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Guideline update for the performance of fusion procedures for degenerative disease of the lumbar spine. Part 11: Interbody techniques for lumbar fusion

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Interbody fusion techniques have been promoted as an adjunct to lumbar fusion procedures in an effort to enhance fusion rates and potentially improve clinical outcome. The medical evidence continues to suggest that interbody techniques are associated with higher fusion rates compared with posterolateral lumbar fusion (PLF) in patients with degenerative spondylolisthesis who demonstrate preoperative instability. There is no conclusive evidence demonstrating improved clinical or radiographic outcomes based on the different interbody fusion techniques. The addition of a PLF when posterior or anterior interbody lumbar fusion is performed remains an option, although due to increased cost and complications, it is not recommended. No substantial clinical benefit has been demonstrated when a PLF is included with an interbody fusion. For lumbar degenerative disc disease without instability, there is moderate evidence that the standalone anterior lumbar interbody fusion (ALIF) has better clinical outcomes than the ALIF plus instrumented, open PLF. With regard to type of interbody spacer used, frozen allograft is associated with lower pseudarthrosis rates compared with freeze-dried allograft; however, this was not associated with a difference in clinical outcome.
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Key Words • fusion • lumbar spine • bone graft • spondylosis • practice guidelines

Recommendations

There is no evidence that conflicts with the previous recommendations formulated from the first generation of Lumbar Fusion Guidelines published in the original version of the "Guidelines for the performance of fusion procedures for degenerative disease of the lumbar spine."

Grade B

The addition of an interbody fusion is recommended as an option to enhance the fusion rate (which lowers the reoperation rate) in patients undergoing lumbar fusion. However, the improvement in fusion rates with the addition of interbody fusion has not consistently translated to an improvement in clinical outcomes (multiple Level II reports).

The addition of posterolateral lumbar fusion (PLF) to interbody fusion is not recommended in patients undergoing lumbar interbody fusion since the evidence indi-

Abbreviations used in this paper: ALIF = anterior lumbar interbody fusion; DDD = degenerative disc disease; FRA = femoral ring allograft; LOS = length of stay; ODI = Oswestry Disability Index; PLF = posterolateral lumbar fusion; PLIF = posterior lumbar interbody fusion; PPS = instrumented PLF with pedicle screws; SF-36 = 36-Item Short Form Health Survey; TLIF = transforaminal lumbar interbody fusion; VAS = visual analog scale.

cates no substantial clinical benefit but an increased rate of complications if a PLF is added to an interbody fusion (Level II and III reports).

Grade C

Anterior lumbar interbody fusion (ALIF) performed with a frozen femoral ring allograft (FRA) has a lower pseudarthrosis rate than ALIF performed with a freeze-dried FRA for the treatment of degenerative disc disease with or without spondylolisthesis. However, the improved fusion rate did not affect clinical outcomes (Level II evidence from a single report).

Anterior lumbar interbody fusion has better clinical outcomes and fewer perioperative morbidities than instrumented PLF, although the fusion rate is similar between the 2 techniques (Level III evidence from 2 reports).

Rationale

The surgical treatment of degenerative disease of the lumbar spine has evolved over the last several decades, and interbody techniques have been proposed as surgical alternatives to supplement or replace PLF. 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 particular advantages and disadvantages. The purpose of this review is to examine the current evidence investigating the experience with interbody fusion techniques and their relative safety and efficacy compared with PLF techniques for the treatment of patients with degenerative lumbar disease.

Literature Search

A computerized search of the National Library of Medicine MEDLINE database, utilizing the online search engine PubMed, was conducted from 2003 through December 2011, utilizing the following search terms: (((“Lumbosacral Region”[MeSH] OR “Lumbar Vertebrae”[MeSH]) AND “Spinal Fusion”[MeSH]) OR “lumbar fusion”[All Fields] OR (“lumbar”[title] AND “fusion”[title])) AND (interbody) AND (low back pain). The search yielded 183 citations. Clinical series reported in English-language journals dealing with adult patients who had undergone fusion with instrumentation for degenerative lumbar disease were selected. Relevant articles pertaining to the comparison of interbody fusion techniques with other surgical techniques or nonsurgically treated controls were selected and are summarized in Table 1. A number of case series provide supporting data and are referenced in the bibliography.

