



## Commentary



# Commentary on “Mini-Open Intercostal Retroperitoneal Approach for Upper Lumbar Spine Lateral Interbody Fusion”

Alexander E. Ropper

Department of Neurosurgery, Baylor College of Medicine, Houston, TX, USA

### Corresponding Author

Alexander E. Ropper

Department of Neurosurgery, Baylor  
College of Medicine, 7200 Cambridge  
St. - Suite 9A, Houston, TX, USA  
Email: aropper@gmail.com

See the article “Mini-Open Intercostal  
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Multiple minimally invasive anterior and lateral operative techniques have been developed to achieve indirect decompression and arthrodesis of the lumbar spine. Amongst them is the oblique lateral lumbar interbody fusion (OLIF) which utilizes a left-sided anterior-to-psoas window to access the disc space. This minimally invasive approach was designed to allow direct access to the anterolateral lumbar spine, through the retroperitoneal space, and lessen the retraction on the psoas muscle and lumbar plexus as compared to the relatively similar direct lumbar interbody fusion, which utilizes a transpsoas approach. Both of these lateral approaches allow for placement of larger interbody cages across the lumbar intervertebral spaces as compared to traditional posterior based interbody fusion such as the transforaminal lumbar interbody fusion.<sup>1</sup> Both the direct and oblique lateral approaches are clinically beneficial for select cases of spinal canal stenosis as the large graft expands foraminal height as well as increases the spinal canal diameter by stretching the ligamentum flavum, a process referred to as indirect decompression.<sup>2</sup> This indirect decompression may lose its effectiveness if there is cage subsidence, which is commonly a result of bony endplate injury during the discectomy. A central technical tenet of the OLIF technique is to align the retractor in parallel with the disc space to both aid in the discectomy and interbody placement as well as lessen the chance of this endplate injury as the discectomy is completed and prepared for arthrodesis.<sup>3</sup> While this parallel retractor placement can be achieved more easily in the lower lumbar spine, even under the iliac crest for L4–5 access, OLIF at the upper lumbar levels may be obstructed by the 10th, 11th and 12th ribs. To overcome this rib impediment, many surgeons resect the anterior portions of these ribs to access the thoracolumbar junction during the OLIF approach in order to obtain the necessary parallel retractor placement.

This issue of *Neurospine* features the article “Mini-Open Intercostal Retroperitoneal Approach for Upper Lumbar Spine Lateral Interbody Fusion”<sup>4</sup> which describes a novel adaptation of the OLIF technique that obviates the need for rib resection and maintains parallel access to the disc spaces. The authors describe a dissection of the intercostal muscles over the top of the ribs to allow sufficient space to open the retractor. By avoiding the traditional rib resection at these levels, the author postulate that the rate of pneumothorax, chest wall pain and chest tube insertion would be lower than in the traditional approach. The present study examines 121 total patients; 99 of whom had traditional OLIF approaches to the L1–2



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or L2–3 disc spaces and 22 patients who had the intercostal retroperitoneal approach (ICRP). The disc removal, endplate preparation and interbody placement in the groups were similar. The rib line, as measured by a line connecting the distal tips of the 10th, 11th and 12th ribs were also measured. There was significantly less endplate injury in the ICRP group (9.1%) as compared to the traditional OLIF approach (34.3%) as measured by postoperative magnetic resonance imaging. In patients with low rib lines (caudal to the L2–3 disc). The advantage of the ICTR was maintained with a comparative rate of endplate injury of 15.4% versus 52.6%. This low rib line anatomy can make traditional OLIF even more challenging. Although the long-term follow-up in patients was not included in the report, it could be inferred that the higher rates of endplate injury in the traditional OLIF group may result in higher subsidence and less clinical benefit. While the study's small size and biases are explained by the authors, it should not detract from the important technical nuances that are presented.

Lateral surgery of the upper lumbar spine and thoracolumbar junction requires anatomical knowledge of this complex region. Either (or both) the retroperitoneal and retropleural cavities may need to be entered, as these 2 cavities are essentially contiguous aside from the separating diaphragm.<sup>5</sup> The diaphragm may need to be opened or reflected in order to access the disc space. Since the lateral attachments of the diaphragm are typically between the inferior edge of the 10th rib and superior edge of the 12th rib, skin incision lines above the 10th rib have traditionally been used for retropleural approaches and below the 12th rib for retroperitoneal approaches.<sup>6</sup> While these incision placement recommendations are good general guidelines, there is significant variability in the diaphragmatic attachments in different patients, and surgeons may need to mobilize the diaphragm even if anticipating a purely retroperitoneal approach.<sup>7</sup> In addition, the parietal pleura may be encountered in upper lumbar retroperitoneal approaches as the parietal pleura descends posteriorly to the 12th rib but laterally to the 10th rib. Therefore, even though the approach is started in the retroperitoneal space, it may transgress the retropleural space, especially when these lower ribs are resected. Mitsui et al.<sup>8</sup> recently published on the need for rib resection specifically in the OLIF approach to upper lumbar lateral fusion (L1–2 and L2–3). In the study of Mitsui et al.,<sup>8</sup> factors affecting the need for rib resection were studied postoperatively. The decision for rib resection was made intraoperatively based on a true lateral fluoroscopic image. While these authors concluded that thoracolumbar kyphosis and the location of the apex of a coronal lumbar deformity were the in-

dependent risk factors associated with the need for rib resection during OLIF. With the standard OLIF technique, the rate of endplate injury was higher in the nonrib resection group and the rate of pleural violation was higher in the rib resection group. These secondary results of the (endplate injury and pleural violation) support the utility and value of an approach such as the ICRP OLIF.

Balancing the need to obtain a parallel view of the disc space with the associated risks of rib resection required in many upper lumbar OLIF was the basis of the development of the ICRP technique. The authors did report a pleural laceration and pneumothorax complication with the ICRP approach which they postulated was secondary to a posteriorly biased incision and the posterior and dorsal descent of the parietal pleura. It will be interesting to see the longer term results of the ICRP approach, and whether these selected complications continue to be lower than with traditional OLIF approaches. Based on the variable anatomy of the diaphragm, caudal ribs and soft tissue structures at the thoracolumbar junction, it is unlikely that any lateral access approach will eliminate the risks of complications. The authors should be commended for their description of this novel technique and their critical investigation. While larger scale studies of ICRP OLIF are certainly forthcoming to validate these early results, the ICRP approach does provide lateral surgeons with an additional strategy to avoid potential complications and improve outcomes in this crowded and challenging region of the spine.

• **Conflict of Interest:** The author has nothing to disclose.

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