

A Study on Functional and Radiological Outcome of Lumbar Spine Fusion Surgery (TLIF / PLIF) with Minimum 6 Months Duration (21 Patients)

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Abstract: *Background:* Among various spine disorders degenerative conditions like lumbar disc disease and spondylolisthesis are commonly encountered. Surgery is option when conservative treatment fails. Fusion is the only option to alleviate instability. The aim of our study is to evaluate functional and radiological outcome of lumbar spine fusion surgery (TLIF/PLIF) and to study its complications. *Materials and Methods:* This is a retrospective study of 21 patients of lumbar spine fusion surgery (TLIF/PLIF) which were admitted and operated at Guru Govindsingh Govt. Hospital and M.P.Shah Medical College Jamnagar, Gujarat. All patients with age between 18 to 72 years were included in this study. *Results:* The mean age of the patients is 52.44 years. Males account for 38.10% and females account for 61.90%. Spondylolisthesis was present in 47.6% and Lumbar canal stenosis in 19.00%. Most common level involved in surgery was L4-L5 level (57.40%). Neurological deficit was present in 62.00%. O.D.I score at more than 6 months follow up was 13.70% as compare to 67.79% at the time of admission. Fusion rate was 90.46%. One patient (4.76%) had dural tear per operative and one patient (4.76%) had infection. *Conclusion:* Proper patient selection and surgeon expertise are important for successful outcome. It is an ideal management for treatment of degenerative disc disease and spondylolisthesis.

Keywords: Spondylolisthesis, Degenerative disc disease, Radiculopathy, Lumbar spine, Neurological deficit

1. Introduction

The incidence of back pain in the working class people is on such a steep rise in recent years. The loss of productivity is considered to be the greatest with back pain than any other medical conditions [1,2]. With the advent of technology related occupation, the sitting posture is adopted for long hours, which may have a deleterious effect on the spine, especially if the posture is incorrect. Lack of exercise and obesity add to the increasing incidence of back pain.

Among various spine disorders, degenerative conditions such as spondylolisthesis and lumbar disc disease are initially treated conservatively with rest and medication and physical therapy. Surgical management is indicated in certain cases or in cases which do not respond to conservative management. In case of spinal Interbody fusion in addition to decompression and pedicle screw fixation, two widely used techniques for spinal fusion are posterior lumbar interbody fusion (PLIF) and transforaminal lumbar interbody fusion (TLIF). The PLIF technique for instrumented spinal fusion was introduced more than a half century ago in 1952 by Cloward [3]. Harms and Blume developed the TLIF technique further, and Harms described this in detail together with Jerszensky in 1998 [4].

2. Materials and Methods

A retrospective study of 21 patients of TLIF/PLIF spine surgery for studying functional and radiological outcome had been carried out at the department of orthopaedics, in a Tertiary Care Government Hospital, Jamnagar for the cases managed between December 2014 to May 2019 with a minimum follow up duration of 6 months.

Inclusion Criteria

- Men and women are both included in the study.
- Patients with lumbar instability secondary to fracture, degeneration and congenital conditions are included in the study.
- Patients aged 18 years or more has been included in the study.
- Patients with features of instability as per defined criteria.
- Patients willing to give consent for surgery.

Exclusion Criteria

- Patients not fit for surgery.
- Patient with polio and cerebral palsy.
- Pregnancy and lactating mother.
- Immunosuppressive disorder.

Preoperatively, all the patients were admitted through the outpatient department. A complete history regarding the nature of illness, the duration since starting of illness and history of constitutional symptoms or any other medical or surgical ailments was taken. Thorough clinical evaluation of the disease was done. Radiological confirmation of the diagnosis was carried out by taking antero-posterior and lateral view in flexion and extension of spine and MRI study.

Routine follow up of patients was undertaken at 2 weeks, 1 month, 3 months and 6 month interval and clinical and radiological data was maintained. Radiological assessment was done as per Modified Lee's criteria for fusion

3. Observation and Results

1) **Age Distribution:** In my study lumbar fusion is performed commonly in patients of 6 decade with an

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average age of 52.44 years. Minimal age is 26 years and maximum age is 72 years.

2) **Sex Distribution:** My study has female preponderance with 13 female patients and 8 male patients. Yi Xiang J. Wang et al [5] in their study shows prevalence ratio of Spondylolisthesis in Female: Male of 1.3:1 and also suggested that menopause may be a condition factor for accelerated development of Degenerative Spondylolisthesis in postmenopausal women.

