Transforminal Lumbar Interbody Fusion in Management of Degenerative Disorders of the Lumbar Spine (Tlif)

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ABSTRACT

Objective TLIF is now a popular spinal surgical technique, we conduct study to evaluate clinical and radiological outcome of TLIF with respect to indication, and to demonstrate surgical technique and advantage of TLIF for lumbar interbody fusion. Methods: Twenty patients who underwent TLIF were prospectively studied. They were 13 women 7 men with long term severely disabling low back pain. Result: The average duration of follow up was 6 month; preoperative pain and disability were significantly improved of final postoperative follow up as regard VAS and ODI scores.

Conclusion: Out data suggests that TLIF improve the functional outcome for degenerative disorders of lumbar spine with good selection of patients, surgical decompression and patient's comorbidities.

Key Words: Transforminal, Lumbar, Interbody, spine

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INTRODUCTION

Posterior lumbar interbody fusion (PLIF) after lumbar disc removal was first reported by Jaslow [1]. Cloward [2] presented his first 100 cases at the Harvey Cushing Society meeting in 1947. More recently, Steffee [3] and Brantigan, [4] have reported on the use of posterior segmental instrumentation or the use of cage implants for PLIF. [1].

Perhaps the greatest concern with a standard PLIF is the amount of neural retraction needed. An improper amount could potentially lead to nerve root injury, cauda equine injury, dural la

ceration, and epidural fibrosis. Consequently, the unilateral transforaminal lumbar interbody fusion (TLIF) was developed to address some of these problems. The purpose of this approach was to obtain the same goals as a PLIF without the potential risks and complications. [5].

The TLIF technique allows clearance of the entire intervertebral disc compartment by opening the neural foramen on one side. After appropriate clearance, it is possible to achieve further enlargement of the cleared intervertebral compartment by posterior transpedicular distraction. This enables definitive anterior column support and certain fusion by transforaminally introduced bone material and support structures. After the introduction of these anterior fusional elements, segment stability is restored by converting the distraction force into compression force. The TLIF approach helps to avoid damage to important anatomic structures such as the nerve roots, dura, ligamentumflavum, and interspinous ligament. Preservation of the ligamentous structures is of great importance to restoring biomechanical stability of the segment and its adjacent counterparts [5].

The advantages over the standard PLIF include the ability to provide bilateral anterior column support through a single posterolateral approach of the disc space. The

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transforaminal approach preserves the anterior and most of the posterior longitudinal ligamentous complex, which provides a tension band for compression of the graft and prevents retropulsion of the graft. It avoids excessive soft tissue dissection, which may help prevent scarring and instability of adjacent segments, as well as injury to the exiting nerve root. Epidural bleeding is less of a problem than with the standard bilateral PLIF because of the unilateral transforaminal approach, and, with experience, proper cage placement within the disc space is consistently achieved.[2].

Indications and Contraindications

Indications

Best indication is a grade I or grade II spondylolisthesis without neurologic deficit or with a deficit on one side only. Degenerative disease with positive discography without any intracanal pathologic condition. Anterior column deficiency with chronic mechanical pain related to degenerative disc disease, recurrent disc herniation, and/or spondylolisthesis. Segmental kyphosis related to disc narrowing.

MATERIAL AND METHODS

From June 2012 to Jan 2014, there were twenty patients (7 men, 13 women), mean age 43 years, ranged from 31 to 55 years with long-term severely disabling low back pain. Patients were postoperatively evaluated after 3, 6, 9, 12 months. Four patients (20%) already underwent prior low back surgery.

Patient selection

Inclusion criteria:

Pain localized in the lower back radiating in one or both legs. Compliant lasting more than 6 months.Failure of conservative treatment at least for 3 to 6 months.Disability to daily activities. No neurological deficits related to the actual condition.

Surgical technique

Positioning

The patient is placed very carefully in the prone position to lessen its adverse effects. Care must be taken not to allow pressure on the abdomen, because this may cause venous engorgement, stasis, and increased bleeding from the epidural veins.

Exposure

After administration of perioperative antibiotics and infiltration of the skin and para-spinal muscles with 1% bupivacaine (Marcaine), a midline skin incision of approximately 10cmis made slightly rostral to the pathologic disc space. Dissection is carried down to the level of the lumbosacral fascia, which is opened along the midline. The spinous processes and the laminae of the vertebrae above and below the level of the pathology are exposed and cleaned of all soft tissues. A complete facetectomy permits complete neural decompression and a direct approach to the disc space with minimal neural retraction.

