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## Case Report

# Asymmetric bone mineral density in the bilateral femoral necks due to gluteal implants: a case report

Jennifer L. Favinger MD\*, Charles H. Chesnut MD, Felix S. Chew MD

Department of Radiology, University of Washington, 4245 Roosevelt Way NE, Box 354755, Seattle, WA 98105, USA

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## ABSTRACT

Interpreting asymmetric bone mineral density in the bilateral hips on dual energy x-ray absorptiometry requires investigation into the potential causes, both real and artifactual. Silicone gluteal implants have been reported to cause abnormally elevated bone mineral density. We report a case of abnormally low bone mineral density in a patient with bilateral gluteal implants. This is likely due to patient positioning and inability of the computer to identify the superior margin of the proximal femur and the femoral neck.

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## Case report

A 44-year-old African-American woman presented for screening bone densitometry with concerns for osteoporosis. She had a history of acute myelogenous leukemia, which had been treated with chemotherapy and bone marrow transplant approximately 1 year earlier. She was 1.625 m in height (64.0 inches) and 61.23 kg in weight (135 pounds). She had had a prior dual energy x-ray absorptiometry (DXA) scan 10 months earlier that showed normal bone mineral density. On the prior study, the T scores for her lumbar spine, left hip, and right hip were 1.8, 1.3, and 0.6, respectively.

Bone mineral densitometry of the spine and bilateral hips was measured with the Lunar Prodigy DXA technology (Fig. 1). At the spine L1-L4, total bone mineral content measured 66.8

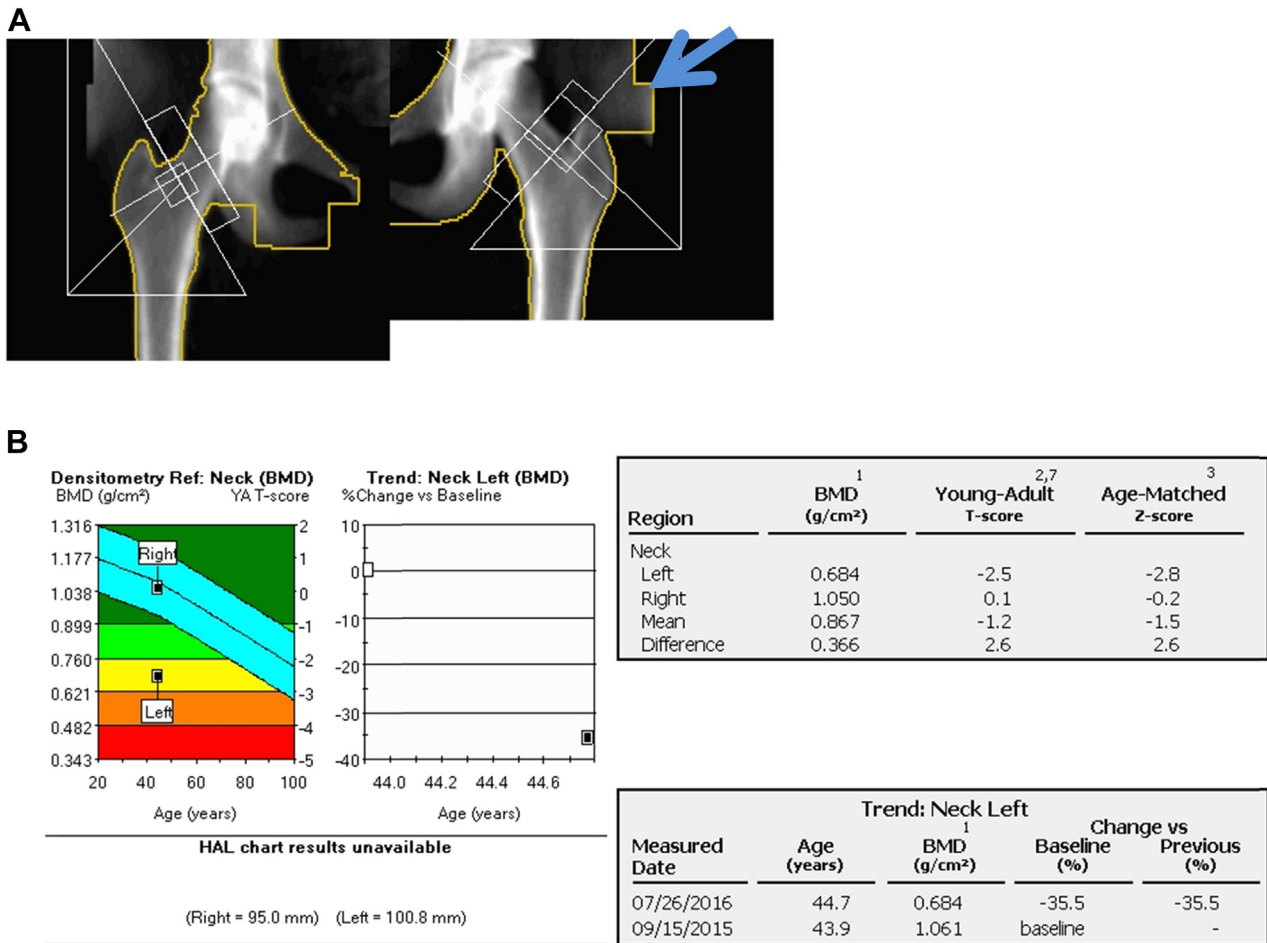
grams with average bone mineral density of 1.387 grams/cm<sup>2</sup>. The T score was 1.6 (116% of 20–40-year-old young normal values), and the Z score was 1.0 (110% of age-matched normal values). At the right hip, total bone mineral content measured 23.7 grams with average bone mineral density of 1.041 grams/cm<sup>2</sup>. The T score was 0.3 (103% of young normal values), and the Z score was –0.3 (96% of age-matched normal values). At the left hip, total bone mineral content measured 28.5 grams with average bone mineral density of 0.942 grams/cm<sup>2</sup>. The T score was –0.5 (94% of young normal values), and the Z score was –1.1 (87% of age-matched normal values). Total bone mineral content and average bone mineral density at the femoral necks of the hips measured 4.6 and 5.0 grams, and 1.050 and 0.684 grams/cm<sup>2</sup>, of the right and left hips, respectively. Of note, the areas included in the DXA measurements

