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Indications, Techniques, Risks, and Future Directions in Lateral Surgery

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Overall, while lateral surgery provides good outcomes for appropriate cases, it can also present challenges that must be recognized and managed. In this session, presenters reviewed various aspects of the lateral approach.

Andrew A. Sama, MD, Hospital for Special Surgery, New York, New York, USA, provided an overview of indications for the use of lateral surgery. The lateral approach was originally used as a less invasive technique that could preserve abdominal muscles. As surgeons have become more comfortable with the technique, indications for the use of lateral surgery have expanded, including interbody fusion, correction of coronal and sagittal deformity, interbody access in obese patients, adjacent segment access, and a retropleural approach to the thoracic spine or thoracolumbar junction. The lateral approach can also be used for an anterior retroperitoneal approach for trauma, infection, or tumor and for hardware removal for failed interbody fusions above L5. Dr Sama illustrated these points with case studies that demonstrate outcomes over several years (Table 1).

To conclude, Dr Sama noted that indications can continue to evolve as surgeons better understand the approach.

Alexander P. Hughes, MD, Hospital for Special Surgery, New York, New York, USA, discussed lateral surgery in deformity correction. He first reviewed indications, including interbody fusion T12-L5, degenerative scoliosis, degenerative disc disease, adjacent segment disease, nonunion, and degenerative spondylolisthesis. He then discussed the therapeutic targets, such as nerve compression, spondylolisthesis, coronal deformity, sagittal deformity, and fracture.

Some studies have suggested that decompression and laminectomy are more efficacious than more complex surgical treatment. One study compared minimally invasive surgery with open

Peer-Reviewed
Highlights From the

North American Spine Society Annual Meeting

November 12–15, 2014
San Francisco, CA, USA

Table 1. Lateral Approach Outcomes in Several Case Studies

Patient	Diagnosis	Treatment	Outcome
Woman aged 50 y with severe low back and bilateral leg pain	Grade 1 spondylolisthesis L4/5 with foraminal stenosis	Treated with LLIF and posterior percutaneous screws	Left hospital within 1 d with excellent improvement of preoperative pain
Woman aged 47 y who had MVC 4 y prior; progressive worsening of severe TL pain that became disabling	Chronic compression fracture T12 with focal kyphosis	Injection for temporary improvement; then retropleural T12 corpectomy and posterior decompression and fusion	Did well and left hospital within 2 d
Woman aged 66 y with severe low back pain and bilateral leg pain	Work-up showed normal laboratory results and severe adjacent segment degeneration with spondylolisthesis and severe stenosis	Treated with LLIF with PLDF	Immediate relief of leg pain and left hospital within 2 to 3 d; 1 y postoperatively, mild residual low back pain
Man aged 38 y with work-related injury and severe incapacitating low back and right leg pain	DDD L3/4 45 with disc space narrowing and right-side NF stenosis	Treated with stand-alone LLIF L3/4 45 with 85% improvement of preoperative back pain	Initially had right-side femoral nerve neuropathy that resolved with postoperative R L3/4 NFESI

DDD, degenerative disc disease; LLIF, lateral lumbar interbody fusion; MVC, motor vehicle collision; NF, neural foraminal; NFESI, neuroforaminal epidural steroid injection; PLDF, posterior lumbar decompression fusion; TL, thoracolumbar.

Table 2. Studies that Support Advantages of Lateral Approaches

Technique	Studies	Outcome
Indirect decompression	Oliveira L et al. <i>Spine (Phila Pa 1976)</i> . 2010	Indirect canal and foraminal decompression without exposure of neural structures via disc space distraction and spinal realignment
Stability and fusion rates	Waddell B et al. <i>Ochsner J</i> . 2014; Anand N et al. <i>Neurosurg Focus</i> . 2010; Dakwar E et al. <i>Neurosurg Focus</i> . 2010; Rodgers WB et al. <i>SAS</i> . 2010	Strong construct with high rates of fusion (94% to 98%)

surgery [Dangelmajer S et al. *Neurosurg Focus*. 2014], while another compared interspinous process spacer, laminectomy, and laminectomy with fusion [Brodke DS et al. *Spine (Phila PA 1976)*. 2013]. Dr Hughes noted that the patients in these populations have an average curve magnitude of about 15°; however, he believes that the lateral approach is best for those who have greater curvature and who will not do well with decompression alone. He stated that it is important to be careful in patient selection for this surgery. For the stand-alone lateral approach, the stability of the segment, coronal and sagittal balance, bone quality, and connective tissue envelope should all be considered.

Joseph M. Zavatsky, MD, Florida Orthopaedic Institute, Tampa, Florida, USA, addressed the risks and pitfalls of lateral surgery. He noted important benefits of minimally invasive surgery, including lower complication rates, reduced blood loss, and shorter hospital stays. These benefits may contribute to better patient outcomes. Additional benefits are located in Table 2.

Major risks include inappropriate patient selection, difficulty with patient positioning, problems with the locations of vessels, choosing the incorrect approach (convexity vs concavity), limited access to L4/5, and limited rotational, sagittal, and lordosis correction. There is also the possibility of neurologic deficits, bowel perforation, or vascular injury.

Dr Zavatsky suggested looking at x-rays to ensure the use of a true lateral approach, minimizing incisions and operational time, limiting the use of shavers to protect bone, approaching from the left to reduce risks of vessel damage, and paying attention to the computed tomography scan. He concluded by emphasizing the importance of good positioning, an understanding of anatomy,

knowledge of rotational deformity in scoliosis, and awareness of arteries. Neurological monitoring and paying special attention to patients with previous abdominal or vascular surgery are also important. Surgeons must respect the end plates and use a larger cage for osteoporosis cases. Additionally, surgery should be aborted if anatomy is uncertain, there is no safe corridor, neural elements are present on the annulus, or monitoring fails in some way.

The final talk of the session was presented by Frank P. Cammisa Jr, MD, Hospital for Special Surgery, New York, New York, USA, who addressed the future of lateral surgery. He reviewed classic vs mini-open approaches, followed by potential improvements in retractors to allow better visualization and stabilization of the surgical corridor. As instrument designs are improved, articulating instruments may be developed that allow easy access around corners. The ability to use single positioning for both lateral and anterior approaches would simplify surgery and is under development. Because damage to the lumbar plexus is a risk during surgery, improved options to monitor and protect it will help to reduce the risk of palsies.

Adding titanium coating to poly-ether-ether-ketone and using titanium substrates is an improvement because it is hydrophilic and promotes better integration, especially if the texture is appropriate to maximize bony on-growth [Olivares-Navarrete R et al. *Spine J*. 2012]. Other improvements in design are also under development. Biologics such as autogenous bone graft, bone morphogenetic protein 2, demineralized bone matrix, synthetics, and bone mineral area mass concentrators are also options.

Dr Cammisa concluded by summarizing that improved access in minimally invasive approaches, ways to address deformity, improvements to materials and designs, improved fixation, and new approaches to using biologics will help to improve surgical approaches in the future.

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