

# Reunión Anual SOCIEDAD ESPAÑOLA DE **NEURORRADIOLOGÍA**

20 - 22 de octubre de 2022

**ZARAGOZA**

Sede: Cámara de Comercio



## **Infiltración de Médula Ósea en RM: Diagnóstico y Cambios Post-tratamiento**

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# MENU

- Introducción
- Médula ósea
- Señal RM médula ósea – secuencias -
- Análisis MO
- Fisiológico: **reconversión**
- Patológico:
  - Reemplazamiento (M1)
  - Proliferación (MM)
  - Edema
- Monitorización



# INTRODUCCIÓN

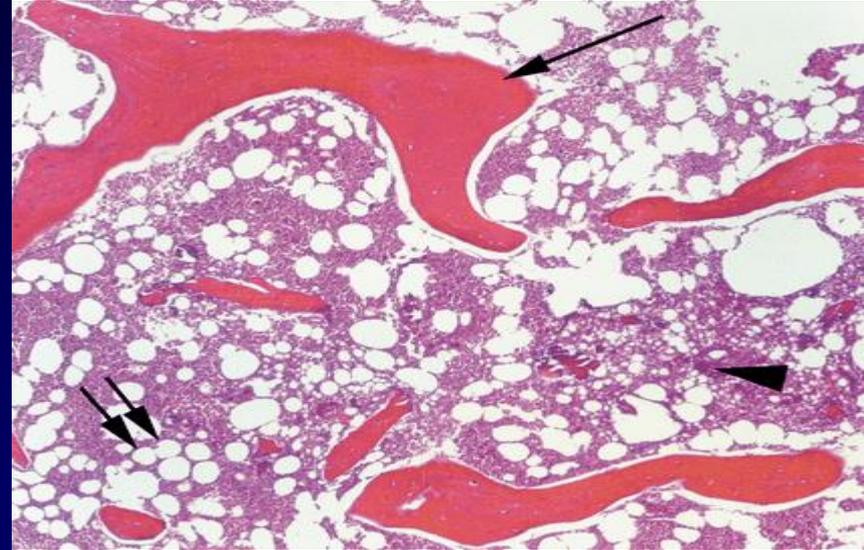
- Órgano dinámico variable agua/grasa
  - Individual (fisiología)
  - Tiempo (edad)
- Radiólogo debe entender:
  - MO normal fisiológica en relación a la edad
  - MO patológica: Dx y Tx
- Error → FP → sobreDx → sobre Tx
- RM técnica de elección
- Cambios fisiológicos vs cambios patológicos
  - Múltiples Secuencias (T1, T2, sup grasa T2, Ffase (Dixon), DWI)

# MÉDULA ÓSEA

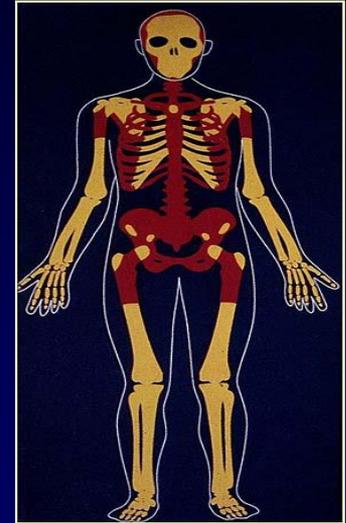
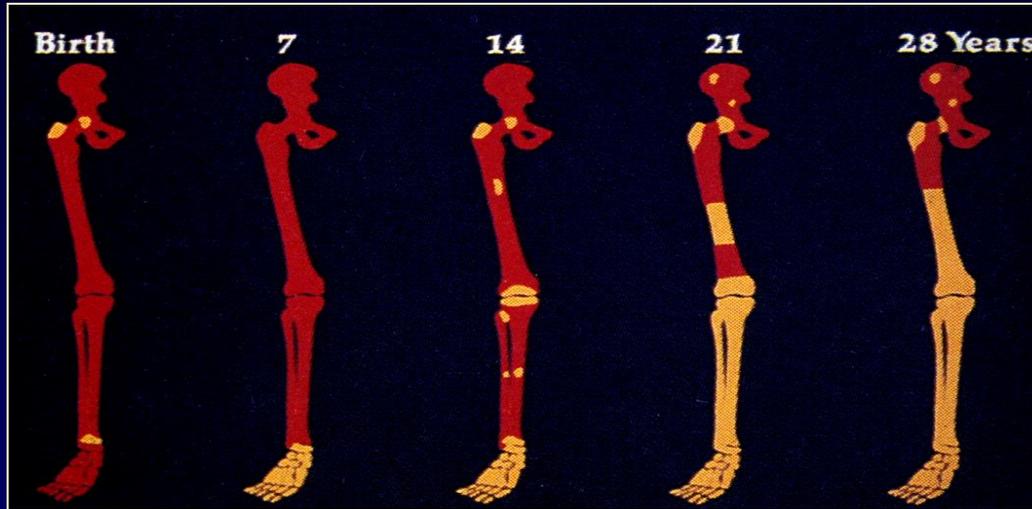
- Producción elementos sangre

## COMPOSICIÓN

- Hueso trabecular
- Tejido fibroso reticular
- Cels – AGUA -
  - Cels. Madre
  - Eritrocitos
  - Mieloide
  - Megacariocitos
- Adipocitos – GRASA -



- **Médula roja: hematopoyética – Cels sangre (40% agua)**
- **Médula grasa (Amarilla): no hematopoyética – grasa- (80%)**

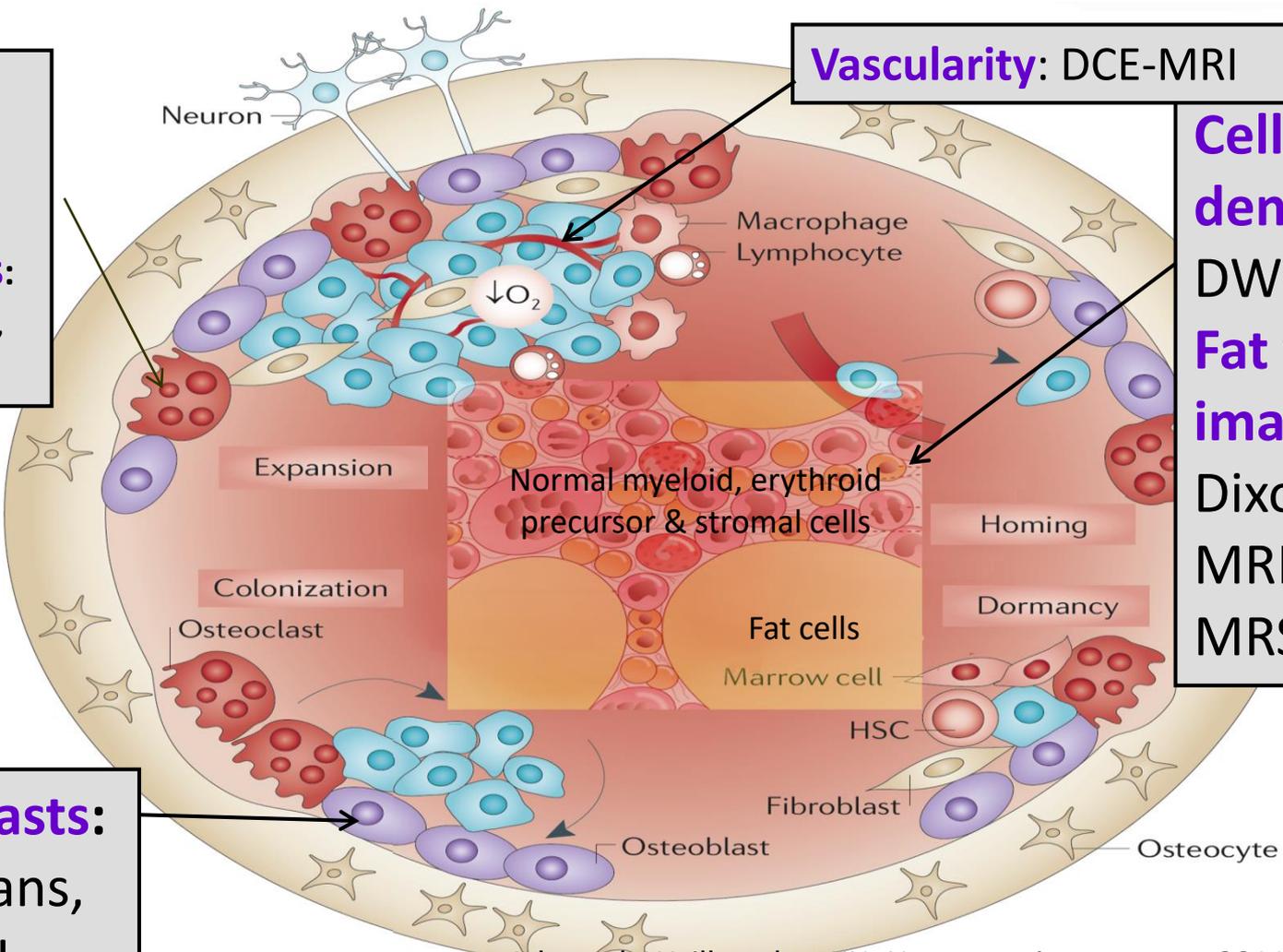


- **Nac: Conversión** M Roja → M. Grasa. Distal a proximal. Bilateral, simétrico
- **Reconversión** : ↑ Demanda hematopoyésis. Proximal a distal
- **MO Normal:** Siempre MR & MG → % depende edad, región, condición

