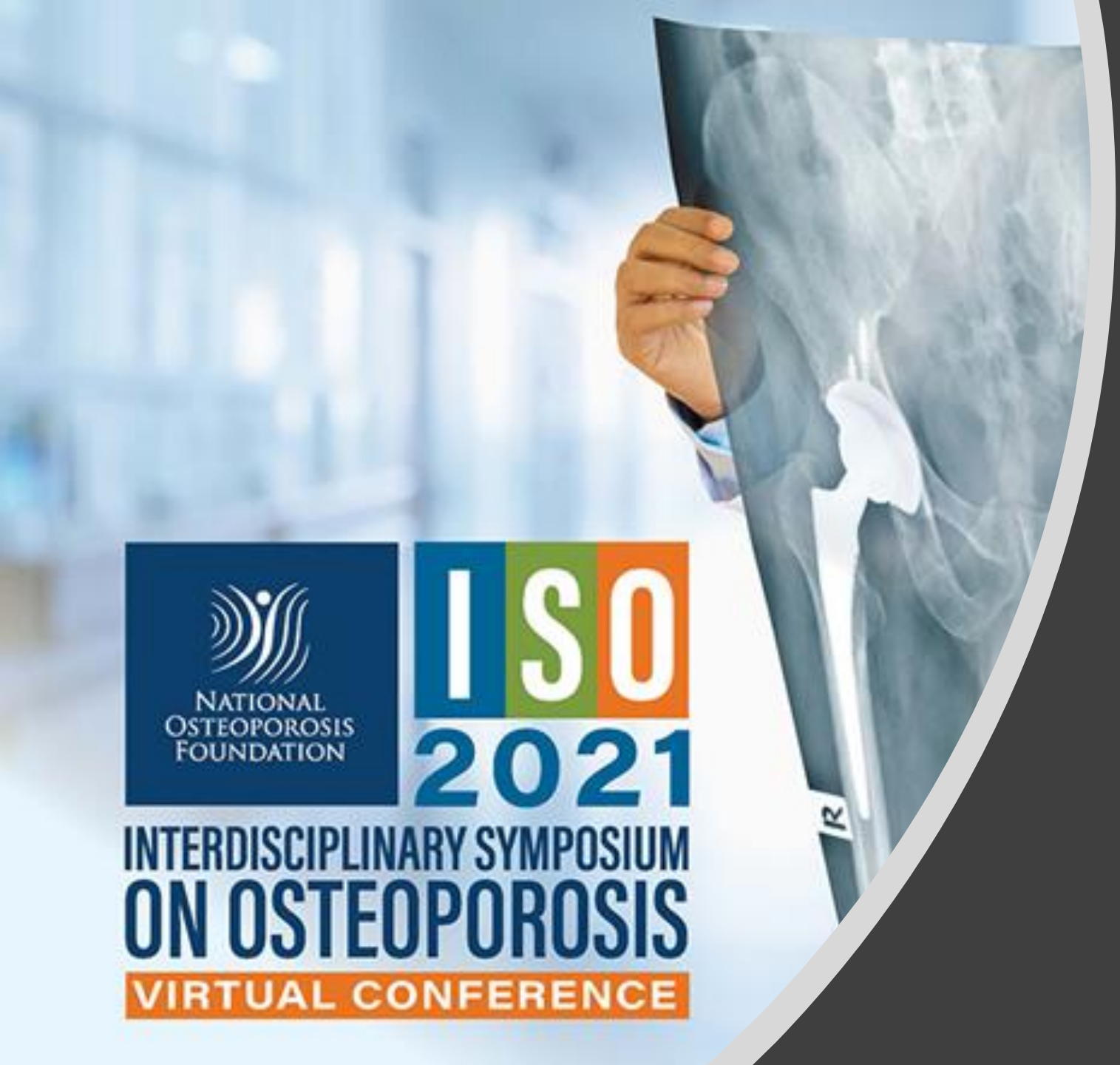

DXA Troubleshooting And Challenging Cases

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UAB

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IBJI

COI Disclosures:

Sarah Morgan: MD, RD, CCD : None

Lawrence Jankowski CBDT: None

Course Objectives

- Reconsider the appropriateness of “image not for diagnostic use” disclaimer
- Review situations where the DXA images give clues to the diagnosis or mis-interpretation
- List common errors in DXA scanning and reporting with examples

Outline

- “image not for Diagnostic Use
- List the most common errors in DXA scanning with examples
  - Not labelling spinal levels appropriately
  - Not labelling spinal levels analogously on follow up scans
  - Differences in hip positioning
- Review situations where the DXA images give clues to the diagnosis (reconsider the appropriateness of “image not for diagnostic use” disclaimer.
  - Common artifacts
  - Problems in spine and hip analysis
  - Interval compression fracture
  - Show examples of specific disease processes seen on the DXA image.

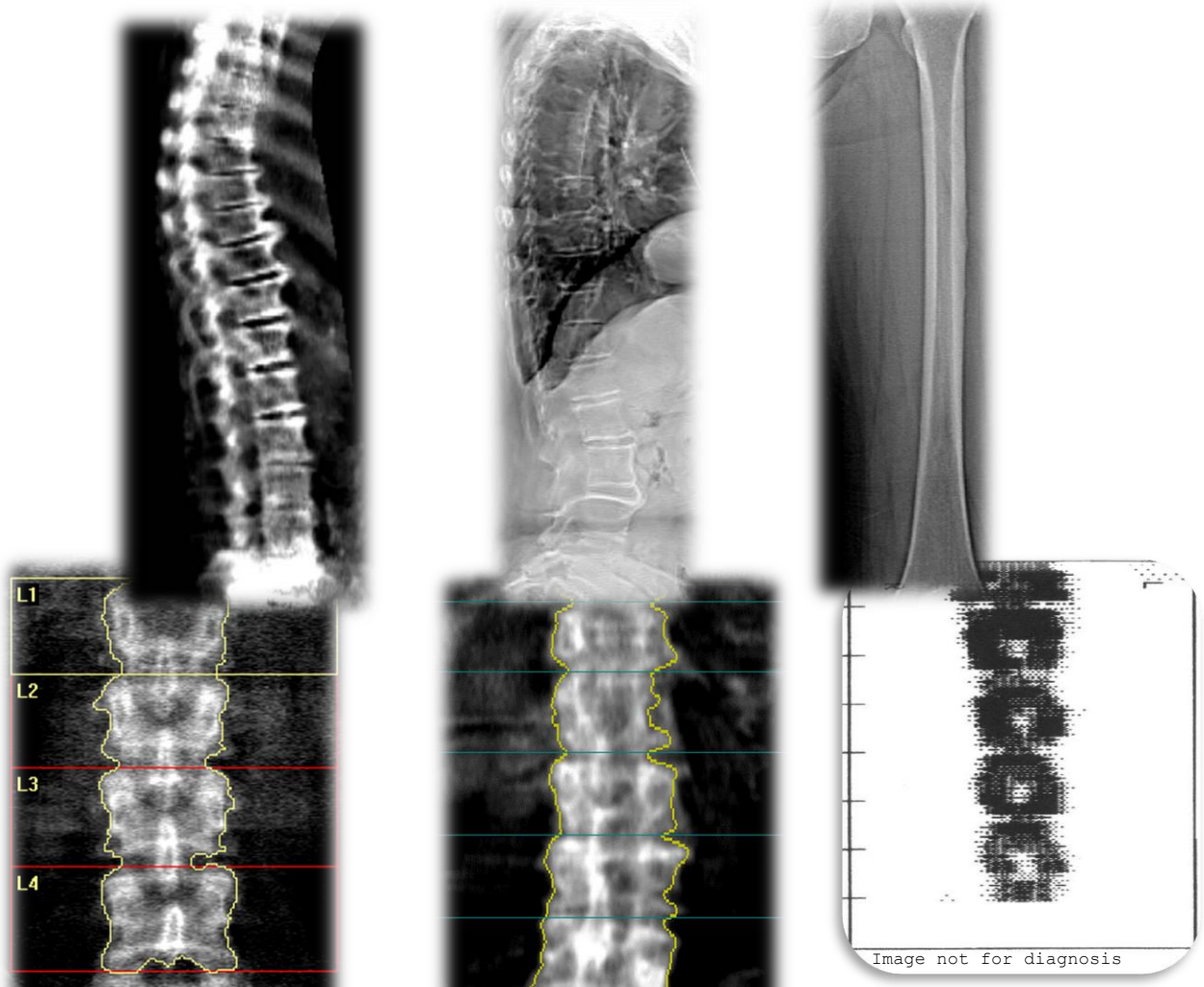
“Image not for diagnostic use”

Where did this disclaimer come from?

Is it still valid?

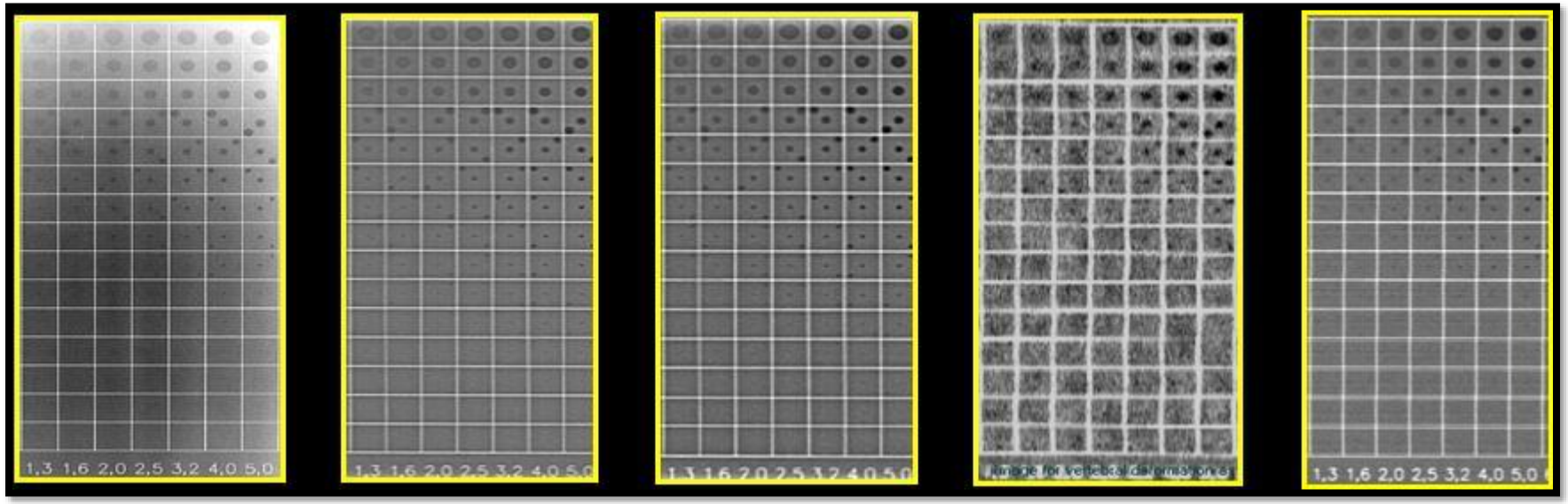
History of Imaging in Bone Densitometry

- 1963 SPA - No image.
- 1980 - FDA approves first DPA device and requires the disclaimer: “Image not for diagnosis” to appear on all image printouts.
- 1986 FDA approves first pencil beam DXA
- Fan-beam DXA devices:
  - 1991 Linear scanning (transverse beam)
  - 1993 Rectilinear scanning (sagittal beam orientation)
- 2002 FDA approves Vert. Fx. Assessment
- 2007 FDA approves SE IVA for AAC
- 2017 FDA approves extended femur imaging for detection of AFF

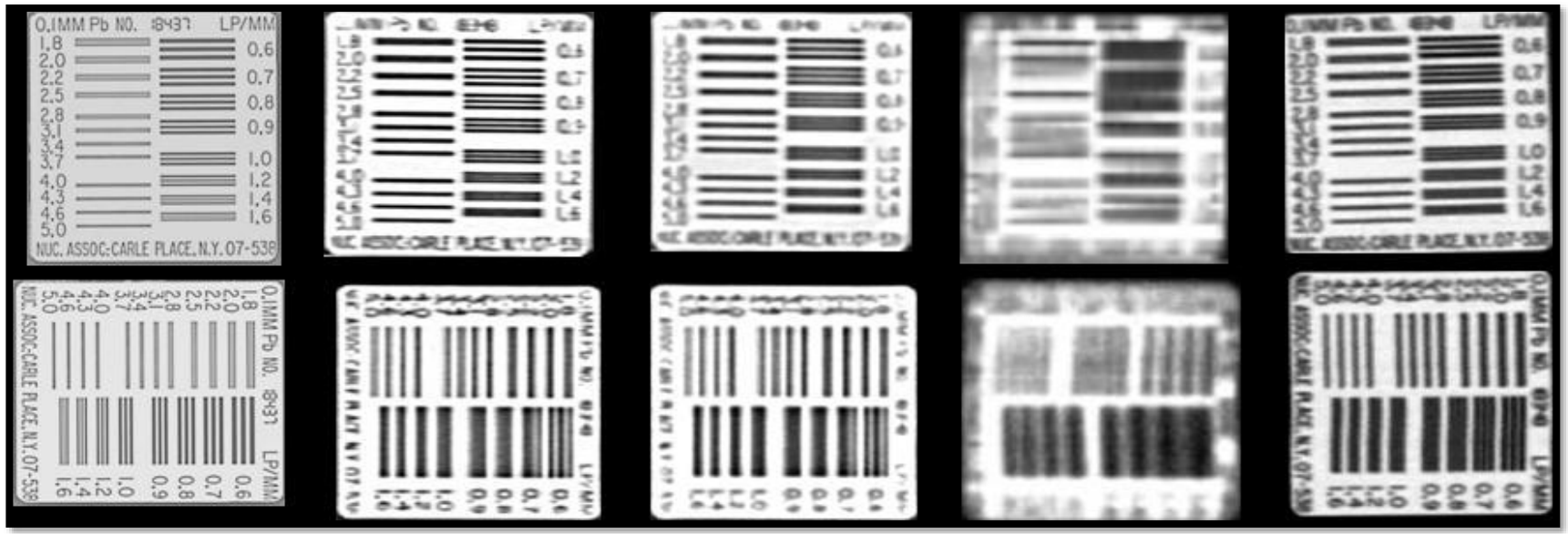


DPA - 1983

Image Resolution Varies By Scanner

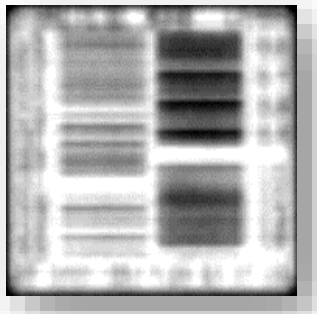


Digital XR | Horizon-HD VFA | Discovery-IVA | Prodigy | iDXA

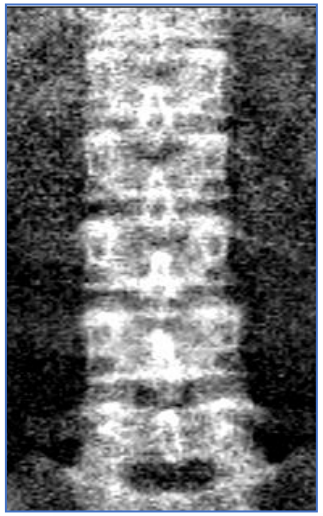


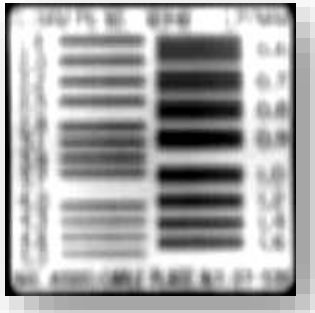
Resolution Varies with Scan Mode

Express



Fast Array





Array

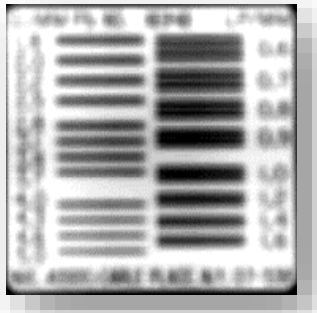
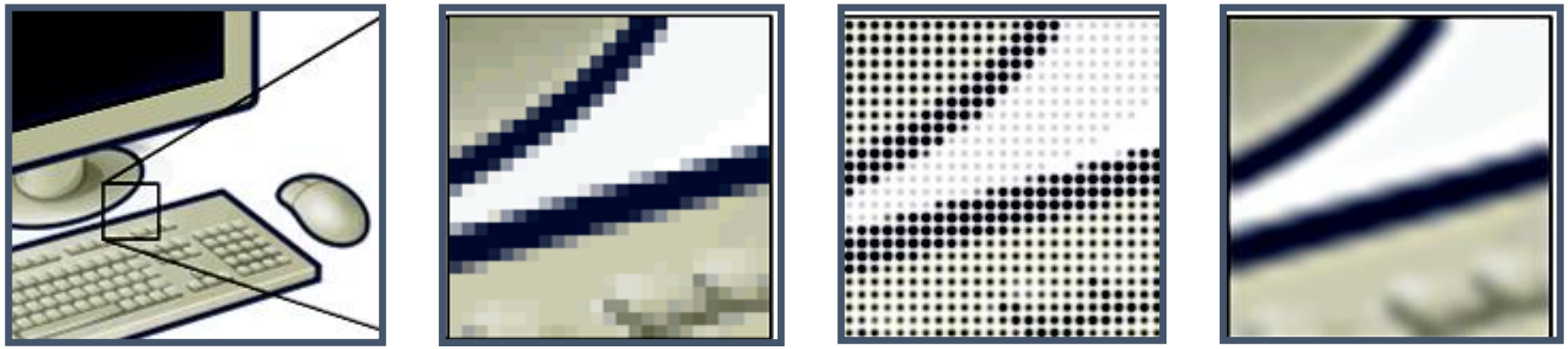
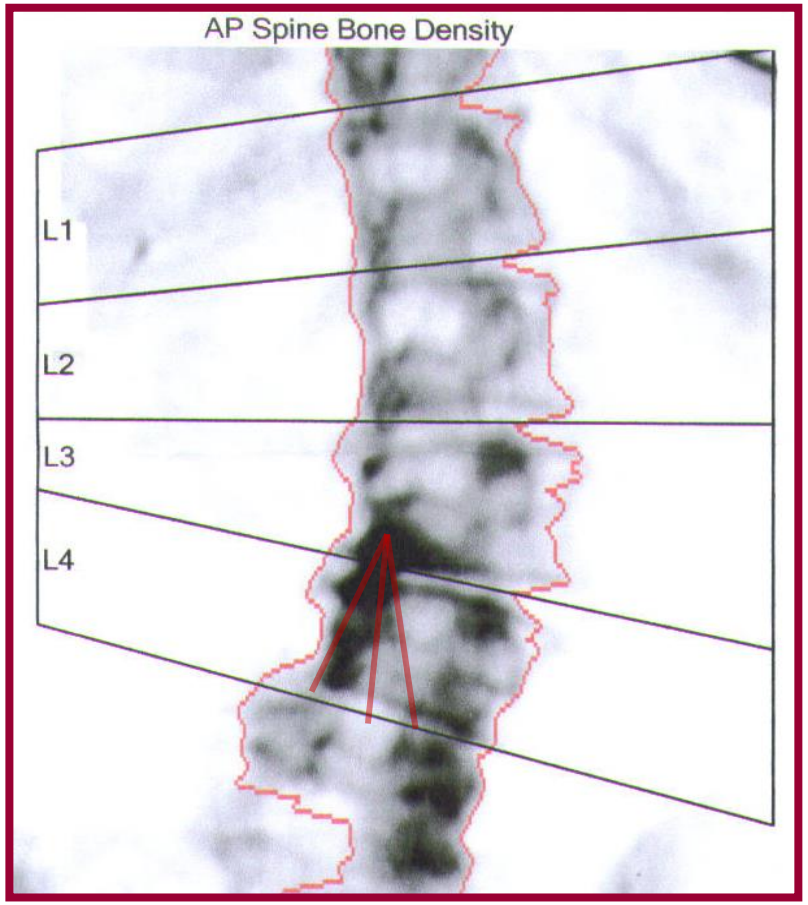


Image Post-processing Cannot Improve Resolution

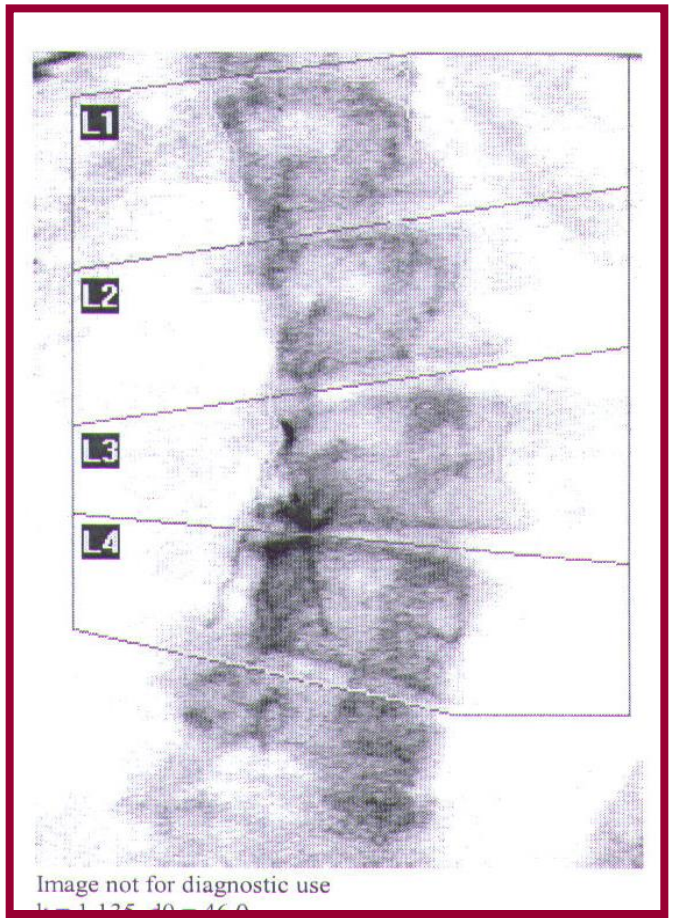


- Image processing (window, level, interpolative smoothing, anti-aliasing) make image more pleasing to the eye
- Cannot create detail not present in raw data

Post-processing and Artifact Detection



Baseline



Follow-up

“Image not for diagnostic use”?

