#1824 - Posters

How Does The Hip Fossas Cellular Architecture Change With Age And Arthritis?

Orthopaedics / Pelvis, Hip & Femur / Epidemiology, Prevention & Diagnosis

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Background
The biological processes associated with the development of Hip Osteoarthritis (OA) remain poorly understood. The Intra-articular Adipose Tissue (IAAT) has surfaced as a potential key player in the regulation of synovial joint homeostasis, as per knee-based studies.

Objectives
This study aims to determine how the cellular (including mesenchymal stem cell (MSC) profile and the microenvironment of the hip's IAAT change with age and with the development of OA.

Study Design & Methods
This is a prospective, IRB-approved, study. IAAT samples from the hips acetabular fossa were obtained from 40 consenting patients that underwent hip surgery (inclusion criteria included BMI <35 and the absence of inflammatory arthropathy or AVN). Patients fell into one of four groups: (1) young patients (<20 years), without OA undergoing hip arthroscopy; (2) young patients (20 – 40 years), without OA undergoing hip arthroscopy; (3) young patients (<40 years) with OA undergoing arthroplasty; and (4) old patients (>70 years) with OA undergoing arthroplasty. Comparisons between groups 1 & 2 and 3 & 4 allow for age-related comparisons and comparisons between groups 2 & 3 allow for OA-related comparisons. Using 3D confocal microscopy imaging we compared the MSC content, adipocyte composition, innervation, and immuno-infiltration of the tissue between the different groups.

Results
Significant differences in the cellular content and micro-environment were identified between groups. The number and density of adipocytes increase with age and with OA (1118/hpf vs. 1981/hpf; $p<0.05$). However, the volume (1.87E+05um^3 vs. 1.23E+05um^3) and sphericity (0.40 vs. 0.42) of adipocytes as well as their innervation (adipocytes innervated: 39% vs.24%; p,0.05; mean fiber size: 1.5E+03um^3 vs. 5.4E+03um^3) decreases with age and OA. Patients with OA also appear to have a much higher immuno-infiltration compared to patients without OA. The MSC content of young patients without OA (Groups 1 & 2) is much smaller and thus their capacity to grow and differentiate in culture is reduced compared to patients with OA (Groups 3 & 4). Additionally, tissues from young and old patients with OA both highly express markers of senescence.

Conclusions
The distinct cellular and micro-environmental changes identified provide cellular mechanistic insights into aging and OA development. Ageing reduces size and innervation of adipocytes, however in the absence of OA there appears to be no/small amounts of senescence MSC presence (a marker of biological attempt of healing). Hip OA, affects adipocytes number, volume and innervation and increases immune infiltration as well as the expression of senescence markers in MSCs, highlighting a highly biologically active, inflamed microenvironment. Future research should focus on molecular expression of these cellular lines.