

Supplemental online content for:

Metastatic Versus Osteoporotic Vertebral Fractures on MRI: A Blinded, Multicenter, and Multispecialty Observer Agreement Evaluation

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eTable 1. Sequences for MRI Examinations

Pulse Sequence	TR/TE (ms)	FOV (mm)	MAX	NAV	Thickness (mm)	Comments
Localizer	30/10	400	128 × 128	1	10	Flip angle 50° Gradient echo
Sagittal T1	440–550/14–20	270	156–307 × 192–512	2	4	1.3–0.4 mm gap Spin-echo
Sagittal T2	3,300–2,896/102.9–120	270	156–307 × 192–512	2	4	1.3–0.4 mm gap Turbo spin-echo imaging, 12-echo train length
Sagittal STIR	3,000/45/150 (inversion time)	270	156–307 × 192–512	2	4–6	1.3–0.4 mm gap Turbo spin-echo imaging, 12-echo train length
Axial T2	3,040–2,896/103–120	180	224–190 × 256–512	3	4	0.4 mm gap Turbo spin-echo imaging, 5-echo train length

Abbreviations: FOV, field of view; MAX, matrix; NAV, number of signals acquired; STIR, short inversion time inversion-recovery; TE, echo time; TR, repetition time.

eTable 2. Imaging Findings Assessed

Imaging Finding	Possible Values
Pattern of signal abnormalities (pattern of replacement of normal vertebral signal with bone marrow edema)	“Partially or completely” vs “showing a bandlike pattern”
Horizontal fracture line on fluid-sensitive sequence (STIR) or T2-weighted images	“Yes” vs “no”
Deposit-like appearance of pedicle involvement	“Yes” vs “no”
Convexity of posterior vertebral body border (bulging posterior cortex)	“Yes” vs “no”
Posterosuperior retropulsion	“Yes” vs “no”
Symmetry of signal intensity changes	“Symmetrical” vs “asymmetrical”

Abbreviation: STIR, short inversion time inversion-recovery.

eTable 3. Interobserver Agreement on Imaging Findings

	Kappa (95% CI)
Radiology (n=9)	
Pattern of signal abnormalities	0.410 (0.351–0.473)
Horizontal fracture line	0.352 (0.277–0.432)
Deposit-like appearance of pedicle involvement	0.476 (0.422–0.534)
Bulging posterior cortex	0.602 (0.545–0.661)
Posterosuperior retropulsion	0.367 (0.312–0.424)
Symmetry of signal intensity changes	0.277 (0.229–0.327)
Neurosurgery (n=7)	
Pattern of signal abnormalities	0.428 (0.365–0.495)
Horizontal fracture line	0.130 (0.087–0.176)
Deposit-like appearance of pedicle involvement	0.473 (0.409–0.539)
Bulging posterior cortex	0.400 (0.339–0.464)
Posterosuperior retropulsion	0.445 (0.390–0.502)
Symmetry of signal intensity changes	0.267 (0.213–0.324)
Orthopedic surgery (n=5)	
Pattern of signal abnormalities	0.327 (0.270–0.386)
Horizontal fracture line	0.198 (0.145–0.253)
Deposit-like appearance of pedicle involvement	0.412 (0.340–0.487)
Bulging posterior cortex	0.104 (0.064–0.144)
Posterosuperior retropulsion	0.533 (0.467–0.602)
Symmetry of signal intensity changes	0.163 (0.109–0.219)
Radiation oncology (n=4)	
Pattern of signal abnormalities	0.355 (0.280–0.433)
Horizontal fracture line	0.326 (0.242–0.412)
Deposit-like appearance of pedicle involvement	0.416 (0.341–0.493)
Bulging posterior cortex	0.635 (0.561–0.711)
Posterosuperior retropulsion	0.101 (0.047–0.155)
Symmetry of signal intensity changes	0.388 (0.314–0.465)

