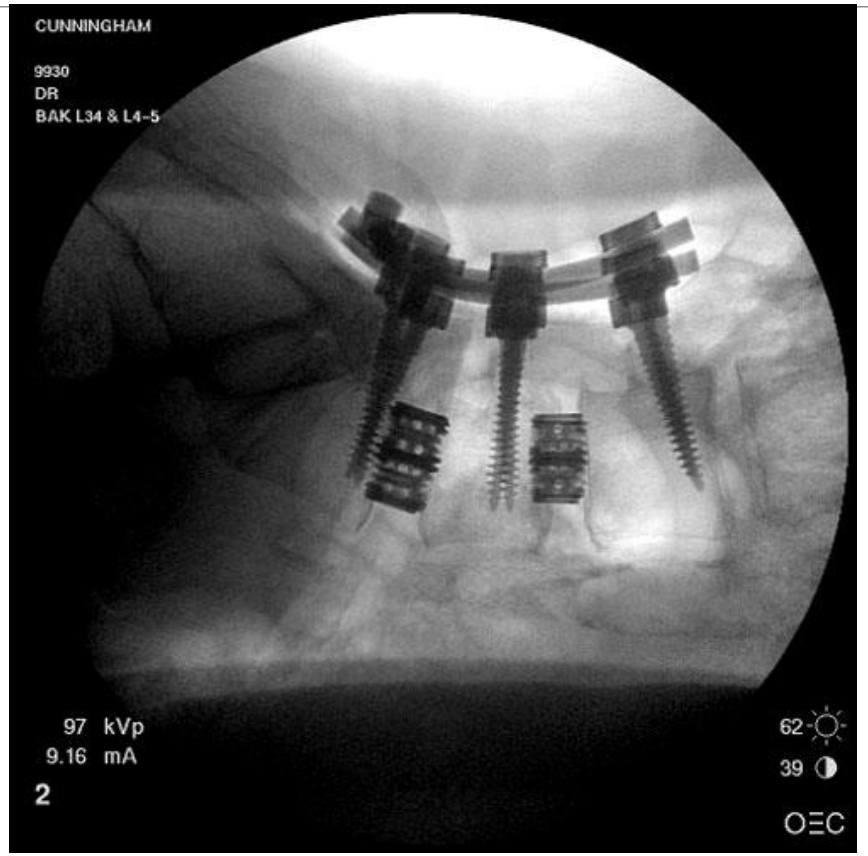
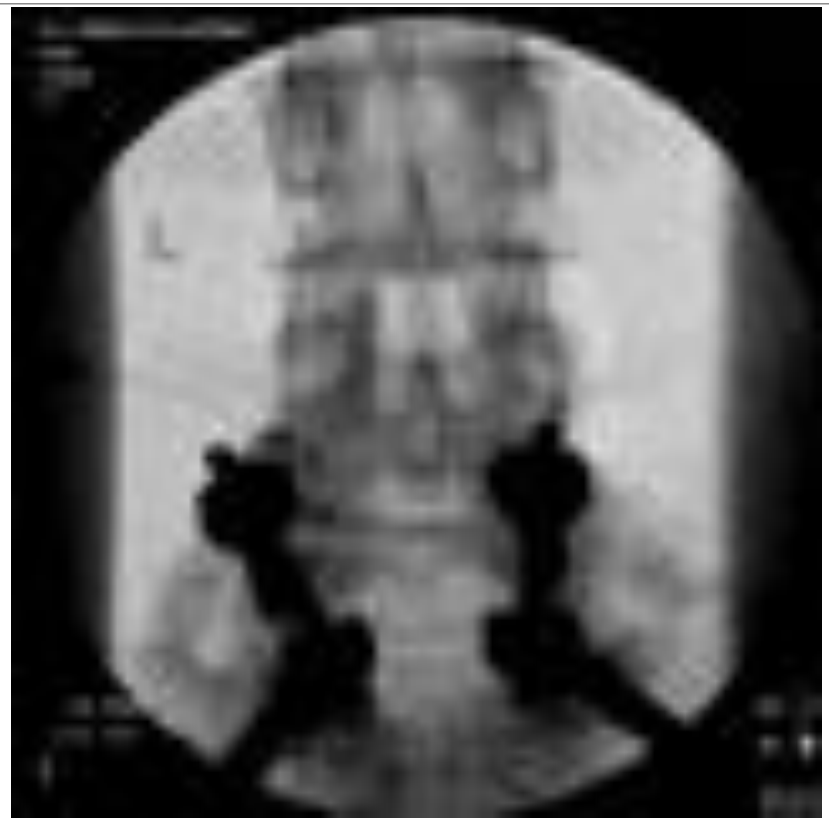
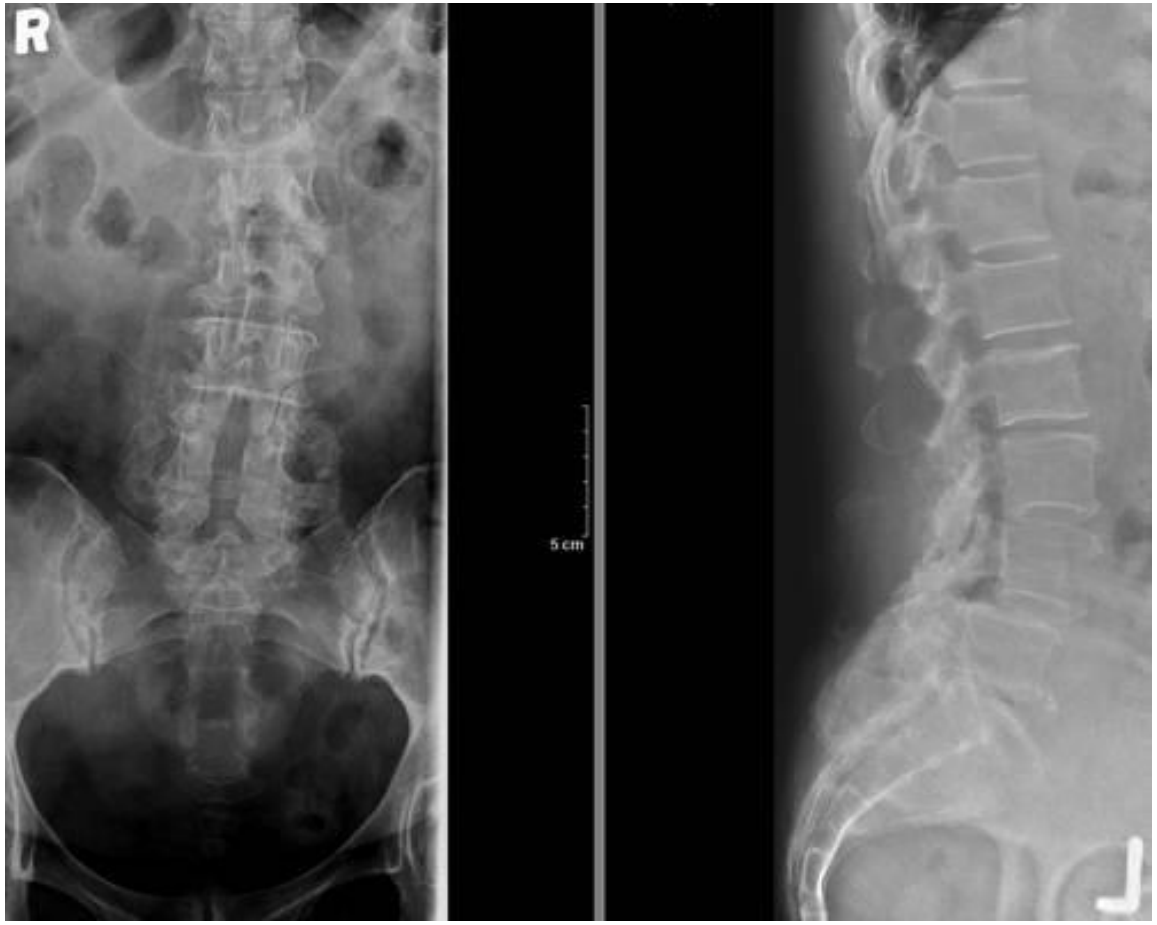
Case studies, Artifacts, and other fun things.

LECTURE 10

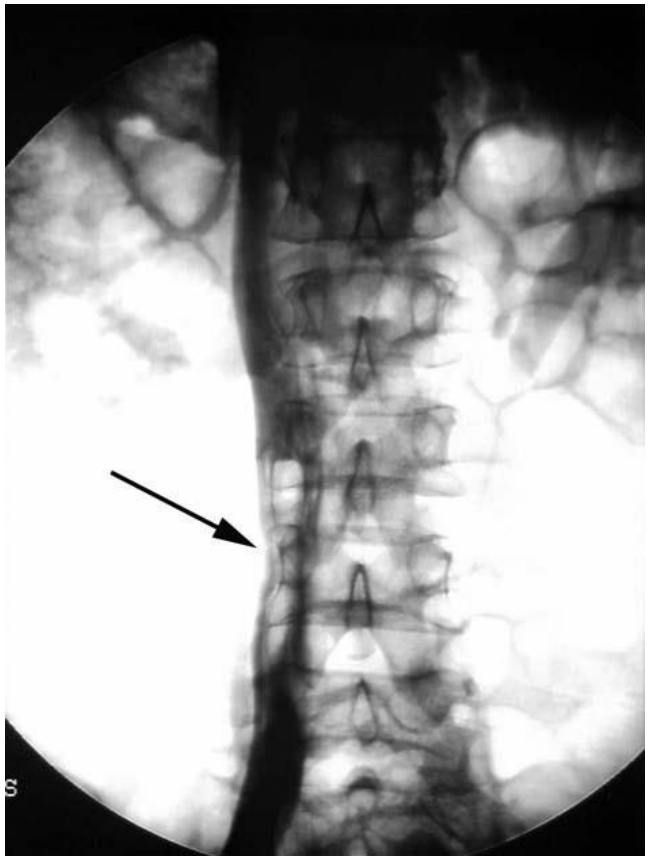
Prosthetics, fusion

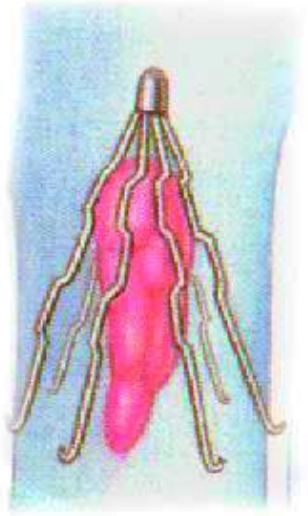






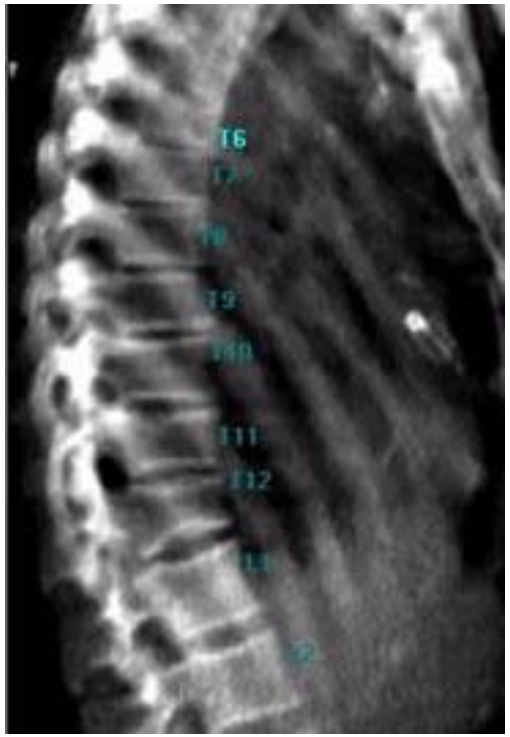
Lumbar Laminectomy





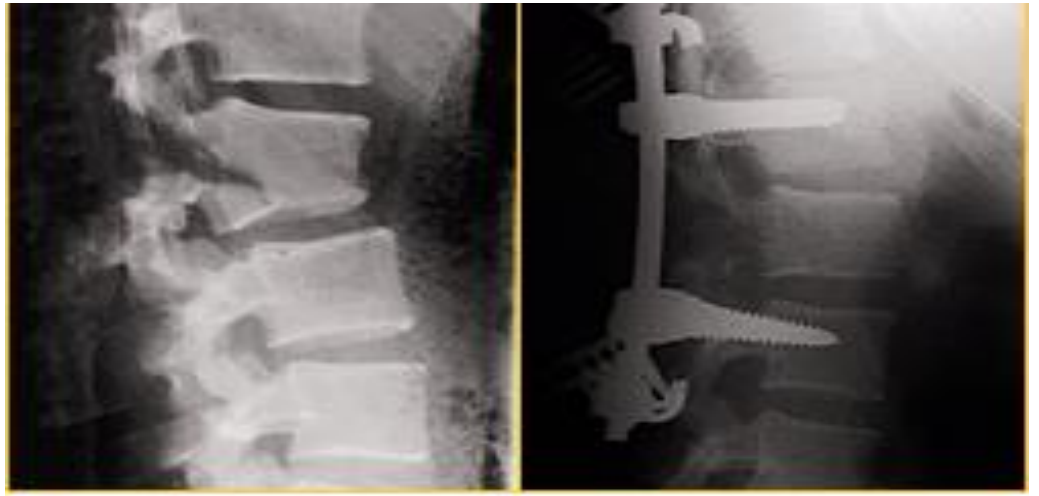
Vena Cava Filter

Patient History



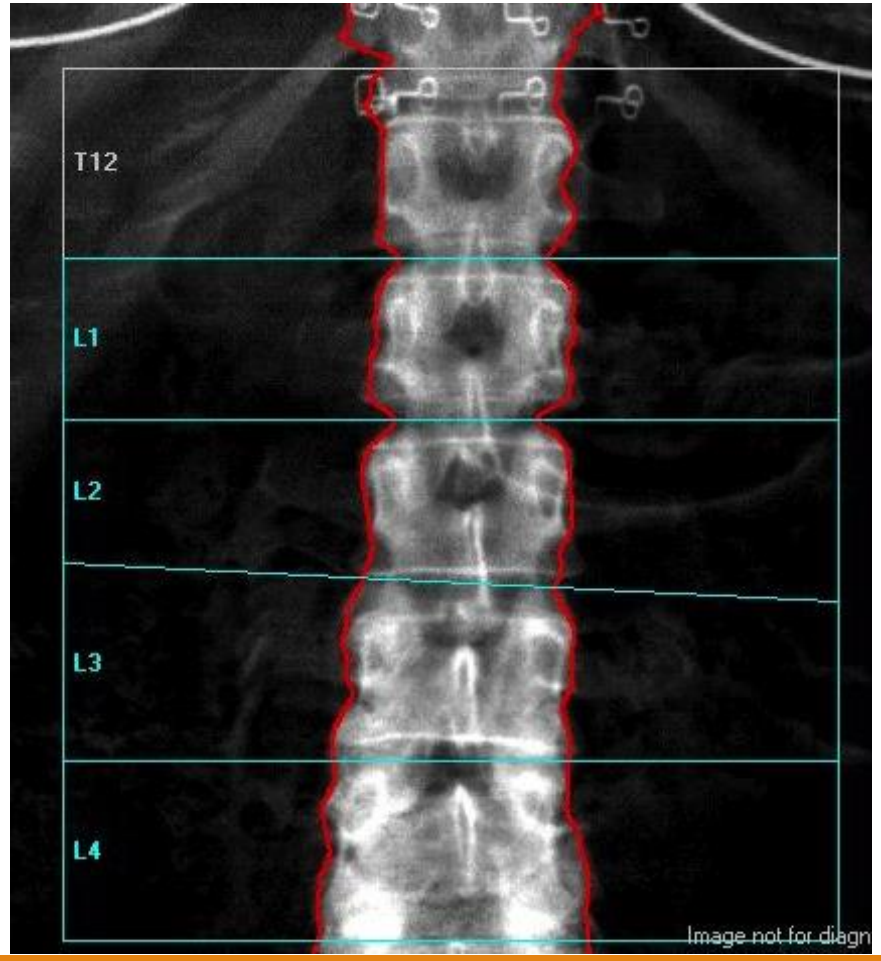
Previous fractures in scan region

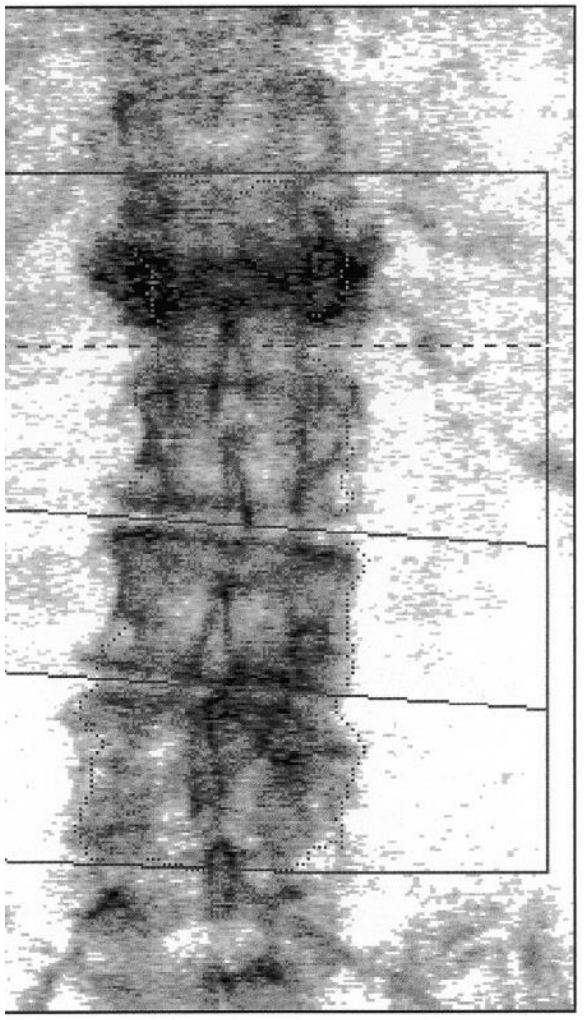
Increase, decrease or not affect BMD?