Scientific Foundation

Recent trends in spinal surgery involve the use of interbody fusion techniques, including ALIF, posterior lumbar interbody fusion (PLIF), transforaminal lumbar interbody fusion (TLIF), or axial lumbar interbody fusion 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.

Comparison of Interbody Fusion and PLF

Christensen et al. reported 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.[2] The Dallas Pain Questionnaire and the Low Back Pain Rating Scale were used to assess outcomes. Patients treated with circumferential procedures had better overall functional outcome, but this was not statistically significant ($p = 0.08$). This patient group did have statistically significant less leg pain at the 1-year follow-up evaluation ($p < 0.03$) and less maximum back pain at 2 years ($p < 0.04$). Fusion rate, which was determined on static plain radiographs, was significantly higher in the circumferential fusion group (92%) than in the PLF with pedicle screws group (80%) ($p < 0.04$). The circumferential fusion group had an 82% interbody fusion rate. The reoperation rate was significantly lower in the circumferential group (7%) than in the PLF group (22%) ($p < 0.009$). This paper provides Level II evidence supporting the role of interbody grafts in improving arthrodesis rates and the role of interbody grafts in improving outcome with respect to back and leg pain. The lack of flexion-extension views or CT scans to supplement the static radiographs rendered a less accurate evaluation of fusion status, and thus this study was downgraded to Level II.

Kim et al. also performed a prospective randomized study comparing PLF, PLIF, and PLIF+PLF in 167 patients who underwent 1- or 2-level fusion surgery for degenerative lumbar disease.[7] The patients were randomized into one of 3 treatment groups: Group 1 (PLF; n = 62), Group 2 (PLIF; n = 57), and Group 3 (PLF+PLIF; n = 48). The minimum follow-up was 3 years. Local autograft from the lamina and spinous processes was placed in the interbody cage, and iliac crest autograft was used for PLF. Clinical follow-up included the visual analog scale (VAS), Oswestry Disability Index (ODI), and Kirkaldy-Willis criteria. Radiological follow-up included flexion-extension radiographs and a CT scan when fusion status was in question. All groups demonstrated significant clinical improvement from preoperative status. There was no significant difference in clinical results or fusion rates (92% in Group 1, 95% in Group 2, and 96% in Group 3; $p > 0.05$) between the 3 groups. The PLIF group had better sagittal balance than the instrumented PLF. With the addition of PLF to the PLIF, the patients reported donor site pain as well as increased blood loss and operative time, all of which were secondary to harvesting iliac crest. The authors suggested that the addition of PLF is not beneficial when PLIF is performed. This study provides Level II evidence against the addition of PLF to PLIF. The study was downgraded to Level II because of a lack of power analysis and no report of the rate of loss to follow-up.

Greenough et al. reported a prospective case series assessing the results of instrumented PLF in 135 patients

