Association of Vertebral Bone Marrow Edema with Low Back Pain in Degenerative Lumbar Scoliosis in the Elderly: A Cross-sectional Observational Study

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Introduction: The symptoms of degenerative lumbar scoliosis (DLS) in the elderly are low back pain (LBP) and leg pain. However, the cause of LBP is unclear. Some MRI studies investigated the correlation between pain and bone marrow edema (BME) in osteoarticular diseases. We speculated that BME adjacent to the vertebral endplate at the concave side of scoliosis would be correlated with LBP in elderly DLS patients. The purpose of this study was to evaluate the correlation between vertebral BME on magnetic resonance imaging (MRI) and LBP in elderly DLS patients.

Methods: From 2002 to 2004, 120 DLS patients over 65 years were enrolled. Of these patients, 64 with LBP were allocated to LBP group, and 56 without LBP to control group. DLS was defined as de novo DLS with a Cobb’s angle > 10°, developing after bone maturation without previous history of scoliosis. LBP was defined as axial pain in the area from lower margin of the thorax to the iliac crest. Patients whose LBP was improved by facet joint block were excluded. Clinical characteristics, radiographic factors, MRI findings and physical findings between LBP and control group were investigated. We compared between both groups on the following factors. 1) clinical characteristics: age, gender, body mass index, duration of LBP and visual analog scale of LBP (0-100mm), 2) radiographic parameters: Cobb’s angle, scoliotic curve laterality, and location of intervertebral vacuum and vertebral endplate sclerosis, 3) MRI: frequency and distribution of BME positive intervertebral levels and BME score, and 4) physical findings: identification of the daily pain by tenderness of lumbar spinous process in prone position. BME was evaluated using gadolinium-contrasted T1-weighted fat-saturated or T2-weighted fat-saturated coronal sections. We defined BME as the high signal intensity area, and classified and scored into three grades. Grade 0 (no findings of BME, score 0), grade 1 (BME size in less than half of the height of vertebral body, score 1), and grade 2 (BME size in half or more of the height of vertebral body, score 2). The radiographic and MRI findings were evaluated by two spine specialists. The intra- and inter-reader kappa value was 0.80 (p<0.001) and 0.79 (p<0.001).

Results: In LBP group, severe LBP (VAS score, mean 83.5 ± 29.4 mm) had persisted long periods (37.4 ± 40.2 months). There was no significant difference for any other clinical characteristics and radiographic parameters. However, BME was significantly appeared in LBP group (96.9%) more than control group (37.5%). The mean BME score was significantly higher in LBP group (1.5 ± 0.6) than in control group (0.4 ± 0.6). BME was located significantly more frequently on the concave side of scoliosis. The daily pain was significantly confirmed in LBP group. In LBP group, the spinal level of tenderness was practically identical to the BME level (kappa value, 0.79, p<0.001). In logistic regression analysis, the highest odds ratio was BME grade 2 (OR, 121.40; 95%CI, 11.21-1315.08; p<0.001) among the factors of LBP. The correlation was noted between VAS and BME score (r = 0.724; p<0.001).
Discussion: Our results show that BME in DLS is associated with LBP. BME was much more prevalent in patients with LBP than in those without it. In patients with LBP, we found a substantial correlation between BME score and LBP severity. Thus, our results suggest that BME contributes to the occurrence of LBP. In addition, BME was more prevalent on the concave side of scoliosis. We speculate that LBP is attributable to biomechanical stress on the vertebral endplate on the concave side of scoliosis.

Significance: We propose that BME adjacent to the vertebral endplate in DLS is associated with LBP. In DLS patients, the biomechanical stress loaded on the vertebral endplate at the concave side of scoliosis might be the causes of LBP.