IBDW2014-00117-F0045
A NOVEL 3D QCT TECHNIQUE TO QUANTIFY THE MUSCLE-LIPID-
COMPOSITION IN THE THIGH AND ITS ASSOCIATION WITH FRACTURE OF THE PROXIMAL FEMUR

Alexander Mühlberg 1, Oleg Museyko 1, Bastian Gerner 1, Dominique Töpfer 1, Valerie Bousson 2, Jean-Denis Laredo 3, Klaus Engelke 4

1Institute of Medical Physics, Friedrich-Alexander-University Erlangen-Nürnberg, Germany
2Service de Radiologie OstéoArticulaire, Assistance Publique-Hôpitaux de Paris, Hôpital Lariboisière, Paris, France

Introduction: The characterization of muscle morphology and function is important in sarcopenia and other muscle diseases. CT imaging has been used to quantify muscle volume and density. Here we developed a new analysis technique to also quantify the spatial muscle-lipid distribution. CT is widely available, scan times are short and the appendicular skeleton radiation exposure is low. It was the specific aim of this study to apply this new technique to discriminate patients with acute femur fractures from unfractured controls.

Methods: The 3D QCT analysis consists of a semiautomatic segmentation of the skin and of the fascia, which separates subcutaneous adipose tissue (SAT) and intermuscular adipose tissue (IMAT). Inside the fascia in each voxel muscle and lipid concentrations were determined based on the CT value relative to that of SAT. In addition to standard parameters (adipose tissue and muscle volume and density), the muscle-lipid-distribution was analyzed using structural descriptors such as texture, topology, or roughness. The new method was applied in QCT-datasets (120K, 170mAs, slice thickness 1 or 1.25mm, pitch 1) of 91 patients of the EFFECT-Study (36 patients with fresh fractures) and 51 controls. For fracture discrimination, the best subset analysis was performed to construct multivariate models consisting of soft tissue or BMD descriptors that were selected by univariate analysis adjusted for age and BMI.

Results: The figure shows the muscle-lipid segmentation results. The table shows Area-Under-Curve (AUC) of a BMD model (parameters: troch trab BMD B neck cort thick) and a soft tissue model (parameters: local inhomogeneity of muscle, local anisotropy (directedness) of adipocytes within the muscle and percentage of muscle tissue). In the EFFECT cohort, the combination of the soft tissue and bone model achieved the best discrimination. The discrimination was stable to simulated added noise. A model of standard parameters like muscle density and volume added only little discriminative power compared to the bone model alone.

Conclusion: The analysis of the structural muscle-lipid distribution using a novel 3D QCT analysis technique may contribute to the understanding of hip fracture etiology. In contrast, simple measurements of lean and fat volume did not give comparable results.

Figure: Left: VOI used for muscle analysis; Center: fractured subject: high local anisotropy of adipocytes within the muscle and high muscle inhomogeneity; Right: Non-fractured subject.

Table: ROC-AUC of bone mineral, soft tissue and a combined model.

<table>
<thead>
<tr>
<th>Models</th>
<th>AUC [CI] (170 mAs)</th>
<th>AUC [CI] (135 mAs)</th>
<th>AUC [CI] (100 mAs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bone Mineral Model</td>
<td>0.80 [0.72; 0.90]</td>
<td>0.90 [0.83; 0.96]</td>
<td>0.86 [0.78; 0.94]</td>
</tr>
<tr>
<td>Soft Tissue Model</td>
<td>0.90 [0.80; 0.96]</td>
<td>0.90 [0.83; 0.96]</td>
<td>0.86 [0.78; 0.94]</td>
</tr>
<tr>
<td>Combined Model</td>
<td>0.96 [0.88; 0.99]</td>
<td>0.94 [0.90; 0.99]</td>
<td>0.94 [0.90; 0.98]</td>
</tr>
</tbody>
</table>

IBDW2014-00118-F0046
ICARITIN PROTECTS POSTMENOPAUSAL OSTEOPOROSIS VIA THE AKT/ GSK-3β/J-CATENIN SIGNALING PATHWAY IN 3T3-L1CELS

Linying Wang a, b, Nan Wang a, b, Xin-Luan Wang a, b, Hui-Juan Cao a, b, Ling Qin a, d

aTranslational Medicine R&D Center, Shenzhen Institutes of Advanced Technology Shenzhen, 518055, China
bShenzhen Bioactive Materials Engineering Lab for Medicine, Shenzhen, PR China
cNano Science and technology Institute, The University of Science and Technology of China, Suzhou, China
dDepartment of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong

Introduction: Postmenopausal osteoporosis is highly associated with the increase in marrow adipogenesis and controlling the differentiation of mesenchymal stem cells to either osteoblasts or adipocytes has been reported as one of the mechanisms. Icaritin, a hydrolytic product of Icariin, which is an active molecular compound from Epimedium-derived flavonoids have the effect on preventing postmenopausal osteoporosis, but its underlying mechanisms remains to be identified.

Methods: The 3T3-L1 fibroblasts were differentiated into adipocytes by the differentiation medium (high-glucose DMEM containing 10% FCS, 1mM L-glutamine, 300μM isobutylmethylxanthine or Bt2CAMP, 1μM dexamethasone, and 1μM insulin) with the absence or presence of Icaritin, and the cells were harvested for Oil Red O staining and RT-PCR. LY294002, a PI3K inhibitor, was able to inactivate Akt/PI3K and used as a tool to test whether icaritin directly