

Morfometria Vertebrale:

Rx tradizionale

o

DXA?

Daniele Diacinti

Dipartimento di Scienze Radiologiche Università degli Studi "La Sapienza" Roma

daniele.diacinti@uniroma1.it

Definizione di frattura vertebrale da osteoporosi metodo semiquantitativo (SQ)

La frattura vertebrale è una deformazione del corpo vertebrale per riduzione di almeno il 20% dell'altezza anteriore (cuneo), centrale (biconcava), globale (collasso)

NORMAL



0 assente

0.5 borderline

MILD FRACTURE
20-25%



ANTERIOR



MIDDLE



POSTERIOR

1 lieve

MODERATE
FRACTURE
25-40%



ANTERIOR



MIDDLE



POSTERIOR

2 moderata

SEVERE
FRACTURE
>40%



ANTERIOR



MIDDLE



POSTERIOR

3 grave



Le fratture vertebrali da osteoporosi spesso (50%) sono lievi ed asintomatiche per cui non sono diagnosticate!



Table 1 Comparison of demographics data and results from the 12 studies that were reviewed

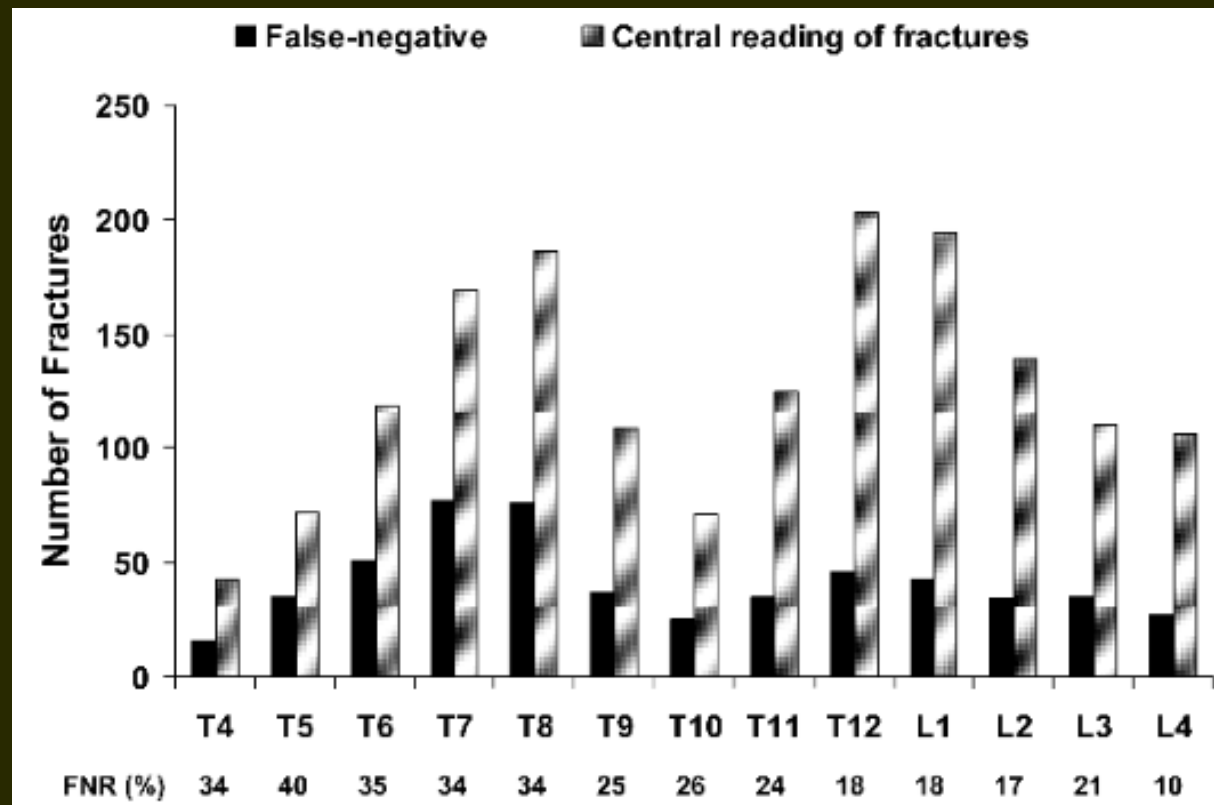
Scientific study			Patients demographics					Vertebral fractures (%)			
Year and author ¹	Imaging modality	Anatomical region	Total (n)	Sex (%)		Age		Method of assessment	Morphometric cut-off	Fractures prevalence	Reporting rate
				Male	Female	Range	Mean				
2000-Gehlbach	X-Rays	Chest	934	0.0	100	60-97	75.9	SQM	25	14.1	51.8
2003-Mui	X-Rays	Chest	106	0.0	100	55-89	65.0	SQM	25	24.5	15.3
2004-Kim	X-Rays	Chest	100	53.0	47	> 60	75.2	SQM	25	22.0	54.5
2004-Delmas	X-Rays	Spine	2451	0.0	100	65-80	71.3	SQM and QM	20	32.1	66.3
2005-Majumdar	X-Rays	Chest	459	52.3	47.7	> 60	75.2	SQM	25	15.6	59.7
2006-Casen	X-Rays	Chest or Spine	464	54.0	46	60-97	75.9	SQM	20	30.8	29.3
2007-Williams	MD/CT	Chest	192	50.5	49.5	55-93	70.1	SQM	25	19.7	13.1
2007-Woo	MD/CT	Chest	200	52.0	48	18-92	61.0	SQM	20	35.0	8.5
2007-Bartalena	MD/CT	Chest and/or Abdomen	323	60.7	39.3	20-88	62.6	Mixed	15	9.5	14.6
2008-Muller	MD/CT	Chest and/or Abdomen	112	0.0	100	55-87	67.4	SQM	20	24.1	0.0
2008-Obaid	MD/CT	Abdomen	307	51.5	48.5	18-90	65.0	SQM	20	13.6	4.7
2008-Cataldi	X-Rays	Chest	145	50.3	49.7	50-86	67.5	SQM	25	12.4	11.0

