



EVALUATION OF CLINICAL PROFILE, RADIOLOGICAL AND FUNCTIONAL OUTCOME FOLLOWING TRANSFORAMINAL LUMBAR INTERBODY FUSION (TLIF): AN INSTITUTIONAL EXPERIENCE

Neurosurgery

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ABSTRACT

Objective. We studied the clinical, radiological and surgical profile with outcome of the patients undergoing Transforaminal lumbar interbody fusion (TLIF) for lumbar or lumbosacral listhesis.

Methods. In this retrospective study, data were collected from patients who underwent TLIF for lumbar or lumbosacral listhesis in our department between 2015 and 2019. All patients who underwent TLIF irrespective of cause for the listhesis were included in the study. Clinical and radiological profile with surgical outcome were studied. Dynamic X ray of lumbosacral spine in flexion and extension position in erect posture was done for all the patients. All the patients were operated using the same technique. Their clinical and surgical profile with outcome were studied.

Results. There were 110 patients (46 males; 64 females; mean age, 53.4 years, range, 28 years to 69 years). Magnetic resonance imaging (MRI) Lumbosacral spine was available for all the patients. 65 (59%) of the patients had computed tomographic (CT) images of lumbosacral spine. Dynamic Xray of lumbosacral spine in flexion and extension position in erect posture was done for all the patients. All our patients presented with history of low back pain with two third of them having history of radicular pain. 38% of the patients had history suggestive of neurogenic claudication. 76% of the patients had examination findings pertaining to the radiological features. Average time taken for surgery was 3 hours with an average blood loss of 150 mL. Mean follow up duration was 3 years (range 3 months to 5 years). 12% of the patients were lost to follow up after 6 months of the surgery. 2 cases had implant failure with no mortality.

Conclusions

TLIF is a gold standard surgical method of stabilisation for the lumbar or lumbosacral listhesis patients. Its associated with least morbidity amongst all the surgical modalities for correction of listhesis. Long term outcome for the patients undergoing TLIF was significantly better than patients undergoing only decompression and flavectomy or pedicular screw fixation without cage placement. Larger database including the subgroup of the patients opting for decompression without TLIF would be required for further analysis.

KEYWORDS

TLIF; Transforaminal; Lumbar; Interbody; Spinal Fusion; Radiology

Introduction:

Spinal fusion techniques are continuously evolving since its inception in early 1990. Of all the fusion techniques circumferential fusion provides the best stability along with maintaining the loadbearing capacity and proper disc height (1). Posterior lumbar interbody fusion (PLIF) has been used since the 1940s (2) with well-known procedure related injuries (1, 3, 4). Transforaminal lumbar interbody fusion (TLIF), a modified PLIF technique pioneered by Harms and Jerszensky (5) provided several advantages as compared to most of the traditional techniques by accessing the spinal canal and disc via a path which goes through the far-lateral portion of the vertebral foramen. This single staged circumferential fusion technique has significantly reduced the surgical risk of neurological injury by minimizing the retraction on the nerve roots and thecal sac. In this retrospective study we describe our results associated with the TLIF technique.

Materials and methods:

Patients:

The patients were recruited for surgery based on the clinical symptoms, MRI LS spine and dynamic X-ray of LS spine findings. All the surgeries were performed at Himalayan hospital, Swami Rama Himalayan University, Jolly Grant, Dehradun by 2 Neurosurgeons between 2015 and 2019. All patients who underwent TLIF irrespective of cause for the listhesis were included in the study.

Radiological profile:

X ray lumbar spine in neutral position was the first radiological investigation for the patients presenting to our OPD. Some of the patients had X ray and MRI images taken elsewhere. All the patients were subjected to MRI Lumbosacral spine based on the symptoms. Following MRI, if there was suspicion of listhesis, a dynamic X ray of lumbosacral spine in flexion and extension position was recorded in erect posture. Some of the patients had CT lumbosacral spine images from other hospitals. Indication for doing CT of lumbosacral spine were history of trauma and X ray image evidence of pars fracture or osteoporosis.

