THE LUNAR ACHILLES AS A SCREENING TOOL FOR OSTEOPOROSIS: COMPARISON WITH SPINE DXA

P132MO

S. Poriau[1], P. Geusens[2], F. Van den Bosch[1], F. De Keyser[1]
[1]Locomotorisch Centrum, Sijsele-Damme, Belgium; [2]Biomedical Research Institute, Diepenbeek, Belgium and University Hospital, Maastricht, The Netherlands

INTRODUCTION

Although dual energy X-ray absorptiometry (DXA) is the most widely accepted method for osteoporosis diagnosis and management, it is economically and practically impossible to test with DXA the whole population at risk for osteoporosis. Quantitative ultrasound (QUS) of the os calcis has been introduced as an effective, low-cost method to assess osteoporotic fracture risk. Recently the International Society for Clinical Densitometry (ISCD) recommended the use of peripheral densitometry (such as heel ultrasonometry) to identify patients who might have osteoporosis and should therefore undergo BMD testing at the hip and spine [1]. This recommendation requires the use of a device specific T-score cutpoint on the peripheral device that detects 90% of individuals with osteoporosis (T-score ≤ -2.5) at either the spine or hip. In this study, we wished to determine the 90% sensitivity cutpoint that could be used with the Achilles bone ultrasonometer.

METHODS

A total of 1087 women aged 50 years and older (mean age 68 ± 10 years) had a heel ultrasound measurement using a Lunar Achilles Solo (GE Healthcare). Caucasian female reference values for Europe were used to compute T-scores based on Stiffness Index (SI). SI is a linear combination of speed of sound (SOS) and broadband ultrasound attenuation (BUA). The same subjects had DXA measurements at the spine (L1-L4) using a Lunar Prodigy or a Lunar DPX-NT. T-scores for spine L1-L4 were calculated using Lunar USA Caucasian female reference values. Subjects with a T-score ≤ -2.5 for spine were classified as osteoporotic, as recommended by the ISCD. ROC analysis based on Achilles T-score was performed using Analyse-it for Excel v.1.68 (Leeds, UK) to obtain the area under the curve (Wilcoxon) and its 95% confidence interval. Rockit v.0.9.1B Beta (Charles E. Metz, Department of Radiology, University of Chicago) was used to fit binormal ROC curve values and 95% confidence intervals for true positive fraction (TPF = sensitivity) as a function of false positive fraction (FPF = 1 – specificity). The estimated binormal TPF values as a function of FPF (in the range 0.4 to 1.0) output by Rockit were fit to a cubic polynomial to calculate TPF as a function of FPF. The binormal fit of FPF values as a function of Achilles T-score output by Rockit were used to regression fit Achilles T-score as a second order standard rational polynomial function of FPF using TableCurve 2D v.4.07 (SPSS Inc.). The two equations were used to estimate sensitivity and specificity for specific Achilles critical T-score values, as well as to compute the critical T-score for 90% sensitivity.

CONCLUSION

This study provides evidence that over ninety percent of the patients with osteoporosis at spine will be identified using an Achilles T-score cutpoint of -1.4. The specificity at this threshold value is nearly forty percent. Better specificity likely would be obtained if hip DXA data would be included in this model in addition to the spine DXA data. The threshold value found in this study may not be appropriate for use on other peripheral densitometry systems, as T-scores will differ by device. We conclude that the Achilles bone ultrasonometer can be used as a valid screening tool for osteoporosis according to ISCD recommendations. In situations where central DXA measurements are not available, the Achilles is a useful device to identify those patients who should be considered for spine and hip bone density assessment.

REFERENCE

1. Miller PD et al. What are the standards by which bone mass measurement at peripheral sites should be used in the diagnosis of osteoporosis? J Clin Densitometry; 5 (Supp1), S39-45, 2002.

RESULTS

From the DXA results, 332 out of the 1087 patients were classified as osteoporotic at the spine. Figure 1 shows the ROC data and fitted binormal curve with 95% confidence intervals for sensitivity. The Wilcoxon area under the curve was 0.76 with a 95% confidence interval 0.73 to 0.79. The ROCKIT analysis also contains binormal estimates of TPF (true positive fraction) and FPF (false positive fraction) for a set of T-Score values. The data points in a plot of critical T-Score versus binormal estimates of the FPF are shown in Figure 2 as well as the fit of a regression equation to these points. This equation, shown at the top of Figure 2, was used to estimate sensitivity and specificity for given values of T-scores. The estimated sensitivity is 90% at a heel T-score cutoff of –1.4, with an estimated specificity of 36%. Applying this cutoff to the study data yielded an observed sensitivity of 91% and a specificity of 38%. Higher observed specificity of nearly 50% could be obtained with a T-score cutpoint of –1.8, which has an observed sensitivity of 85% (Table 1).

