CONCORDANCE IN PAIRED QCT AND DXA AT THE LUMBAR SPINE

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Objective: Quantitative CT (QCT) of the lumbar spine is used for diagnosis of osteoporosis and osteopenia. The upper thresholds for these classifications are bone mineral densities (BMD) of 80 and 120 mg/cc, respectively, according to guidelines of the American College of Radiology (ACR). World Health Organization (WHO) standards for interpretation of DXA use T-Scores of -2.5 and -1 as thresholds for the same classifications. A study by Cann indicated that these QCT thresholds lead to the same rates of osteoporosis and osteopenia in the population as the WHO thresholds. We investigated whether paired DXA and QCT measurements have similar thresholds as rate-based studies.

Methods: DXA and CT imaging of 58 subjects was completed at vertebrae L1 and L2, for 116 total vertebrae. Subject ages ranged from 49 to 86 years (mean 79 ± 8.7 SD). In each case, the time between DXA and CT imaging was less than 10 months (mean 72 days ± 57 SD). DXA imaging and analysis was done on a Lunar Prodigy (GE, Madison, WI). CT was collected on a LightSpeed Ultra and LightSpeed 16 (GE) and analyzed using asynchronous calibration data with QCT Pro (Mindways Software, Austin, TX). QCT T-Scores were calculated by linearly transforming the BMD thresholds to match the WHO thresholds.

Results: Equal rates for QCT and DXA occur in this cohort below BMD thresholds of 90 mg/cc for osteoporosis and 125 mg/cc for osteopenia. (BMD estimates have been rounded to the nearest 5 mg/cc.) Concordance of classification at these thresholds by weighted Cohen’s κ is κ = 0.54. Maximum concordance is κ = 0.58 and occurs nearest 75 — 130 mg/cc; the figure shows this as a scatterplot of QCT versus DXA T-Scores. Green curves at left and bottom show the projected distribution envelopes of the QCT and DXA, respectively. Horizontal and vertical red lines at -2.5 (solid) and -1 T-Scores (dashed) show regions with matched or unmatched classification. The cyan line is the line of best fit by Deming regression, which is equivalent to thresholds 75 — 120 mg/cc; a dotted black line is shown at unity for comparison.

Conclusions: For this cohort, concordance-based thresholds differ markedly from rate-based thresholds at the osteoporosis threshold, but they overlap at the osteopenia threshold. The one-sided difference is explained by the variances around the best-fit line and higher skewness of the DXA in this cohort (0.45 versus 0.13 for QCT). Concordance-based thresholds in this paired study support the ACR guidelines.

CONTEXT SENSITIVITY OF MICROCT BONE DENSITOMETRY: BEAM HARDENING, TRUNCATION AND EFFECT OF SURROUNDING MEDIUM

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Objectives: MicroCT bone densitometry assumes a fixed relationship between reconstructed voxel grayscale and x-ray attenuation – a proxy of bone mineral concentration or “density”. However beam hardening artefacts make densitometry context-sensitive. Changes in thickness of both bone itself and surrounding media (water, alcohol, biological tissue) artificially change reconstructed density. This is significant since bone is frequently scanned in a living animal or in liquid filled tubes. Here a series of test scans of aluminium and water, surrogates of x-ray absorption of bone and soft tissue respectively, were conducted to assess these effects in common laboratory bone scanning protocols. The ability of software beam hardening correction (BHC) to mitigate the errors was assessed.

Methods: Test scans were done on aluminium tubes and rods with thicknesses from 0.127mm — 3mm, both in air or surrounded by up to 2cm water. Scans were performed with different energy filters and degrees of software BHC. Also tested were the effects of truncation (scanned object wider than the camera field of view), changing magnification and signal-to-noise ratio.

Results: Thickness of both aluminium and surrounding water significantly affected measured density. When scanned in air, the effect of changing aluminium thickness could be readily removed by BHC, but when scanned with a surrounding water layer, BHC was much less effective at correcting the aluminium thickness effect. However the effect of different thickness of surrounding water on density of aluminium of a specific thickness could be almost eliminated by finding an optimal BHC value. The “cupping” artefact of reconstructed density heterogeneity in uniform material, could be readily corrected if aluminium was scanned in air; however in water cupping correction was only possible with high filtration and maximal values of BHC. Scan truncation caused severe alteration of measured attenuation especially where the ambient medium was excluded from projections. Changes to magnification and signal-to-noise ratio also caused artificial changes to measured attenuation/density.

Conclusions: Measurement of bone mineral density by microCT is highly context sensitive. A surrounding layer of liquid or biological tissue reduces...
the ability of software BHC to remove density artefacts. Meaningful microCT bone densitometry is possible provided that scans are made with suitable filter, appropriate BH correction is applied, X-ray absorption outside the camera field of view (truncation) is minimal, and that as far as possible sample (and calibration phantom) dimensions and mounting are standardised. Densitometry is more accurate in the absence of surrounding media such as water or tissue.

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A MULTICENTER, RANDOMIZED, DOUBLE-BLIND, AND PLACEBO-CONTROLLED STUDY OF CHINESE ZUOGUI PILL AND YOUGUI PILL FOR IMPROVING BONE MINERAL DENSITY

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BACKGROUND: Bone mineral density (BMD) is a strong predictor of osteoporosis. The treatment of osteoporosis is to evaluate the efficacy and safety of natural Chinese herbs, Zuogui Pill (ZGP) and Yougui Pill (YGP), for low bone mineral density (BMD).