TABLE 1: Interbody techniques for lumbar fusion: summary of evidence*

Authors & Year	Level of Evidence	Description	Results	Conclusion
Christensen et al., 2002	II: Prospective randomized clinical trial that was downgraded due to using only static radiographs to evaluate fusion status.	A prospective randomized clinical study analyzed the effects of circumferential fusion using ALIF radiolucent carbon fiber cages & titanium posterior instrumentation vs instrumented PLF (w/ pedicle screws) w/ 2-yr follow-up.	The circumferential lumbar fusion group had a higher fusion rate w/ significantly fewer reops, showed a tendency toward better functional outcome than the instrumented PLF group.	The authors favored circumferential fusion as a definitive surgical procedure in complex lumbar pathology involving major instability, flat back, & previous disc surgery in younger pts, compared w/ PLF w/ pedicle screws alone.
Fritzell et al., 2002	II: Prospective comparison study downgraded to Level III due to using only static radiographs to evaluate the fusion status.	A multicenter randomized study to compare 3 commonly used surgical techniques to achieve lumbar fusion in pts w/ severe chronic low-back pain due to disc degeneration or spondylosis.	All surgical techniques (PLF, PLF combined w/ pedicle screw fixation, & PLF combined w/ pedicle screw placement & interbody fusion using ALIF or PLIF) were found to reduce pain & decrease disability substantially.	All fusion techniques used in the study could reduce pain & improve function in pts w/ severe chronic low-back pain. Fusion rate was significantly better when internal fixation was used.
Kim et al., 2006	II: Study downgraded to Level II because of a lack of power analysis & no report of loss to follow-up.	A prospective randomized study compared 3 fusion methods: instrumented PLF, PLIF, & PLF+PLIF w/ minimum 3-yr follow-up.	No statistical differences were found among the 3 groups in terms of clinical outcomes & pseudarthrosis rates.	No significant differences in clinical results & union rates were found among the 3 fusion methods. PLIF had better sagittal balance than PLF. PLIF w/o PLF had advantages of the elimination of donor site pain, shorter operating time, & less blood loss.
Thalgott et al., 2009	II: This is a randomized control study downgraded to Level II due to lack of power analysis.	A prospective, randomized clinical trial compared the outcomes & fusion rates of an ALIF procedure w/ freeze-dried or frozen FRA w/ a minimum 24-mo follow-up.	The freeze-dried graft had a higher likelihood of pseudarthrosis.	When the results are considered in terms of clinical outcomes, the 2 methods of graft preservation perform w/ few statistically significant differences. Radiographic analysis showed that the freeze-dried graft had a higher likelihood of pseudarthrosis.
Videbaek et al., 2011	II: Downgraded because this study is not an actual randomized controlled trial.	A randomized clinical trial compared ALIF+instrumented PLF vs instrumented PLF in pts w/ severe back pain w/ 10-yr follow-up.	Sagittal balance parameters were similar btwn randomization groups. None of the parameters differed significantly btwn pts w/ an ODI from 0 to 40 & pts w/ ODI >40. Balanced pts had a significantly superior outcome as measured by ODI than unbalanced pts.	No difference in the investigated sagittal balance parameters btwn pts treated w/ PLF+ALIF vs those w/ instrumented PLF alone.
Abdu et al., 2009	III: A retrospective cohort comparison study w/ a lack of fusion status evaluation & possible selection bias as the surgeon chose the fusion technique.	This study retrospectively examined data collected during a prospective, randomized trial of 380 pts w/ degenerative spondylolisthesis & stenosis treated w/ standard decompressive laminectomy & 1 of 3 fusion techniques at the surgeon's discretion: PLF, PPS, or PPS+interbody fusion.	Early outcomes varied, favoring PLF compared w/ PPS & PPS compared w/ 360° at 6 wks & 3 mos. At 2 yrs, 360° had better outcomes. However, these differences were not maintained at 3- & 4-yr follow-up, when there were no statistically significant differences btwn the 3 fusion groups.	In pts w/ degenerative spondylolisthesis & associated spinal stenosis, no consistent differences in clinical outcomes were seen among fusion groups over 4 yrs.

(continued)

TABLE 1: Interbody techniques for lumbar fusion: summary of evidence* *(continued)*

Authors & Year	Level of Evidence	Description	Results	Conclusion
Pradhan et al., 2002	III	Retrospective review of pts who underwent either an anterior interbody or posterolateral intertransverse process w/ single-level instrumented lumbar spinal fusion performed.	There was significantly less blood loss, need for transfusion, amount of blood transfused, operative time, & hospital stay for pts w/ anterior fusion procedures.	The anterior approach to single-level lumbar fusion is associated w/ less morbidity than the posterolateral approach. However, both approaches to single-level lumbar fusion produce similar early fusion rates & clinical results.
Schofferman et al., 2001	III	A prospective randomized comparison of ALIF+transpedicular instrumentation+PLF (360° fusion) to ALIF+transpedicular instrumentation w/o PLF (270° fusion) w/ an average follow-up of 35 mos.	There were significant postop improvements in pain & function in both groups w/o significant differences in percentage solid ALIF. However, the 270° fusion group had significantly less blood loss, shorter operative times, shorter LOS, & lower professional fees.	Both the 360° & 270° fusions significantly reduce pain & improve function, & there are no significant clinical differences btwn them. There were shorter operating times, less blood loss, lower costs, & less utilization of health care resources associated w/ the 270° fusions.
Yan et al., 2008	III: Retrospective comparison study	This study retrospectively compared PLIF & TLIF w/ pedicle screw fixation in pts w/ degenerative spondylolisthesis.	All pts had bone fusion, & there were no cases of cage extrusion. The JOA score in all pts was good or excellent. Both techniques achieve statistical significance in restoration of disc & foraminal; however, there was no statistical difference btwn the 2 techniques.	Interbody fusion w/ either a PLIF technique or a TLIF technique provides good outcomes in the treatment of adult degenerative spondylolisthesis.
Greenough et al., 1998	III	A prospective case series assessed the results of instrumented PLF in pts w/ intractable back pain w/ a minimum 2-yr follow-up & compared them w/ a historical control of ALIF.	The method of outcome assessment profoundly affected the results; whereas 65% of pts rated themselves significantly improved by the procedure, only 19% achieved a good or excellent result on the LBOS.	Overall, the results of instrumented PLF were inferior to those in a similar series treated by ALIF.

