Question 61

A 64-year-old woman undergoes a dual-energy X-ray absorptiometry scan. The report is shown below.

According to the World Health Organisation (WHO) definitions, the patient’s lumbar spine bone density is:
A. High normal
B. normal
C. osteopenic
D. osteoporotic
E. severely osteoporotic

BONE QUALITY — Bone strength is determined by bone mineral density (BMD) and other properties of bone that are often collectively called "bone quality" [6]. Non-BMD determinants of bone strength include bone turnover, architecture (size and shape, or bone geometry), microarchitecture (eg, trabecular thickness, trabecular connectivity, trabecular perforation, cortical thickness, and cortical porosity), damage accumulation,
matrix properties, mineralization, and mineral properties (eg, crystal size and orientation). 1994 World Health Organization Definitions of Osteoporosis Based on Bone Density Levels

**Normal.**
Bone Density is within 1 SD (+1 or -1) of the young adult mean.

**Low Bone Mass.**
Bone density is 1 to 2.5 SD below the young adult mean (-1 to -2.5 SD).

**Osteoporosis.**
Bone density is 2.5 SD or more below the young adult mean (> -2.5 SD).

**Severe (established) osteoporosis.**
Bone density is more than 2.5 SD below the young adult mean and there has been one or more osteoporotic fractures.

BMD testing is a widely available clinical tool to diagnose osteoporosis, predict fracture risk, and monitor response to therapy. While BMD testing at any skeletal site with a variety of technologies can predict fracture risk, dual-energy X-ray absorptiometry (DXA) of the spine, hip and forearm is the only method for diagnosis of osteoporosis and monitoring changes in BMD over time.

**DXA TECHNOLOGY** — A typical DXA instrument consists of a padded table on which the patient lies and a movable C-arm with an X-ray tube below the patient and a detector above the patient (show figure 1). The X-ray tube generates photon beams of two different energy levels, thus the term "dual-energy." A collimator below the table limits the scatter of the photons and directs them toward the area of interest. The difference in attenuation (reduction in intensity) of the two photon beams as they pass through body tissue of variable composition distinguishes bone from soft tissue and allows quantification of BMD. Denser and thicker tissue contains more electrons and allows fewer photons to pass through to the detector. A computer with specially designed proprietary software designed by each manufacturer completes the DXA "system."

Radiation exposure to the patient is very small, usually of a similar magnitude to daily background radiation. Radiation scatter beyond the edge of the DXA table is negligible. No shielding of the technologist or the room is necessary. As a safety precaution, the technologist should not sit within three feet of the table edge while the patient is being scanned.

DXA measures bone mineral content (BMC, in grams) and bone area (BA, in square centimeters), then calculates "areal" BMD in g/cm² by dividing BMC by BA. T-score, the value used for diagnosis of osteoporosis, is calculated by subtracting the mean BMD of a young-adult reference population from the patient's BMD and dividing by the standard deviation (SD) of young-adult population. Z-score, used to compare the patient's BMD to a population of peers, is calculated by subtracting the mean BMD of an age-, ethnicity-, and sex-matched reference population from the patient's BMD and dividing by the SD of the reference population. The mean BMD and SD of the reference populations used for these calculations is a critical variable in the determination of T-scores and Z-scores.

**International Society for Clinical Densitometry indications for bone density testing**

- Women aged 65 years and older.
- Postmenopausal women under age 65 years with risk factors for osteoporosis.
- Men aged 70 years and older.
- Adults with fragility fracture.
- Adults with a disease or condition associated with low bone mass or bone loss.
- Adults taking medication associated with low bone mass or bone loss.
- Anyone being considered for pharmacological osteoporosis therapy.
- Anyone being treated for low bone mass to monitor treatment effect.
- Anyone not receiving therapy in whom evidence of bone loss would lead to treatment.
- Women discontinuing estrogen should be considered for bone density testing according to the indications listed above.
Year 2003 Paper one: Questions supplied by Tricia


Contraindicated in pregnancy

**Question**
This lady’s T score – the score used for the diagnosis of osteoporosis in her lumbar spine ranges from -2.70 to -3.42
As we have not been told about any osteoporotic fractures the answer is D – osteoporosis – although I thought E initially