Introduction: Alendronate, which is a potent inhibitor of bone resorption, has been widely used clinically for treatment of osteoporosis, and reported excellent clinical outcomes for patients with osteoporosis. Physiological mechanisms of alendronate include the inhibition of osteoclast formation from its precursors. Inhibition of alendronate is thought to induce adverse effects for spine fusion. Although it has been reported that alendronate inhibits spine fusion in a normal animal, it is still unknown whether alendronate affects integrity of bony fusion in the osteoporotic spine. The aim of this study was to assess the effect of alendronate on spine fusion in an osteoporotic animal model.

Materials and Methods: Twenty-four female Sprague-Dawley rats were targeted in this study. Six-week-old rats underwent either sham-operated (Sham) or bilateral ovariectomy (OVX). Eight weeks after the first surgery, animals underwent intertransverse fusion with autologous bone (0.3 g/one side) harvested from tail at L5-6. Then they received vehicle (Control) or 70 μg/kg/week alendronate (Aln) for 8 weeks. Animals were divided into four groups: Sham-Control (N=6), Sham-Aln (N=6), OVX-Control (N=6), OVX-Aln (N=6). 8 weeks after fusion operation, animals were euthanized and the lumbar spines were removed. Each intertransverse fusion was assessed by following evaluation parameters. A bone radiograph of graft bone was taken with a soft x-ray apparatus. A radiographic fusion of grafted area was evaluated. The fusion was evaluated as solid or not solid by two examiners in a blinded fashion, based on the presence of a continuous trabecular pattern within the intertransverse fusion mass. They were graded as solid only when both observers agreed. Bone mineral density (BMD) in fusion bone was measured by peripheral quantitative computed tomography (pQCT) scanning techniques. And measurement of cross-sectional area was performed with pQCT. Bone mineral density (BMD) in fusion bone and cross-sectional area of graft bone at L5-6 disc level. The BMD in Sham-Control group was significantly higher than that in Sham-Aln group (P<0.01; Mann-Whitney test). Cross-sectional area in OVX-Control group was significantly larger than that in OVX-Aln group (P<0.01; Mann-Whitney test).

Discussion: The most important thing is to achieve spine fusion in the osteoporotic spine. Our results suggest that alendronate is effective for radiological, biomechanical and histological successes of spine fusion in an osteoporotic animal model. In the previous studies, in which alendronate was used for spine fusion in animal models and manual palpation was only used for evaluation of solid fusion, alendronate might not affect or inhibit spine fusion. In the present study, however, we used a bone strength measuring apparatus to assess the ultimate load and stiffness at the fused segment. This methodology can biomechanically evaluate the actual fixation of the fused segment. Alendronate might result in inhibition of bone resorption with regard to radiograph, pQCT and histological analyses. In the present study, we demonstrated that alendronate decreased the stiffness of the intertransverse graft in sham-operated group but increased in OVX group. Collectively, alendronate may effective for spine fusion in patients with osteoporosis.