3) **Occupation Distribution:** Majority of patient operated for fusion surgery in present study belong to labour group accounting for 42.86%. Jeffery et al in their study shows association between labour work and development of Spondylolisthesis. Heavy weight lifting by labourer may lead to defect in par interarticularis due to chronic stress fracture and development of Spondylolisthesis.

4) Distribution according to indication of surgery

Causes	Frequency	Percentage (%)	Mick.j et al[6]
Spondylolisthesis - degenerative	6		66
Spondylolisthesis - isthmic	4	47.6	
Lumbar canal stenosis	4	19.0	47
Disc diseases	3	14.28	23
Infective spondylodiscitis	4	19	-

- Above table shows most common cause for lumbar spine fusion is Spondylolisthesis in both studies followed by lumbar canal stenosis with or without lysis
- There are 3 cases of PID for which fusion was done: First patient was having L5-S1 PID with facet hypertrophy. Second patient had severe facet hypertrophy with kissing facets, complete decompression only possible by sacrificing facets. So TLIF was done in this case.
- Third patient was having recurrence of PID at higher lumbar level (L2-L3).
- There are 4 cases of Infective Spondylodiscitis in lumbar region for which fusion was done, as tuberculosis is common in India and lumbar region is second most common site in spine.
- Zaveri and Mehta [7] in their study on 15 patient of lumbar tuberculosis by doing TLIF surgery shows good clinical and radiological outcomes.

5) **Duration of Symptoms:** Majority of patients in present study has duration of symptoms between 1 year to 2 years as they were treated conservatively for 6 months if there is no neurological deficit. In my study neurological deficit was common in patients having duration more than 2 years.

6) **Distribution based on Symptoms:** In my study lower back pain is most common symptom (66.66%) as majority of patients operated for lumbar fusion had Spondylolisthesis followed by neurogenic claudication.

7) **Illness:** Comorbid illness was present in 47.61 % of patients. Most common is hypertension (33.33%).

8) Distribution by level of involvement:

- L1-L2 involved in 4.76%, L2-L3 in 14.28%, L3-L4 in 19.04%, L4-L5 in 57.40% and L5-S1 in 4.76%.
- L1-L2 TLIF is done in one patient of infective spondylodiscitis.
- L2-L3 fusion was done in 3 patients: Two patients of infective spondylodiscitis and one patient of recurrence of PID.

9) Distribution by Neurological Deficit:

Neurological deficit was present in 62% and absent in 32% patients.

	L3	L4	L5	S1
MOTOR	1	1	7	0
SENSORY	1	7	12	5

In my study more than one nerve root was involved. Sensory deficit was present in 57.3% and motor deficit was present in 33.33% patients. Most common nerve root involved in both sensory and motor deficit was L5 nerve root.

10) Visual Analogue Scale:

VAS	Present Study	Raship et al[8]	V.A. Balasubramanyam et al[9]
VAS on admission	6.4	8	8
VAS on > 6 months post operative	1.38	1	2

Above table is suggestive of significant improvement in pain after surgery and showing good results.

11) Distribution Based on ODI Score:

ODI	Present Study	Raship et al	V.A. Balasubramanyam et al
ODI on admission	67.79 %	64 %	70 %
ODI on >6 months post operatively	13.70 %	20 %	15 %

17 patients out of 21 patients (80.95%) shows excellent results (minimal disability), with ODI score between 0-20%. Raship et al and V.A. Balasubramanyam et al also shows comparatively similar results.

12) Neurological Recovery:

Recovery	Present Study	V.A. Balasubramanyam et al
1. Sensory recovery	75 %	75 %
2. Motor recovery	71.42%	75 %

Out of 12 patients of sensory deficit in my study, 9 patients (75%) improved, while 3 patients (25%) shows no improvement. Out of 7 patients of motor deficit, 5 patients (71.42%) improved, while 2 patients (28.58%) had no improvement. Improvement in motor deficit of grade 1 in power is seen in 5 patients. 1 patient was having bowel and bladder involvement at time of admission while improved after one month of surgery. V. A. Balasubramanyam et al in their study had 5 patients with pre operative neurological deficit in form of sensory blunting in 4 patients and motor weakness in 4 patients. It had improved in all except in one patients.

