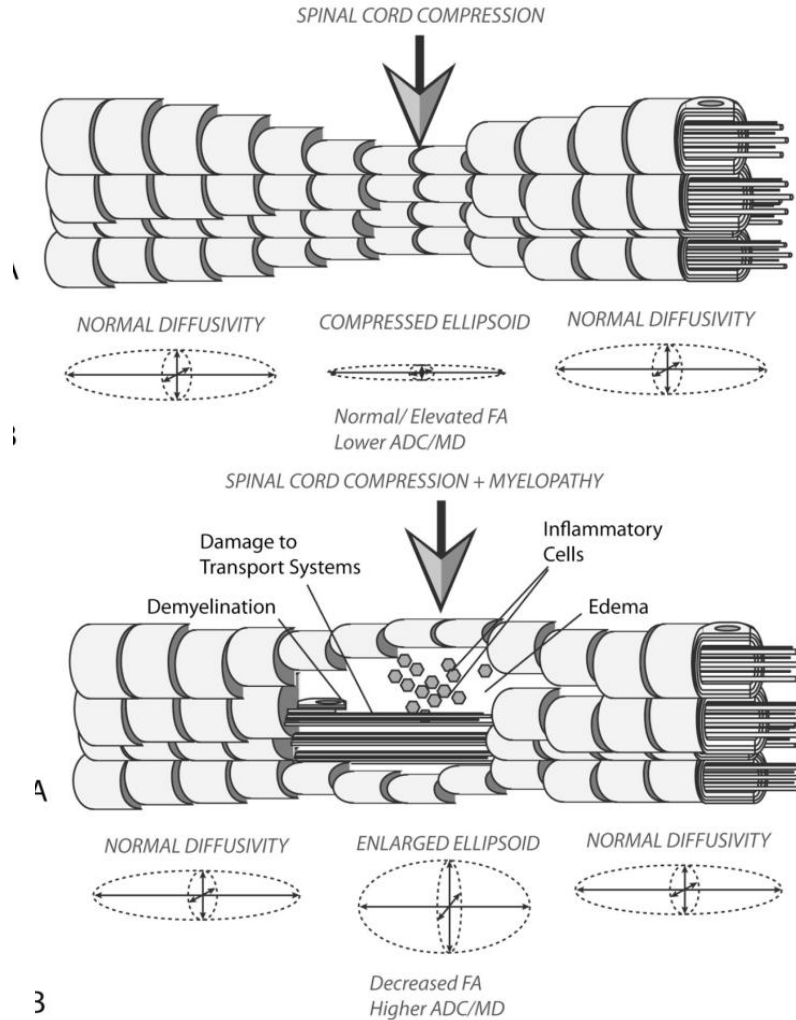
ELA



Control año



Mielopatía compresiva

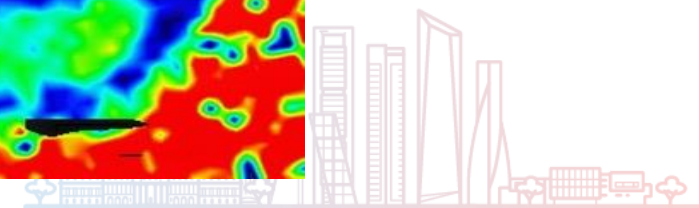
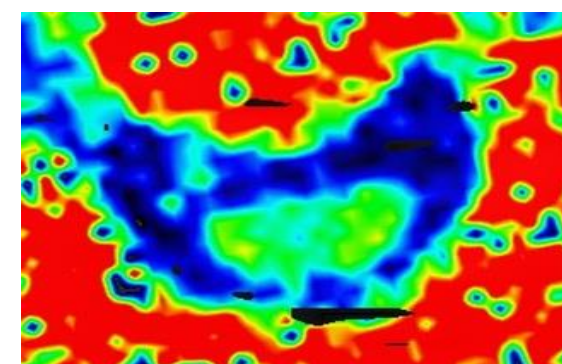
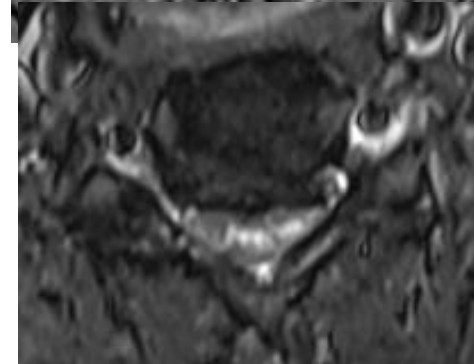
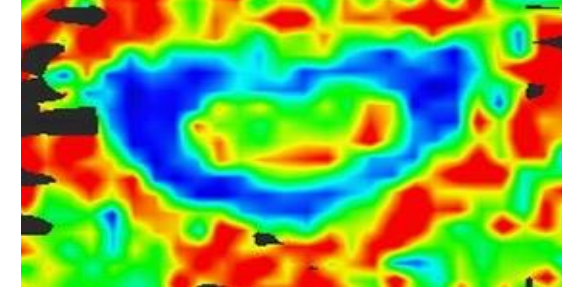
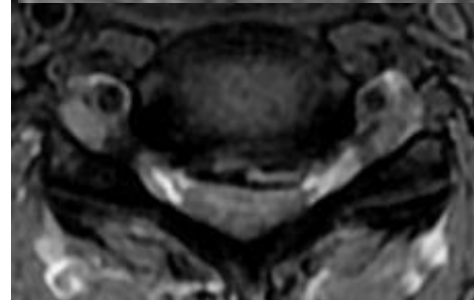
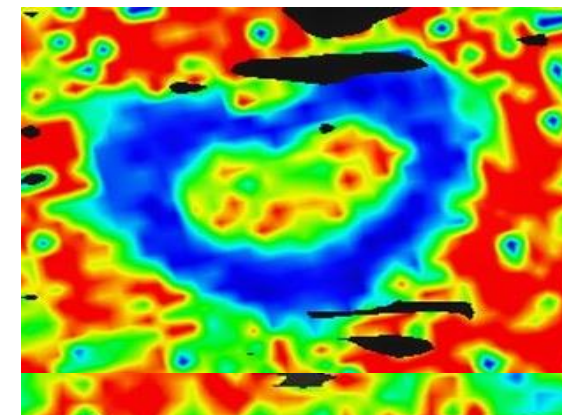
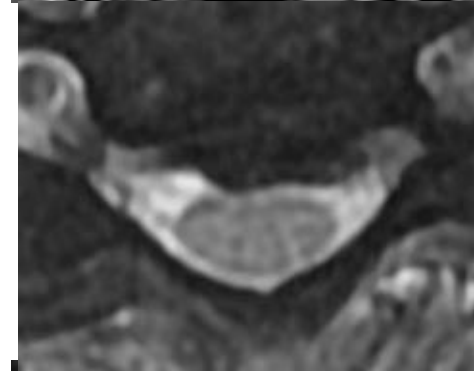
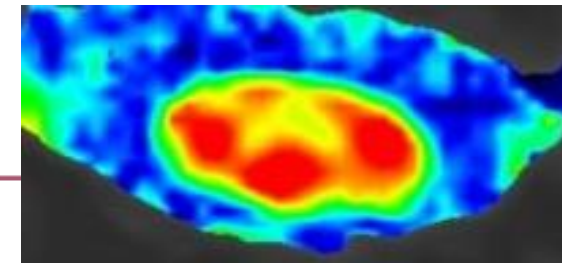
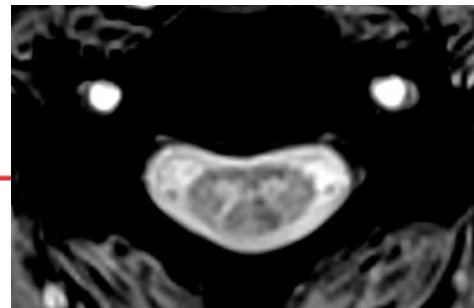


