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Young Investigator Award

Abstracts

Title: **29 — IMPACT OF ISCD OFFICIAL POSITIONS ON INTERPRETATION OF FOREARM BMD**

Authors: ***Mary C. Schoeller, RT(R), CDT*** Radiology Technologist, HealthEast Osteoporosis Care; Christine Simonelli, Director, HealthEast Osteoporosis Care

Current ISCD official position statement advises the one-third radius should be used as the forearm region of interest. Prior to this, our practice used either the one-third radius or ultradistal radius site. The aim of this report is to evaluate the impact of changing to the one-third radius as the exclusive forearm region of interest. A consecutive sample of one hundred scans were reviewed. Scans were included if they had spine, femur and forearm acquisition on the same day. In all cases the forearm scan was indicated on the basis of significant artifact on the spine scan. In 38 (38%) scans, the lowest BMD value was recorded at either the one-third radius or ultradistal radius. Twenty-two (22%) patients were given a presumptive diagnosis of osteoporosis based on the ultra-distal region of interest alone. Nine (41%) of these were osteopenic and 13 (59%) were normal at all other sites. Seven (7%) patients had a diagnosis of osteopenia based on the ultra-distal region of interest alone. Applying a revised protocol to comply with the ISCD position statement, 8 (8%) patients had a diagnosis of osteoporosis and 10 (10%) patients had a diagnosis of osteopenia based on the one-third radius scan. Twenty-two (22%) of scans had a change in diagnostic classification: from osteoporosis to osteopenia (9, 9%) or osteoporosis to normal (13, 13%). Seven (7%) patients diagnosed as osteopenic were normal. The new ISCD position statement has impacted our clinical bone density interpretation and rate of diagnosis of osteoporosis.

Title: **49 — BONE MINERAL DENSITY TRENDS IN PATIENTS WITH INFLAMMATORY BOWEL DISEASE**

Title: ***Vidhya Subramanian, MD*** Assistant Professor of Medicine, LSUHSC/VAMC, Shreveport, LA; Subhashini Yaturu, Associate Professor of Medicine, LSUHSC/VAMC, Shreveport, LA

The aim of our study was to compare the bone mineral density (BMD) of subjects with inflammatory bowel disease (IBD) to age and sex matched controls and follow BMD trends in IBD subjects on anti-resorptive agents. BMD was measured at the lumbar spine and femoral neck sites by dual energy X-ray absorptiometry (DXA) using Lunar Prodigy. Demographic data, smoking and alcohol use, steroid use, IBD duration and 25-hydroxy Vitamin D levels (when available) were recorded. Paired t-test was used to analyze the differences in serial BMD. A total of 21 subjects with IBD were included, mean age was 60.2 years (range 33-86). Mean IBD duration was 14.6 years (range 2-35). Mean T-score at the AP spine was 1.07 (+1.4) and 1.9 at the femoral neck (+0.9). IBD subjects had significantly lower BMD at all sites ($p<0.001$). Patients with lower body mass index tend to have bone loss at the hips but no association was seen between BMD and duration of IBD, steroid use or vitamin D levels. Follow up DXA of 12 subjects with IBD at mean duration of 21 months was compared to the baseline DXA. Seven subjects were on corticosteroids and ten subjects were on anti-resorptive agents. There was no significant difference in the BMD at the AP spine, total hip or femoral neck sites on follow-up.

We conclude that subjects with IBD have low BMD but there is no progressive decline in BMD with addition of antiresorptive agents despite continued steroid use.

Title: 20 — MEASUREMENT OF TIBIAL SUBCHONDRAL BMD IN THE KNEE USING DXA

Authors: ***Low Siew-Leng,*** Technologist Senior Lab Officer, Dept of Orthopaedic Surgery, National University Hospital; Wong Pui-San, Dept of Orthopaedic Surgery, National University of Singapore; Xu Yue-ping, Orthopaedic Diagnostic Centre, National University Hospital; Das De Shamal, Dept of Orthopaedic Surgery, National University of Singapore; Wong Pui-San, Dept of Orthopaedic Surgery, Lab Officer; Xu Yue-ping, Orthopaedic Diagnostic Centre, Technician; DasDe Shamal, Dept of Orthopaedic Surgery, Professor

The aim of this study is to validate a technique to measure tibial subchondral BMD in normal and OA knees using DXA. 30 subjects were scanned using a Norland XR-36 DXA scanner. The knee to be scanned was positioned with the patella facing upwards. To determine the intra-operator error in positioning, 5 subjects were scanned 3 times each, with re-positioning of the knee after each scan. Regions of interest (ROI) were placed in the lateral and medial compartments of the tibial subchondral bone. Medial and lateral ROI were determined by measuring a distance 10 mm distal to the tip of the tibial spine, which was used as a reference point. The height of each ROI was 5.0 mm and is defined within two rectangles either medially or laterally to the edge of the image. To determine the inter-operator variation in the placement of ROIs, 3 operators independently analysed both knees of 14 subjects with normal knees and the unaffected knee of 16 subjects with OA knee. The precision of the intra-operator positioning was 2.2% for the medial ROI and 1.6% for the lateral ROI in normal knees. In OA knees, the precision error increased to 3.8% and 2.0% in the medial and lateral ROI respectively. DXA is a reliable technique which can measure subchondral tibial BMD with good precision. This method may be used to prospectively monitor the progression of knee OA.

