Feasibility of Percutaneous Posterolateral Spinal Fusion With Recombinant Bone Morphogenetic Protein-2 (rhBMP-2)  
A Comparison With Standard Methods Using an Animal Model Study  
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Background Context The clinical application of recombinant bone morphogenetic protein in spinal surgery has been shown to be safe and effective. However, its use in minimally invasive spine surgery has been limited to anterior interbody fusion procedures. To date, no study has evaluated the feasibility of percutaneous posterolateral fusion in the spine utilizing recombinant bone morphogenetic protein-2 (rhBMP-2).  

Purpose: To evaluate the feasibility of percutaneous posterolateral fusion in the spine utilizing rhBMP-2.  

Study Design: Animal study.  

Methods: This is an animal research model involving 32 New Zealand white rabbits stratified into 4 study groups: control, autogenous iliac crest bone graft (ICBG), demineralized bone matrix (DBM), and rhBMP-2 groups, with 8 study subjects per group. The rhBMP-2 group was subdivided into the open technique (right side) and the percutaneous technique groups (left side). Fusion was graded at 6 weeks and 3 months after plain radiography, computed tomography, and clinical assessment with the following grading system: grade A, no bone formation; grade B, non-bridging bone formation; grade C, fusion; and grade D, fusion with ectopic bone formation.  

Result: No fusion was noted in the placebo and the DBM groups. However, in the DBM group, bone formation occurred in 37.5% of the subjects. The rhBMP-2 group had a higher fusion rate compared with the ICBG group at 6 weeks and 3 months. The fusion rate for the ICBG, the rhBMP-2 (open), and the rhBMP-2 (percutaneous) groups were 7.5%, 87.5%, and 50%, respectively, at 6 weeks and 50.0%, 100.0%, and 62.5% at 3 months, respectively. Ectopic bone formation occurred in 12.5% of the cases in the rhBMP-2 (percutaneous) group and in 25.0% of the cases in the rhBMP-2 (open) group.  

Conclusions: Usage of rhBMP-2 is feasible for percutaneous posterolateral fusion of the lumbar spine in this animal model. Moreover, a more precise delivery system might improve the fusion rate when the percutaneous technique is used. A significant rate of ectopic bone formation occurred when rhBMP-2 was used.  

Key Words: percutaneous posterolateral spinal fusion, recombinant bone morphogenetic protein-2, rhBMP-2, animal study.  

Surgical fusion is one of the most commonly performed operations for a variety of surgical indications. Techniques to enhance fusion rates have concentrated on providing a better mechanical environment for fusion and on the use of osteoinductive and osteoconductive agents to promote bone growth. Autogenous bone graft has long been considered to be the “gold standard” material for spinal fusion procedures. However, harvesting of autogenous bone graft from the iliac crest is associated with various morbidities. Since the discovery of bone morphogenetic protein (BMP) by Urist in 1965 and research in the use of BMPs for spinal fusion has intensified. The efficacy of BMPs in promoting fusion has been proven in many animal research models and in clinical research. Off-label use of BMPs has increased as more studies have demonstrated the efficacy of this agent in posterior fusion of the spine for either single-level or multilevel deformity surgery, in transforaminal lumbar interbody fusion/posterior lumbar interbody fusion procedures, and in anterior and posterior cervical fusion surgery. Although concerns regarding the safety of BMPs have been raised in the literature, in posterospine fusion, most published reports have confirmed the safety of BMPs for this indication. The evaluation of spinal technologies has