La anisotropía detecta mielopatía precoz, sin alteración de señal
Cuando hay alteración de señal en T1/T2, el pronóstico postQ es peor

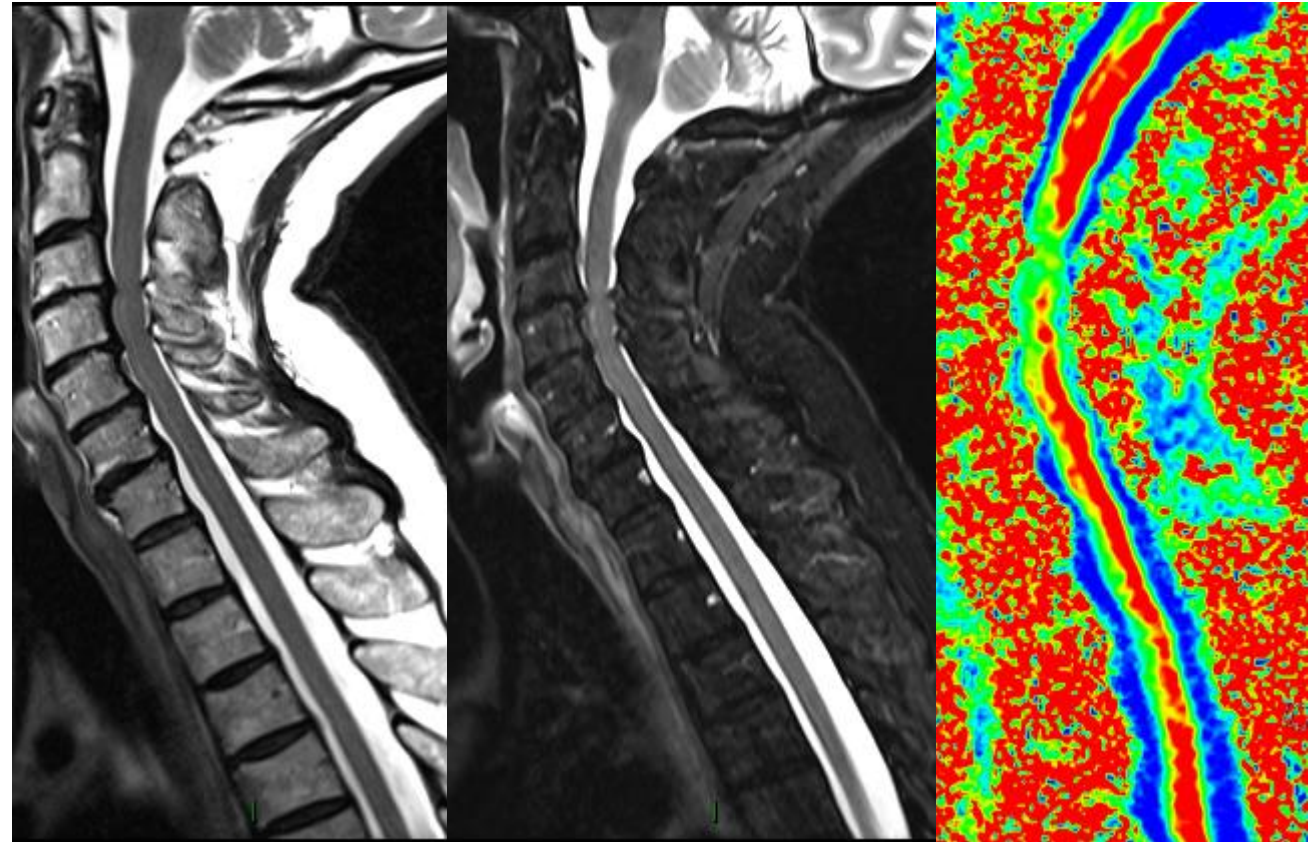
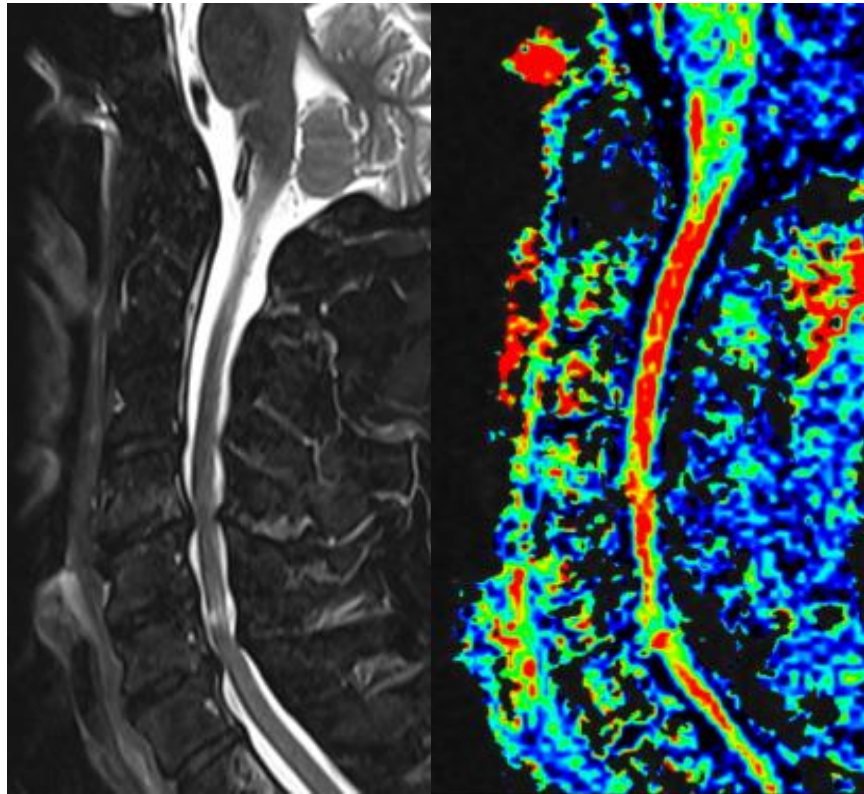


