Lumbar translaminar screw fixation

Types

In 1998, Di Lorenzo et al. proposed a less invasive direct procedure by utilizing a translaminar approach (TLA) through a fenestration of the pars interarticularis, thus circumventing facetectomy or hemilaminectomy in many cases. The increasing availability of high-definition imaging modalities (MRI, CT) has contributed to the growing popularity of the TLA, since identifying the exact location and extent of the spinal lesion is crucial for surgical planning to limit unnecessary biomechanical damage and prevent intraoperative conversion to conventional approaches.

Several studies have demonstrated the feasibility, safety and efficacy of this technique to successfully treat disc herniations affecting the foraminal and preforaminal regions [1) 2) 3) 4) 5) 6) 7)].

The translaminar approach is the only “tissue-sparing” technique viable in cases of cranially migrated lumbar disc herniation encroaching on the exiting nerve root in the preforaminal zones, for the levels above L2-L3, and in the preforaminal and foraminal zones, for the levels below L3-L4 (L5-S1 included, if a total microdiscectomy is unnecessary). This approach is more effective than the standard one, because it resolves the symptoms; it is associated with less postoperative pain and faster recovery times without the risk of iatrogenic instability, and it can also be used in cases with previous signs of radiographic instability. The possibility to spare the flavum ligament is one of the main advantages of this technique. For these reasons, the translaminar approach is a valid technique in terms of safety and efficacy. Vanni et al., extensively analyzed and highlighted the tips and tricks [8)].

<html><iframe width=“560” height=“315” src=“https://www.youtube.com/embed/r87vbFeRIaE” frameborder=“0” allow=“autoplay; encrypted-media” allowfullscreen></iframe></html>

Case series

see Translaminar approach case series.

Indications

Short segment lumbar fusion.

Posterior component in a 360º fixation combined with interbody fusion.

<html><iframe width=“560” height=“315” src=“https://www.youtube.com/embed/sJHPFtadqcs” frameborder=“0” allow=“autoplay; encrypted-media” allACowfullscreen></iframe></html>

Pros

Small skin incision, minimal soft tissue disruption.

Decrease cost (fewer screws implanted)

Translaminar screw fixation represents an alternative operative technique to transpedicular screw fixation systems for short-segment lumbar fusion that permits the use of a minimally invasive strategy. The strategy behind this technique is to block the facet joints with perforating screws.

It is not known whether facet screw fixation can provide stability equivalent to pedicle screw fixation during cyclical loading. Therefore, transfacet pedicle screw fixation and standard pedicle screw fixation techniques were compared biomechanically.

Lumbar motion segments were tested under short-term and long-term cyclic loading conditions. For the short-term phase, specimens were tested intact for six cycles (to 400 N or 4 Nm) in compression, flexion, extension, lateral bending, and torsion. The specimens then were instrumented with bilateral semicircular interbody spacers and pedicle screw instrumentation or transfacet pedicle screws, and the testing sequence was repeated. For the long-term phase, 12 specimens were instrumented in a similar manner and loaded to 6 Nm of flexion bending for 180,000 cycles.

For the short-term phase, both fixation systems had significantly greater stiffness and reduced range of motion, as compared with the intact state. No differences were observed between the fixation systems except in flexion, wherein transfacet pedicle screw specimens were significantly stiffer than traditional pedicle screw specimens. For the long-term phase, the stiffness and range of motion did not significantly increase or decrease over repetitive cycling of the instrumented specimens. Furthermore, no significant difference between the fixation systems was observed.

The stability provided by both transfacet pedicle screw fixation and traditional pedicle screw fixation was not compromised after repetitive cycling. In this model, transfacet pedicle screw fixation appears equivalent biomechanically to traditional pedicle screw fixation [9)].

see also Percutaneous Lumbar Transfacet Screw Fixation

Case series

The Core Outcome Measures Index, a multidimensional outcome questionnaire, was sent to 643 consecutive patients who had undergone lumbar fusion with translaminar screws between 1987 and 2004, for various degenerative conditions of the lumbar spine. Patients also rated the global outcome and their satisfaction with treatment. Disc height was measured from preoperative radiographs using the distortion compensated roentgen analysis method. 476 patients (74%) completed and returned the questionnaire. Multiple logistic regression analysis was used to identify factors associated with a good outcome.