13) Out of 21 patients of lumbar fusion surgery in my study, 15 patients had TLIF procedure and 6 patients had PLIF procedure for lumbar spine fusion.

14) **Fusion:** Fusion is assessed by using modified Lee’s criteria

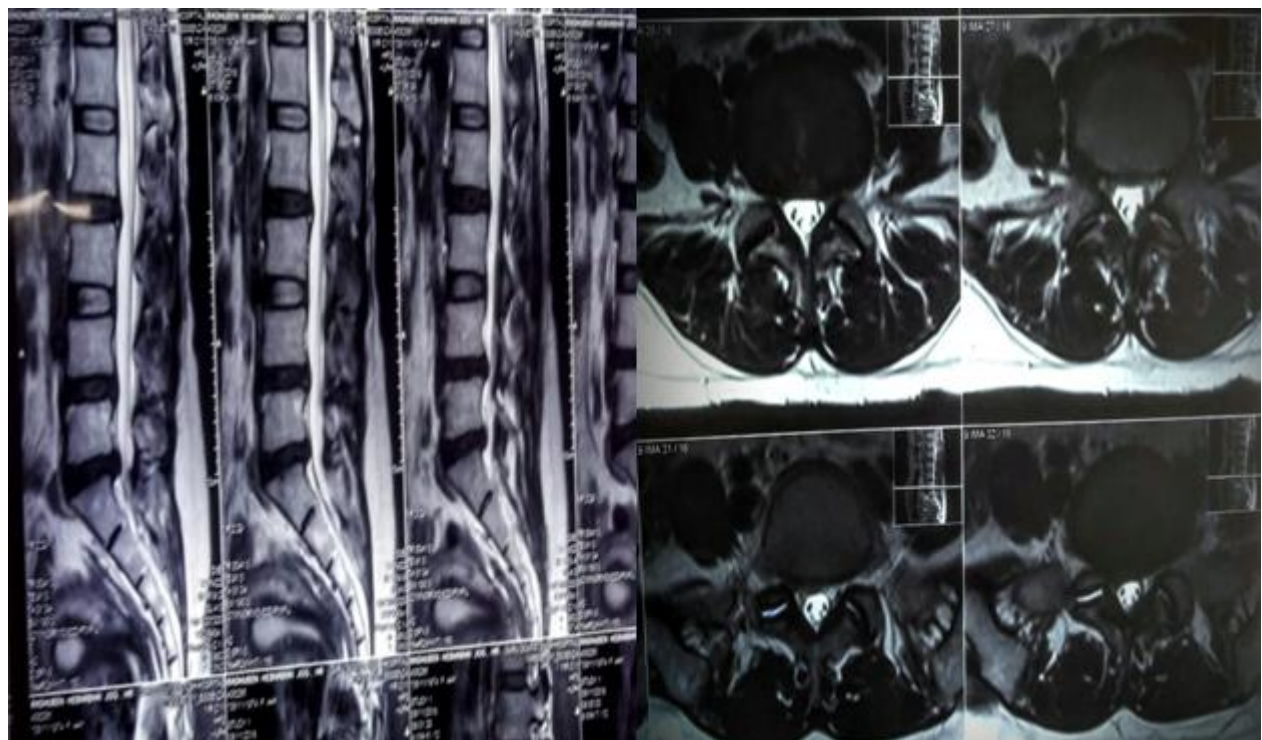
Fusion	Present Study (%)	Rashid ET AL (%)	V.A. Balasubramanyam et al (%)
Definitive fusion	71.42	55.0	62.5
Probable fusion	19.04	25.0	22.85
Possible pseudoarthrosis	9.52	20.0	11.42
Definitive pseudoarthrosis	-	-	5.71

