



Case Series of Anterior Intervertebral Graft Extrusions in Transforaminal Lumbar Interbody Fusion Surgeries

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■ **BACKGROUND:** According to the published reports, revision surgery is sometimes recommended even in patients with asymptomatic anterior lumbar intervertebral graft migrations. The main purpose of this chart review study was to report on the clinical course and outcomes of patients who had anterior intervertebral graft extrusions after transforaminal lumbar interbody fusion (TLIF).

■ **METHODS:** From July 2002 to July 2014, 1259 consecutive TLIF surgeries were performed. These were reviewed, and patients who had anterior intervertebral graft extrusions were identified.

■ **RESULTS:** The incidence of graft extrusion was 0.6% (7 of 1259 patients). There were 6 female patients and 1 male patient with an average age of 65.7 years (range, 44–80 years). All patients underwent TLIF with bilateral pedicle screw fixation, and 6 received recombinant human bone morphogenetic protein-2. Graft migrations were diagnosed between 5 days and 8 months postoperatively except for 2 cases in which migration occurred intraoperatively. The patients were closely followed for an average of 27.4 months (range, 12–43 months). All patients remained asymptomatic during the follow-up period and had solid fusion despite extrusions with an average time to fusion of 13 months (range, 10–18 months). No other adverse events occurred during the follow-up period.

■ **CONCLUSIONS:** The risks of additional and highly invasive revision surgery should be weighed against the potential short-term and long-term complications associated with graft extrusions or migrations. It was demonstrated that fusion may take longer but can be achieved,

and close observation may be adequate for asymptomatic patients.

INTRODUCTION

Lumbar intervertebral graft extrusion is a complication that can occur during or after lumbar interbody fusion procedures. The clinical implications of graft extrusion depend on the location. Posterior implant migrations into the spinal canal can cause nerve root compression symptoms and usually require revision surgery.^{1–6} Kuslich et al.⁷ reported 1.7% of posterior implant migrations requiring reoperation and 1.4% without reoperation. The reported rate for posterior graft migration is 0.8%–3.2%.^{1,4,6–9} Only 1 posterior lumbar implant migration case out of 11,817 spinal operations accounted for major neurologic deficit (paraparesis) that resulted in spinal canal compromise.¹⁰

Anterior graft extrusions are less frequent but may occur more easily if the structural integrity of the anterior annulus fibrosus or the anterior longitudinal ligaments is inadvertently compromised. A few published case reports described complications and management strategies associated with retroperitoneal graft migrations. Retroperitoneal migrations may lead to vascular complications,^{11–13} damage to the viscera,¹⁴ or radicular symptoms.¹⁵ Revisions for asymptomatic cage migrations^{3,16} and pseudarthrosis¹⁷ were also described in the literature. The reported rate for anterior graft migrations is 0.8% with reoperation and 1.5% without reoperation.⁷ According to the published reports, revision surgery is sometimes recommended in cases of anterior lumbar intervertebral graft extrusions.^{3,16} The main purpose of this retrospective chart review study was to report on the clinical course and outcomes of patients who had

Key words

- Complications
- Graft extrusions
- Lumbar fusion

Abbreviations and Acronyms

- CT:** Computed tomography
PEEK: Polyetheretherketone
rhBMP-2: Recombinant human bone morphogenetic protein-2
TLIF: Transforaminal lumbar interbody fusion

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Citation: *World Neurosurg.* (2016) 85:130–135.
<http://dx.doi.org/10.1016/j.wneu.2015.08.047>

Journal homepage: www.WORLDNEUROSURGERY.org

Available online: www.sciencedirect.com

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anterior intervertebral graft extrusions after transforaminal lumbar interbody fusion (TLIF).