* ALIF = anterior lumbar interbody fusion; FRA = femoral ring allograft; JOA = Japanese Orthopaedic Association; LBOS = Low Back Outcome Score; LOS = length of stay; ODI = Oswestry Disability Index; PLF = posterolateral lumbar fusion; PLIF = posterior lumbar interbody fusion; PPS = instrumented PLF with pedicle screws; pts = patients; TLIF = transforaminal lumbar interbody fusion.

with intractable back pain who were treated by a single surgeon.[6] They compared the results of this cohort with a previously published historical control of 151 patients who underwent ALIF performed by the same single surgeon. A solid bony fusion was obtained in 82% of patients as assessed mainly using static radiographs. The Low Back Outcome Score was statistically significantly better in the historical cohort of ALIF patients than in the instrumented PLF group ($p < 0.01$). This report provides Level III evidence that ALIF has better clinical outcomes than instrumented PLF in patients with chronic back pain. However, the authors did not compare the fusion rates between the 2 fusion techniques, and they used a historical ALIF cohort to compare the clinical results.

Videbaek et al. studied patient cohorts from a prospective randomized study analyzing the long-term (8–13 years) impact of ALIF+PLF versus PLF on sagittal spinal balance in 1- or 2-level fusion surgery.[11] The original study patients underwent additional radiography, which is the focus of this paper. There were 48 patients in the ALIF+PLF group and 44 in the PLF group. Posterolateral fusion was performed with pedicle screw fixation and iliac crest bone graft in the PLF group and with pedicle screw fixation or facet screw fixation in the ALIF+PLF group, depending on the necessity of posterior decompression. In the ALIF+PLF group, the PLF was performed first followed by ALIF in one stage. The radiographic parameters included pelvic incidence, sacral slope, pelvic tilt, maximal thoracic kyphosis, maximal lumbar lordosis, and segmental lordosis. The clinical outcome assessed was ODI. All parameters except for segmental lordosis showed no statistical difference in the 2 groups. Patients with 2-level fusion were over-represented in the ALIF+PLF group. The difference in segmental lordosis was eliminated in subgroup analysis according to number of levels fused. There was a significant positive correlation between lumbar lordosis and ODI score ($r = 0.31$, $p < 0.01$) when considering the entire cohort. The authors concluded that the sagittal alignment is not dependent on anterior column support and lumbar lordosis correlated with postoperative outcome. This paper did not focus on fusion status and instead focused on the sagittal balance and radiographic alignment parameters. The authors asked participants of a prior prospective, randomized trial to undergo new imaging studies. The follow-up rate was less than 65%, and therefore the report was downgraded to Level II evidence. This paper is a subsequent analysis of a prospective, randomized trial.

Schofferman et al. reported a prospective, randomized study comparing 26 patients who were treated with ALIF+pedicle screws+PLF (360° fusion group) with 22 patients who were treated with ALIF+pedicle screws without PLF (270° fusion group).[9] An FRA filled with cancellous allograft chips is used in ALIF. Flexion-extension plain radiographs were used to evaluate fusion status. The mean follow-up period was 35 months. Clinical outcomes were measured using the Numerical Rating Scale and the ODI. In the 360° fusion group, the PLF part of the procedure failed to heal 68% of the time. There was no significant difference ($p = 0.6$, chi-square test) in the fusion rate of the interbody graft between the groups, although there was a trend favoring the 270° fusion group (77% fusion rate in the 360° fusion group compared with 89% fusion rate in the 270° fusion group). The 270° fusion group had a shorter operating time, less intraoperative blood loss, and shorter length of stay (LOS) (all $p < 0.05$). This study provides Level III evidence that the addition of PLF to an ALIF with pedicle screw construct increases blood loss, LOS, and operating time without any resultant benefit. It was downgraded due to a lack of power analysis and suboptimal randomization. In addition, the patient population was not well defined.