Los mapas de AF pueden servir
para estratificar pacientes de cara
a cirugía

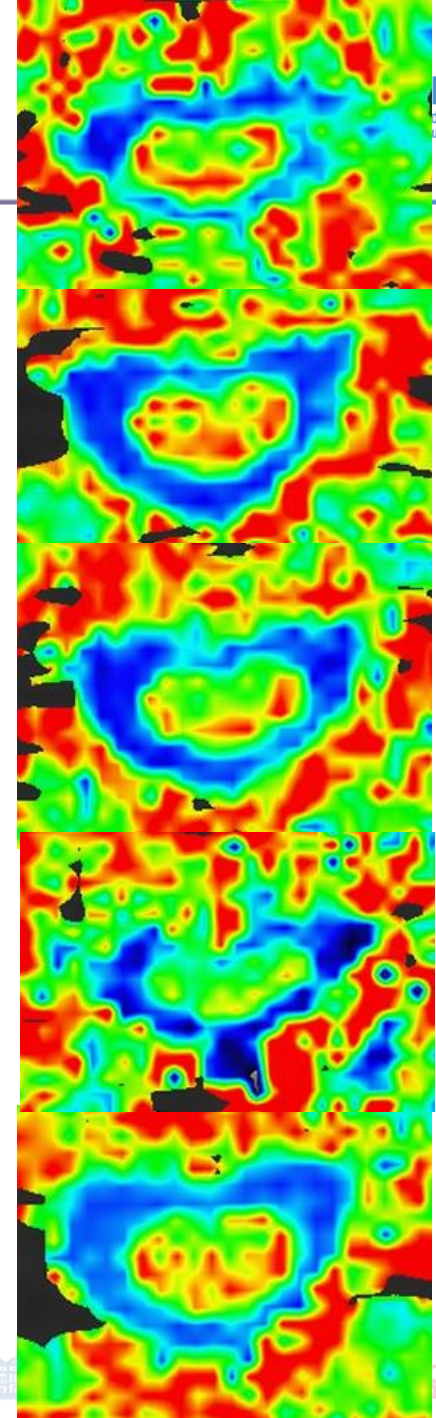
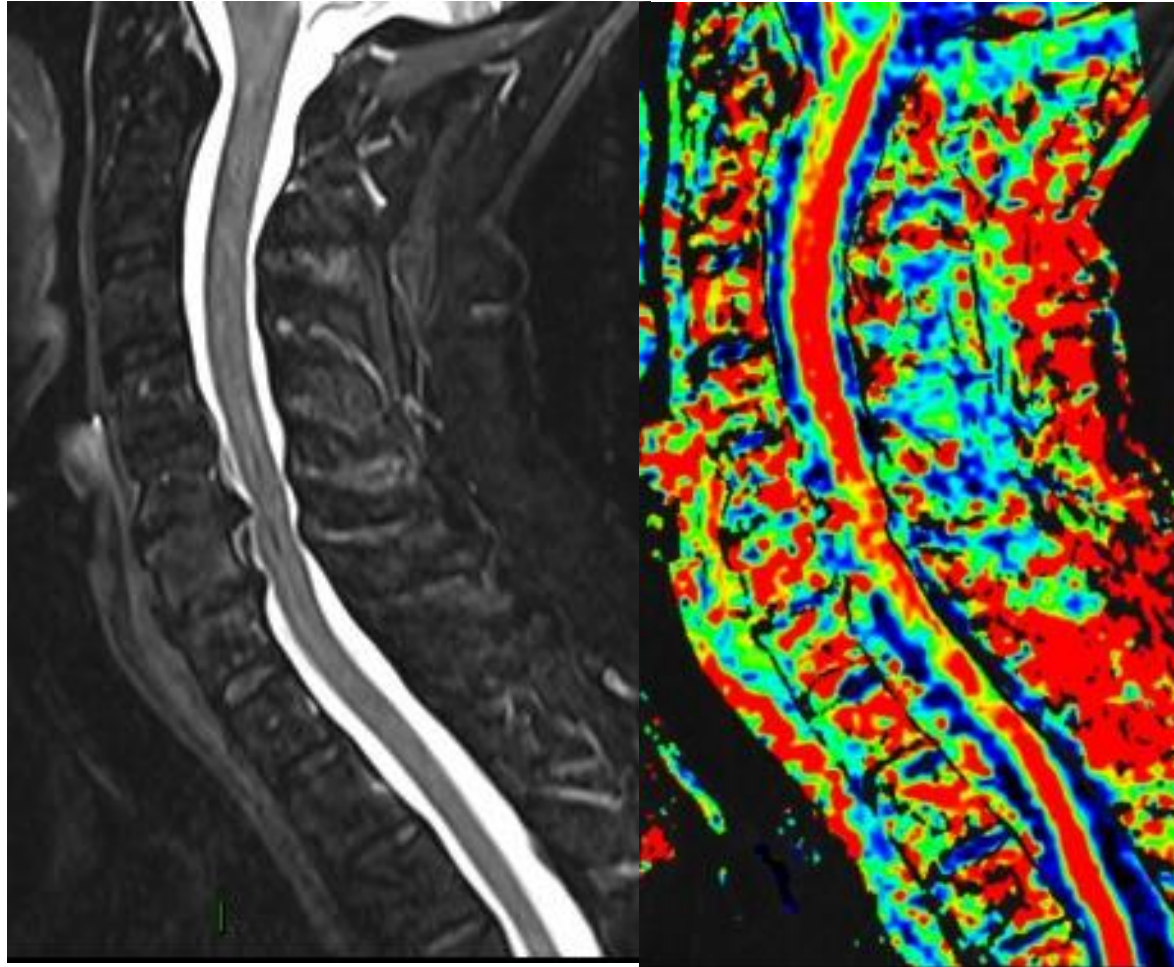
La correlación con la clínica y
potenciales es mejor con la AF
que con el grado de estenosis