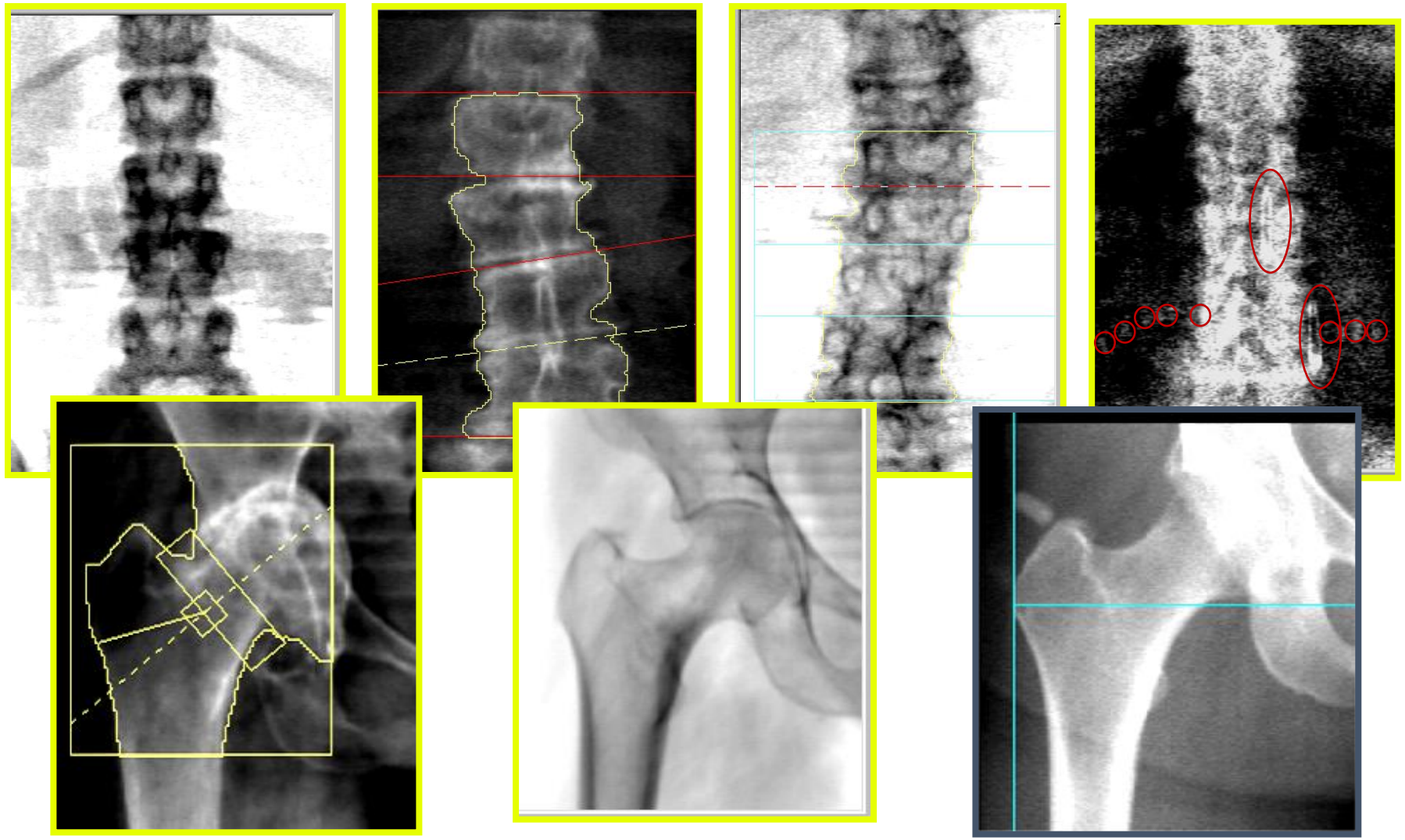


Image not for diagnostic use

- Disclaimer is not a mandate
- Images convey the veracity of the underlying BMD
- Comparing serial images compensates for lower resolution
- Synergy between BMD, images, and patient presentation
- Errors of omission if we ignore them

Image for limited diagnostic use

The most common DXA errors

Spine Errors

- Incorrect or inconsistent vertebral labeling
- Incorrect intervertebral space identification
- Unrecognized pathology or artifacts
- Unrecognized interval changes

Hip Errors

- Incorrect or inconsistent patient positioning
- Incorrect or inconsistent regions of interest sizes and placements
- Unrecognized pathology or artifacts

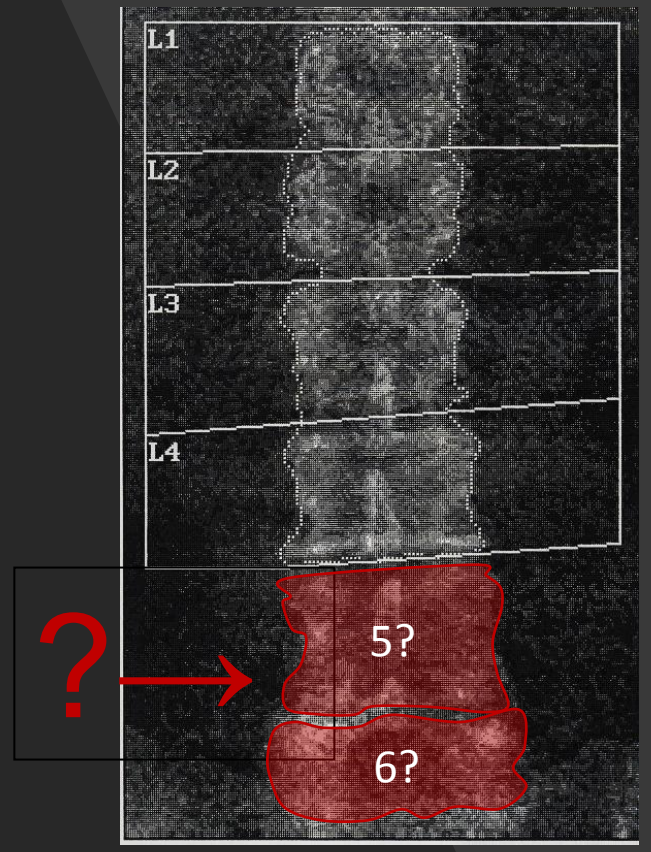
Other Errors

- Unappreciated or ignored serendipitous findings
- Discordance in changes at skeletal sites
- Results unexpected or mismatched to patient presentation

Problems with Intervertebral Marker Identification and Placements

Vertebral Level Identification

- Extra Lumbar Vertebral Body?
- Establish a vertebral body numbering convention in your center?
- ISCD recommendation is to count from sacrum upward



375 Patients with complete spine exams
(assumes 12 thoracic vertebra and first rib on T1)

Appear as 5 Lumbar

Appear as 6 Lumbar

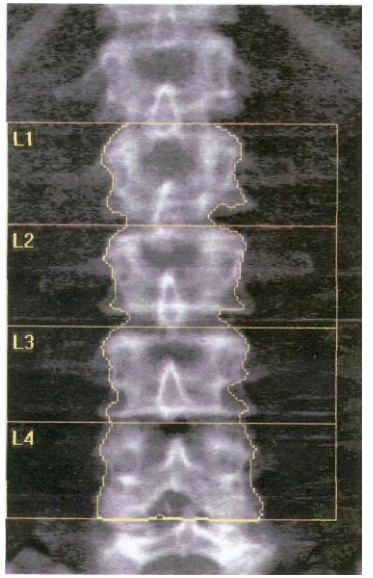
# of Lumbar	Lowest Pair of Ribs			
	T-11	T-12	L1	Total
4	**5.3% (20)**	2.1% (8)	0% (0)	7.4% (28)
5	**7.2% (27)**	**83.5% (313)**	0% (0)	90.7% (340)
6	0% (0)	**0.8% (3)**	**1.1% (4)**	1.9% (7)
Total	12.5% (47)	86.9% (324)	1.1% (4)	100% (375)

Peel NFA, et al. *JBMR* 1993;8:719-723.

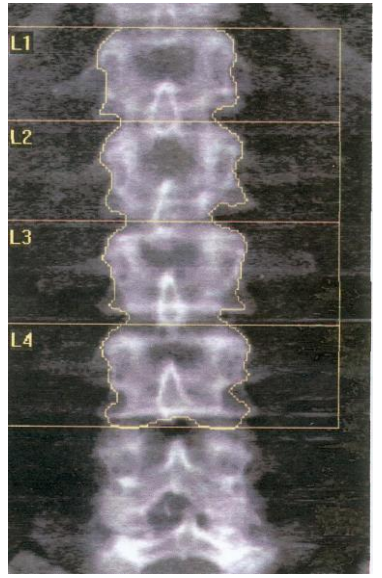
Mislabeling affects BMD and T-scores

- Can misclassify diagnosis
- Impedes ability to monitor with serial scanning

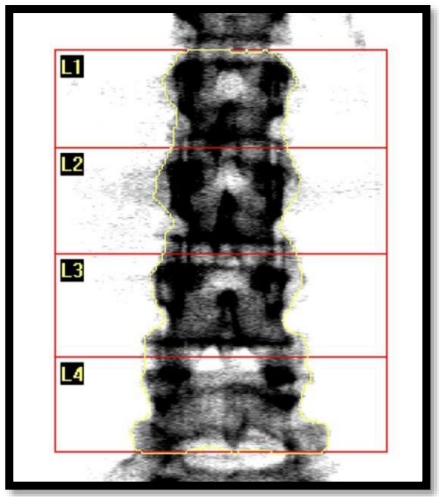
Region	Area (cm^2)	BMC (g)	BMD (g/cm^2)	T - Score
L1	15.56	12.47	0.802	-1.1
L2	15.70	13.33	0.849	-1.6
L3	16.09	13.14	0.816	-2.4
L4	18.66	16.42	0.880	-2.1
Total	**66.02**	**55.36**	**0.839**	**-1.9**



Region	Area (cm^2)	BMC (g)	BMD (g/cm^2)	T - Score
L1	14.56	10.66	0.733	-1.7
L2	15.30	12.39	0.810	-2.0
L3	15.64	13.31	0.851	-2.1
L4	16.75	13.67	0.816	-2.7
Total	**62.25**	**50.03**	**0.804**	**-2.2**



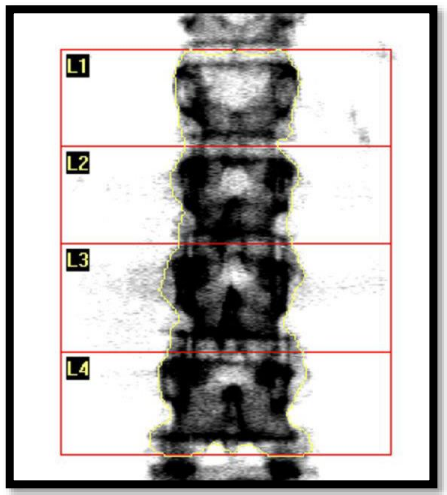
Bone Loss



Baseline

DXA Results Summary:

Region	Area (cm^2)	BMC (g)	BMD (g/cm^2)	T - score	Z - score
L1	13.72	12.68	0.924	0.0	0.8
L2	16.68	16.37	0.981	-0.4	0.5
L3	18.21	17.66	0.970	-1.0	-0.1
L4	20.17	17.27	0.856	-2.4	-1.4
Total	**68.78**	**63.97**	**0.930**	**-1.1**	**-0.1**



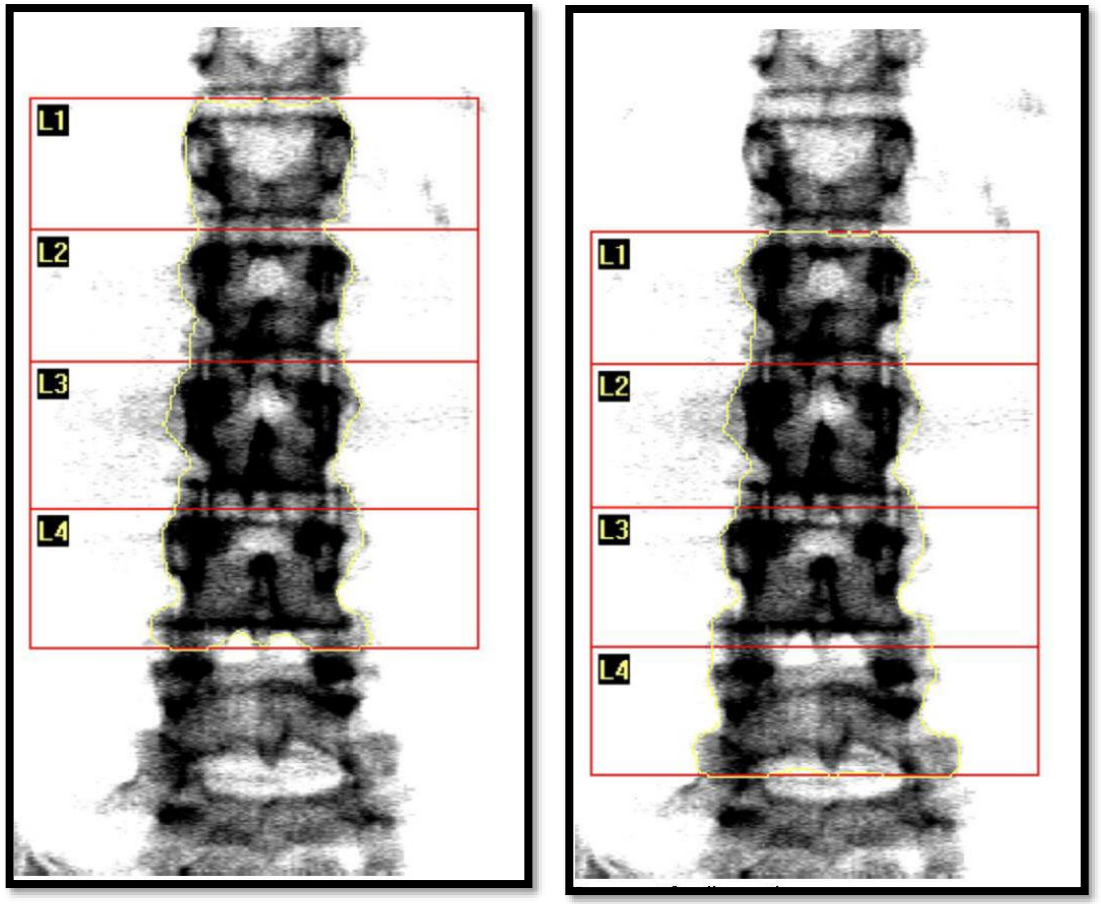
Follow-up

DXA Results Summary:

Region	Area (cm^2)	BMC (g)	BMD (g/cm^2)	T - score	Z - score
L1	13.32	9.49	0.713	-1.9	-1.1
L2	13.77	12.39	0.900	-1.2	-0.2
L3	16.92	16.26	0.961	-1.1	-0.1
L4	17.86	17.25	0.966	-1.4	-0.4
Total	**61.87**	**55.39**	**0.895**	**-1.4**	**-0.4**

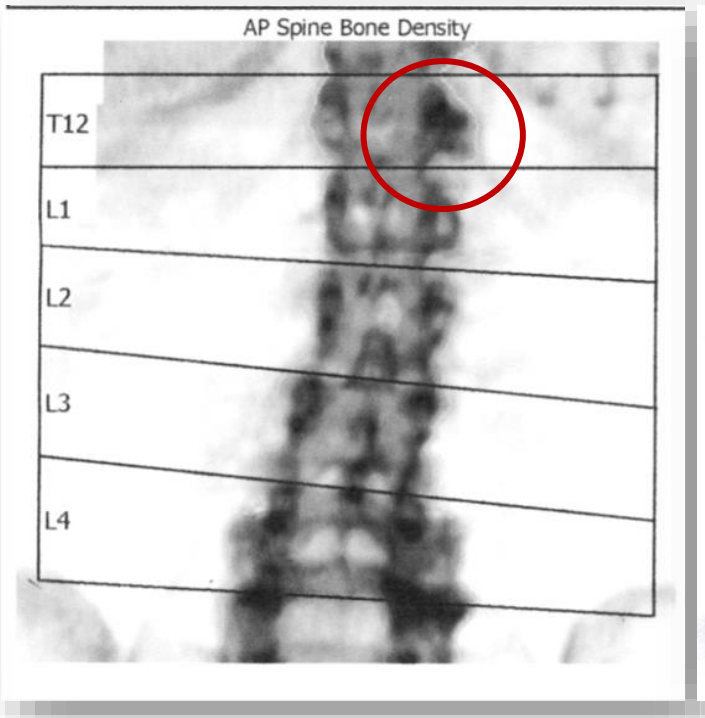
Total BMD CV 1.0%, ACF = 1.026, BCF = 0.997, TH = 5.927

Bone Loss Imaging (cont)

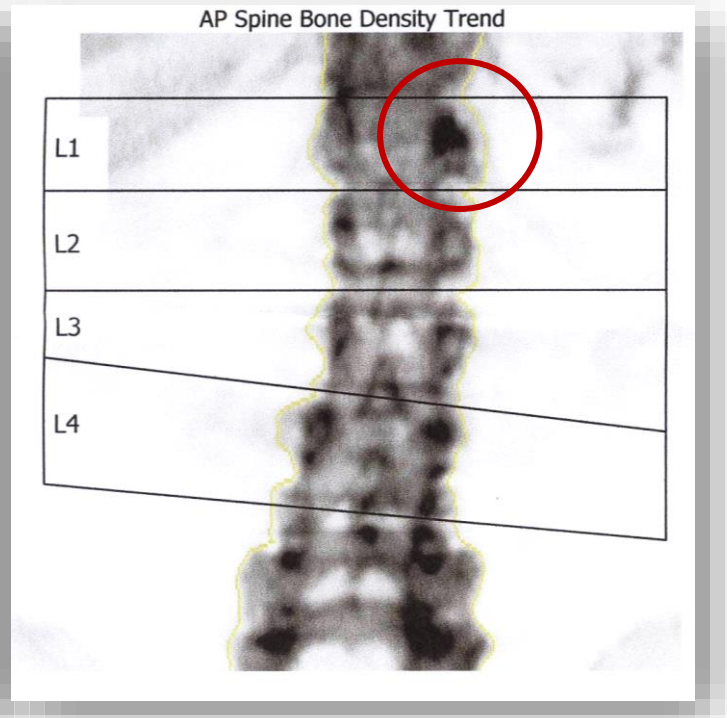


The ISCD recommendation is to include all levels from pelvis to first set of ribs and count from pelvis upward, even if 6 non-rib bearing VB's for consistency

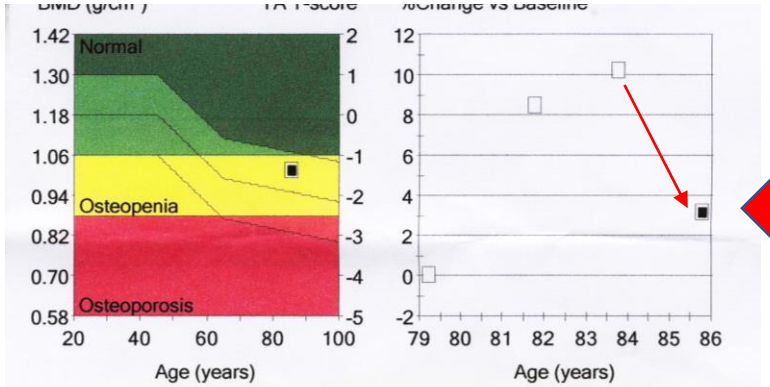
Different Levels Invalidates Serial Results



