

The Impact of Type 2 Diabetes on Bone Microarchitecture: A Cross-sectional Evaluation in Postmenopausal Women

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PURPOSE: In adults with type 2 diabetes (T2D), fracture risk is elevated despite normal or elevated areal bone mineral density (aBMD). The primary objective of this study was to compare trabecular bone microarchitecture in postmenopausal women with long-standing T2D, to that of postmenopausal women without T2D. The secondary objective was to compare aBMD between groups.

METHODS: The non-dominant distal radius was imaged using a 1T peripheral magnetic resonance imaging (pMRI) system. The axial MR images were segmented and parameters of microarchitecture were derived using in-house software. Body composition, lumbar spine aBMD, and proximal femur aBMD were measured using DXA. The characteristics of participants and all bone variables are reported as mean \pm SD. Variables were compared using an unpaired t-test.

RESULTS: Participants with T2D (n=29) were similar in age (71.0 \pm 4.8 yrs vs. 70.7 \pm 4.8 yrs, p=0.87) and number of years since menopause (21.7 \pm 6.6 yrs vs. 22.1 \pm 7.7 yrs, p=0.84) compared to the participants without T2D (n=26). Participants with T2D had greater body mass index (34.6 \pm 7.6 kg/m² vs. 27.9 \pm 5.6 kg/m², p=0.00), but not percent body fat (40.3 \pm 6.1% vs. 37.2 \pm 6.5%, p=0.06) compared to participants without T2D. Table 1 displays bone densitometry and microarchitecture data for the participants.

CONCLUSIONS: To the best of our knowledge, this is the first study to demonstrate that marrow pore size is greater in women with T2D. Therefore, skeletal fragility in postmenopausal women with T2D may be due in part to enlarged perforations between trabecular units in cancellous bone.

KEYWORDS: type 2 diabetes, osteoporosis, bone quality, MRI, bone mineral density, fracture

Table 1. Bone density and trabecular bone microarchitecture results for postmenopausal women with and without type 2 diabetes

<i>Parameter, mean (SD)</i>	Diabetes n= 29	Control n=26	<i>P-value</i>
Lumbar spine (L1-L4) aBMD, g/cm ²	1.09 (0.17)	0.98 (0.18)	0.045
Femoral neck aBMD, g/cm ²	0.74 (0.12)	0.69 (0.10)	0.229
Marrow pore size, mm ²	2.25 (0.44)	1.99 (0.39)	0.023
BV/TV, %	47.5 (1.1)	48.0 (1.2)	0.095
App. Tb.Th, μm	71.1 (3.5)	70.2 (2.7)	0.282
App. Tb. Sp, μm	79.1 (6.1)	104.3 (143.1)	0.356
App. Tb. N, per mm	6.7 (0.4)	6.9 (0.4)	0.143
No. free ends/area, per mm	0.50 (0.07)	0.47 (0.06)	0.109

Values are expressed as mean (SD) and compared using an unpaired 2-tailed t-test.
Abbreviations: BV/TV: bone volume-to-total volume ratio; App: apparent; Tb.Th: trabecular bone thickness; Tb.Sp: trabecular bone separation; Tb.N: trabecular bone number