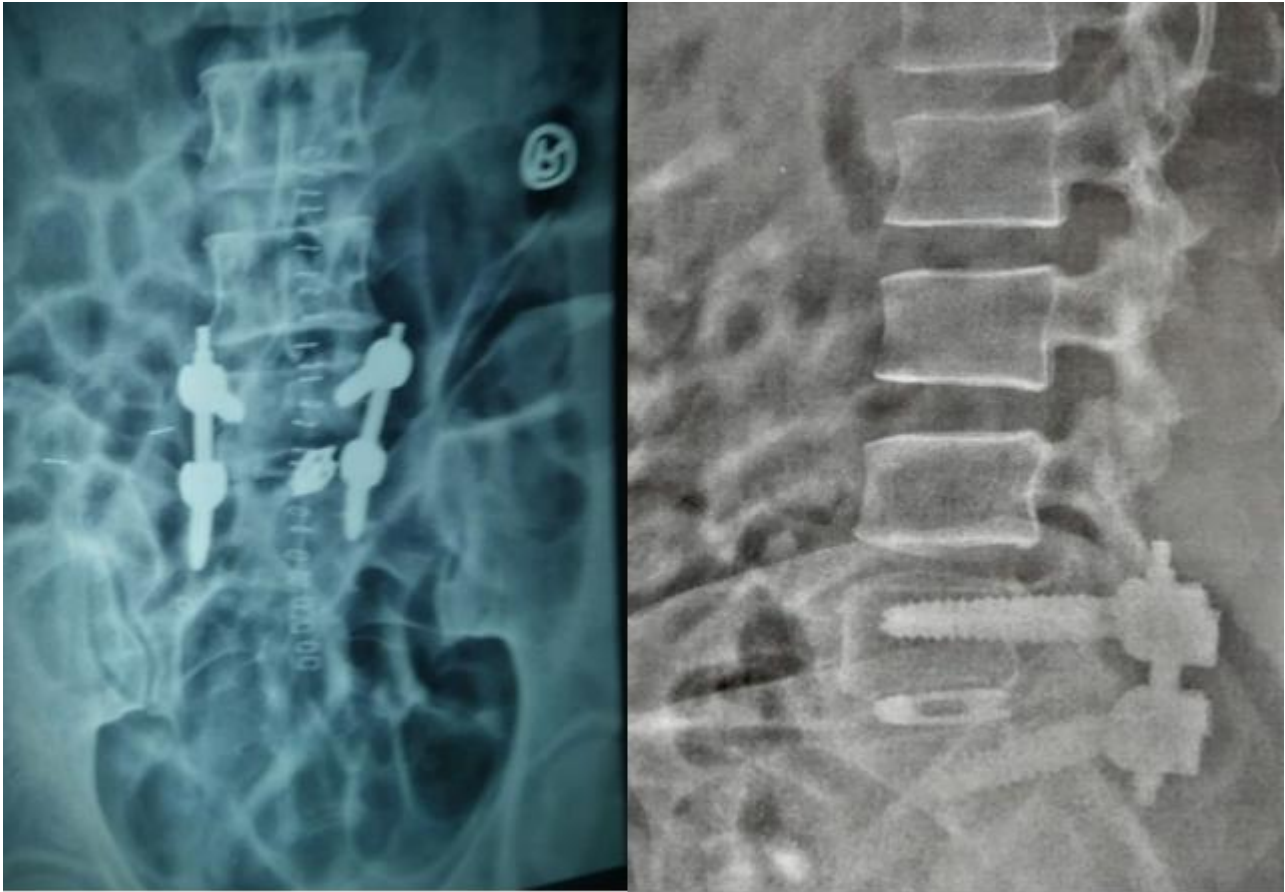
So fusion rate in my study is 90.46 % (Definitive fusion + Probable fusion), which is greater than fusion rate by V.A. Balasubramanyam et al of 85.35 %. Won-suh choi et al (2016) in their study shows 67.7% fusion rate at end of 6 month post operatively and fusion rate of 95.2% at end of 12 months post operatively. In my study 4 patients shows radiological signs of probable fusion. All 4 patients is having post operative follow up of 6-9 months, which may show Definitive fusion if these patients are evaluated further again after 1 year of post operative period.

15) Out of 21 patients, 18 patients return to their life style, while 3 didn’t.

