Minimally invasive lateral lumbar interbody fusion case series

A retrospective analysis of a prospectively collected series of all patients undergoing LLIF by the senior author Levi AD from January 2010 to January 2018 after implementation of a modified surgical mini-open technique, compared with previously reported institutional results with the originally recommended percutaneous technique. LLIF-specific complications examined included groin/thigh sensory dysfunction, flank bulge/pseudohernia, psoas-pattern weakness, and femoral nerve injury.

The incidence (19%, n = 98 patients) of groin/thigh sensory dysfunction in this cohort was significantly lower than that of the historical control (60%, n = 59) (P < 0.0001). The incidence of abdominal flank bulge/pseudohernia (2.0%, n = 98 patients) in the cohort was improved but not significantly lower than that of the historical control (4.2%, n = 118) (P = 0.36). The incidence of psoas-pattern weakness (3.1%, n = 98) in this cohort was significantly lower than that of the historical control (23.7%, n = 59) (P = 0.0001). The incidence of femoral nerve injury (0%, n = 98 patients) in this cohort was improved but was not significantly lower than that of the historical control (1.7%, n = 118) (P = 0.20).

The adoption of an exclusive mini-open muscle-splitting approach in LLIF with first-look inspection of the lumbosacral plexus nerve elements may improve motor and sensory outcomes in general and the incidence of postoperative groin/thigh sensory dysfunction and psoas-pattern weakness in particular [1).

2018

A multicenter retrospective review of a minimally invasive adult spinal deformity database was queried with a minimum of 2-yr follow-up. Patients were divided into 2 groups as determined by the side of the curve from which the LLIF was performed: concave or convex.

No differences between groups were noted in demographic, and preoperative or postoperative radiographic parameters (all P > .05). There were 8 total complications in the convex group (34.8%) and 21 complications in the concave group (52.5%; P = .17). A subgroup analysis was performed in 49 patients in whom L4-5 was in the primary curve and not in the fractional curve. In this subset of patients, there were 6 complications in the convex group (31.6%) compared to 19 in the concave group (63.3%; P < .05) and both groups experienced significant improvements in coronal Cobb angle, Oswestry Disability Index, and Visual Analog Scale score with no difference between groups.

Patients undergoing LLIF for ADS had no statistically significant clinical or operative complication rates regardless of a concave or convex approach to the curve. Clinical outcomes and coronal plane deformity improved regardless of approach side. However, in cases wherein L4-5 is in the primary curve, approaching the fractional curve at L4-5 from the concavity may be associated with a higher complication rate compared to a convex approach [2)].

Over a 5-yr period, 303 patients underwent MIS-LIF at the Department of Neurosurgery, University of South Florida, Tampa, Florida. Sixty-one patients had surgery only at the L4-5 level (20.1%). Twelve of these patients (19.6%) had postoperative neurological deficits including 2 motor deficits (2/61 = 3.2%) and 11/61 (18%) sensory deficits. At 12-mo follow-up, 3 of the deficits persisted for a long-term complication rate of 3/61 (4.9%), motor complication 2/61 (3.2%). Hospital stay and follow-up averaged 2.1 d and 15 mo. Average Oswestry Disability Index improved from 51.1 to 31.1 ($P < .00001$). Visual Analog Scale (VAS) improved from 7.4 to 3.9 ($P < .016$). There were no reoperations secondary to hardware failure or pseudoarthrosis. Fusion rate was 89% at 12 mo.

MIS-LIF is a safe and effective approach for interbody fusion at L4-5 with low rate of lumbar plexus injury. Most immediate postoperative deficits will resolve over time [3].

