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Research Paper

Surgical Evaluation of Transforaminal Lumbar Interbody Fusion and Posterior Instrumentation in Degenerative Lumbar Spine

Medical Science

KEYWORDS : TLIF, degenerative lumbar spine disease, interbody fusion

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ABSTRACT

The goal of fusion of the lumbar spine is to obtain primary solid arthrodesis thus to alleviate pain. The TLIF procedure has rapidly gained popularity; because of its posterolateral extracanalar discectomy and fusion, it has been reported as a safe technique, without the potential complications.(1) A retrospective clinical and radiographic study of 46 patients with symptomatic degenerative lumbar spine treated with TLIF was performed. In this study improvement in ODI score from 63% to 13% and in mJOA score from 9 to 25 at final follow up. The advantages of this technique are: few complications, the simplicity and speed of execution and versatility, less neurologic injury. Few complications encountered during study do not affect overall long term outcome. Adjacent segment disease and accelerated disc degeneration above or below the level of fusion is major concern on long term follow-up.

INTODUCTION

Problem of degenerative lumbar spine is a big issue. Surgical treatment for degenerative disc disease was lumbar inter-body fusion with the bone graft without posterior fixation. But this resulted into nonunion, graft collapse, graft resorption, inconsistent fusion and non relief of pain. These problems were due to instability of spine that is the direct result of performing the operation in form of extensive posterior element removal. By utilizing transpedicular screws, rods and interbody fusion with cage, surgeons are now able to perform extensive laminectomy, facetectomy, nerve root decompression and restoration of spinal stability which permits early post operative ambulation. Transforaminal lumbar interbody fusion (TLIF) is an increasingly popular treatment for degenerative lumbar conditions. Its unilateral posterior approach enables anterior column stabilisation and 360º fusion, while reducing the morbidity associated with posterior and anterior lumbar interbody fusion (PLIF and ALIF).(2) We evaluated the outcomes in form of clinical improvement in symotoms, radiological fusion rates, complications and adjacent segment degeneration associated with TLIF.

MATERIALS AND METHODS

Retrospective study of 46 cases of degenerative lumbar spine treated with TLIF was performed. The skeletally mature patients (more than 40 years) with lumbar canal stenosis, recurrent disc herniation, facet hypertrophy, instability, lumbar degernerative spondylolisthesis were included in this study(Fig 1). And patients with acute prolapsed intervertebral disc, severe spodylolisthesis (more than grade I–II), traumatic lumbar spine disease and active infection were excluded from study.

46 patients with 30(65%) male and 16(35%) female with average age 57 years ranging from 40 to 78 years underwent TLIF procedure for different lumbar pathology. 2 patients were operated for discectomy and they presented with recurrence of symptoms and their MRI showed lumbar canal stenosis due to recurrent disc herniation so they were planned for TLIF. 30 patients(65%) had L45 disc affection. 7 patients had double level affection out of which 3 patients had L34,L45 discs affection and 4 patients had L45 L5S1 discs affection.

All patients in this series had low back pain as their predominant symptom, with varying degrees of radicular pain, neurologic symptoms, disturbed sleep patern and reduced walking distance. All patients underwent atleast 6 months of non-operative care of medication, physiotherapy and lumbo-sacral brace before coming to surgery.

The bilateral, posterior pedicle screw-rod instrumentation was performed using a consistent surgical technique. The patient was placed in prone position. Standard posterior approach to lumbar spine is taken. After completing the exposure, with help of nibbler spinous process is held and vertical movement is made to check and confirm instability. Posterior fixation with pedicle screws is done under fluoroscopy. Distraction is done between two levels of screws. Adequate decompression is achieved. One facet is removed if symptomatic. Appropriate sized kidney-cage with bone graft is inserted in sagital plane and gradually rotated so that it lies over anterior aspect of vertebral space and stays transversely to give maximum support. In some patients we use tricortical bone graft instead of cage. Lastly compression is done between pedicular screws. Layerwise closure was done over drain. Physiotherapy was started the next day, ambulation with a lumbo-sacral belt was encouraged as long as the pain was tolerable. The drain was removed about 48 hours after surgery. Patients were discharged when independently ambulant and capable of selfcare. Sitting on the floor, sitting cross legged and stooping forward are avoided for minimum of 3 months post-operatively.

