## CLINICAL PRESENTATION AND RADIOLOGY QUIZ QUESTION

A 44 year man old presents with acute pain in the back after opening a garage door. The patient states that the pain came on suddenly and was accompanied by a popping sensation. The pain was so severe that it caused him to fall to the floor and pass out. He has some numbness in the ball of his right foot. He can ambulate. He has no pain in his genitals or abdomen. A plain film of the lumbar spine was obtained:

Which of the following imaging studies would be *least* helpful in further evaluation of this patient?
   (a) magnetic resonance (MR) imaging of the spine
   (b) computed tomography (CT) of the spine
   (c) dual energy X-ray absorptiometry (DXA) study of the spine and hip
   (d) quantitative ultrasound (US) of the calcaneus

RADIOLOGY QUIZ QUESTION, ANSWER, AND EXPLANATION
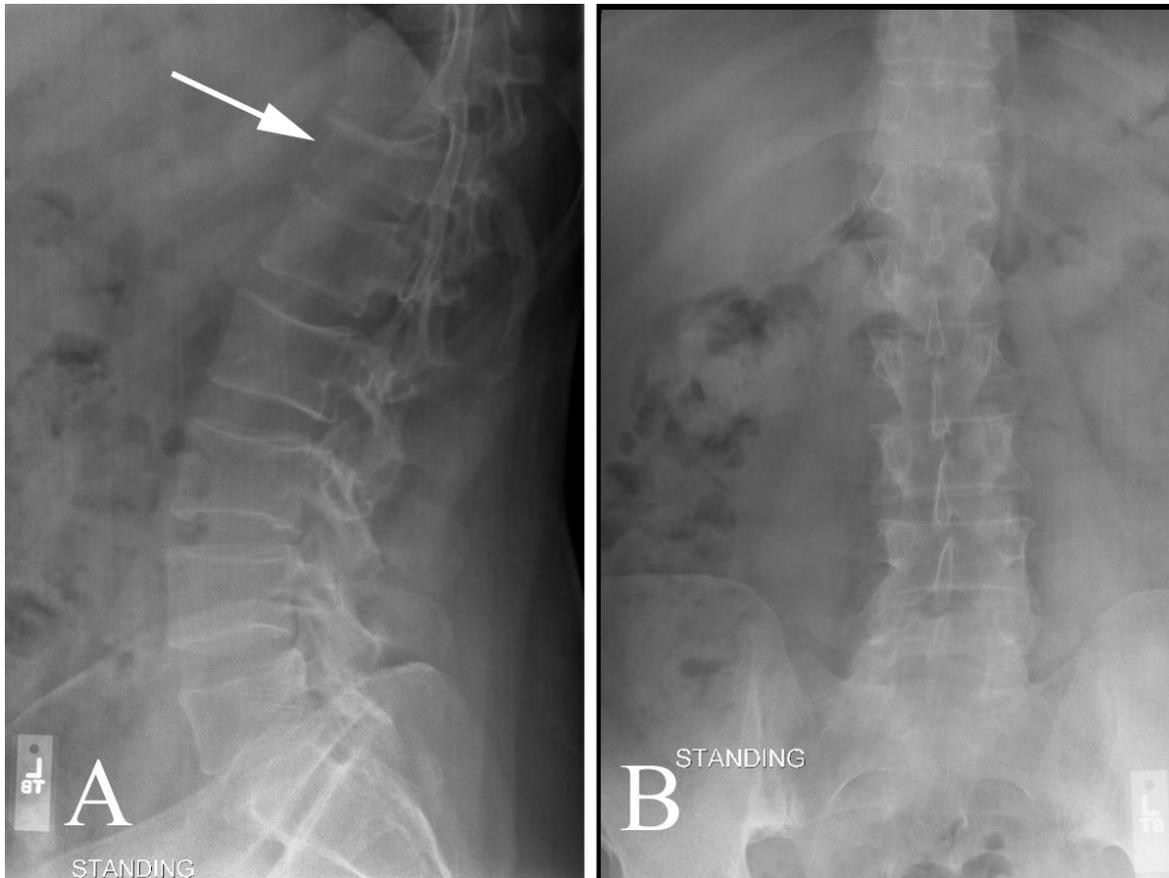
For history and the question, see Page 1.

A plain film of the lumbar spine demonstrates a T12 compression deformity compatible with a compression fracture. Without old films for comparison, it is not possible to determine whether this is an acute or chronic finding. The spine also appears somewhat demineralized. In the setting of a relatively young man who has sustained an apparent acute fracture with minimal trauma, underlying bone pathology including tumor and osteopenia or osteoporosis should be considered. Either MR (a) or CT (B) could be used to further characterize the fracture. MR is better at distinguishing acute from chronic fractures and demonstrating abnormal marrow. DXA (c) would be useful since it is the standard technique for evaluating bone mineral density. Quantitative US (d) of the calcaneus is used to evaluate bone mineral density, but it is *not* the recognized standard and lacks the sensitivity of DXA. Since quantitative US would be *least* helpful in further evaluation, (d) is the correct answer.