2007



2011

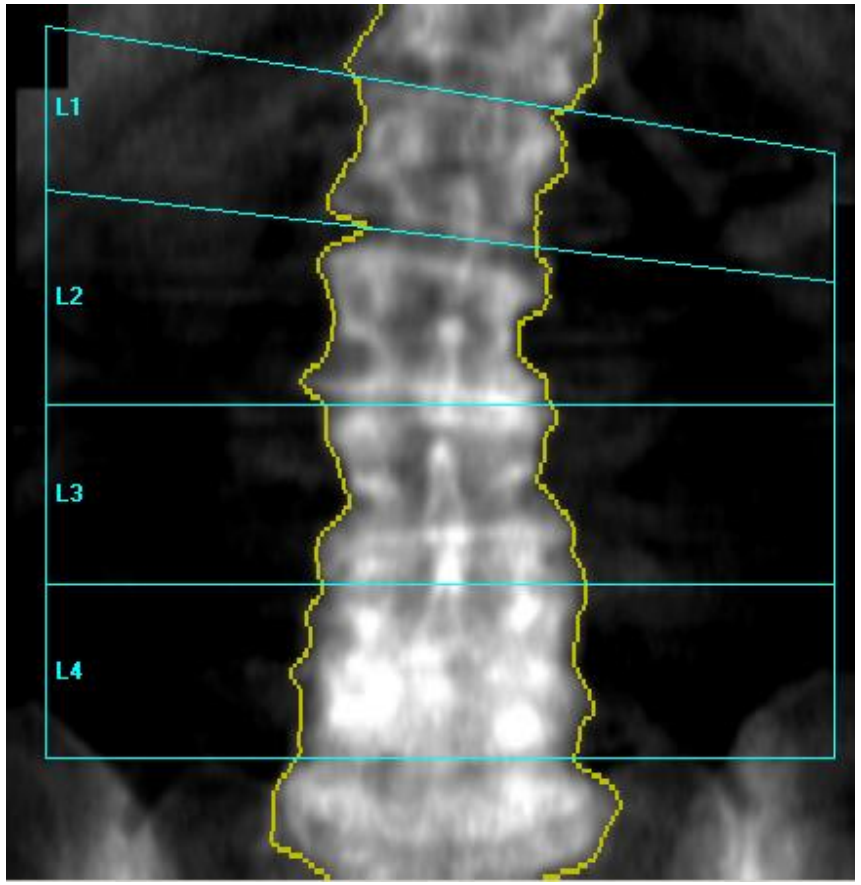


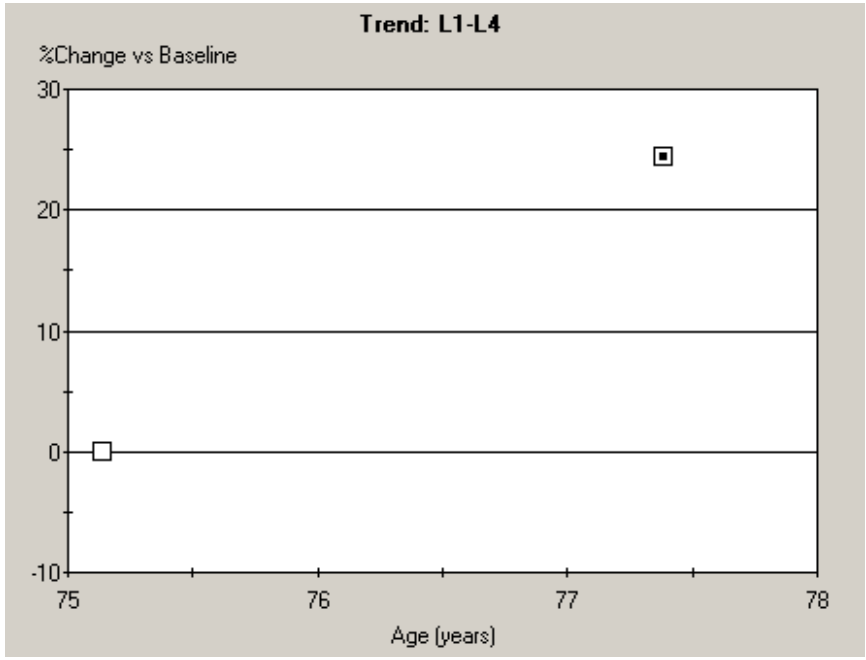
Region	BMD [1] (g/cm²)	Young-Adult [2] T-score	Age-Matched [3] Z-score
L1	1.034	-0.8	1.1
L2	0.951	-2.1	-0.1
L3	0.978	-1.8	0.1
L4	1.073	-1.1	0.9
L1-L4	1.013	-1.4	0.5

Trend: L1-L4

Measured Date	Age (years)	BMD [1] (g/cm²)	Change vs Previous (g/cm²)	Change vs Previous (%)
6/23/2011	85.7	1.013	-0.069 *	-6.4 *
6/22/2009	83.7	1.082	0.017	1.6
6/21/2007	81.7	1.065	0.083 *	8.5 *
12/6/2004	79.2	0.982	-	-

Auto-Analysis marker placement is imperfect

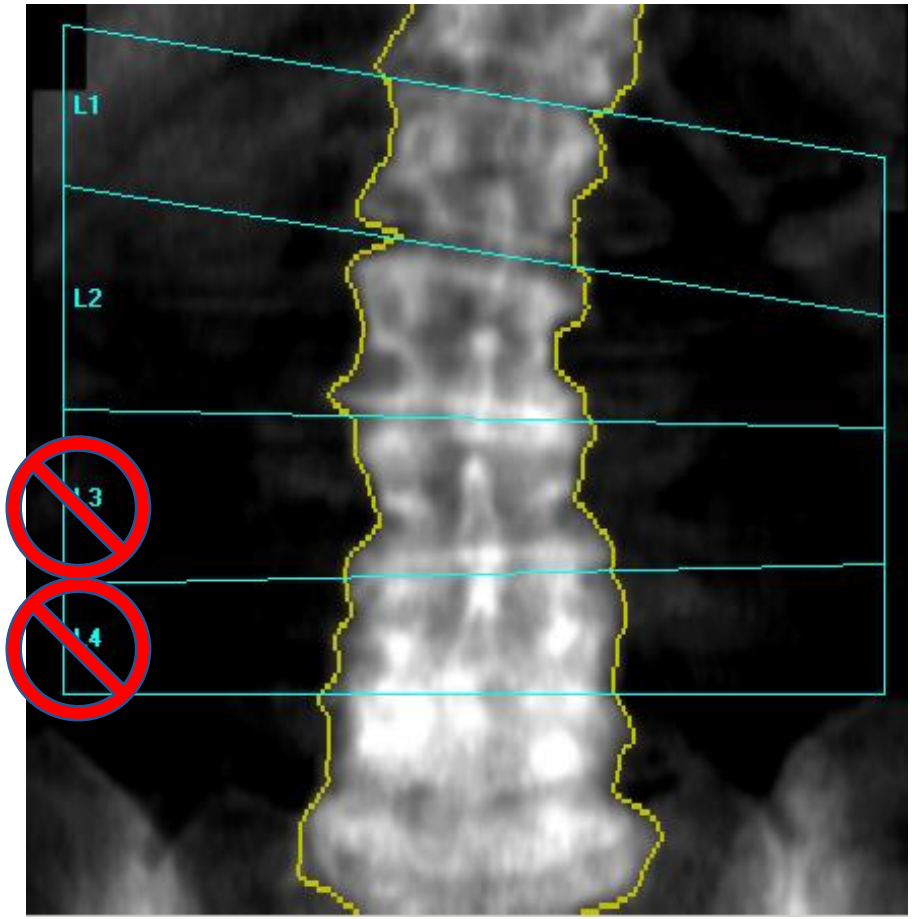


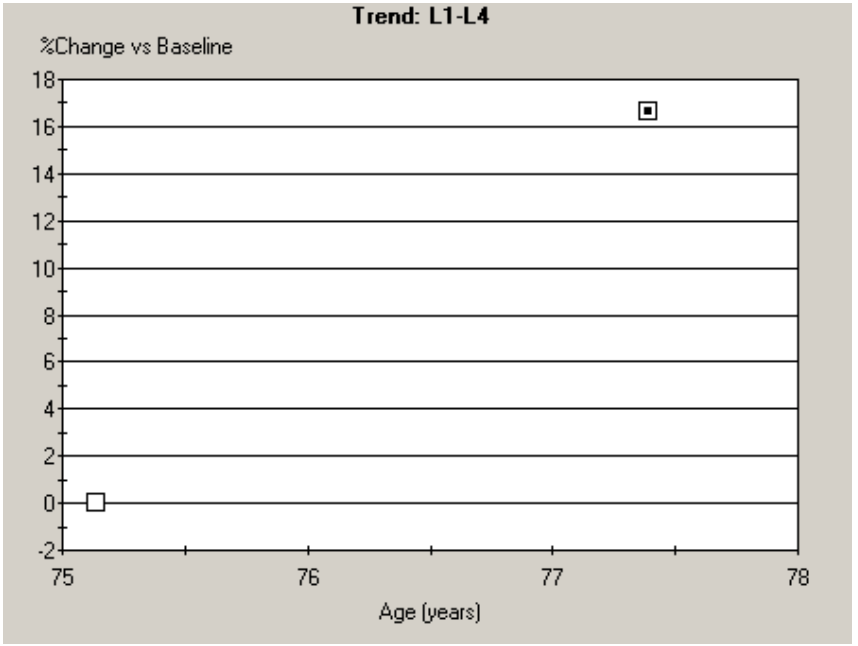


Trend: L1-L4

Measured Date	Age (years)	BMD (g/cm²)	Change vs Baseline (%)	Change vs Baseline (%/yr)
01/19/2004	77.3	1.507	24.4 *	10.8 *
10/19/2001	75.1	1.211	baseline	baseline

Manual analysis is not always perfect

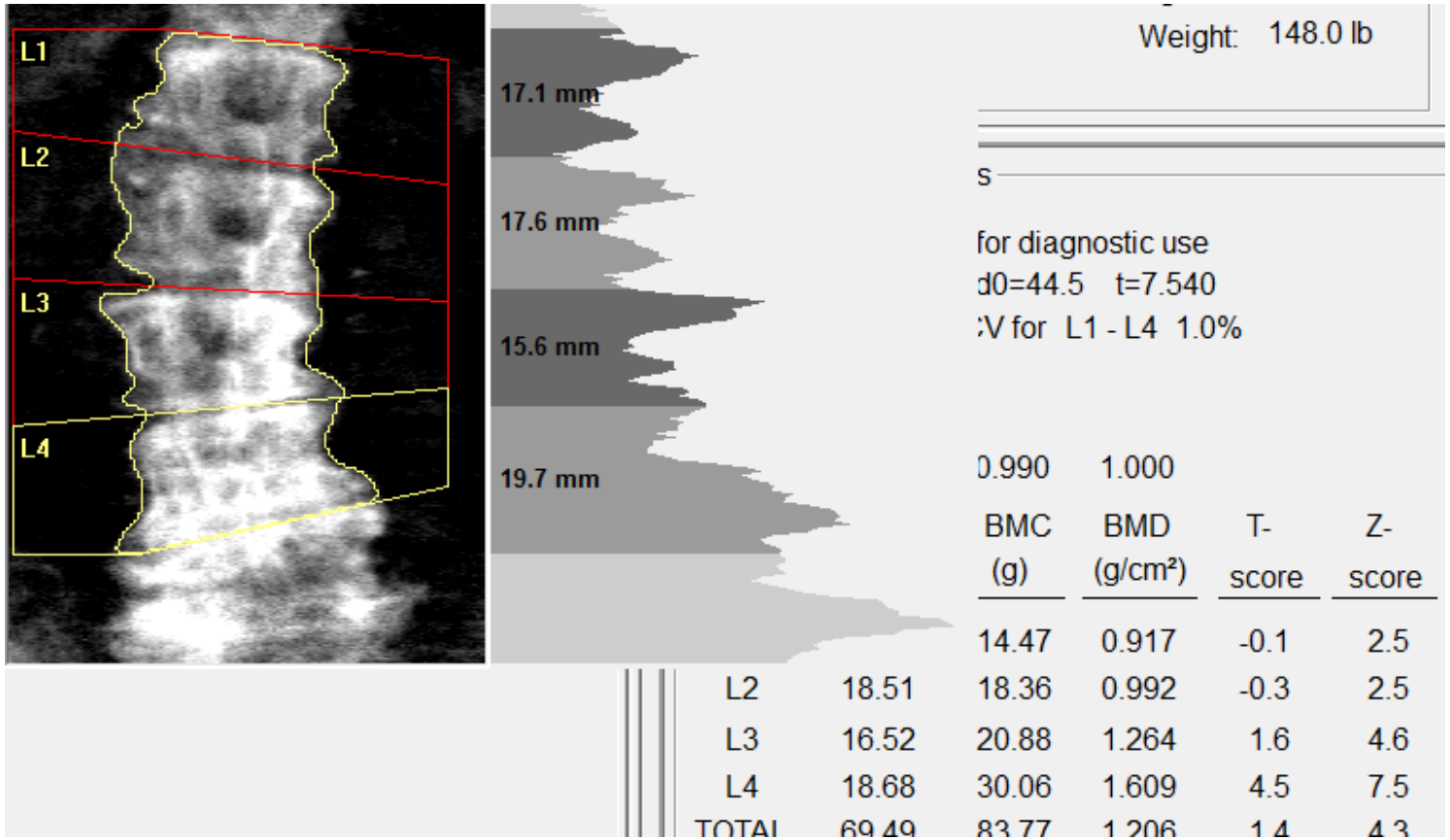




Trend: L1-L4

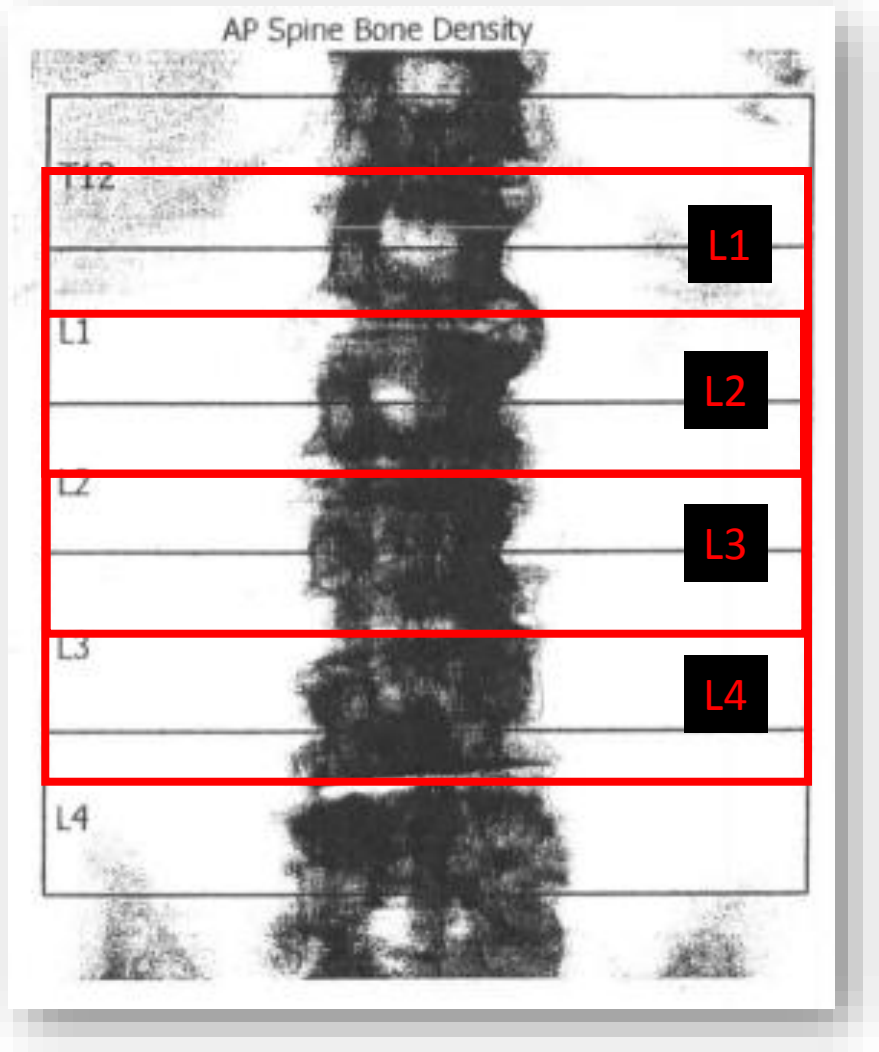
Measured Date	Age (years)	BMD (g/cm²)	Change vs Baseline (%)	Change vs Baseline (%/yr)
01/19/2004	77.3	1.412	16.6 *	7.4 *
10/19/2001	75.1	1.211	baseline	baseline

BMC Histogram may help or hinder line placement



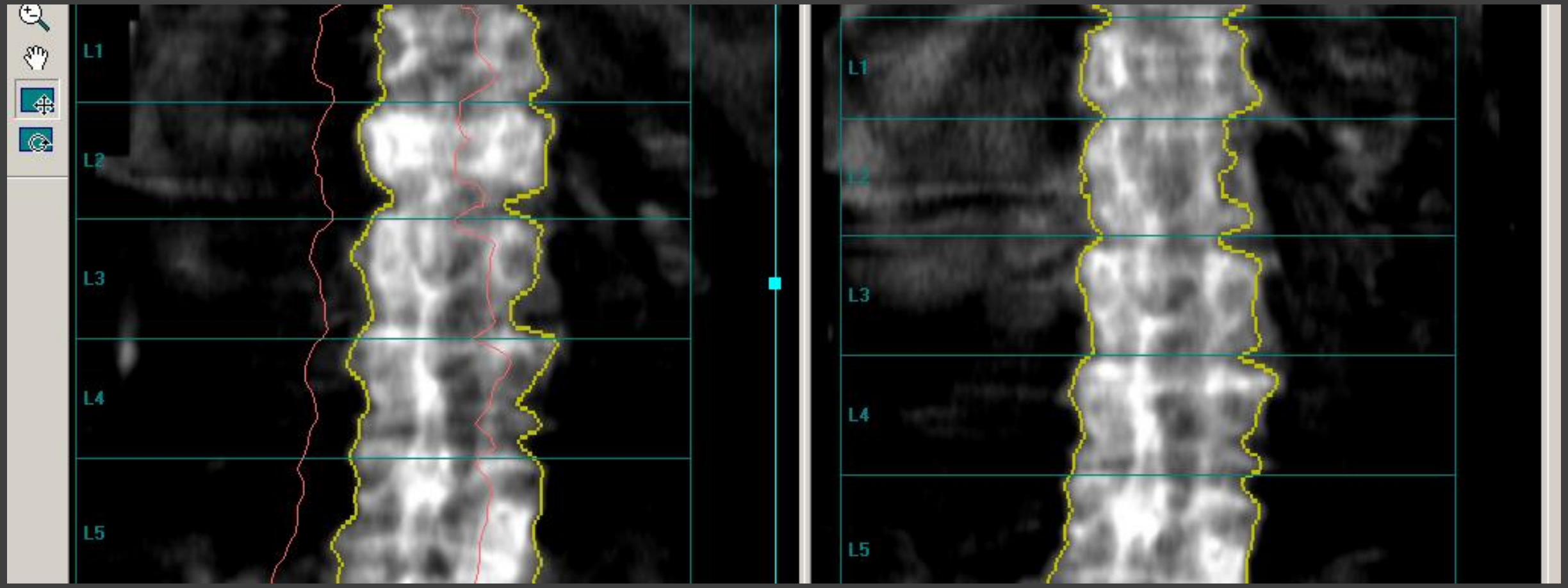
- “Valleys” should represent intervertebral disks
- Osteophytes can turn valleys into peaks

Not Labeling Spinal Levels Appropriately



- Inconsistent or improper intervertebral labeling confounds
  - Identifying levels with pathology
  - Comparisons to prior or subsequent scans proper placement
  - Identification of vertebral height loss and incident vertebral deformities

Interval Compression Fractures

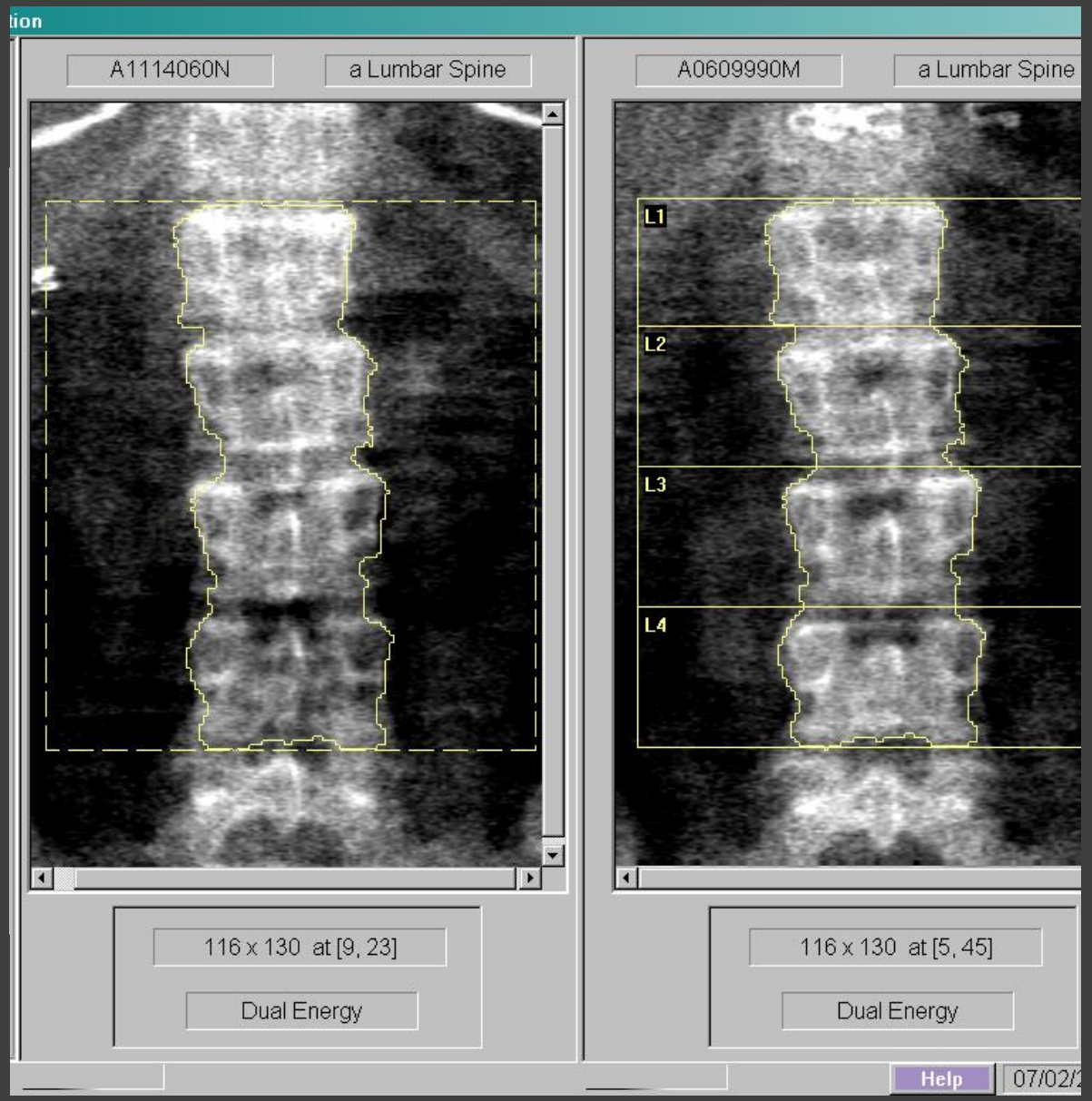


Side by side image comparisons

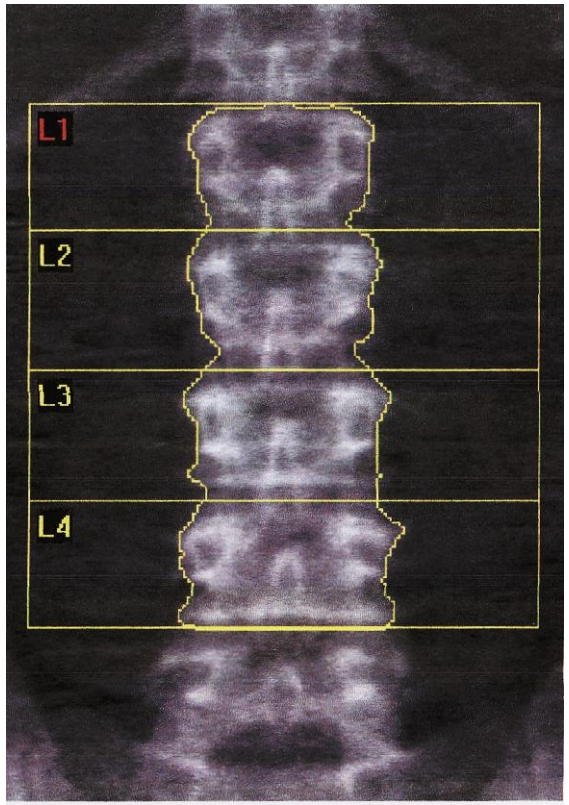
- Modern scanners allow display of prior study (on right) to current exam during acquisition
- Mask of prior analysis copies heights and labels
- But not all facilities may know of this feature

