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High Resolution pQCT Micro-Architectural Parameters to Predict Bone Failure in the Case of a Forward Fall Martin Revel*, François Duboeuf, François Bermond, Jean-Paul Roux, David Mitton, H el ene Follet. Univ Lyon, INSERM, UMR1033, France

The gold standard for the diagnosis of osteoporosis is the measurement of bone mineral density by Dual X-ray absorptiometry. However, the assessment of the risk of fracture is still not sufficiently discriminant. Indeed, half of the patient considered non-osteoporotic will fracture [1]. In this context, the objective of this study is to evaluate whether bone micro-architecture of distal radius assessed by high-resolution peripheral quantitative computed tomography (HR-pQCT) manage to discriminate fractured from non-fractured bones obtained in an ex vivo experimental study reproducing a forward fall under dynamic loading conditions [2]. Thirty radii from elderly donors (79 ± 12 y.o., 15 M, 15 F) were scanned using a HR-pQCT device with an isotropic $82 \mu\text{m}$ voxel size (XtremeCT, Scanco Medical AG) before being loaded at 2 m/s to mimic impact that corresponds to a fall, leading to two groups: fractured and non-fractured. Clinical standard evaluation was performed on the images in order to assess bone micro-architecture. Statistical non-parametric Spearman's and Wilcoxon's rank-sum tests were performed using R software and p-values under 0.05 were considered as significant. On the entire population, all the parameters were significantly correlated to the maximal load. Nevertheless, important differences appeared when analyzing in two groups. Indeed, the fractured group shows high significant correlation with the trabecular parameters whereas no link was found with any parameters in the other group (Table 1). Furthermore, the two groups showed in the second test a significant difference for: all trabecular parameters, the cortical thickness and the experimental load ($p < 0.05$) but the cortical vBMD remain non-significant. The aim of this study was to assess whether micro-architecture assessed by HR-pQCT could discriminate bone fracture obtained experimentally. The correlations showed that trabecular parameters explained the bone strength for the fractured group and showed significant difference between the two groups. The results are in accordance with an epidemiologic study where the authors conclude that the trabecular micro-architecture in the radius is a good predictor of incident fracture in postmenopausal women [3]. Finite element analysis will be performed to enhance our understanding of bone fracture during a fall. [1] E. S. Siris et al, Arch Intern. Med. 164:10, 2004 [2] E. Zapata et al, J. Biomech., 63, 2017 [3] E. Sornay-Rendu et al, JBMR, 32:6, 2017

	Tt.vBMD (mg/cm^3)	Tb.vBMD (mg/cm^3)	BV/TV (%)	Microarchitectural Parameters					
				Tb.N ($1/\text{mm}$)	Tb.Th (mm)	Tb.Sp (mm)	Tb.Sp/SD (mm)	Ct.vBMD (mg/cm^3)	Ct.Th (mm)
All samples									
r	0.68	0.62	0.62	0.45	0.73	-0.49	-0.47	0.35	0.51
p-value	<.0001	0.0003	0.0003	0.01	<.0001	0.006	0.008	0.03	0.004
Fractured									
r	0.69	0.81	0.81	0.69	0.74	0.72	0.74	0.34	0.48
p-value	0.007	0.0004	0.0004	0.006	0.003	0.004	0.003	0.2	0.08
Non Fractured									
r	0.30	0.10	0.10	-0.10	0.42	0.053	0.096	0.15	0.24
p-value	0.3	0.7	0.7	0.7	0.1	0.8	0.7	0.6	0.4

Table 1 : Spearman correlation (r) between the experimental load and the micro-architectural parameters. Regarding the fractured group, the coefficient ranged between 0.69 to 0.81 for the trabecular parameters whereas the cortical ones were found as not significant. As to non-fractured group, no link was found with any cortical or trabecular parameters. Tt: Total, Tb: Trabecular, Ct: Cortical, vBMD: Volumetric Bone Mineral Density, N: number, Th: Thickness, Sp: Separation, SD: Standard Deviation.

Disclosures: Martin Revel, None