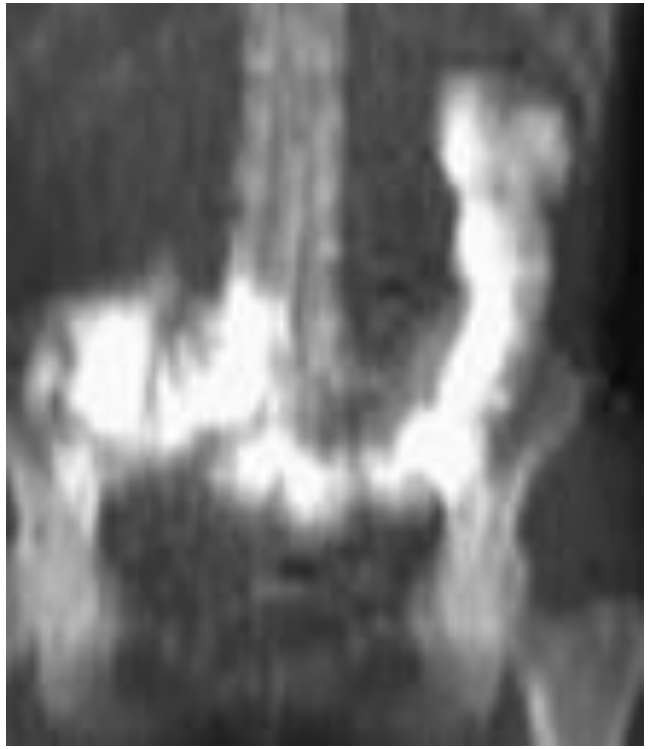
Lumbar vertebral fracture before (left) and after

What is Wrong





What is this?



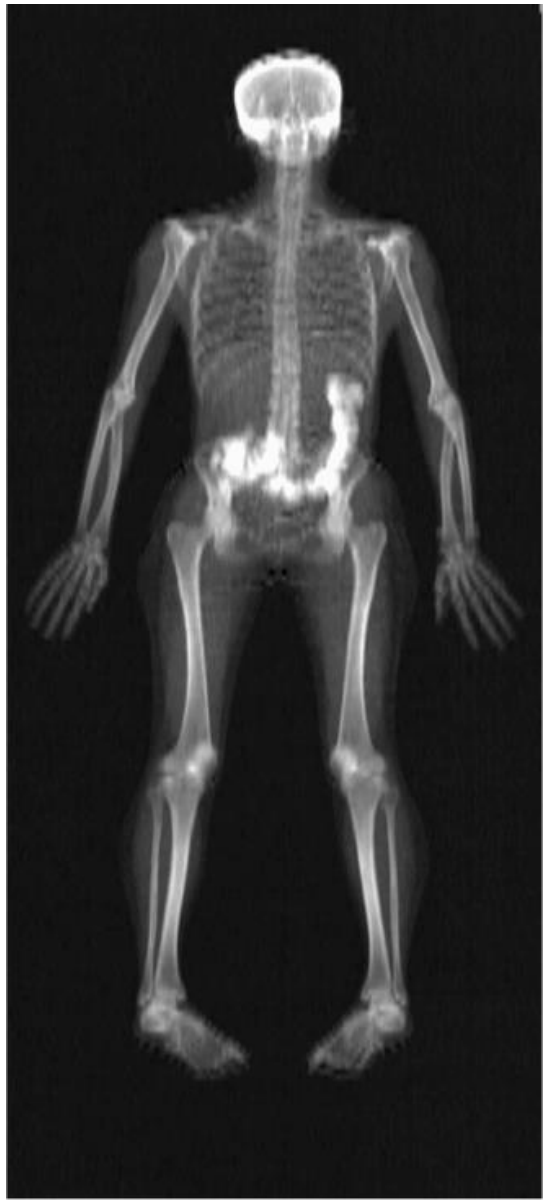
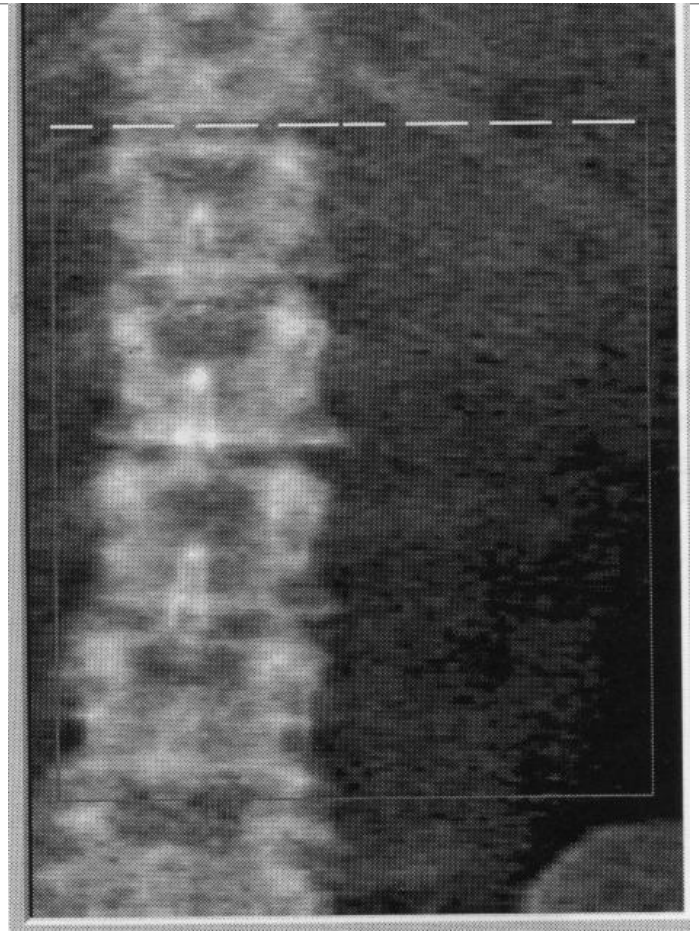


Image Evaluation



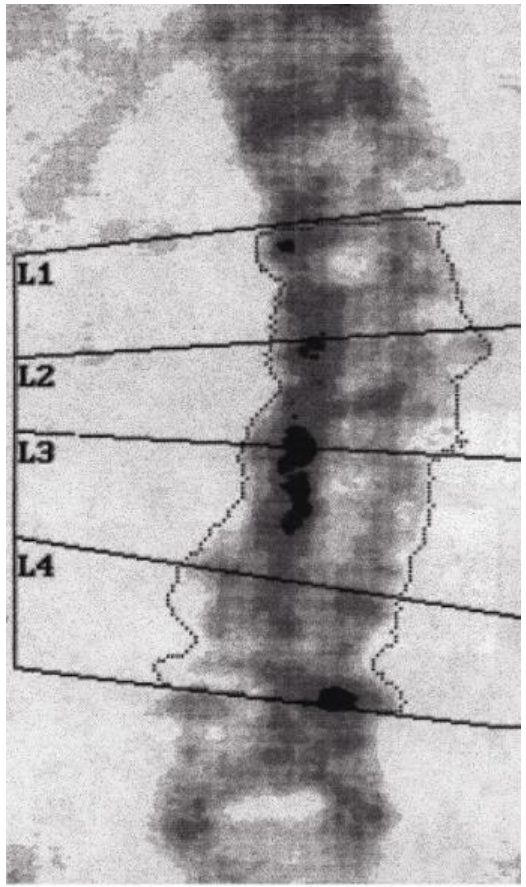
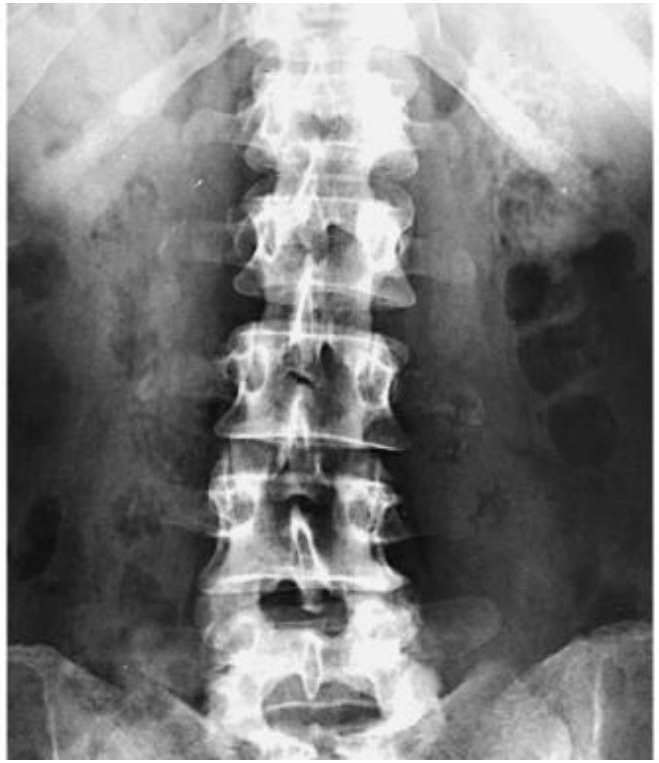
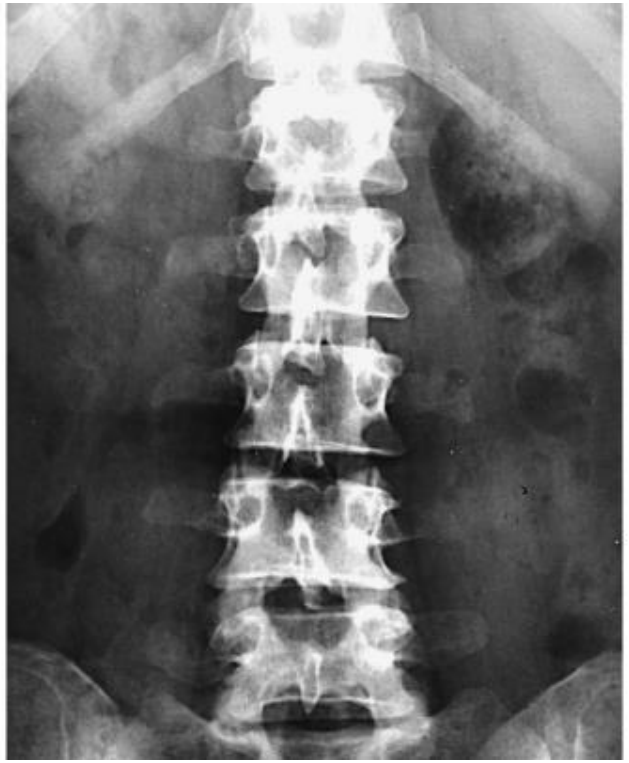
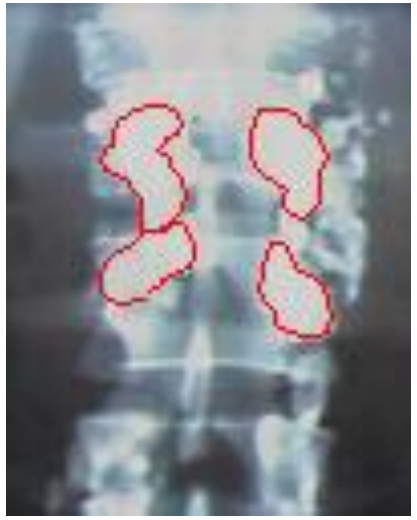


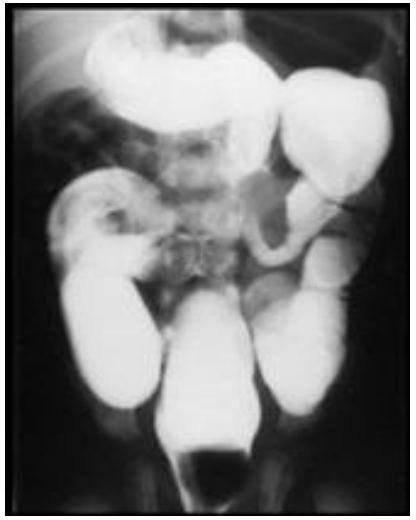
Image Evaluation

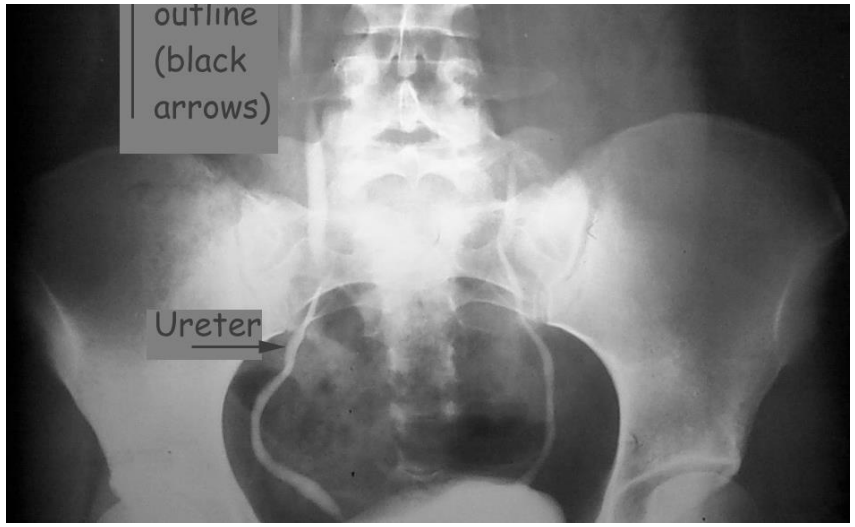




What is the difference ?

