



Clinical commentary

Extreme lateral interbody fusion relieves symptoms of spinal stenosis and low-grade spondylolisthesis by indirect decompression in complex patients

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ABSTRACT

Spinal stenosis and low-grade spondylolisthesis produce symptoms of neural compression that can be treated with extreme lateral lumbar interbody fusion (XLIF) via indirect decompression. This study aimed to investigate whether the restoration of disc dimensions would relieve symptoms of radiculopathy, claudication and back pain. In this retrospective study, patients undergoing XLIF surgery for relief of radicular symptoms or degenerative disc disease were included. Radiologically proven changes were used to assess the modes of degeneration. Objective measures such as the Visual Analogue Scale (VAS) for back and legs and the Oswestry Disability Index (ODI) were used. Complications were collated post-operatively from clinical notes and outpatient appointments. Twenty-three consecutive patients were included, of whom 91% had spinal stenosis. The cohort presented with multiple comorbidities and 35% of the cohort had undergone previous lumbar surgery. There was a 61% improvement of coronal Cobb angle and an 11% correction of the lordosis sustained 1 year after surgery. Clinical outcomes at 1 year showed 39%, 50% and 60% improvements in the ODI, back and leg VAS scores respectively. 48% of patients had reduced sensation related to lumbosacral plexus manipulation and one retroperitoneal haematoma was conservatively managed. Minimally invasive spinal (MIS) XLIF resulted in effective restoration of disc dimensions via indirect decompression, providing good relief of clinical symptoms evidenced by significant improvement in clinical outcome scores. XLIF corrected scoliosis and improved lumbar lordosis significantly. Several plexopathies did not hinder long-term recovery. XLIF is highly suited to treating complex patients with multiple comorbidities and degenerative disease.

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1. Introduction

Extreme lateral interbody fusion (XLIF) is a minimally invasive surgical technique that allows access to the intervertebral disc space and vertebral bodies via the retroperitoneal transpsoas approach [1]. The insertion of an implant, with opportunity for bony fusion, can provide indirect decompression of the neural elements at that level. As a result, XLIF is increasingly being used to treat degenerative disc disease with comorbid spondylolisthesis and scoliosis. These have a prevalence of 11.5% and 8.5% respectively, in the over 40 population [2,3]. Such conditions, which are the result of asymmetric changes to the vertebral body and disc, can produce disc height loss and thecal or nerve root compression

causing claudication or radiculopathy [4,5]. MRI demonstrates best the spinal stenosis, defined as the narrowing of the lateral recess, neural foramen or central canal. Treatment for spinal stenosis with degenerative disc disease has traditionally been decompression surgery followed by fusion (i.e. posterior lumbar interbody fusion [PLIF]) [6]. XLIF however, is increasingly being used in these patient populations.

XLIF was originally developed as a way of overcoming the drawbacks of anterior and posterior lumbar interbody fusion (ALIF and PLIF), however it is increasingly being used in preference to traditional laminectomy. XLIF's ability to indirectly decompress and thus restore disc and foraminal height resulting in symptomatic relief is its main advantage over more invasive decompression and interbody fusion surgeries. Indeed, the minimally invasive XLIF approach can produce reduced post-operative pain, entry wounds, tissue trauma, operating, recovery and mobility times resulting in shorter hospital stays. A faster recovery facilitates greater

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adherence to rehabilitation programs and final symptom improvement [1]. XLIF, unlike traditional decompression surgery, such as laminectomy or foraminotomy, does not require the need to dissect the muscles surrounding the spine causing possible paraspinal muscle denervation [7]. Furthermore, decompression by laminectomy can risk post-operative instability and increased functional recovery time or the need for concomitant fusion [8].

XLIF is shown to have utility in complex patients with numerous comorbidities; especially diabetes mellitus and smoking that contribute to poor healing [9]. Indeed, the extreme lateral approach can confer lower complications for patients who have undergone previous spinal surgeries, by avoiding the old scarred surgical plane and muscle denervation. Furthermore, larger interbody cages and more complete discectomy are possible, compared with a posterior approach [10].

This study aimed to investigate the efficacy of XLIF in treating the symptoms of a population with multiple medical comorbidities presenting with symptoms of degenerative disc disease and spinal stenosis with comorbid spondylolisthesis or scoliosis.

2. Methods

A cohort of 23 consecutive patients with back and/or leg pain undergoing XLIF surgery performed by a single surgeon (KL) at a single National Health Service (NHS) hospital (Guy's and St. Thomas' NHS Foundation Trust, London, UK) over 3 years from September 2012 to September 2015, was studied retrospectively.

