

Guidelines for the performance of fusion procedures for degenerative disease of the lumbar spine. Part 11: interbody techniques for lumbar fusion

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Recommendations

Standards. There is insufficient evidence to recommend a treatment standard.

Guidelines. In the context of a single-level stand-alone ALIF or ALIF with posterior instrumentation, the addition of a PLF is not recommended as it increases operating room time and blood loss without influencing the likelihood of fusion or the functional outcome.

Options. 1) It is recommended that both PLF and interbody fusion (PLIF, TLIF, or ALIF) techniques be considered as treatment options for patients with low-back pain due to DDD at one or two levels. 2) Placement of an interbody graft is recommended as a treatment option to improve fusion rates and functional outcome in patients undergoing surgery for low-back pain due to DDD at one or two levels. The surgeon is cautioned that the marginal improvement in fusion rates and functional outcome with these techniques is associated with increased complication rates, particularly when combined approaches (that is, 360°) are used. 3) The use of multiple approaches (anterior

or and posterior) to accomplish lumbar fusion is not recommended as a routine option for the treatment of patients with low-back pain without deformity.

Rationale

The surgical treatment of low-back pain has evolved over the last several decades, and interbody techniques have been proposed as surgical alternatives to posterolateral lumbar fusion. Placement of the graft within the load-bearing column of the spine has biomechanical advantages and has been reported to result in higher fusion rates with improved patient outcomes compared with PLF techniques. A variety of techniques are available for the application of interbody grafts, and each technique has its particular advantages, disadvantages, and champions. The purpose of this review is to examine the literature reporting experience with interbody fusion techniques and their relative safety and efficacy compared with posterolateral fusion techniques for the treatment of patients with low-back pain.

Literature Search

A computerized search of the National Library of Medicine database of the literature published from 1966 to June 2003 was performed. A search using the subject heading “spinal fusion, lumbar, treatment outcome, low-back pain” yielded 1030 citations. Clinical series reported in English-language journals dealing with adult patients

Abbreviations used in this paper: ALIF = anterior lumbar interbody fusion; CT = computerized tomography; DDD = degenerative disc disease; DPQ = Dallas Pain Questionnaire; LBO = low-back outcome; LOS = length of stay; ODI = Oswestry Disability Index; PLF = posterolateral fusion; PLIF = posterior LIF; TCBD = threaded cortical bone dowel; TLIF = transforaminal LIF; VAS = visual analog scale.

Interbody techniques

who had undergone fusion with instrumentation for degenerative lumbar disease were selected (333 references). Relevant articles pertaining to the comparison of interbody fusion techniques with other surgical techniques or nonsurgically treated controls were selected and are summarized in the evidentiary table. A number of case series provide supporting data and are referenced in the bibliography.

Scientific Foundation

Recent trends in spinal surgery include the use of interbody fusion techniques including ALIF, PLIF, or TLIF as a means to enhance the rate of successful arthrodesis. Authors of several studies have compared the results of these techniques with respect to each other as well as with respect to PLF.

Christensen, et al.,¹⁰ studied a series of 148 patients with severe low-back pain who were prospectively randomized to treatment with PLF with pedicle screws or ALIF with Brantigan cages in addition to posterior instrumentation and PLF. Outcomes were measured using the DPQ and the Low Back Pain Rating Scale. There was a trend toward better overall functional outcome for patients treated with the circumferential procedure but this was not statistically significant ($p < 0.08$). This patient group did have statistically significantly less leg pain at the 1-year follow-up evaluation ($p < 0.03$), and less peak back pain at 2 years ($p < 0.04$). The patients who underwent circumferential fusion were found to have a higher PLF rate (92%) than the patients treated with PLF with pedicle screws (80%) ($p < 0.04$) when fusion status was evaluated based on static plain x-ray films. The circumferential fusion group had an 82% interbody fusion rate. The plain x-ray film findings for the remaining 18% of the circumferential group were described as "ambiguous." The repeated operation rate was significantly lower in the circumferential group (7%) than in the PLF group (22%) ($p < 0.009$). This paper provides Class III medical evidence supporting the role of interbody grafts in improving arthrodesis rates because of the lack of flexion-extension views or CT scans to supplement the static radiographs. The medical evidence supporting the role of interbody grafts in improving outcome with respect to back and leg pain is considered Class II despite the randomized design of the study because the difference in the improvement between the surgical groups in the primary outcome measure did not reach statistical significance. This information must be considered in light of the fact that similar measures of back and leg pain were not significantly different between treatment groups at other time points.