MATERIALS AND METHODS

Among 1259 consecutive TLIF surgeries performed by 3 surgeons from July 2002 to July 2014, we prospectively identified patients who had anterior intervertebral graft extrusions and reviewed their medical records and imaging studies. Data collected included sex, age, body mass index, preoperative diagnosis, previous lumbar surgeries, comorbidities, smoking status, detailed notes on surgical procedures, and complications. All patients underwent open TLIF procedures with attempted bilateral pedicle screw placement using three-dimensional image guidance. The surgical technique was described previously.¹⁸

Follow-up appointments occurred at approximately 7–14 days postoperatively, at 3 and 6 months, and annually thereafter. Intervertebral graft extrusions were diagnosed if an implant moved at least 2 mm past the line connecting the anterior margins of the rostral and caudal vertebral bodies, and the distance from that line was measured. Radiographic fusion was determined to be present if there was a $<5^\circ$ difference in angular motion between flexion and extension on plain radiographs or no radiolucency lines >2 mm in thickness covering $>50\%$ of the superior or inferior surface of the grafts.

RESULTS

Out of 1259 cases, 7 patients (0.6%) were identified as having anterior intervertebral graft extrusions. There were 6 female patients and 1 male patient with a mean age of 65.7 years (range, 44–80 years). All patients were undergoing surgery for painful degenerative disk disease with radiculopathy ($n = 1$), spondylolisthesis ($n = 3$), or spinal stenosis ($n = 4$) symptoms. The average body mass index was 25.2 (range, 20.1–30.7). Osteopenia was present in 2 patients; there were no other comorbidities that could affect fusion. Two patients were smokers. In 5 patients, a 1-level TLIF procedure was performed; 2-level surgeries were performed in 2 patients. All patients underwent TLIF with bilateral pedicle screw fixation, and 6 patients received recombinant human bone morphogenetic protein-2 (rhBMP-2). Polyetheretherketone (PEEK) spacers were used in 5 patients, cortical bone allografts were implanted in 2 patients. Banana-shaped cages 7–10 mm in size were used in all patients. Patient characteristics are listed in **Table 1**. Of 7 patients, 3 (42.9%) had scoliosis with curvature of 15° – 22° , and 3 patients (42.9%) were undergoing surgery for spondylolisthesis. A statistically significant ($P = 0.013$) reduction of spondylolisthesis was achieved from an average of 7.2 mm (range, 6.0–8.8 mm) to 4.7 mm (range, 2.0–3.0 mm).

Radiographic evidence of graft extrusions was observed during regular follow-up visits between 5 days and 8 months postoperatively except for 2 grafts in which extrusion occurred intraoperatively. One of these grafts completely migrated into the pelvic cavity anterior to the sacrum, and another graft migrated ventrally into the prevertebral space at the L5/S1 level. The remaining graft extrusions measured 8–20 mm. No disk space loss (average preoperative disk height was 5.6 mm [range, 3.9–7.3 mm], and average postoperative disk height was 8.2 mm [range, 6.3–11.7 mm]) or segmental kyphosis was noted.

Table 1. Patient Characteristics.

Patient Number	Age (years)/Sex	Preoperative Diagnosis	Previous Surgeries	TLIF Level	Extr. Level	BMP	Graft	Follow-Up (months)	Fusion (months)	Extrusion (months)	Extrusion (mm)	Symptoms	Revision Surgery
1	80/F	Spinal stenosis/spondylolisthesis	—	L3-L5	L4/L5	Yes	PEEK	27	12	0.2	14	NA	No
2	78/F	Radiculopathy	TLIF L5/S1	L4/L5	L4/L5	Yes	PEEK	12	10	6	10	NA	No
3	71/F	Spinal Stenosis/scoliosis	—	L4/L5	L4/L5	Yes	PEEK	43	18	8	20	NA	No
4	71/F	Spinal stenosis/scoliosis	—	L3/L4	L3/L4	Yes	PEEK	24	13	3	8	NA	No
5	58/F	Spinal stenosis	TLIF L3-L5	L2/L3	L2/L3	Yes	Allograft	34	12	3	10	NA	No
6	44/F	Spondylolisthesis/scoliosis	Laminectomies L4-S1	L4-S1	L5/S1	Yes	PEEK	40	—	Intraoperative	Pelvic cavity	NA	No
7	57/M	Spondylolisthesis	MCD L5/S1	L5/S1	L5/S1	No	Allograft	12	—	Intraoperative	Prevertebral space	NA	No

TLIF, transforaminal lumbar interbody fusion; BMP, bone morphogenetic protein; Extr., extrusion; F, female; M, male; MCD, microdiskectomy; PEEK, polyetheretherketone; NA, not applicable.

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