Great care must be taken to avoid over distraction and traction of the neural structures during any of these steps. Typically the nerve root exiting below the superior pedicle is at the greatest risk for injury, especially with the placement of intervertebral instrumentation. Injury to the dorsal root ganglion in this area may result inpermanent neuropathic pain that is very resistant to all treatment modalities.

Discectomy and Preparation of the Graft Site

The disc space is entered, and a 7mm intradiscal shaver is inserted on one side, parallel to the endplates, and rotated a number of times. These shavershaveside-cutting flutes so that disc material and end plate are removed. Adequate preparation of the host graft site and removal of the cartilaginous end-plates are important steps to ensure successful fusion. Total decortication down to the anterior longitudinal ligament, excellent visualization is achieved but it carries the risk of vascular injury.

Grafting

Autologous cancellous bone interbody graft, alone, is of inadequate mechanical strength to resist the forceful recoil against the graft, even with transpedicular instrumentation. Some form of vertical column support can be provided by an intervertebral fusion device that maintains disc space height as the graft heals. In addition, a tight, close fit is critical to grafting, because bone is less successful in bridging a gap greater than about 200µm.On completion of graft insertion, the distracting instruments are removed to allow the fused segment to compress to prevent graft extrusion.

However, once the disc space expansion has been achieved using interbody distraction, the pedicle screws on the side opposite the interbody approach can be tightened over a temporary rod to maintain the distracted position. Alternatively, a laminar spreader may be used to maintain distraction of the space to avoid loosening of the pedicle screws. We prefer distraction over pedicle screws as it more accurate in maintaining distraction than distraction over lamina. Vigorous distraction of the pedicle screws to achieve the disc space expansion should be avoided because this practice may lead to loss of screw purchase.

Autogenouscancellous bone was then packed into the anterior and contralateral portions of the disc space to promote interbody fusion. The interbody space was then reconstructed by selecting an appropriately sized interbody cage. Trial implants were useful for ensuring optimal sizing of the interbody device. Proper sizing of the trial cage depend on disc height at the level above and below the affected disc.Using an interbody cage, the cage was packed with autogenouscancellous bone or an appropriate graft substitute.

The interbody cage was then impacted into the discspace. Additional cancellous graft material should be packed around the cage, filling any residual voids within the interbody space.

Cage position has been confirmed using image intraoperative by markers fixed to the cage. There were markers showing antero-posterior position and markers for lateral position of the cage.

Any distraction that has been temporarily used to hold open the interbody space should be released after placement of the interbody cage. Rods were attached to the pedicle screws, and gentle compression was applied to the construct.

Additional grafting of the posterolateral region of the spine was performed.

Care should be taken to ensure that graft material was not packed into the intervertebral foramen. Before wound closure, a probe was used to confirm adequate space around the neural structures and ensure that no graft material has migrated into the foraminal region.

Case presentation

47 years old female with low back pain with bilat sciatica lytic Spondoylolithesis at L3-4. ODI preoperative was 74.2%, at last follow up was 20.3%. VAS for back pain preop was 7.5, last visit 1.6. VAS for leg pain was 6 preop, at last visit 0.

RESULTS

No patient was lost to follow up, all patient were followed up for 3 – 6 – 9– 12 months.

Mean operative time around 140 minutes with longest time 200 minutes.

Mean blood loss was 885 ml (± 269) with max blood loss was (1500 ml).

Mean hospital stay was 3 days and maximal hospital stay was 4 days.

