ACCURATE ASSESSMENT OF FEMORAL ECHOSOUND APPROACH PERFORMANCE THROUGH DXA ERROR ANALYSIS

M. Muratore[1], F. Conversano[2], P. Pisani[2], M. Peccarisi[3], A. Greco[3], T. De Marco[3], E. Quarta[1], L. Quarta[1], A. Grimaldi[1], S. Casciaro[2]

1. *OU of Rheumatology Galateo Hospital, San Cesario di Lecce, ASL-LE*
2. *National Research Council, Institute of Clinical Physiology*
3. *Echolight Spa, LECCE, Italy*

Background Currently, the accepted "gold standard" method for bone mineral density (BMD) measurement and osteoporosis diagnosis related to the reference axial anatomical sites is dual-energy X-ray absorptiometry (DXA). However, actual DXA effectiveness is limited by several factors, including intrinsic accuracy uncertainties and specific errors in patient positioning, image segmentation, and post-acquisition data analysis, as documented by very recent literature [1]. This may affect the comparative evaluation of the effectiveness of novel diagnostic methods whose validation studies adopt DXA outcomes as standard reference to assess diagnostic performance.
Objectives To assess the impact of DXA errors on the performance of an innovative ultrasound parameter for osteoporosis diagnosis on the femoral site, known as Osteoporosis Score (OS).
Methods 202 patients aged in 46–75 years underwent two diagnostic investigations on the femoral neck: a conventional femoral DXA and an echographic scan performed by employing the innovative EchoSound technology [2]. Initially, the performance of the OS parameter was evaluated considering all the available DXA reports as reference in the data analysis, and calculating the corresponding accuracy in patient classification (osteoporotic, osteopenic, or healthy) and the correlation coefficient between the DXA-measured BMDs and the OS-derived BMD values. At a later stage, the DXA errors were taken into account by performing a strict quality control on DXA reports: all those cases affected by a typical inaccuracy [1] were excluded from the analysis and the actual diagnostic accuracy of the EchoSound technology was re-assessed by analysing only the reliable DXA reports. Intra- and inter-operator repeatability of OS-derived BMD values were also measured in a group of patients.
Results A diagnostic accuracy of 84.4% (r =0.78, p<0.001) was obtained for the EchoSound approach when all the DXA reports were included in the analysis. In the second part of the study, 61 out of the initial 202 (30.4%) patients were excluded from the analysis because their DXA reports were affected by specific errors. An actual diagnostic accuracy of 94.2% was then obtained on the remaining 141 patients, together with a high correlation between DXA-measured BMDs and OS-derived BMD values (r =0.88, p<0.001). Intra- and inter-operator repeatability of OS-derived BMD values, expressed in terms of the root mean square coefficient of variation (RMS-CV), resulted equal to 0.29% and 0.34% for intra- and inter-operator variability, respectively, therefore documenting a very good measurement repeatability.
Conclusions Undetected DXA errors had an impact on the accuracy evaluation of EchoSound femoral neck densitometry, causing an underestimation of OS performance in osteoporosis diagnosis. The quality control analysis on DXA reports can be useful to study the actual performance of different ultrasonic methods that considered routine DXA reports as the gold standard reference.

References

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