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Case Report open access

Bone Loss or a Case of Mistaken Identity?

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Abstract

The diagnosis of osteoporosis and monitoring of treatment is a challenge due to the use of different technologies for measuring bone mineral density (BMD), with many instrument manufacturers, instrument models, and software versions. Interpreters of bone density tests must be aware of these complexities when evaluating the results, with care to examine the images as well as the numerical data. Dual-energy X-ray absorptiometry (DXA) is the "gold-standard" technology for the diagnosis of osteoporosis and monitoring the skeletal effects of treatment. However, BMD results can sometimes be misleading due to lack of technologist training leading to errors in patient positioning, incorrect analysis, or invalid data. This is a case presentation that illustrates an easily avoidable BMD testing error that could lead to inappropriate treatment decisions, highlighting the importance of quality BMD testing and reporting.

Keywords: DXA; Scan interpretation; DXA analysis; Osteoporosis; Quality

Introduction

Dual-energy X-ray absorptiometry (DXA) is a non-invasive, widely available, modestly priced technology for measuring bone mineral density (BMD). It is conveniently performed with a rapid acquisition time and low dose of ionizing radiation. DXA is used to diagnose osteoporosis, assess fracture risk, and monitor changes in BMD over time [1]. Despite the ease of performing a DXA study, its clinical utility requires great attention to detail by a well-trained technologist and interpretation by a knowledgeable physician according to well-established standards [2]. Mistakes in obtaining demographic information, inattention to instrument calibration, faulty acquisition and analysis, and incorrect interpretation can lead to inappropriate clinical decisions that could be costly or harmful to the patient [3-6]. The case presented here shows one of many possible errors with BMD testing.

Case Report

A 61-year-old woman has a baseline DXA study in December 2012 (Figure 1) and a follow-up in December 2013 (Figure 2). The patient was nine years postmenopausal. She was never placed on hormone therapy. She was not on any treatment known to be harmful or beneficial to bone metabolism. She was reported to have BMD loss of 0.034 g/cm^2 at the lumbar spine (L1-L4), from 1.098 g/cm^2 to 1.032 g/cm^2, with possible implications for clinical management. Precision assessment in the field of bone densitometry is the process whereby the ability of the instrument and the technologist to reproduce similar results, given no real biologic change, is tested. The mathematical result of precision assessment is called the precision error, from which the least significant change (LSC) is calculated [7]. The LSC is the smallest change in BMD that is statistically significant, usually with a 95% level of confidence. For this patient, the 3.1% decrease in BMD would be considered to be statistically at most high quality DXA facilities, suggesting the need for further evaluation and possible medical intervention.

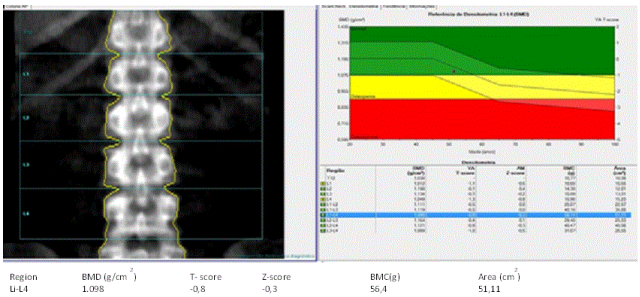

Figure 1: Baseline DXA study of December 2012. Although DXA image is not for diagnosis the analyzer has to evaluate the positioning, format and vertebral anatomy. The bone mineral density (BMD), T-score and Z-score are shown on the right.

However, upon further examination of the images, several questions arise:

Is there a problem with the DXA scan?

What is the cause of the problem?

How could the problem be avoided?

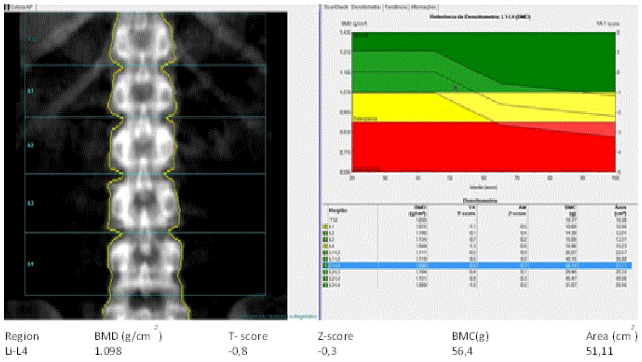

Figure 2: "Follow-up" DXA study of December 2013. The lumbar spine is very similar to the one in the first scan but no identical. When compared to the first scan there was BMD decrease.

Discussion

Examination of the lumbar spine images reveals major differences in the anatomy, suggesting that the two scans are from different patients (Figure 3).

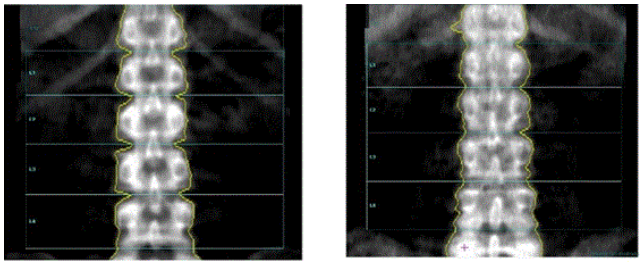

Figure 3: The two DXA scans. The analyzer should match both image and they are not identical.

A review of the demographic information entered into the system by the DXA technologist finds that the DXA studies were of two different patients with the same name, both registered in the database. The patients were incorrectly assumed to be the same person and therefore the BMD values were compared. This is, of course, an invalid comparison.

This type of error can be prevented by taking great care when entering and reviewing all demographic information for every patient. In this patient, recognition that the age and date of birth were not the same should have lead to early recognition of the error. A careful look at the images also would have shown that these were not comparable.

Bone density testing is a technology that is used to measure BMD. Although the skeletal image is not for diagnosis, it is used to check for correct patient positioning, something that the technologist must determine before the patient leaves the testing center. Positioning should also be double-checked by the clinician who interprets the test [8,9].

Conclusion

Bone densitometry is not a push button test. The acquisition, analysis, and interpretation of BMD tests require trained and skilled staff. Meticulous attention to detail, including assessing the demographic information, is necessary. The main purpose of the DXA scan image is to check for correct patient positioning, something that the technologist must determine before the patient leaves the testing center. Although the DXA image is not used to diagnose skeletal disorders, it is important to review the images to assure that patient positioning is correct, that bone edges and regions of interest are correctly identified, and that serial BMD tests are comparing "apples with apples."

There are many available resources for BMD technologists and physicians training, such as ISCD or International Osteoporosis Foundation (IOF) courses. A basic knowledge of skeletal anatomy is necessary for a good test interpretation.

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