Look for subtle visual changes

- Subtle change in appearance of L1
  - Incident mild wedge deformity?
  - Consider VFA or other imaging for verification?
  - Change in management?
- Serendipitous finding: Did patient have a cholecystectomy between exams

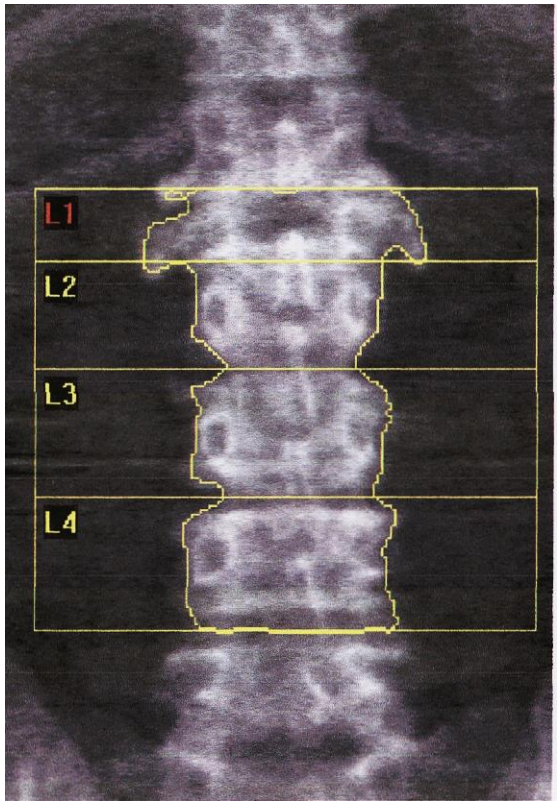


2005



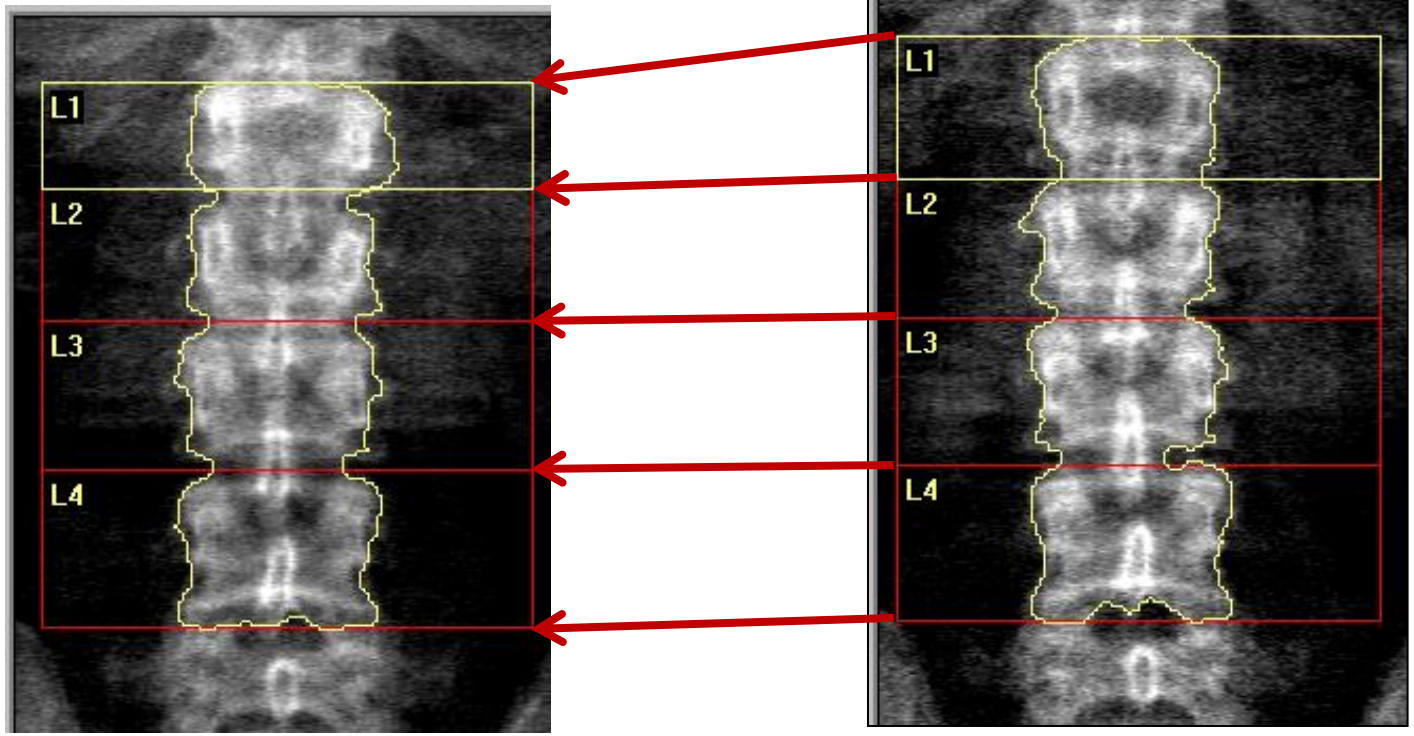
Region	Area (cm^2)	BMC (g)	BMD (g/cm^2)	T - score
L2	12.64	11.35	0.898	-1.2
L3	12.85	12.72	0.990	-0.9
L4	14.14	13.58	0.960	-1.4
Total	**39.63**	**37.65**	**0.950**	**-1.2**

2008



Region	Area (cm^2)	BMC (g)	BMD (g/cm^2)	T - score
L2	10.49	10.69	1.019	-0.1
L3	12.76	11.80	0.925	-1.4
L4	14.75	13.42	0.910	-1.9
Total	**38.00**	**35.90**	**0.945**	**-1.2**

Comparing Images and BMD data



The BMD of L1 went from the lowest to the highest.

Region	Area(cm²)	BMC(g)	BMD(g/cm²)
L1	11.45	10.88	0.951
L2	12.97	11.72	0.903
L3	14.95	11.80	0.789
L4	16.50	14.35	0.870
TOTAL	55.87	48.75	0.873

Region	Area(cm²)	BMC(g)	BMD(g/cm²)
L1	13.56	10.07	0.743
L2	13.75	11.63	0.846
L3	14.56	11.83	0.812
L4	16.44	14.34	0.872
TOTAL	58.31	47.87	0.821

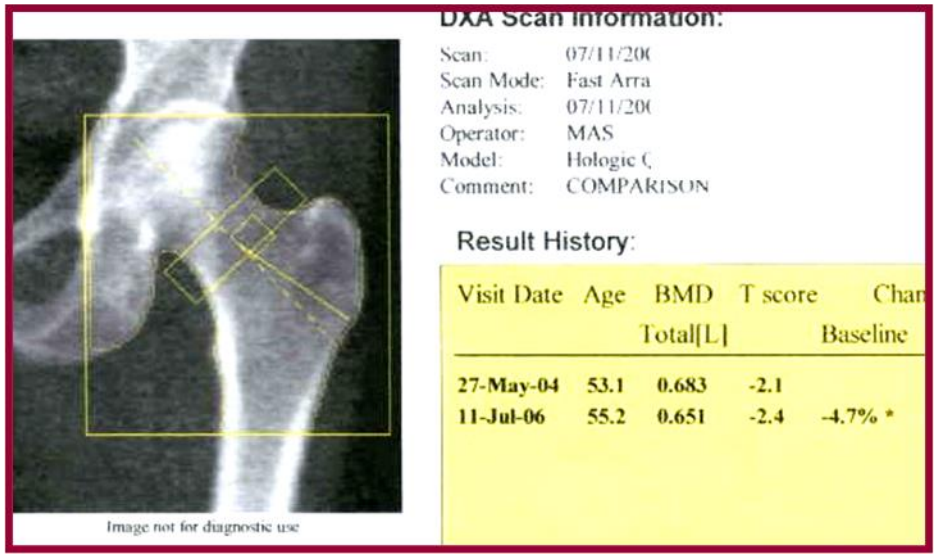
Images in discordant and unexpected changes

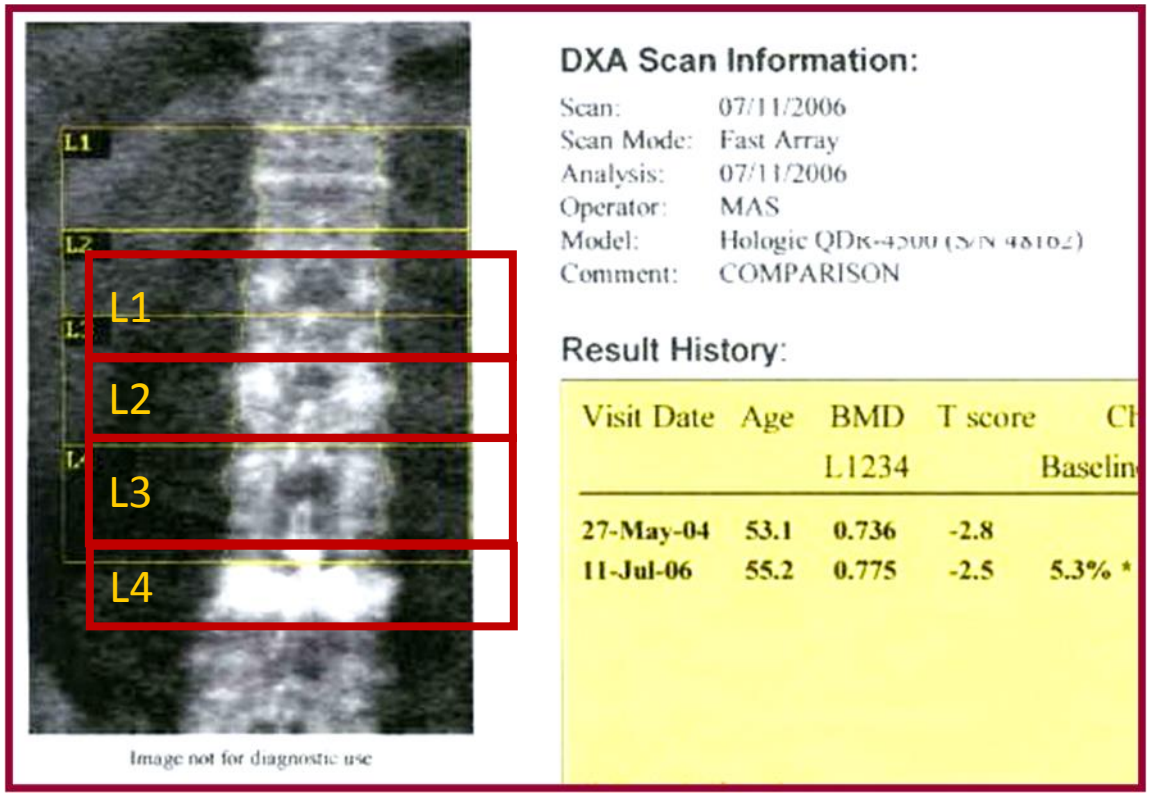
Indications: Established osteoporosis with vertebral augmentation, follow-up on alendronate

Results: Osteopenia of the hip and osteoporosis at the spine. There has been a 5.3% increase in BMD at the spine and a 4.7% loss at the hip.

Changes of less than 5% are not considered to be statistically significant.

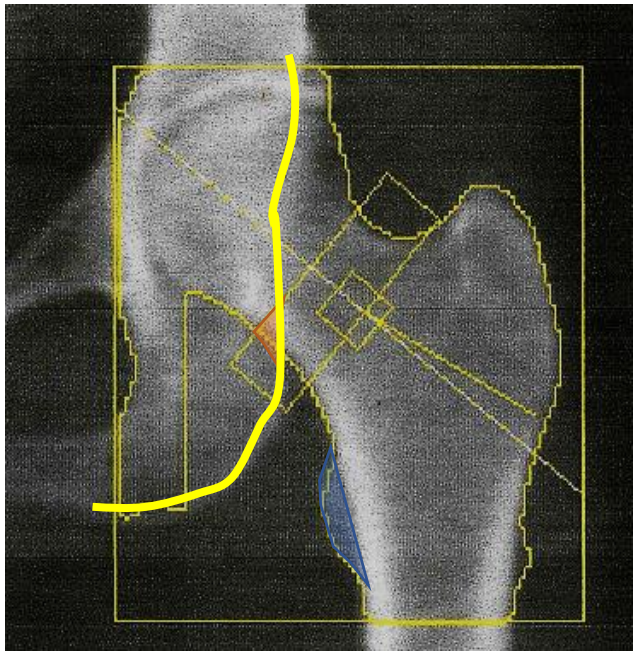
Impression: Improvement in bone mineral density on alendronate. The patient is encouraged to continue her current therapy and return for a repeat scan in two years."



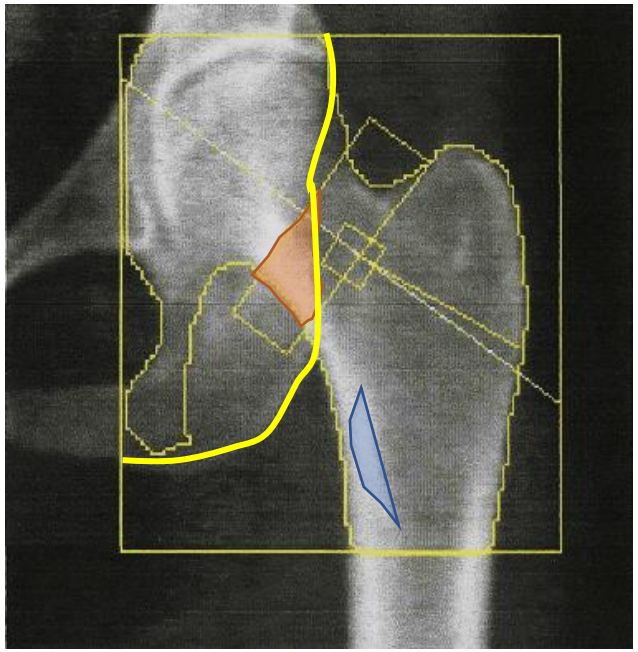


Differences in Hip Positioning

Differences in Hip Rotation and Abduction



Region	Area (cm²)	BMC (g)	BMD (g/cm²)	T - score	PR (%)	Z - score
Neck	4.63	3.43	0.741	-1.0	87	0.6
Total	33.95	28.10	0.828	-0.9	88	0.3



Region	Area (cm²)	BMC (g)	BMD (g/cm²)	T - score	PR (%)	Z - score
Neck	4.68	4.17	0.891	0.4	105	2.1
Total	31.01	26.23	0.846	-0.8	90	0.6

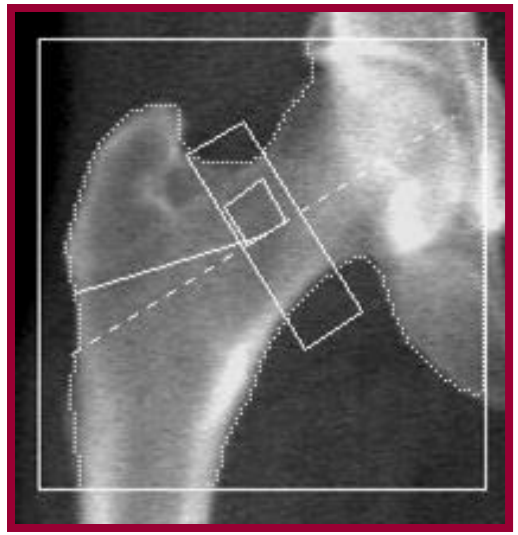
- Lesser trochanteric profiles not same size and location
- Pelvic rim outline
- Pelvic bone measured within the femur neck box.

Table 2-8
The Effect of Increasing Internal or External Rotation from the Neutral Position on the Femoral Neck BMD (g/cm²) of Cadaveric Femurs

	Neutral	External Rotation from Neutral of			Internal Rotation from Neutral of		
Cadaver No.	0°	15°	30°	45°	15°	30°	45°
1	0.490	0.524	0.549	0.628	0.510	0.714	0.845
2	0.574	0.567	0.632	0.711	0.581	0.619	0.753
3	0.835	0.872	0.902	1.071	0.874	1.037	1.222
4	0.946	0.977	1.005	1.036	1.102	1.283	1.492

Goh JC et al. Effect of femoral rotation on bone mineral density measurements with dual energy x-ray absorptiometry *Calcif Tissue Int* 57: 340-343, 1995.

Synthesis of Images, BMD & Med Hx.



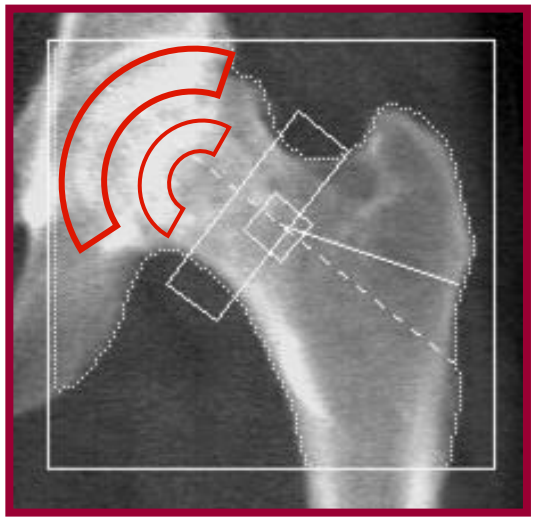
SLE, long-term GCC

Lt. FN: T-Score = +2.2

Rt. FN: T-Score = -1.3

Mean FN T-score = +0.4

Mean Tot T-score = -0.9



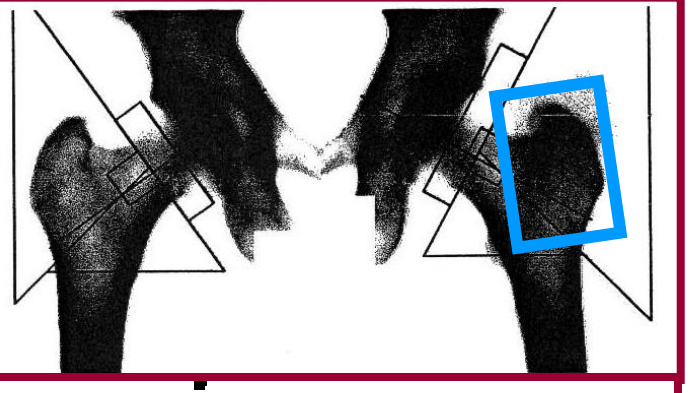
Region	BMD	T	Z
Neck	0.705	-1.30 83% (25.0)	-0.94 87%
Troch	0.732	+0.29 104% (25.0)	+0.46 107%
Inter	1.107	+0.05 101% (35.0)	+0.16 102%
TOTAL	0.932	-0.08 99% (25.0)	+0.15 102%
Ward's	0.591	-1.22 81% (25.0)	-0.48 91%

Region	BMD	T	Z
Neck	1.092	+2.19 129% (25.0)	+2.55 135%
Troch	0.670	-0.33 95% (25.0)	-0.16 98%
Inter	1.027	-0.47 93% (35.0)	-0.36 95%
TOTAL	0.930	-0.10 99% (25.0)	+0.13 102%
Ward's	1.062	+2.81 145% (25.0)	+3.54 164%

Where's Waldo? – A case of TMI?

