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Interesting image

How a Metal Belt Turned Osteopenia into Osteoporosis

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ABSTRACT

In Bone Mineral Density (BMD) assessment via Dual-energy X-ray Absorptiometry, the presence of external metallic artifacts is not merely a visual nuisance but a critical source of diagnostic error. This case highlights how a streak artifact from a patient's belt significantly altered the T-score, emphasizing the vital role of radiological technologists in ensuring diagnostic integrity.

Keywords: Bone Mineral Density, Metallic Artifact, Streak Artifact

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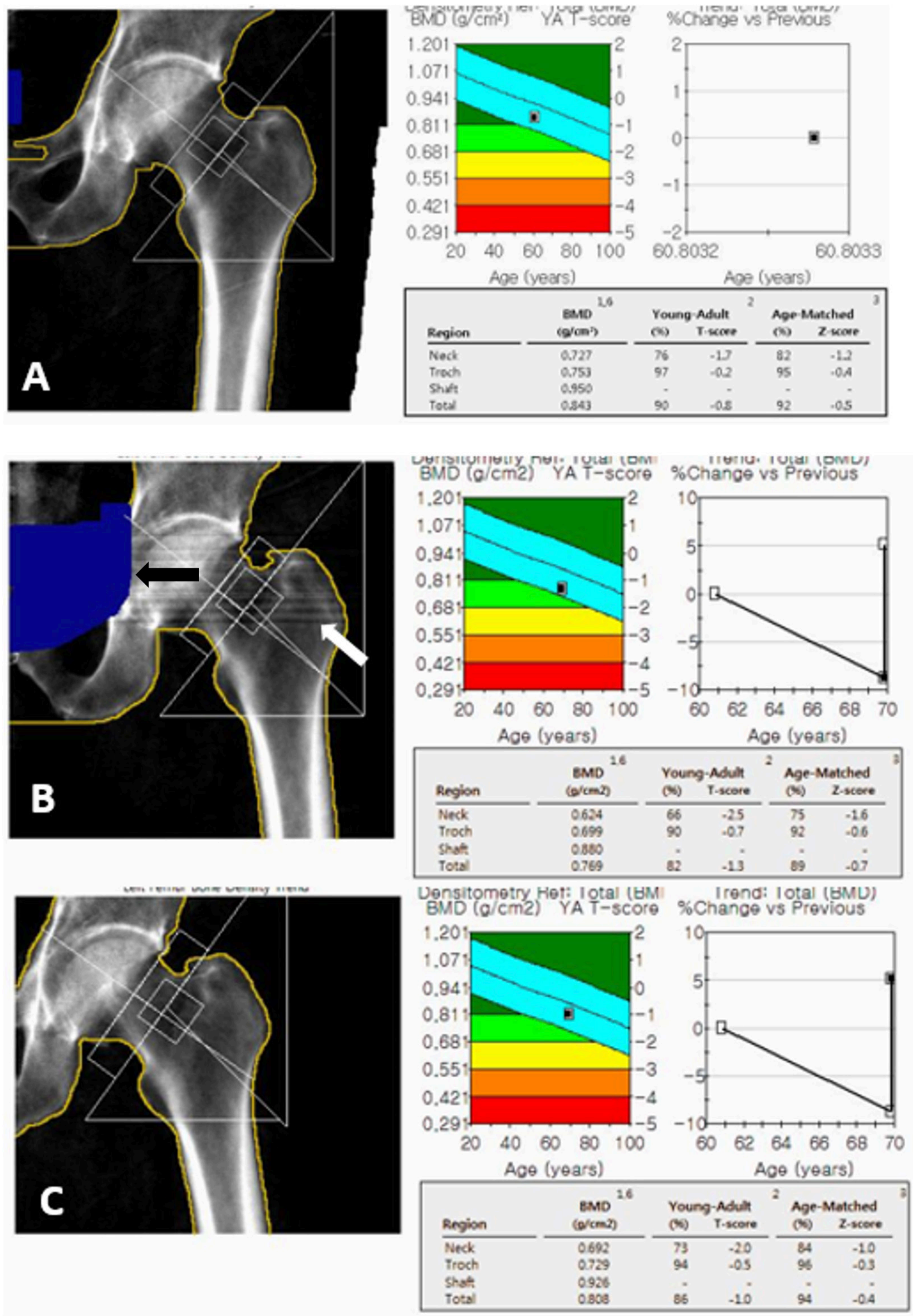

Fig. 1. A 69-year-old male patient underwent a BMD scan; however, due to a radiological technologist's error, the examination was conducted without removing the patient's metallic belt(B). Upon retrospective review after the patient's discharge, a significant decrease in BMD at the femur neck was observed(B) compared to the 2017 baseline(A). A subsequent re-test(C) confirmed that this discrepancy was an artifact (white arrow) caused by the metallic object (black arrow). Specifically, the patient's 2017 femur neck T-score was -1.7 (osteopenia) with a total T-score of -0.8(A). The initial scan with the metal belt yielded a femur neck T-score of -2.5 (osteoporosis) and a total T-score of -1.3(B). Following the removal of the metallic artifact, the repeat scan showed a femur neck T-score of -2.0 (osteopenia) and a total T-score of -1.0(C).

A 69-year-old male patient underwent a BMD scan for routine bone density monitoring. Due to a technical oversight, the patient's metal belt was not removed during the initial scan. Upon reviewing the results, the radiological technologist noticed a suspicious streak artifact and a drastic discrepancy compared to the patient's 2017 baseline data. To rectify this, a re-scan was performed after removing the belt in two days.

Table 1. Quantitative analysis of femur neck

Scanning Condition	Femur Neck T-score	Diagnosis	Total T-score
2017 Baseline	-1.7	Osteopenia	-0.8
Initial (With Metal Belt)	-2.5	Osteoporosis	-1.3
Follow-up (After Removal)	-2.0	Osteopenia	-1.0

The metal belt induced a "streak artifact," a phenomenon where high-density objects absorb X-ray photons, causing "photon starvation" and "beam hardening"[1-3]. When X-rays pass through a metal belt, the interaction causes photon attenuation, where most photons are absorbed. The unabsorbed, high-energy photons that manage to pass through the belt cause a beam hardening effect and reach the detector. The detector interprets these high-energy photons (though few in number) as an extremely high-density material within the bone area, displaying them as a bright streak [4].

Conversely, dark streaks are caused by photon absorption and Compton scattering by the metal belt. Rather than simple data dropout, these scattered photons enter the detector as additive background signals. The equipment's algorithm interprets this distorted energy ratio−specifically the increased low-energy component−as a higher proportion of soft tissue relative to bone content. Consequently, the impact of this scatter-induced distortion leads to an underestimation of bone mineral content, resulting in a systematic downward bias in the final BMD values [5-8].

The T-score shift from -2.0 to -2.5 is clinically profound, as it crosses the threshold for an osteoporosis diagnosis. This error could lead to unnecessary pharmacological treatment, such as bisphosphonates. This incident serves as a stark reminder that a radiological technologist's professional diligence directly impacts clinical outcomes.

Conflicts of interest

The author declared no conflicts of interest.

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