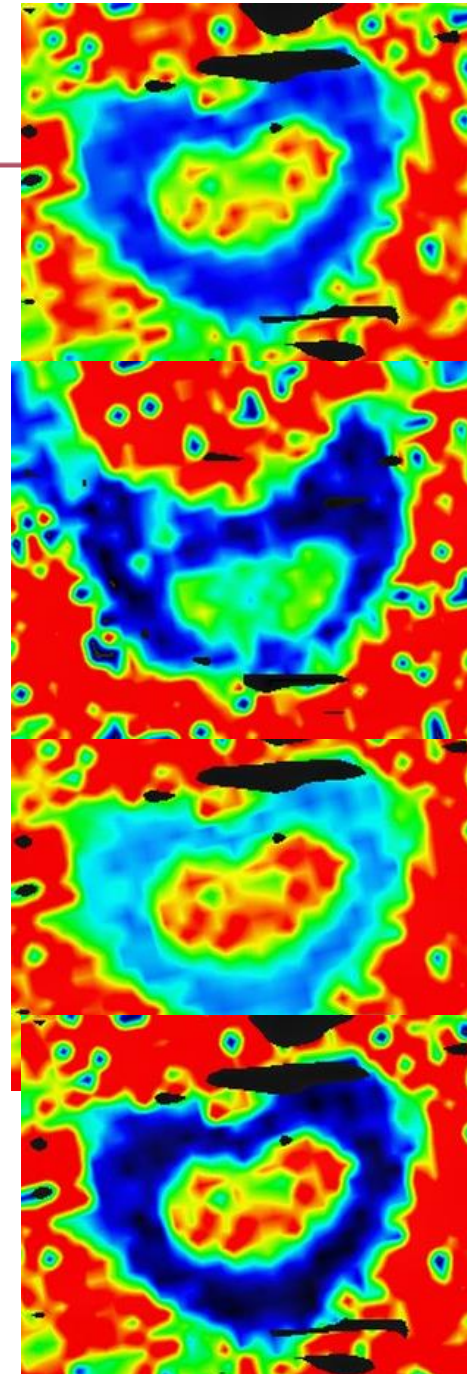
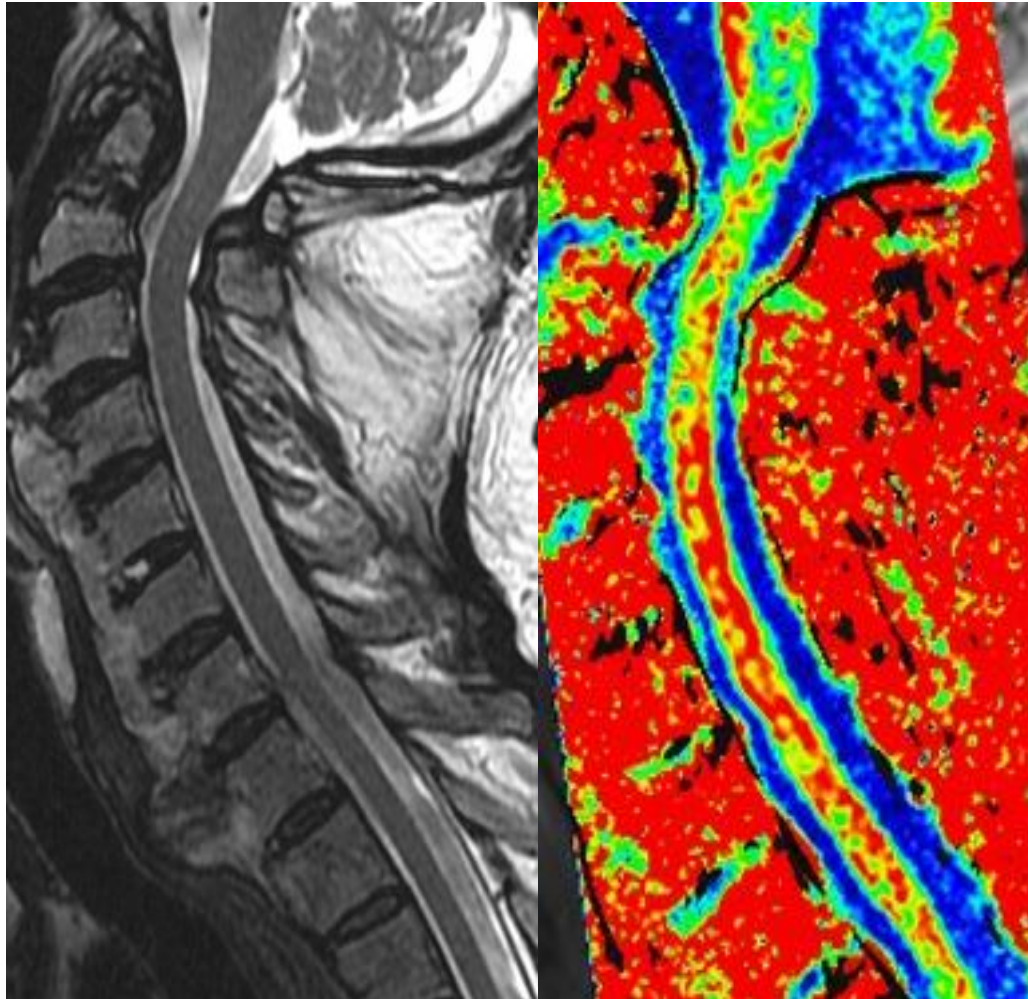
Mielopatía con cambios en T2