ANCILLARY RESULTS [DualFemur]

Region	BMD [1] (g/cm²)	Young-Adult [2,7] (%)	Young-Adult T-Score	Age-Matched [3] (%)	Age-Matched Z-Score	BMC (g)	Area (cm²)
Neck Left	0.752	70	-2.4	83	-1.2	4.7	6.2
Neck Right	0.891	83	-1.4	99	-0.1	5.0	5.6
Neck Mean	0.822	77	-1.9	91	-0.6	4.8	5.9
Neck Diff.	0.139	13	1.1	15	1.1	0.3	0.6
Upper Neck Left	0.591	65	-2.5	80	-1.1	2.1	3.5
Upper Neck Right	0.721	79	-1.5	98	-0.1	2.0	2.8
Upper Neck Mean	0.656	72	-2.0	89	-0.6	2.0	3.1
Upper Neck Diff.	0.129	14	1.0	17	1.0	0.1	0.7



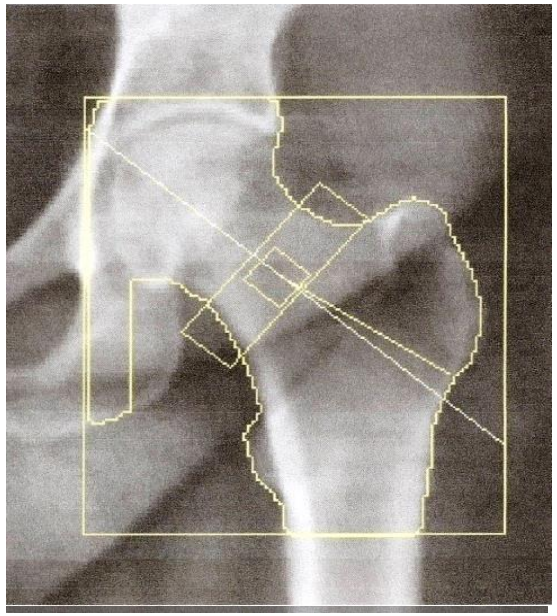
Region	BMD (g/cm²)	Young-Adult (%)	Young-Adult T-Score	Age-Matched (%)	Age-Matched Z-Score	BMC (g)	Area (cm²)
Troch Left	0.830	89	-0.9	95	-0.4	36.5	44.0
Troch Right	0.896	96	-0.3	102	0.2	20.1	22.4
Troch Mean	0.863	93	-0.6	98	-0.1	28.3	33.2
Troch Diff.	0.066	7	0.6	8	0.6	16.5	21.7

Common Artifacts That Affect BMD

- Internal artifacts
- External artifacts
- Serendipitous findings – obligation to report?
- Implications for VFA

Position of the Panniculus

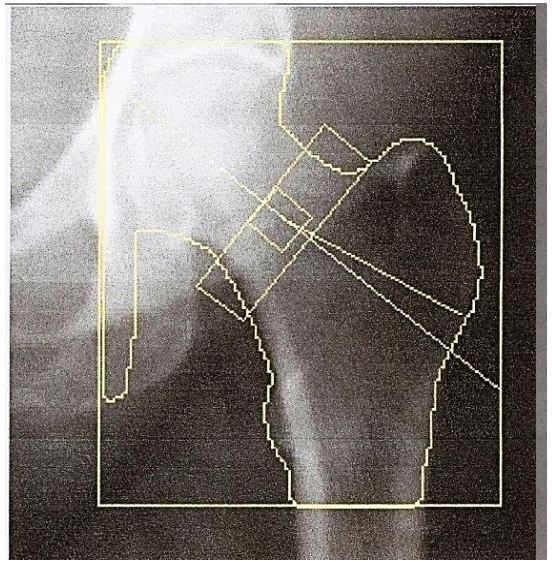
2003



Single energy

Region	Area (cm^2)	BMC (g)	BMD (g/cm^2)	T - score
Neck	5.36	4.24	0.790	-0.5
Total	36.88	36.41	0.987	0.4

2012



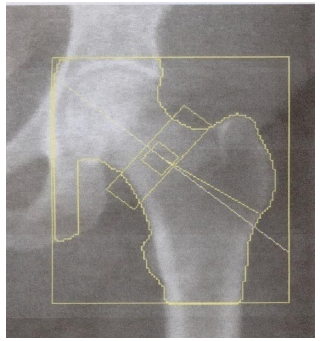
Single energy

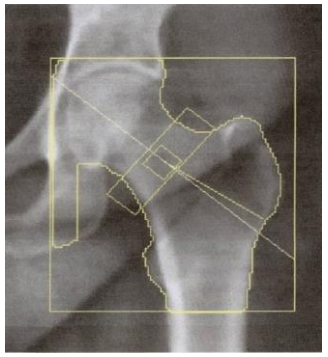
Region	Area (cm^2)	BMC (g)	BMD (g/cm^2)	T - score
Neck	5.35	4.24	0.793	-0.5
Total	37.41	36.79	0.984	0.3

67”, 260 pounds

Position of the Panniculus

2003





Single energy

Region	Area (cm^2)	BMC (g)	BMD (g/cm^2)	T - score
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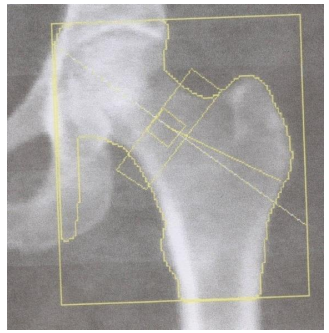
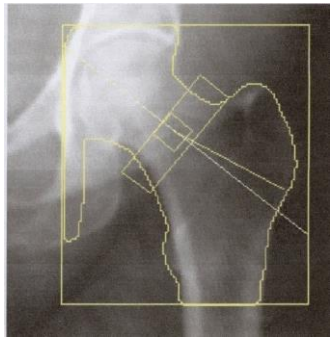
Total	36.88	36.41	0.987	0.4

2012





Single energy

Region	Area (cm^2)	BMC (g)	BMD (g/cm^2)	T - score
Neck	5.35	4.24	0.793	-0.5
Total	37.41	36.79	0.984	0.3

67”, 260 pounds

Journal of Clinical Densitometry, vol. 6, no. 3, 199–204, 2003

1094-6950/03/6:199–204/$25.00

Original Article

An Overlying Fat Panniculus Affects Femur Bone Mass Measurement

Neil Binkley, MD,[*,1] *Diane Krueger, BS,*[1] *and Nellie Vallarta-Ast, RT(R), CDT*[2]

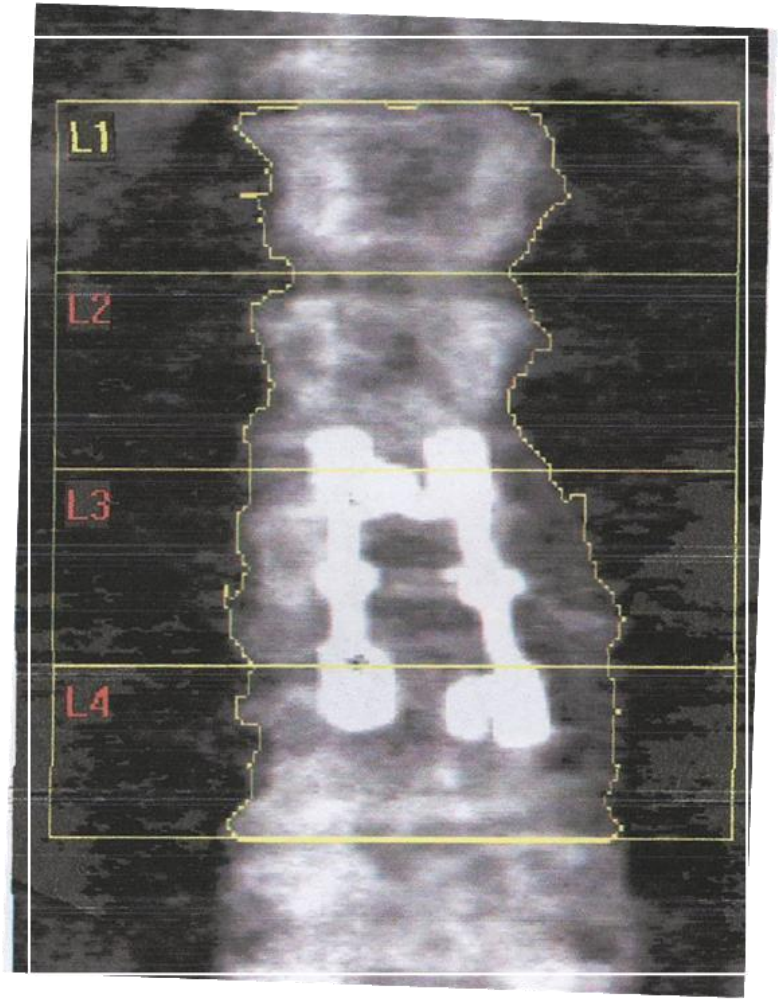
[1]*University of Wisconsin Institute on Aging,* [2]*Department of Radiology, Wm. S. Middleton VAMC, Madison WI*

Abstract

Dual-energy X-ray absorptiometry (DXA) is currently the gold standard technique for osteoporosis diagnosis. However, DXA has limitations, including artifacts, such as degenerative disease or metallic foreign bodies, that may confound bone mineral density (BMD) results. Because fat folds overlying the proximal femur may alter soft-tissue density in a nonuniform manner, this may be a currently unappreciated confounder of proximal femur BMD measurement. This possibility was evaluated in 127 patients (52 women/75 men) referred for routine BMD measurement who were identified as having a fat panniculus overlying their proximal femur scan area. Presence of a fat panniculus within the scan field was confirmed by visual assessment of images obtained utilizing a GE Lunar Expert-XL. Subsequently, these individuals were rescanned while retracting their fat panniculus away from the femur scan area without other repositioning between scans. In 49% of the men, and 56% of the women, either the femoral neck, trochanter, or total femur BMD differed by more than the least significant change at our facility. No pattern was observed to predict whether BMD would increase or decrease upon fat retraction. Subsequently, 30 patients were scanned using the standard and retracted technique twice, with repositioning between scans to establish precision. Retracted and standard precision was similar. In conclusion, an overlying fat panniculus may alter proximal femur BMD measurement, which would be expected to impair the ability to accurately diagnose low bone mass and monitor osteoporosis therapy. When a fat panniculus overlays the proximal femur scan area, its retraction should be part of routine densitometric practice.

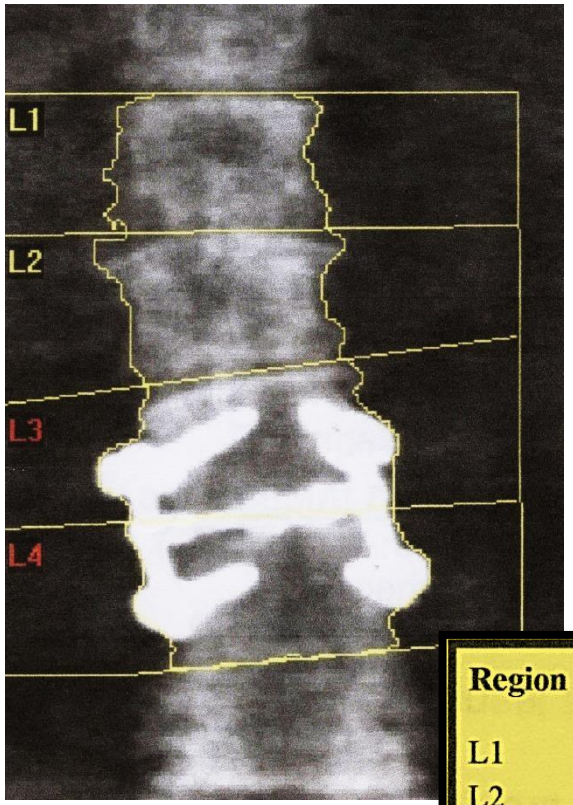
Key Words: Bone density; obesity; DXA; femur.

Surgical Hardware

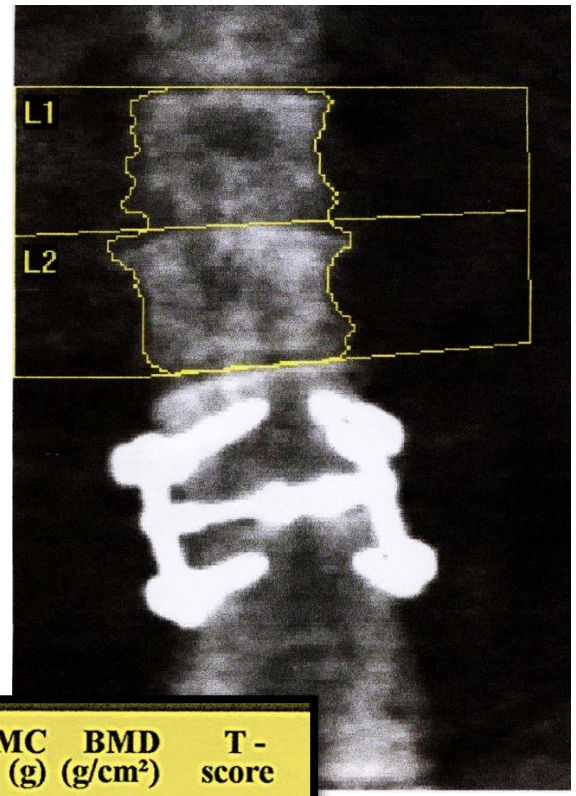


- Vertebral levels that include an artifact should be excluded
- ISCD recommends a minimum of 2 vertebra for diagnosis and monitoring.
- They don’t need to be contiguous.
- This spine is not diagnostic, and an alternative site should be measured

Which analysis is more correct?



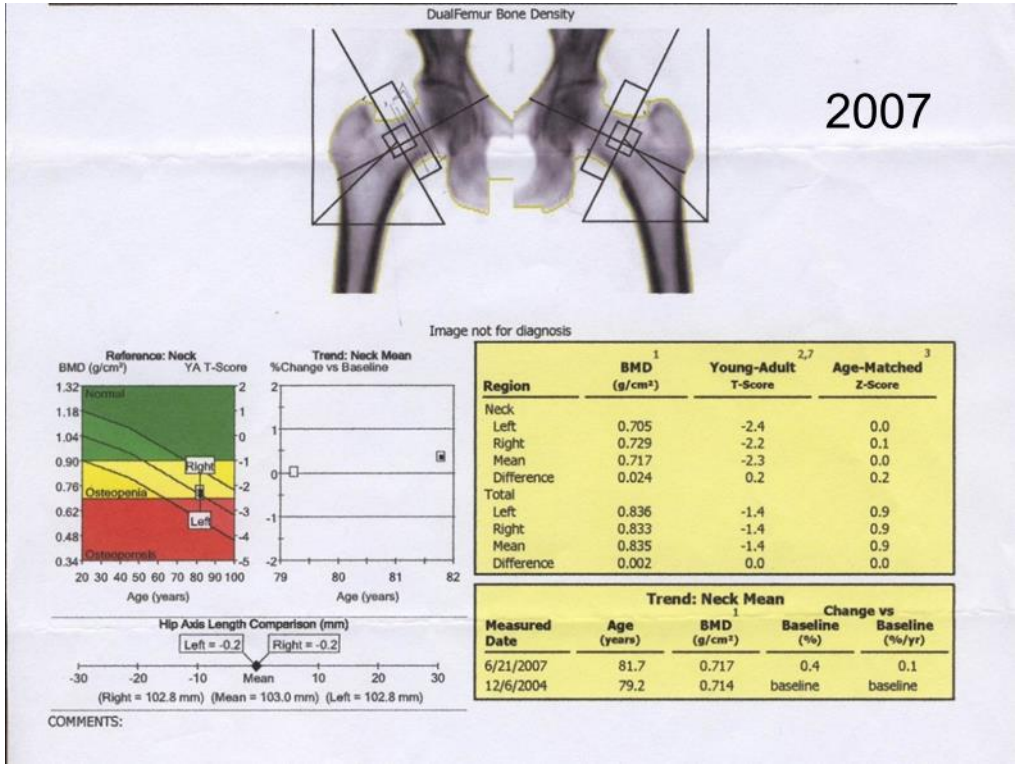
Region	Area (cm^2)	BMC (g)	BMD (g/cm^2)	T - score
L1	14.34	15.24	1.063	0.7
L2	15.48	18.56	1.199	1.6
Total	**29.82**	**33.80**	**1.134**	**1.4**



Region	Area (cm^2)	BMC (g)	BMD (g/cm^2)	T - score
L1	13.96	14.33	1.027	0.3
L2	15.14	17.69	1.169	1.3
Total	**29.09**	**32.03**	**1.101**	**1.1**

Analysis and Reporting Issues

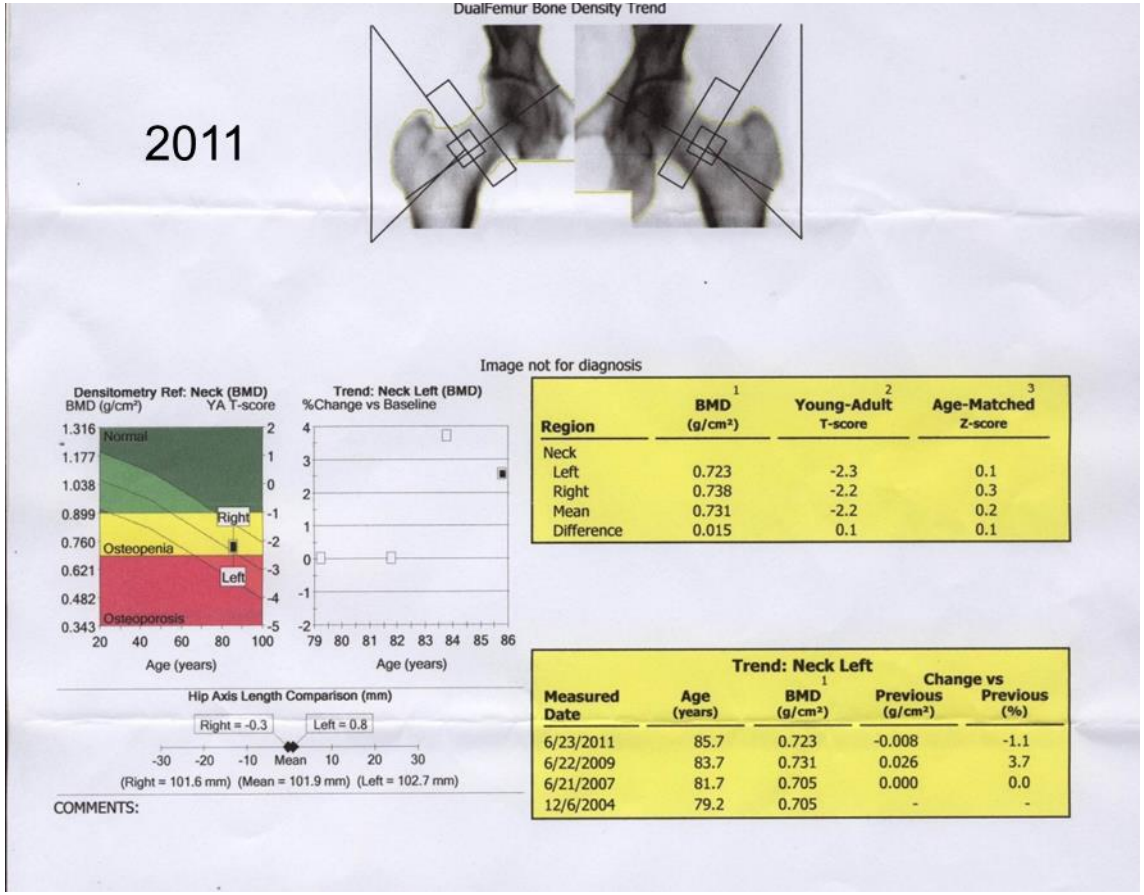
Insufficient Anatomy



Region	BMD [1] (g/cm²)	Young-Adult [2,7] T-Score	Age-Matched [3] Z-Score
Neck			
Left	0.705	-2.4	0.0
Right	0.729	-2.2	0.1
Mean	0.717	-2.3	0.0
Difference	0.024	0.2	0.2
Total			
Left	0.836	-1.4	0.9
Right	0.833	-1.4	0.9
Mean	0.835	-1.4	0.9
Difference	0.002	0.0	0.0

Trend: Neck Mean

Measured Date	Age (years)	BMD [1] (g/cm²)	Change vs Baseline (%)	Change vs Baseline (%/yr)
6/21/2007	81.7	0.717	0.4	0.1
12/6/2004	79.2	0.714	baseline	baseline