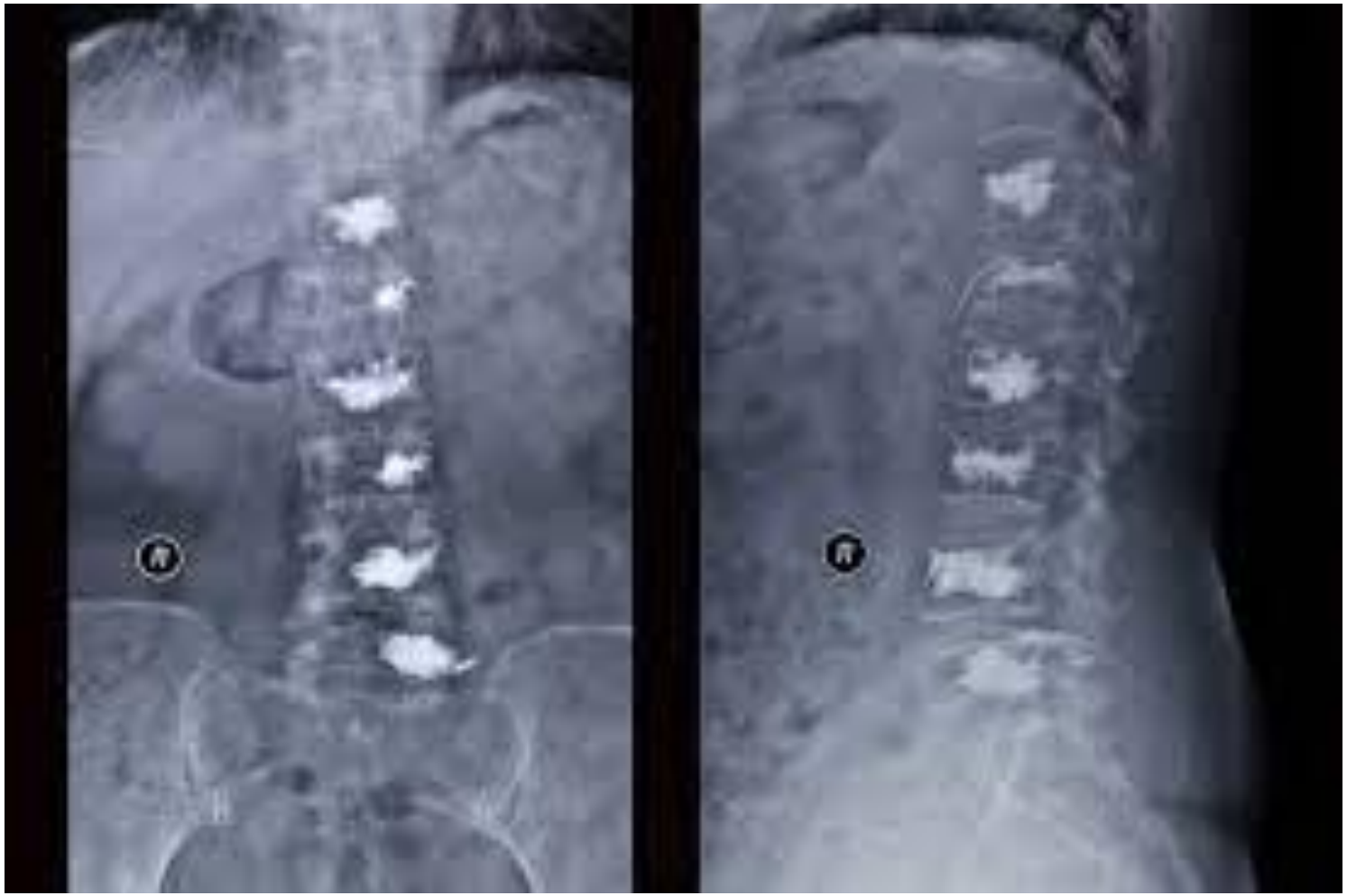


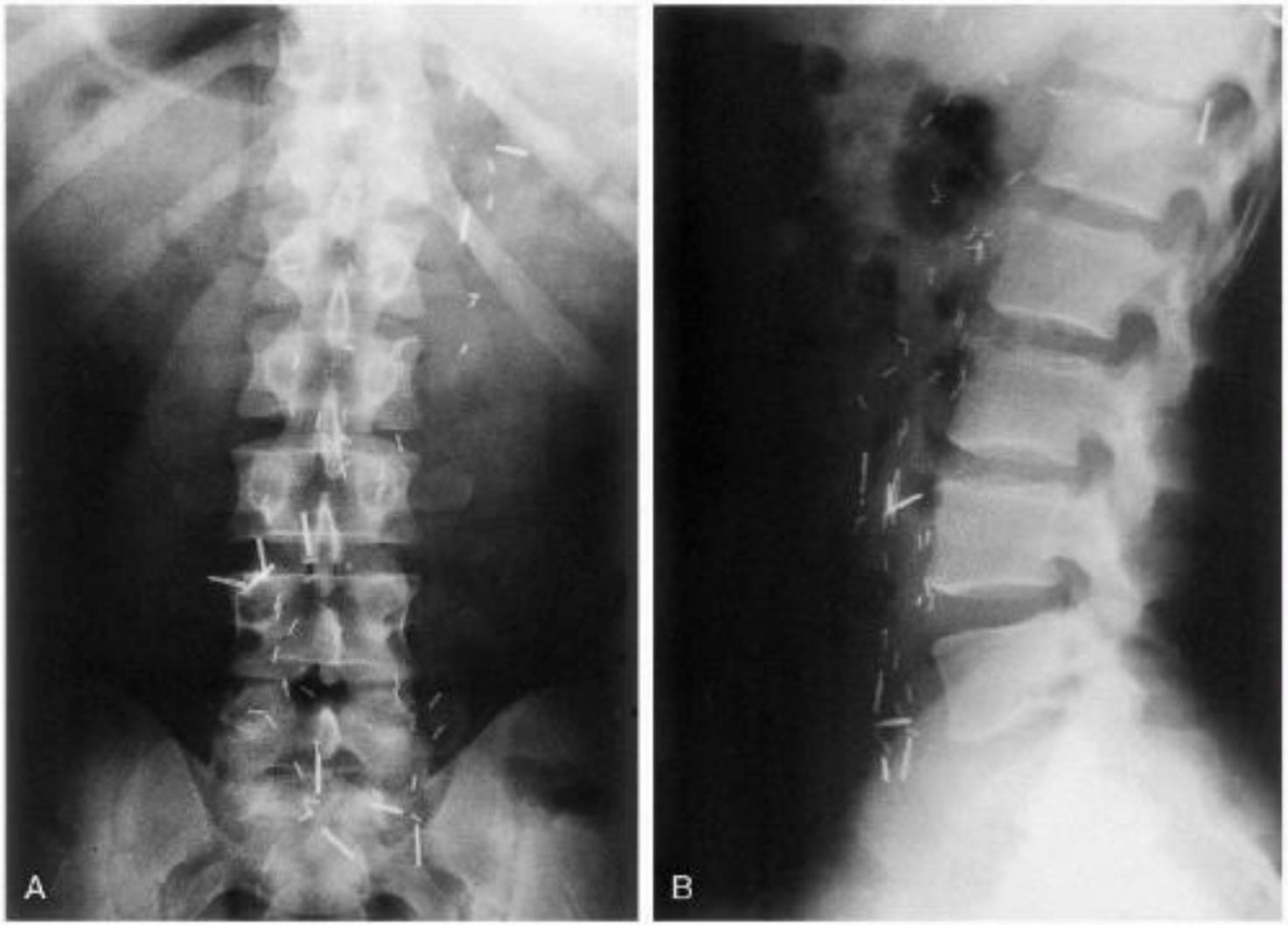




Patient History

CONTRAST MEDIA WHICH COULD AFFECT THE EXAM REGION

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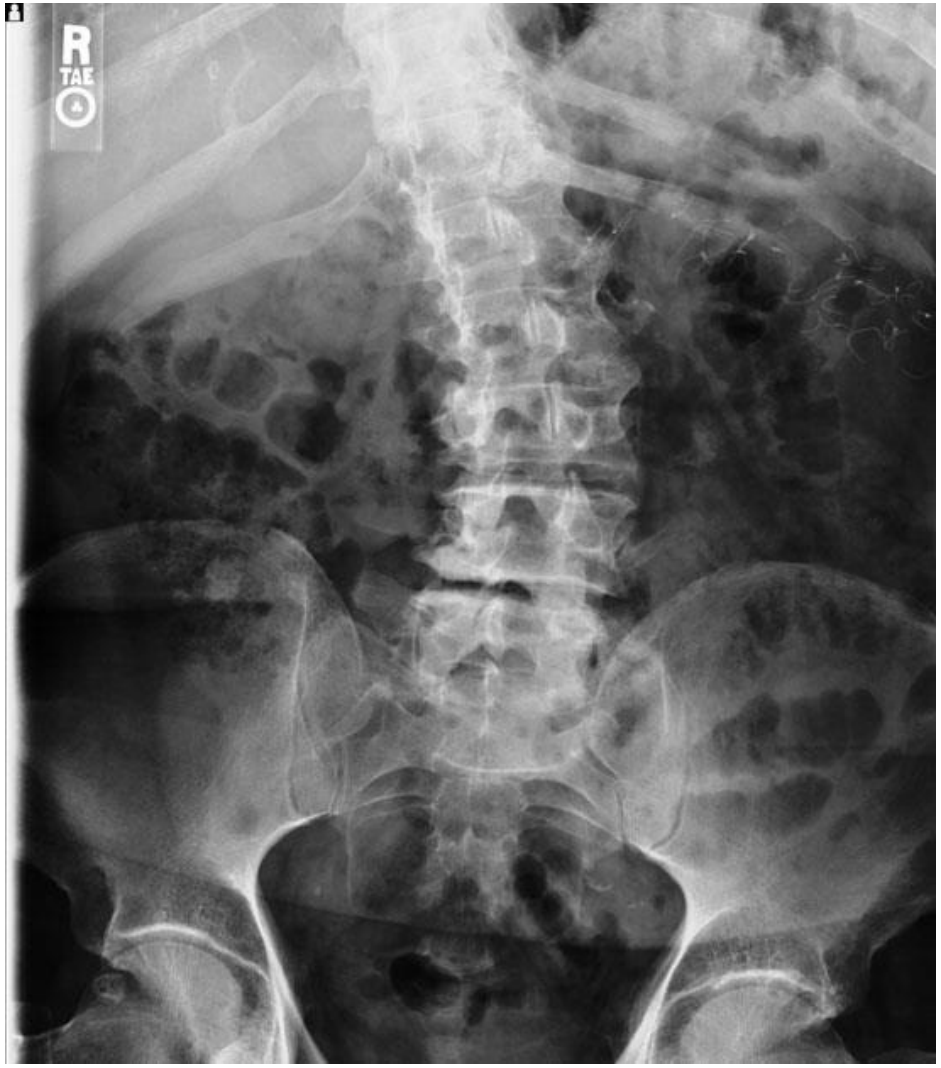
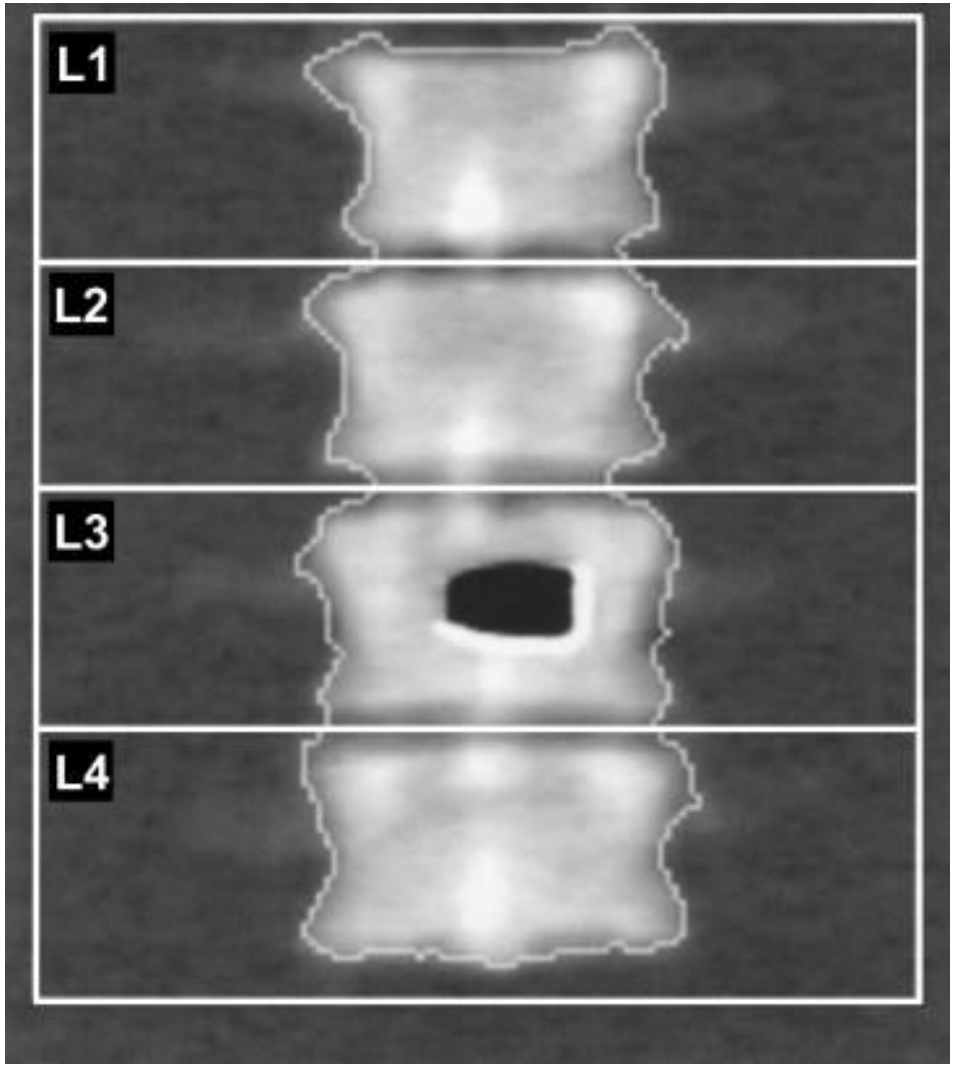
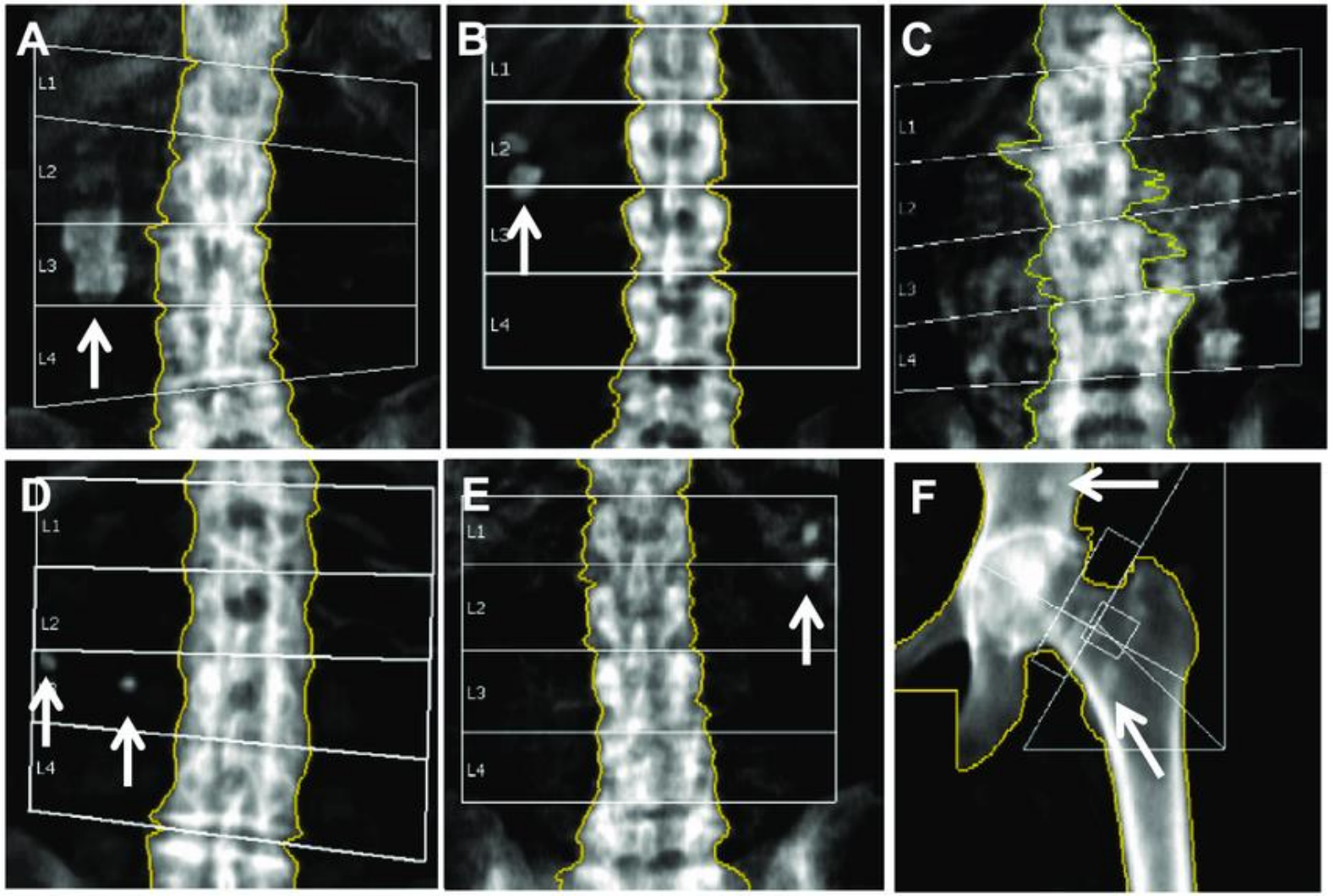
B


R
TAE


L1
L2
L3
L4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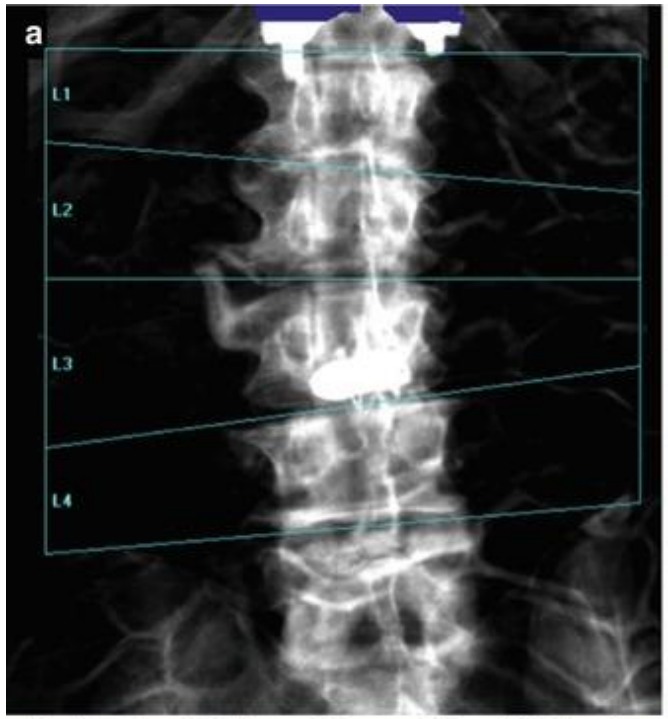
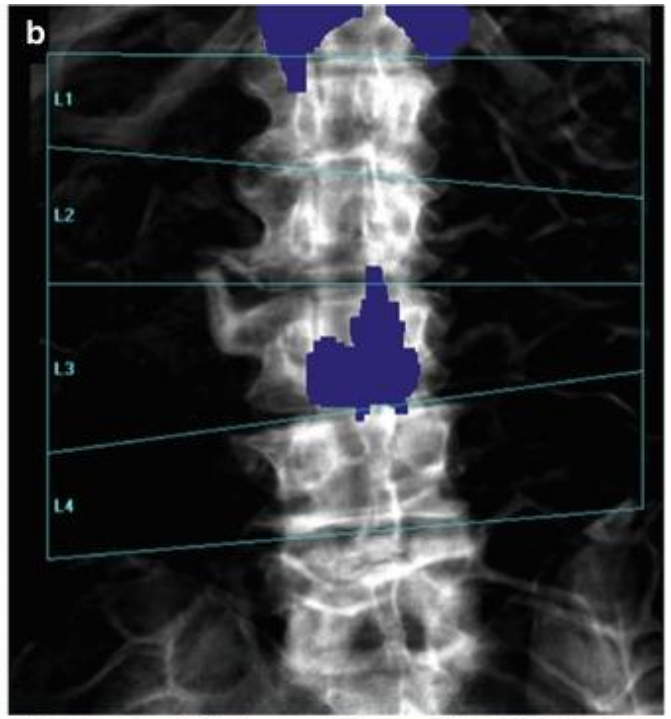
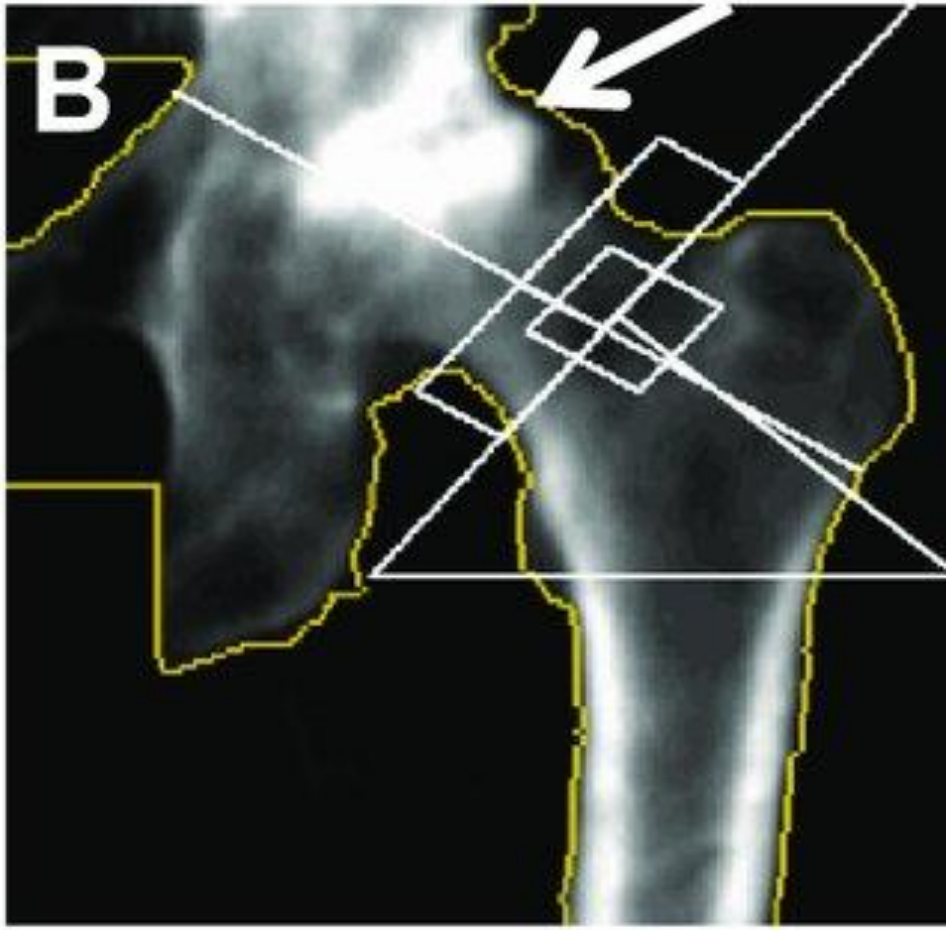




Regione	BMD (g/cm²)	GA T-score	PE Z-score	BMC (g)	Area (cm²)
L1	1,838	5,9	6,1	28,95	15,75
L2	1,613	3,4	3,6	26,89	16,67
L3	2,799	13,3	13,5	55,27	19,74
L4	1,760	4,7	4,8	31,97	18,16
L1-L2	1,723	4,6	4,8	55,84	32,41
L1-L3	2,130	8,0	8,2	111,10	52,16
L1-L4	2,034	7,1	7,3	143,07	70,32
L2-L3	2,256	8,8	9,0	82,15	36.41
L2-L4	2,091	7,4	7,6	114,12	54,57
L3-L4	2,301	9,2	9,4	87,23	37,91