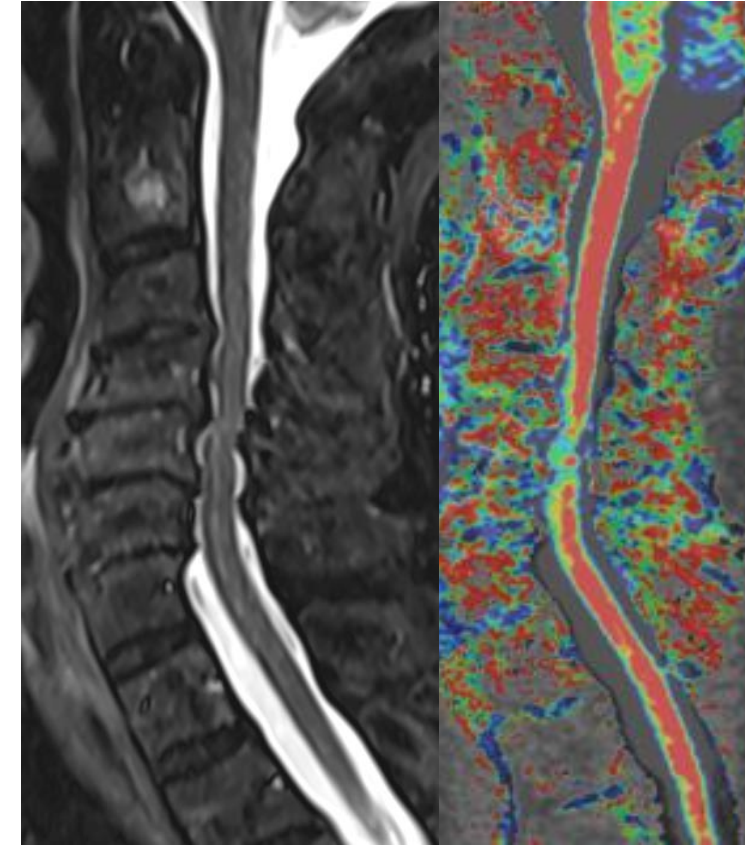
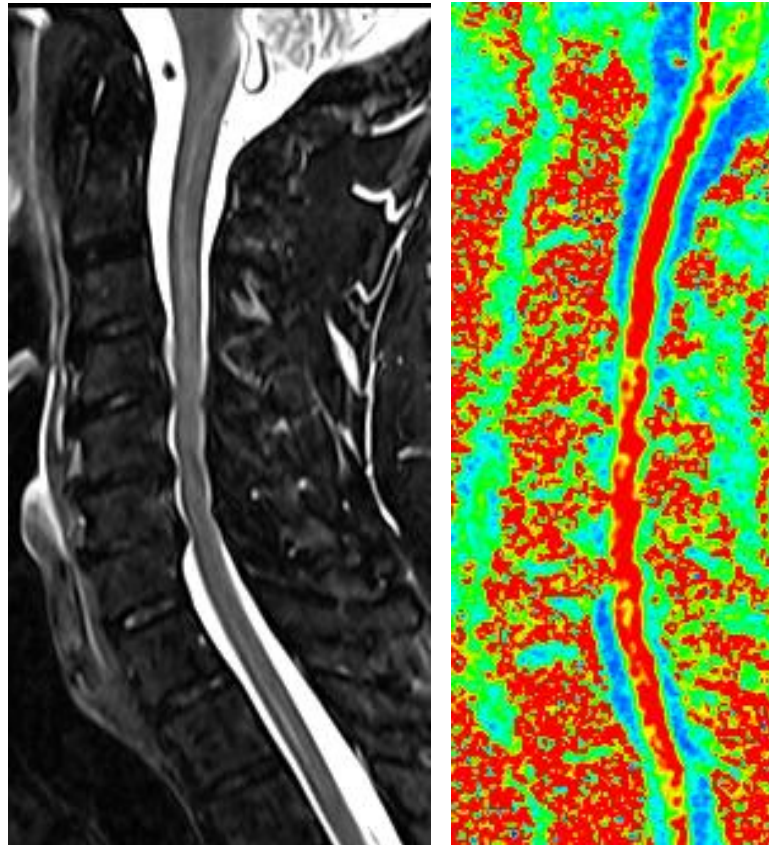
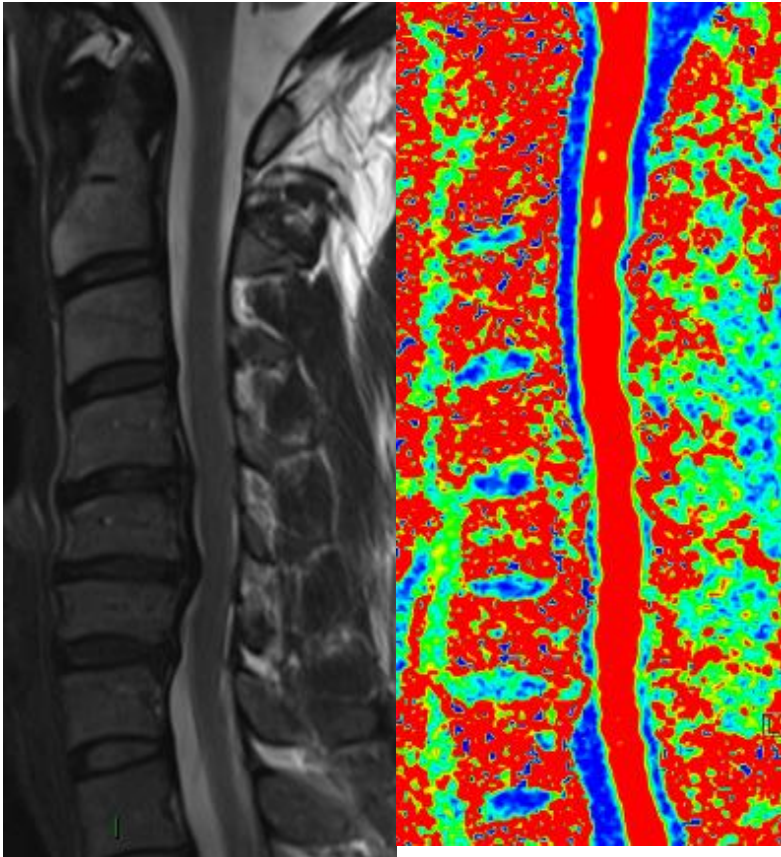
Mielopatía sin alteración de señal