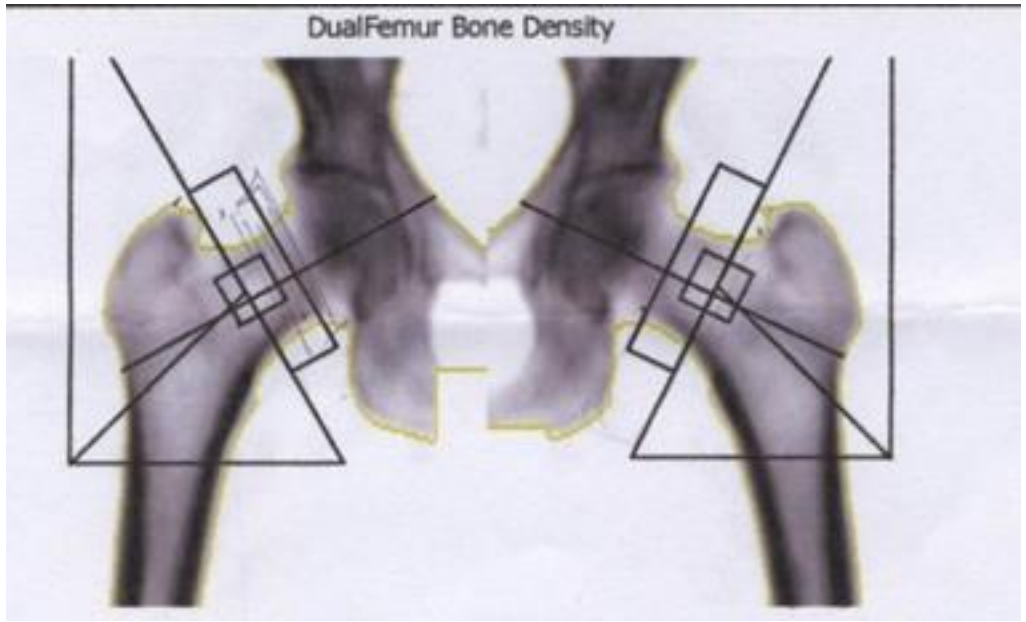


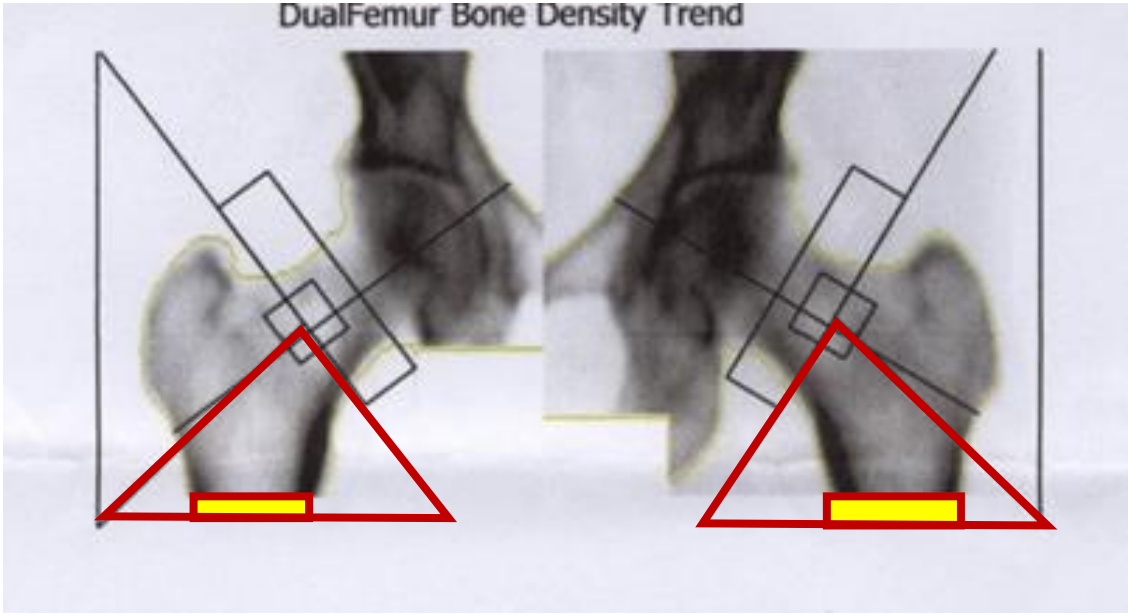
Region	BMD [1] (g/cm²)	Young-Adult [2] T-score	Age-Matched [3] Z-score
Neck			
Left	0.723	-2.3	0.1
Right	0.738	-2.2	0.3
Mean	0.731	-2.2	0.2
Difference	0.015	0.1	0.1

Trend: Neck Left

Measured Date	Age (years)	BMD [1] (g/cm²)	Change vs Previous (g/cm²)	Change vs Previous (%)
6/23/2011	85.7	0.723	-0.008	-1.1
6/22/2009	83.7	0.731	0.026	3.7
6/21/2007	81.7	0.705	0.000	0.0
12/6/2004	79.2	0.705	-	-

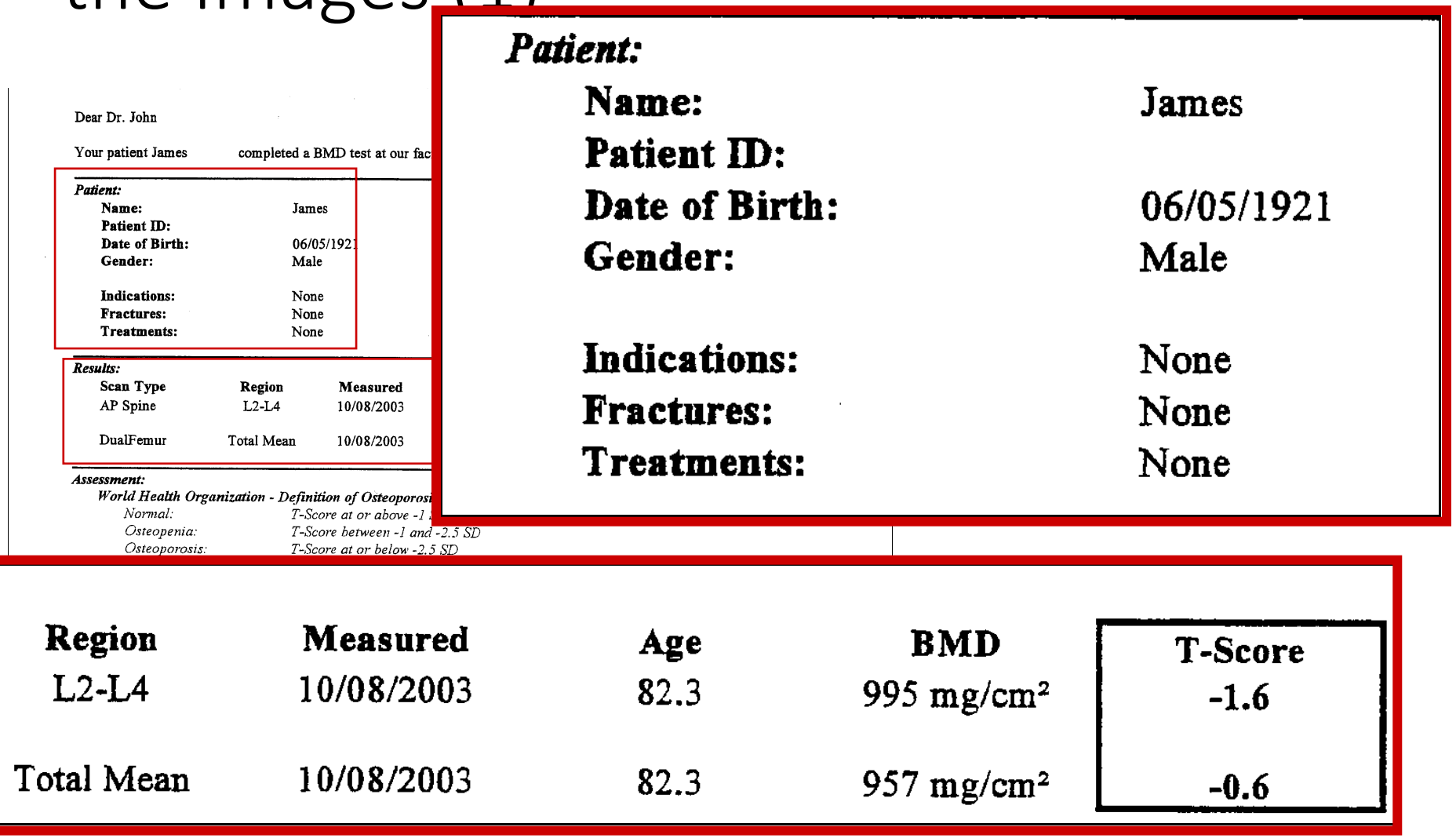
Insufficient Anatomy





Not scanning down far enough in the hip is a common error on GE Healthcare scan

Never Sign a Report Without Seeing the Images (1)



Dear Dr. John

Your patient James completed a BMD test at our fac

Patient:

Name:	James
Patient ID:	
Date of Birth:	06/05/192
Gender:	Male
Indications:	None
Fractures:	None
Treatments:	None

Results:

Scan Type	Region	Measured
AP Spine	L2-L4	10/08/2003
DualFemur	Total Mean	10/08/2003

Assessment:

World Health Organization - Definition of Osteoporosi

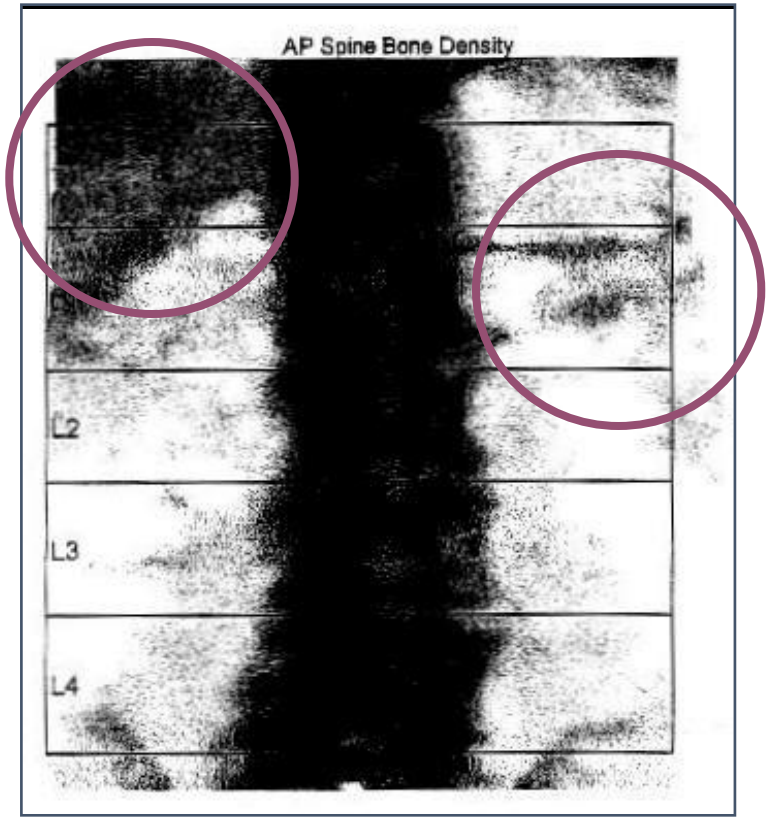
Normal:	*T-Score at or above -1*
Osteopenia:	*T-Score between -1 and -2.5 SD*
Osteoporosis:	*T-Score at or below -2.5 SD*

Patient:

Name:	James
Patient ID:	
Date of Birth:	06/05/1921
Gender:	Male
Indications:	None
Fractures:	None
Treatments:	None

Region	Measured	Age	BMD	T-Score
L2-L4	10/08/2003	82.3	995 mg/cm²	-1.6
Total Mean	10/08/2003	82.3	957 mg/cm²	-0.6

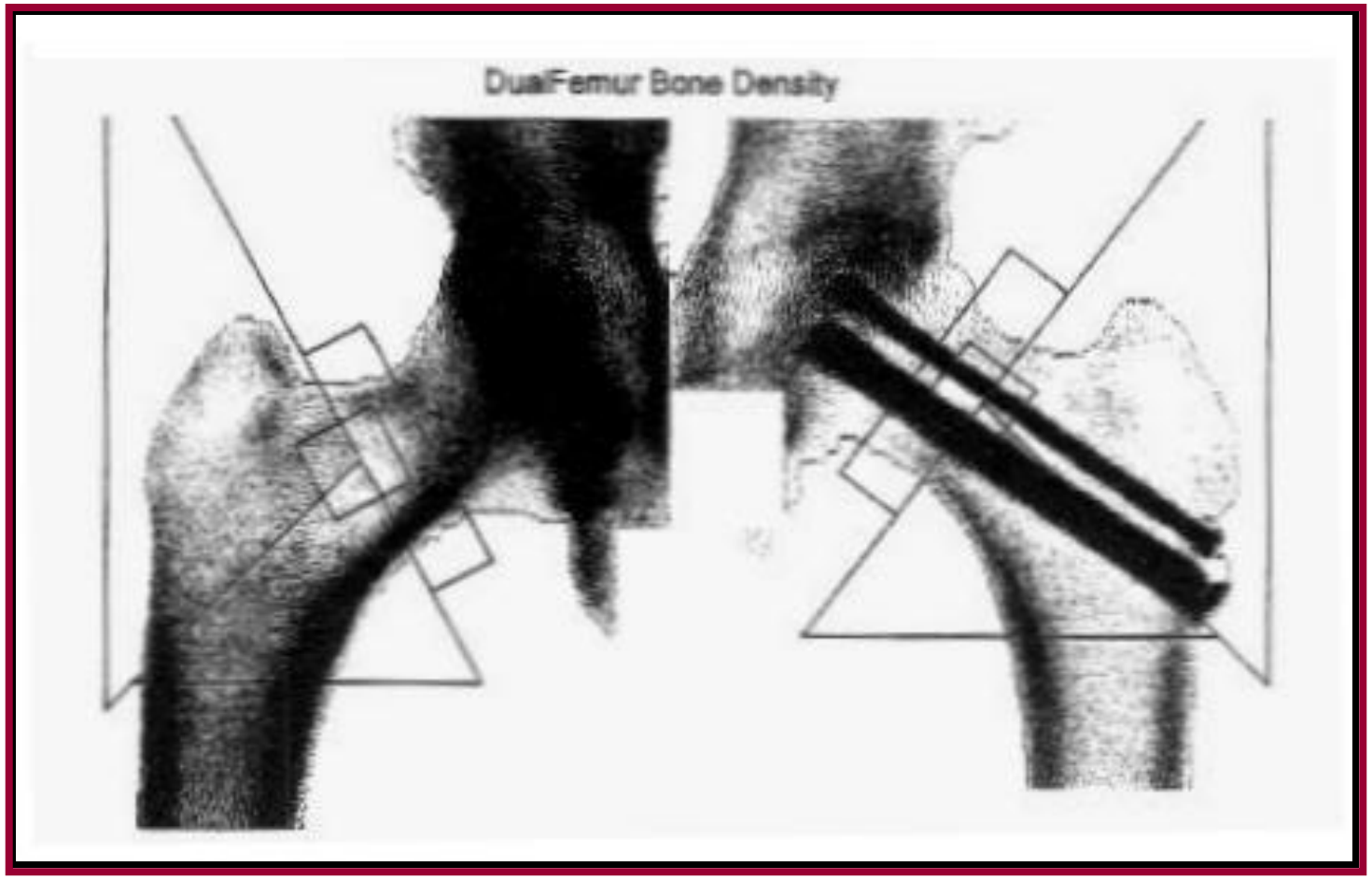
Look for discordance in T-scores



Region	BMD	T-score	Z-score
L1	0.729	-3.6	-3.0
L2	0.897	-2.9	-2.3
L3	0.999	-2.0	-1.5
L4	1.188	-0.4	+0.1
L2-L4	1.045	-1.6	-1.1

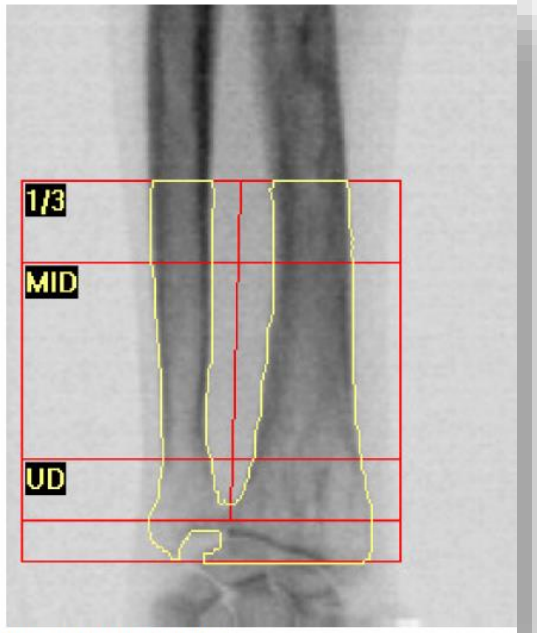
L1-L3	0.871	-2.8	-2.3

Look for discordance between hips

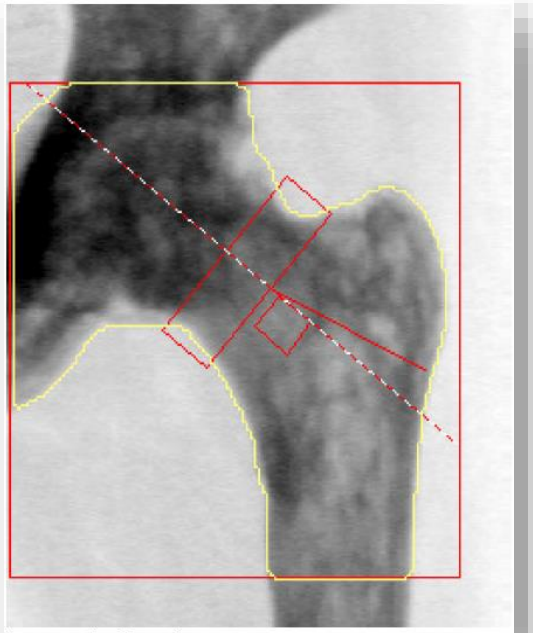


Specific Disease States

What is the diagnosis?

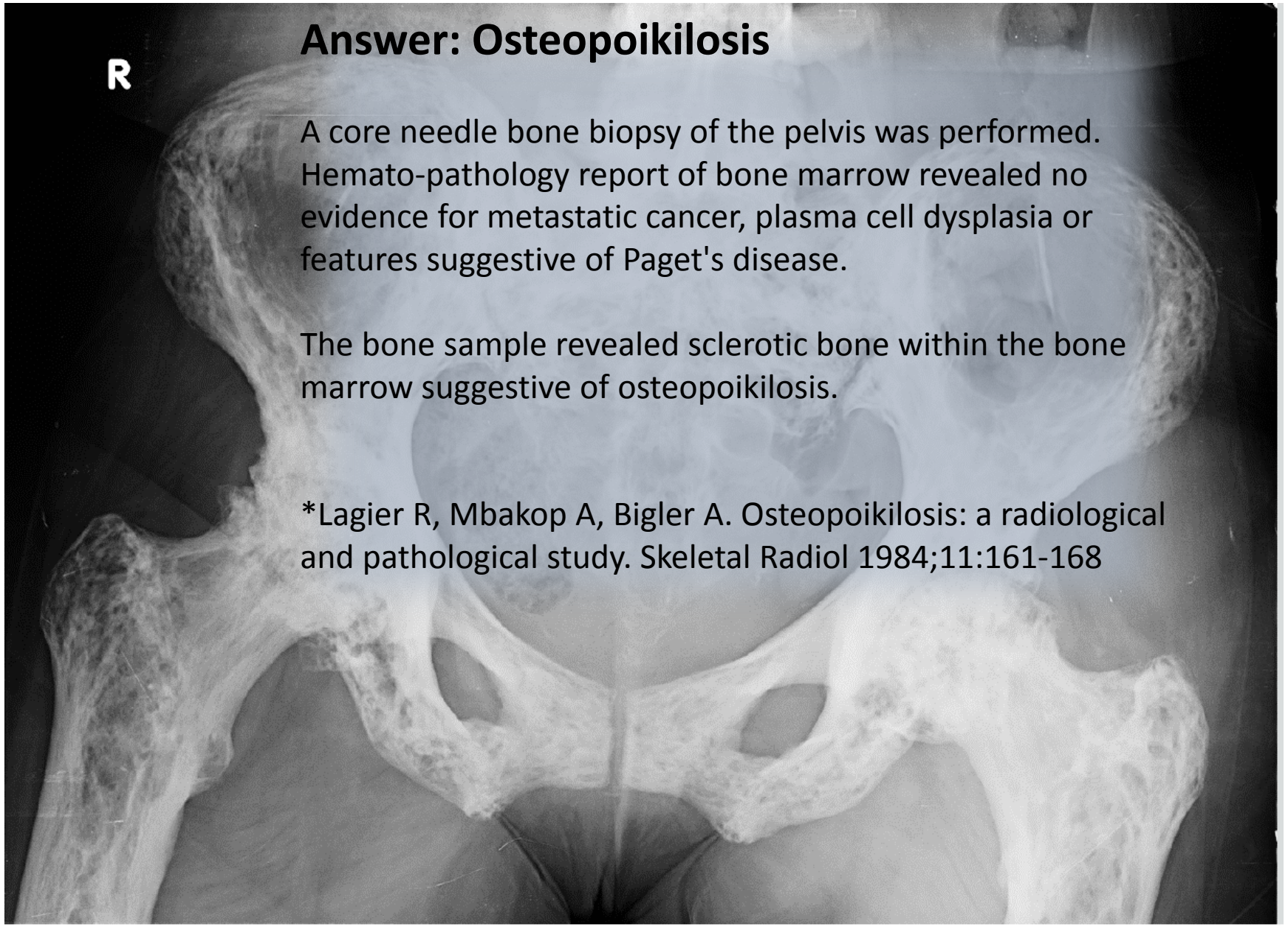


Radius	Area (cm²)	BMC (g)	BMD (g/cm²)	T - score	PR (%)	Z - score
1/3	**3.46**	**2.01**	**0.582**	**-1.9**	**84**	**-0.1**
MID	8.95	4.04	0.451	-2.9	74	-1.1
UD	4.26	1.12	0.264	-3.1	60	-1.8
Total	16.67	7.17	0.430	-2.8	74	-1.0



Region	Area (cm²)	BMC (g)	BMD (g/cm²)	T - score	PR (%)	Z - score
Neck	6.24	11.92	1.910	9.6	225	11.2
Troch	12.54	17.58	1.402	6.9	199	8.1
Inter	25.57	38.94	1.523	2.7	138	3.8
Total	**44.35**	**68.45**	**1.543**	**4.9**	**164**	**6.3**

Region	Area (cm²)	BMC (g)	BMD (g/cm²)	T - score	PR (%)	Z - score
L1	15.88	23.54	1.482	4.5	150	6.1
L2	15.36	22.67	1.476	4.1	144	5.9
L3	17.07	26.18	1.534	4.1	141	6.1
L4	22.90	34.49	1.506	4.0	142	6.1
Total	**71.21**	**106.88**	**1.501**	**4.1**	**143**	**6.0**



Answer: Osteopoikilosis

A core needle bone biopsy of the pelvis was performed. Hemato-pathology report of bone marrow revealed no evidence for metastatic cancer, plasma cell dysplasia or features suggestive of Paget's disease.

The bone sample revealed sclerotic bone within the bone marrow suggestive of osteopoikilosis.

*Lagier R, Mbakop A, Bigler A. Osteopoikilosis: a radiological and pathological study. Skeletal Radiol 1984;11:161-168

What is this diagnosis?

What is your diagnosis?