Surgical technique:

All the patients were operated under general anesthesia. Patients were positioned prone maintaining lumbar lordosis. Based on C-arm image intensifier guidance, level confirmation was done and subperiosteal dissection of the muscles were done to expose, laminae and transverse process bilaterally. Pedicular screws were introduced ensuring good purchase and cortical bone all around under fluoroscopic guidance. Decompression of the vertebral canal and intervertebral foramen was done as per the needs. For most of the patients right sided partial resection of the inferior articular process of the vertebra superiorly and superior articular process of the vertebra inferiorly was done to expose the traversing and exiting nerve roots. Following adequate discectomy from both the sides and decompression of the traversing nerve root, a distractor was introduced into the disc space. An autologous bone filled banana cage was introduced into the disc space. Connecting rods were used and cap was tightened after getting adequate sequential reduction. Operative wound was closed in layers over a suction drain, which was removed within 48 hours of the surgery.

Postoperative care and follow up:

The patients were kept for one day in the recovery ward and motivated to walk from the first postoperative day itself with the help of a relative or walking aids, if needed. Opioid analgesics were given with intravenous antibiotics for three days postoperatively. The patients were advised lumbosacral corset for 3 months and discharged on 5th postoperative days. The clinical and radiological profile was assessed on 15th day, 1 month, 3 month and 6 months from the date of surgery. Some of the patients, hailing from remote areas were followed up telephonically.

Data recording and statistical analysis:

Data were entered in Excel software (Microsoft, Seattle, WA) and were analyzed using SPSS software, version 11.5 (SPSS, Inc., Chicago, IL).

Results:

Patients: (Table 1)

Table 1. Age and diagnosis

Age	No of patients (%)
Less than 30 years	2 (1.8)
31-50 years	62 (56.4)
51 to 60 years	35 (31.8)
61 years or more	11 (10)
Sex	No of patients (%)
Males	46 (41.8)
Females	64 (58.2)
Diagnosis	No of patients (%)
L5-S1 listhesis	64 (58.2)
L4-5 listhesis	33 (30)
L3-4 listhesis	8 (7.3)
L2-3 listhesis	1 (0.9)
L1-2 listhesis	Nil
Recurrent lumbar disc prolapse	2 (1.8)
Iatrogenic instability	2 (1.8)
Etiology	No of patients (%)
Spontaneous	101 (91.8)
Post traumatic	7 (6.4)
Iatrogenic	2 (1.8)

There were 110 patients (46 males; 64 females; mean age, 53.4 years, range, 28 years to 69 years). 96.4% of patients had listhesis due to various causative factors. 2 patients were operated for recurrent disc prolapse without listhesis and 2 patients had spine instability due to surgeries performed elsewhere. L5-S1 level was most commonly affected (58.2%) followed by L4-5 level (30%).

Clinical profile:

The clinical features of the patients are summarized in Table 2.

Table 2. Clinical features (n = 110)

Feature	No of patients (%)
Symptoms	
Low back pain	110 (100)
Radicular pain	86 (78.2)
Neurogenic claudication	79 (71.8)
Weakness of ankle dorsiflexion	6 (5.4)
Urinary and fecal incontinence	2 (1.8)

All the patients had history of low back pain at the time of presentation in hospital. Every third patient out of four had history of radicular pain. 70% patients had low back pain more than the radicular pain. Neurogenic claudication before completing a distance of 500 meters was present in 52% patients. About 20% patients had similar symptoms after walking a distance of 1 km. Rest of the patients had either predominant radicular pain or no claudication. 30% of the patients had L4-5 level listhesis but only 5% of all the patients had some form of weakness in ankle dorsiflexion. Only 2 patients had preoperative foot drop, which showed no change after the surgery too. 2 patients had urinary and fecal incontinence and both of the patients had post traumatic listhesis.

Radiological profile

The features are summarized in table 3.

Table 3. Radiological features

Feature	No of patients (%)
Grade of listhesis (n-107)	
Grade 1	36 (33.6)
Grade 2	58 (54.2)
Grade 3	10 (9.4)
Grade 4	3 (2.8)
Lumbar canal stenosis (n 110)	
14-12.1 mm (mild)	40 (36.4)
12-10.1 mm (moderate)	52 (47.3)
10 mm or less (severe)	18 (16.4)
Evidence of Pars fracture (n 110)	
Present	85 (77.3)
Absent	25 (22.7)
Movement on dynamic X ray imaging (n 107)	
Present	89 (83.2)
Absent	18 (16.8)

MRI LS spine and dynamic X-ray of LS spine was available for all the patients. In 29 patients, we had CT of LS spine, which was either done at other centers before the patients was seen by us or the patient had history of trauma. About half of the patients had grade 2 listhesis. Grade 1 listhesis was second most common followed by grade 3 listhesis (about 10% patients). Most of the patients had moderate canal stenosis (10.1 to 12 mm canal diameter). More than 77% of the patients had X-ray or CT evidence of pars fracture at the affected level. Most common level of involvement was L5-S1 (58%) followed by L4-5 listhesis (about 30%) (Table 1).