L2	1,613
L3	2,799

Regione	BMD (g/cm²)	GA T-score	PE Z-score	BMC (g)	Area (cm²)
L1	1,760	5,3	5,4	26,61	15,12
L2	1,610	3,4	3,6	26,52	16,48
L3	1,363	1,4	1,5	17,96	13,18
L4	1,758	4,7	4,8	31,69	18,03
L1-L2	1,682	4,3	4,5	53,14	31,59
L1-L3	1,588	3,5	3,7	71,10	44,77
L1-L4	1,637	3,8	4,0	102,79	62,80
L2-L3	1,500	2,5	2,7	44,48	29.65
L2-L4	1,598	3,3	3,5	76,18	47,68
L3-L4	1,591	3,3	3,4	49,65	31,21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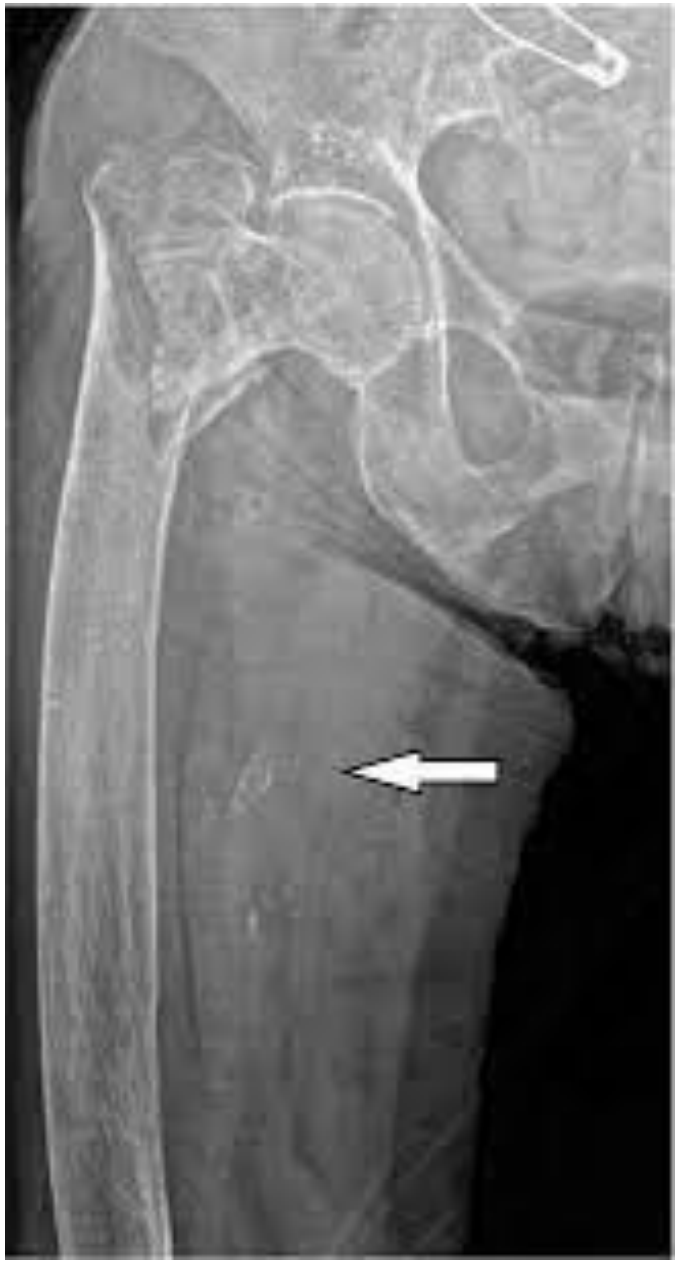

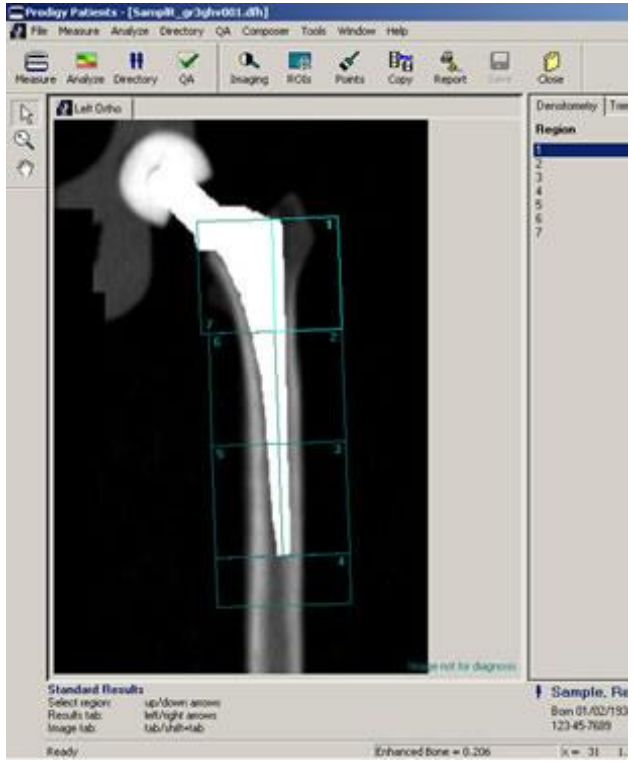
Prodigy Patients
File Measure Analyze Directory QA Composer Tools Window Help
Measure Analyze Directory QA Imaging ROIs Points Copy Report Close
Left Ortho
Densitometry
Region
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123-45-7689
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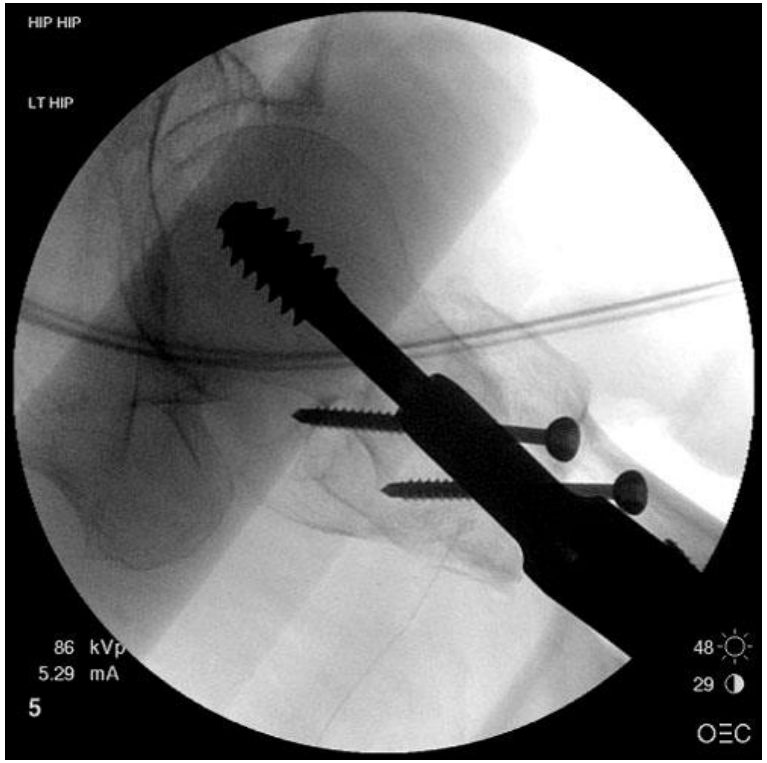
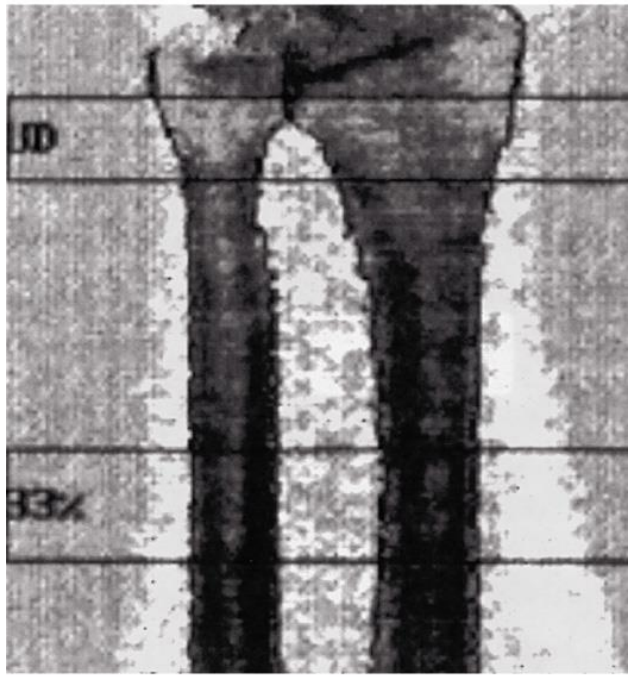
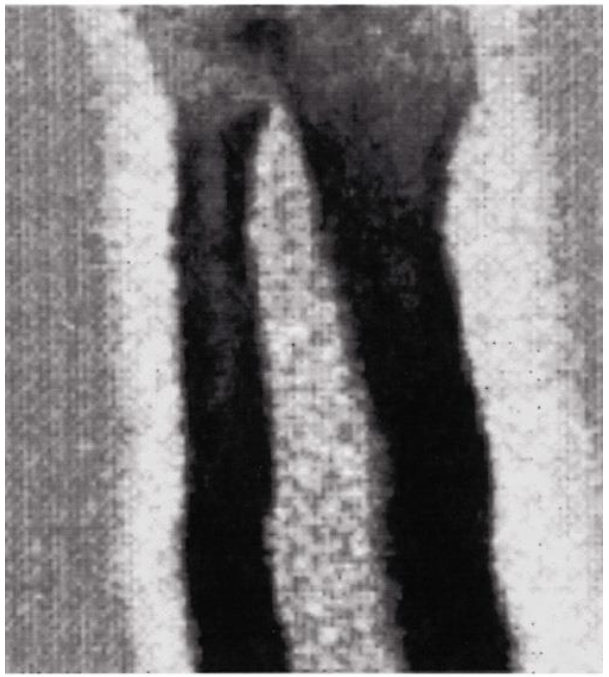

HIP HIP
LT HIP
86 kVp
5.29 mA
5
48
29
OEC

What is this?

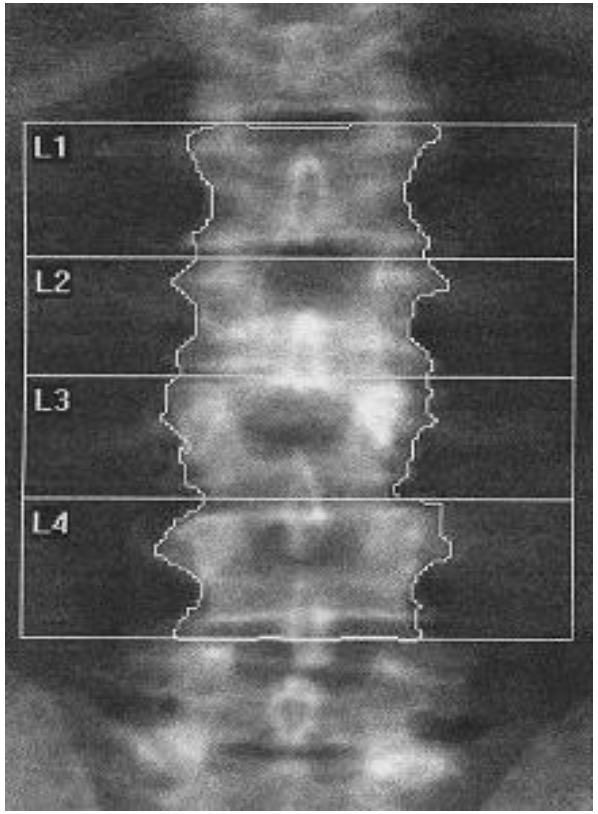
B



A



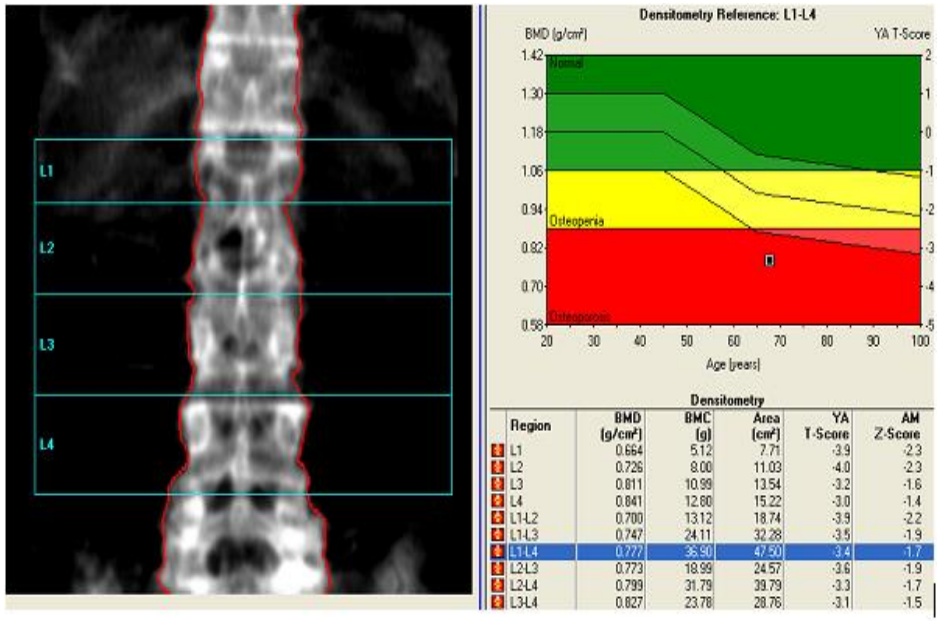
What's wrong with the image on the left?

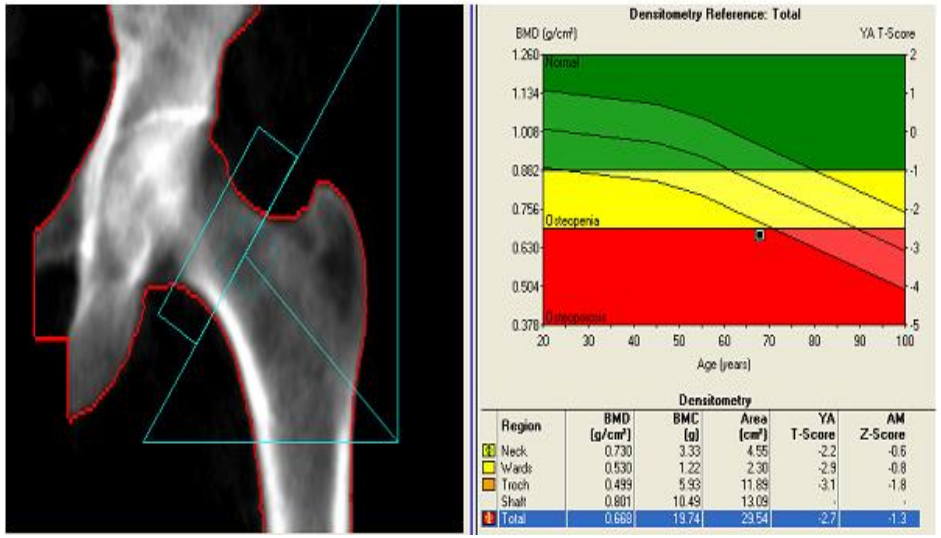


Region	Area (cm^2)	BMC (g)	BMD (g/cm^2)	T - score	PR (%)	Z - score	AM (%)
L1	14.54	13.13	0.904	-0.9	90	-0.1	98
L2	14.12	18.25	1.293	1.8	118	2.7	130
L3	14.65	17.42	1.189	0.8	108	1.7	118
L4	17.46	18.17	1.041	-0.9	91	0.0	100
Total	**60.76**	**66.97**	**1.102**	**0.1**	**101**	**1.0**	**111**

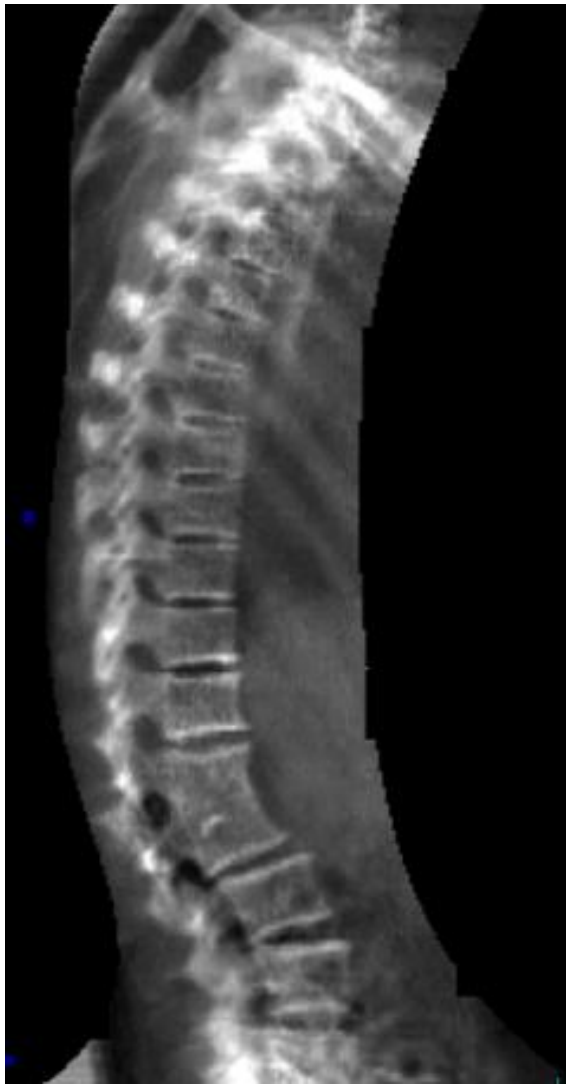
Question: Why does this patient have an elevated BMD (note Z-score = +2.7 at L2) and why is there significant variability between vertebrae (T-score at L2 almost 3 S.D. greater than L1 and the T-score at L3 almost 2 S.D. greater than L4)?

Answer: Elevated BMD is a common finding on DXA scans in elderly patients and can be secondary to many artifacts. In this patient, the increased density seen around the L1-L2 disc space suggests endplate sclerosis due to degenerative disc disease. Subsequent x-ray shown below does show disc degeneration (confirmed by a vacuum phenomena) but also reveals a compression deformity at L2 with secondary anterior osteophytes explaining the increased BMD.





