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## Functional outcome of transforaminal lumbar interbody fusion for lytic and degenerative spondylolisthesis

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### Abstract

**Introduction:** Spondylolisthesis is defined as the forward displacement of one vertebra over the vertebra below. It is often accompanied by spinal canal stenosis and compression, which is the cause of all the symptoms.

**Aim:** The aim of this prospective study is to analyze the Functional outcome of Transforaminal Lumbar Interbody Fusion in Spondylolisthesis.

**Methods:** 20 patients of Isthmic spondylolisthesis grade I-III, patients who don't respond to conservative treatment (6 months), Degenerative spondylolisthesis grade I-II, patients who don't respond to conservative treatment (6 months), Traumatic spondylolisthesis were included in this study.

**Results:** The most common level involved is L4-L5 in 55% of cases and L5-S1 in 40% of cases. The L4-L5 Level is most commonly affected in Degenerative type (80%). The L5-S1 level was most commonly affected in Lytic type (60%). The mean preoperative Visual analog score for Back pain was 10 which improved to 2(1-4) at final follow up implying better pain score postoperatively. The mean preoperative Visual analog score for Leg pain was 8 which improved to 1 (1-5) at final follow up implying better pain score postoperatively. The mean preoperative Oswestry Disability Index (ODI) Score was 64% (range from 56% -74%) which improved to 20% at final follow up which indicates improvement in daily activities of the patient.

**Conclusion:** Transforaminal Lumbar Interbody Fusion is a safe and effective surgical procedure for the treatment of lytic and degenerative spondylolisthesis.

**Keywords:** Lumbar spine, Myerding slip grading, neurological deficits

### Introduction

Spondylolisthesis is defined as forward slippage of a cephalad vertebra on a caudal vertebra. The percentage of Isthmic spondylolisthesis in adult males and females is 5–6% and 2–3% respectively. Degenerative spondylolisthesis is common in age group of 50 years and above. 10% females in the age group of 60 years and above have degenerative spondylolisthesis [1-3].

The main aim of treatment in spondylolisthesis is stabilization and fusion at involved vertebral level. Stabilization is done by Pedicle screws and rods. Various types of Fusions are Anterior Lumbar interbody fusion, Posterior Lumbar interbody Fusion, Transforaminal Lumbar Interbody Fusion and Posterolateral Fusion. Posterolateral fusion is considered the gold standard of treatment for adults with spondylolisthesis. Transforaminal lumbar interbody fusion (TLIF) is an alternative to posterior lumbar interbody fusion (PLIF) [4, 5].

In the year 1982, Harms and Rolinger used bone graft packed in a titanium cage which was inserted through the transforaminal route, termed Transforaminal Lumbar Interbody Fusion [6]. TLIF is done by distracting the vertebrae using pedicle screws which are placed before the cage insertion. The entire facet joint is removed on the one side and the cage is inserted. TLIF has the major advantage of restoring the disc space height, maintaining the lumbar lordosis and sagittal balance]. It also has the additional advantage of preserving the posterior elements on the contralateral side which increase the surface area for fusion. When compared to other techniques of fusion TLIF provides better fusion rates, lesser dural damage and nerve damage [7].

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## Aim

The aim of this prospective study is to analyse the Functional outcome of Transforaminal Lumbar Interbody Fusion in Spondylolisthesis.

## Materials and methods

This study was conducted at Department of Orthopaedics, Madurai Medical College and Government Rajaji Hospital on 20 patients with Spondylolisthesis. All patients were treated with posterior decompression, stabilization with pedicle screw system and Transforaminal Lumbar interbody fusion.

Inclusion criteria: age: 20 to 70 years, Isthmic spondylolisthesis grade I-III, patients who don't respond to conservative treatment (6 months), Degenerative spondylolisthesis grade I-II, patients who don't respond to conservative treatment (6 months), Traumatic spondylolisthesis.

Exclusion Criteria: Unfit for anaesthesia, severe osteoporosis, spondyloptosis

During study age of the patient, mode of presentation, Level of the lesion and associated comorbid condition are considered.

By using X rays vertebral level involved, pars interarticularis defect identified, slip %, Meyer ding Grading is done, Pelvic incidence, Sacral slope, Pelvic tilt, Disc space height measured. 5.MRI- to find neural compression, canal stenosis, facet hypertrophy, Disc Prolapse.

