Staged-injection procedure to prevent cement leakage during vertebroplasty: An in vitro study.

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Abstract:

STUDY DESIGN. Fibrin sealant (FS) combined with or without growth factor was used to improve the micro-architectural and biomechanical properties of vertebral body in osteoporotic ovine spine. OBJECTIVE. To analyze the treatment effects of bovine bone morphogenetic protein (bBMP) combined with FS on osteopenic ovine vertebral architecture, bone mineral density, and biomechanics in vivo. SUMMARY OF BACKGROUND DATA. Vertebroplasty and kyphoplasty were used to treat spinal osteoporosis. They can increase strength of vertebrae physically. However, each has specific disadvantages. bBMP could rapidly increasing bone formation and suppressing bone resorption, but little is known about its effect on ovariectomized-induced osteoporosis. METHODS. Six sheep underwent ovariectomy and were placed on a low-calcium diet. Twelve months later, according to Ladin square design, L4-L6 vertebrae in all sheep were randomly assigned to 3 treatment groups: A (30 mg bBMP/1.5 mL FS), B (30 mg bBMP) and C (1.5 mL FS). All materials were injected into the assigned vertebra transpedicularly. Animals were killed 3 months after injection, and bone mineral density (BMD), biomechanics, and histomorphometry were assessed. Analysis of variance was used to determine effects of bBMP/FS (alpha = 0.05). RESULTS. The BMD in Group 1 was 17.1% and 14.7% higher than that in Group 2 and Group 3, respectively. The micro-CT reconstruction analysis showed that the density and connectivity of trabecular bone in bBMP/FS treated vertebrae were higher than those in control groups. The mechanical properties (yield stress, ultimate stress, energy absorption, bone modulus) of the vertebrae were also significantly higher. In this study, local bBMP/FS treatment showed a positive

trend in improving BMD, histomorphometric parameters, and mechanical strength of osteoporotic vertebra. Slow release of bBMP using FS appeared to be an effective method of protein delivery. CONCLUSION. The use of bBMP/FS in the treatment of vertebral osteoporosis in an attempt to enhance bone strength merits further study.