Perioperative analysis:

One level fusion was performed for all the patients. Fusion was achieved with titanium pedicle screws, rods and banana cage. Postoperatively, 70% of the patients had reduction of listhesis by at least one level. (Image 1 and 2)



Image 1: MRI Lumbosacral spine in a 61 year old lady showing exaggerated lumbar lordosis with grade 2 listhesis at L5-S1 level associated with moderate canal stenosis. The patient had severe neurogenic claudication and low back pain.

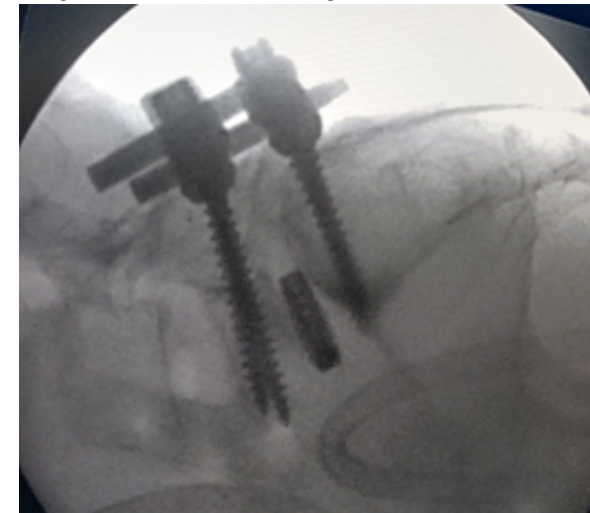


Image 2: Xray LS spine image of the patient in Image 1 taken intraoperatively showed mild reduction of the listhesis to grade 1. Further reduction was not attempted as we got adequate canal decompression. The patient showed significant improvement in her symptoms postoperatively.

Average duration of surgery was 3.5 hours and the mean blood loss was 300 mL. Based on the visual analog pain scale (VAS), 55% patients had good pain control (score of 4 or less) in the perioperative period, 35% had moderate pain control (VAS 5 to 7) and 10% patients had severe pain (VAS 8-10) despite the opioid analgesics. 64% patients could start walking from first postoperative day. 80% patients were ambulant without support within 5 days of surgery. In 4% cases there were incidences of dural breach, primarily due to adhesion bands. 4 patients had postoperative wound leak, which was managed with repeat dressing and resuturing. 2 patients had surgical site infection. 94% patients were discharged within one week of surgery.

Postoperative care and follow up: (Table 4)**Table 4. Follow up and outcome (n= 110)**

Feature	No of patients (%)
Postoperative pain relief	
Good	60 (54.5)
Moderate	39 (35.5)
Poor	11 (10)
Physical restriction (after one week of surgery)	
No	15 (13.6)
Mild	68 (61.8)
Moderate	23 (20.9)
Severe	4 (3.6)
Return to work / Normal household within a month of surgery	
yes	76 (69.1)
No	34 (30.9)
Quality of life	
Improvement	90 (81.8)
No improvement	15 (13.6)
Worsened after the surgery	5 (4.5)
Satisfaction with surgery	
Complete satisfaction	68 (61.8)
Moderate satisfaction	32 (27.3)
Unhappy with surgery	10 (9.1)

All the patients could be followed up for 6 months duration. Repeat X-ray imaging showed no incidence of implant failure or graft migration. At the end of one week of surgery, 62% of patients had mild restriction of movement. About 70% of the patients returned to work or started normal household work after one month of surgery. About 80% of patients mentioned about significant improvement in the life style with about 60% of them showing complete satisfaction with their surgical decision.

