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New diagnostic tools for bone health assessment: Perspectives in medical oncology

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Background

Pituitary down regulators, aromatase inhibitors tamoxifen and chemotherapeutic drugs, all have a negative impact on bone health in breast cancer patients.

Although trabecular bone accounts for only 20% of skeleton mass, bone resistance depends also on the its micro-architecture, or quality, of, in addition to bone density. The BESTEST® is an innovative and inexpensive diagnostic method that gives an indication of the quality of the bone structure: it measures the weight-bearing capacity of the bone structure, evaluated from simulated application of loads on bone structure images acquired by radiograms in the proximal epiphysis of the hand. Results are expressed as BSI_T-score and BSI_Z-score (which refers the results to the average value for the same age) and provide precious add-on information to densitometry.

We discuss the preliminary results obtained in female patients undergoing breast cancer treatment.

Material and methods

100 Caucasian women, took BESTEST® as follow-up while undergoing oncological treatment. Femoral neck DXA T-score available in a subgroup of 60. 10 patients self-reported an osteoporotic fracture, DXA T-score available for 8.

Control population: 200 women, accessing BESTEST® and DXA for screening purposes, 30 self-reporting an osteoporotic fracture.

Results

Statistics: mean (min, max).

	N	Age	BSI_T-score	BSI_Z-score	DXA_T-score
Population	100	61 (33, 88)	-1.7 (-3.4, -0.0)	-1.3 (-2.6, 0.6)	NA
DXA subgroup (of oncological population)	60	62 (35, 88)	-1.8 (-3.4, -0.1)	-1.3 (-2.6, 0.6)	-1.6 (-3.2, 0.5)
Fractured subgroup	10	67 (56, 82)	-2.4 (-2.9, -1.3)	-1.8 (-2.6 -0.1)	NA
Fractured subgroup with DXA	8	68 (60, 82)	-2.4 (-2.9, -1.3)	-1.8 (-2.6 -0.1)	-1.5 (-2.9, 0.1)
Control	200	63 (32, 89)	-1.1 (-3.6, 2.9)	-0.6 (-3.0, 2.9)	-1.9 (-3.7, 1.0)

The fractured subgroup exhibits significantly lower BSI T-score than the population (T-test p< 0.0100) and results are similar after BSI Z-score correction for age (T-test p = 0.0300). The BSI T-score of the DXA subgroup is representative of the oncological population undergoing treatment (T-test p=0.8668).

As expected, BSI T-score and DXA T-score are not correlated: R^2 = 0.0917 in the control and R^2 = 0.0294 in the population. The DXA subgroup exhibit significantly lower BSI T-score than the control (T-test p = 0.0002) and similar results are obtained after BSI Z-score correction for age. A lower significance (T-test p = 0.0281) is found for DXA T-score.

The 8 fractured oncological patients exhibit significantly lower values of BSI T-score that the oncological population (T-test p = 0.038) and all patients have a BSI T-score indicative of a compromised trabecular structure. DXA T-score values cannot be considered statistically different (T-test p = 0.6744) and results span all possible diagnostic results from high risk to normal.

Conclusions

Statistical analyses show that bone micro-architecture is indeed affected by oncological treatment and that bone alterations due to oncological treatment are easily detected with BESTEST, especially when associated with fractures.

This preliminary study clearly provides a rational background for further, deeper investigations into the use of a new, rapid and

safe technique for monitoring the effect of breast and prostate cancers therapies on bone micro-architecture modifications.