After an average follow-up period of 10 years (range: 2-20 years) 352 of 476 patients (74%) reported that the operation had either “helped a lot” or “helped” (good outcome); 124 of 476 patients (26%) declared that it “helped only little,” “didn't help,” or “made things worse” (poor outcome). Controlling for potential confounders, a preoperative disc height <80% of that reported for a normal population was the most significant unique predictor of a good outcome (OR = 14.86, 95% CI: 6.77-32.61, P <

0.0001).

Translaminar screw fixation is a straightforward and effective technique for short-segment fusion in the lumbar spine. For patients with a strict indication for spondylodesis, intact posterior elements (lamina and facets) and a low preoperative disc height, translaminar screw fixation represents a successful fixation technique in the lumbar spine with good long-term results [10)]

1)
Di Lorenzo N, Porta F, Onnis G, Cannas A, Arbau G, Maleci A. Pars interarticularis fenestration in the treatment of foraminal lumbar disc herniation: a further surgical approach. Neurosurgery. 1998 Jan;42(1):87-9; discussion 89-90. PubMed PMID: 9442508.
2)
Cossandi C, Fanti A, Gerosa A, Bianco A, Fornaro R, Crobeddu E, Forgnone S, Panzarasa G, Di Cristofori A. Translaminar approach for treatment of hidden zone foraminal lumbar disc herniations: considerations on the surgical technique and pre-operative selection of patients with a long term follow-up. World Neurosurg. 2018 May 18. pii: S1878-8750(18)31025-8. doi: 10.1016/j.wneu.2018.05.072. [Epub ahead of print] PubMed PMID: 29783010.
3)
Papavero L, Langer N, Fritzsche E, Emami P, Westphal M, Kothe R. The translaminar approach to lumbar disc herniations impinging the exiting root. Neurosurgery. 2008 Mar;62(3 Suppl 1):173-7; discussion 177-8. doi: 10.1227/01.neu.0000317389.83808.16. PubMed PMID: 18424983.
4) , 8)
Vanni D, Galzio R, Kazakova A, Guelfi M, Pantalone A, Salini V, Magliani V. Technical note: microdiscectomy and translaminar approach. J Spine Surg. 2015 Dec;1(1):44-9. doi: 10.3978/j.issn.2414-469X.2015.10.03. Review. PubMed PMID: 27683678; PubMed Central PMCID: PMC5039873.
5)
Vogelsang JP. The translaminar approach in combination with a tubular retractor system for the treatment of far cranio-laterally and foraminally extruded lumbar disc herniations. Zentralbl Neurochir. 2007 Feb;68(1):24-8. PubMed PMID: 17487805.
6)
Bernucci C, Giovanelli M. Translaminar microsurgical approach for lumbar herniated nucleus pulposus (HNP) in the “hidden zone”: clinical and radiologic results in a series of 24 patients. Spine (Phila Pa 1976). 2007 Jan 15;32(2):281-4. PubMed PMID: 17224827.
7)
Soldner F, Hoelper BM, Wallenfang T, Behr R. The translaminar approach to canalicular and cranio-dorsolateral lumbar disc herniations. Acta Neurochir (Wien). 2002 Apr;144(4):315-20. PubMed PMID: 12021876.
9)
Ferrara LA, Secor JL, Jin BH, Wakefield A, Inceoglu S, Benzel EC. A biomechanical comparison of facet screw fixation and pedicle screw fixation: effects of short-term and long-term repetitive cycling. Spine (Phila Pa 1976). 2003 Jun 15;28(12):1226-34. PubMed PMID: 12811265.
10)
Aepli M, Mannion AF, Grob D. Translaminar screw fixation of the lumbar spine: long-term outcome. Spine (Phila Pa 1976). 2009 Jun 15;34(14):1492-8. doi: 10.1097/BRS.0b013e3181a0934f. PubMed PMID: 19525842.