*Incidental vertebral compression fractures in imaging studies.
Lessons not learned by radiologists*

Bartalena T et al. World J Radiol 2010



Underdiagnosis of Vertebral Fractures Is a Worldwide Problem: The IMPACT Study



172 Centri ; 2451 pazienti ; 31863 vertebre valutate da CR e LR

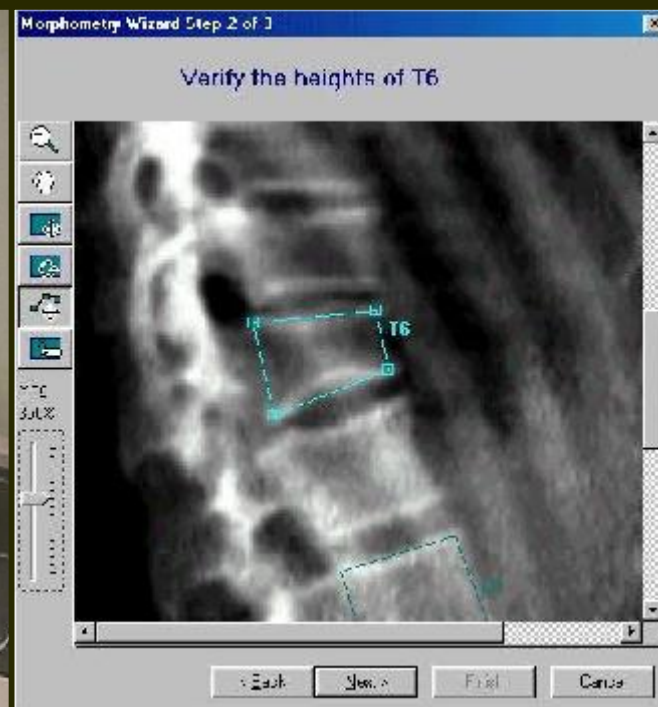
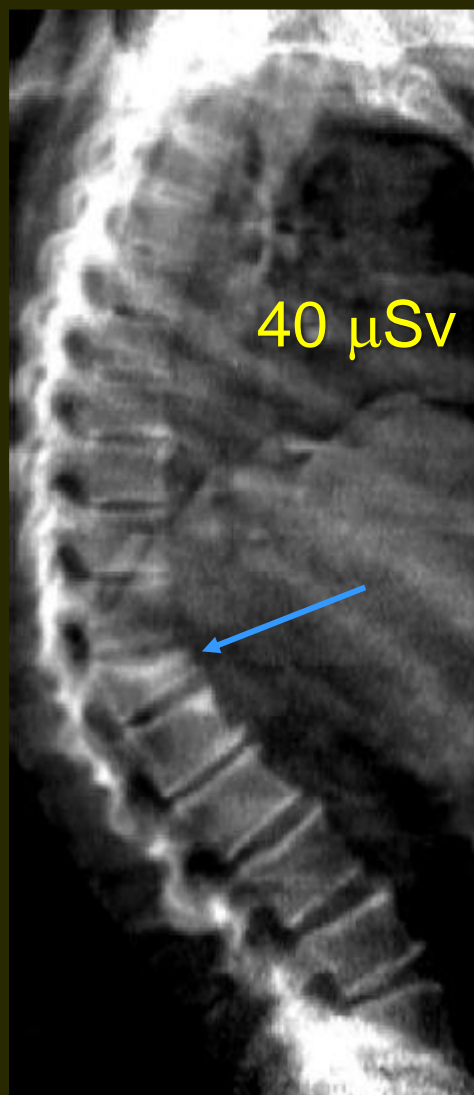
CR 1642 vfx; LR 1292 vfx

350 mild VFx misdiagnosed by LR (21%)