**Bone trabeculae & osteoclasts:**  
CT, MRI (GRE),  
FDG-PET

**Vascularity:** DCE-MRI

**Cell density:** DW-MRI  
**Fat water imaging:** Dixon MRI, MRS, CT



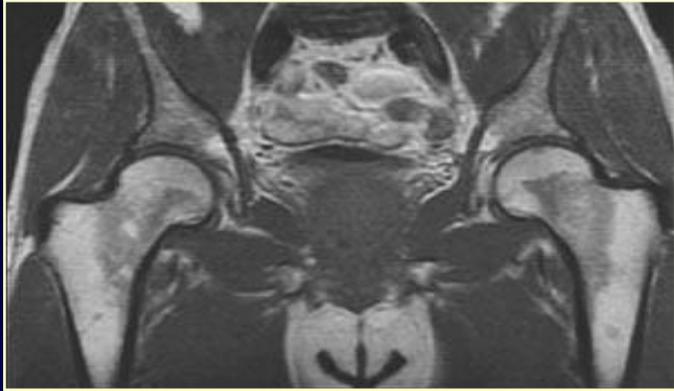
**Osteoblasts:**  
Bone scans,  
PET, MRI

# SEÑAL RM MÉDULA ÓSEA

- Fast/Turbo SE T1 – T2
- Supresión grasa T2 – STIR
- GRE
- Dixon (fuera fase)
- Difusión
- DCE
- Cuerpo entero

# SE

T1



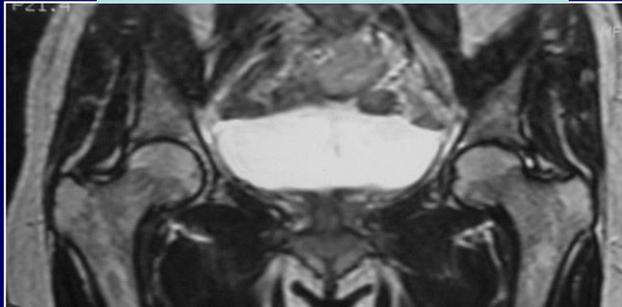
Médula roja

- ↓ señal que grasa (↑ músculo-disco)

Médula grasa

- señal = grasa

T2



Médula roja

- ↓ señal que grasa- intermedia (↑ músculo-disco)

Médula grasa

- señal = grasa

# SUP/GRASA T2 - STIR

STIR



Médula roja

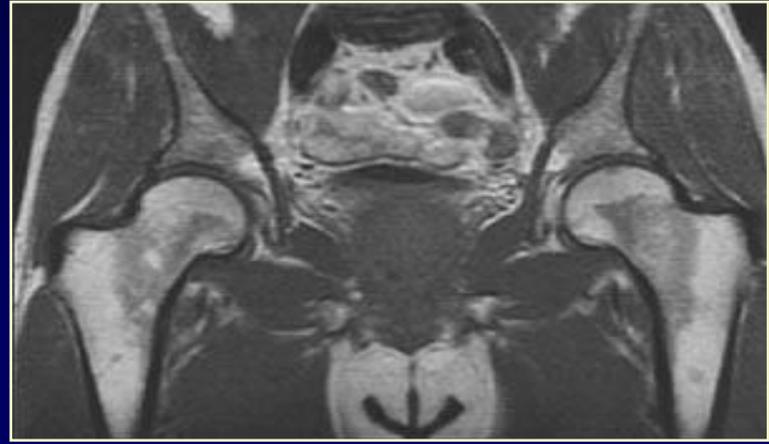
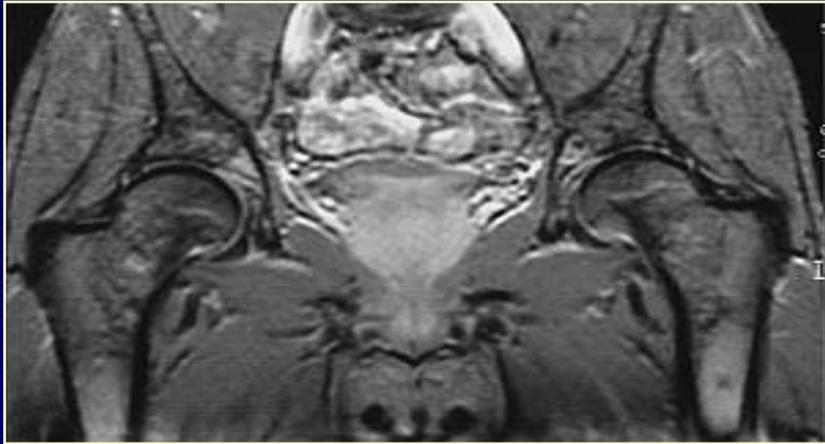
- Intermedia & ↑ señal

Médula grasa

- ↓ señal = grasa

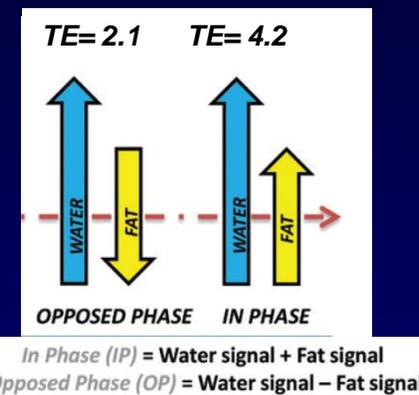
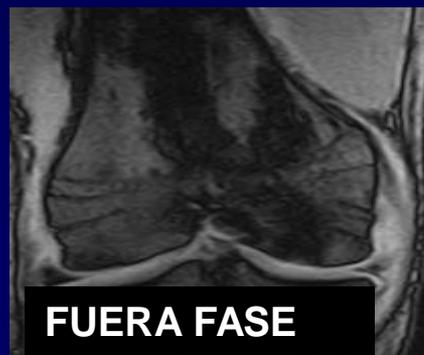
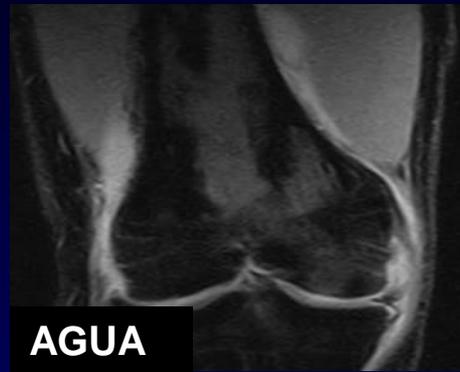
# GRE

- Hueso trabecular: ↓ señal , susceptibilidad
  - Relación: densidad ósea & integridad trabecular



# DIXON (“ IDEAL - X-BONE ”)

- Método “chemical shift” de separación de grasa y agua. Mejor S/R
- SE - GE / T1 o T2
- Separa grasa-agua + combina en fase y fuera de fase la grasa y agua →
- 4 Imágenes: agua (“sup. Grasa”) – grasa – fase – fuera fase



# DIXON (“ IDEAL - X-BONE ”)

➤ Imagen FUERA FASE - FASE → Adquisición con # TE.

✓ Fuera de Fase:

✓ Margenes negros entre interfase agua y grasa

✓ Out-phase: Elimina la señal

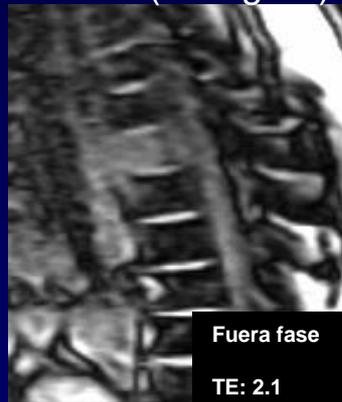
✓ si % grasa /agua = 50:50 en voxel → presencia de grasa “BENIGNO”

✓ Fase:

✓ Aspecto similar a imagen SE T1

➤ M roja normal y hueso benigno graso → ↓ señal en fuera fase

➤ Médula ósea hipercelular → ↑ = señal fuera de fase (“maligno”)

