Bone Mineral Densitometry Reporting and the CAR Technical Standards: Tips for the Radiologist

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Central dual X-ray absorptiometry (DXA) of the lumbar spine and hips is the dominant method of measuring bone mineral density (BMD) and has 3 major objectives: diagnosing osteoporosis, estimating fracture risk, and monitoring BMD changes over time.1 Audits have shown that reporting physicians may err in their interpretation of these categories.2,3 The aim of this article is to assist Canadian radiologists in applying the 2013 Canadian Association of Radiologists (CAR) Technical Standards for Bone Mineral Densitometry Reporting on adult patients.4 The important topic of pediatric BMD is beyond the scope of this article.

We recommend strongly that reporting physicians, who play a key role in supporting quality assurance in the BMD facility, familiarize themselves thoroughly with these comprehensive CAR standards. We cannot overemphasize the importance of working with highly trained BMD technologists and utilizing the invaluable services of a medical physicist to oversee quality assurance and precision at the testing facility. It is essential that facilities providing DXA select the correct reference databases in their scanning software, as outlined in the CAR standards.

Diagnostic Category: The World Health Organization classification is used in adults 50 years of age or over to assign one of 3 possible diagnostic categories. This is determined from the lowest T-score for the lumbar spine, femoral neck, or total hip. For younger adults, there are only 2 possible diagnostic categories, and these are determined from the lowest Z-score of the same 3 anatomic locations.

a) Age 50 years or older: (i) T-score ≥ −1.0 = normal, (ii) T-score between −1.0 and −2.5 = low bone mass, (iii) T-score ≤ −2.5 = osteoporosis.
b) Under age 50: (i) Z-score > −2.0 = within expected range for age, (ii) Z-score ≤ −2.0 = below expected range for age.

Estimation of 10-Year Fracture Risk: This is a key piece of information for the referring physician, as it provides important guidance as to management. The CAR standards employ the CAROC fracture risk tool,6 which we believe to be the most practical tool for Canadian radiologists.7 The CAROC tool, which has the approval of Osteoporosis Canada, uses sex, age, and femoral neck T-score, along with 2 clinical risk modifiers (prior fragility fracture and prolonged recent corticosteroid therapy) to estimate 10-year fracture risk for major osteoporotic fracture. Patients are assigned to one of 3 risk categories: low risk (<10%), moderate risk (10%-20%), or high risk (> 20%). It has been shown that patients with high estimated risk for future osteoporotic fracture risk should be offered bone-active therapy.8 Stepwise instructions on the estimation of 10-year fracture risk are provided in Appendix 4 of the CAR standards and can be kept at one’s side when reporting.

Interval change in bone density: The significance of serial change in bone density can be determined only with reference to the least significant change (LSC) for each anatomic structure, as determined from facility-specific precision testing.9 The lumbar spine and the total hip are monitored most commonly, as they provide the best precision. A serial change in BMD that equals or exceeds the relevant LSC is considered to represent a true biological change, with 95% confidence, and can be reported as a statistically significant interval change.

It is common to conclude the report with a recommendation on the timing of the next DXA scan. In general terms, the test interval is the facility-specific LSC divided by the anticipated

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- Assign one diagnostic category, for example, do not report “low bone mass in the spine, osteoporosis at the total hip.”
- Do not attempt to categorize further into mild, moderate, or severe values.
- The diagnosis of osteoporosis from the T-score is operational-based, and a person with a documented fragility fracture has reduced bone strength, regardless of bone density.5

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rate of annual bone loss. The numerator is known, but the denominator must be estimated by clinical judgment. Patients with diseases (or on therapy such as high-dose glucocorticoids, aromatase inhibitors, or androgen deprivation) that are known to lead to rapid bone loss, those with the lowest baseline BMD, and those on bone-active therapy are usually monitored at shorter intervals than those at low risk for fracture. Appendix 6 in the CAR standards provides useful guidance on this matter.

In addition to the 3 cardinal elements of the report described above—diagnostic category, fracture risk, and interval change in BMD—there is additional information that might be provided depending upon the individual situation. This includes indication for the examination, a comment regarding its technical adequacy, scan limitations related to patient factors, and a recommendation for additional useful investigations. Some referring physicians appreciate a comment on management based upon current Osteoporosis Canada guidelines. These and other points are covered in the CAR standards.

We hope to have shown that a meaningful interpretation of the DXA scan goes far beyond the reiteration of the data generated by the machine and can be “deceptively simple” (ie, harder than it looks).

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