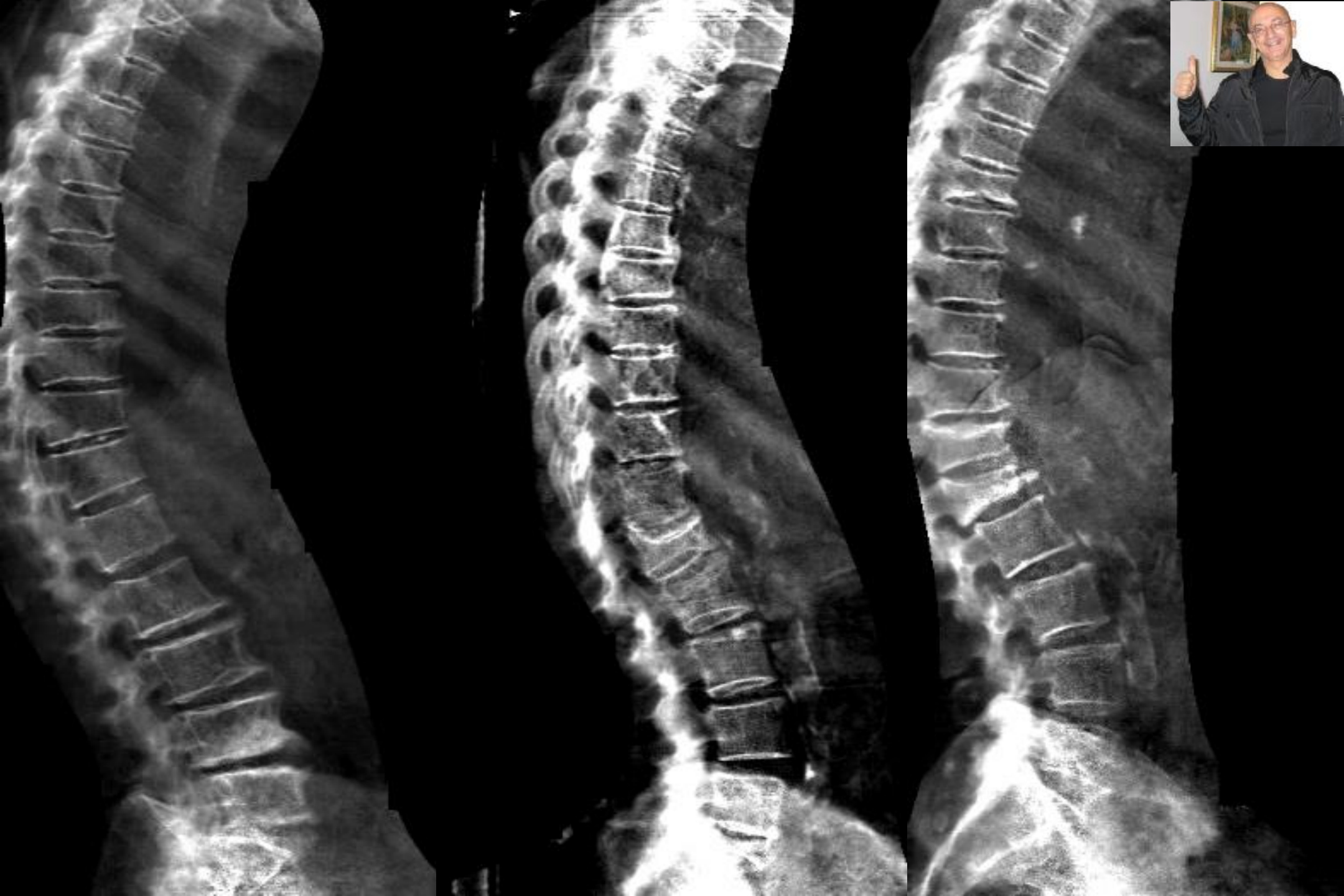
Delmas PD et al JBMR 2005



Vertebral Fracture Assessment (VFA) by Dual-X-Ray Absorptiometry



Vertebral Fracture Assessment (VFA) is the correct term to denote densitometric spine imaging performed for the purpose of detecting vertebral fractures

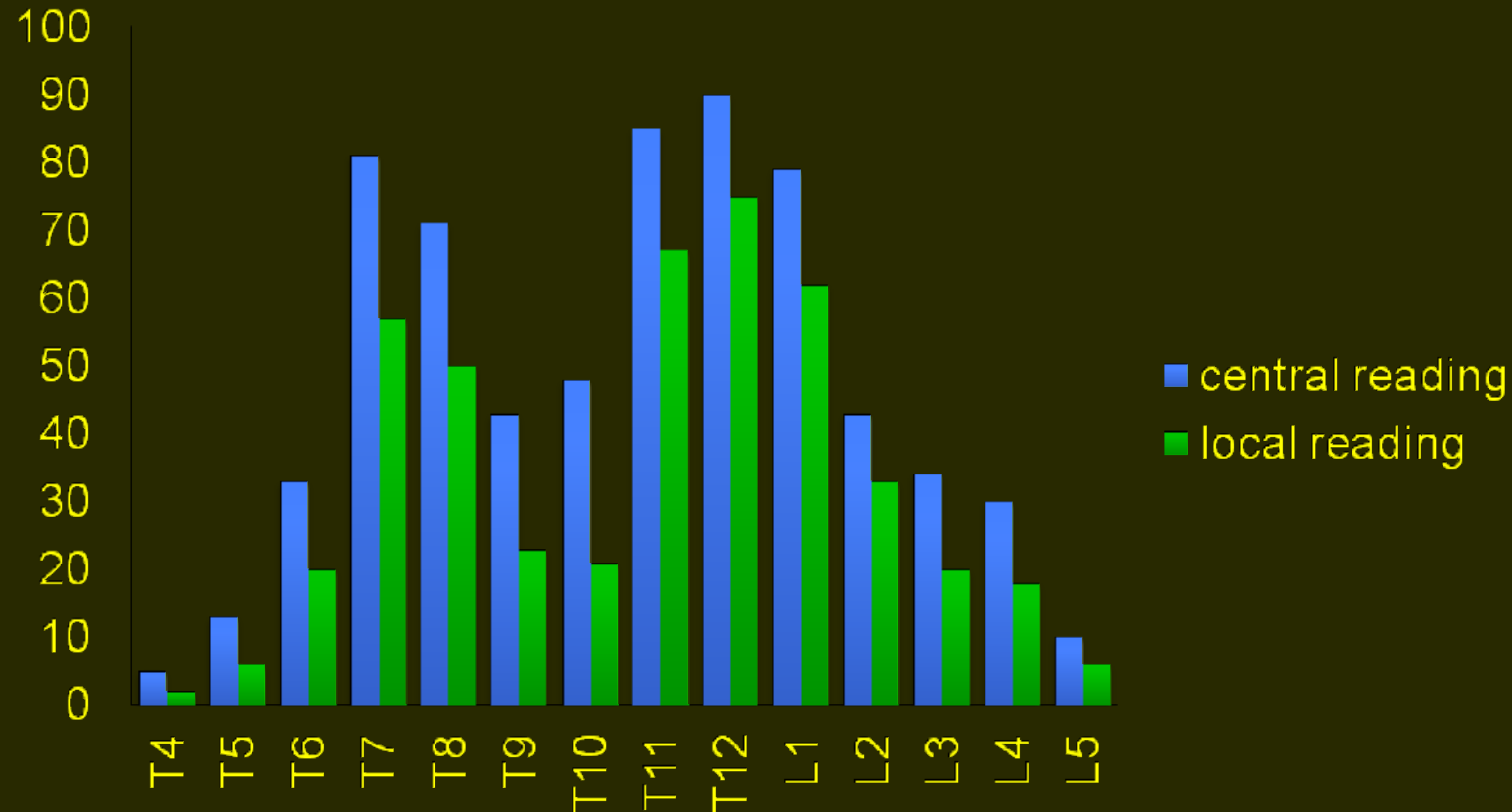


A scenic view of a beach with a large white rock formation on the left and a large white rock in the water. The sky is blue with some wispy clouds. The water is a mix of green and blue. The beach is sandy and pebbly.