Patients are reviewed at monthly intervals for six months and then at 6 monthly intervals and examined for neurological status, back pain, radicular pain, walking distance and persistence or recurrence of any symptoms and complications. Patients were reviewed with oswestry disability index(ODI)(3) and modified Japanese association score(mJOA)(4). Patients were reviewed with CT scan to see the interbody fusion and union status. X-rays were taken to see fusion and any complication like implant failure.

Union is defined by 1- flexion-extension lateral x-rays $<3^0$ movement at the fusion level. 2- Trabecular pattern seen on anterior or posterior aspect of cage on lateral xray. 3- on CT scan union is seen through the cage and outside the cage. 4- intact hardware. (1)

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Adjacent segment is defined radiologically by 1- the presence of progression of arthritic grade more apparent in the segments adjacent to the fused segment than other segments, or 2- instability in the adjacent segments (defined as >4 mm translation, or segmental kyphosis >10° on lateral flexion-extension radiographs). Clinically, adjacent segment degeneration is defined as presence of new symptoms (back pain or lower limb pain), which were confirmed by MRI when radiographic evidence was absent.

RESULTS:

This is a retrospective study of 46 patients with mean age 57years (range 40-78) operated with TLIF. In this study 57% patients had predominantly left sided radicular pain, 26% of patients had right sided radicular pain and 17% patients had both lower limb radicular pain. Comparison of preoperative and post operative symptoms suggest most of the patient have improvement in symptoms.(ChartI) 65% of patients have improvement in low back pain and 83% of patients have improvement in radicular pain and walking distance and 86% of patients have normal sleep pattern postoperative suggestive of good clinical outcome of this operative procedure. In this study, number of patients had other signs or symptoms like urinary frequency, bowel/bladder affection, sensory disturbances like hypoesthesia in specific dermatome, motor symptoms in specific group of muscle or restriction of straight leg raising test. All patients have recovered sensory and motor symptoms but foot drop did not recover.

In this study, improvement in average ODI score from 63% to 13% and improvement in average mJOA score from 9 to 25 with 80% improvement suggests good clinical outcome. At final follow up 80% patients showed excellent, 17% showed good and 3% showed average results(ChartII).

In this study on CT scan images, all the patients had solid union through the cage but 3 patients did not show union outside the cage, rest 41 patients showed solid union outside the cage. In two patients isolated tricortical bone graft block is used and in 5 patients (out of 7 double level fixations) one level cage and one level bone graft is used. They all had solid union at bone graft site. In this study 34 (74%) patients show trabecular pattern on x-ray. Rest all patients have union on CT scan. On lateral x-ray flexion-extension view average movement at fusion level is 1.740 (no gross movement) suggesting union.(Fig 3) No subsidence of cage is seen through either superior end plate or inferior end plate in any patients.

Overall 11 (24%) patients showed complication in this study.

We identified per-operative inadvertent dural tear in 3(7%) patients. They were repaired with mersilk 4-0. And post-repair valsalva manoeuvre performed to confirm repair of dura did not show any leak. No other peroperative complications like haemorrhage or damage to major structures were identified.

In early post operative period 4(9%) patients had mild serous discharge. They were seen as soaked dressings. No active pus discharge was found and were treated by continued use of antibiotic. They all were normal by the time of stitch removal and did not progress to any major complication.

One patient faced neurological weakness in form of some foot drop and quadriceps weakness post operatively. It was recovered fully by 2 months. At final follow up patient was neurologically normal.

In late complication one patient had broken implant on follow up x-ray but patient had no major complains and this is an incidental finding.

Two(4%) patients had late infection after 2 months of stitch removal. One patient had serious wound infection which led to wound gapping and raw area at the stitch line and had deep infection treated by higher antibiotic but finally implant removal was done in that patient at 4 months. At final follow up at two year the patient had no major complain or neurological worsening and back pain and radicular pain was relieved. Another patient was treated by higher antibiotic only, no surgical intervention was required but that patient has some stiffness and muscle spasms at the local site at one year follow up.

In this study, two(4%) patients are showing adjacent segment disease.(Fig 4) One patient had radiological evidence of increase motion, end plate sclerosis, osteophytes, reduced disc space and increased lumbar spondylolisthesis above the fusion level and clinically had recurrence of back pain and lower limb radicular pain after 2 year of surgery. Another patient had clinical recurrence of symptom and increase motion on adjacent segment.