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\* Corresponding author.

E-mail address: [jtorpey@uw.edu](mailto:jtorpey@uw.edu) (J.L. Favinger).  
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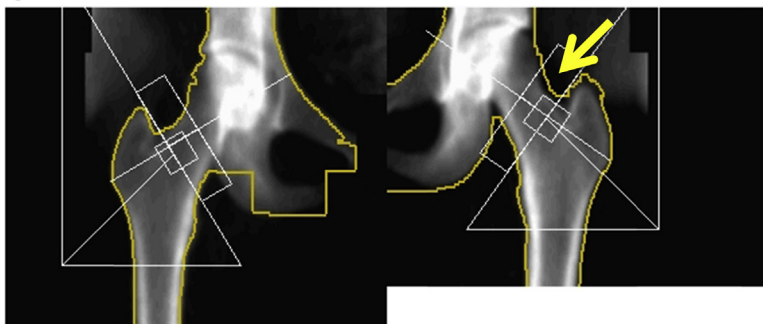
**Fig. 1 – Initial dual energy x-ray absorptiometry (DXA) report showing (A) the outline of the hip and proximal femur chosen by the system and (B) the calculations of bone mineral density. In image (A), the yellow outline of the left hip includes soft tissue superior and lateral to the proximal femur, and the femoral neck area box is too large and centered superior to the femoral neck (blue arrow). This results in an abnormal calculation (B) of osteoporosis of the left hip and normal bone mineral of the right hip. The DXA report was manually corrected (C) with the new outline and femoral neck area box readjusted (yellow arrow). The new calculations (D) show normal bone mineral density of both hips.**

for the femoral neck measurements were 4.3 and 7.4 cm<sup>2</sup>. The area automatically calculated for the left femoral neck was nearly twice as large as the area for the right femoral neck. T scores at the femoral necks of the right and left hips were 0.1 and -2.5, 101% and 66% of young normal values, respectively. By World Health Organization's criteria, there was significant osteoporosis at the left femoral neck, but normal bone mineral density at the right femoral neck and lumbar spine. Compared with the prior study, there was a significant 2.3% decrease in bone mineral density at the spine, and a significant 35.5% decrease in bone mineral density at the hips, as a mean change across both hips.

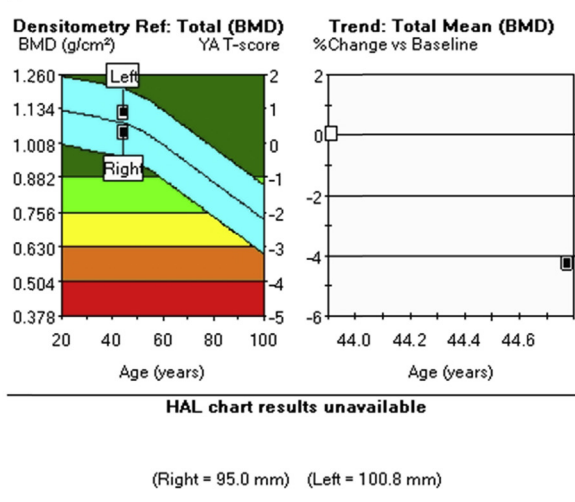
On further review of the DXA images, the program clearly had difficulty identifying the contour of the left proximal femur likely due to overlying and adjacent abnormally dense tissue.

This raised suspicion for an erroneous and artifactual left hip calculation. In addition, given the much larger area included in the calculation for bone mineral density of the left hip, we suspected that the computer had included other soft tissue such as subcutaneous fat, within the calculation, which would artificially lower bone mineral density. The asymmetry in bone density of the bilateral hips, and the normal values less than 1 year prior, reinforced the possibility that these results were due to artifact. On review of the patient's medical record, searching for a clinical explanation of the change in measured bone density, the prior imaging was reviewed, including a computed tomography of the abdomen and pelvis performed 13 months prior that revealed bilateral gluteal cosmetic augmentation (Fig. 2). The implants are hyperdense on computed tomography, and we suspect that they are made of silicone.