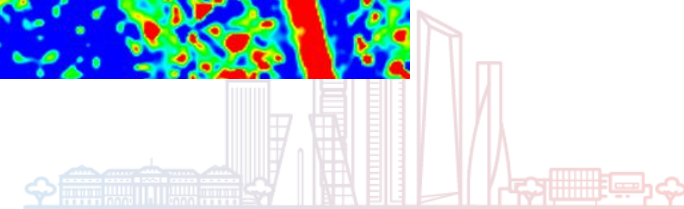
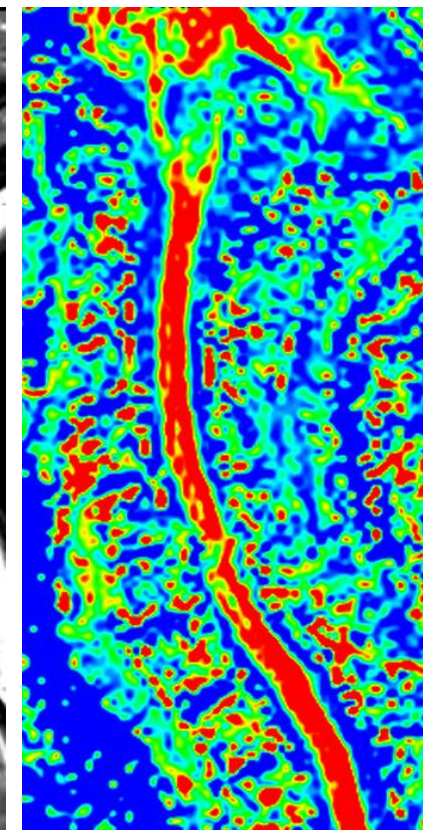
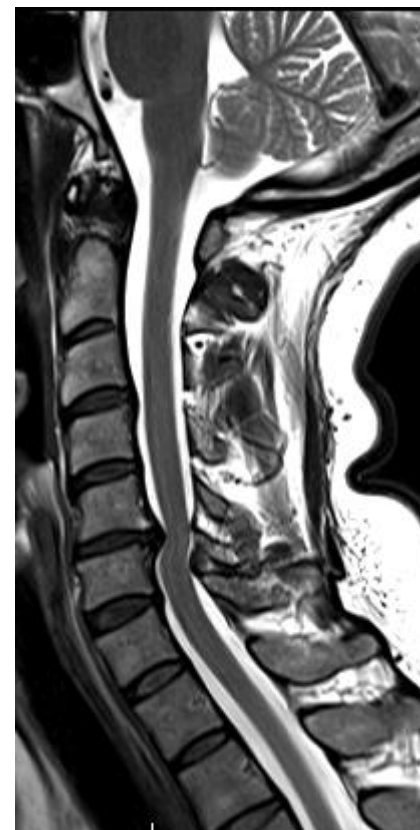
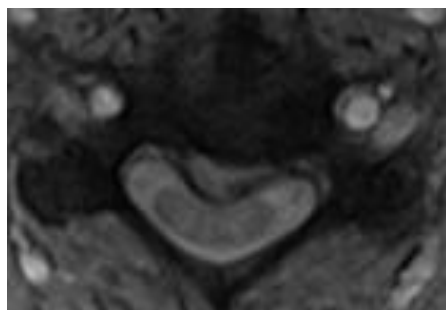
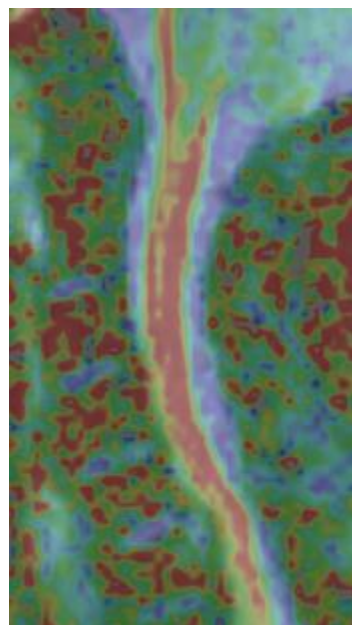
Pseudoartrosis Ap. odontoides