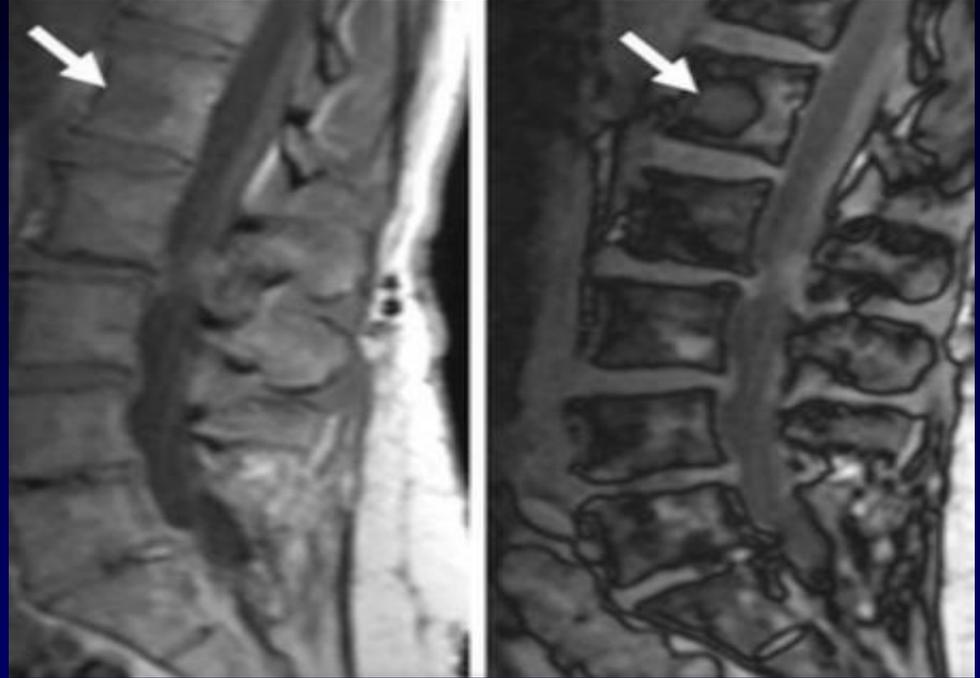
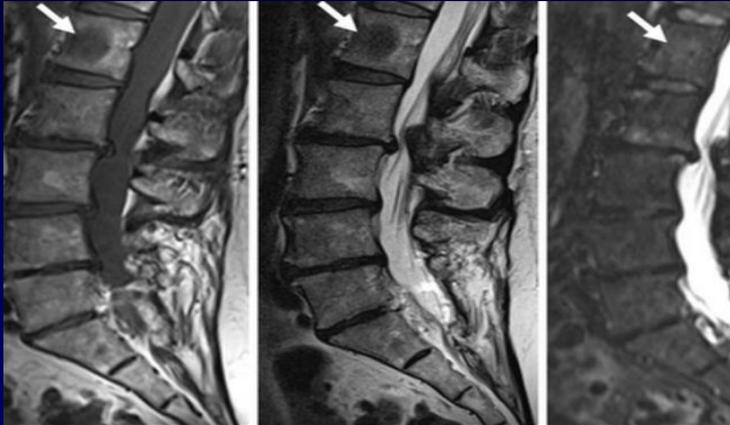


**Metástasis vertebral**

# CUANTIFICACION

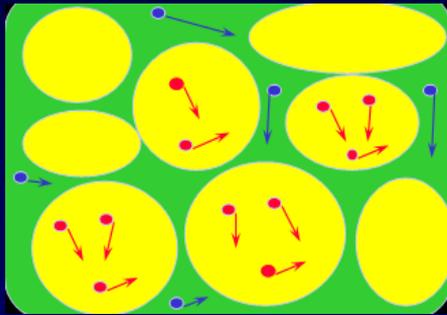
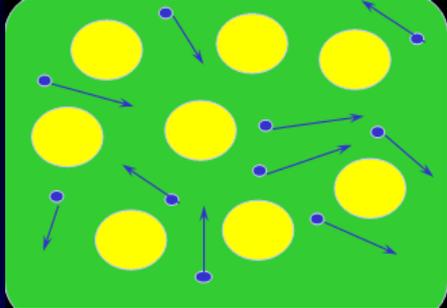
## Phase/Out phase:

- Cociente FF/F < 0.80
- Pérdida de señal >20%
- \*Fat fraction: >20%
- \*Fat Sat r (sL/sBM): ~1 (M1>2)



- Martel Villagrán J. Radiologia. 2015
- Schmeel FC, et al. Eur Radiol. 2018
- \*Park S, Do Huh J. Differentiation of bone metastases from benign red marrow depositions of the spine: the role of fat-suppressed T2-weighted imaging compared to fat fraction map. European Radiology. 2022 Oct 1;32(10):6730–8.

# DIFUSIÓN



- Difusion RM mide la movilidad del agua
- Cuantitativa: ADC (apparent diffusion coefficient)
- Señal depende:  $\downarrow$  difusión  $\rightarrow$   $\uparrow$  señal DWI  $\rightarrow$   $\downarrow$  ADC
  - Elevada celularidad (tumor)
  - No Integridad membrana (infarto)
  - Intersticial (infección)
- $\downarrow$  Difusion  $\rightarrow$  metastasis, infección
- $\uparrow$  Difusion  $\rightarrow$  edema benigno, necrosis post QT

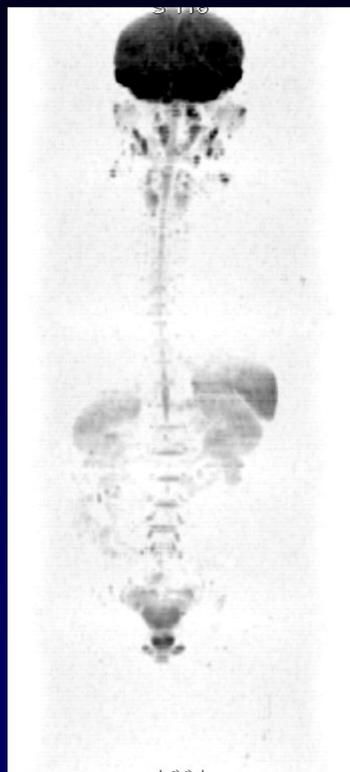
# Contraste MO en RM DIFUSIÓN con la edad



