Heel Quantitative Ultrasound to Cut down on DXA Costs in HIV-infected Patients

Marilia Rita Pinzone, Maria Gussio, Daniela Castronuovo, Adriana Di Gregorio, Benedetto Maurizio Celesia, Marco Borderi*, Bruno Cacopardo, Giuseppe Nunnari

Unit of Infectious Diseases, Department of Clinical and Molecular Biomedicine, University of Catania, Italy *Infectious Diseases Unit, Department of Medical and Surgical Sciences, Alma Mater Studiorum University of Bologna, Italy

INTRODUCTION

HIV infection has been associated with increased risk of osteopenia/osteoporosis and fragility fractures.

Dual-energy X-ray absorptiometry scan (DXA) is the reference standard to assess bone mineral density (BMD), however it is a radiation-based and expensive technique, not easily accessible in several clinical settings.

Quantitative ultrasound (QUS) of the heel is a radiation-free, easy-to-perform technique, which has been proposed as an alternative method to DXA for assessing bone status.

METHODS

In this cross-sectional study, we evaluated the prevalence of and risk factors for low BMD in a cohort of 244 HIV-infected patients. QUS (Hologic Sahara®) was used to evaluate heel stiffness, defined by the Quantitative ultrasound index (QUI). A QUI threshold >83 has been suggested to identify patients with a low likelihood of fracture, a QUI<59 those with a high likelihood of fracture.

We compared the demographic, viro-immunological and biochemical parameters of low-risk patients (QUI value >83) and intermediate/high-risk ones (QUI≤83). Moreover, we compared QUS results with those of 36 sex- and age-matched HIV-negative controls.

Mann-Whitney test was used to compare continuous variables, Chi-squared test for categorical variables. Statistically significant variables in the univariable analysis were included in the multiple logistic regression analysis. Age, gender and sex were considered required covariates.

Spearman's correlation was used to assess the correlation between Frax® and QUS results.

All analyses were performed using Openstat and Graphpad statistical software.

RESULTS

The demographic and clinical characteristics of the study population are shown in Table 1.

Median heel QUI value in the HIV-positive cohort was 83 (interquartile range (IQR) 73-96). As shown in Figure 1, it was significantly lower in comparison with HIV-negative controls (93 (IQR 84-104), p=0.04).

In univariable analysis, the following parameters were significantly different between the low-risk group and the intermediate/high-risk one: age (44 vs. 49 years respectively, p=0.0005), prevalence of HCV coinfection (13 vs. 26% respectively, p=0.01), exposure to cART (83 vs. 94% respectively, p=0.007), time since HIV diagnosis (113 vs. 142 months respectively, p=0.04), prevalence of TDF exposure (58 vs. 70% respectively, p=0.05), prevalence of PI exposure (45 vs. 58% respectively, p=0.08). In addition, the number of patients with one or more risk factors for secondary osteopenia/osteoporosis was significantly higher in the intermediate/high-risk group (84 vs. 67%, p=0.007).

Variable	N=244
Age (years)	47 (39-53)
Gender, male	179 (73)
Risk factors	
IDU	29 (12)
MSM	110 (45)
Time since HIV diagnosis (months)	128 (47-217)
Current CD4+ T-cell count (cells/µl)	549 (397-733)
HIV viral load <50 copies/ml	181 (84)
Patients on cART	216 (89)
Time on cART (months)	128 (48-204)
Current use of PI	110 (51)
Current use of TDF	138 (64)
Current use of raltegravir	24 (11)
BMI (kg/m2)	24 (21.8-26.3)
Current smoking	128 (59)
Hepatitis C coinfection	42 (17)
eGFR (ml/min/1.73 m^2)	100 (86-109)
Diabetes mellitus	15 (6)
Hyperthyroidism	8 (3)
Vitamin D insufficiency (<20 ng/ml)	75 (31)
Hyperparathyroidism	54 (22)
Hypogonadism	9 (5)
One or more risk factors for secondary osteoporosis	183 (75)

Data are n. (%) of patients or median (interquartile range)

Table 1. Demographic and clinical characteristics of the study population

RESULTS

A significant correlation between QUI values and FRAX score was found (r=-0.22, p=0.004).

The results of the multiple logistic regression analysis are shown in Table 2.

Variable	OR	95% CI	p
Age (years)	1.04	1.01-1.07	0.0040
Gender, female	1.6	0.84-3.03	0.1506
BMI (kg/m2)	0.94	0.87-1	0.0653
Time since HIV diagnosis (months)	0.99	0.89-1.2	0.4022
Exposure to cART, yes	0.98	0.28-3.44	0.9828
Current PI use, yes	1.86	1.03-3.35	0.0393
Current TDF use, yes	2.28	1.22-4.27	0.0097
Risk factors for secondary osteoporosis (n)	1.46	1.09-1.95	0.0105

Table 2. Factors associated with a QUI value ≤83 in the multiple logistic regression analysis

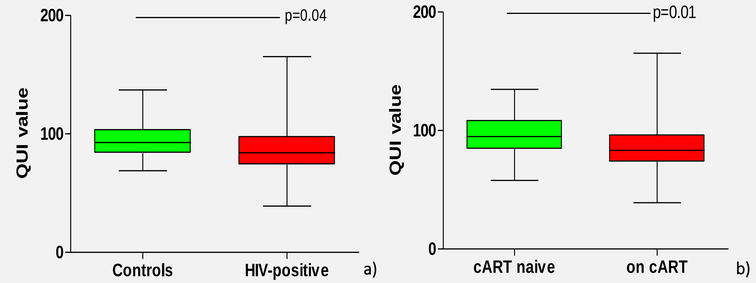


Figure 1. a) QUS values in HIV-positive patients and controls: QUI values were significantly higher in controls compared to HIV-positive subjects (93 vs. 83, p=0.04); **b) QUS values in cART naive patients and patients on cART:** QUI values were significantly higher in cART naive patients in comparison to those receiving cART (95 vs. 83, p=0.01)

RESULTS

Figure 2. Screening of the study population for osteopenia/osteoporosis by using heel QUS. In the subgroup of patients with risk factors for low BMD, the use of QUS may halve the number of required DXA. In the subgroup with no known risk factors for osteoporosis, QUS may help identifying those requiring an addition diagnostic workup.

CONCLUSIONS

Heel QUS is a quick, easy-to-perform, relatively inexpensive and radiation-free technique which may help redefining the need for DXA. In fact, in the subgroup of patients with risk factors for osteopenia/osteoporosis, heel QUS may halve the number of required DXA, whereas in the cohort of subjects with no known risk factors for low BMD, it may help identifying those requiring lifestyle modifications and an additional diagnostic workup for osteoporosis.

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marilia.pinzone@virgilio.it / gnunnari@hotmail.com