eTable 4. Intraobserver Agreement on Imaging Findings

	Median Kappa (IQR)
Radiology (n=9)	
Pattern of signal abnormalities	0.722 (0.606–0.764)
Horizontal fracture line	0.639 (0.472–0.721)
Deposit-like appearance of pedicle involvement	0.707 (0.624–0.732)
Bulging posterior cortex	0.768 (0.640–0.800)
Posterosuperior retropulsion	0.673 (0.624–0.731)
Symmetry of signal intensity changes	0.575 (0.383–0.646)
Neurosurgery (n=7)	
Pattern of signal abnormalities	0.754 (0.533–0.894)
Horizontal fracture line	0.657 (0.458–0.914)
Deposit-like appearance of pedicle involvement	0.653 (0.527–0.914)
Bulging posterior cortex	0.844 (0.495–0.969)
Posterosuperior retropulsion	0.689 (0.617–0.941)
Symmetry of signal intensity changes	0.597 (0.402–0.902)
Orthopedic surgery (n=5)	
Pattern of signal abnormalities	0.549 (0.510–0.555)
Horizontal fracture line	0.457 (0.399–0.515)
Deposit-like appearance of pedicle involvement	0.504 (0.460–0.549)
Bulging posterior cortex	0.682 (0.618–0.693)
Posterosuperior retropulsion	0.712 (0.587–0.719)
Symmetry of signal intensity changes	0.409 (0.360–0.460)
Radiation oncology (n=4)	
Pattern of signal abnormalities	0.646 (0.603–0.808)
Horizontal fracture line	0.486 (0.433–0.712)
Deposit-like appearance of pedicle involvement	0.666 (0.592–0.797)
Bulging posterior cortex	0.724 (0.639–0.846)
Posterosuperior retropulsion	0.586 (0.429–0.775)
Symmetry of signal intensity changes	0.584 (0.517–0.753)

Abbreviation: IQR, interquartile range.

eTable 5. Diagnostic Accuracy^a		
	N	Median Kappa (IQR)
All readers		
Cancer history undisclosed	25	0.437 (0.326–0.511)
Cancer history disclosed	25	0.443 (0.398–0.526)
Specialty		
Neurosurgery		
Cancer history undisclosed	7	0.327 (0.230–0.511)
Cancer history disclosed	7	0.411 (0.314–0.534)
Radiation oncology		
Cancer history undisclosed	4	0.446 (0.348–0.507)
Cancer history disclosed	4	0.435 (0.354–0.490)
Orthopedic surgery		
Cancer history undisclosed	5	0.368 (0.325–0.445)
Cancer history disclosed	5	0.398 (0.311–0.444)
Radiology		
Cancer history undisclosed	9	0.437 (0.414–0.525)
Cancer history disclosed	9	0.484 (0.443–0.526)
Hospital category (complexity)^b		
Category 2		
Cancer history undisclosed	2	0.381 (0.325–0.437)
Cancer history disclosed	2	0.372 (0.311–0.433)
Category 3		
Cancer history undisclosed	9	0.470 (0.403–0.525)
Cancer history disclosed	9	0.484 (0.410–0.534)
Category 4		
Cancer history undisclosed	7	0.445 (0.327–0.565)
Cancer history disclosed	7	0.437 (0.411–0.543)
Category 5		
Cancer history undisclosed	7	0.413 (0.281–0.426)
Cancer history disclosed	7	0.443 (0.359–0.526)
Years of experience		
≤7		
Cancer history undisclosed	7	0.403 (0.325–0.437)
Cancer history disclosed	7	0.411 (0.359–0.491)
8–13		
Cancer history undisclosed	6	0.397 (0.253–0.445)
Cancer history disclosed	6	0.421 (0.314–0.526)
≥14		
Cancer history undisclosed	12	0.491 (0.428–0.543)
Cancer history disclosed	12	0.477 (0.435–0.554)

Abbreviations: IQR, interquartile range; MVF, metastatic vertebral fracture; OVF, osteoporotic vertebral fracture.

^aDefined as the concordance between each reader's diagnosis at the first round (OVF vs MVF) and the reference diagnosis (established through biopsy or follow-up >6 months).

^bBased on size, availability of high-tech medical equipment and procedures, and degree of educational activity. No readers from category 1 hospitals (simplest) were included in this study.

eTable 6. Diagnostic Accuracy^a Depending on Presence of Preexisting Fractures and Disclosure of Clinical History

Median Kappa (IQR)	
Cases without preexisting fractures	
Before clinical history of cancer was disclosed	0.452 (0.387–0.509)
After clinical history of cancer was disclosed	0.462 (0.407–0.570)
Cases with preexisting fractures	
Before clinical history of cancer was disclosed	0.286 (0.183–0.396)
After clinical history of cancer was disclosed	0.331 (0.219–0.368)

Abbreviations: IQR, interquartile range; MVF, metastatic vertebral fracture; OVF, osteoporotic vertebral fracture.

^aDiagnostic accuracy is defined as the concordance between each reader's diagnosis at the first round (OVF vs MVF) and the reference diagnosis (established through biopsy or follow-up >6 months).

eAppendix 1.

Members of the Spanish Back Pain Research Network Task Force for the Improvement of Inter-Disciplinary Management of Spinal Metastasis (in alphabetical order)

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