AbstractID: 12645 Title: Some Physical and Clinical Factors Influencing the Measurement of Precision Error, Least Significant Change, and Bone Mineral Density in DXA

Purpose: In bone densitometry, Dual-Energy X-ray Absorptiometry (DXA) is commonly used to calculate a patient's Bone Mineral Density (BMD) which is used to determine the risk of developing a fracture. The International Society for Clinical Densitometry (ISCD) is the governing body whom sets forth quality control guidelines. Among these guidelines are phantom measurements which are used, for example, to detect any drift in the x-ray tube . Another necessary aspect of quality control is determining the Least Significant Change (LSC) by completing a precision study. Several factors, both machine and human based, affect the BMD measurement. Our institution performed precision and phantom-based accuracy studies and compared our results to those of other investigators.

Method and Materials: In this work, a GE Lunar Prodigy Advance DXA was used. For our precision study, 15 patients had BMD measurements both at the PA lumbar spine and total hip (left) by five different technologists. The accuracy study employed custom-built aluminum lumbar spine phantoms in the shapes of a parallelepiped and trapezoid and were placed each in a basin filled with 15 cm of water. Identical measurements were made also with the vendor supplied phantom.

Results: At the 95% confidence level, the calculated LSC's for the spine and hip, respectively are 0.045 g/cm^2 and 0.027 g/cm^2. The machine calculated measurements of our custom-built and vendor supplied aluminum phantoms were approximately 40%-50% lower than the physical measurements made in the lab.

Conclusion: Based on our results and those reported by other investigators, we conclude that some of the major factors to affect BMD measurements are: precision error is higher for the spine than the hip and the degree of BMD measurement accuracy can be affected by the specific phantom being used as well as faults in edge detection algorithms.

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