Lumbar interbody fusion: techniques, indications and comparison of interbody fusion options including PLIF, TLIF, MI-TLIF, OLIF/ATP, LLIF and ALIF.

Mobbs RJ¹, Phan K¹, Malham G², Seex K³, Rao PJ¹.

Author information

Abstract

Degenerative disc and facet joint disease of the lumbar spine is common in the ageing population, and is one of the most frequent causes of disability. Lumbar spondylosis may result in mechanical back pain, radicular and claudicant symptoms, reduced mobility and poor quality of life. Surgical interbody fusion of degenerative levels is an effective treatment option to stabilize the painful motion segment, and may provide indirect decompression of the neural elements, restore lordosis and correct deformity. The surgical options for interbody fusion of the lumbar spine include: posterior lumbar interbody fusion (PLIF), transforaminal lumbar interbody fusion (TLIF), minimally invasive transforaminal lumbar interbody fusion (MI-TLIF), oblique lumbar interbody fusion/anterior to psoas (OLIF/ATP), lateral lumbar interbody fusion (LLIF) and anterior lumbar interbody fusion (ALIF). The indications may include: discogenic/facetogenic low back pain, neurogenic claudication, radiculopathy due to foraminal stenosis, lumbar degenerative spinal deformity including symptomatic spondylolisthesis and degenerative scoliosis. In general, traditional posterior approaches are frequently used with acceptable fusion rates and low complication rates, however they are limited by thecal sac and nerve root retraction, along with iatrogenic injury to the paraspinal musculature and disruption of the posterior tension band. Minimally invasive (MIS) posterior approaches have evolved in an attempt to reduce approach related complications. Anterior approaches avoid the spinal canal, cauda equina and nerve roots, however have issues with approach related abdominal and vascular complications. In addition, lateral and OLIF techniques have potential risks to the lumbar plexus and psoas muscle. The present study aims firstly to comprehensively review the available literature and evidence for different lumbar interbody fusion (LIF) techniques. Secondly, we propose a set of recommendations and guidelines for the indications for interbody fusion options. Thirdly, this article provides a description of each approach, and illustrates the potential benefits and disadvantages of each technique with reference to indication and spine level performed.

KEYWORDS:

Degenerative disc disease; anterior lumbar interbody fusion (ALIF); anterior to psoas (ATP); interbody; lateral lumbar interbody fusion (LLIF); lumbar spine fusion; minimally invasive transforaminal lumbar interbody fusion (MI-TLIF); oblique lumbar interbody fusion (OLIF); posterior lumbar interbody fusion (PLIF); spine; transforaminal lumbar interbody fusion (TLIF)

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Surgical approaches to the lumbar spine for interbody fusion techniques. The five primary interbody fusion approaches are shown here schematically: anterior (ALIF), lateral or extreme lateral interbody fusion (LLIF or XLIF), oblique lumbar interbody fusion/anterior to psoas (OLIF/ATP), transforaminal (TLIF or MI-TLIF), and posterior (PLIF); (B) surgical approaches to the lumbar spine for interbody fusion techniques: anatomy of the psoas and anterior vasculature determines approach at various levels.
L5/S1 PLIF. High grade isthmic spondylolisthesis presenting with bilateral L5 radiculopathy suitable for posterior rather than anterior approach. (A) T2 weighted magnetic resonance imaging demonstrating vertical angulation of the L5/S1 articulation with Grade II spondylolisthesis; (B) severe foraminal stenosis with bilateral L5 nerve impingement (arrows); (C) bilateral pars and lamina resection with interbody cage insertion (Vigor PLIF, A-Spine ASIA, Taiwan) and pedicle screw fixation with L5 reduction screws (ES-2, Stryker, USA); (D) reduction maneuver and final result. PLIF, posterior lumbar interbody fusion.
Transforaminal lumbar interbody fusion (TLIF). (A) TLIF with percutaneous screws offers a minimally-invasive option for interbody fusion (ES-2, Stryker, USA); (B) facetectomy followed by insertion of an interbody device can be performed via either a midline or paramedian approach.
L5/S1 anterior lumbar interbody fusion (ALIF). Efficient vascular access to the L5/S1 disc space provides a wide visualization that assists with disc space clearance and insertion of a large footprint lordotic interbody device.
Lateral lumbar interbody fusion (LLIF). The transpsoas corridor is used to access the disc space via a retroperitoneal approach performed with the patient in the lateral position.
Oblique lumbar interbody fusion/anterior to psoas (OLIF/ATP). Lateral position for disc exposure anterior to the psoas. The exposure can be expanded via posterior retraction of the psoas to widen the corridor.