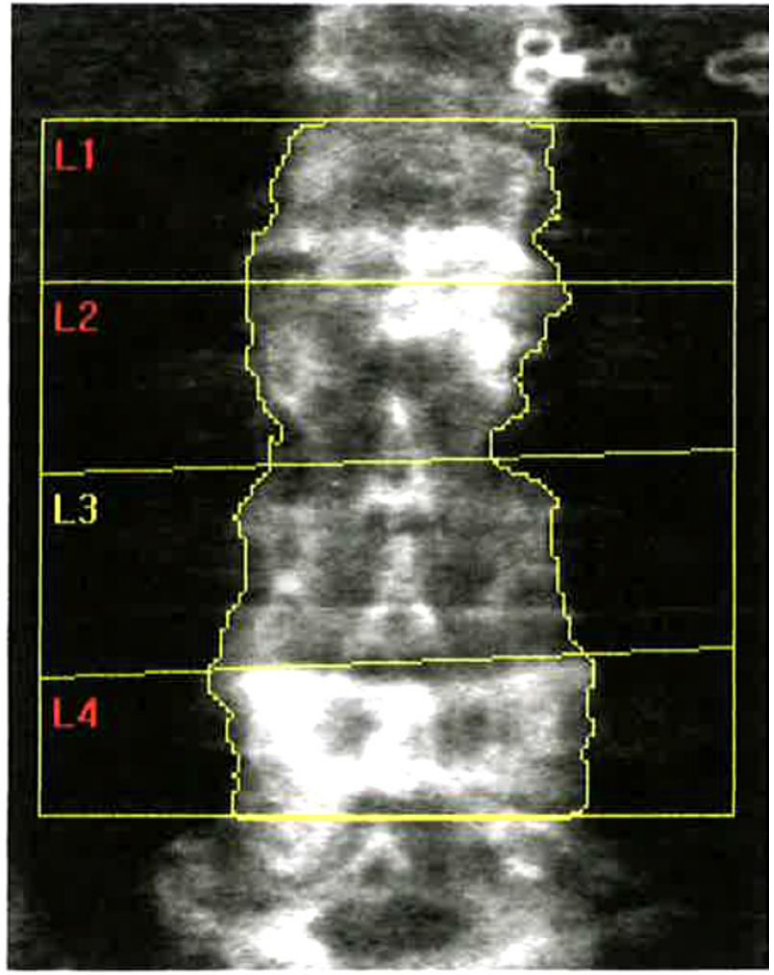


Image not for diagnostic use

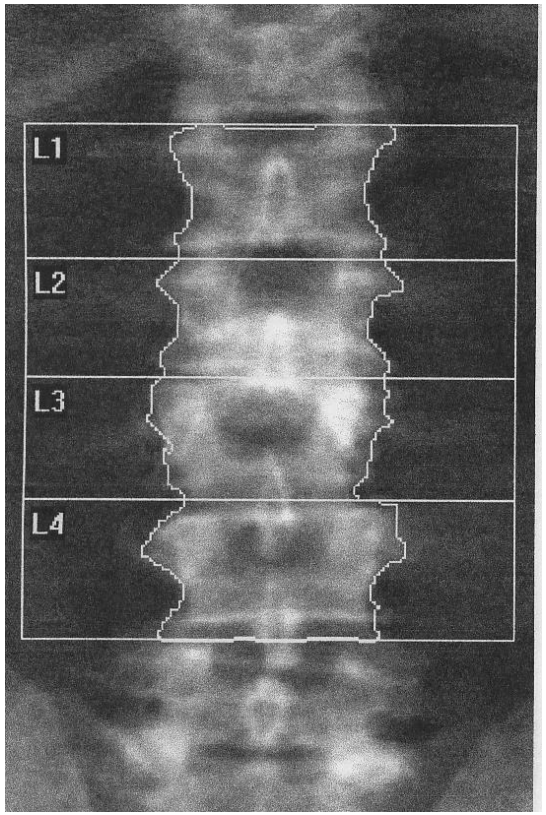
Paget's Disease

Lumbar Spine AP Lat L5-S1 with Obliques

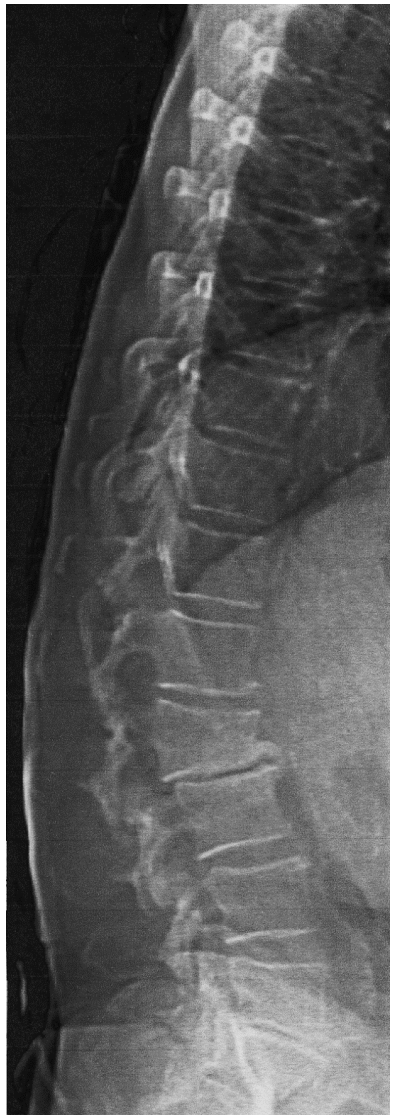
Findings/Conclusion: Pagetoid appearance of the L3 and L4 vertebral bodies. Advanced joint
space height loss at L1-L2, L4-L5 and L5-S1. No acute compression deformity.

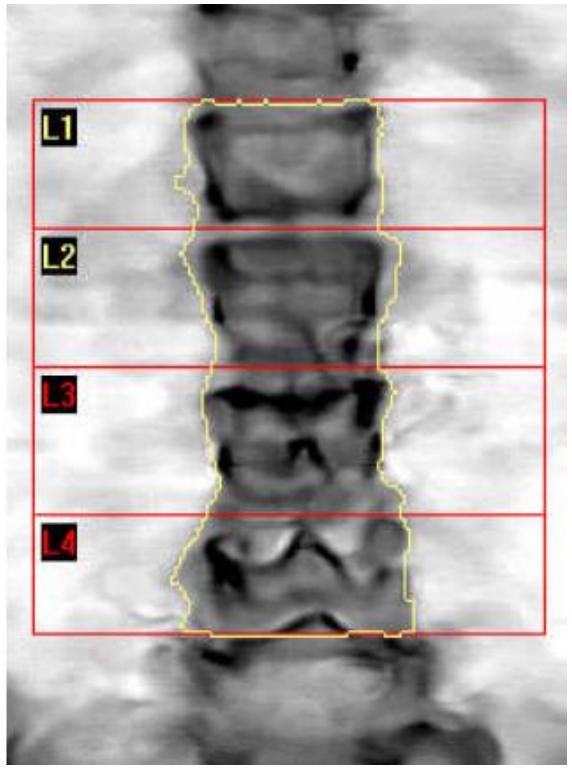
Dell;Atti C. et al. The Spine In Paget's Disease. Skeletal Radiol 36: 609-626, 2007

VFA Imaging in suspected compression fx's

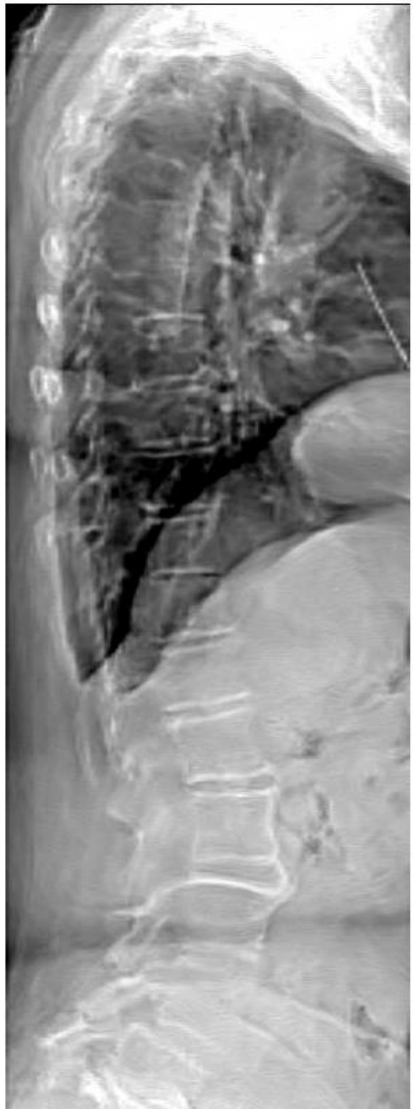


Region	Area (cm²)	BMC (g)	BMD (g/cm²)	T - score
L1	14.54	13.13	0.904	-0.9
L2	14.12	18.25	1.293	1.8
L3	14.65	17.42	1.189	0.8
L4	17.46	18.17	1.041	-0.9
Total	**60.76**	**66.97**	**1.102**	**0.1**

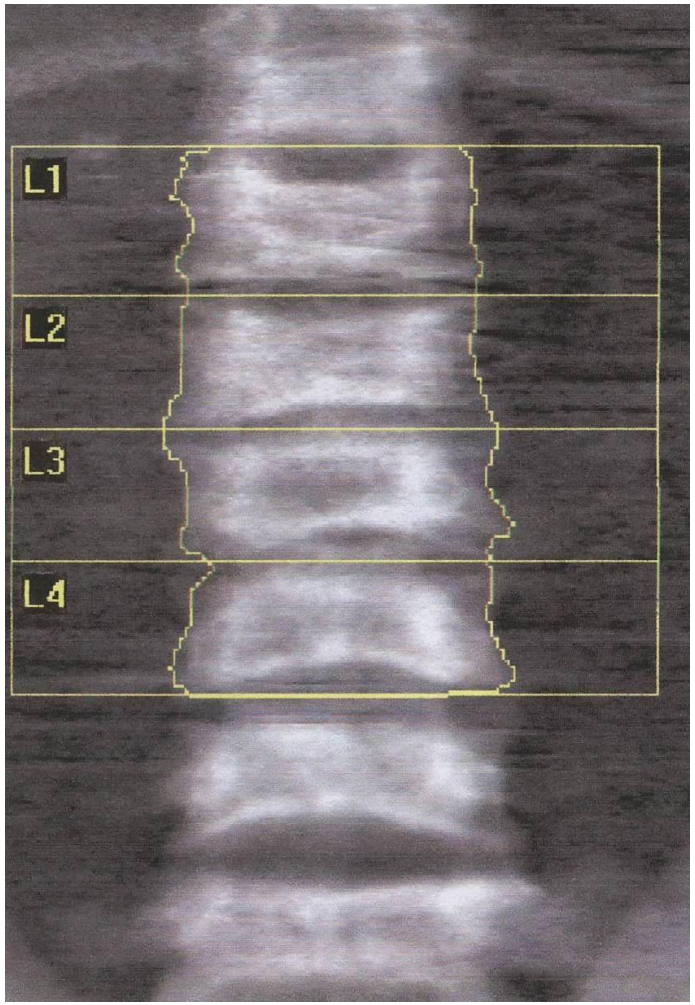




Region	Area (cm²)	BMC (g)	BMD (g/cm²)	T - score
L1	11.53	9.40	0.816	-1.6
L2	12.47	11.28	0.905	-1.1
L3	12.64	12.45	0.985	-0.9
L4	12.96	10.48	0.808	-2.3
L1-L2	24.00	20.69	0.862	-1.1



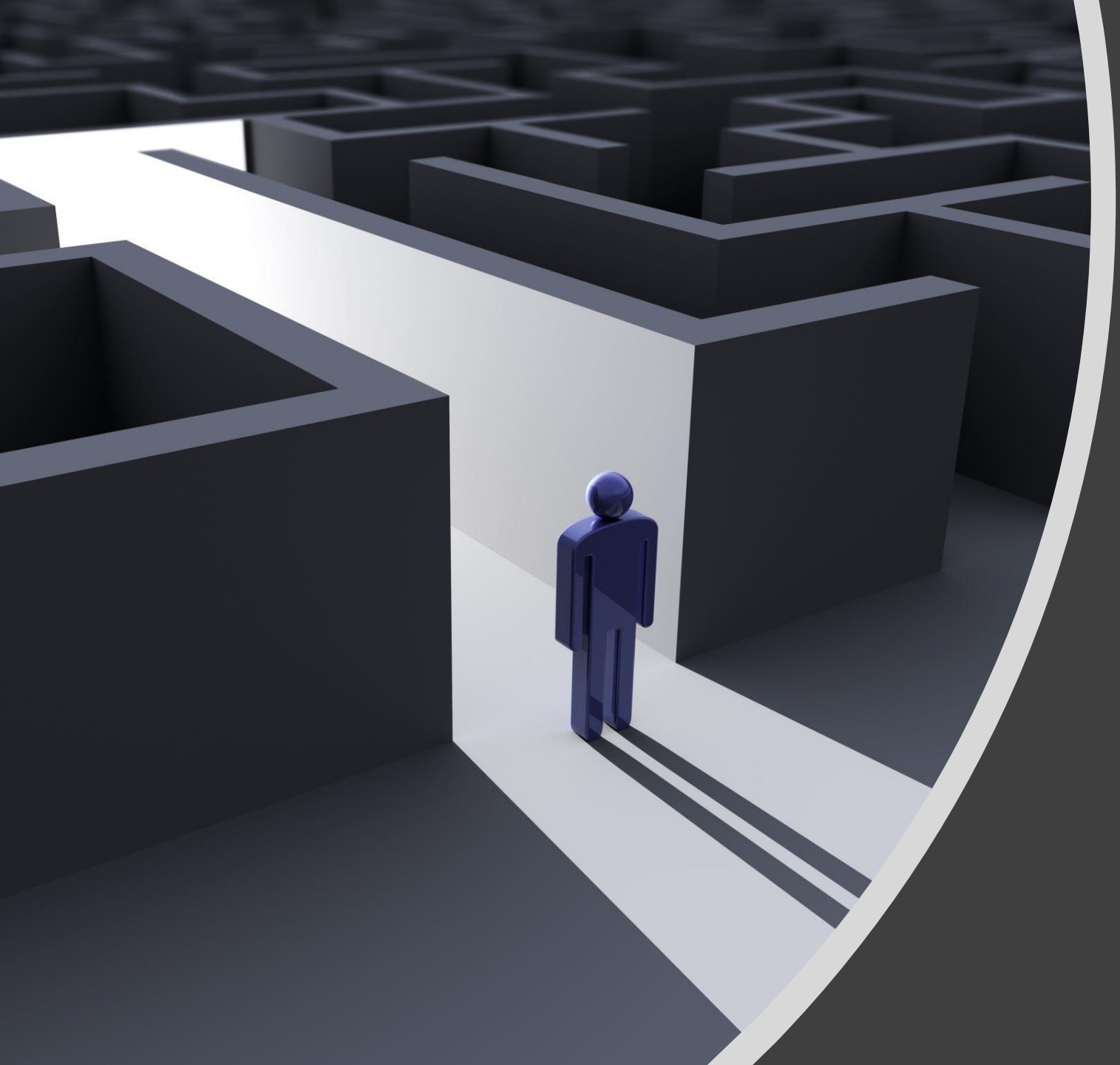
What is your diagnosis?



Sickle Cell Disease

Region	Area (cm^2)	BMC (g)	BMD (g/cm^2)	T - score	PR (%)	Z - score	AM (%)
L1	12.95	20.75	1.602	4.8	149	3.9	137
L2	13.74	21.63	1.575	4.4	144	3.4	131
L3	14.02	21.86	1.559	4.1	141	3.2	129
L4	15.98	25.32	1.584	4.5	145	3.5	132
Total	**56.69**	**89.56**	**1.580**	**4.4**	**145**	**3.5**	**132**

Rudy HL. Et all Review of sickle cell disease and spinal pathology. Global Spine 9: 761-766, 2019.
Ntagiopoulos PG. The “fish-vertebra” sign. Emerg Med J 24: 674-675, 2007.

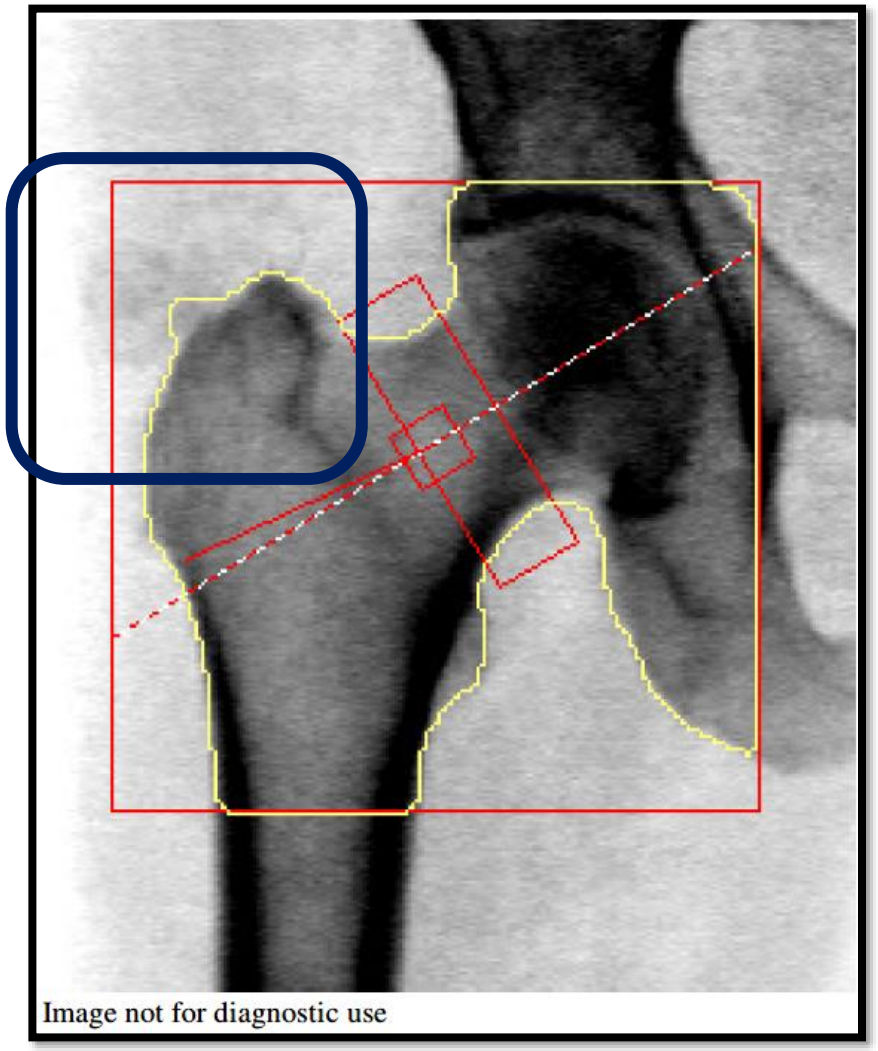


Where is it?
What is it?
Visual Challenge

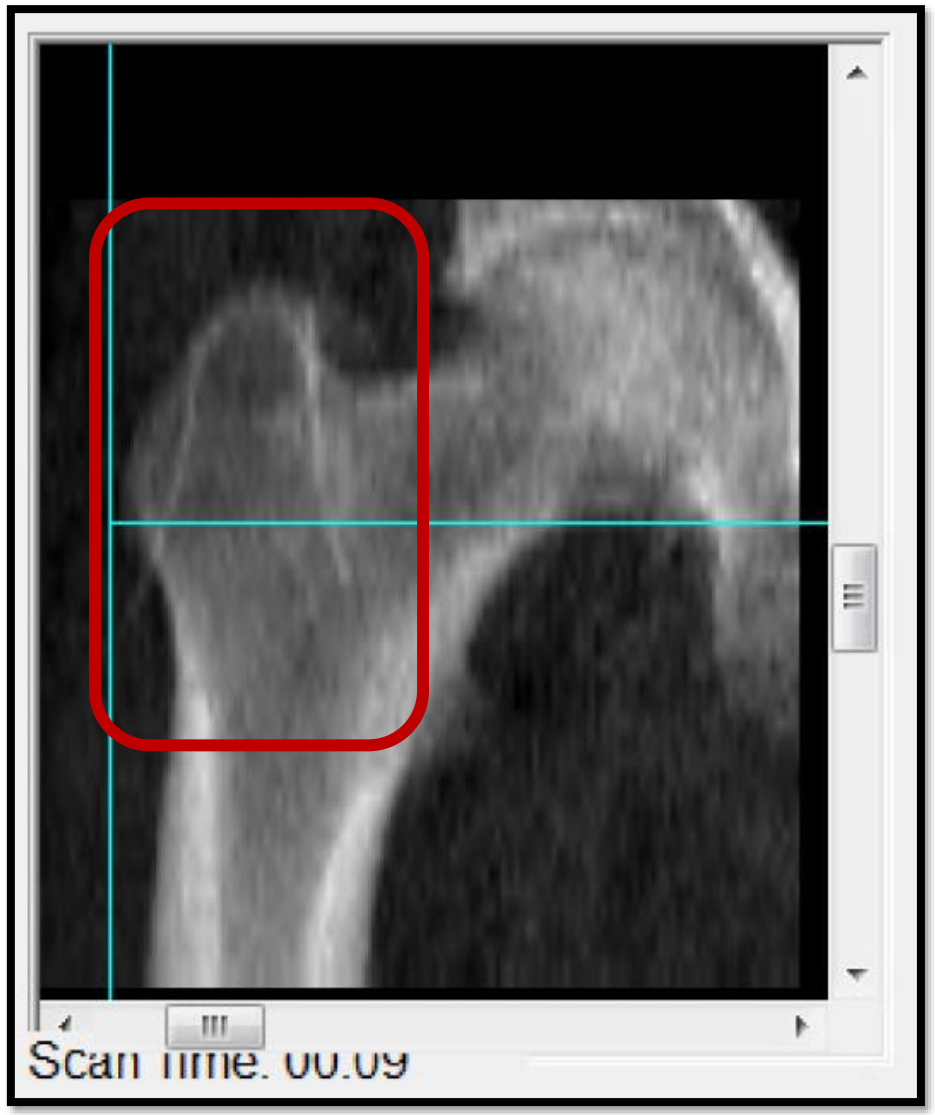
Practicing visual identification of common hip and spine artifacts

Where is it? What is it?