Abdu et al. reported a subgroup analysis of 3 different fusion methods from data collected during a prospective randomized trial of 395 surgically treated patients with degenerative spondylolisthesis and stenosis.[1] In addition to decompressive laminectomy, one of 3 fusion techniques was used at the surgeon's discretion: in situ PLF; instrumented PLF with pedicle screws (PPS); or PPS plus interbody fusion using ALIF, TLIF, or PLIF (360° fusion). Main outcome measures were the 36-Item Short Form Health Survey (SF-36) bodily pain and physical function scales and the modified ODI assessed at 6 weeks, 3 months, 6 months, and yearly to 4 years. From the surgical cohort, 380 patients (96%) met inclusion criteria for analysis. The distribution of surgical procedures was as follows: 21% ($n = 80$) underwent PLF; 56% ($n = 213$) underwent PPS; 17% ($n = 63$) underwent 360° fusion; and 6% ($n = 23$) underwent a decompression without a fusion. Significant differences in outcome were observed that varied during the early follow-up period. Greater improvements in the physical function score were observed for PLF compared with PPS at 6 weeks (physical function: 12.73 vs 6.22, $p < 0.020$) and 3 months (physical function: 25.24 vs 18.95, $p < 0.025$). More substantial improvements in the ODI scores were observed for patients undergoing PPS compared with the 360° fusion cohort at 6 weeks (ODI: −14.46 vs −9.30, $p < 0.03$) and 3 months (ODI: −22.30 vs −16.78, $p < 0.02$). At 2 years, the 360° fusion cohort demonstrated statistically significant improvement in bodily pain and physical function scores compared with the PLF cohort ([bodily pain: 39.08 vs 29.17, $p < 0.011$] and [physical function: 31.93 vs 23.27, $p < 0.021$]) and the PPS cohort ([bodily pain: 39.08 vs 29.13, $p < 0.002$] and [physical function: 31.93 vs 25.29, $p < 0.036$]). The differences in outcome between the 3 fusion cohorts were not observed beyond 2 years, with no significant differences at either the 3- or 4-year follow-up time point. The authors concluded that there was no significant advantage of one fusion technique over another on clinical outcomes at 4-year follow-up; however, longer follow-up may be needed. This report is a subgroup analysis of varied fusion methods using the combined cohorts from a randomized controlled trial and a concurrent observational cohort. It is not an actual randomized controlled trial itself but rather a prospective comparison study (Level II) with a lack of fusion status evaluation. Another limitation of this report is that the fusion techniques were not randomly assigned and thus selection bias may exist since the surgeons chose which technique to use at their own discretion. Thus, it is downgraded to Level III.

Fritzell et al. performed a randomized, prospective, multicenter trial involving 294 patients with chronic low-back pain due to degenerative disc disease at 1 or 2 levels.[4,5] Patients were randomized to one of 4 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 and 19 of these patients underwent PLIF with PLF and pedicle screws). Group 4 was treated nonsurgically. Ninety-one percent of patients were available 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 on plain radiographs (without flexion-extension views) and was 72% in Group 1, 87% in Group 2, and 91% in Group 3. The authors 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. 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 Level II evidence supporting the beneficial effects of instrumentation and interbody grafts on fusion rates. However, the fusion status is determined by static radiographs. It is downgraded due to lack of power to detect a difference in functional outcomes and also due to the use of only static radiographs to evaluate fusion status.

With respect to complication rates, the same authors found that overall complication rates were higher in the instrumented PLF and interbody groups than in the noninstrumented PLF group.[3] 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. 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: 2 iliac vein lacerations and 2 sympathetic nerve injuries. There were 7 instances of new nerve root pain, 2 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° fusion group ($p = 0.0003$). This complication rate includes reoperations for instrumentation removal, whether 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.

