Mini-Open or Percutaneous Bilateral Lumbar Transfacet Pedicle Screw Fixation: A Technical Note

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Introduction
Pedicle screw and rod constructs have been the predominant method for posterior fixation in spine fusion. Facet screw fixation is a growing alternative and has been shown to be biomechanically comparable to pedicle screw fixation\(^1-3\). The literature is lacking a clear description of technique steps for placing transfacet pedicle screws. Recognizing that screw placement is not intuitive could help avoid the experience of the pedicle screw era when early adoption led to substantial lawsuits around complications\(^4\), which required amended FDA Rules and Regulations governing their use\(^5\). Knowledge of lumbar facet anatomy can be used to provide the anatomic landmarks for placement of tranfacet fixation\(^6\).

Here we describe technique steps used to place transfacet pedicle screws as a guide for surgeons and to assist their understanding of starting points and trajectories on anteroposterior (AP) and lateral fluoroscopy.

Materials and Methods

Illustrative case 1
A 38 year-old female presented with back pain, right leg pain and sciatica after a motor vehicle accident 1 year prior. Magnetic resonance imaging (MRI) revealed a L4-5 central herniated nucleus pulposus with an annular tear and disc desiccation (Figure 1A-B). A L4-5 discogram was positive. We recommended L4-5 instrumented fusion with percutaneous bilateral transfacet pedicle screw fixation.

Operative Technique
The patient was placed prone on a Wilson frame. A midline incision was used for decompression and placement of a L4-5 Transforaminal Lumbar Interbody Fusion (TLIF) polyetheretherketone (PEEK) (SpineFrontier Inc., Beverly, MA) interbody cage. The Wilson frame was taken down to restore lordosis. We used a separate 1 inch midline incision just about the L3 spinous process for placement of two transfacet pedicle screws (FacetFuse) (SpineFrontier Inc., Beverly, MA, USA) as described below (Figure 2).

Step 1: Started with a Jamshidi needle.
1. The needle was placed on the L4 lamina just medial to the inferior L4 facet.
2. The AP trajectory was obtained (Figure 3A-B).
3. The lateral trajectory was located (Figure 4A-B).
4. A mallet was used to place the needle into position.

Step 2: Guidewire
The inner needle of the Jamshidi was removed and a guidewire was drilled along the trajectory, identified in step 1, into the vertebral body until approximately 40mm in depth (Figure 5A-B).

Step 3: Drill Guide

Figure 2. CASE-1: Summary of the technique steps for placement of transfacet pedicle screws.

CASE-1: Illustration (A) and radiographic view (B) of anteroposterior starting locations and trajectories for transfacet screw placement.

Figure 3A
Figure 3B

CASE-1: Illustration (A) and radiographic view (B) of lateral starting locations and trajectories for transfacet screw placement.

Figure 4A
Figure 4B

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Step 4: Drill
A cannulated drill was used over the guidewire to enter across the posterior vertebral body wall cortex (Figure 6A-B).

Step 5: Dilator
The dilator was then placed over the guidewire. The screw cannula was inserted and the dilator removed.

Step 6: A 5.5x50 mm cannulated screw was then placed.

Steps 7 and 8: Fluoroscopy was obtained to confirm accurate screw placement and step 1-8 were repeated for contralateral transfacet screw placement (Figure 7A-B) through the same incision (Figure 8). Postoperative radiograph at one week demonstrated satisfactory placement of bilateral facet screws (Figure 9).

Illustrative case 2
A 61 year-old female presented with a history of prior lumbar surgery, chronic lower back pain and left leg radiculitis. MRI revealed possible L5-S1 hemilaminectomy defect, L4-5 herniated nucleus pulposus with severe L4-5 spinal stenosis, disc collapse at L4-5 and endplate changes at L4-5 (Figure 10A-B). The patient underwent a revision L4-5 posterior decompression and instrumented fusion with placement of transfacet pedicle screws using an open midline approach, which followed the same steps we have described above.

Results
Postoperative radiographs at 11 months showed intact fixation and evidence of fusion (Figure 11A-B).

Discussion
A successful fusion can be aided by a rigid construct in order to obtain arthrodesis\(^\text{3}\). The use of interbody cages along with posterior instrumentation works together to increase stability in all directions at the targeted level\(^\text{4}\). With a growing interest in less exposure surgery for the advantages of preserving the anatomy (e.g. facets) and decreasing tissue disruption for lumbar surgeries, there has been resurgence in facet screw fixation as an alternative to pedicle screw-rod fixation\(^\text{5}\).

Facet fixation has a long history; King first described placement of a short screw transversely across the inferior border of the lamina through the facet joints for spine internal fixation in 1948\(^\text{1}\). In 1959, Boucher described placement of a longer screw starting obliquely on the lamina, through the facet joint, and into the pedicle\(^\text{2}\). The Boucher technique described in this report has the advantages of a small midline incision to fix multiple levels with less exposure of the spine, avoidance of the adjacent facets, diminished extensive soft tissue dissection, and decreased blood loss and operative time. Additionally, this fixation technique has demonstrated biomechanical equivalence to pedicle screws\(^\text{1,5,8}\).

References

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