IMAGING STUDY AND QUESTIONS

The patient underwent a lumbar MR study which demonstrated findings of a single level acute post-traumatic fracture with features to suggest underlying malignancy. The patient underwent an additional study:
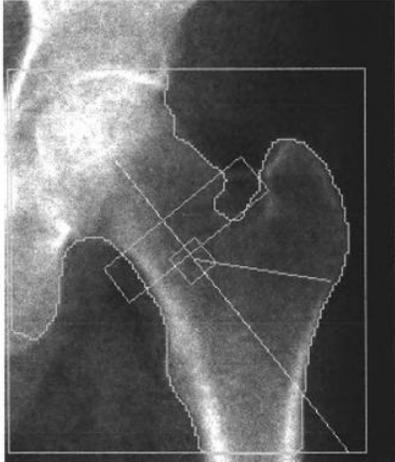

Scan Information:

Scan Date: February 23, 2010   ID: A0223100R
Scan Type: f Left Hip
Analysis: February 23, 2010 11:44 Version 11.2.1
          Left Hip
Operator: JL
Model: Delphi W (S/N 70002)
Comment:

DXA Results Summary:

Region	Area (cm²)	BMC (g)	BMD (g/cm²)	T-Score	Z-Score
Neck	5.66	2.79	0.494	-3.2	-2.6
Troch	12.30	5.44	0.442	-2.7	-2.4
Inter	28.38	23.85	0.840	-2.0	-1.8
Total	**46.35**	**32.08**	**0.692**	**-2.3**	**-2.0**
Ward's	1.29	0.50	0.384	-2.8	-1.9

Total BMD CV 1.0%

Image not for diagnostic use
116 x 125

Imaging questions:
1) What type of study is shown?
2) Are there any abnormalities?
3) What is the most likely diagnosis?
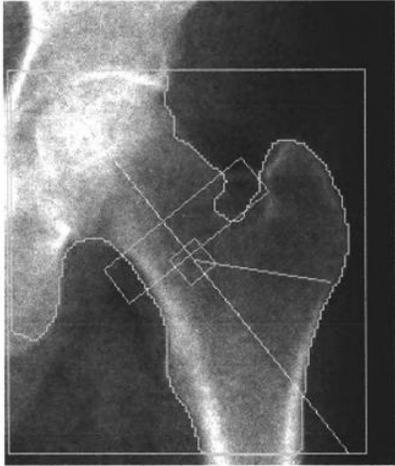4) What is the next step in management?

IMAGING STUDY QUESTIONS AND ANSWER

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Imaging questions:

1) What type of study is shown? A dual-energy X-ray absorptiometry (DXA) bone mineral density study.

2) Are there any abnormalities? Yes. The patient's bone mineral density in the femoral neck is greater than 2.5 standard deviations below the peak bone mineral density for a young, healthy adult male. Measurement of the lumbar spine was also performed (not shown) and demonstrated similar results.

3) What is the most likely diagnosis? The patient has, by definition, osteoporosis (bone mineral density more than 2.5 standard deviations below the mean for a same-sex healthy adult). Primary or involutional osteoporosis may be either postmenopausal or senile, and clearly the patient is neither. Therefore, he has secondary osteoporosis, the cause of which will need to be determined.

4) What is the next step in management? History, physical examination, and laboratory testing directed toward discovering the cause of the patient's secondary osteoporosis.

PATIENT DISPOSITION, DIAGNOSIS, AND FOLLOW-UP

Review of the patient's chart disclosed several admissions related to alcohol and alcohol withdrawal. He was in recovery at the time of the fracture.

As noted above, osteoporosis may be either primary or secondary. Primary osteoporosis (also known as involutional osteoporosis) follows cumulative bone loss from loss of sex hormones (Type I or postmenopausal osteoporosis) or aging (Type II or senile osteoporosis). There are multiple causes of secondary osteoporosis, the most common being treatment with glucocorticoid medication, alcoholism, hypercalciuria, and hypogonadism. Patients with GI disorders associated with malabsorption (e.g., celiac disease) and chronic liver or kidney disease may also have secondary osteoporosis.

SUMMARY

Presenting symptoms: The patient had the acute onset of back pain following trivial trauma.

Imaging work-up: The initial study of choice is usually plain film examination because of its relative availability and cost. MR is typically performed next in patients with severe back pain. In this case where there appears to be demineralization on the plain film exam and the MR demonstrated a single level post-traumatic fracture with no evidence of malignancy, DXA is appropriate to evaluate bone mineral density.

Establishing the diagnosis: Osteoporosis is defined as having bone mineral density of greater than 2.5 standard deviations below the mean peak bone mineral density in a young, healthy adult. Osteopenia is defined as more than 1 but less than 2.5 standard deviations below the mean peak bone mineral density in a young, healthy adult.

Take-home message: In patients with a fracture following trivial trauma, imaging should first be directed at discovery and characterization of fractures. In patients with no underlying tumor, a DXA study is indicated to evaluate bone mineral density.

FURTHER READING

Guglielmi G, Muscarella S, Bazzocchi A. Integrated imaging approach to osteoporosis: state-of-the-art review and update. RadioGraphics 2011;31:1343-1364.

Lewiecki EM. Overview of dual-energy X-ray absorptiometry. UpToDate, accessed 11/9/09.

Renfrew DL. Polyarthritis, musculoskeletal masses, and osteoporosis. Chapter 13 in *Symptom Based Radiology*, Symptom Based Radiology Publishing, Sturgeon Bay, WI, 2010, available for no charge at www.symptombasedradiology.com.