Non sempre è tutto così chiaro...

La frattura vertebrale appare sempre
come una deformazione del corpo vertebrale,
ma non tutte le deformazioni vertebrali sono fratture!

Misdiagnosis of vertebral fractures on local radiographic readings of POINT (Prevalence of Osteoporosis in INTernal medicine) study

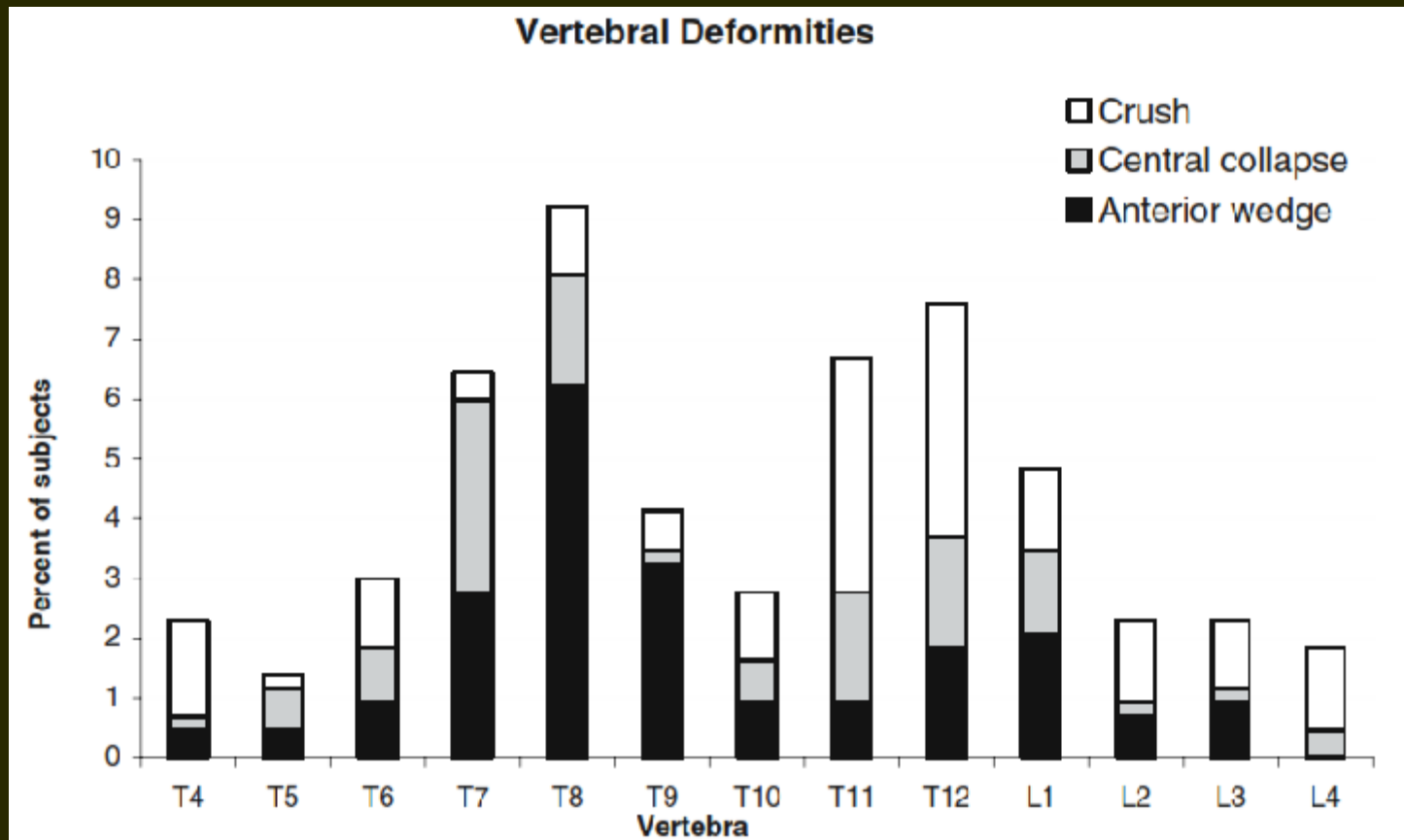


37 Centri ; 661 pazienti ; 9254 vertebre valutate da CR e LR