The patients are followed up at 3 months, 6 months, 1 year and every 6 months and evaluated for the Pain using Visual analogue pain scale and the functional outcome evaluated using Oswestry disability index and modified Macnab's criteria. X-rays AP and Lateral views are taken to assess the fusion and to check whether the postoperative reduction and disc space height are maintained or not.

## Results

The majority of cases are females. Female: male ratios is 6:1. The majority of patients are housewives (80%) followed by manual workers (20%). The comorbid conditions associated with spondylolisthesis in our study is diabetes in 2 patients (10%), hypertension in 2 patients (10%) and hypothyroidism in one patients. The most common age group affected is 6th decade (40%) and 4th decade (25%). Degenerative type is common in 5th and 6th decade. Lytic type is common in younger age group below 5th decade. The mean duration of symptoms in these patients before surgery is 2.4 years. (range from 1 year to 5 years)All patients had undergone non-operative treatment for the minimum period of 6 months. The 50% cases are of lytic type and other 50% is of degenerative type. The most common mode of presentation is Low Backache (100%). Next to this is Radiculopathy (94%) and neurogenic claudication (50% among all cases and 100% in Degenerative type of listhesis). The sensory deficit is seen in 6 (30%) out of 20 patients. Motor deficit is present in 2 (10%) cases. No bowel and bladder symptoms in any patient. The most common level involved is L4-L5 in 55% of cases and L5-S1 in 40% of cases. The L4-L5 Level is most commonly affected in Degenerative type (80%). L5-S1 level was most commonly affected in Lytic type (60%). The most common grade (Myerding grading) of listhesis was grade II (60%). Degenerative type (60%) and lytic type (60%). The most common type according to Spinal Deformity Study Group classification (SDSG classification) was Type 3- Pelvic incidence >60\* (75%). In all our patients spondylolisthesis involved only single level, thus single level fusion is done in

all cases. The mean duration between surgery and onset of symptoms was 2.4 yrs (range 1 yr to 5 yrs). The mean surgical time was 3 hours 20 minutes (range 2hr 20 min-4hr10 min). The average blood loss was 450 ml (400 ml – 1000 ml). The mean preoperative Visual analog score for Back pain was 10 which improved to 2(1-4) at final follow up implying better pain score postoperatively. The mean preoperative Visual analog score for Leg pain was 8 which improved to 1(1-5) at final follow up implying better pain score postoperatively. The mean preoperative Oswestry Disability Index (ODI) Score was 64% (range from 56% -74%) which improved to 20% at final follow up which indicates improvement in daily activities of the patient. The neurological improvement is seen in all patients postoperatively. The radicular pain is relieved in all patients (100%) at final postoperative follow up. The sensory improvement is seen in all 6 patients. The two patients with preoperative motor deficits, both patients had grade 1 increase in power. The mean slip percentage preoperatively was 31% (range from 64% to 18%) which decreased to 14% (range from 45% to 10%) postoperatively and this was maintained in final follow up. The preoperative Myerding grading of slip in one patient with grade III reduced to grade II postoperatively, all of the patients with grade II slip (12 patients) reduced to grade I. In other patients with grade 1 slip remained to have some amount of slip but slip percentage decreased in these patients. The Preoperative mean disc space height at the involved segment is 5.6mm (range 2mm to 8mm). The mean postoperative disc space height at final follow up is 9mm (range 8mm-10mm).

In our study 11 cases (55%) out of 20 cases are Class E (fusion), 5 cases (25%) are class D (probable fusion) other 4 cases (20%) are uncertain. Thus 80% of cases show fusion. None of the cases show pseudoarthrosis. The mean time taken for fusion is 5 months. (Range 4 months to 8 months)

In our study four patients developed complications out of which one was the major complication with Pedicle screw misplacement, other three patients had a minor complication which includes two patients with radiculitis and one with superficial wound infection.

One of our patient (5%), we had pedicle screw misplacement which leads on to Low back pain and radicular pain postoperatively. X-ray and CT scan were taken which showed pedicle screw misplacement. So we removed all pedicle screws leaving the cage in situ and advised patient for rest and Brace application for 3 months. After 5 months of rest and Bracing, patient X-ray at 5 months showed fusion at the involved level.

One patient developed superficial wound infection (5%) which healed by conservative methods and extended antibiotic therapy.

Two patients (10%) developed radiculitis postoperatively which was treated conservatively and radiculitis settled within three weeks in all patients.