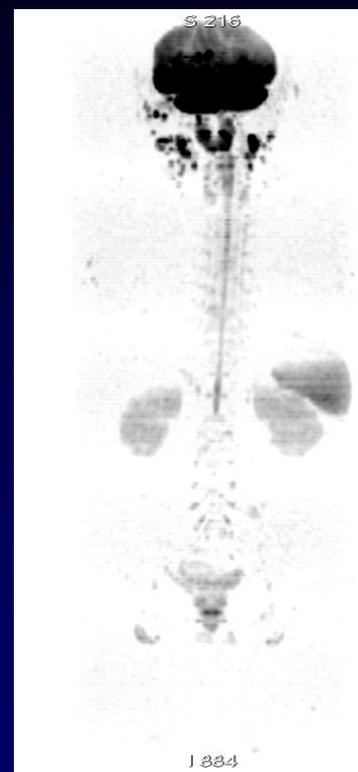
edad: 17



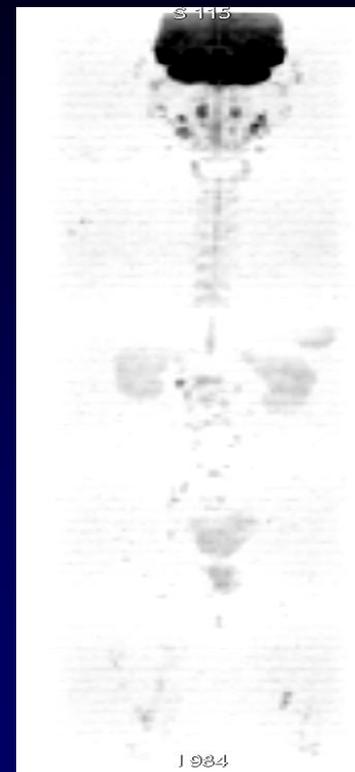
24



36



57

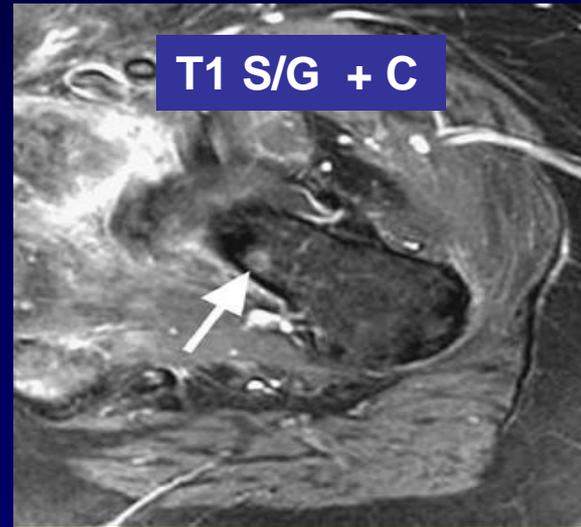
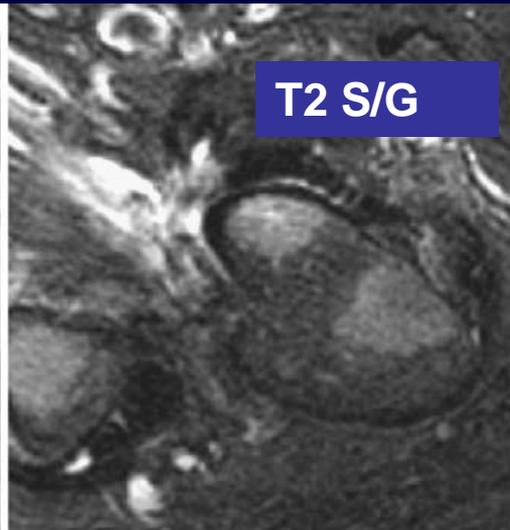
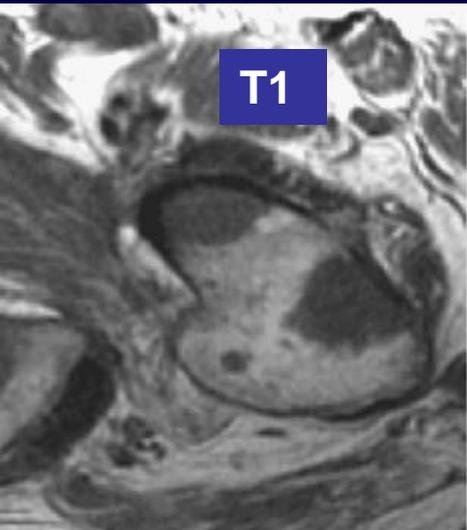


80

# SEÑAL RM MÉDULA ÓSEA

## En relación a:

- Contenido: GRASA / AGUA (cels.)/ HUESO TRABECULAR
- CONTRASTE ev: Sup/grasa T1 + C
- SECUENCIA: **T1** – T2 sup/grasa/STIR - > M grasa (+ fácil identificar lesión hipo)
- EDAD: principal factor. Homogéneo <2a (MRoja) . Heterogéneo- conversión > 2 < 20. Variabilidad inter-indv

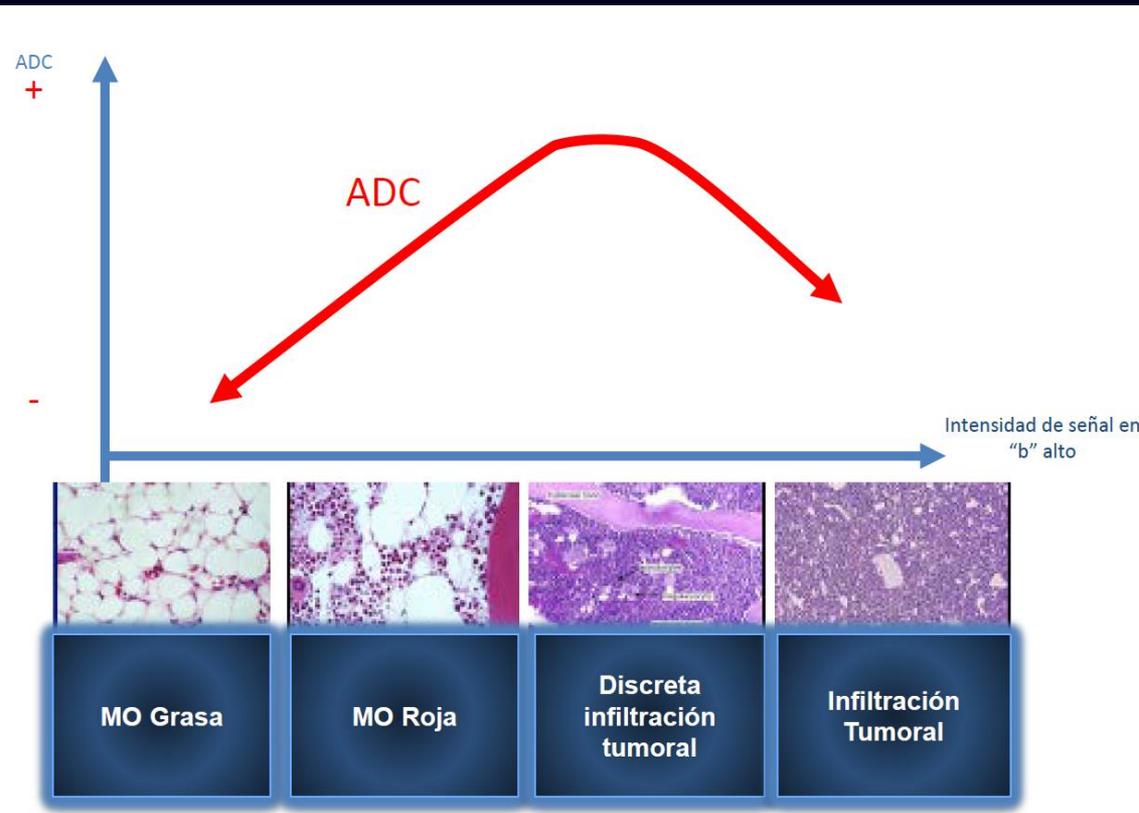


# SEÑAL RM MÉDULA ÓSEA

## SECUENCIA

Secuencia	Señal (respecto al disco vertebral)			
	Médula grasa	Médula roja	<u>Osteolítica</u>	<u>Osteoblástica</u>
T1	↑	=	↓	↓
T2 supresión grasa (STIR)	↓	=	↑	↓
En fase	↑	=	=	↓
Fuera de fase	↓	=	↑	↓
Difusión	↓	=	↑	↓
ADC (mm <sup>2</sup> /s) (18)	<0.4 x10 <sup>-3</sup>	0.4-0.6 x10 <sup>-3</sup>	0.6-0.9 x10 <sup>-3</sup>	~0
Contraste (T1 Fat Sup)	↓	=	↑	↓

# DWI de la Médula Ósea



No relación lineal ADC y celularidad

**DWI:**

- Celularidad
- Intersticio
- Agua
- Grasa

# SEÑAL RM MÉDULA ÓSEA

## GUÍA

- Esqueleto axial (raquis-pelvis)
- Secuencia T1, Supresión grasa T2/STIR
- Simetrías (patrones de MO similar huesos mismo individuo)
- Patrones: Focal / Difuso
- Señal: T1 → cuerpo > disco

### Patrones de señal en T1



**Focal hiper:** grasa, hemangioma, Modic II, infarto óseo, cicatriz post infección/tumor



**Focal hipo:** resto MO Roja, hemangioma atípico, Metástasis, neoplasias linfoproliferativas



**Vacio señal:** enostosis (islote óseo), mts osteoblásticas, necrosis ósea + gas, osteopoiquilosis, mastocitosis



**Difuso hiper:** normal MO grasa, anemia aplástica

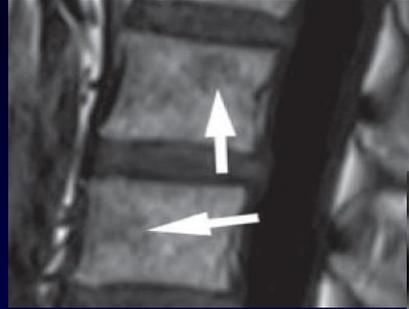


**Difuso hipo:** MO roja jóvenes, reconversión, neoplasias LF, Gaucher

# SEÑAL RM MÉDULA ÓSEA

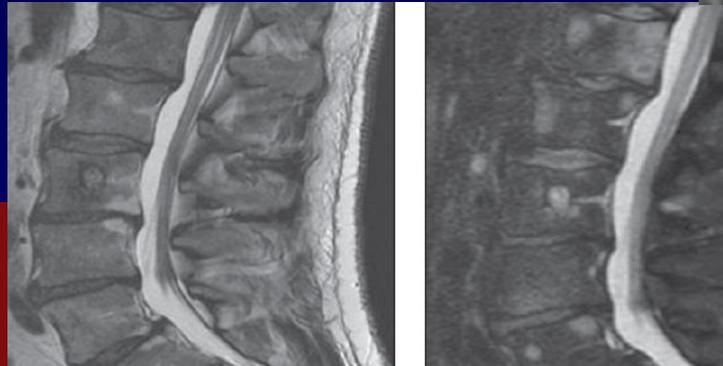
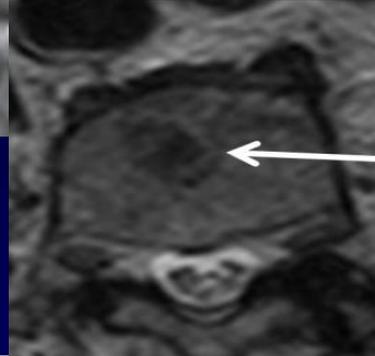
## ➤ T1:

- **Patología:** menor señal al músculo or disco
- Signo ojo de buey: normal (centro hiperseñal-grasa)



## ➤ T2 S/G – STIR :

- **Patología:** más hiperintenso que la MO normal → difícil de diferenciar en T2 metástasis de MO normal
- Signo del halo: malignidad (anillo hiperintenso)