DISCUSSION:

Degenerative spondylolisthesis in adults is characterized by the loss of disc height across the affected segment with sagittal translational and is often coupled with rotational deformity.(5) Lumbar spondylolisthesis is a disease with several etiopathogenetic origins, as shown by Marchetti and Bartolozzi.(6) The aspect of pathologic anatomy and radiological findings, the age and clinical appearance of the patients are different when they are diagnosed.If conservative treatment fails this may be an indication for surgery. The gold standard of the spondylolisthesis surgical treatment is fusion.(7)

The different techniques for fusion discussed in literature have advantages and disadvantages,(7) with mixed and variable results and with the possibility of having several complications,(8) which must be taken into account in the choice of treatment. Posterolateral instrumented or noninstrumented fusion (with or without decompression), anterior interbody fusion, and circumferential fusion have all been reported to provide acceptable fusion rates and clinical outcomes in adult patients with spondylolisthesis.(5)

In August 2007, Chad D. Cole et al carried out a study of comparison of low back fusion techniques by TLIF or PLIF approach in patients with vertebral body instabilities and spinal deformities(9). The chief advantages of TLIF procedure include a decrease in potential neurological injury, improvement in lordotic alignment given graft placement within the anterior column, and preservation of posterior column integrity through minimizing lamina, facet, and pars dissection. Biomechanically, TLIF provides anterior column support and a posterior tension band. (10) Inter-body fusion techniques were developed in an attempt to preserve the load-bearing capacity of the spine, restore the sagittal plane alignment, and use the compressive loading on the bone to enhance the likelihood of fusion.

In this study pre-operative ODI score is 63% and at final follow-up this comes down to 13%. So by TLIF procedure overall there is recovery in disability. And pre-operative average mJOA score is 9 which improved upto 25 at final follow up with average 80% of improvement. And in mJOA score improvement, 37 patients(80%) have excellent, 8 patients(17%) have good and 1 patient(2%) has average improvement. In study of Deng-lu Yan et al(5) average JOA improvement was 84.1%. In study by Fan Shunwu et al(11) ODI score improvement from 52% to 27.2% at 2 years follow up. On reviewing these studies and our study, overall TLIF procedure has favourable outcome.

Minor complications rates vary from 20 to 35.3%,(18) and a revision rate of 7.6% has been reported.(12) General complications include ileus and pseudomembranous colitis.(13) Specific complications include pseudoarthrosis, pedicle screw malposition, haematoma, symptomatic contralateral disc herniation, dural tears, wound infection, wound dehiscence, seroma formation, donor-site infection, as well as transient and persistent radiculopathy(12,13). In this study, no patient had a life-threatening or permanent neurological complication or revision. 3 patients(7%) had per-operative dural tear. 4 patients(9%) had mild serous discharge in early postoperative period. One patient developed early postoperative neurological weakness which recovered. All the complications in this study had no major adverse effects. Two patients had late complication of infection

and out of them one patient underwent implant removal. Overall in this study there is no major complication rate. This shows that TLIF is obviously advantageous.

In this study 2 patients(4%) developed adjacent segment disease clinically by reappearance of symptoms and radiologiacally after 2 years of operation. Adjacent segment degeneration adversely affects functional outcomes, and thus long-term follow-up and/or additional surgical intervention are needed. 70% of the cases of adjacent segment degeneration developed proximally, which is consistent with another study.(2)

CONCLUSION:

The study evaluated the clinical and radiographic results in 46 patients who underwent interbody fusion and posterior instrumentation in degenerative lumbar spine. The analysis of the mid-term results of degenerative lumbar spine treatment with pedicular screw fixation and interbody fusion mainly TLIF gave a very satisfactory response. The technique of putting interbody cage and bone graft anterior to cage with pedicular screw fixation is forming a solid construction with 3600 of fusion and is reliable in allowing an optimal primary stability and creating the best biomechanical conditions to obtain a solid fusion. The success of the surgery is due to the correct indication. Using diagonal insertion of a single threaded cage and bone graft anterior to cage with supplementary transpedicular screw and rod instrumentation enables sufficient decompression and good number of patients achieves solid interbody fusion by optimum duration.

Reviewing the literature and in our experience, the TLIF procedure had led to shortened surgical times, less neurologic injury, and improved overall outcome. In this study improvement in ODI score from 63% to 13% and in mJOA score from 9 to 25 at final follow up shows TLIF procedure improves the general condition of patient.

TLIF procedure allows surgeon to achieve anterior fusion with low risk of injuring the nerve root. Minimal retraction of the root required while putting the anterior cage in comparison to PLIF.

