ASSESSMENT OF MICROARCHITECTURAL PARAMETERS IN TRANSILIAC BONE BIOPSIES OF FEMALES AND MALES WITH FRAGILITY FRACTURES

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Introduction:

Despite all progress in non-invasive diagnostic procedures for metabolic bone diseases such as osteoporosis, there is still a small subgroup of female and male patients who may benefit from adding bone biopsy into the diagnostic procedure. Bone tissue analyses are performed to assess bone mineralization and structure. The invasive procedures are restricted to a subgroup of patients with untypical, unclear and complicated pattern. Since biomechanical characteristics of bone are not only determined by bone mass, but also by the geometry of cortical and trabecular microarchitecture new techniques such as µCT have been applied to elucidate abnormalities on deeper levels of the bone hierarchy. (Fig1)
Different patterns of bone structure diminution in females and males leading finally to osteoporosis and bone tissue fragility are emphasised:[1]

- In women, menopause-related oestrogen deficiency accelerates bone loss and causes trabecular deterioration, disconnection, cortical thinning and porosity.[2]
- In males hypogonadism contributes to bone loss in 23-30% of elderly men, worsening the cortical thinning and porosity and predisposing to hip fracture, usually in men, trabecular thinning rather than loss of connectivity tends to dominate. However, those with osteoporosis and fractures have greater loss of connectivity than men with osteoporosis but without fractures

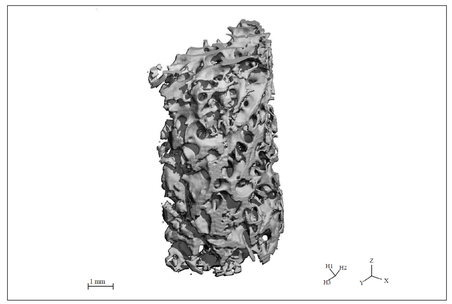

Fig.1: µCT image

Aim of the study:

To proof the concept of gender specific structure deterioration a total of 83 transiliac bone biopsies of male and female patients with osteoporosis diagnosed either by very low bone density or spinal and peripheral fractures was studied on genderspecific differences in structural parameters of bone.

Methods:

In this retrospective study we evaluated transiliac bone biopsies of 48 male patients (aged 18 to 71 years) and 35 female patients (aged 17 to 73 years).

All samples were analysed by micro-tomographic imaging system (µCT40, Scanco Medical AG, Brüttisellen, Switzerland). The following morphometric indices were determined: VOX-BV/TV, Conn-Dens., TRI-SMI, Dt-TbN, DT-TbTh, DT-Tb Sp, DT-Tb (1/N).SD, Apparent Density and Tissue Density. The total group was divided into age-related quartiles (<35.9; 35.9 – 43.11; >43.11-<54.71; >54.71yrs) (Fig.2.) and split in gender groups. Additionally, BMD and T-score of lumbar spine and hip, prevalent fracture status and previous medication were recorded. (Tab.1) Laboratory tests did not reveal any evidence metabolic disorder or vitamin D deficiency. In order to compare female and male patients with and without fractures, with and without bisphosphonate treatment, a two-way ANOVA (SPSS Version 17.0) was used.

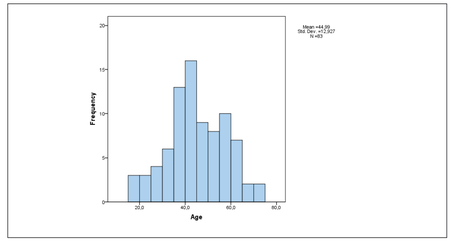

Fig.2: Age distribution in patients undergoing bone biopsy

	Female	Male	Total
N	35 (42,9%)	48 (57.1%)	83
Mean age (yrs)	45.3	44.5	44.9
Bisphosphonates	13 (15.5%)	11 (13.1%)	24 (28.6%)
Vertebral fractures	22 (26.2%)	19 (22.6%)	41 (48.8%)
BMD lumbal	0.63	0.89	0.78
BMD hip	0.75*	0.86	0.81

*p-value = 0.005

Tab.1: Clinical characterisatics of the total group

Results:

Despite significant differences in BMD of the total hip (p=0.005) in the total group we did not find significant gender specific differences in the microarchitectural parameters. Even the age quartiles showed no differences in the indices except the youngest and the oldest quartile. In these subgroups significant gender-specific changes in BMD of the total hip (p=0.028) were detected, furthermore VOX-BV/TV (p=0.035), Apparent Density (p=0.041) and Tissue Density (p=0.029) demonstrated significant differences in the youngest subgroup, but not in the other quartiles. As an additional approach sample differences between patients with fractures and bisphosphonate treatment were evaluated and apart of significant differences in the bisphosphonate and fracture group in DT-Tb (1/N).SD no significant genderspecific changes in bone structure could be obtained. (Tab.2)
Fracture status and previous medication demonstrated no distinctions in the subgroups and the total group.

	Vertebral fractures			Bisphosphonate treatment		
	Gender	Fractures	Gender* fractures	Gender	Therapy	Gender* therapy
BV/TV	0.420	0.817	0.823	0.495	0.285	0.813
Conn-Dens	0.737	0.935	0.649	0.416	0.711	0.253
TRI-SMI	0.702	0.589	0.639	0.341	0.820	0.092
Dt-TbN	0.716	0.719	0.601	0.473	0.574	0.554
DT-TbTh	0.159	0.427	0.463	0.516	0.238	0.378
DT-TbSp	0.803	0.453	0.920	0.405	0.431	0.383
DT-Tb(1/N)SD	0.208	0.023	0.483	0.031	0.749	0.163

Tab.2 Stratification of the total group in patients with fractures and bisphosphonate treatment. (Two way ANOVA; p-values)

Conclusions:

According to our results we could not obtain significant genderspecific differences in microarchitectural parameters in transiliac bone samples of osteoporotic males and females with and without with fragility fractures being around 50. Our results are in contrast to the gender specific pattern of cortical and trabecular bone loss in elderly people with osteoporosis and does not give evidence of different patterns of architectural changes in female and males with osteoporotic fractures.

References

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