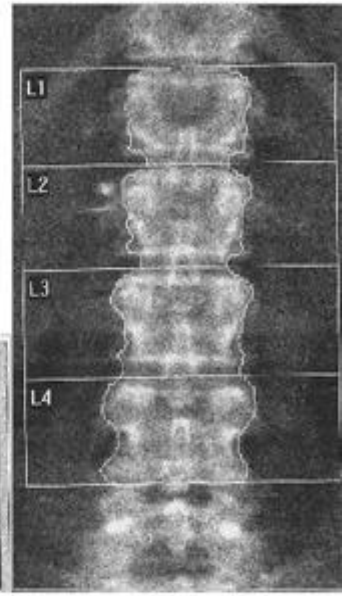
- What is your diagnosis?
- Do you agree with the spine analysis?
- What would you recommend to properly interpret this scan?
- How would you evaluate this patient?



- The diagnosis using the World Health Organization criteria is osteoporosis (T-score less than -2.5 at the spine and total hip).
- The T12-L1, L3-L4 and L4-L5 endplates are well visualized but the L1-L2 endplate is not seen making it difficult to place the intervertebral markers. In addition, the shape of the L1 and L2 vertebrae appears unusual.
- By using lateral spine vertebral fracture assessment (VFA below), it is possible to see that L1 and L2 are actually fused. The preserved vertebral height on x-ray argues against acquired fusion from pathology (e.g., tuberculous spondylitis); this is a congenital block vertebra. The abnormal vertebral anatomy makes interpretation of lumbar spine BMD difficult as normal reference data were acquired from people with normal vertebral anatomy. A second measurement site should be evaluated. In this case, the left hip was assessed and confirmed that a diagnosis of osteoporosis is appropriate (total hip T-score -2.7). The lumbar spine could still be used as a monitoring site, however.
- The congenital block vertebra was an incidental discovery and does not require any evaluation or intervention. Although osteoporosis may be explained by the very low BMI, secondary causes should always be considered before treatment.

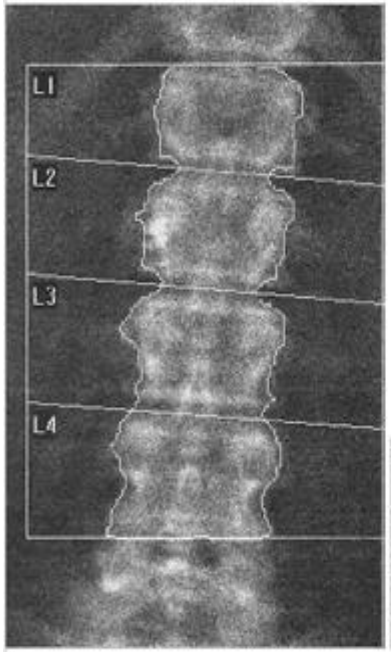
- It is important to review the DXA image to recognize abnormal vertebral anatomy. Although the lumbar spine usually has 5 vertebrae with the lowest ribs on T12, altered segmentation of the lumbar spine is not unusual (16% of cases from NF Peel et al. JBMR 1993;8:791).
- Unexplained findings on the DXA image (in this case, abnormal shape and no end-plate at L1-L2) should prompt further evaluation. A specific diagnosis requires further imaging.

69 postmenopausal Caucasian female with history of vertebral compression fracture. Follow-up DXA on alendronate. Weight 132#, height 66”, BMI = 21.3



2005

Region	Area (cm²)	BMC (g)	BMD (g/cm²)	T - score	PR (%)	Z - score	AM (%)
L1	13.03	8.49	0.652	-2.5	70	-0.8	87
L2	13.90	10.67	0.768	-2.4	75	-0.6	93
L3	16.02	13.21	0.825	-2.4	76	-0.4	94
L4	17.92	15.38	0.859	-2.3	77	-0.4	96
Total	**60.87**	**47.76**	**0.785**	**-2.4**	**75**	**-0.5**	**93**



2009

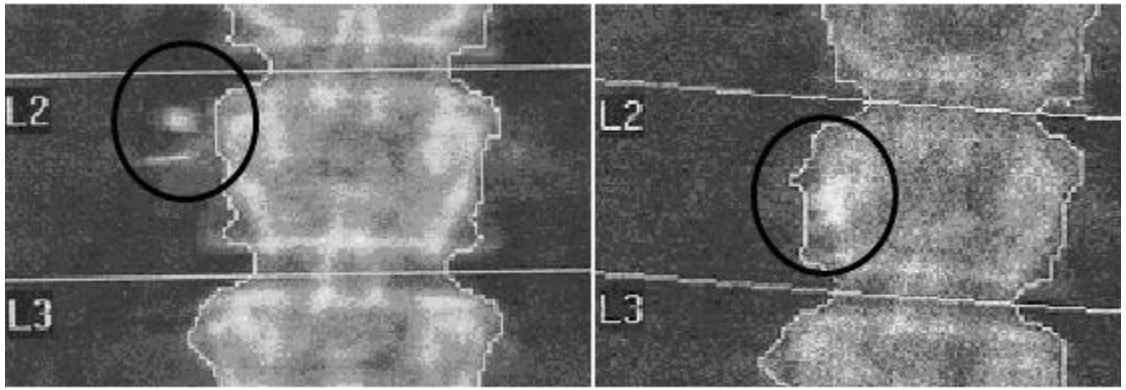
Region	Area (cm²)	BMC (g)	BMD (g/cm²)	T - score	PR (%)	Z - score	AM (%)
L1	13.30	8.97	0.674	-2.3	73	-0.4	93
L2	14.40	12.19	0.847	-1.6	82	0.4	105
L3	16.22	13.55	0.836	-2.3	77	-0.1	99
L4	17.76	15.79	0.889	-2.1	80	0.2	102
Total	**61.67**	**50.50**	**0.819**	**-2.1**	**78**	**0.0**	**100**

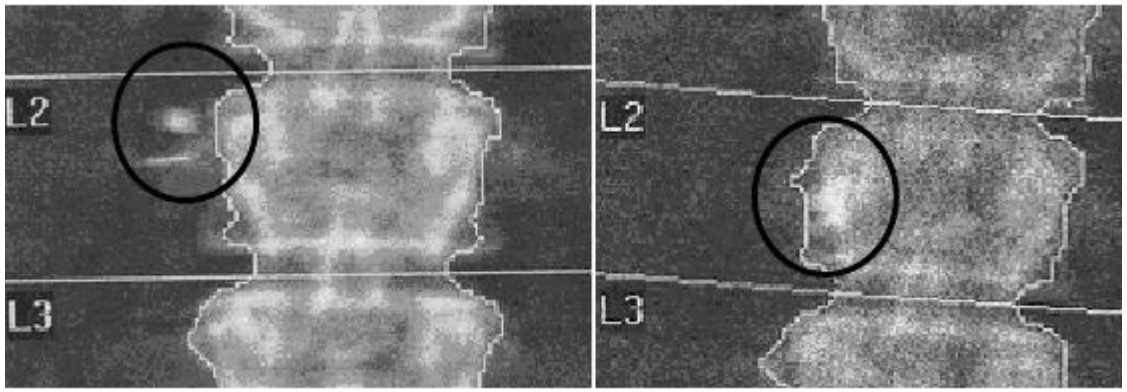
Question

- Is the patient positioned the same in both scans?
- Why does the 2009 scan show a HIGHER T-score at L2 compared to L1 and L3 when this pattern was not seen in 2005?
- Has there been a significant change in bone density between 2005 and 2009?

ANSWER:

1. No – in 2005, patient is centered and straight but in 2009, patient is positioned on an angle.
2. Surgical clips are seen in both scans but in the 2005 scan they are adjacent to the vertebra and in 2009 they overly the L2 vertebra falsely elevating bone density in this area.
3. The measured change in BMD is +.034 gm/cm2 which exceeds the least significant change at this center of 0.30 gm/cm2. If L2 is eliminated, the measured change remains significant at +0.32gm/cm2.





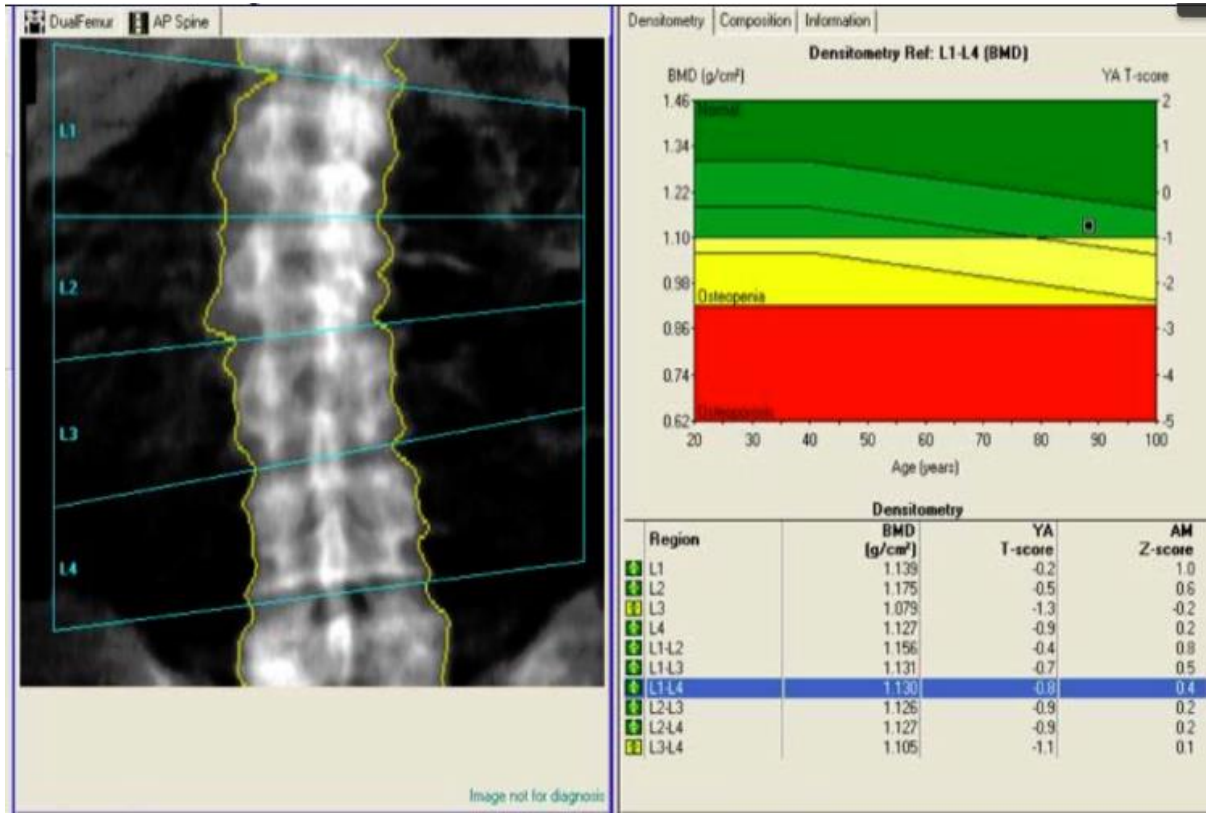
ANSWER:

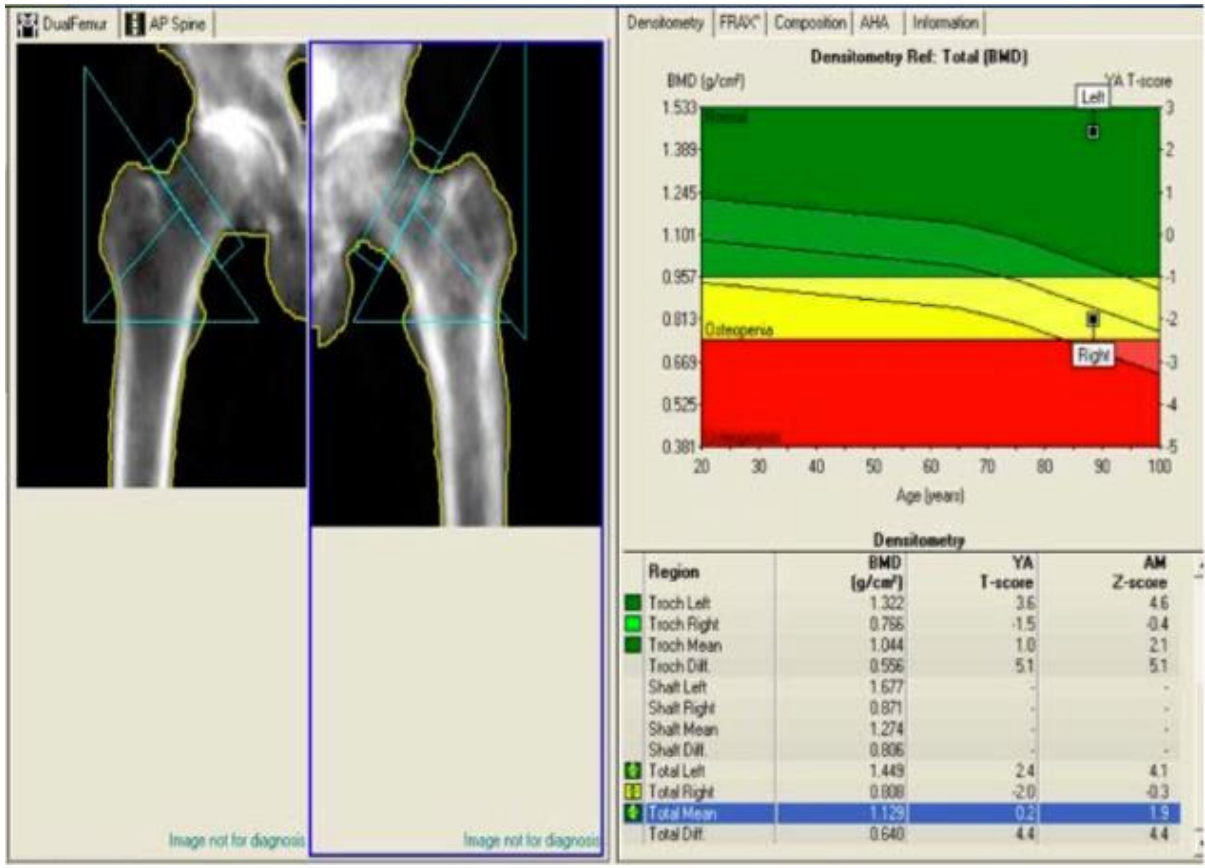
- Although the artifact had little effect on L2 BMD and eliminating this vertebra did not change your conclusion, the effect of different positioning cannot be determined.

TEACHING POINTS:

- Artifacts that overly the vertebral body can falsely elevate measured bone density.
- Since the effect of a given artifact cannot be predicted, vertebrae with artifacts should be eliminated from the analysis.

77 year-old white male presents for bone density testing on a GE Lunar Prodigy densitometer. He reports a history of arthritis but is otherwise healthy. Height is 66.5 inches and weight 150 pounds.





- Based on the spine and femur scans, what is your diagnosis?
- Is the bone density of the lumbar spine normal?
- Why may there be such a discrepancy between the right and left total mean BMD values?
- Does the femur discrepancy invalidate the Total Mean Femur BMD?
- What further evaluation is indicated?
- Is treatment appropriate?

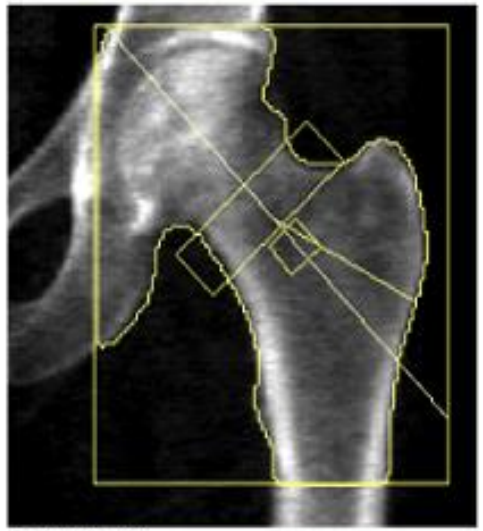
Case Answers and Discussion

- Based on the spine and femur scans he has ‘low bone mass’.

- Is the bone density of the lumbar spine normal?
  - He does appear to have false elevation of the bone density related to sclerotic artifact making the ‘normal’ BMD values misleading.
- Why may there be such a discrepancy between the right and left total mean BMD values?
  - Visually the left femur looks significantly different than the right and other metabolic bone disease should be considered.
- Does the femur discrepancy invalidate the Total Mean femur BMD?
  - The marked disparity between the right and left femur BMD values make the total femur mean misleading.
- What further evaluation is indicated?
  - Metabolic evaluation included biochemical markers of bone turnover that were elevated, particularly the bone specific alkaline phosphatase.
  - A follow-up bone scan confirmed the diagnosis of Paget’s disease.

Bone density may be increased in bone that is affected by Paget’s disease and a large discrepancy between right and left femur BMD should prompt further evaluation.

A 69 year old Post Menopausal woman with history of low bone density has completed 5 years of bisphosphonate therapy and two years of a ‘drug holiday’. She continued with her calcium 500mgs and vitamin D 10 mcg/day. Repeat bone density with Discovery A Hologic densitometer is performed and reveals a surprising increase of 4% in bone density, beyond least significant change:



l = 1.154, dl = 49.4
94 x 114
NECK 49 x 15
DAP: 1.5 cGy·cm²

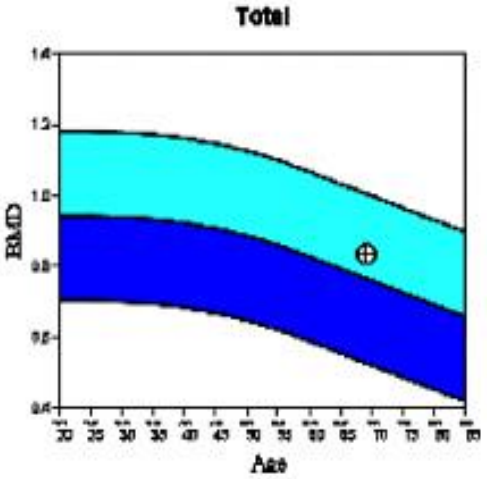
Scan Information:

Scan Date: 25 June 2013
Scan Type: f Left Hip
Analysis: 18 July 2013 07:07 Version 13.4:3
Left Hip
Operator:
Model: Discovery A
Comment:

DXA Results Summary:

Region	Area (cm²)	BMC (g)	BMD (g/cm²)	T-score	Z-score
Neck	5.39	4.11	0.763	-0.8	1.0
Total	**36.97**	**30.88**	**0.835**	**-0.9**	**0.6**

Total BMD CV 1.0%, ACF = 1.019, BCF = 1.019, TH = 1.000
WHO Classification: Normal



10-year Fracture Risk*	Without Prior Fracture	With Prior Fracture
Major Osteoporotic Fracture	7.7%	12%
Hip Fracture	0.7%	1.1%
Reported Risk Factors:		
UK, T-score (WHO) = -0.8, BMI = 24.2		

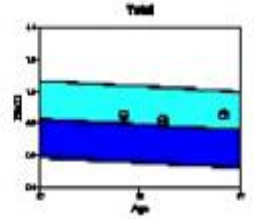
*FRAX® Version 3.8. Fracture probability calculated for an untreated patient. Fracture probability may be lower if the patient has received treatment.

