Using aggrecan as a molecular biomarker to monitor accelerated disc degeneration in the spine

Purpose
In cartilage disc tissues and in serum samples from patients who had surgery for disc degeneration and from healthy individuals, evaluate the pattern and concentrations of specific aggrecan fragments.

Background and clinical significance
Disc degenerative disease is a major health problem both out of health economic view but also out of the affected person’s view in terms of disability and severe pain. There are difficulties in establishing a correct diagnosis and difficulties in identifying patients who benefit from surgery. In 2012, approximately 2300 disc herniation surgeries were registered in Sweden according to the annual report of the Swedish Spine Register. Degeneration of the disc leads to spinal diseases such as herniated disc and spinal stenosis. The early and accelerating degeneration of the disc is a complex interaction between molecular and genetic factors, and environmental factors such as smoking and chronic inflammation. The degenerative process starts with a change in the extra cellular matrix of the disc which leads to lower level of proteoglycans (mainly aggrecan and versican), together with higher synthesis of type I collagen and a loss of type II collagen. Altered levels and structural changes of various proteins, such as aggrecan are critical in the degenerative process. With the loss of aggrecan, nucleus pulposus loses the ability to absorb fluid and the intra-disc pressure decrease, followed by decrease ability for remodeling. At the same time, the ability of the annulus fibrosis to resist extended loads decreases.

Accelerating degenerative processes are present in severe diseases of the spine, such as disc herniation. Since this research field is underdeveloped, the need of increasing knowledge in this area is therefore urgent, especially in comparison with other research of degenerative diseases such as osteoarthritis. It is possible that studying molecular biomarkers for accelerating degenerative processes will provide knowledge about these biomarkers, making it possible to identify patients at risk for disease at the primary health care level.

Project description
All human tissues and bio-fluids have been collected. In this summer-project, which is part of a larger PhD-project, we will from lumbar discs (L4-L5 and L5-S1) extract extra cellular matrix proteins from: (A) patients who had surgery for herniated disc (n=11); (B) healthy individuals (n=12). With glycosaminoglycan, Western blot and electrochemiluminescence analysis, we will then investigate the pattern and concentrations of aggrecan fragments in the extracted discs samples and from serum (n=29 patients and n=11 healthy individuals). We hypothesize that - there is a difference in levels and pattern of aggrecan fragment in the cartilage tissues from patients with degenerative discs compared to individuals without back problems. The project has been approved by the regional boards of ethics in Lund (Dnr 2012812).

André Struglics, PhD, Associate professor
Lund University, Faculty of Medicine
Dept of Clinical Sciences Lund, Orthopaedics

BMC C12, Klinikgatan 28
SE-221 84 Lund, Sweden
Email, andre.struglics@med.lu.se
Tel, +46-46-222 0762