METHODS: 200 subjects were included double-blindly and randomly allocated into two groups, treatment and control. All subjects were diagnosed with low BMD and kidney deficiency in Traditional Chinese Medicine (TCM). Subjects in treatment group were treated for 6 months with either ZGP or YGP based on clinical characters of TCM, while control group received placebo for the same period of time. Primary outcome was lumbar BMD as determined by using dual-energy X-ray absorptiometry. Secondary outcomes included visual analogue scale (VAS), quality of life (ECOS-16), and serum markers of bone metabolism. Adverse effects were documented for safety assessment. Follow-ups were performed at regular intervals during a one-year period.

RESULTS: In ZGP group, lumbar BMD was increased by 4.1% immediately after treatment (P <0.05), and by 4.7% at the end of the additional 6-month follow-up. Bone anabolic marker was also significantly improved after treatment (P <0.05). In YGP group, the VAS and ECOS-16 scores were also significantly reduced after treatment (P <0.05). Furthermore, bone resorption marker was significantly suppressed after treatment in YGP group (P <0.05), and bone anabolic marker was significantly increased (P <0.05), respectively. No severe adverse effects were observed.

CONCLUSION: ZGP and YGP are effective and safe therapeutic drugs for osteoporosis, which improve lumbar BMD, reduce pain intensity, alleviate bone resorption, and stimulate bone formation.

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BONE MINERAL DENSITY IN POSTMENOPAUSAL WOMEN WITH ESSENTIAL HYPERTENSION

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BACKGROUND: Menopause represents a period when many physiological changes develop such as hypertension, a decrease in BMD, osteoarthritis and changes in bone quality.

METHODS: In Department of Clinical Physiology and Pathology of Locomotor Apparatus, Institute of Gerontology AMS Ukraine 115 women aged 46-78 (average age is 66±6.4) were subdivided into three groups: group I comprised 42 patients with hypertension (stage II (Kellgren & Lawrence, classification)), group II comprised 24 patients with hypertension second degree, group III (13 women) with stage II osteoarthritis combined with hypertension of the second degree. Bone mineral density (BMD) was determined by means of Dual-energy X-ray absorptiometer "Prodigy" (GE Medical systems).

RESULTS: BMD was decreased group III patients compared with women in I and II groups (0.97±0.05, 1.1±0.03 and 1.14±0.09 respectively P <0.05). This indicates an violation bone quality due to influence of hypertension on bone metabolism. These results point to necessity prescribe early treatment to improve bone quality in group III women aged 60-80 years.

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BONE MINERAL DENSITY OF THE LOWER EXTREMITIES IN DIABETIC POLYNEUROPATHY

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BACKGROUND: Diabetes affects over 170 million people globally. Peripheral diabetic polyneuropathy is one of the more debilitating complications arising from hyperglycemia, affecting 30-70 % of all diabetics and making it the most prevalent painful neuropathy. Although diabetic neuropathy occurs often and has characteristic clinical manifestations, it is typically poorly diagnosed, especially in the early stages of the disease. Cellular and molecular mechanisms of interaction of peripheral nervous system with a bone metabolism till now poorly studied. Different screening methods have reproduced different results.

AIM: The aim of this study to assess the bone mineral density (BMD) of the lower extremities in women in the postmenopausal period with diabetes mellitus (DM) type 2 and its dependence from diabetic peripheral polyneuropathy.

METHOD: This research have taken 51 women, average age 54.7±2.49 year with DM type 2, of whom 29 were diagnosed with distal polyneuropathy of the lower extremities. The control group consisted of 25 women, average age 52.2±2.15 year with no risk factors for reduction in BMD. Clinical evaluation comprised clinical and neurologic status, questionnaire related to osteoporosis (the Kanis, 2010), DN4, a visual analogue scale (VAS), scale NISLL. BMD was determined by dual-energy X-ray absorptiometry (DXA) ("Prodigy", GE Medical systems).

RESULTS: BMD (0.63±0.02) was significantly lower in patients with type 2 diabetes, complicated by distal polyneuropathy of the lower extremities, compared with either patients without polyneuropathy (0.83 ±0.05 (p=0.021)) or with healthy women (1.03 ±0.2 (p=0.045)). This data confirms the impact of diabetic polyneuropathy on bone metabolism. Future research will focus on these findings and comprise correlation with intensity of pain syndromes to determine the value of a personalized treatment approach.

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TRABECULAR BONE SCORE AND LOSS OF TEETH IN POSTMENOPAUSAL WOMEN WITH PARODONTITIS

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BACKGROUND: Menopause is the special period in women's life when many physiological changes develop simultaneously, for example, hypertension, decrease BMD, osteoarthritis, but, unknown how the quality of bone can changes.

METHODS: In Department of Clinical Physiology and Pathology of Locomotor Apparatus, Institute of Gerontology AMS Ukraine 115 women aged 46-78 (average age is 66±6.4) were subdivided into three groups: group I comprised 42 patients diagnosed with osteoarthritis (gonarthritis) roentgen phase II according to classification of Kellgren & Lawrence (1957), group II comprised 24 patients with hypertension second degree, group III (13 women) with gonarthritis of stage II in combination with hypertension of...