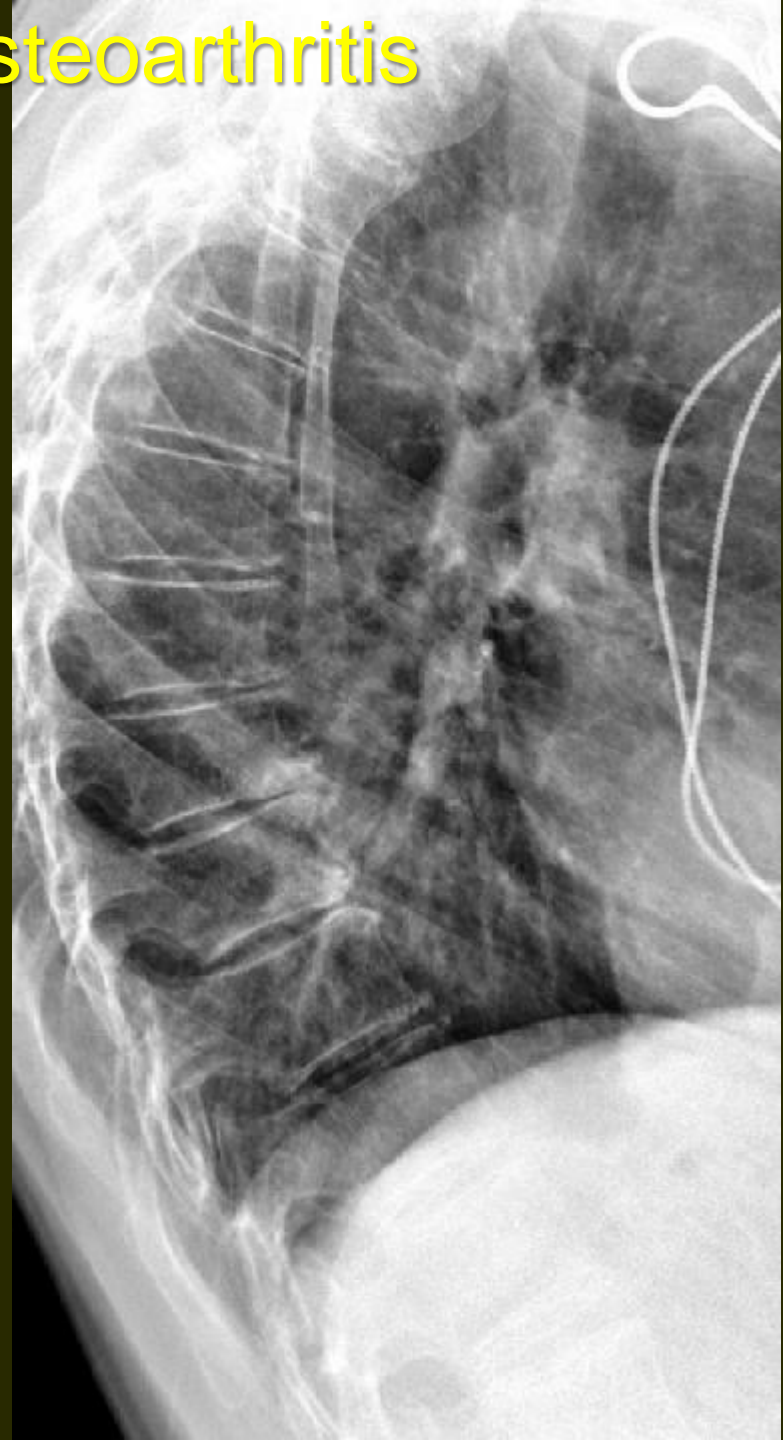
CR 665 vfx; LR 460vfx

205 (31%) mild VFx misdiagnosed by LR

Elevata frequenza delle fratture a cuneo nel rachide toracico!



Thoracic wedging in osteoarthritis



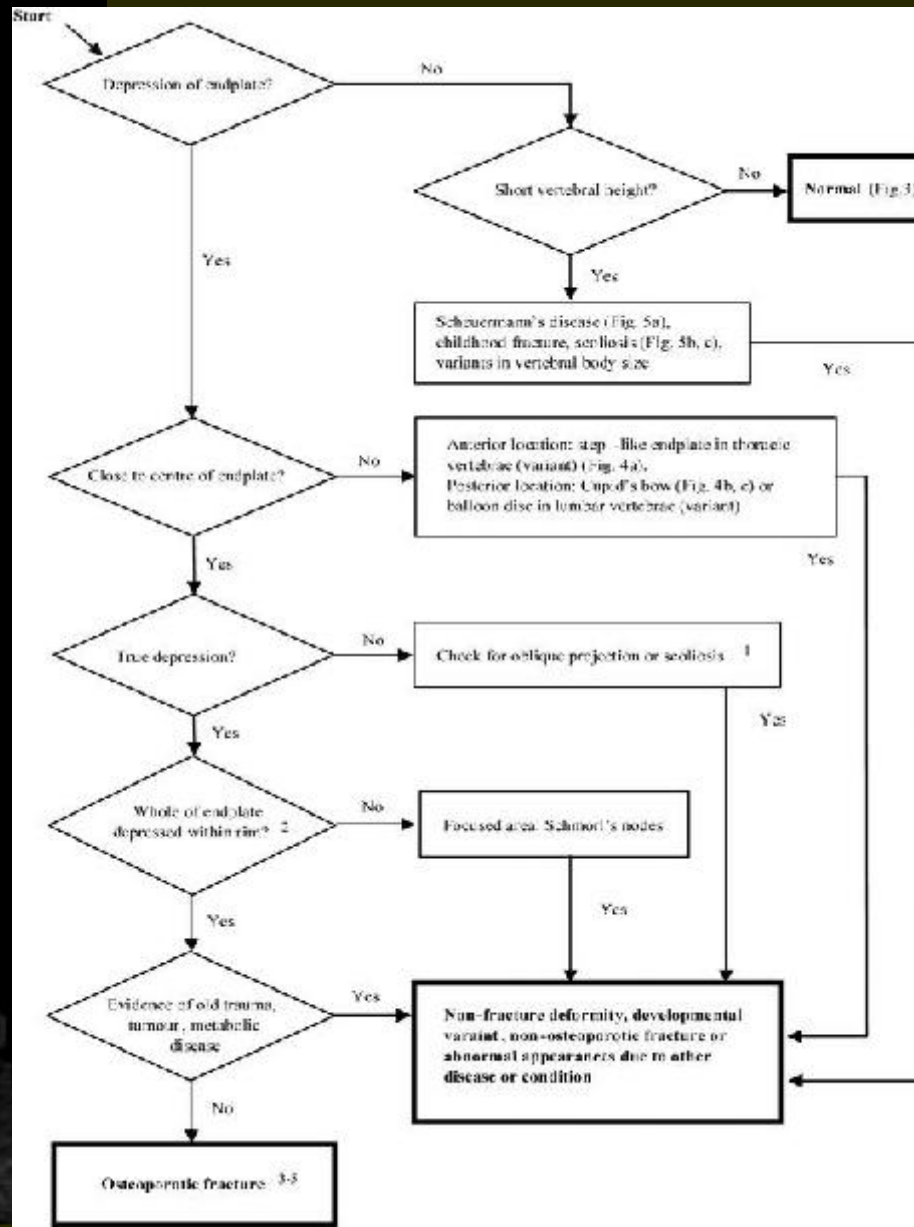
Algorithm-based qualitative (ABQ) assessment of vertebral fracture

(G. Jiang et al, Osteoporos Int 2004)

T5 W2

L2 B1

D11 SVH





Vertebral *Fracture*
or
Vertebral *Deformity*?