The clinical outcome was scored using Macnab classification

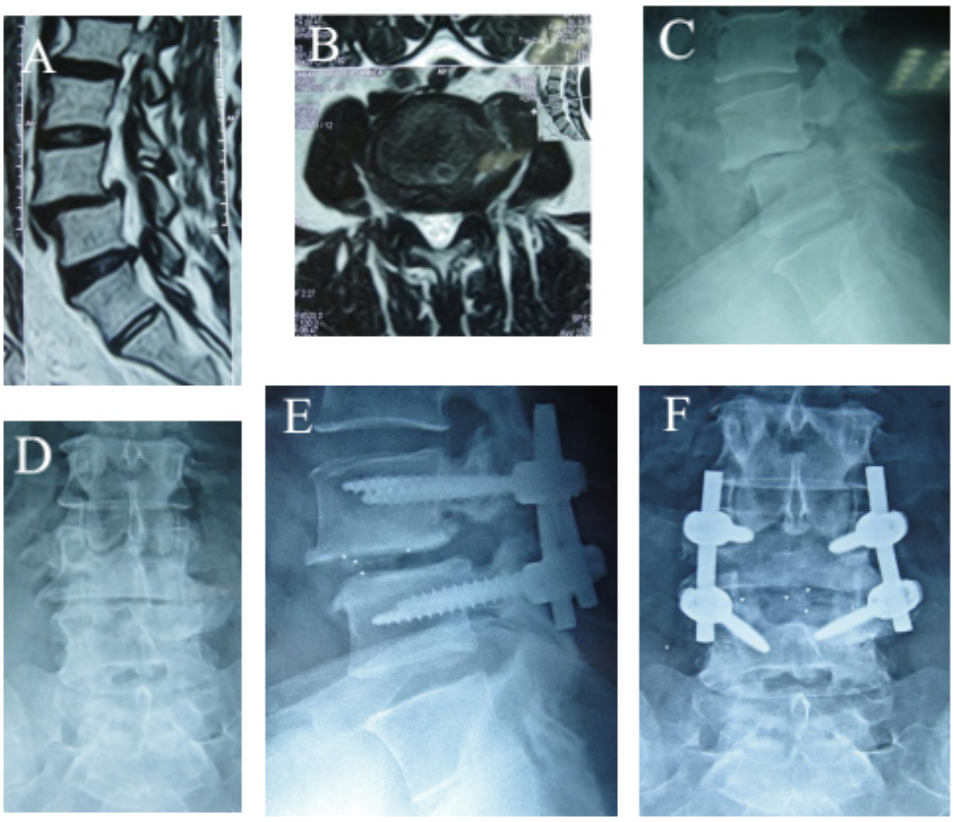

Figure 1: (A- F) A. T2 sagittal MRI lumbosacral spine showing L3-4 spondylolisthesis. B. Axial view L3-4 disc. C-D.plain x-ray lateral and A-P view showing spondylolisthesis with fracture pars. E.-F. Postoperative plain x-ray L3-4 transpedicular screw fixation with transforaminalinterbody fusion with reduction of the step.

Table1: The clinical outcome score according to Macnab classification.

Result	Cases	Percentage
Excellent	14	70%
Good	6	30%
Fair	0	0%
Poor	0	0%

No patients reported postoperative pain greater than their preoperative level.

Patients were asked to complete pre- and postoperative questionnaires assessing pain (medication use) and ability to perform activities of daily living (ADLs) including lifting, walking, standing, sitting, work status, and social activities. The questionnaire was largely based on the Oswestry outcomes instrument.

According to Oswestry disability index ODI

ODI improved from (66%) (± 5.7) preoperative to (19%) (±1.5) at final follow up and this was found to be highly statistically significant (P = 0.00).

According to Visual analogue score VAS

The mean VAS for back pain improved from (7.8) (±0.4) preoperative to (1.7) (± 0.2) postoperative at the final follow up.

The mean VAS for leg pain improved from (7.1) (± 0.2) preop to (0.5) (± 0.1) and this was found to be highly statistically significant (P = 0.00).

Table2: Basic statistics for ODI preoperative/ postoperative, VAS for back pain and leg pain preoperative /postoperative.

		Mean	N	Std. Deviation	Paired t	P
Pair 1	ODI PRE	66.9200	20	5.74324	36.8	0.00**
	ODI POST	19.7350	20	1.52076		
Pair 2	VAS for back pain PRE	7.8900	20	.41536	71.8	0.00**
	VAS for back pain POST	1.7350	20	.25397		
Pair 3	VAS for leg pain PRE	7.1	20	0.2131	80.1	0.00**
	VAS for leg pain POST	0.5	20	0.1211		

According to radiological Outcome: Fusion

Time needed to asses the fusion 6 – 9 months. Radiographic fusion was present in 19 of 20 (95%) of the patients based on the presence of obliteration of the disc space anterior to the cages as well as continuous trabecular bone throughout the inter-transverse fusion mass, no loosening or breakage of implants, and no demonstrable motion on flexion-extension radiographs. One patient had a confirmed pseudoarthrosis but he was clinically free so we did not re-operate again.

Table3: Basic statistics for age, hospital stay, ODI preoperative, ODI postoperative, VAS for leg pain preoperative and VAS for leg pain postoperative.