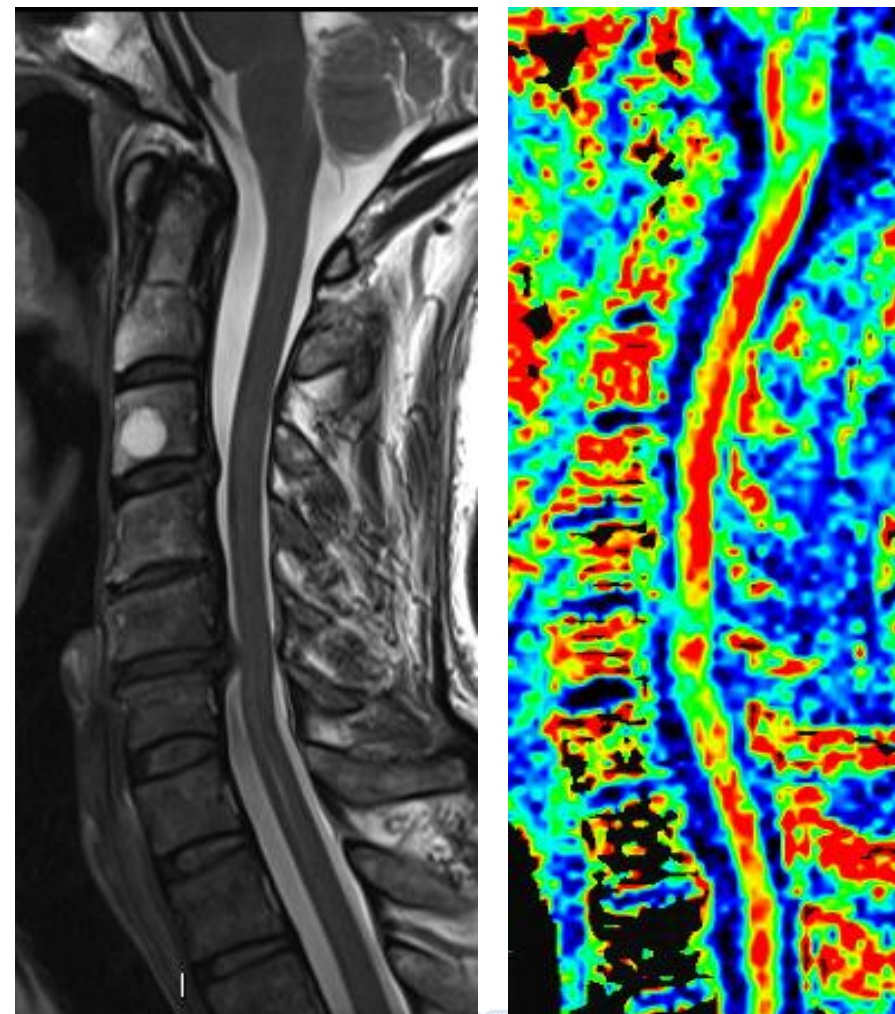
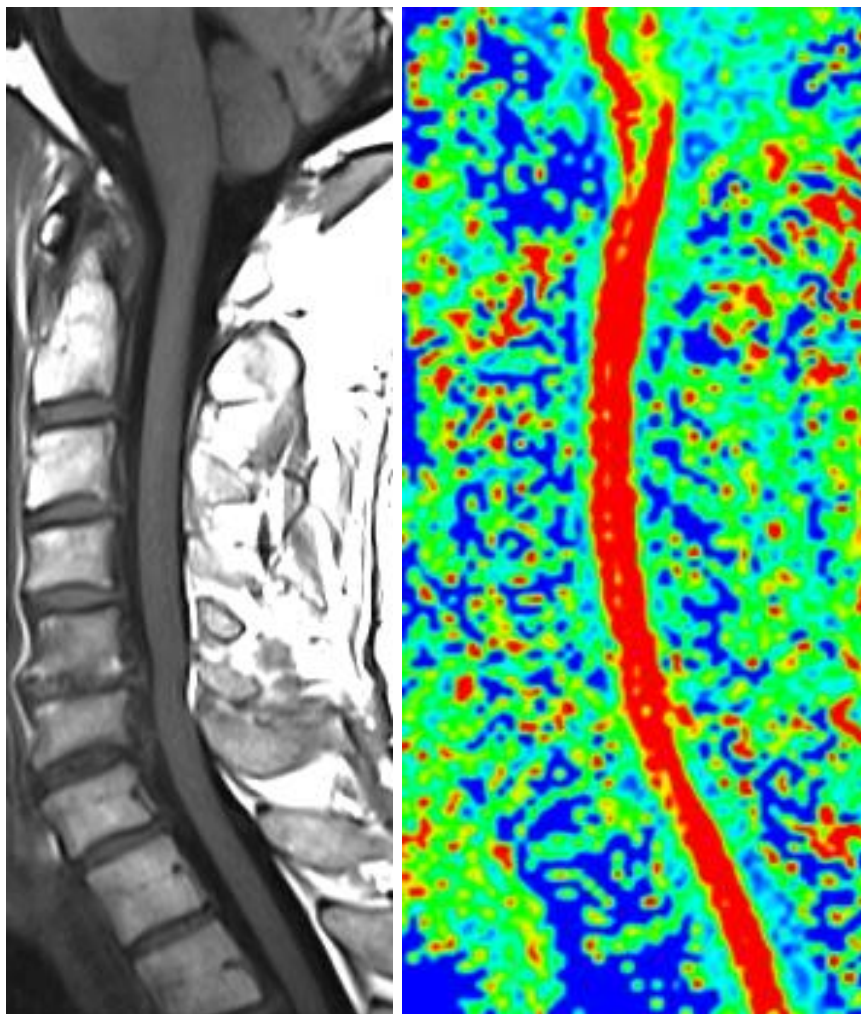