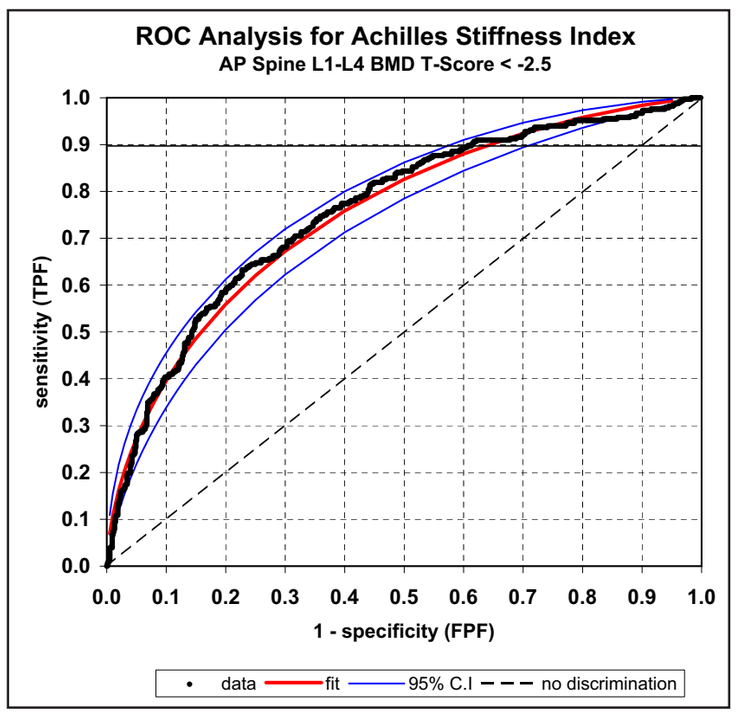

Figure 1: ROC and binomial curve with 95% confidence intervals.

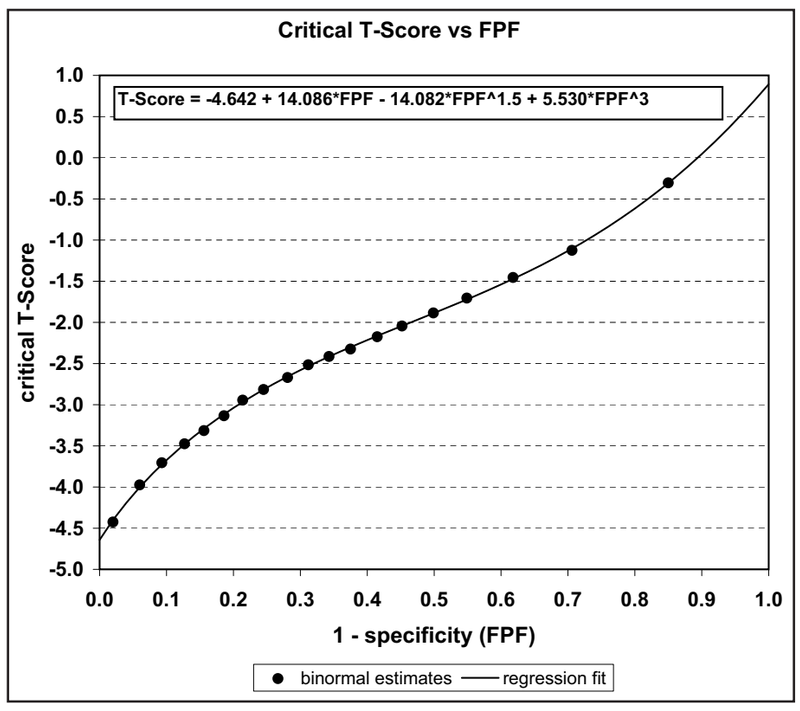

Figure 2: Plot of critical T-Score versus binormal estimates of the FPF obtained by the ROCKIT analysis. The regression equation obtained from a fit to the data points (shown in the top) is used to estimate the specificity for certain T-score cutpoints.

Heel T-Score	Sensitivity	Specificity
-0.6	95%	20%
-0.8	94%	24%
-1.0	94%	27%
-1.2	91%	31%
-1.4	91%	38%
-1.6	88%	43%
-1.8	85%	49%
-2.0	82%	55%
-2.5	70%	69%

Table 1: Observed sensitivity and specificity for osteoporosis at spine for a set of heel T-score cutpoints

Presented at the International Osteoporosis Foundation World Congress on Osteoporosis Rio de Janeiro, Brazil, May 14-18, 2004.