Title: 58 — LASER-ASSISTED DXA OF THE HEEL VERSUS CENTRAL-DXA

Authors: ***Peter Olsson, PhD*** Student Student, Uppsala University, Sweden; Osten Ljunggren, Professor of Internal Medicine, Uppsala University, Sweden; Hans Mallmin, Assoc Professor of Orthopedic Surgery, Uppsala University

The WHO osteoporosis definition criterias and the ISCD guidelines are based on BMD-measurements of the lumbar spine, proximal femur and distal forearm. Although only valid for Caucasian postmenopausal females, the same cut-offs are often also applied for males. BMD-measurements of the heel have been proposed as an osteoporosis-screening tool. The DXL Calscan® combines a laser-measured diameter of the calcaneus with a DXA-scan of the calcaneus and claims to be able to differentiate between calcaneal bone and the adipose tissue inside and adjacent to the bone. We compared heel-BMD to central-DXA lumbar spine-BMD and proximal femur-BMD to evaluate the sensitivity and specificity for the DXL Calscan®.

A population-based cohort of 189 Caucasian males, m=73.9 yrs (range 70.5-79.9) were measured with the DXL Calscan®. A Swedish reference-population (T-score) was applied. At the same visit, central DXA-measurements with Prodigy, Lunar/GE®, were performed on the lumbar spine and proximal femur. The manufacturers North American Caucasian male reference-population was applied to create male "osteoporosis" cut-off criterias (T-scores). Simple regression analysis was performed for comparison between heel-BMD and lumbar spine and proximal femoral BMD's. Sensitivity and specificity for T-score -2.5 was calculated accordingly.

Simple regression analysis revealed significant r^2-values: 0.30 (L1-L4), 0.35 (Neck), 0.43 (Total Hip) and 0.44 (Trochanter). The specificity T-score -2.5 or less varied between 97-98% whereas the sensitivity was considerably lower, from 22 % (L1-L4) to 42 % (Trochanter).

Based on data from the population-based cohort of Swedish Caucasian males the heel-BMD measured with the DXL Calscan® has a consistently high specificity but a low sensitivity.

Title: **50 — OPTIMIZATION OF MR-RELAXOMETRY FOR BMD-MEASUREMENTS AND ITS CORRELATION WITH DEXA**

Authors: ***Morteza Bakhtiary, MSc*** MSc of Medical Physics,Medical Physics Department, Tehran University of Medical Sciences; Nader Riyahi-Alam, Assisstant Prof.,Ph.D, Medical Physics Department, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran; Mohammad Ali Oghabian, Assisstant Prof., Ph.D, Medical Physics Department, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran; Ali Ghasemzadeh, MSc of Medical Physics,Medical Physics Department, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran; Hossein Qanaaty,Assisstant Prof.,Ph.D, Radiology Department, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran

The aim of this study was to optimize MRI conventional protocols for BMD measurements using MR-Relaxometry in systems not facilitated with special multi echo protocols. Since, cortical and trabecular bone separation can not be performed in DEXA, so the results might lead to erroneous interpretation of BMD values. One method for bone quality determination is MR relaxometry that derives R2(=1/T2), R2*(=1/T2*) and R2 (=R2*-R2). This study was performed by 1.5T MRI system(Picker Vista-Q800), an uniformity phantom(1.25gr/l CuSO4, with T2=200ms for calibration), a body RF-Coil, 12 normal, 9 osteopenia, 7 osteoporosis volunteers and Lunar DEXA system(DPX-MD). To determine R2* and R2, multi GE and SE protocols with different TE/TR were used. Then in phantom and in coronal section of femoral-neck, relaxation rates were compared with BMD. The slope of neperian-logarithm of signal vs. TE in GE as -R2* used for protocol optimization. Therefore, for phantom calibration, optimized GE parameters of TE=13.42/18/26.8 ms, TR=800ms and ST=8mm used for the measurement of R2*, while, the measurement of R2 required the optimized SE parameters of TE=30/60/90/120ms, TR=800ms and ST=8mm, with CV(R2*)=2.96%, CV(R2)=3%, respectively. In volunteers for SE, TE of 36/54/63/72ms and TR=800ms were used, while, for GE the TEs/TR were the same as those of phantom study. R2* and R2 showed a significant positive correlation with BMD, $r=0.62(p<0.05)$ & $r=0.62(p<0.05)$ respectively. Finally, in accordance with DEXA values, the results showed that MR-Relaxometry is a proper tool for BMD-measurements in femoral-neck. Also it may be used as a complement method for DEXA failure in BMD-assessments.