	Age	hosp stay	blood loss	ODI PRE	ODI POST	VAS for leg pain PRE	VAS for leg pain POST
Mean	43.9000	3.45	885.0000	66.9200	19.7350	7.8900	1.7350
Median	45.0000	3.00	850.0000	69.0000	19.2000	8.0000	1.6000
Std. Deviation	9.07802	.510	269.55128	5.74324	1.52076	.41536	.25397
Minimum	31.00	3	600.00	55.70	18.20	7.00	1.50
Maximum	55.00	4	1500.00	74.20	23.00	8.50	2.20

Intra-operative Complications:

One case of unintended durotomy that was repaired intraoperatively. 13 cases lost more than 600 cc blood that required blood transfusion intraoperative and during the post-operative period.

Postoperative complications:

Transient radicular manifestation in the form of numbness, tingling and partial motor weakness involving L4&L5 dermatomes occurred in 3 patients; These symptoms improved gradually within three months in all patients with use of neurotonics and anti oedema medications.

Foot drop occurred in one patient was managed conservatively with splinting, exercise and neurotonics medications. Patient showed gradual progression over four months and no further surgical procedure was needed.

Gastrointestinal disturbances in the form of nausea, vomiting and ileus happened in two patients needed medical treatment for few days postoperatively.

DISCUSSION

Lumbar spine fusion has become a commonly performed surgery, and its use continues to rise. Initially, reconstructive spinal fusion surgery was used for the management of infectious conditions, adolescent scoliosis, and trauma. The indications for spinal fusion among these patients have remained largely unchanged. Based on these experiences, the use of spinal arthrodesis has been extended to treat degenerative lumbar disorders, spondylolisthesis, and disc-related problems. Currently, the majority of lumbar fusion surgeries are performed for this latter group of conditions.

A meta-analysis of the surgical literature regarding the operative treatment of degenerative spondylolisthesis shows enhanced outcomes in those patients treated by instrumented posterolateral fusion in combination with an interbody graft compared with those treated with either an interbody fusion or instrumented posterolateral fusion alone. Other studies have also demonstrated both clinical and radiographic benefits of adding interbody support to posterior instrumentation constructs when reducing listhetic vertebrae [6].

Interbody fusion has gained broader usage in the treatment of motion segment instability pain since its introduction by Cloward. Proponents point to the multiple advantages of interbody fusion over posterolateral fusion. Since the anterior and middle spinal columns support 80% of spinal loads, placing the bone graft in this load-bearing position subjects it to compressive forces that enhance bony fusion as predicted by Wolff's Law. The vertebral body represents 90% of the osseous surface area and receives a more generous vascular supply than the posterolateral elements, which further improve fusion potential. Inrebody grafts can better restore coronal and sagittal balance. Radiographically differentiating a successful fusion from a pseudarthrosis is also easier after

posterior interbody fusion than after posterolateral fusion [7].

Clinical outcomes studies for TLIF are typically comprised of level III and IV evidence. Most are case series documenting the safety and comparable clinical efficacy of TLIF in treating lumbar disc disease as well as isthmic and degenerative spondyloslisthesis. [8].

In this study, the reduction of VAS and ODI was statistically highly significant in VAS improved from (7.8) to (1.7) at last follow up and ODI improved from (66.9%) to (19.7%) at last follow up which is comparable to Zhou et al [9] who reported ODI of 16.9+5.6 at final follow up and to Wang et al [10] who reported final ODI of 11.5+4.2.

Park and Foley, [11] operated on 40 patients mean ODI preoperative 55% to 16% postoperative with reduction in Spondoylolithesis was achieved in all cases.

This difference may be due to multiple co- morbidity such as DM and smoking.

The mean blood loss was higher than Fessler [9] who reported a mean blood loss of 150 ml, higher than Ould-Sliman et al., [12] who reported blood loss of 570±360 ml and Zhou et al., [12] who reported blood loss of 320± 142.3 ml .This can be attributed to the excessive use of non-steroidal anti-inflammatory drugs preoperatively by the patients. The intraoperative blood loss can be reduced by discontinuation of non steroidal drugs 2 weeks before surgery and by maintaining hypotensive anaesthesia during operation.

The mean hospital stay was 3.4 days (± 0.5) which was not much different from Fessler [12] who reported a hospital stay of 84 hours (±36).

Radiological outcome

Kai et al., [14] reported a solid fusion in 95.2% (20 patient out of 21) this is near our result.

Our radiological outcome was less than Mcafee et al. [15] he had a solid fusion in 98% there were no pseudoarthrosis, instrumentation failure or subsidence although reduction of the slip was not the primary goal.

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