•Schweitzer ME, ***Bull's-eyes and halos: useful MR discriminators of osseous metastases.*** Radiology 1993

•Shah LM. MRI spinal bone marrow. AJR 2011

# FISIOLÓGICO

## CONVERSION-RECONVERSION

➤ **RECONVERSION** → grasa → roja : ↑ demanda hematopoyesis

- Tabaquismo severo
- Corredores de fondo / residencia en altitud
- Obesidad
- Mujeres edad fértil
- Anemia (HBpatias, infección crónica, hemorragia)
- Enfermedades crónicas (Cardiopatía, Insuf. Renal-hepática)
- QT/ RDT extensa (reconversión en médula no irradiada)

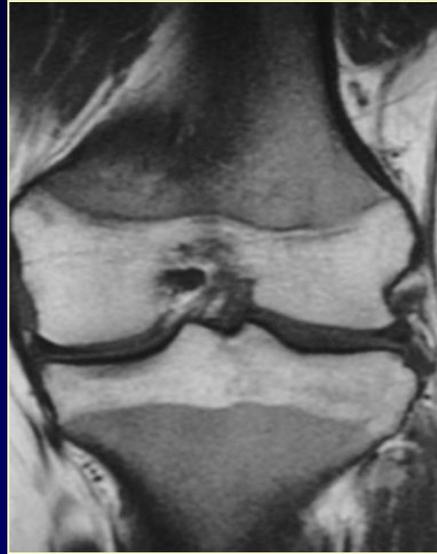
➤ **Inverso a la conversión: central a periferia**

➤ **Más rápido en huesos planos (esternón, raquis, escápula)**

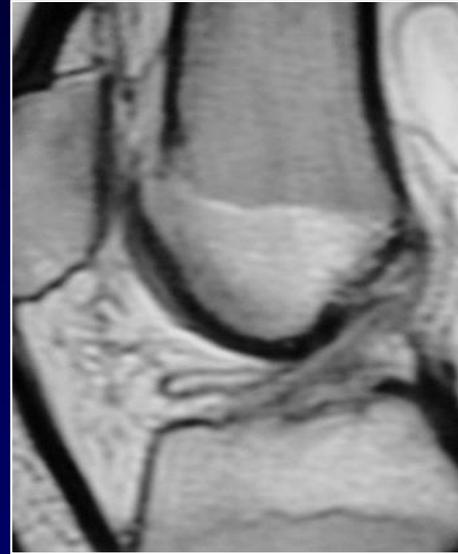
# CONVERSION-RECONVERSION



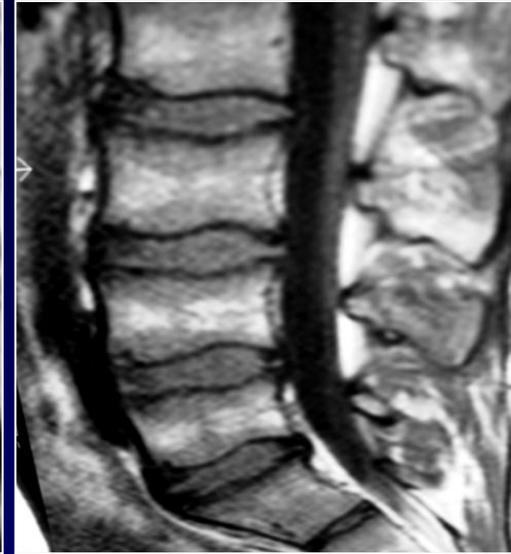
**Mujer**



**Anemia**



**Corredor**



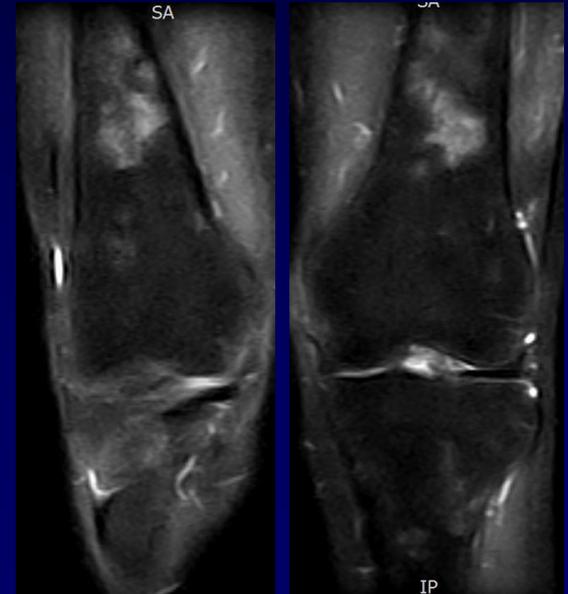
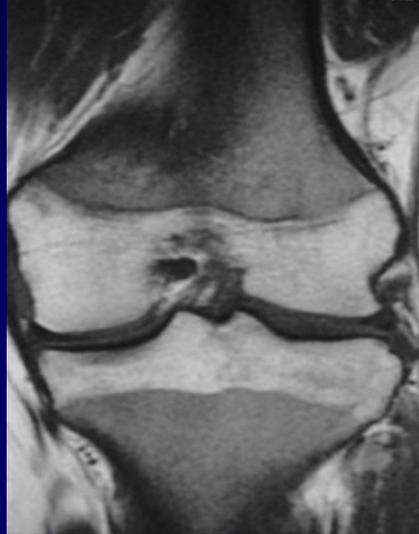
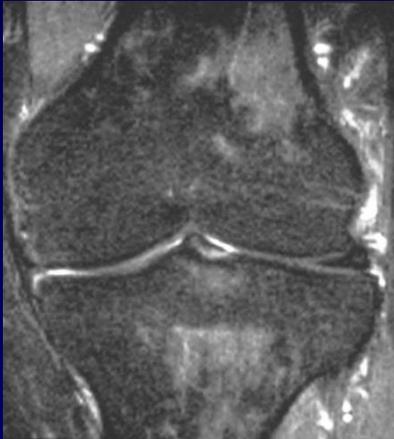
**Ciclista**

# CONVERSION-RECONVERSION

## Médula roja - hematopoyética

### ➤ RM - Características:

- Parcheado más que confluyente— islotes – (↑ señal músculo T1)
- No cruzan la fisis (aunque no siempre!)
- Márgenes mal definidos (DD: Metastasis → redondeado & fino)
- **Islotes, resto de médula roja**
- **Simétrico**



# PATOLÓGICO

## ➤ **Reemplazamiento:** Infiltración –

### ➤ Metástasis

### ➤ Linfoma

### ➤ Tumor óseo: benigno/maligno

### ➤ Osteomielitis

## ➤ **Proliferación:** Cuantitativa –

### ➤ Mieloma múltiple

### ➤ Enfermedades de Cels. Plasmáticas

### ➤ Leucemia

## ➤ **Vascular:** Edema, isquemia, necrosis

# INFILTRACIÓN (M1)

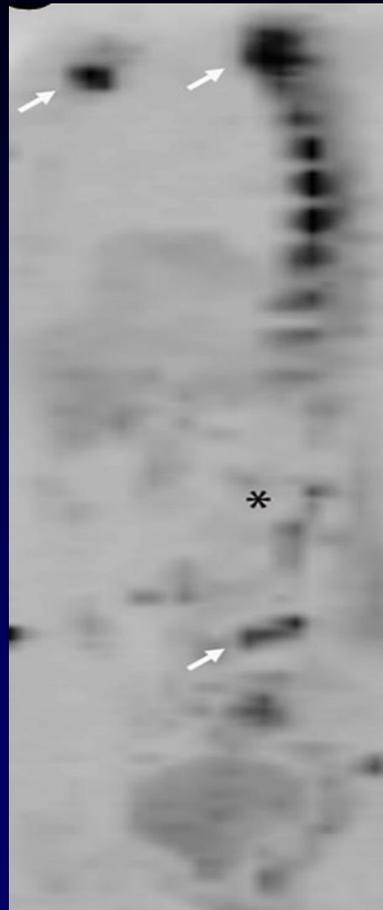
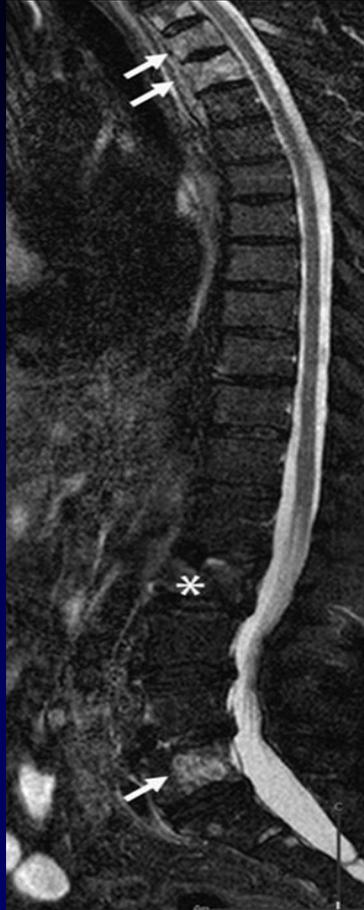
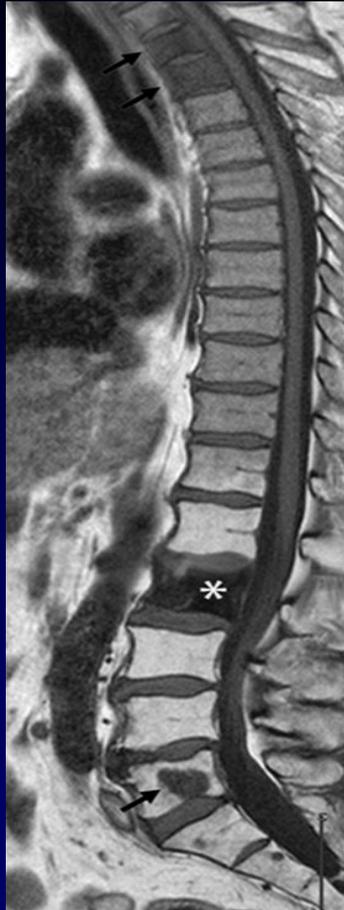
## ➤ Sustitución de la grasa