Vertebral *Fracture* or Vertebral *Deformity*?



E' una frattura vertebrale !



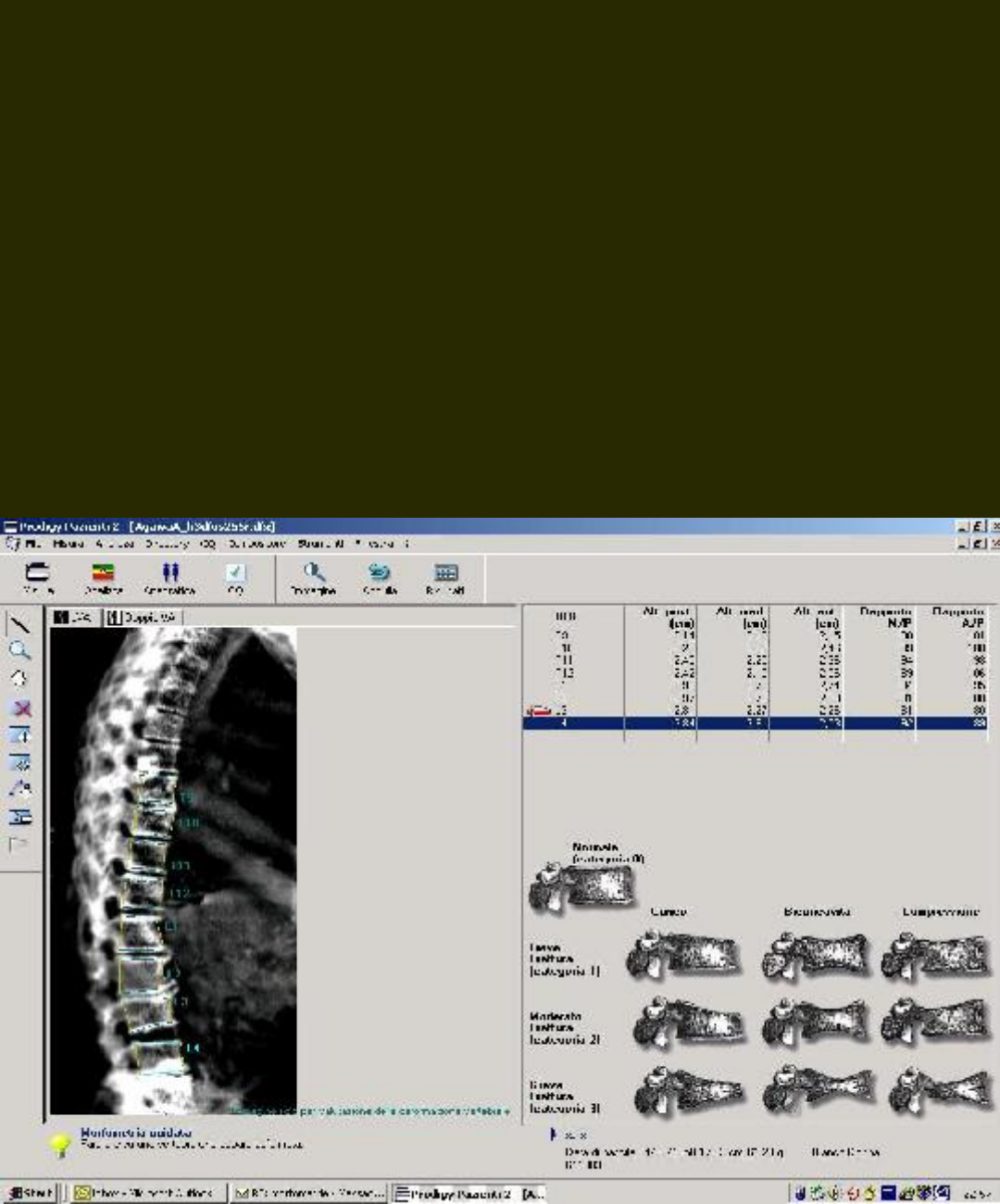
E' una SVH!



VFA Report

- 1) Vertebre non valutabili
- 2) Vertebre deformate (ABQ)
- 3) Vertebre fratturate (SQ)
- 4) Reperti patologici collaterali
- 5) Consigli per ulteriori esami

VFA con MORFOMETRIA VERTEBRALE



2013 Position Development Conference on Bone Densitometry
The Official Positions of the International Society for Clinical Densitometry: Vertebral Fracture Assessment

Indications for Vertebral Morphometry

- Vertebral morphometry **alone is not recommended** because it is unreliable for diagnosis.
- Vertebral morphometry **is useful** for evaluation of **fracture severity** and for the **follow-up**

Spine Imaging: comparison of X-ray and VFA

	CR	VFA
Radiation dose	600μSv	3-40μSv
Spatial Resolution	5 lp/mm	0.3 lp/mm
Visualization	Good entire spine	Good entire spine
Fractures or deformities	easy	<i>possible</i>
Vertebral texture	achievable	unfeasible
Obliquity	Common in lumbar spine	No parallax effect
Computerized Morphometry	No	Yes
Spine exposure	Double	Single
Access	Separate visit	Combined with BMD
Cost	Higher (\$92)	Lower(\$45)