The advantages of this technique are: few complications, the simplicity and speed of execution and versatility. Few complications (Dural tear, Local wound infection, Brocken implant) encountered during study (observed in 24% patients) do not affect overall long term outcome. Adjacent segment disease and accelerated disc degeneration above or below the level of fusion is major concern on long term follow up, it is observed in 4% patient in this study.

chart I: Improvement in symptoms in post operative as compared to preoperative period

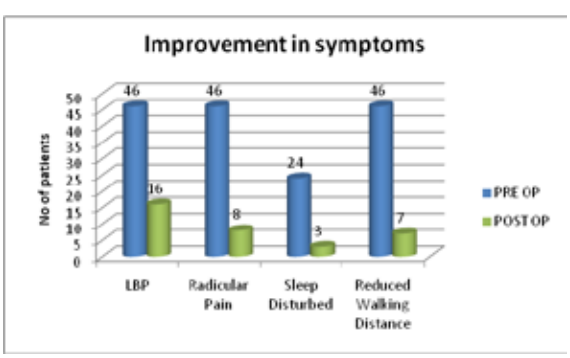


Chart II: Improvement in mJOA score.

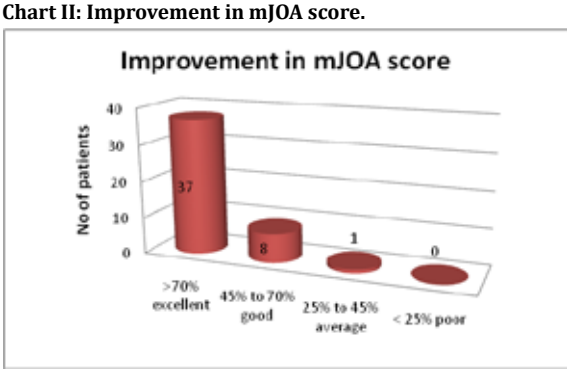


Fig 1: mri showing l4-5 canal stenosis and facet hypertrophy

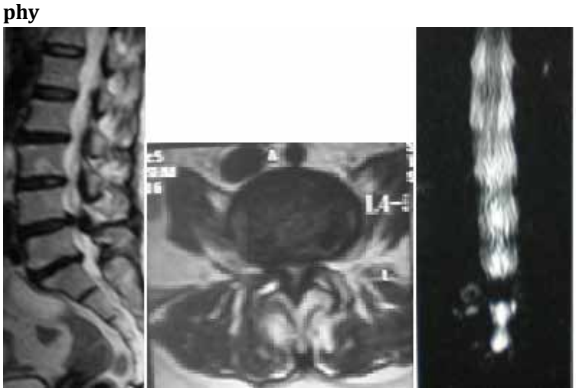


Fig 2: Solid union at anterior aspect of cage, no movement on flexion-extension view

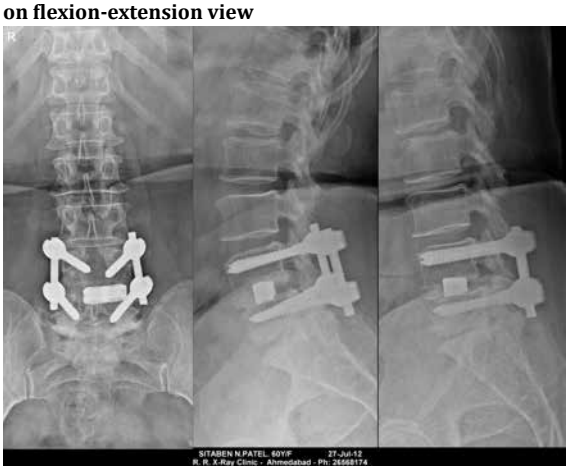
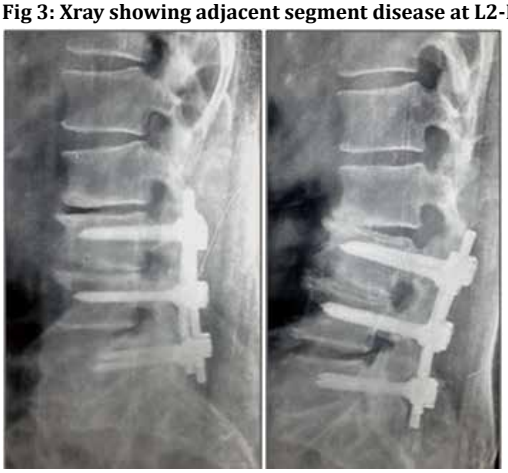


Fig 3: Xray showing adjacent segment disease at L2-L3



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