Comment:

94 x 114
NECK 49 x 15
DAP: 1.7 cGy·cm²

Scan Information:

Scan Date: 25 June 2013
Scan Type: f Left Hip
Analysis: 25 June 2013 09:54 Version 13.4
Left Hip
Operator:
Model: Discovery A (S/N 82521)
Comment:



T-score w. White Female, Z-score w. White Female, Source BMDC NHANES White Female

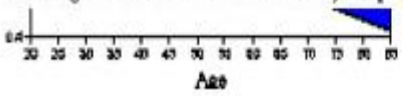
10-year Fracture Risk*	Without Prior Fracture	With Prior Fracture
Major Osteoporotic Fracture	7.2%	12%
Hip Fracture	0.5%	0.8%
Reported Risk Factors:		
UK, T-score (WHO) = -0.5, BMI = 24.2		

*FRAX® Version 3.8. Fracture probability calculated for an untreated patient. Fracture probability may be lower if the patient has received treatment.

DXA Results Summary:

Scan Date	Age	BMD (g/cm²)	T-score	BMD Change vs Baseline	BMD Change vs Previous
25.06.2013	69	0.856	-0.7	0.3%	4.0%
11.06.2010	66	0.823	-1.0	-3.5%	-3.5%
24.06.2008	64	0.853	-0.7		

*Denotes significance at 95% confidence level, site specific LSC is 0.055 g/cm²



Comment:

Questions

- Should there be a significant increase of 4% over a 2-year period in which the patient was on a ‘drug holiday’?
- What questions should we ask ourselves about this scan?
- Is there anything in the region of interest or outside the region of interest that should not be visible?
- Should we repeat the bone density?

Case Answers and Discussion

- It would be unusual to see a significant increase in this situation so it should draw our attention to look for artifact that may be increasing the bone density.
- On closer scrutiny, you can see an artifact, which turned out to be an engagement ring on the patient’s finger overlying the hip region.
- The scan was repeated, showing an insignificant change of 1.5%

1 = 1154, dB = 49.6
94 x 114
NECK 49 x 15
DAP: 1.5 cGy*cm²

Scan Information:

Scan Date: 25 June 2013
Scan Type: f Left Hip
Analysis: 18 July 2013 07:07 Version 13.4:3
Left Hip
Operator:
Model: Discovery A
Comment:

DXA Results Summary:

Region	Area (cm²)	BMC (g)	BMD (g/cm²)	T-score	Z-score
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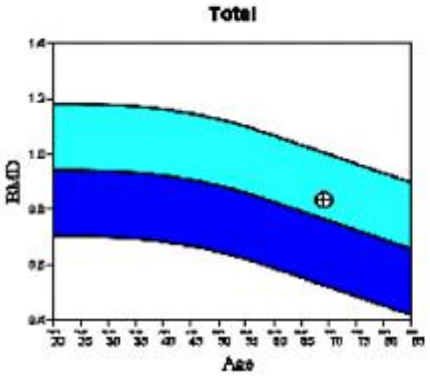
Total	**36.97**	**30.88**	**0.835**	**-0.9**	**0.6**

Total BMD CV 1.0%, ACF = 1.019, BC F = 1.019, TH = 1.000
WHO Classification: Normal

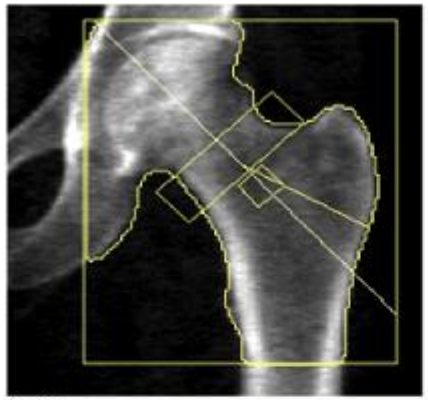


10-year Fracture Risk[1]	Without Prior Fracture	With Prior Fracture
Major Osteoporotic Fracture	7.7%	12%
Hip Fracture	0.7%	1.1%

Reported Risk Factors:
UK T-score (WHO) = -0.9, BMI = 24.2

[1] FRAX® Version 3.05. Fracture probability calculated for an untreated patient. Fracture probability may be lower if the patient has received treatment.

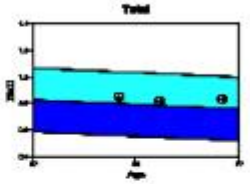
Comment:



94 x 114
NECK 49 x 15
DAP: 1.5 cGy*cm²

Scan Information:

Scan Date: 25 June 2013
Scan Type: f Left Hip
Analysis: 18 July 2013 07:07 Version 13.4
Left Hip
Operator:
Model: Discovery A
Comment:



T-score vs. White Female, Z-score vs. White Female, Source BMDC/NHANES White Female

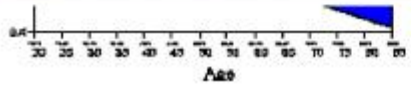
10-year Fracture Risk[1]	Without Prior Fracture	With Prior Fracture
Major Osteoporotic Fracture	7.7%	12%
Hip Fracture	0.7%	1.1%

Reported Risk Factors:
UK T-score (WHO) = -0.9, BMI = 24.2

[1] FRAX® Version 3.05. Fracture probability calculated for an untreated patient. Fracture probability may be lower if the patient has received treatment.

DXA Results Summary:

Scan Date	Age	BMD (g/cm²)	T-score	BMD Change vs Baseline	BMD Change vs Previous
25.06.2013	69	0.835	-0.9	-2.0%	1.5%
11.06.2010	66	0.823	-1.0	-3.5%	-3.5%
24.06.2008	64	0.853	-0.7		

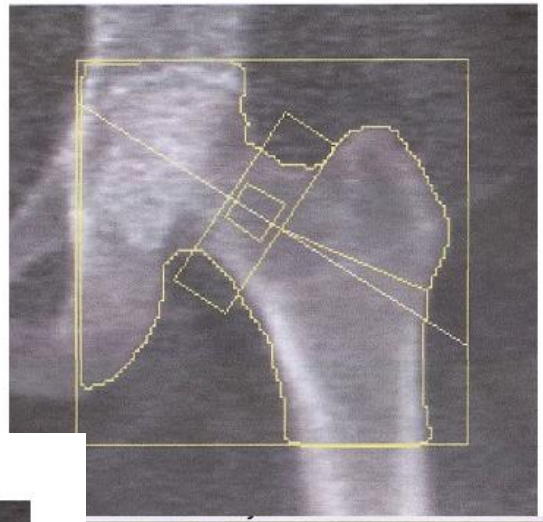


Comment:

- Artifacts within or outside the region of interest may cause unexpected increase in bone density that may lead to a false conclusion.
- Good patient positioning, hands removed from near the scan field will prevent this type of error and unnecessary repeated measurements, exposing the patient to extra radiation.
- Close scrutiny of the analysis at all times is required. Artifacts change bone density measurement and give misleading results.

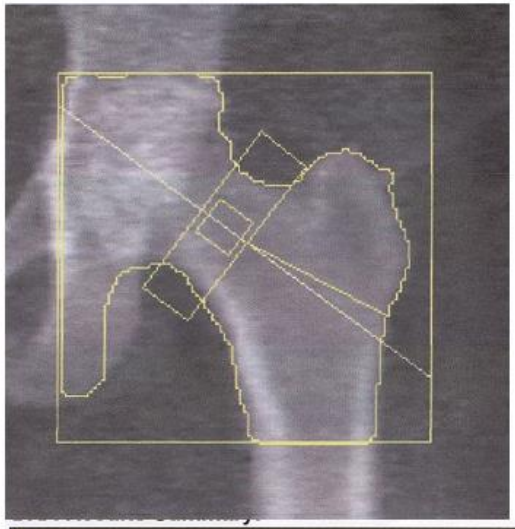
65 year old Caucasian female, 61” tall, 248 pounds, BMI = 46.85. Bone density scan for estrogen deficiency in 2007 was normal. Repeat scan in 2009 found a 21% increase in bone density at the femoral neck. Both scans were completed on the same Hologic Discovery W. Patient is taking calcium supplements and a multiple vitamin, but is not taking any other bone-active medications.

2007



Area (cm²)	BMC (g)	BMD (g/cm²)	T - score	PR (%)	Z - score	AM (%)
4.64	**3.48**	**0.750**	**-0.9**	**88**	**-0.7**	**89**
10.24	7.78	0.760	0.6	108	0.5	109
16.05	20.35	1.268	1.1	115	0.7	112
30.93	31.62	1.022	0.7	108	0.5	108

2009



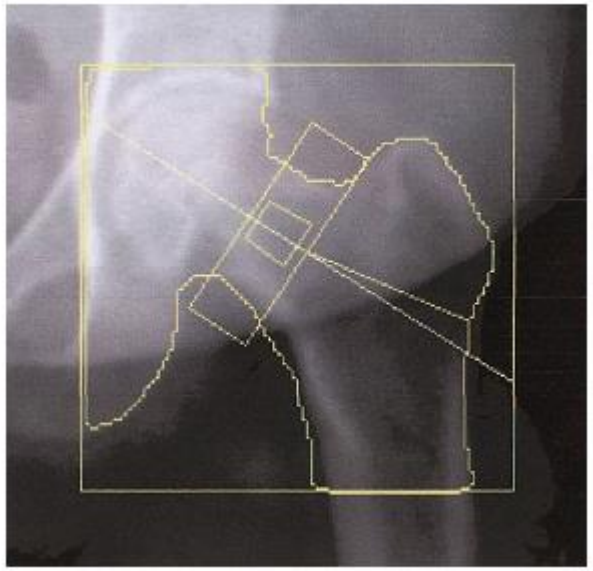
Region	Area (cm²)	BMC (g)	BMD (g/cm²)	T - score	PR (%)	Z - score	AM (%)
Neck	**4.56**	**4.14**	**0.908**	**0.5**	**107**	**0.6**	**110**
Troch	10.60	8.70	0.821	1.2	117	1.1	120
Inter	14.98	17.79	1.188	0.6	108	0.4	107
Total	30.14	30.63	1.016	0.6	108	0.5	109

The interval change between 2007 and 2009 was -0.6% (not significant) in the total hip and +21% at the femoral neck (well above the LSC at this center). What could explain this discrepancy?

Patient’s BMI was 46.85 and she had an abdominal fat pad (panniculus). The presence of a panniculus affects the measurement of bone mineral density at the hip. An article in the Journal of Clinical Densitometry documented this phenomenon: Of 127 patients with a panniculus, retracting the panniculus altered the BMD readings by values that exceeded the center’s least significant change (LSC) in 49% of men and 56% of women. The authors concluded that retraction of the fat panniculus should be routine densitometric practice. Binkley N, Krueger D, Vallarta-Ast N. An overlying fat panniculus affects femur bone mass measurement. J Clin Densitom 2003;6(3):199-204.

On a standard dual-energy view on a Hologic machine, a panniculus is difficult to see. However, images in the single-energy mode can easily visualize the presence and position of a panniculus.

2007

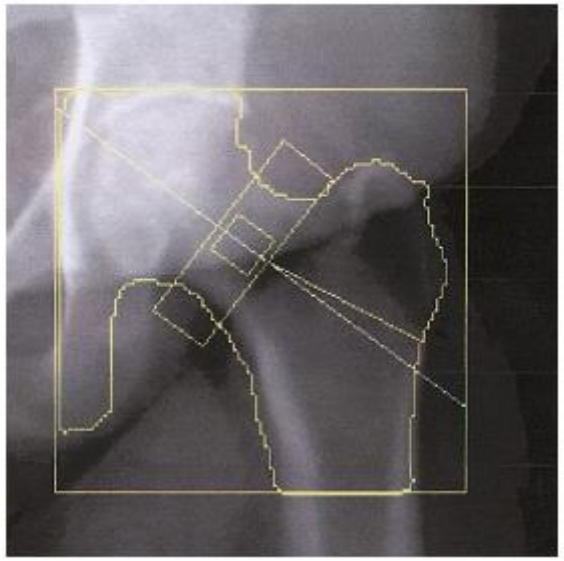


These single energy images clearly show a panniculus that is in a different location on the 2 scans which confounds the interpretation of interval change at the femoral neck.

Teaching Points:

- A significant discrepancy in interval change between 2 sites or an unexpected change in measured bone density (21% change in bone density at the femoral neck) should prompt a careful review of the scan for technical problems
- A single-energy image can better visualize soft tissue such as a panniculus
- It is important to have a convention in your standard operating procedures related to panniculus placement – i.e. a reasonable convention is to always ask the patient to retract the panniculus

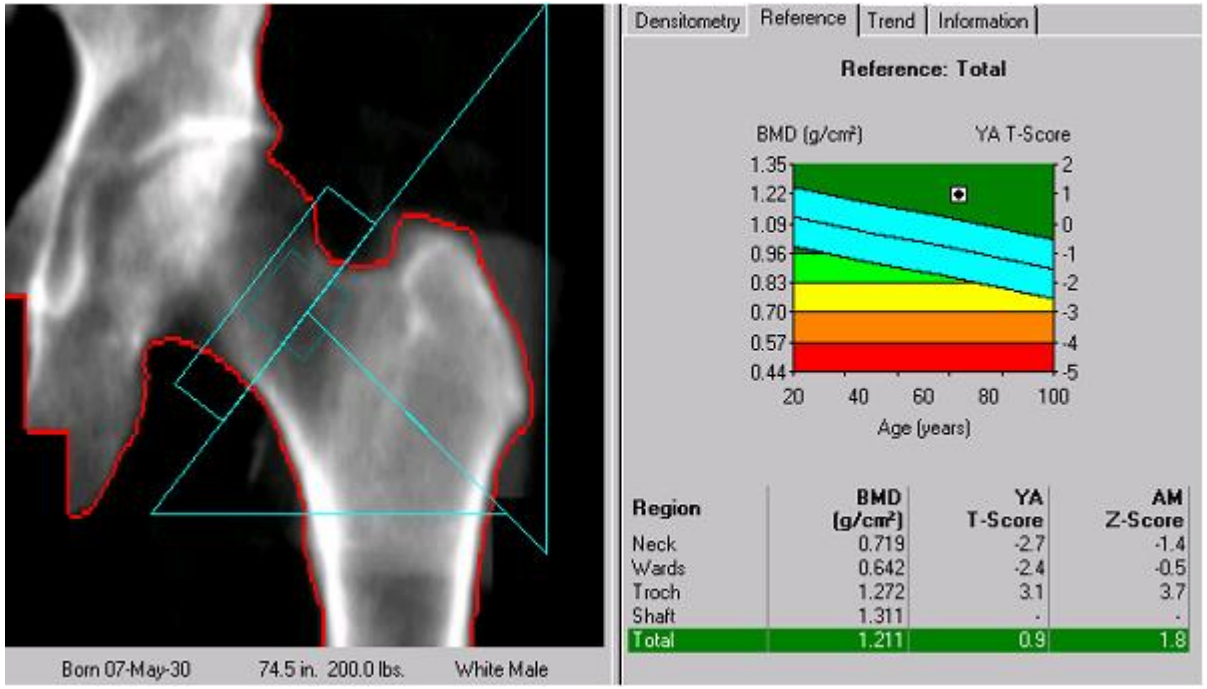
2009



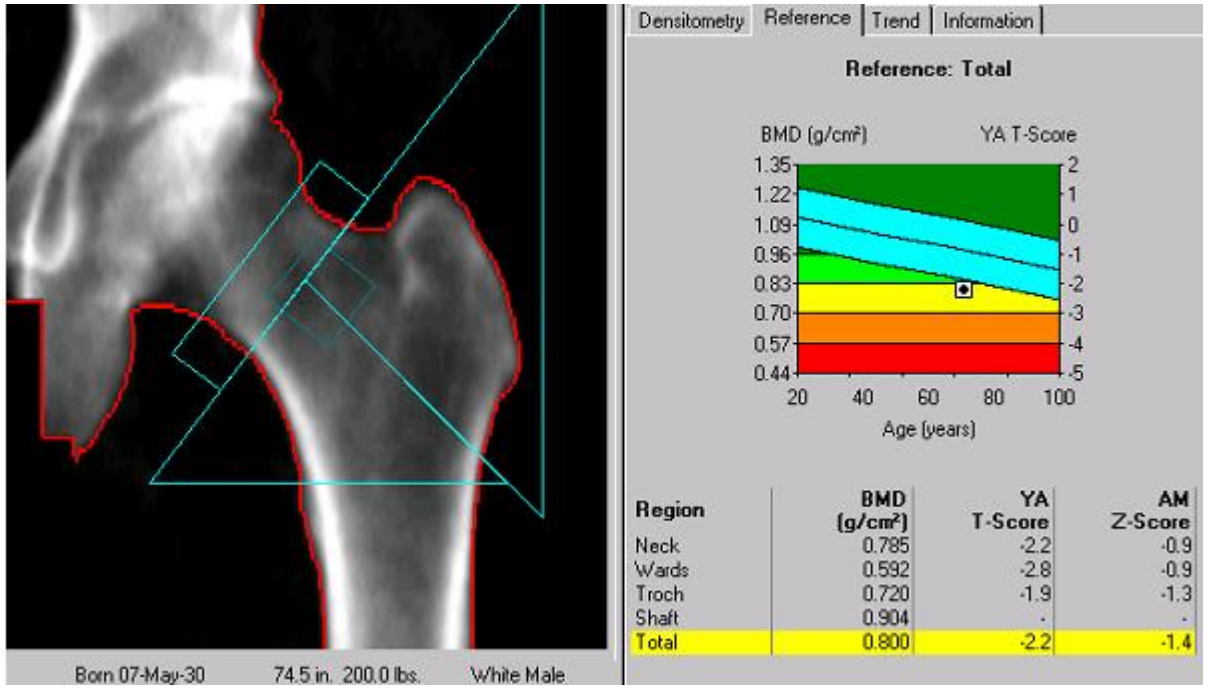
71 year old male presents for an initial DXA scan, indication = age, alcohol intake. Patient meets criteria for a DXA scan by NOF (all males ≥70), Canadian guidelines (all males ≥65), NOGG guidelines (intermediate fracture risk by FRAX without BMD). No other risk factors by medical history. Weight 200 pounds, height 74.5 inches, BMI = 25.3. Because of severe degenerative disc disease, spine was uninterpretable.

QUESTION:

- What could explain the significant discrepancy between the bone density in the femoral neck (T=-2.7) and the total hip (T=+0.9)?