A pro forma was produced which collated demographic data such as age, primary diagnosis, comorbidities, age at operation, previous lumbar spine surgery and levels fused. Clinical data was collected from case notes, operation charts and radiological images. Radiological assessment entailed the measurement of parameters before and after surgery. Radiographs, CT scans and MRI were used for data collection and the measurement of radiological angles. Radiological measurements were performed using Surgimap software (Nemaris Inc, New York, USA). Such angles included the Cobb angles, segmental lordosis angle, lordotic angle, sacral slope, pelvic incidence and pelvic tilt. Fusion grade was also assessed on post-operative radiographs and CT scans where available, looking for bridging bone and absence of any halo around the implant. Operation details recorded included duration of surgery, fusion product used and type of surgery. Post-operative complications were recorded from inpatient notes and clinic letters. Clinical outcome was measured using Oswestry Disability Index (ODI), Visual Analogue Scale Back (VASB) and Visual Analogue Scale Leg (VASL) scores, which were recorded before and 6 weeks after surgery and at 6-monthly follow-up thereafter with 1 year outcomes analysed where available. The cohort was stratified into several groups during analysis – those with central canal, lateral recess and neural foramen stenosis with or without spondylolisthesis.

3. Results

A total of 23 patients received XLIF surgery during the 3-year study period. Table 1 displays the patient demographics. There was an almost equal split between males and females (11:12) with a mean age of 61 years (27–82) at the time of the operation. Eight (35%) of the cohort had previous spinal surgery. Of these, three had undergone decompression, another three underwent fusion and one patient had received a transforaminal lumbar interbody fusion (TLIF) which did not resolve the pain. The average duration of stay was 7.7 days. There was an abundance of comorbidities with an average of two per patient. One patient had as many as six comorbidities. The most commonly described was hypertension followed

Table 1
Patient demographics, common comorbidities and levels treated.

Mean age at surgery	61 (Standard deviation 13) years
Sex (M:F)	11:12
Diabetes	13.0%
Smoking	13.0%
Hypertension	47.8%
Previous spine surgery	34.8%
Pure extreme lateral interbody fusion	65.2%
Total number of levels fixed	42
L1/2	3
L2/3	8
L3/4	14
L4/5	17

by hypercholesterolaemia, smoking, transient ischaemic attacks and osteoarthritis.

The L4/5 disc was most commonly operated on in 74% of patients. This was followed by the L3/4 disc in 61%. Eighteen patients (78%) received XLIF intervention at two or less levels and 22% received intervention at three or more levels. The latter group had an average age of 71 years, whereas those that received intervention at two or less levels had an average age of 58 years at the time of surgery.

The most common material used as a bone graft was Attrax, followed by de-mineralised bone substitute (DBS). 35% of the patients had a second posterior operation 1 week later; such operations included multi-level fixation with percutaneous screws. Overall, 13 patients (57%) received percutaneous screws, nine (39%) had open posterior instrumentation surgeries to correct deformity and one patient (4%) received interfacetal spacers. No patient received a standalone XLIF. The mean operation time for both the XLIF and posterior fixation combined was 222 min. Figs. 4 and 5 illustrate typical pre- and post-operative radiographs.

The most common primary diagnosis was sciatica; Table 2 illustrates the primary diagnoses for this cohort. Radiological evidence collated from CT scans and MRI showed evidence of spinal stenosis in 91%, spondylolisthesis in 70% and scoliosis in 43%. The most common pathology was spinal stenosis presenting in 55%, followed by 12%, 23% and 20% for central canal, foraminal and lateral recess stenosis (Table 3). The most commonly degenerate disc was L4/5 in 91%. 52% were found to have abnormalities at L5/S1.

Radiological outcomes at 1 year were available in all 23 patients and showed two main improvements. The Cobb angle, a measure of scoliosis, was improved by 60%. The lordotic angle, which directly influences sagittal balance, was improved by 11%. There was little change in the pelvic parameters, which are displayed in Table 4 and Fig. 1. Further outcomes include the correction of Cobb angles synonymous with a diagnosis of scoliosis to <10°, in six scoliotic patients (67%), the maximum correction being 46°. Fusion was confirmed radiologically in 91% of patients at 1 year.

Patient reported outcome measures were universally improved at 1-year follow-up where available. Figs. 2 and 3 display these scores. Six patients (26%) had no 1-year outcome scores on record. Of the remaining 17 patients, the mean post-operative ODI score

Table 2
Frequency of primary diagnoses.

Primary diagnoses	Frequency
Sciatica	13
Degenerative scoliosis	8
Disc failure	4
Degenerative spondylolisthesis	2
Broken metal work	1
Presence of back pain	18
Presence of leg pain	16

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