

The relation between adipokines, body composition and bone health measured with HR-pQCT in hemodialysis patients

S Pelletier^{1,2}, J Bacchetta^{1,3}, S Boutroy¹, C Confavreux¹, J Drai⁴, W Arkouche⁵, D Fouque^{2,6}, F Guebre-Egziabher^{6,7}.

1- INSERM U1033, Lyon, France; 2- Department of nephrology, CHLS, Pierre-Bénite, France; 3- Hospital Femme Mère Enfant, Bron, France; 4- Centre de biologie, CHLS, Lyon, France; 5- AURAL, Lyon, France; 6- INSERM 1060 CARMEN laboratory, CHLS, Pierre-Bénite, France; 7- Department of Nephrology, Hôpital Edouard Herriot, Lyon, France



OBJECTIVES

There is a growing understanding of the impact of body composition on bone health. The relationship between bone mineral density (BMD) and body weight or body fat is complex and may be mediated by several factors which are independent of mechanical stimulation. Indeed the likelihood that adipocyte derived hormones influence BMD has been proven.

The aim of the study is to investigate the individual effect of fat and lean mass and endocrine determinants on bone microarchitecture in chronic hemodialysis patients.

METHODS

Serum leptin, adiponectin, body composition (Dual-energy X-ray absorptiometry: DEXA) and bone microarchitecture (HR-pQCT, XtremeCT, Scanco Medical®, Switzerland) were studied in a cohort of **55 patients** in maintenance hemodialysis in a prospective monocenter study.



Figure 1: the HR-pQCT device

Parameters of density	Parameters of microarchitecture
Compartmental volumetric bone mineral density: <ul style="list-style-type: none"> - total (<i>total vBMD</i>) - cortical (<i>Ct vBMD</i>) - trabecular (<i>Tb vBMD</i>) 	<ul style="list-style-type: none"> - Cortical (Ct) parameters: cortical thickness - Trabecular (Tb) parameters: Trabecular thickness Trabecular separation Trabecular number Heterogeneity of Tb separation

Table 1: parameters assessed by HR-pQCT ■ measured ■ calculated

HR-pQCT:

Very low ionizing technique (\approx DXA) - Voxel resolution: 82 μ m³

No movement during three minutes

Site: ultradistal tibia

Statistical analyses were performed using Staview

RESULTS

Characteristic	Mean \pm SD
Age (years)	50.8 \pm 19.9
Dialysis vintage (months)	31.7 \pm 33.0
Diabetes (%)	14 (25.4)
Body mass index (Kg/m ²)	25.4 \pm 5.1
Albumin (g/L)	39.3 \pm 3.3
Adiponectin (μ g/mL)	14.7 \pm 8.5
Leptin (ng/mL)	71.5 \pm 118.7
Lean mass (kg)	51.04 \pm 11.55
Fat mass (Kg)	20.91 \pm 9.71
Fat mass (%)	27.70 \pm 9.50
Truncal/leg fat mass	1.12 \pm 0.45
Appendicular skeletal muscle mass (kg/m ²)	7.75 \pm 1.40

HR-pQCT parameters (tibia)	
Total vBMD (mg HA/cm ³)	252 \pm 61
Cortical vBMD (mg HA/cm ³)	844 \pm 74
Trabecular vBMD (mg HA/cm ³)	141 \pm 49
Trabecular number (mm ⁻¹)	1.53 \pm 0.33
Trabecular separation (μ m)	620 \pm 20
Trabecular thickness (μ m)	80 \pm 20
Cortical thickness (μ m)	1025 \pm 300

Table 2 : Clinical and biological characteristics of patients (n=55) and bone parameters

On univariate analysis, adiponectin was strongly and negatively associated with total BMD, cortical thickness, trabecular BMD, number and positively with trabecular separation. Leptin was positively correlated with total BMD. Fat mass (DEXA) was positively associated with total BMD and cortical thickness. Truncal/leg fat mass (a measure of central adiposity) was positively associated with total and trabecular BMD and trabecular number and negatively with cortical density and trabecular separation. Lean mass was positively associated with total and trabecular BMD, cortical thickness and trabecular number with a strong negative relation with trabecular separation.

HR-pQCT parameters (distal tibia)	Significant association	R ²	P value
Total vBMD (mg HA/cm ³)	none	-	-
Cortical vBMD (mg HA/cm ³)	Age	0.361	0.0021
	Dialysis vintage		0.0338
	Adiponectin		0.0152
	Lean mass		0.0168
Trabecular vBMD (mg HA/cm ³)	Lean mass	0.214	0.0062
Trabecular number (mm ⁻¹)	Dialysis vintage	0.529	0.0084
	Lean mass		0.0001
Trabecular separation (μ m)	Dialysis vintage	0.139	0.0087
Trabecular thickness (μ m)	Dialysis vintage	0.139	0.0087
Cortical thickness (μ m)	Adiponectin	0.312	0.0026

Table 3: Multivariate analysis of significant association with HR-pQCT parameters

DISCUSSION

The present study is the first assessing bone microarchitecture using a non-invasive 3D-bone imaging device in hemodialysis patients and correlating these data with adipokines and body composition by DEXA.

This study suggests a negative relationship between adiponectin and BMD and cortical and trabecular microarchitecture in dialysis, similar to that observed in CKD II-IV patients [Bacchetta J, et al, Nephrol. Dial. Transplant. 2009]. However, there is no clear understanding of its action on bone.

Lean mass has been associated with bone health in healthy subjects [Bogl LH, et al, JBMR 2011]. Our results confirm the importance of lean mass for bone quality and the lack of an apparent effect of fat mass on bone properties on multivariate analysis.

CONCLUSION

These data suggest that body composition and specifically lean mass is a predictor of bone health in hemodialysis patients supporting the highly-integrated nature of skeletal muscle and bone.

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