C



D



Region	<sup>1</sup> BMD (g/cm <sup>2</sup> )	<sup>2,7</sup> Young-Adult T-score	<sup>3</sup> Age-Matched Z-score
Total			
Left	1.118	0.9	0.3
Right	1.048	0.3	-0.3
Mean	1.083	0.6	0.0
Difference	0.070	-0.6	-0.6

Measured Date	Trend: Total Mean			
	Age (years)	<sup>1</sup> BMD (g/cm <sup>2</sup> )	Change vs Baseline (%)	Change vs Previous (%)
07/26/2016	44.7	1.083	-4.2	-4.2
09/15/2015	43.9	1.131	baseline	-

Fig. 1 – (continued).

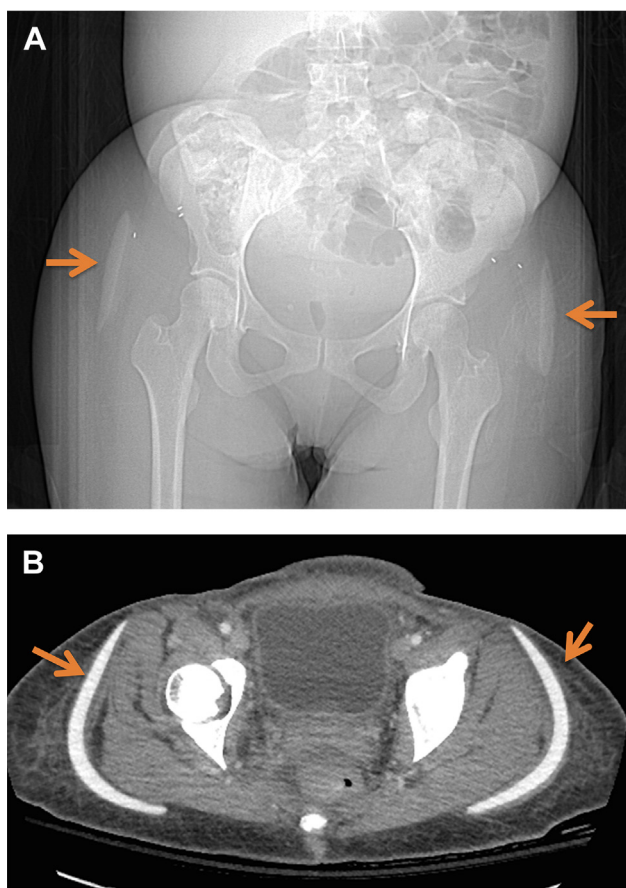
## Discussion

DXA calculates the bone mineral density of the axial skeleton by measuring the transmission of photons through 2 types of tissue, bone and soft tissue, with 2 different energies [1]. The bone density measurement in g/cm<sup>2</sup> is then compared against young normal and age-matched controls. The World Health Organization study group determined that a T score (compared against young normal controls) below -1.0 corresponds to osteopenia, and a T score below -2.5 corresponds to osteoporosis. Patients with lower T scores are at increased risk for fragility fractures [2,3].

In our patient, there was marked asymmetry between the right and left hip and femoral neck measurements. Differential bone mineral density has been reported in several different scenarios. Transient osteoporosis of the hip and regional migratory osteoporosis are rare often self-limited conditions, which could lead to differential bone mineral

density [4,5]. Patients with asymmetric symptoms of multiple sclerosis have been shown to have lower bone mineral density in the femoral neck of the more symptomatic “paretic” lower extremity [6]. This has also been reported in patients with poliomyelitis, who have asymmetrical severe osteoporosis in the poliomyelitic limb [7]. Individuals with osteoarthritis of the knee have also been reported to have lower bone mineral density on the ipsilateral side as compared with the contralateral femoral neck and lumbar vertebrae [8].

When evaluating differential bone mineral density, it is important to evaluate for the possible causes of the difference, and also to identify which part is abnormal. Abnormally elevated bone mineral density has been reported in patients with silicone gluteal implants [9,10]. In these cases, the DXA scan included the dense silicone implant, artificially increasing the bone mineral density as the implant attenuated the transmission of photons to the detector. To our knowledge, there have not been reports of abnormally low bone



**Fig. 2 – Anteroposterior scout image (A) and axial postcontrast image through the pelvis (B) from the patient's prior computed tomography scan of the abdomen and pelvis, demonstrate bilateral high-density (likely silicone) gluteal implants (orange arrows) superficial to the gluteus maximus muscles.**

mineral density as a result of gluteal implants. We postulate that the material in the gluteal implant did not attenuate the photon transmission but did over lie and render undetectable the superior border of the femoral neck, as evidenced in both the DXA scan images and the larger scan areas quantitated for the left femoral neck. Because of this, the calculation may

have included fat or other soft tissue density in the calculation that would have resulted in an abnormally low bone mineral density. It is therefore imperative to be aware of any potential imaging artifacts when interpreting a radiologic examination, and to correlate the information with the clinical context to determine the legitimacy of the bone mineral density calculations.

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