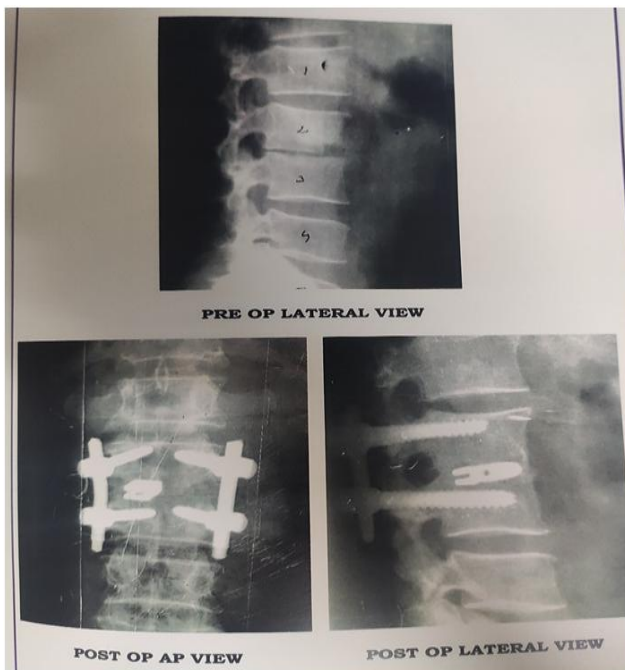
- One patient does not show improvement in neurological deficit (motor weakness persist) and also there is persistence of neurogenic claudication
- One patient has cervical myelopathy (C5-C6 level) in addition to L4-L5 Spondylolisthesis. Their is improvement in lower back ache, but symptoms of cervical myelopathy persist for which surgery is advice to the patient.
- One patient has possible pseudo arthrosis.

16) **Complications:** In my study, one patient (4.76%) had small dural tear which was irreparable and so abgel was kept over the dural tear and water tight closure was done with positive drain kept. Patient was given I.V antibiotics for 10 days and then shifted to oral antibiotics till suture removal. One patient (4.76%) developed infection, for which thorough debridement was done and then I.V antibiotics was given till stitch removal and then oral antibiotics for 7 days. At 6 months follow up incision site is clear without any discharge.





Above MRI scan shows a patient having L5-S1 PID with facet tropism for which patient was operated in form of discectomy and TLIF



Above X-ray is of a patient who had L2-L3 infective spondylodiscitis who was treated in form of debridement plus fixation and interbody fusion with bone graft and cage and follow up post-operative AP and Lateral views after one year shows definitive fusion.

4. Discussion

Several fusion techniques were reported in literature like PLF, TLIF, PLIF, ALIF. Traditional treatment included standard posterolateral fusion with decompression. However its draw backs were, disc space settling due to compression, torsion, shear forces centered over the void disc space. Failure of load bearing capacity due to lack of support in anterior and middle column. High implant failure and pseudoarthrosis with graft on tension side instead of compression side [Wolf's law]. Large amounts of graft and extensive far lateral muscle stripping. The interbody space has more vascularity than the posterolateral space, hence less potential for a solid fusion mass to form [10,11]. Watkins in 1953 described a technique which consists of decorticating spinous process, transverse process, pars and facets and application of bone grafts using iliac bone strips over decorticated areas [12]. This remains gold standard method for spinal fusion. This fusion rate is around 60-70% in various studies. The main disadvantage of PLF was pseudoarthrosis. Pseudoarthrosis rates range from 14 to 70%. Reoperation and disability rates are 24% and 25%, respectively. Thus to increase the fusion rates and thereby to decrease the pseudoarthrosis rates and reoperation rates nowadays Interbody fusion is used in spondylolisthesis [13]. PLIF for spondylolisthesis enables neural decompression, stabilization of the deranged motion segment, reconstruction of the disc height, and restoration of the sagittal plane translation and rotational alignment. Nonetheless, there is a risk of neural damage during retraction manoeuvres and damage to the cauda in higher levels [14,15]. Various

studies demonstrated efficacy of TLIF in relation to pain, Yan D et al comparing PLIF with TLIF for lytic listhesis the mean VAS score for pain improved from 7.2 to 2.8. In another study by Yahya et al. of 30 patients the VAS score for low back pain decreased from 7.0 to 2.1 and that for leg pain decreased from 6.4 to 2.0, whereas the ODI decreased from 69.3% to 11.8% [16,17].

5. Conclusion

Patients must be selected properly, after thorough evaluation and identification of the cause of their pain. Conservative management in form of physiotherapy and anti-inflammatory drugs must be tried first. Etiology, pathogenesis and diagnosis must be properly studied and confirmed before subjecting the patient to surgery.

Lumbar spine surgery (TLIF/PLIF) is a safe and less morbid approach. It provides better functional outcome by providing pain relief and improving quality of life of the patients. Surgery restores the normal sagittal balance of spine and maintains the disc space height and also provides better fusion rates.

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