A retrospective review of prospectively collected data was conducted on consecutive patients who underwent stand-alone LLIF between July 2008 and June 2015; 297 patients (623 levels) met inclusion criteria. Imaging studies were examined to grade graft subsidence according to Marchi criteria, and compared between those who required revision surgery and those who did not. Additional variables recorded included levels fused, DEXA (dual-energy x-ray absorptiometry) T-score, body mass index, and routine demographic information. The data were analyzed using the Student t-test, chi-square analysis, and logistic regression analysis to identify potential confounding factors. RESULTS Of 297 patients, 34 (11.4%) had radiographic evidence of subsidence and 18 (6.1%) required revision surgery. The median subsidence grade for patients requiring revision surgery was 2.5, compared with 1 for those who did not. Chi-square analysis revealed a significantly higher incidence of revision surgery in patients with high-grade subsidence compared with those with low-grade subsidence. Seven of 18 patients (38.9%) requiring revision surgery suffered a vertebral body fracture. High-grade subsidence was a significant predictor of the need for revision surgery ($p < 0.05$; OR 12, 95% CI 1.29-13.6), whereas age, body mass index, T-score, and number of levels fused were not. This relationship remained significant despite adjustment for the other variables (OR 14.4; 95% CI 1.30-15.9). CONCLUSIONS In this series, more than half of the patients who developed graft subsidence following stand-alone LLIF required revision surgery. When evaluating patients for LLIF, supplemental instrumentation should be considered during the index surgery in patients with a significant risk of graft subsidence [4].

2015

Patel et al. present a series of patients with discitis and osteomyelitis who were surgically treated via a minimally invasive lateral transpsoas approach.

Surgical treatment for spinal discitis and osteomyelitis presents challenges because of comorbidities that are common in patients undergoing this procedure. A retrospective review found six patients who met strict operative criteria including instability, intractable pain, neurological deficit, and disease progression. All patients were non-ambulatory before surgery because of intractable back pain. The patients underwent standard lateral minimally invasive surgery using either the extreme lateral interbody fusion (NuVasive, San Diego, CA, USA) or direct lateral interbody fusion (Medtronic Sofamor Danek, Memphis, TN, USA) system. The patients underwent debridement with a discectomy and partial or complete corpectomy, with polyetheretherketone or titanium cage placement. Two patients had additional posterior fixation with percutaneous pedicle screws, and none had immediate perioperative complications. The postoperative CT scans demonstrated satisfactory debridement and hardware placement. All patients experienced significant pain improvement and could ambulate within a few days of surgery. So far, the 1year follow-up data have demonstrated stable hardware with solid fusion and continued pain improvements. One patient demonstrated hardware failure secondary to refractory infection, 2months postoperatively, and required additional posterior decompression and debridement with pedicle screw fixation. The lateral transpsoas approach permits debridement and fixation coupled with percutaneous pedicle screw fixation to further stabilize the spine in a minimally invasive fashion. Due to the significant comorbidities in this patient population, a minimally invasive approach is a suitable surgical technique. A close follow-up period is necessary to detect early hardware failure which may necessitate more extensive treatment [5].

A total of 128 consecutive patients (with 178 treated levels in total) underwent MIS LIF performed by a single surgeon. The subsidence was deemed to be ECS if it was evident on postoperative Day 2 CT images and was therefore the result of an intraoperative vertebral endplate injury and deemed DCS if it was detected on subsequent CT scans (≥ 6 months postoperatively). Endplate breaches were categorized as caudal (superior endplate) and/or cranial (inferior endplate), and as ipsilateral, contralateral, or bilateral with respect to the side of cage insertion. Subsidence seen in CT images (radiographic subsidence) was measured from the vertebral endplate to the caudal or cranial margin of the cage (in millimeters). Patient-reported outcome measures included visual analog scale, Oswestry Disability Index, and 36-Item Short Form Health Survey physical and mental component summary scores.

Four patients had ECS in a total of 4 levels. The radiographic subsidence (DCS) rates were 10% (13 of 128 patients) and 8% (14 of 178 levels), with 3% of patients (4 of 128) exhibiting clinical subsidence. In the DCS levels, 3 types of subsidence were evident on coronal and sagittal CT scans:

Type 1, caudal contralateral, in 14% (2 of 14), Type 2, caudal bilateral with anterior cage tilt, in 64% (9 of 14), and Type 3, both endplates bilaterally, in 21% (3 of 14). The mean subsidence in the DCS levels was 3.2 mm. There was no significant difference between the numbers of patients in the subsidence (DCS) and no-subsidence groups who received clinical benefit from the surgical procedure, based on the minimum clinically important difference ($p > 0.05$). There was a significant difference between the fusion rates at 6 months ($p = 0.0195$); however, by 12 months, the difference was not significant ($p = 0.2049$) [6].

1)
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