- Hiposeñal en T1 (< disco-músculo)
- Variable en T2
- Etiología infiltrativa (lítico-blástico-mixto)

## ➤ Análisis:

- Clínica + morfología + señal + partes blandas (epidural) - edema
- Otras técnicas
- Evolución

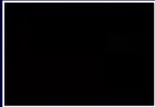
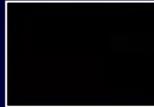
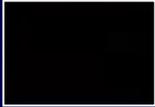
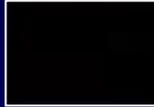
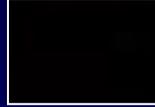
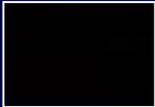
Metastasis: líticas & blásticas → Mixtas



Fusion T1+DWI

# METASTASIS

## SEÑAL en RM

	T1	T2(Sup/STIR)	DWI	ADC	
<b>Osteolítico:</b>					→ = infección !!
<b>Osteoblástico:</b>					no difusión
<b>Edema Benigo</b>					

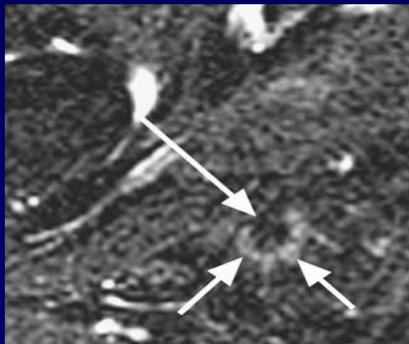
•Vilanova JC et al. Diffusion-weighted whole-body MR screening, Eur J Radiol 2008 Sep;67(3):440-7.

•Balliu E, Vilanova JC, Diagnostic value of apparent diffusion coefficients to differentiate benign from malignant vertebral bone marrow lesions. Eur J Radiol. 2009

# METASTASIS

## METASTASIS

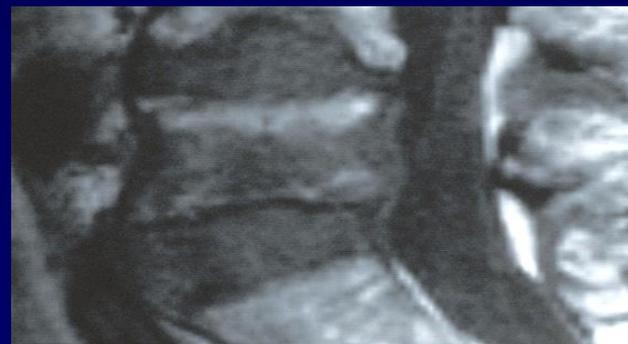
- ✓ Sustitución difusa
- ✓ Multifocal
- ✓ Edema elementos posteriores
- ✓ Convexidad muro posterior
- ✓ Masa de partes blandas
- ✓ Signo halo (T2)
- ✓ ADC bajo/ Cociente FF/F  $>0.8$  --  $>20\%$  PS



## BENIGNO

### traumatismo agudo-osteoporosis

- ✓ Edema heterogéneo
- ✓ Línea fractura
- ✓ Conservación señal grasa del cuerpo
- ✓ Edema en la plataforma
- ✓ Reversibilidad
- ✓ Signo del líquido vertebral (Enf. Kummel)
- ✓ ADC elevado/Cociente FF/F  $<0.80$  --  $<20\%$  PS



# PROLIFERACIÓN (MM)

- Esqueleto axial y apendicular
- Difuso
- Simetria ~ reconversión
- Carga tumoral para reemplazar grasa
- Hiposeñal en T1 (< disco-músculo)
- Análisis:
  - Clínica + morfología + señal
  - Otras técnicas



# RM CE – DWI MY-RADS

## Radiology

REVIEWS AND COM

### Guidelines for Acquisition, Interpretation, and Reporting of Whole-Body MRI in Myeloma: Myeloma Response Assessment and Diagnosis System (MY-RADS)

Recomendación para estandarizar, reducir variabilidad en RM CE del MM:

- Adquisición-protocolos
- Interpretación
- Informe
- Valoración de respuesta: DWI-ADC (%) - RAC

RAC
1: RESPONSE: highly likely
2: RESPONSE: likely
3: STABLE
4: PROGRESSION : likely
5: PROGRESSION: highly likely

Table 3: MY-RADS Response Assessment Categories

RAC Descriptions
1: Highly likely to be responding
Return of normal fat containing marrow in areas previously infiltrated by focal or diffuse myelomatous infiltration
Unequivocal decrease in number or size of focal lesions
Conversion of a packed bone marrow infiltrate into discrete nodules, with unequivocal decrease in tumor load in the respective bone marrow space
Decreasing soft tissue associated with bone disease
Emergence of normal interstitial fat within/around focal lesions (fat dot or halo sign)
Previously evident lesion shows increase in ADC from $\leq 1400 \mu\text{m}^2/\text{sec}$ to $> 1400 \mu\text{m}^2/\text{sec}$
$\geq 40\%$ increase in ADC from baseline with corresponding decrease in normalized high <i>b</i> -value signal intensity; morphologic findings consistent with stable or responding disease
For soft-tissue disease, RECIST version 1.1 criteria for PR/CR
2: Likely to be responding
Evidence of improvement but not enough to fulfill criteria for RAC 1. For example:
Slight decrease in number/size of focal lesions
Previously evident lesions show increases in ADC from $\leq 1000 \mu\text{m}^2/\text{sec}$ to $< 1400 \mu\text{m}^2/\text{sec}$
$> 25\%$ but $< 40\%$ increase in ADC from baseline with corresponding decrease in high <i>b</i> -value signal intensity; morphologic findings consistent with stable or responding disease
For soft-tissue disease, RECIST version 1.1 not meeting requirements for PR
3: No change
No observable change
4: Likely to be progressing
Evidence of worsening disease, but not enough to fulfill criteria for RAC 5
Equivalent appearance of new lesion(s)
No change in size but increasing signal intensity on high <i>b</i> -value images (with ADC values $< 1400 \mu\text{m}^2/\text{sec}$ ) consistent with possible disease progression
Reappearance or reemergence of lesion(s) that previously disappeared or enlargement of lesion(s) that had partially regressed/stabilized with prior treatments
Soft tissue in spinal canal causing narrowing not associated with neurologic findings and not requiring radiation therapy
For soft-tissue disease, RECIST version 1.1 criteria not meeting requirements for PD
5: Highly likely to be progressing
New critical fracture(s) (rod compression requiring radiation therapy/surgical intervention; only if confirmed as malignant with MRI signal characteristics)
Unequivocal new focal ( $> 5$ to $10$ mm)/diffuse area(s) of infiltration in regions of previously normal marrow
Unequivocal increase in number/size of focal lesions
Evolution of focal lesions to diffuse neoplastic pattern
Appearance/increasing soft tissue associated with bone disease
New lesions/regions of high signal intensity on high <i>b</i> -value images with ADC value between $600$ – $1000 \mu\text{m}^2/\text{sec}$

Messiou C, et al. Guidelines for Acquisition, Interpretation, and Reporting of Whole-Body MRI in Myeloma: Myeloma Response Assessment and Diagnosis System (MY-RADS). Radiology. April 2019.