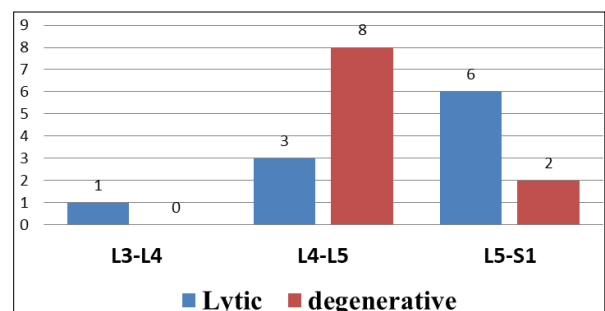


Fig 1: Level of lesion and type of listhesis

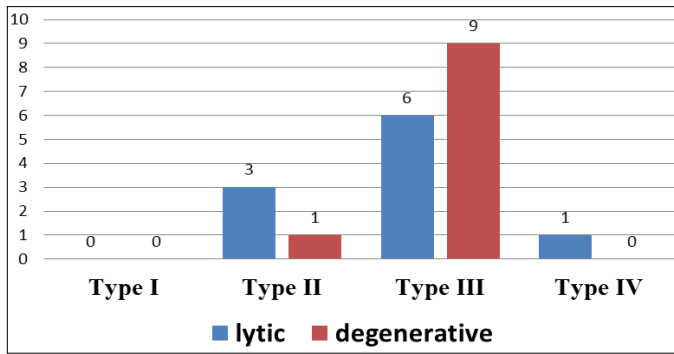


Fig 2: Spinal Deformity Study Group Classification

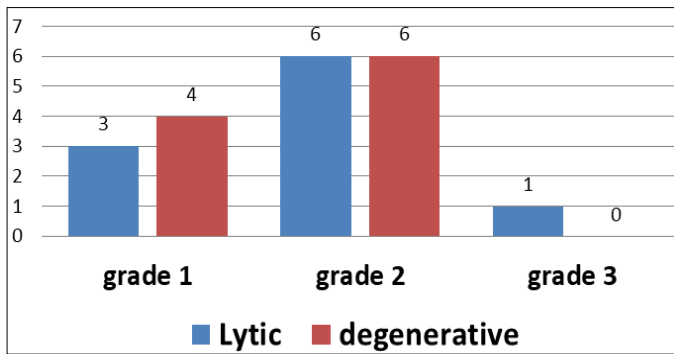


Fig 3: Meyerding Grading

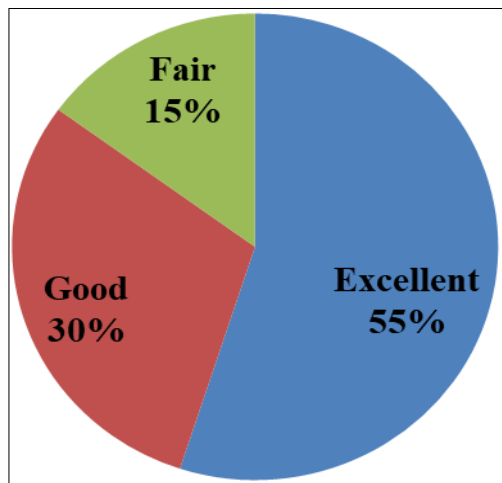


Fig 4: Modified Macnab's criteria

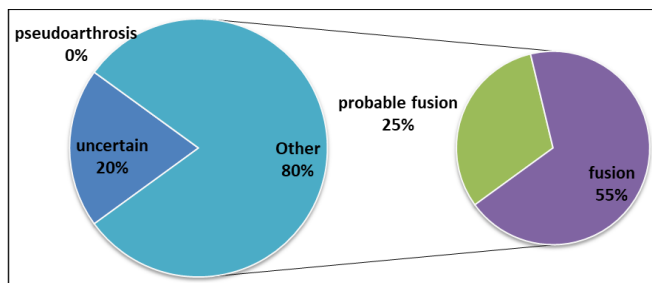


Fig 5: Fusion rates

**Discussion**

Several fusion techniques were reported in literature like PLF, TLIF, PLIF, ALIF. Traditional treatment included standard posterolateral fusion with decompression. However its drawbacks 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 [3,4].

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 [8]. 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 [9].

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 [10,11].

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% [12,13].

**Conclusion**

The Transforaminal Lumbar Interbody Fusion is a safe, simpler and less morbid approach with low complication rate. It provides better functional outcome by providing pain relief and improving the quality of life in the patients. TLIF restores the normal sagittal balance of spine and maintains the disc space height and also provides better fusion rates.

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