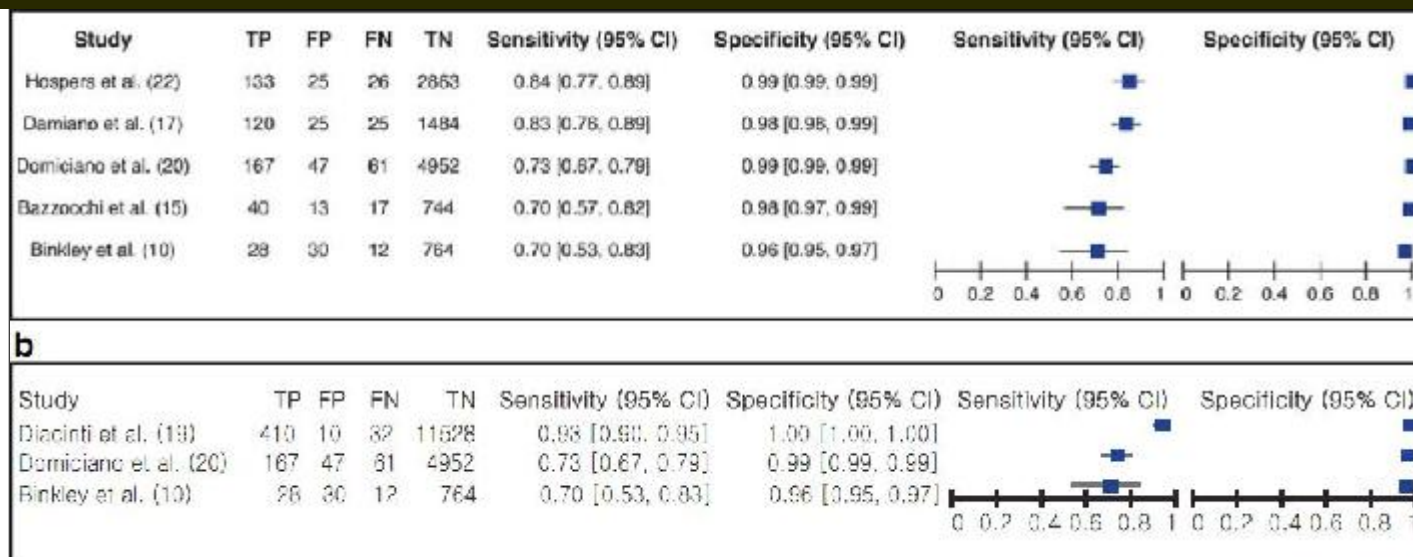
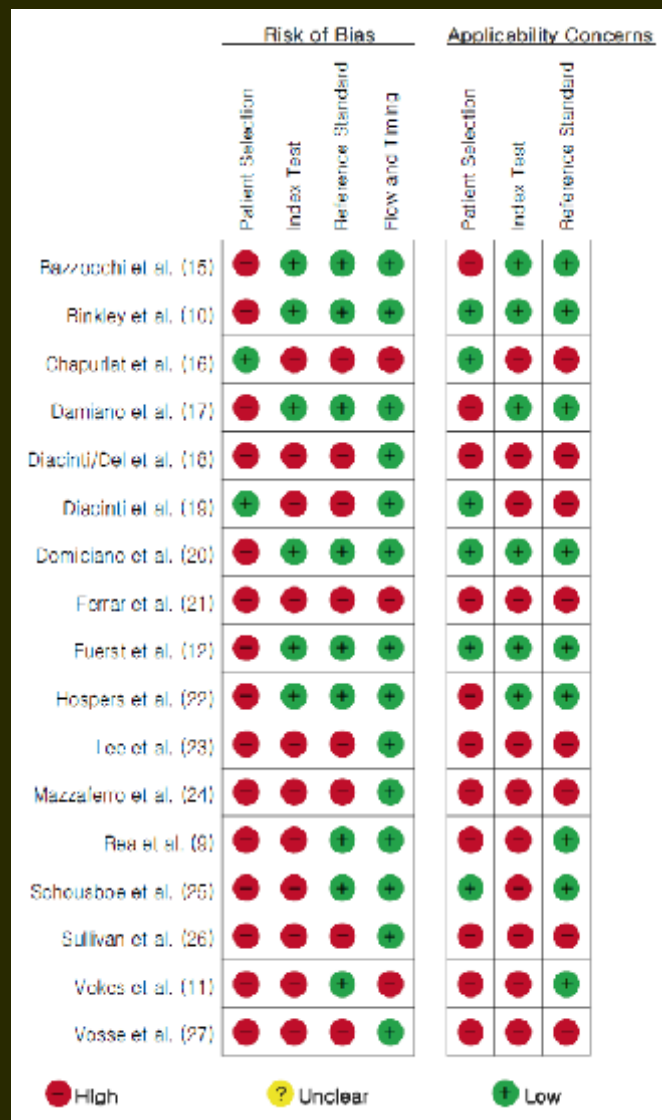


EBM of high VFA diagnostic accuracy

A systematic review of diagnostic accuracy of vertebral fracture assessment (VFA) in postmenopausal women and elderly men

J.-H. Lee¹ • Y. K. Lee² • S.-H. Oh² • J. Ahn² • Y. E. Lee³ • J. H. Pyo⁴ • Y. Y. Choi⁵ • D. Kim⁶ • S.-C. Bae⁶ • Y.-K. Sung⁶ • D.-Y. Kim⁷

Osteoporos Int (2016) 27:1691–1699



VFA

Analisi per vertebra: **Sensibilità 0.70-0.93**

Specificità 0.95-1.00

Analisi per paziente : **Sensibilità 0.65-1.00**

Specificità 0.74-1.00

Lee JH et al. Osteoporosis Int 2016

Indications for vertebral imaging with standard radiography or densitometric VFA

A) In the **presence of symptoms** suggestive for vertebral fracture: intense back pain that worsens with standing, current or past