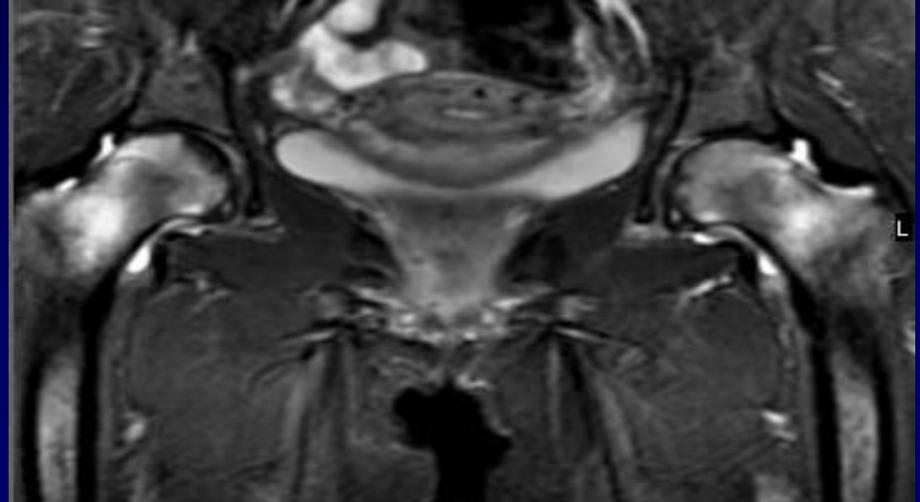
# EDEMA

## ✓ Aumento líquido intersticial

- Hiperémico/vasogénico: Infección
- Congestivo: Osteoporosis transitoria
- Permeabilidad: trauma- fractura, contusión, estrés

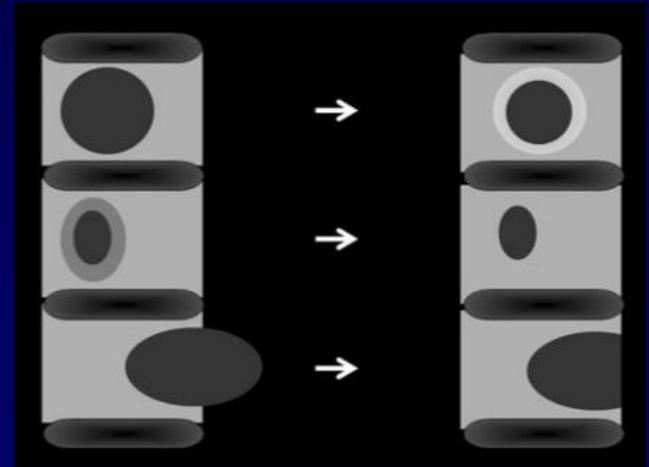
## ✓ SEÑAL EDEMA RM

- T1 – Hipointenso
- T2 – leve hiperintensidad
- STIR/Fat-sat: Hiperintenso
- Post Contraste: realce
- DWI: ↑ ADC



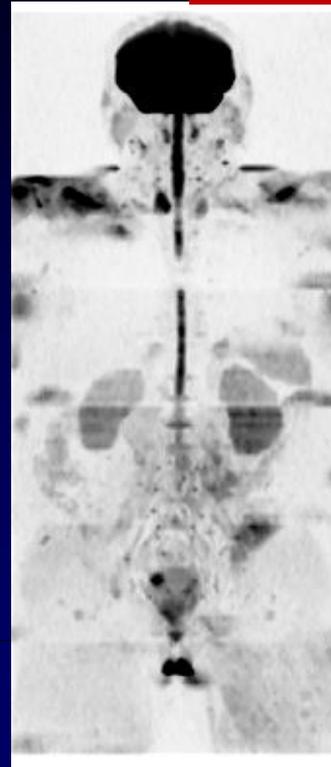
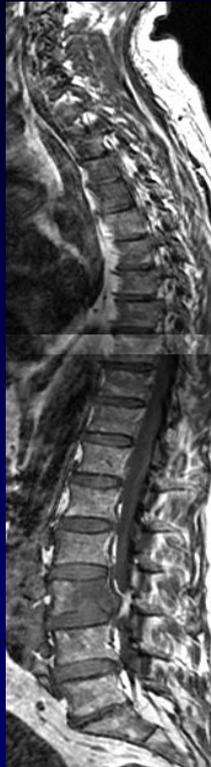
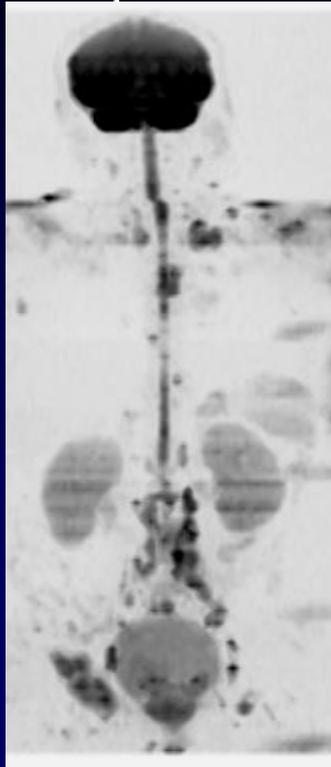
# MONITORIZACIÓN

- Respuesta # al tamaño.
- No existe clara correlación, respuesta → señal RM
- Valoración necrosis – tumor viable
- RM convencional poco útil- RECIST – (lítico-mixtas-partes blandas)
- Necrosis → factor pronóstico
- Tumor viable → + cels → restricción difusión
- Necrosis → ↑ Difusión- ↑ ADC
- Hiper en T1 (grasa intralesional o perilesional → “signo del halo en T1”)



# MONITORIZACION

4 meses



# MET-RADS

Platinum Priority – Prostate Cancer

Editorial by Jelle O. Barentsz, Peter Mulders, Winald Gerritsen and Jurgen J. Fütterer on pp. 93–95 of this issue

## METastasis Reporting and Data System for Prostate Cancer: Practical Guidelines for Acquisition, Interpretation, and Reporting of Whole-body Magnetic Resonance Imaging-based Evaluations of Multiorgan Involvement in Advanced Prostate Cancer

Anwar R. Padhani<sup>a,\*</sup>, Frederic E. Lecouvet<sup>b</sup>, Nina Tunariu<sup>c</sup>, Dow-Mu Koh<sup>c</sup>, Frederik De Keyzer<sup>d</sup>, David J. Collins<sup>e</sup>, Evis Sala<sup>e</sup>, Heinz Peter Schlemmer<sup>f</sup>, Giuseppe Petralia<sup>g</sup>, H. Alberto Vargas<sup>e</sup>, Stefano Fanti<sup>h</sup>, H. Bertrand Tombal<sup>i</sup>, Johann de Bono<sup>1</sup>

### RAC

1: RESPONSE: highly likely

2: RESPONSE: likely

3: STABLE

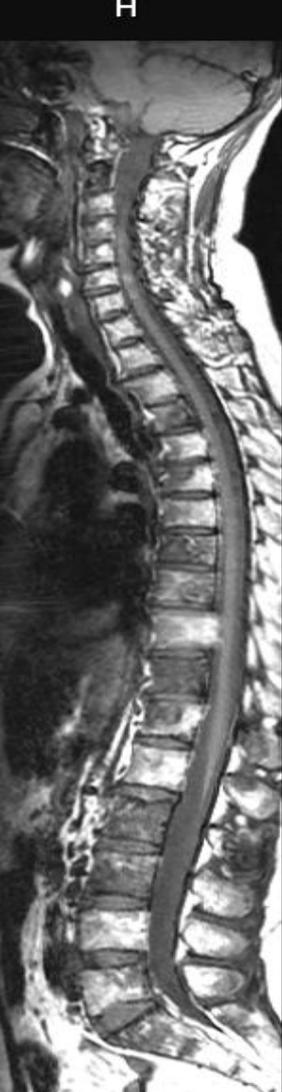
4: PROGRESSION : likely

5: PROGRESSION: highly likely

Table 3 – METastasis Reporting and Data System for Prostate Cancer regional response assessment categories