Pradhan et al. performed a retrospective review to compare 58 patients who were treated with lumbar ALIF with BAK cages (Sulzer Spine-Tech) (Group 1) with 64 patients who were treated with PLF with pedicle screw fixation (Group 2).[8] The follow-up period was 22 months for ALIF and 26 months for PLF. Fusion was assessed based on flexion-extension radiographs and CT scanning for ambiguous cases. Radiographic fusion was confirmed in 95% of the Group I patients and in 92% of the Group II patients; however, this difference was not statistically significant. The ALIF cohort had a lower operative blood loss, shorter operative time, and shorter LOS ($p < 0.01$). The complication rates or clinical outcomes were not statistically different between the groups. Although this paper provides Level III evidence indicating that placement of an interbody graft through a stand-alone ALIF technique does not improve fusion rates compared with PLF, the small size of the treatment groups in this study makes any statement regarding functional outcomes suspect. The ALIF group was reported to have a shorter LOS, less blood loss, and less exposure to anesthetic agents.

Implants Used for Interbody Fusion

Thalgott et al. performed a prospective, blinded, randomized, single-site study from a single surgeon's patient population to evaluate the clinical and radiographic outcome differences between frozen and freeze-dried FRA for ALIF as part of a circumferential fusion for the treatment of degenerative disc disease including Grade I degenerative spondylolisthesis.[10] Patients were observed for a minimum of 24 months. Outcome measures included complications, fusion status, implant intactness, 1–10 pain scores, ODI, and SF-36 scores. Radiographic assessment was performed by an independent, blinded, board-certified radiologist and included dynamic lateral radiographs as part of the fusion assessment. The ODI improved more than 10 points in 62.5% of patients and SF-36 scores improved more than 10 points in 27.5% of patients. There was no statistically significant difference in clinical outcomes between the 2 groups. However, the freeze-dried allograft had a statistically higher rate of pseudarthrosis ($p = 0.026$). This paper suggests that frozen FRA has a lower rate of pseudarthrosis compared with freeze-dried allograft. In this study, the patients with 100% of their treated levels fused had better clinical outcomes than patients with pseudarthrosis. These differences were statistically significant with regard to the SF-36 Physical Component Summary and trended toward significance with the ODI. This study did not have a power analysis; it was therefore downgraded to Level II evidence in support of the use of frozen FRA instead of freeze-dried allograft for use in anterior lumbar fusion procedures.

Yan et al. performed a retrospective review of 187 patients who underwent either a PLIF with bilateral cages or a TLIF with unilateral placement of an interbody cage for the treatment of single-level degenerative spondylolis-

thesis.[12] Ninety-one patients underwent PLIF with 2 cages and pedicle fixation (Group 1), and 96 patients underwent TLIF with 1 cage and pedicle fixation (Group 2). Before surgery and at the 2-year follow-up, pain and functional disability were quantified using the VAS and Japanese Orthopaedic Association scales, respectively. The follow-up rate was 93.4% (85 of 91 patients) in the PLIF group and 94.8% (91 of 96 patients) in the TLIF group. All patients had bone fusion, and there were no cases of cage extrusion. Both groups demonstrated similar clinical and radiographic outcomes. The authors concluded that interbody fusion with either a PLIF technique or a TLIF technique provides good outcomes in the treatment of adult degenerative spondylolisthesis. The TLIF procedure is simpler and is as safe and effective as the PLIF technique. This study provides Level III evidence supporting TLIF over PLIF as a lumbar fusion option.

Summary

The medical evidence continues to suggest that interbody techniques are associated with higher fusion rates compared with PLF in patients with degenerative spondylolisthesis who demonstrate preoperative instability. However, there is no conclusive evidence supporting better clinical and radiographic outcomes based on different interbody fusion techniques. The evidence generally comprises Level II and III studies.

The addition of PLF when PLIF or ALIF is performed is optional and has been found to be associated with increased cost and complications.

With regard to type of interbody spacer used, frozen ALIF allograft is associated with lower pseudarthrosis rates compared with freeze-dried ALIF allograft. This is a Grade C recommendation supported by a single Level II study.

There is no conclusive evidence supporting better clinical or radiographic outcomes based on technique when performing interbody fusion. No general recommendation can therefore be made regarding the technique that should be used to achieve interbody fusion. We did not analyze any comparisons of minimally invasive surgery versus traditional open surgery in this report.

Key Issues for Future Investigation

1) The optimal approach and technique for interbody fusion at different levels of the lumbar spine should be investigated using prospective comparison/cohort studies to ascertain which one has the lowest complication rate along with the highest fusion rate and greatest clinical outcomes benefit.

2) The cost-effectiveness and long-term outcomes of different techniques for lumbar fusion should be investigated.

A prospectively registered database will assist in reporting the efficacy and associated complications of new approaches.

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