Fritzell and colleagues^{13,14} performed a randomized, prospective, multicenter trial involving 294 patients with chronic low-back pain due to DDD at one or two levels. Patients were assigned to one of four treatment groups. Patients in Group 1 (73 patients) underwent a noninstrumented PLF. Those in Group 2 (74 patients) were treated with PLF with pedicle screw fixation; patients in Group 3 were treated with interbody arthrodesis supplemented with pedicle screw fixation (56 of these patients underwent ALIF with pedicle screws, 19 of these patients underwent PLIF with PLF and pedicle screws). Group 4 was treated nonsurgically. Ninety-one percent of patients were avail-

able for follow up by an independent observer. Although all surgical groups did substantially better than the nonsurgical group, there were no statistically significant differences in ODI, Low Back Pain Questionnaire, Million VAS, and General Function Score between the surgical groups. The early complication rate was 6% in Group 1, 16% in Group 2, and 31% in Group 3. The fusion rate was evaluated by plain radiographs (without flexion-extension views) and was 72% in Group 1, 87% in Group 2, and 91% in Group 3. They concluded that all surgical groups had similar functional outcomes, but they noted that their study did lack power to detect a difference in functional outcome between the surgical groups.^{13,14} There was an increase in the fusion rate in the instrumented group and in the interbody group compared with the noninstrumented group ($p = 0.004$). This paper provides Class III medical evidence supporting the beneficial effects of instrumentation and interbody grafts on fusion rates because of its reliance on static radiographs. Because of the sample size, the medical evidence against a beneficial effect on functional outcome is also considered Class III.

The same authors analyzed their data with respect to complication rates and found that overall complication rates were higher in the instrumented PLF and interbody groups compared with the noninstrumented PLF group.¹² The early complication rate was 6% in the PLF group, 18% in the PLF with screw group, and 31% in the 360° fusion group ($p = 0.001$). There was no significant difference in the reoperation rate between the interbody group and the PLF with pedicle screw group. Twenty of the 27 reoperations were performed because of "hardware discomfort" or the patient's desire for device removal. These reoperations would appear to be unrelated to the use of an interbody implant. Seventeen of the 29 complications reported in the 360° fusion group did not necessarily result from the interbody procedure itself. These complications included donor site pain, pressure sores, and screw malposition. Four complications were specifically related to the anterior approach: two iliac vein lacerations and two sympathetic nerve injuries. There were seven instances of new nerve root pain, two of which required reoperation within 2 years. The 2-year follow-up complication rate was 12% in the PLF group, 22% in the PLF with screws group, and 40% in the 360° group ($p = 0.0003$). This complication rate includes reoperations for instrumentation removal, whether or not the removal was performed because of any problems associated with the instrumentation. The only delayed complication reported in the interbody group was continued donor site pain in the patients who underwent ALIF. The lack of beneficial effect on functional outcome, along with the higher complication rate associated with the circumferential procedures may be interpreted as evidence against the use of circumferential procedures as a means to improve patient outcomes.

Greenough, et al.,¹⁷ performed a nonrandomized study in which a cohort of 135 patients treated with PLFs with pedicle screws were compared with a historical control cohort of 151 patients treated with ALIF by the same surgeon. Fusion assessment was performed based on plain radiographs, occasionally supplemented with flexion-extension films. Outcome was measured using a patient satisfaction score as well as the LBO score. The authors dichotomized the LBO data by considering a score of