RAC	Classification	Region	Descriptions <sup>a</sup>
1	Highly likely to be responding	Local, nodal, and visceral Bone	<ul style="list-style-type: none"> <li>Consistent with RECIST v1.1/PCWG criteria for unequivocal response (partial/complete; see below)</li> <li>Return of normal marrow in areas previously infiltrated by focal/diffuse metastatic infiltration</li> <li>Decrease in number/size of focal lesions sufficient to indicate high likelihood response</li> <li>Evolution of diffuse neoplastic pattern to focal lesions</li> <li>Decreasing soft tissue associated with bone disease</li> <li>Dense lesion sclerosis (edge to edge), sharply defined, very thin/disappearance of hyperintense rim on T2W-FS images</li> <li>The emergence or intra/peritumoural fat within/around lesions (fat duct/line signs)</li> <li>Previously evident lesion shows increase in ADC from <math>\leq 1400 \mu\text{m}^2/\text{s}</math> to <math>&gt; 1400 \mu\text{m}^2/\text{s}</math></li> <li><math>&gt;40\%</math> increase in ADC from baseline with corresponding decrease in high b-value SI; and morphological findings consistent with stable or responding disease<sup>c</sup></li> </ul>
2	Likely to be responding	Local, nodal, and visceral Bone	<ul style="list-style-type: none"> <li>Changes depicting tumour response that do not meet RECIST v1.1/PCWG criteria for partial or complete response (see below)</li> <li>Evidence of improvement, but not enough to fulfil criteria for RAC 1. For example: <ul style="list-style-type: none"> <li>Previously evident lesions showing increases in ADC from <math>\leq 1000 \mu\text{m}^2/\text{s}</math> to <math>&lt; 1400 \mu\text{m}^2/\text{s}</math><sup>b</sup></li> <li><math>&gt;25\%</math> but <math>&lt;40\%</math> increase in ADC from baseline with corresponding decrease in high b-value SI; and morphological findings consistent with stable or responding disease<sup>c</sup></li> </ul> </li> </ul>
3	No change	All	<ul style="list-style-type: none"> <li>No observable change</li> </ul>
4	Likely to be progressing	Local, nodal, and visceral Bone	<ul style="list-style-type: none"> <li>Changes depicting tumour progression that do not meet RECIST v1.1/PCWG criteria for progression (see below)</li> <li>Evidence of worsening disease, but not enough to fulfil criteria for RAC 5</li> <li>Equivocal appearance of new lesion(s)</li> <li>No change in size but increasing SI on high b-value images (with ADC values <math>&lt; 1400 \mu\text{m}^2/\text{s}</math>) consistent with possible disease progression<sup>b</sup></li> <li>Relapse disease: re-emergence of lesion(s) that previously disappeared or enlargement of lesion(s) lesions that had partially regressed/stabilized with prior treatments</li> <li>Imaging depicted bone lesions that might be clinically significant (therefore excludes asymptomatic fractures in noncritical bones)</li> <li>Soft tissue in spinal canal causing narrowing not associated with neurological findings and not requiring radiotherapy</li> </ul>
5	Highly likely to be progressing	Local, nodal, and visceral Bone	<ul style="list-style-type: none"> <li>Changes depicting tumour progression that meet RECIST v1.1/PCWG criteria for unequivocal progression (see below)</li> <li>New critical fracture(s)/cord compression requiring radiotherapy/surgical intervention → only if confirmed as malignant by MRI signal characteristics</li> <li>Unequivocal new focal/diffuse area(s) of metastatic infiltration in regions of prior normal marrow</li> <li>Unequivocal increase in number/size of focal lesions</li> <li>Evolution of focal lesions to diffuse neoplastic pattern</li> <li>Appearance/increasing soft tissue associated with bone disease</li> <li>New lesions/regions of high signal intensity on high b-value images with ADC value between <math>600 \mu\text{m}^2/\text{s}</math> and <math>1000 \mu\text{m}^2/\text{s}</math></li> </ul>

\*Padhani AR, et al. METastasis Reporting and Data System for Prostate Cancer MET-RADS: Practical Guidelines for Acquisition, Interpretation, and Reporting of Whole-body Magnetic Resonance Imaging-based in Advanced Prostate Cancer. Eur Urol 2016



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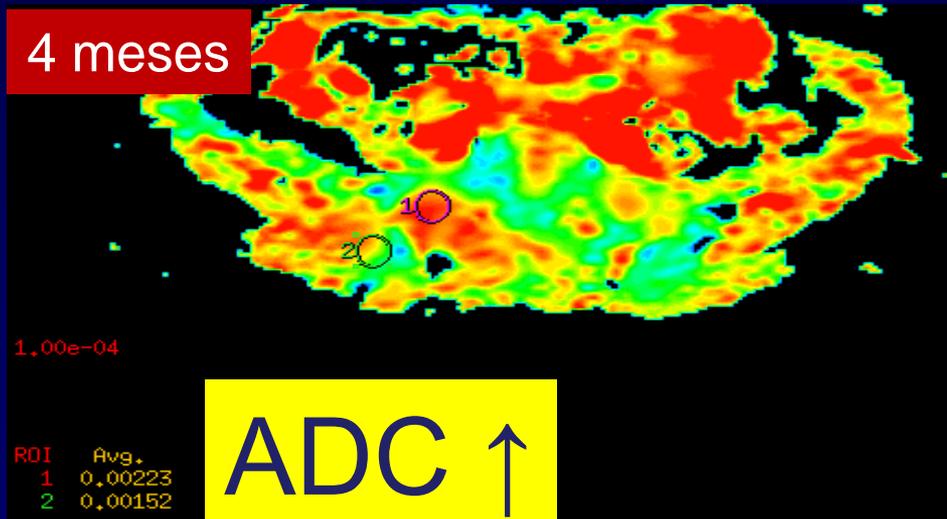
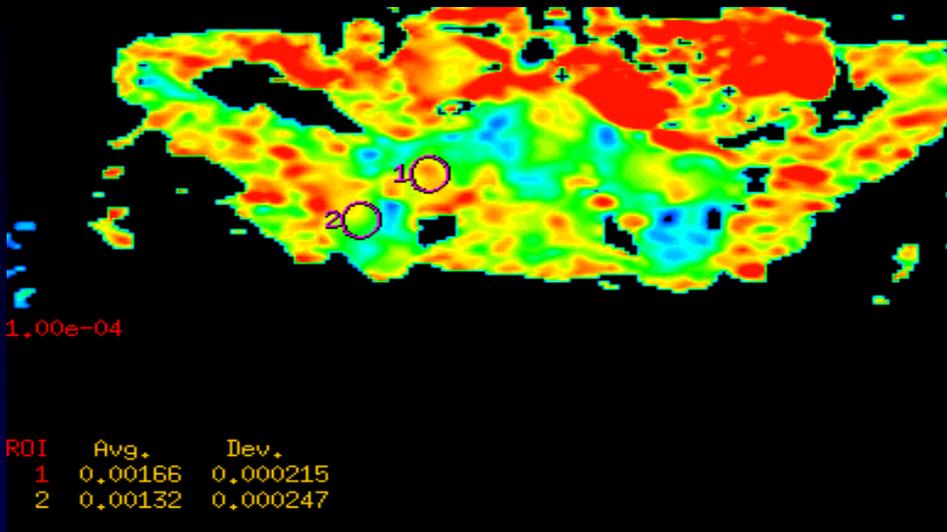


4 meses





4 meses



# RECORDAR...

- El aspecto normal o anormal de la médula ósea depende del contenido agua/grasa y de la secuencia en RM
- Análisis:
  - T1+ sup/grasa T2-STIR - DWI (ADC)-Dixon (Fuera F)
- Dx patología de la médula ósea:
  - Señal-morfología RM (sustitución-proliferación-edema) + historia clínica + analítica + técnicas imagen
- Patrón de reconversión:
  - Simetría, señal (T1), distribución, grasa/agua (F/FF)
- Monitorización: Respuesta funcional # morfológica (ADC)

# SCHOOL OF MRI

November, 3-4 2022 | Girona - Spain

SAVE  
the  
DATE

## The MRI course of -RADS from Head to Toe

### Course Organisers:

K. Vilanova  
Girona/ES

C. C. Quattrocchi  
Rome/IT

An interactive case-base to read and report  
MRI according to -RADS in practice

**REGISTER NOW!**  
[www.esmrmb.org](http://www.esmrmb.org)

### Thursday, November 3

8:00-8:30	Registration
8:30-09:00	BT-RADS
09:00-10:00	Interactive reading cases BT-RADS
10:00-10:30	Coffee break
10:30-11:00	NI-RADS
11:00-12:00	Interactive reading cases NI-RADS
12:00-12:30	BI-RADS
12:30-13:30	Interactive reading cases BI-RADS
13:30-14:30	Lunch
14:30-15:00	LI-RADS
15:00-16:00	Interactive reading cases LI-RADS
16:00-16:30	Coffee break
16:30-17:00	O-RADS
17:00-18:00	Interactive reading cases O-RADS
18:00-18:30	VI-RADS
18:30-19:30	Interactive reading cases VI-RADS

### Social event

- Patrick Asbach. Berlin. Germany
- Minerva Becker. Geneva. Switzerland
- Anna Darnell. Barcelona. Spain
- Dow-Mu Koh. London. UK
- Anwar Padhani. London. UK
- Valeria Panebianco. Rome Italy

### Friday, November 4

8:30 - 09:00	PI-RADS
09:00 - 10:00	Interactive reading cases PI-RADS
10:00 - 10:30	Coffee break
10:30 - 11:00	MET-RADS
11:00 - 12:00	Interactive reading cases MET-RADS
12:00 - 12:30	MY-RADS
12:30 - 13:30	Interactive reading cases MY-RADS
13:30 - 14:30	Lunch
14:30 - 15:30	Onco-RADS
15:30 - 16:30	Interactive reading cases Onco-RADS
16:30 - 17:00	Bone-RADS
17:00 - 18:00	Interactive reading cases Bone-RADS
18:00 - 18:30	Break
18:30-19:00	Node-RADS
19:00-20:00	Interactive reading cases Node-RADS

- Silvia Pérez Rodrigo. Madrid. Spain
- Giuseppe Petralia. Milan. Italy
- Jim S Wu. Boston. USA
- Kai Vilanova. Girona. Spain
- Brent Weinberg. Atlanta. USA
- Maica Sebastià. Barcelona. Spain