Reviewing the image, there is a rectangular density that overlies the greater trochanter. This is a wallet in the patient's pocket. Note that the measurement at the greater trochanter actually shows an increased density with a T-score of +3.1. Repeat DXA with the wallet removed shows similar BMD in the femoral neck, greater trochanter and total hip:

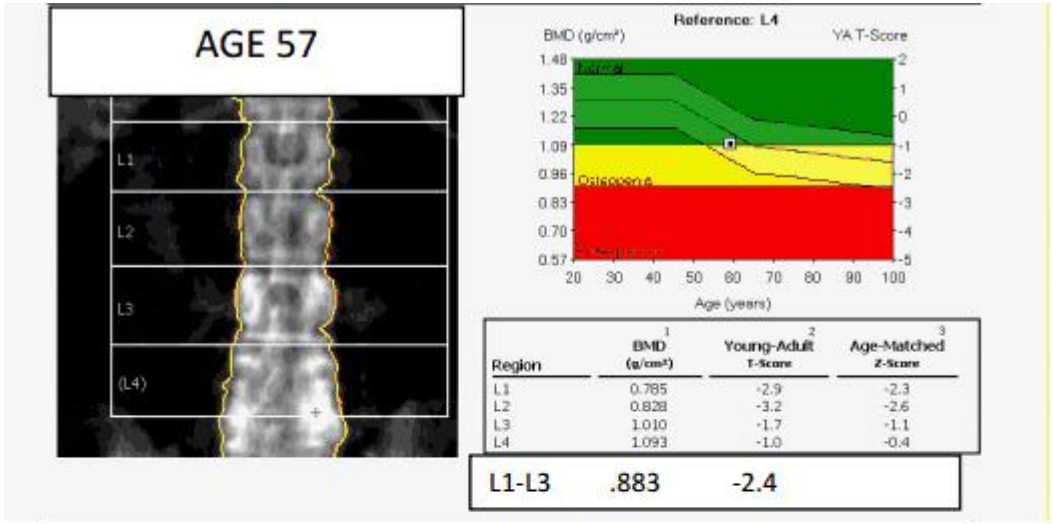


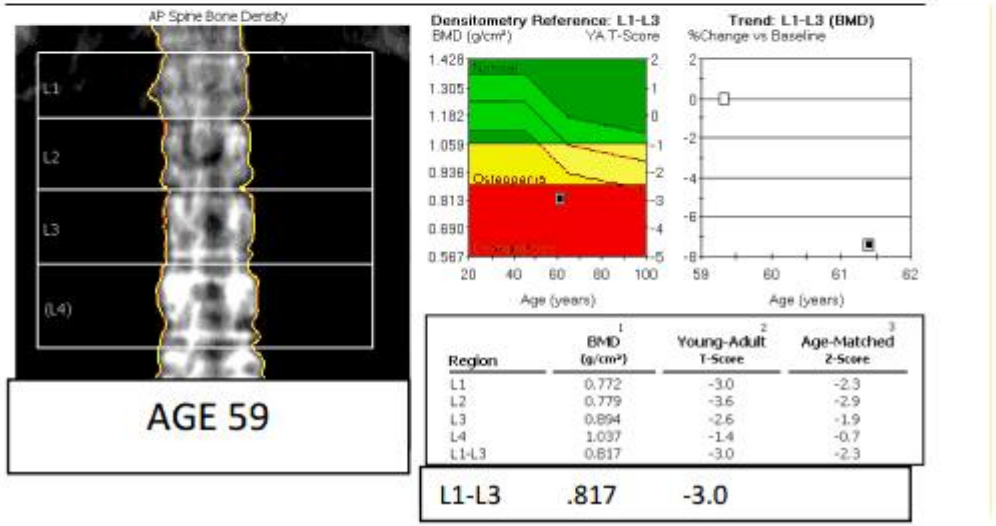
- A significant discrepancy in measured BMD at different sites should prompt a careful review of the image to detect any artifacts or other technical problems
- It is important that technologists ensure there are no external artifacts that could affect measured BMD
- Report should not include a separate diagnosis for different regions of interest (ISCD official position) – the diagnosis is always made on the basis of a T-score at the lowest valid site (spine, femoral neck, total hip or 1/3 radius). If patient had already left the DXA suite, the diagnosis of osteoporosis could be made on the basis of a T-score of -2.7 at the femoral neck.

59 year old postmenopausal Caucasian female on bisphosphonates since age 54 referred because of bone loss. Weight 183 #, Height 65 inches, unchanged. Initial repeat DXA at age 55 reported an 8% increase in BMD of the spine. At age 57, BMD was stable but DXA at age 59 reported a 7.5% loss of bone density in the spine, no change in the total hip or femoral neck.

QUESTIONS:

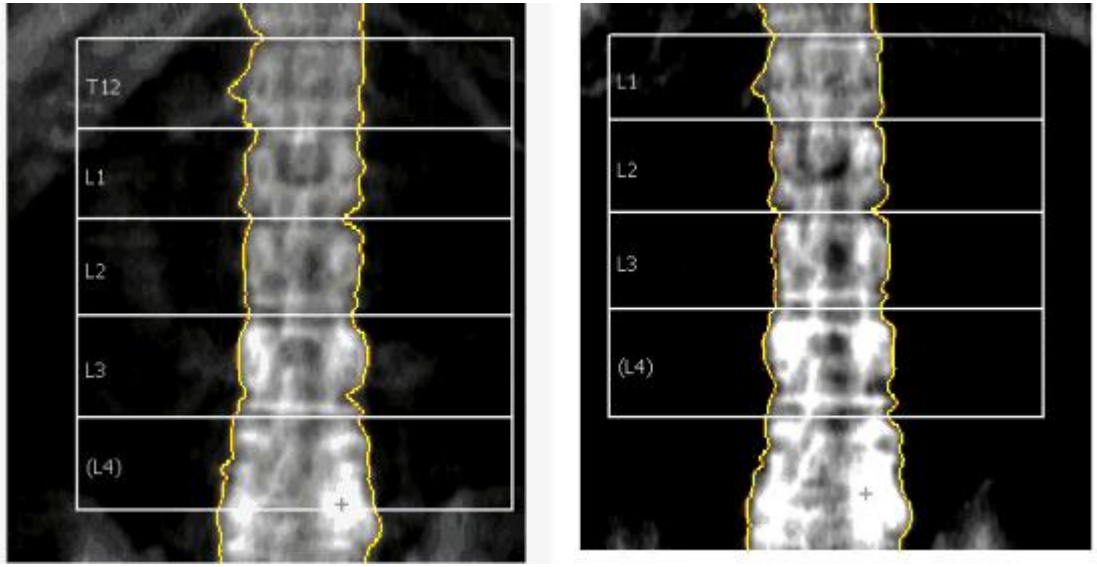
- What could explain bone loss in a patient who previously responded to medical therapy?
- Are there any technical problems with this scan?





ANSWERS:

- Bone loss in a patient on bisphosphonates should prompt re-evaluation to consider:
- Compliance?
- Secondary causes?
- Technical issues with scan?
- The regions of interest in the 2 scans are not the same. This becomes clear when the field is expanded to include T12 and L5 as seen in the images below. “L1 to L4” are incorrectly labeled in the second scan and correspond to T12 to L3 in the first scan. When the appropriate vertebrae are compared, bone density appears stable



Note that L4 was eliminated from the first scan because of degenerative changes falsely elevating BMD in this vertebra. Would also recommend eliminating L3 for the same reason (T-score difference between L2 and L3 is greater than 1 and facet sclerosis is seen).

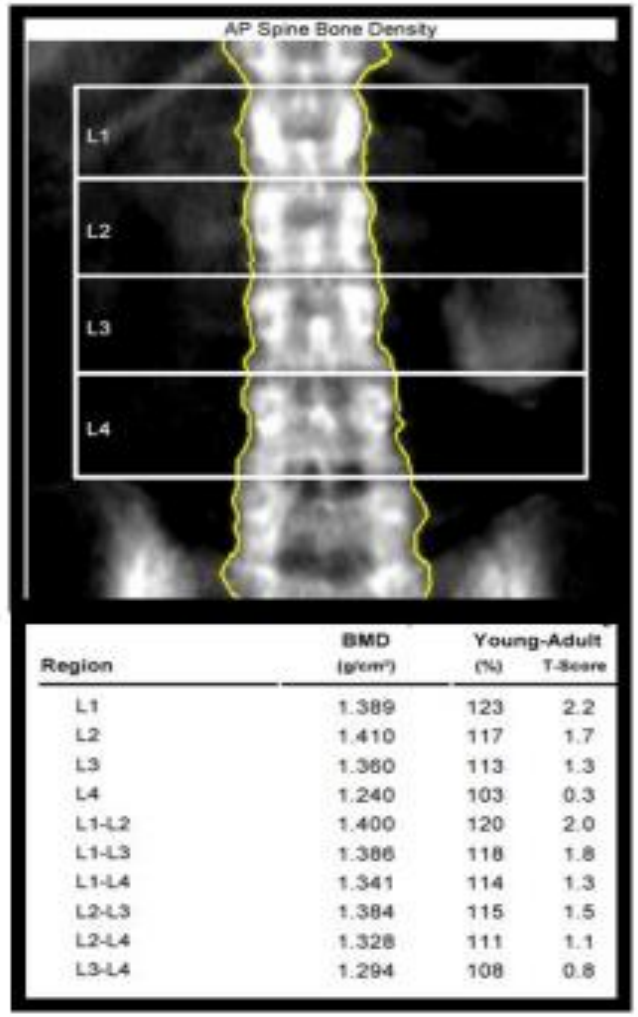
TEACHING POINTS:

- When analyzing a repeat bone density, it is critical to view the images side-by-side to ensure the same regions of interest were compared
- Scan image should include part of T12 and L5 (ISCD official position)
- Vertebral labeling can be difficult as anatomical variations are common. In one study, 16.5% of patients did not have the classic pattern of 5 lumbar vertebrae and ribs on T12 Peel JBMR 1993). Note that ribs are not visualized on T12 on the first scan. This patient may have 6 lumbar vertebra or a non-rib-bearing T12
- If this scan was completed at your center, you could easily change the ROI's if all vertebrae are adequately visualized. If this patient was referred from another center, your only recourse is to compare the appropriate vertebra individually. However, need to remember that this significantly decreases precision
- Although noncompliance and secondary causes can cause bone loss in a patient on therapy, the first task of a densitometrist is to look for technical errors

Sixty-nine year old post natural menopause black female, without personal or family history of prior fractures. She is hypothyroid currently on replacement with normal TSH, and a history of lung cancer in remission for +10 yrs. The patient was properly gowned and gave no history of abdominal surgery or recent contrast studies, that could explain the present of this dense mass in the left lower quadrant. Addition imaging if clinically indicated was suggested in the final DXA report, but the findings or a definite etiology of this mass were not available at the date of this submission.

Questions:

- Would you accept the current analysis of this lumbar spine scan?
- Was the calcified mass in the left lower quadrant adjacent to L3 properly identified by the software and excluded from the soft tissue baseline calculations? How can you tell?

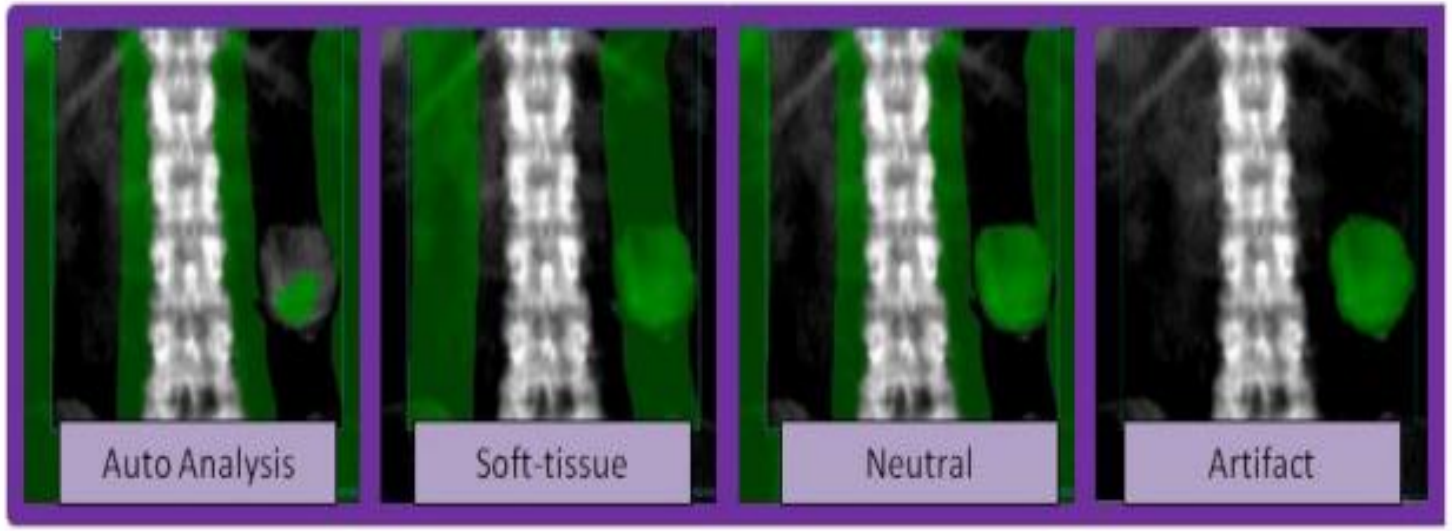


Region	BMD (g/cm²)	Young-Adult (%)	T-Score
L1	1.389	123	2.2
L2	1.410	117	1.7
L3	1.360	113	1.3
L4	1.240	103	0.3
L1-L2	1.400	120	2.0
L1-L3	1.386	118	1.8
L1-L4	1.341	114	1.3
L2-L3	1.384	115	1.5
L2-L4	1.328	111	1.1
L3-L4	1.294	108	0.8

Discussion:

They examined the software tools available to Hologic scan operators to examine whether soft-tissue artifacts are identified and excluded from the soft-tissue baseline calculations.

The scan was acquired on a GE-Lunar Prodigy running enCORE v13.1 software using the thick patient scan mode. Under the “Points” menu, (inset on left) the operator can inspect and modify more than just bone points and their exclusion. The four images on the next slide show, the autoanalysis default with partial recognition of the artifact on the left, and left to right the three methods of correction, namely manually tissue-typing the artifact as soft-tissue neutral, or artifact respectively.



A common concept is that incorrect identification of densities in the soft-tissue will affect only the BMD values of the adjacent vertebra and not those above or below. The table below shows the individual BMD values for each approach to handle the artifact, as well as the L1-L4 totals. No manual adjustment was made to the positioning of the intervertebral markers or bone tissue points selected by the software during each analysis.

Region	Auto-analysis (g/cm^2)	Soft tissue (g/cm^2)	Neutral (g/cm^2)	Artifact (g/cm^2)
L1	1.348	1.336	1.386	1.389
L2	1.404	1.388	1.403	1.410
L3	1.286	1.288	1.350	1.360
L4	1.177	1.172	1.233	1.240
L1-L4	1.294	1.285	1.334	1.341
L1-L2	1.378	1.363	1.395	1.400
L3-L4	1.226	1.224	1.286	1.294

Teaching Points:

1) GE-Lunar tissue-typing during auto-analysis may not always completely identify soft-tissue artifacts. However, it is up to the technologist who is analyzing the scans to verify typing is correct, or to adjust the point typing as required. The interpreting physician is only presented with the bone edges and must rely on the skill of the technologist that this step was completed correctly.

2) From the table, it appears that incorrect classification of this particular soft-tissue artifact as soft-tissue, rather than “neutral” or “artifact” affects all the vertebral levels, not just those adjacent, which is contrary to what conventional thinking would expect.* Using “neutral” or “artifact” results in increases in BMD at all vertebral levels compared to auto-analysis or soft-tissue typing. Excluding the vertebral levels without correcting the point typing does not eliminate the effect at the remaining levels.

3) Whichever method the technologist employs, it would be helpful to document this and also helpful for the interpreting physician to include a comment on the artifact and how it was point-typed for the analysis to be included in the technical comment section of the report. This allows others the ability to reproduce the same type of correction should the patient return for a follow-up study and the same or another GE-Lunar scanner and the artifact is still present. If it is no longer present, then comparisons for rate of change may be affected to a greater extent if no correction or incorrect point-typing, than if these points were removed from the soft-tissue baseline calculations as neutral or artifact.

A 66-year-old white female with with language difficulties presents for a bone density test. History was limited and provided by caregiver with notes that suggest a history of Paget's disease and a recently elevated alkaline phosphatase level. She also has a history of a prior wrist fracture from a simple fall requiring open reduction and internal fixation.

She was referred by a orthopedic surgeon who was evaluating complaints of increasing pain in her hips bilaterally. Hip radiographs suggested severe degenerative arthritis bilaterally as well as evidence of diffuse Paget's disease. She has never been treated for Paget's disease in the

A review of prior medical records found the results of a nuclear medicine bone scan prior. Positive uptake was noted in the area of the recent fracture with evidence of hardware, with no other abnormal foci of increased uptake noted throughout the skeletal system.

Due to limited ability to internally rotate the right femur for DEXA scanning, the left hip, non-fractured dominant forearm were performed, and the results are shown along with pelvis radiograph.