Where is it? What is it?

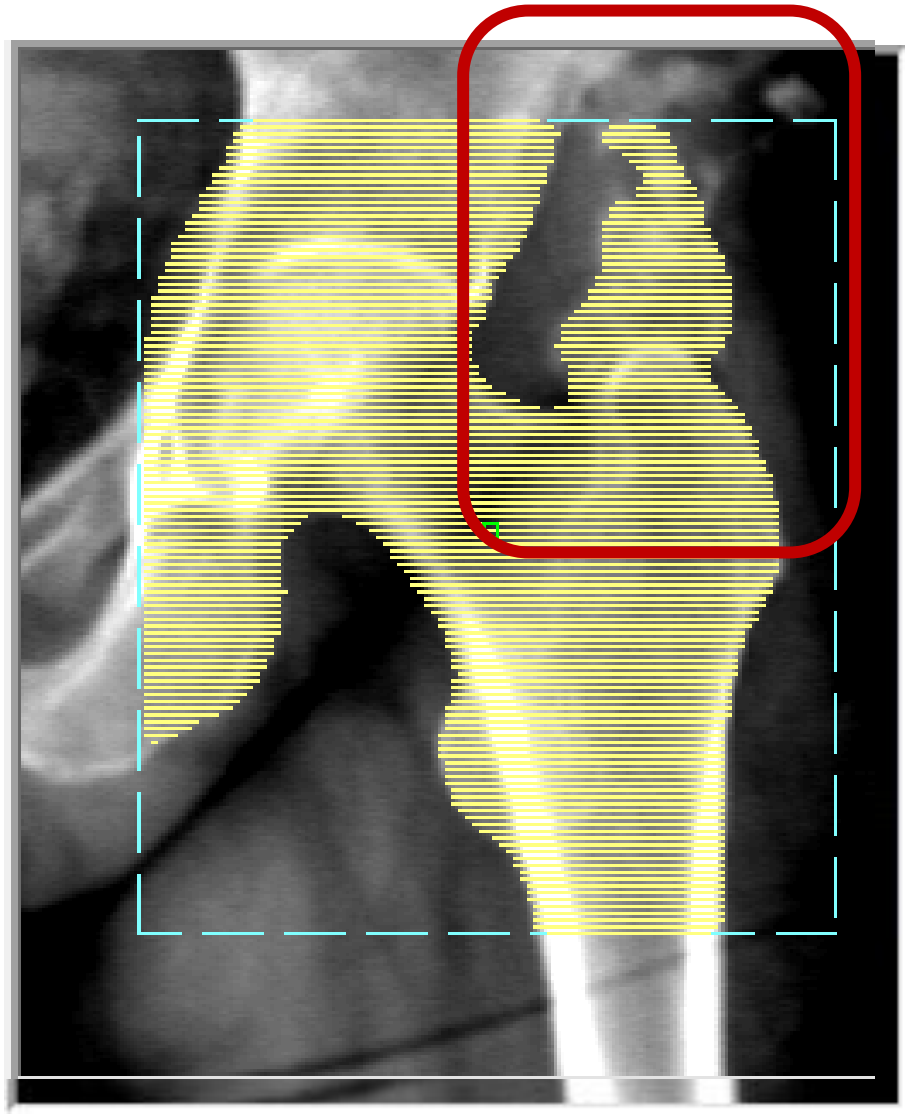


Where is it? What is it?

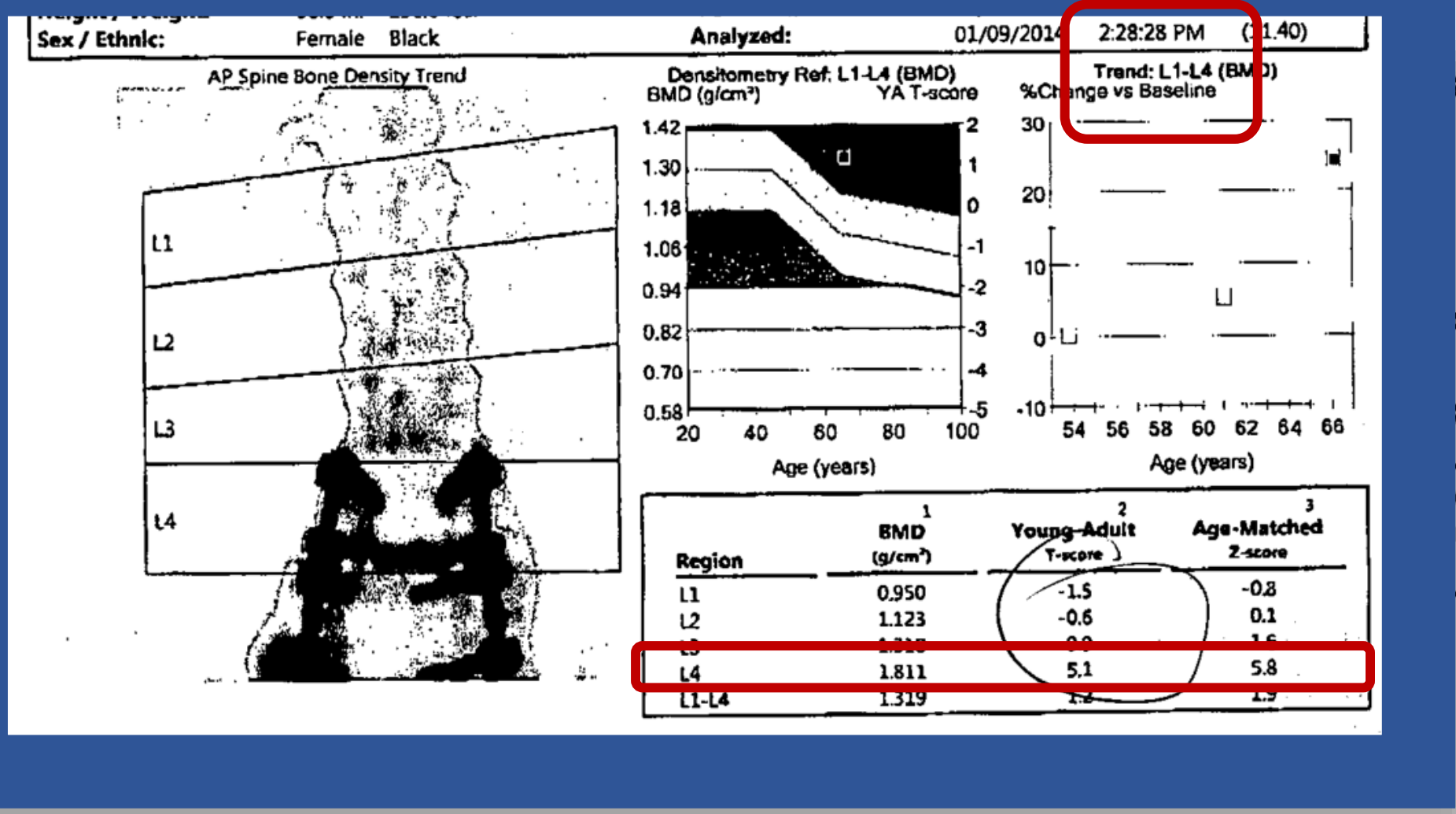


Where is it? What is it?

Where is it? What is it?



Where is it? What is it?



is within range of

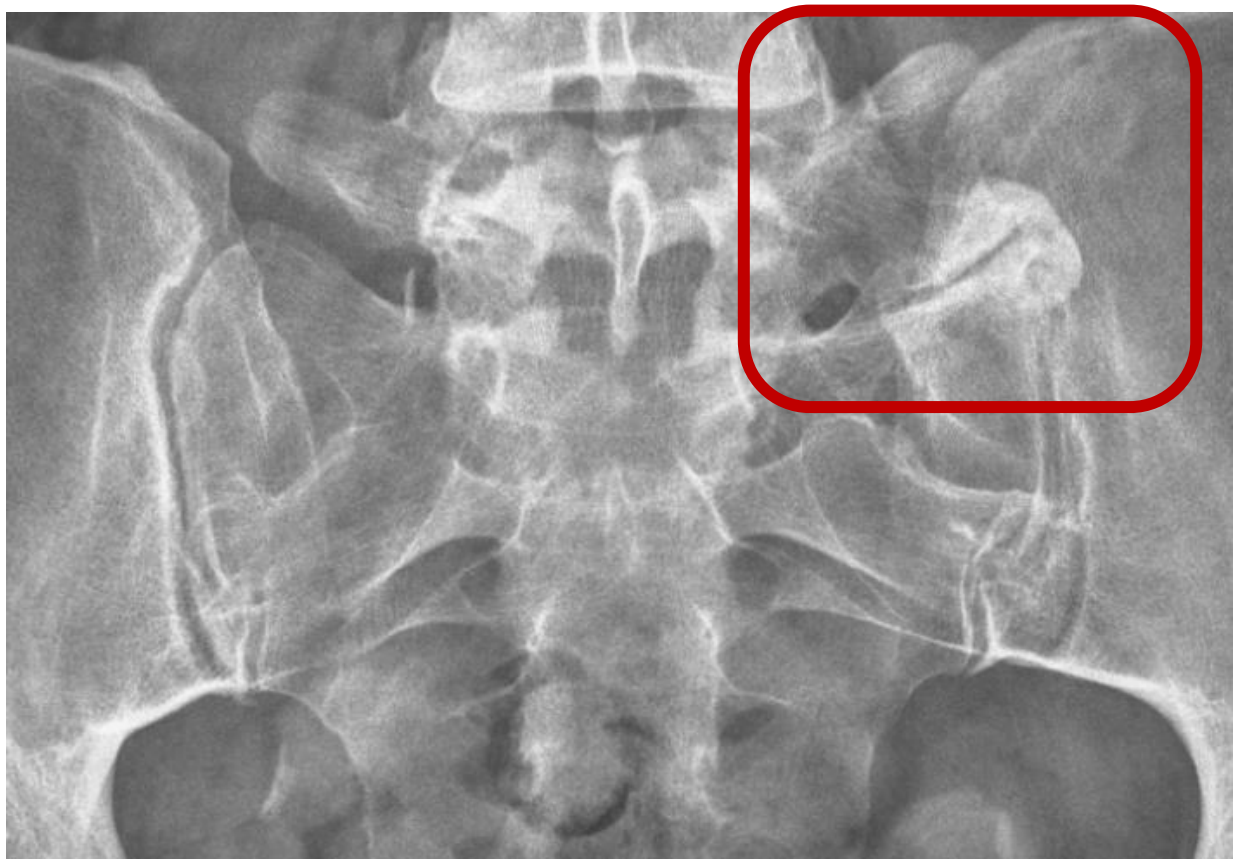
This is within range

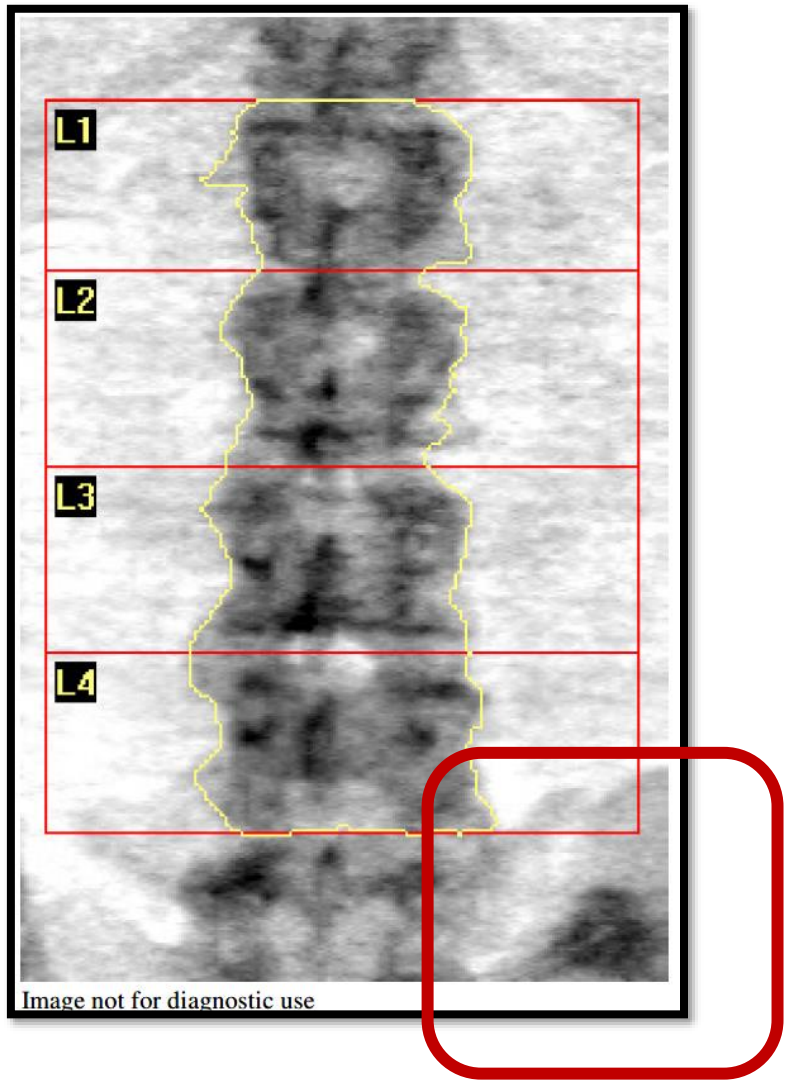
Change vs Previous (g/cm²) | Previous (%)

0.202 * | 18.1 *

0.055 *

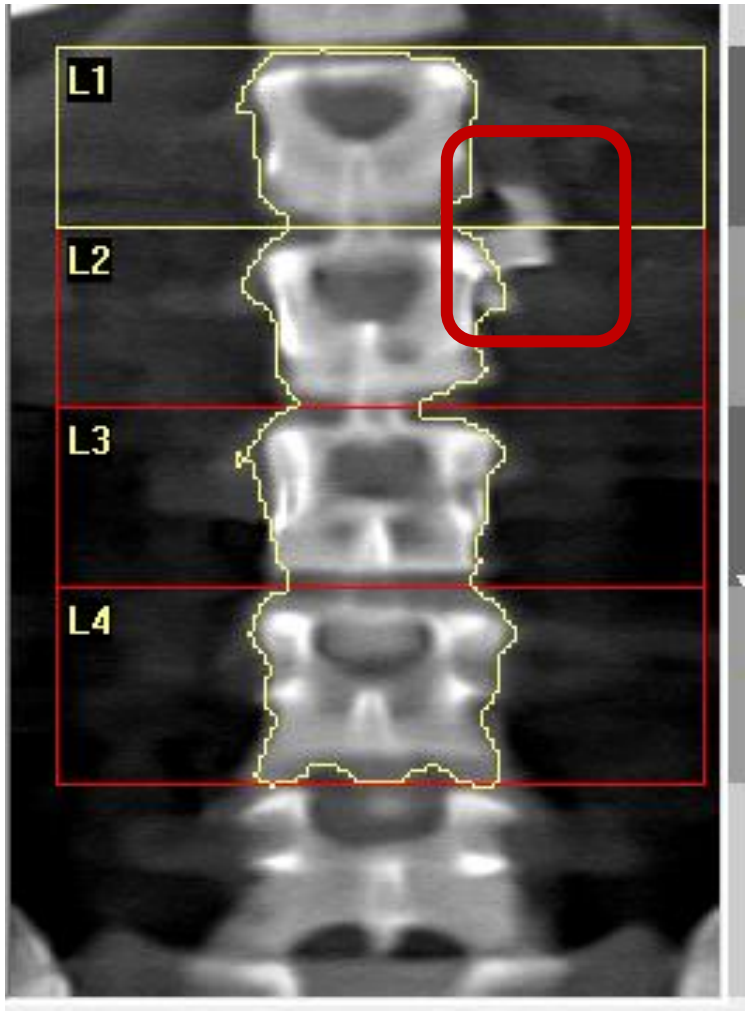
Where is it? What is it?



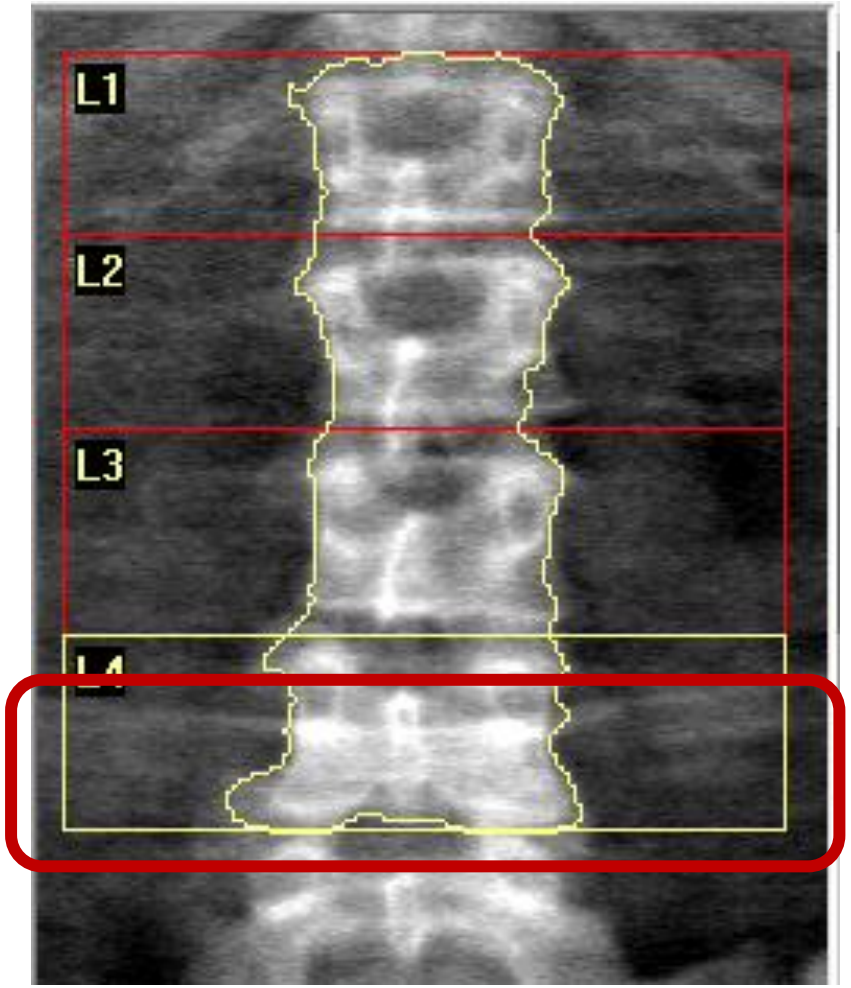


Partial sacralization of L5 with sclerotic articulation

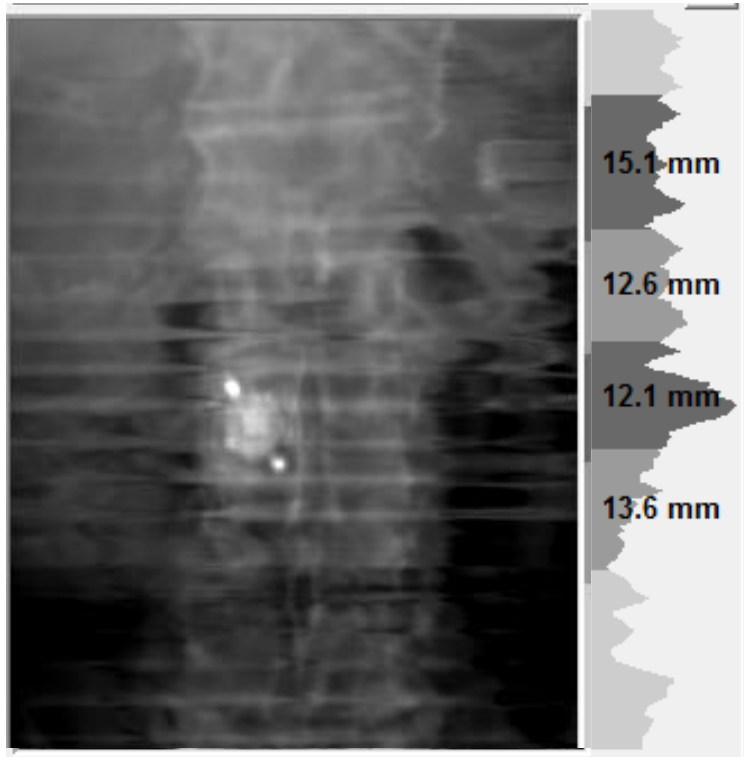
Where is it? What is it?



Where is it? What is it?



Where is it? What is it?



Height: 62.0 in Weight: 115.0 lb
Ethnic: White

Spine Analysis

Image not for diagnostic use
k=1.137 d0=44.6 t=7.024
TOTAL BMD CV for L1 - L4 1.0%

C.F.	1.019	0.990	1.000		
Region	Area (cm²)	BMC (g)	BMD (g/cm²)	T-score	Z-score
L1	15.08	11.54	0.765	-2.0	0.5
L3	11.99	17.14	1.429	3.1	6.1
L4	14.21	12.61	0.888	-1.6	1.5
TOTAL	41.28	41.29	1.000	-0.5	2.4

Where is it? What is it?

DXA Quality Matters!!

Look At The Images!

“You can observe a lot just by watching.”

- Yogi Berra