Discussion:

Fusion techniques in spine were developed to maintain the alignment of the sagittal plane, getting advantage of compression loading and to preserve the load bearing capacity of the spine. (7) For years, posterior fusion has remained a choice for the unstable spine. Since the advent of posterior lumbar interbody fusion (PLIF) by Cloward (6), the advantages of a circumferential arthrodesis were noted. Surgical modifications continued and with introduction of TLIF by Harms and Jerszensky (5), a surgical procedure, having advantage of circumferential arthrodesis but less morbidity in comparison to PLIF. TLIF required minimal retraction of the nerve root and lesser blood loss and soon became surgery of choice for lumbosacral listhesis and recurrent disc prolapse. Multiple previous studies (8, 9, 10, 11, 12, 13) over three decades were done to compare the differences in surgical outcome in cases of TLIF, PLIF, anterior fusion and pedicle screw fixation without cage. Most of the studies clearly established the role of TLIF as a superior surgical option with lesser complications. All of the patients in our study were managed with unilateral TLIF with single cage placement for interbody fusion.



Image 3: MRI LS spine sagittal images and X ray LS spine images of a 58 year old lady showing grade I listhesis at L4-5 level. The patient had predominant low back pain with neurogenic claudication. Dynamic Xray images showed movement at L4-5 level. She underwent decompression and L4-5 TLIF.

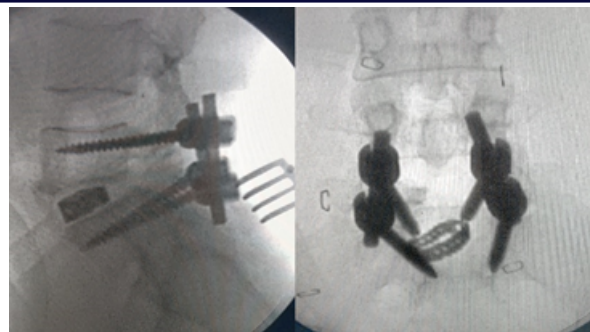


Image 4: Intraoperative imaging of the patient discussed in Image 3 showed complete reduction of the listhesis with adequately placed single diagonal cage.

Our surgical results were at par with most of the studies (Image 3 and 4). Lowe et al (14) operated a total of 29 patients with unilateral introduction of the cage, out of which 25 patients had excellent outcome. Our series had evidence of fusion in 96% of the patients, as compared to 90% of the patients in their study. To the best of our knowledge, the study done by Tormenti et al (15) with 531 cases managed by TLIF is the largest single study. 317 patients were managed by single level fusion. Dural tear was the most common surgical complication encountered (14.3%) by them in comparison to 4% incidence in our study. Dural tear in our patients was managed mostly with primary repair of the dura, reinforced by fibrin glue. None of our patients required revision surgery for symptomatic misplacement of the screws in comparison to the 2.1% of the patients in their study. They further reported the cage migration rate of 1.8%. Much of these complications may probably be due to the history of revision surgeries (46%) in the patient group in contrast to our study. Infection rate of 0 to 3.8% has been reported after TLIF in several studies (15, 16, 17, and 18). None of our patients had implant infection. Only two of our patients had surgical site infection, which was managed with intravenous antibiotics and repeated dressing. Injury to retroperitoneal structures including large vessels (19, 20, and 21) is a rare but reported complication of surgeries on lumbar spine. None of our patients had any such injury. Wrong level surgeries have also been reported in literature (22, 23) with incidence of less than 0.05%, which was not encountered by us.

Overall our results were extremely satisfying with TLIF with minimal complications. More than 2/3rd of patients could not undergo postoperative CT of LS spine due to cost related issues, which may be considered a weakness of the study.

Conclusion:

TLIF is the answer to all the patients with lumbar listhesis irrespective of the etiology. This technique provides significant relief in low back pain, with or without radicular pain due to immobilization. It provides a decompression of the neural elements along with circumferential arthrodesis with excellent postoperative results. The risk to neural elements is minimal and surgery can be accomplished from one side itself. Most of the patients show a remarkable recovery from pain, early mobilization and return to work sooner than any other surgery done for recurrent disc prolapse and lumbosacral listhesis. We believe that the patients with lumbosacral listhesis are underdiagnosed, either due to conservative management by medicinal branches or lack of knowledge of surgical options available. These patients should be promoted to be seen by spine surgeons for their best. Spine surgeons should also consider performing TLIF more frequently, wherever indicated.

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