

BONE MICROARCHITECTURE IN THALASSAEMIA

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Background. Due to improved blood transfusion and chelation therapy, survival has been increased in thalassaemia patients with the consequence of complications like osteoporosis not seen during childhood and adolescence. The diagnosis of osteoporosis or osteopenia is assessed by endocrinological parameters and bone mineral density (BMD) measurements.

Aims. The obvious shortcomings of conventional BMD methods like dual energy x-ray absorptiometry (DXA), can be overcome by simultaneously assessing the microarchitecture of the bone using high-resolution peripheral quantitative computed tomography (HR-pQCT), which may improve the estimation of the fracture risk in patients with thalassaemia.

Patients and Methods. In 17 regularly transfused patients (age: 13 - 43 y, 9/17 female) with beta-thalassaemia major (n = 10), -intermedia (n = 6), and CDA-II (n = 1), the BMD of lumbar spine (LS) and total hip was measured by DXA (Hologic QDR1000+, Bedford, USA). Age, gender and ethnic specific BMD Z-scores were calculated. In addition, we assessed the volumetric BMD and the trabecular architecture of the non-dominant distal radius and tibia by HR-pQCT (XtremeCT[®], SCANCO Medical AG, Bassersdorf, Schweiz). Liver iron concentration and endocrinological parameters were also determined. Nonparametric statistical analysis was used. *Results.* In 15/17 patients low BMD values (LS Z-score range: -1.1 to -3.1) measured by DXA were significantly correlated with total volumetric density (range: 91 - 388 mg/cm³; Rs = 0.70, p = 0.002) measured by HR-pQCT at the distal radius. Seven patients with LS Z-scores < -1.0 had a relatively thick cortical bone (> 570 µm). In 6/17 patients (> 28 y), all with latent hypogonadism, the trabecular inhomogeneity parameter TbSp SD at the distal radius deviated by more than 100% from the upper normal value (Boutroy et al, 2005) and their spongiosa was porous or nearly dissolved. Patients with hypogonadism (n = 9) were significantly different from normals with respect to radial TbSp SD (p = 0.02), but not to LS Z-score. Patients with fractures (n = 5) had lower total densities (p = 0.02) and trabecular TbSp SD (p = 0.02) at the tibia and started blood transfusions (Tx-age) at a higher age (p = 0.023). However, Z-scores did not reflect the fracture risk in this patient group (p = 0.11). Only the trabecular thickness of the tibia seems to be correlated with the Tx-age (Rs = 0.62, p = 0.007), which was higher in the patients with thalassaemia intermedia and CDA-II (> 5 y). Liver iron was mainly correlated with tibial TbSp SD (Rs = 0.54, p = 0.025). *Summary.* In patients with thalassaemia BMD Z-scores seem to underestimate fracture risk because a normal cortical thickness and density may conceal a porous trabecular structure. Endocrinological failures, especially hypogonadism, were responsible for the pathological microarchitecture of distal radius and tibia, while bone marrow expansion as in thalassaemia intermedia and liver iron concentration seem to play a minor role. These initial results from bone microarchitecture measurements in thalassaemia should be confirmed in a larger sample of patients with greater age range.