Estenosis sin/con mielopatía

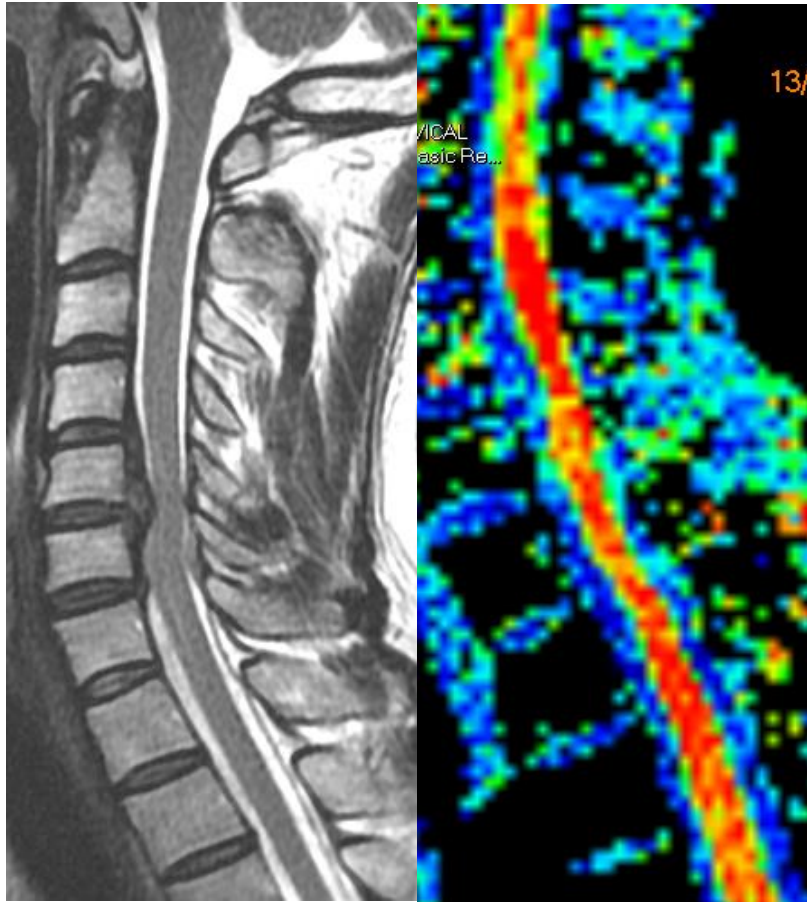


Compresión sin/con mielopatía

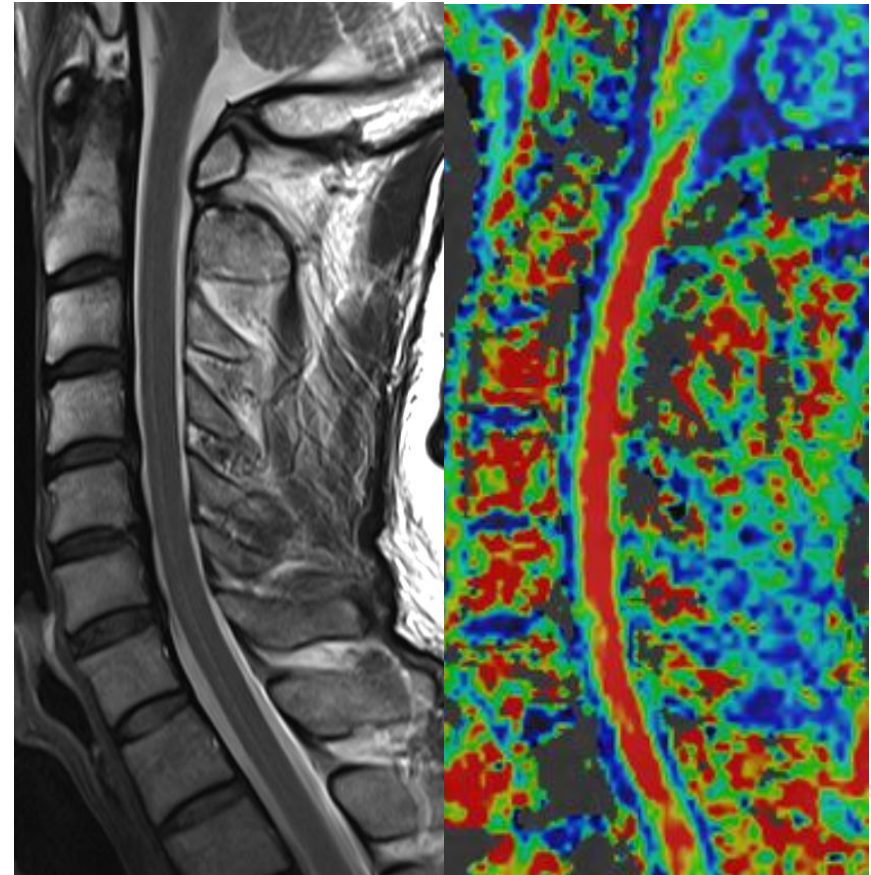




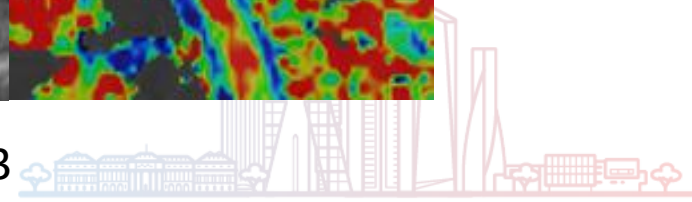
Estenosis sin mielopatía: evolución



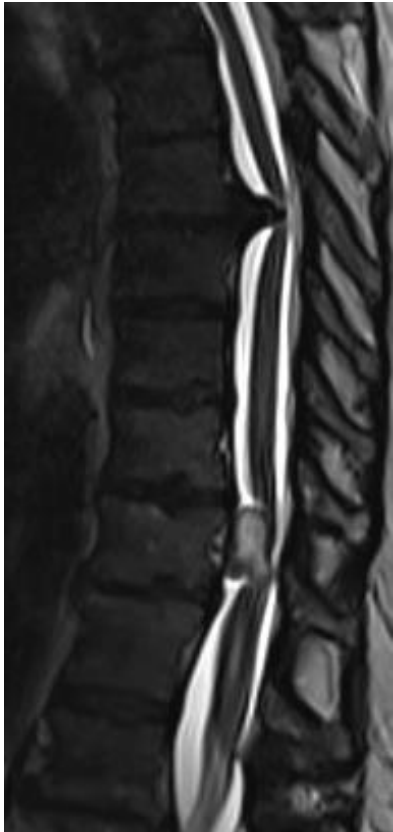
2016



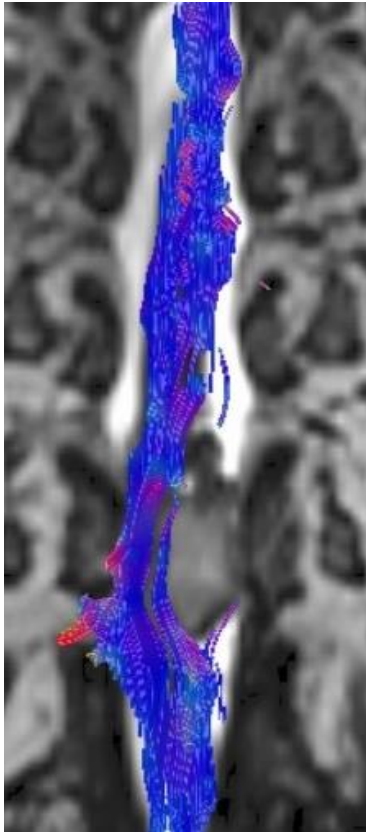
2023



Tractografía

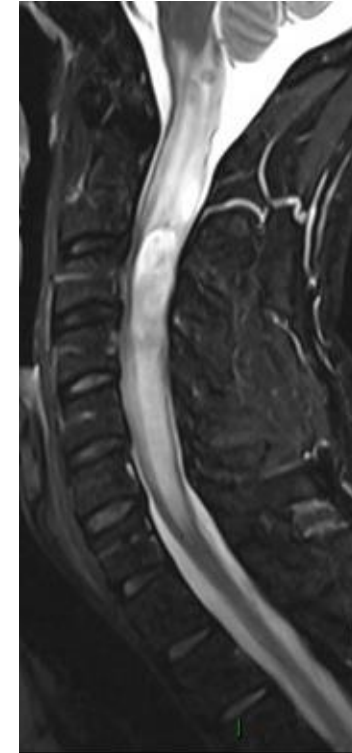


Meningioma



Glioma (infiltrante)

Complemento de la RM estructural para
caracterización/localización prequirúrgica



Ependimoma (no infiltrante)