B) In the **absence of symptoms** :

- All women age 70 and older and all men age 80 and older if BMD Tscore at the spine, total hip, or femoral neck is ≤ -1.0 ¹
- • Women age 65 to 69 and men age 70 to 79 if BMD T-score at the spine, total hip, or femoral neck is ≤ -1.5 ¹
- **Postmenopausal women and men age 50 and older with specific risk factors:**
 - Low-trauma fracture during adulthood (age 50 and older)
 - Historical height loss of 1.5 in. or more (4 cm) ²
 - Prospective height loss of 0.8 in. or more (2 cm) ³
 - Recent or ongoing long-term glucocorticoid treatment *equivalent to >5 mg of prednisone or equivalent per day for >3months*

¹ If bone density testing is not available, vertebral imaging may be considered based on age alone

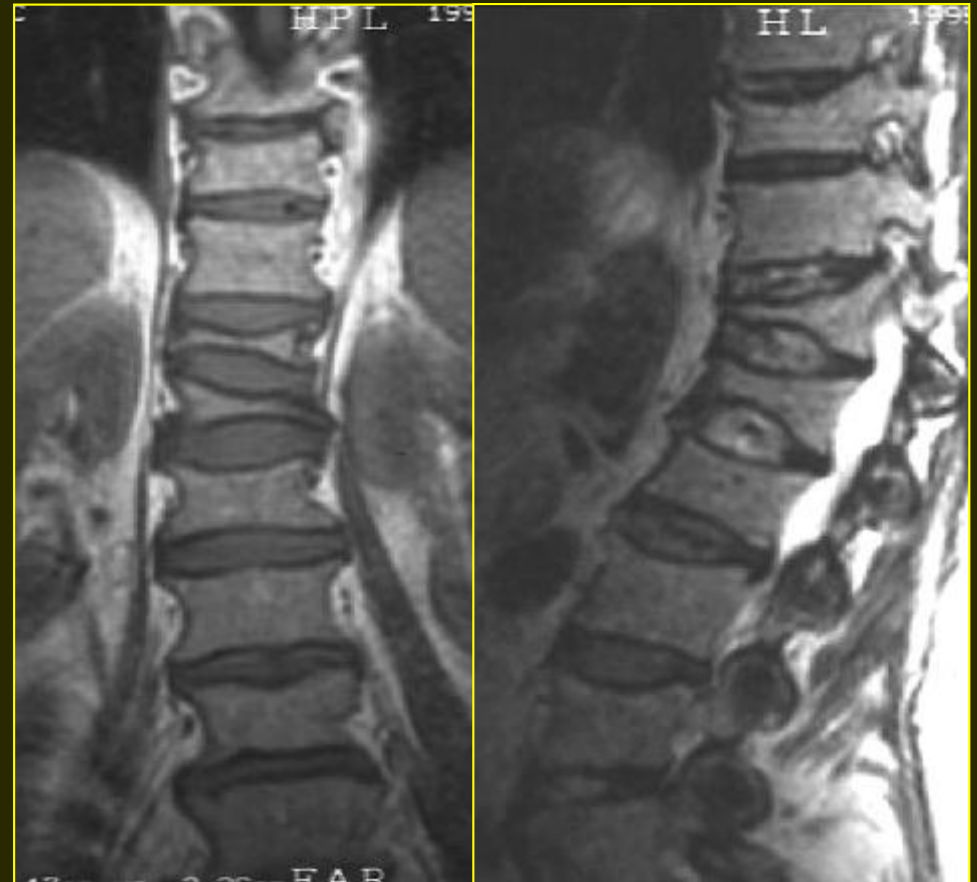
² Current height compared to peak height during young adulthood

³ Cumulative height loss measured during interval medical assessment

*In a patient with a known history of a **relevant malignancy** additional imaging (MR/TC) should be used, to discriminate more accurately between benign or malign causes of vertebral fractures.*

RM frattura vertebrale benigna

- Vertebre crollate con segnale intermedio uguale alle vertebre non fratturate
 - “Fluid sign”
 - Vacuum intra-somatico
- Alterazione di segnale a banda
 - Muro posteriore, piatto
 - Masse epidurali, rare
- Segnale normale in pochi mesi
 - Segnale ipointenso nelle immagini in diffusione



RM frattura vertebrale maligna



- Tutto il soma
- Retropulsione del muro posteriore
- Infiltrazione dei peduncoli
 - Metastasi soprastante
- Segnale iperintenso nelle immagini in diffusione

CONCLUSIONI (1)

- La sola definizione **quantitativa** è **insufficiente** per la corretta diagnosi della frattura vertebrale!
- In prima istanza è necessario **il referto qualitativo del rachide per**
- **Differenziare deformità/frattura** con l'algoritmo ABQ
- poi **graduare** la frattura con il metodo **SQ** o con la **morfometria vertebrale**
- **Caratterizzare la frattura** soprattutto in caso di anamnesi positiva per neoplasia per *orientare sulla natura benigna o maligna della frattura* con **RM**

CONCLUSIONI (2)

- La **VFA** può avere elevata accuratezza diagnostica se effettuata con **moderna tecnologia** da **tecnici dedicati** e se valutata da **radiologi esperti**
- Considerando **la bassa dose di radiazioni** viene raccomandato l'uso della VFA in associazione alla densitometria ossea nella valutazione del paziente osteoporotico (ISCD J Clin Dens 2013 ; NOF Osteoporos Int 2015)
- In tal modo possono essere identificati pazienti con fratture vertebrali lievi ed asintomatiche, non sospettabili dalla sola BMD, da sottoporre alla terapia farmacologica, **riducendo il rischio di "effetto domino"**