AJNR

Significance of Early CT Evaluation after Lumbar Interbody Fusions Using Recombinant Human Bone Morphogenetic Protein-2

T. Smoljanovic, I. Bojanic and T. Dapic

AJNR Am J Neuroradiol published online 26 February 2009
http://www.ajnr.org/content/early/2009/02/26/ajnr.A1499.citation

Published February 26, 2009 as 10.3174/ajnr.A1499

Significance of Early CT Evaluation after Lumbar Interbody Fusions Using Recombinant Human Bone Morphogenetic Protein-2

Williams et al[1] proposed a radiographic protocol consisting of CT scans obtained at 3, 6, and 12 months, with an additional scanning at 24 months if a solid fusion was not seen earlier in evaluating lumbar interbody fusions (LIF) (with special emphasis on using the recombinant human bone morphogenetic protein-2 [rhBMP-2] as a bone graft substitute). The question is why the scannings were scheduled at those intervals, especially because no patient is likely to show healing of the fusion as early as 3 months after surgery, and why they were performed in all patients, even in those who were pain-free and with successful clinical status.[2]

LIF using rhBMP-2 can result in transient bone resorption of vertebral bodies or cystic changes within the endplates adjacent to the implant.[3] All reported or unreported but later discovered[4] bone resorptions occurred when the rhBMP-2–soaked collagen sponge was in direct contact with the bone of vertebral bodies,[3] creating local rapid increase of rhBMP-2, which resulted in transient osteoclastic resorption preceding bone formation (T. Smoljanovic et al, unpublished data, 2008). Depending on the size of the contact area between the rhBMP-2–soaked collagen sponges and the endplates, the size of resorptions of vertebral bodies varied. A larger area of direct contact was created either by placing of additional rhBMP-2–soaked sponges between different interbody spacers or by the construction of interbody spacers that allowed direct contact of the vertebral endplates and the rhBMP-2–soaked sponge within them, as in the case of femoral ring allografts. The incidence of reported vertebral bone resorptions after the use of rhBMP-2 in direct contact with vertebral bodies varied from 7% to 100%.

Most reported bone resorptions of vertebral bodies were first noticed by CT, usually 3 months after the LIF assisted by rhBMP-2 (T. Smoljanovic et al, unpublished data, 2008). The changes usually were not visible on plain radiographs at the time. The resorptions were observed as unanticipated adverse findings without pain during scheduled follow-up examinations in more than half of the reports. In the remaining studies, patients with pain in the early postoperative period (1–3 months) and patients in whom significant graft subsidence had occurred on plain radiographs underwent CT, which then revealed bone resorptions.

Because the resorptions of vertebral bodies after the LIF using rhBMP-2 resulted in many cases with spacer subsidence, loss of correction, spacer dislodgment, and nonunions, the importance of early CT follow-up, even in asymptomatic patients, is significant, at least until surgeons are able to avoid larger areas of direct contact between the rhBMP-2–soaked collagen sponge and the bone of vertebral bodies or until the manufacturers improve the carrier of rhBMP-2. Positive early findings of cystic changes within the endplates after the LIF using rhBMP-2 will determine the restriction of activity for the patient. The residual loss of correction and nonunions will depend on the size of the resorption area; the remaining stability of spinal structures, including additional stabilization if placed; and the patient's activity during the resorption phase of bone regeneration. Although some experts doubt that restricted activity will allow solid fusion once the implants have loosened,[2] in the case of rhBMP-2–caused bone resorptions, most patients with the resorptions finally healed within 2 years after the LIF using rhBMP-2 (T. Smoljanovic et al, unpublished data, 2008).

References

1. Williams AL, Gornet MF, Burkus JK. **CT evaluation of lumbar interbody fusion: current concepts.** *AJNR Am J Neuroradiol* 2005;26:2057–66
2. Lebwohl NH, Williams AL, Gornet MF, et al. **Radiographic evaluation of the postoperative interbody fusion patient: is CT the study of choice?** *AJNR Am J Neuroradiol* 2005;26:1885–87
3. Smoljanovic T, Grgurevic L, Jelic M, et al. **Regeneration of the skeleton by recombinant human bone morphogenetic proteins.** *Coll Antropol* 2007;31:923–32
4. Smoljanovic T, Pecina M. **Re: Burkus JK, Transfeldt EE, Kitchel SH, et al. Clinical and radiographic outcomes of anterior lumbar interbody fusion using recombinant human bone morphogenetic protein-2. Spine 2002;27: 2396–408.** *Spine* 2008;33:224

T. Smoljanovic
Department of Orthopaedic Surgery
School of Medicine
I. Bojanic
Department of Orthopaedic Surgery
Clinical Hospital Center Zagreb
T. Dapic
Department of Orthopaedic Surgery
School of Medicine
and
Department of Orthopaedic Surgery
Clinical Hospital Center Zagreb
Zagreb University
Zagreb, Croatia

DOI 10.3174/ajnr.A1499