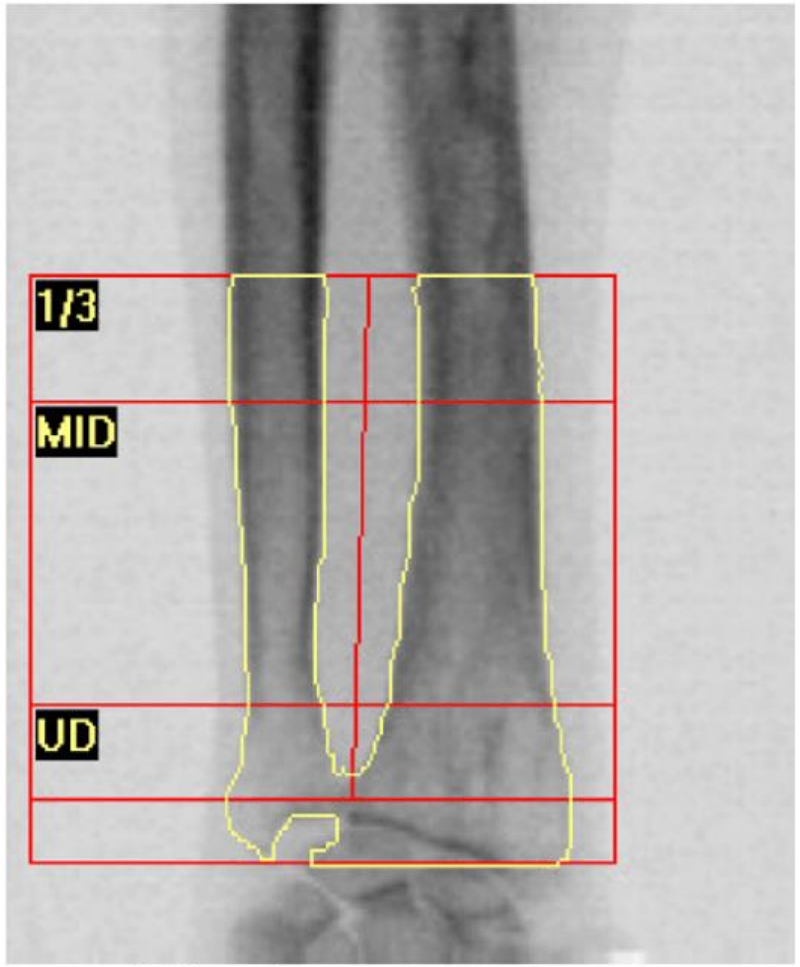


Image not for diagnostic use
k = 1.226, d0 = 71.6
186 x 94. Forearm Length: 25.0 cm

DXA Results Summary:

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

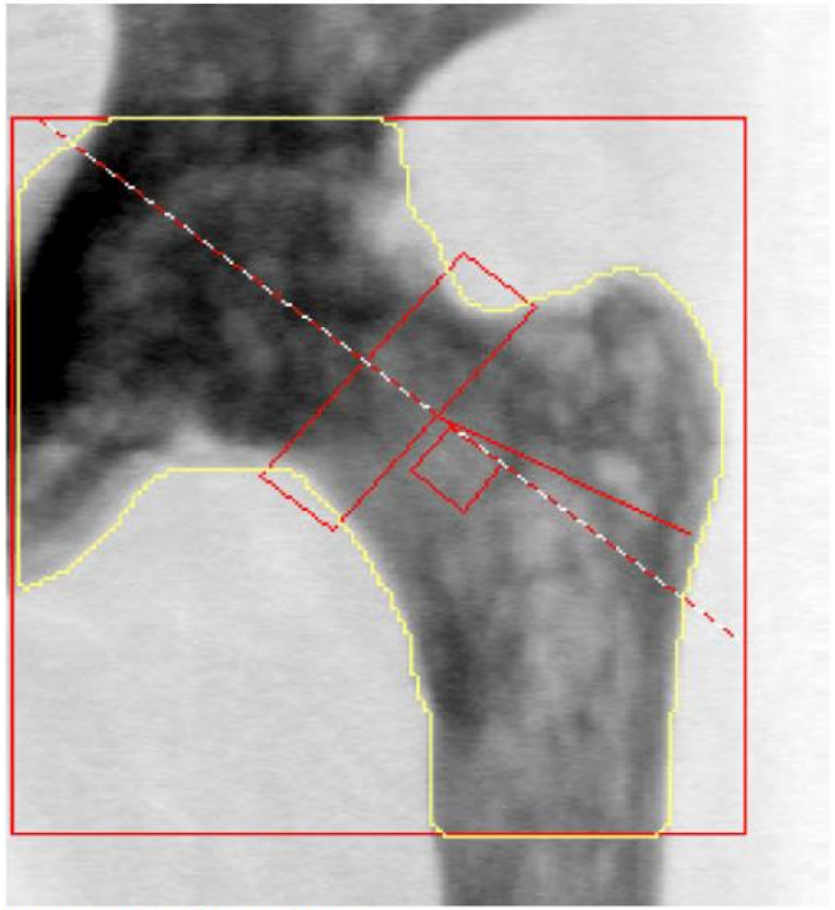


Image not for diagnostic use
k = 1.142, d0 = 50.9
113 x 120
NECK: 49 x 15

DXA Results Summary:

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**

Total BMD CV 1.0%, ACF = 1.019, BCF = 0.990, TH = 6.067

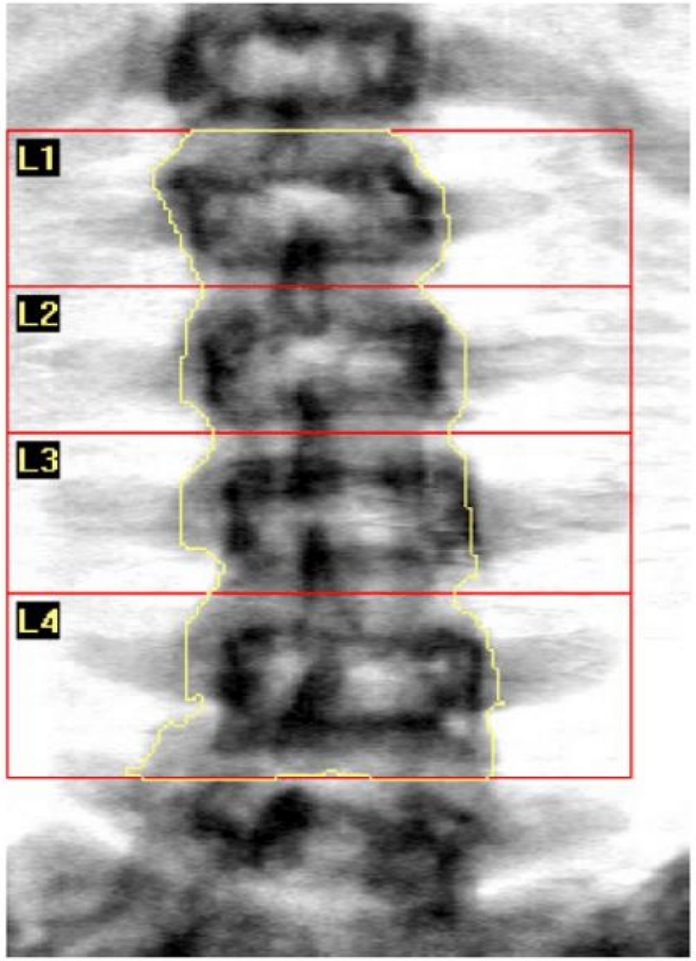
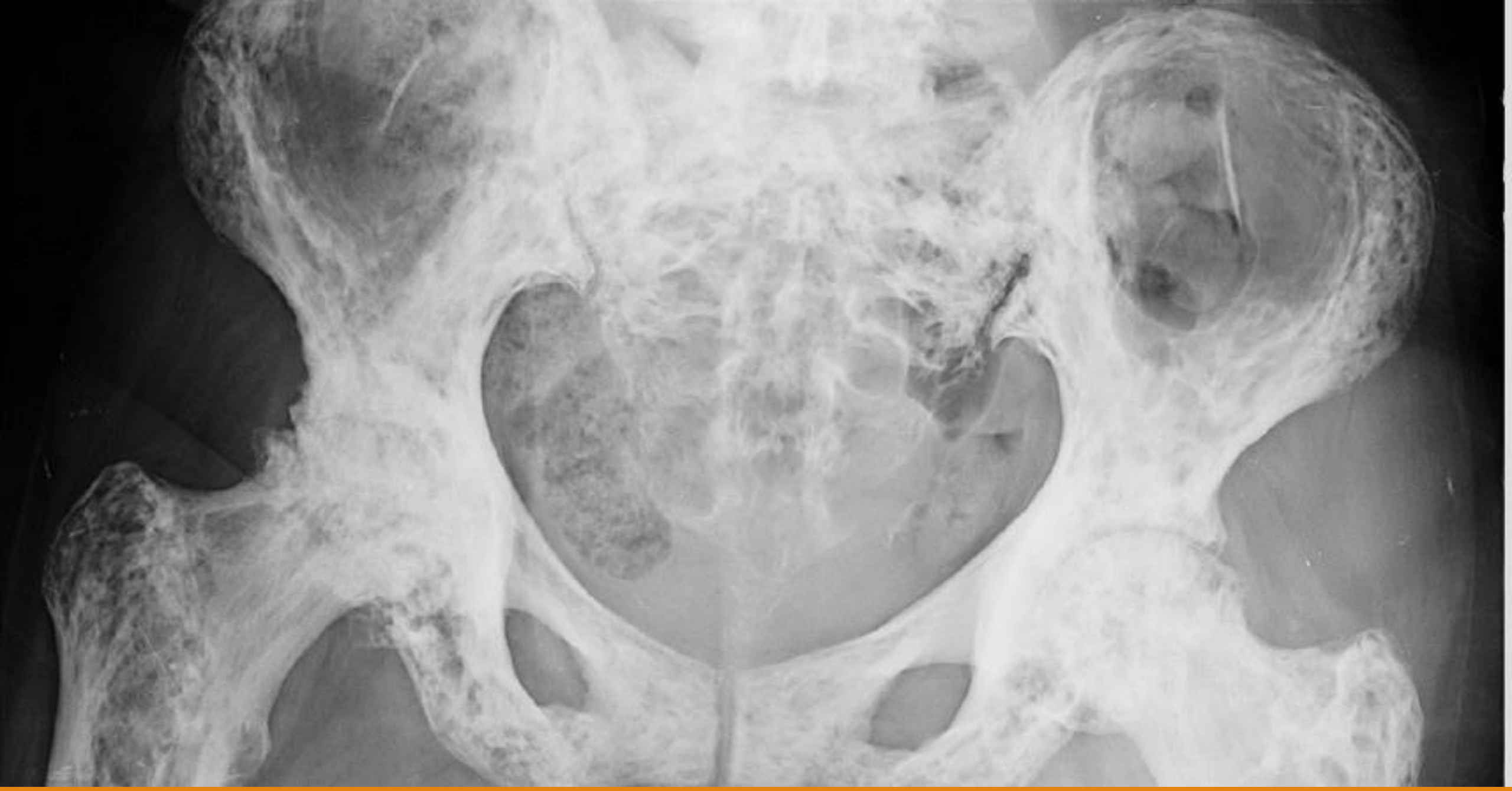


Image not for diagnostic use
k = 1.143, d0 = 46.3
116 x 138

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**

Total BMD CV 1.0%, ACF = 1.019, BCF = 0.990, TH = 6.755
WHO Classification: Normal



Answer and Findings

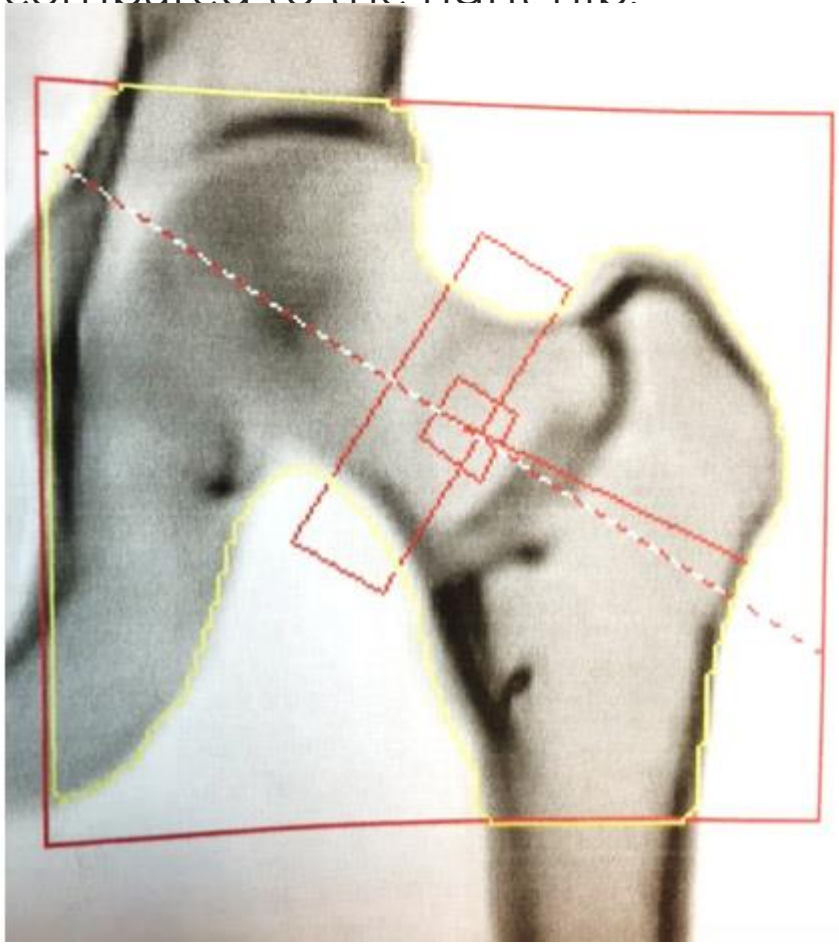
A core needle bone biopsy of the pelvis was performed.
Hematopathology report of bone marrow revealed no evidence for metastatic cancer, plasma cell dysplasia or features suggestive of Paget's disease.

The bone sample revealed sclerotic bone within the bone marrow suggestive of osteopoikilosis.
Osteopoikilosis is a form of bone disease that is characterized by multiple widespread sclerotic lesions histologically described as similar to bone islands. The disease could be sporadic or genetic with autosomal dominance. The condition is usually asymptomatic and may be seen at any age in either sex.

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

Patient History:

An 85-year-old woman with mild hip pain – long standing – for routine DXA. Discordance changes noted at the hips, with increased BMD at the left hip (Figure 1) compared to the right hip.



Bone Density: Exam date 04/11/2016

Region	BMD (g/cm^2)	T-score	Z-score
AP Spine(L1, L2)	0.867	-1.0	1.7
Femoral Neck(Left)	0.709	-1.3	1.3
Total Hip(Left)	0.899	-0.3	2.0
Femoral Neck(Right)	0.598	-2.3	0.3
Total Hip(Right)	0.706	-1.9	0.4
Total Hip Mean	0.803	-1.1	1.2

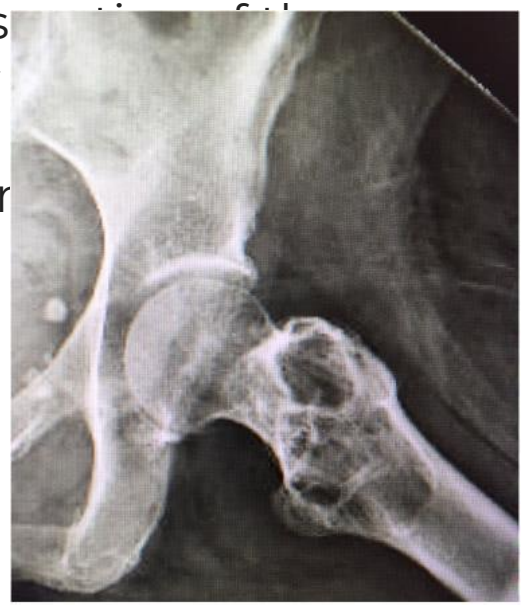
DXA scan results. Degenerative changes at the spine limited assessment to only the upper two vertebral bodies.

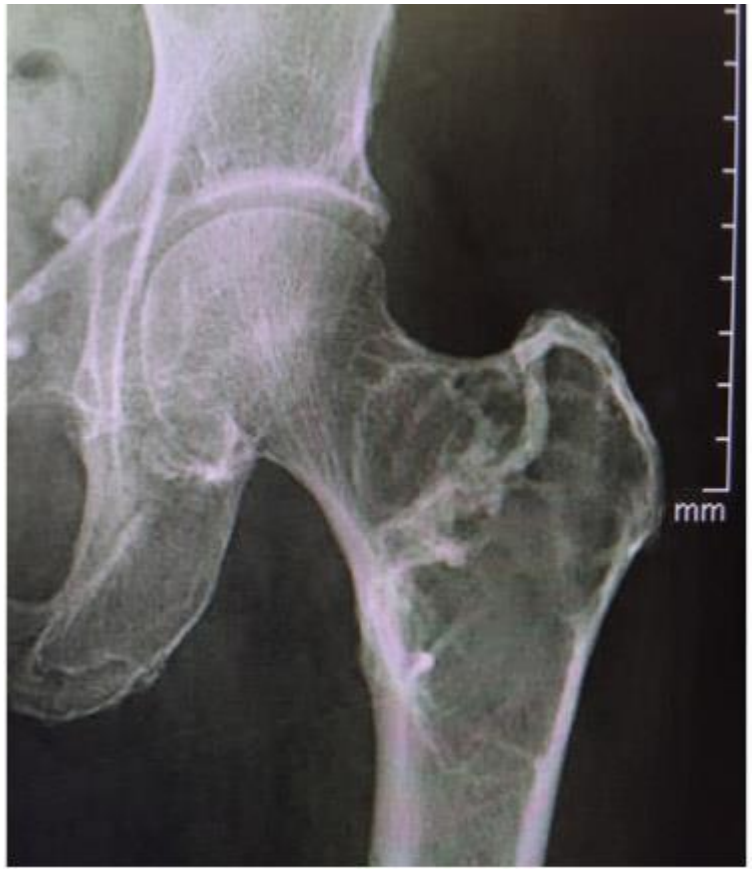
Answer

1.There is a curvilinear area of increased density at the base of the femoral neck. The patient is properly positioned, and ROI placement is appropriate.

2.Images by DXA are not of sufficient resolution to identify or differentiate disease processes. Sometimes, visual comparisons to previous studies can often help identify that morphologic changes have occurred and are a sufficient reason to recommend higher order diagnostic testing. Plain radiographs were ordered to assess the atypical DXA image (Supporting images below)

From the radiologic standpoint, the differential diagnosis for this well-defined lucent lesion with sclerotic margins, lacing mineralized matrix located in the neck, intertrochanteric and subtrochanteric region of this left femur includes intra-osseous lipoma, fibrous dysplasia, and liposclerosing myxofibrous tumor (LSMFT). Plain films and additional work-up led to a final diagnosis of LSMFT. This type lesion appears to be confined to the intertrochanteric region of the hip, and the lesion tends to be well-defined with a sclerotic rim, with little or no dis
endosteal bone contours. Many
underlying fibrous dysplasia on
be that LSMFT is a variant of fibr





Key Teaching Point:

1.While DXA is not typically able to make a differential diagnosis, the disclaimer “Image not for diagnostic use” is not meant to discard the image. To borrow a phrase from another unrelated but similarly serious issue, “If you see something, say something” is good advice for physicians who interpret bone densitometry exams.

2.Unexplained discordance in BMD values warrant more careful visual examination of the underlying images from which they were calculated. Once technical errors in acquisition (external artifacts, scan mode, anatomic positioning) and analysis (incorrect bone mapping, regions of interest size and placement) have been excluded, and external causes such as relative disuse have been considered, higher order imaging should be considered appropriate, if not already done.

3.Reference database derived values (i.e. T-scores or Z-scores, FRAX) assume the underlying anatomy from which they are calculated is normal. In this case, left hip results or any mean values from bilateral hip measurements should not be used for diagnosis or fracture risk assessment.