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Clinical Study

The impact of generalized joint laxity on the clinical and radiological outcomes of single-level posterior lumbar interbody fusion

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Abstract

BACKGROUND CONTEXT: Recent reports have suggested that excessive motion of the lumbar spine might be associated with low back pain and accelerated disc degeneration and may negatively influence the outcome of posterior lumbar interbody fusion (PLIF) surgery. These findings suggest that generalized joint laxity (GJL) might be a negative factor affecting PLIF outcome, although this relationship has not been well studied. In addition, the impact of GJL on adjacent segment pathology (ASP) after PLIF has not been reported.

PURPOSE: To explore the relationship between GJL and the outcome of single-level PLIF, we compared fusion rates, clinical outcomes, and ASP in PLIF patients with and without GJL.

STUDY DESIGN: Retrospective comparative study.

PATIENT SAMPLE: A total of 256 patients who underwent PLIF and were followed for at least 2 years after surgery were classified into two groups: Group A (37 patients with GJL) and Group B (219 patients without GJL).

OUTCOME MEASURES: The primary outcome measure was the fusion rate on dynamic radiographs and computed tomography scans. The secondary outcome measures were pain intensity in the low back based on a visual analog scale, functional outcome based on the Oswestry Disability Index, and prevalence and severity of ASP on lumbar spine magnetic resonance imaging 2 years postoperatively compared with preoperative images.

METHODS: We compared baseline data for the two groups studied. To evaluate the effects of GJL on the outcome of PLIF, we also compared outcome measures between the two groups. No funds were received in support of this work.

RESULTS: Successful fusion 2 years after surgery was achieved in 91.9% of patients in Group A and 91.8% of patients in Group B according to dynamic radiographs (p=.85) and in 86.5% of patients in Group A and 90% of patients in Group B according to computed tomography scans (p=.14). Secondary endpoints including pain intensity (visual analog scale) and Oswestry Disability Index scores were not significantly different between the two groups (p=.71 and .86, respectively). Adjacent segment pathology was present in both the superior and inferior adjacent segments in both groups and was not significantly different (p=.07 and .06, respectively), although severe degeneration that was greater than Grade III on modified Pfirrmann classification was more frequently observed in Group A (15 of 37, 40.5%, at the superior segment and 11 of 20, 55%, at the inferior segment) than in Group B (60 of 219, 27.4%, at the superior segment and 30 of 111, 27%, at the inferior segment), which was statistically significant (p=.02 and .01, respectively). Moreover, ASP was more prominent at the superior adjacent segment compared with the inferior adjacent segment and was most commonly observed at the inferior adjacent segment (L5–S1) after

FDA device/drug status: Approved for these indications (polyetheretherketone cage, pedicle screw-rod systems, and demineralized bone matrix).

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L4–L5 PLIF and the superior adjacent segment (L4–L5) after L5–S1 PLIF (p=.02 and .03, respectively).

CONCLUSIONS: Generalized joint laxity at baseline does not impact fusion rate or clinical outcome with respect to pain intensity or functional status but could negatively impact ASP compared with that in patients without GJL. Consequently, GJL should be evaluated preoperatively, and patients with GJL undergoing PLIF should be informed of the potential risks of surgery.

Keywords: Lumbar spinal stenosis; Posterior lumbar interbody fusion; Generalized joint laxity; Fusion rate; Clinical outcome; Adjacent segment pathology

Introduction

Posterior lumbar interbody fusion (PLIF) is considered a valid surgical option for lumbar pathologies, such as lumbar spinal stenosis (LSS), which may require a surgical fusion procedure if not improved by proper conservative treatment [1–4]. Several studies have reported good clinical and radiological outcomes for PLIF, although it is associated with significant drawbacks, such as persistent low back pain (LBP), postoperative neurologic deterioration, nonunion, and adjacent segment pathology (ASP) [1,3–7]. In particular, ASP has been an important issue for spine surgeons because it can lead to various pathologies ranging from degenerative changes in the adjacent segments (radiological ASP [RASP]) to recurrent or new onset symptoms in the low back and lower extremities (clinical ASP), which may require additional nonsurgical or surgical intervention [1,3,5].

In general, it is acknowledged that ASP after PLIF is caused by excessive load and motion at the adjacent segment because of motion restriction [1,3–6,8]. With this hypothesis in mind, an abnormal increase in segment motion in the lumbar spine, such as generalized joint laxity (GJL), might also be an exacerbating factor. In addition, recent studies have reported that GJL can lead to persistent LBP and accelerated disc degeneration of the lumbar spine, even in the normal population, as a result of increased motion and load on the lumbar spine. Based on this information, we hypothesized that GJL might have a negative impact on the clinical outcome, fusion outcome, and ASP after PLIF.

We aimed to explore the impact of GJL on the outcome of single-level PLIF in terms of clinical outcome, fusion rate, and ASP. To our knowledge, this is the first study to address the significance of GJL in patients undergoing PLIF.

Methods

Participants

This study was approved by the institutional review board. This was a retrospective case-control study that investigated the influence of GJL in patients with single-level PLIF.

This study was conducted using patients who met all the following inclusion criteria: (1) LSS diagnosed on lumbar spine radiographs, computed tomography (CT), and magnetic resonance imaging (MRI) and that corresponded to clinical manifestations and physical examination findings; (2) previous single-level PLIF; (3) age between 40 and 60 years; (4) voluntary participation with written consent; and (5) a follow-up period of 2 years or more. We excluded patients who met any of the following criteria: (1) fracture, infection, or tumor of the lumbar spine; (2) hemorrhagic disorders such as hemophilia and thrombocythemia; and (3) follow-up period of less than 2 years. These inclusion and exclusion criteria were applied to avoid confounding effects. Before surgery, all patients were informed of the details of the PLIF surgery, including the general approach, potential complications, and benefits of the procedure.

Surgical procedure and postoperative protocol

All operations were performed using the same surgical technique. A polyetheretherketone cage (Capstone; Medtronic Sofamor Danek, Memphis, TN, USA) for interbody fusion and bilateral pedicle screw-rod systems (Legacy System, Medtronic Sofamor Danek) for posterior stabilization were routinely used in all patients. To improve the fusion rate for the operative segments, a mixture of a locally harvested autograft during posterior decompression and demineralized bone matrix (Korea Bone Bank, Seoul, Korea) was packed within and around the polyetheretherketone cage.

All patients were admitted to the same ward within the hospital and were managed using the same postoperative protocols. All patients wore a lumbosacral orthosis for 3 months after surgery and were allowed to ambulate on the first day after surgery. Patients were not permitted to sit for long periods for the first month after surgery. Three months after surgery, patients were allowed to resume normal activities including heavy lifting.

Diagnostic criteria for GJL

The Beighton scale was used to determine whether GJL was present, and assessment of the joint range motion was performed using a standard clinical set of goniometers (Table 1). Based on a previous study, a threshold cutoff value of four of a total of nine points was used to classify the presence of GJL [9].