

# Segmental lordosis and cage position in transforaminal lumbar interbody fusion (TLIF)

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## Abstract

To evaluate the radiological outcome of patients who underwent TLIF with an interbody cage. A prospective study was conducted on 57 patients with different lumbar pathologies managed with TLIF procedure, preoperative and postoperative radiological assessment was done with special focus on segmental lordosis and cage position. The mean age of the participants was 41.54 years, there was a highly statistically significant difference between preoperative and postoperative segmental lordosis angle, there was a moderate positive correlation between the cage position and the change in segmental lordosis. In this study, it was concluded that Transforaminal lumbar interbody fusion (TLIF), is a safe and effective technique in management of patients with different pathologies affecting lumbar spine and that it results in significant improvement in the segmental lordosis angle. The current study aimed to assess the change in the segmental lordosis angle following TLIF and the effect of cage position on segmental lordosis.

**Keywords:** Transforaminal Lumbar Interbody Fusion, segmental lordosis angle, cage position.

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## 1. Introduction

The surgical procedure of lumbar interbody fusion is well-established for the treatment of persistent low back pain and a variety of spinal problems, such as spondylolisthesis, degenerative pathologies, trauma, infection, and neoplasia [1]. Transforaminal Lumbar Interbody Fusion is now more commonly used rather than Posterior lumbar interbody fusion which is usually reserved for pathologies confined to the levels of L3 to S1 [6,11]. The vertebral bodies of the lumbar spine and the intervertebral discs wedge together to create lumbar lordosis and the intervertebral discs are responsible of nearly 80% of the lumbar lordosis<sup>[2]</sup>, most of the lumbar pathologies lead to decrease in the disc height and segmental lordosis angle of the affected segment which subsequently decreases the whole lumbar lordosis [5], with interbody fusion procedures, the spine's load-bearing capacity is preserved, disc and foraminal heights are preserved, fusion rates are increased, and implant failure is avoided [3], the objective is to create a stable spinal segment by restoring the disc height and vertebral alignment, hence preventing motion at the afflicted segment [4]. Loss of lordosis, sometimes known as "flat-back syndrome," may occur after instrumented spinal fusion and this loss often results in sagittal spinal imbalance, persistent back pain, and increased muscle fatigue [5,12].

## 2. Materials and methods

A prospective case series study was conducted at the Kasr Al Aini faculty of medicine hospital, Cairo University on 57 patients with a variety of lumbar spine pathologies were indicated for transforaminal lumbar interbody fusion based on clinical and radiological evaluation between June 2021 and February 2023.

### 2.1 Inclusion criteria

- Patients between 18 and 65 years of age.
- Patients indicated for transforaminal lumbar interbody fusion by clinical and radiological assessment in cases of
  - Degenerative disc disease
  - Lytic spondylolisthesis
  - Degenerative spondylolisthesis
  - Failed back syndrome
  - Single level affection
- Patients with unsuccessful conservative therapy for at least 6 weeks.

### 2.2 Exclusion criteria

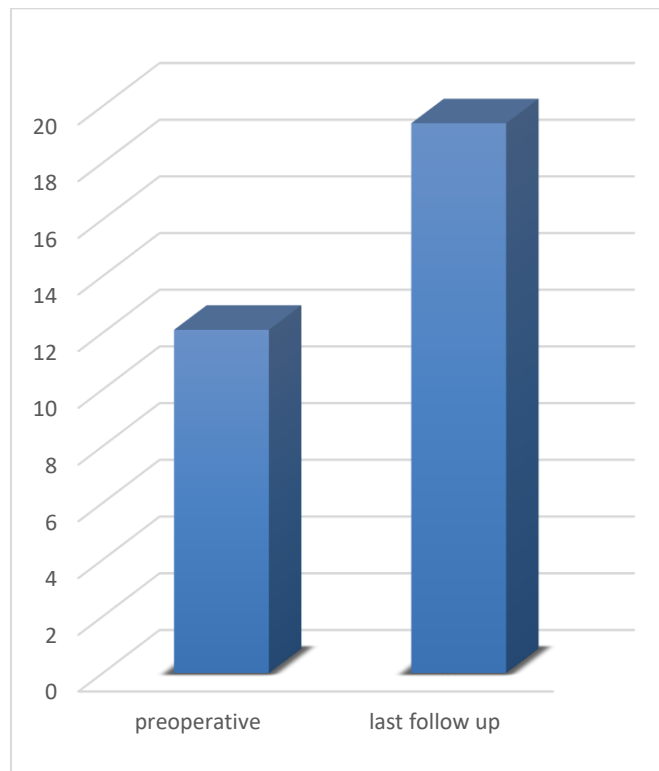
- Patients with Scoliotic deformities
- Severe osteoporosis
- Morbid obesity (BMI>40)
- Multiple level affection

Preoperative and postoperative clinical assessment was done on all patients, also radiological assessment was done and included segmental lordosis, cage position (measured using posterior gap ratio) and their correlation.

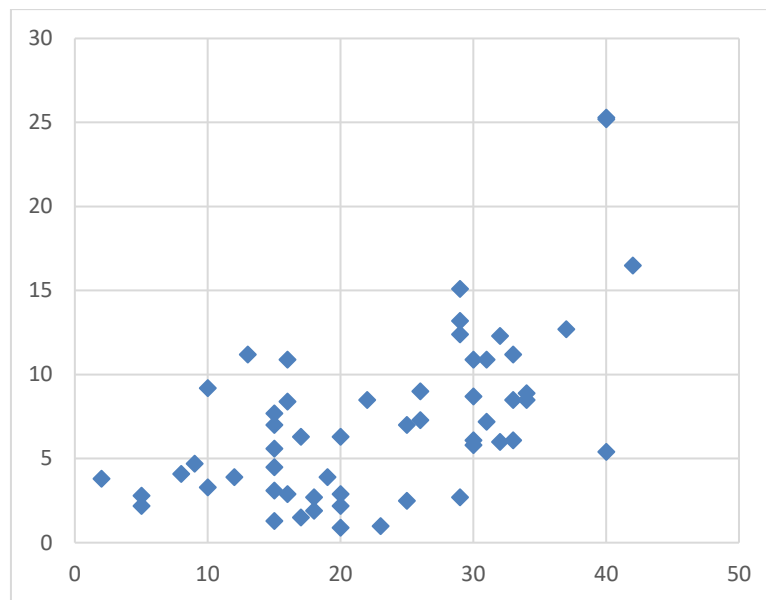
**3. Results**

The mean age of the patients was 41.54 years, 29 participants in the study were males while 28 participants were female, 19 patients had lytic spondylolisthesis, 9 patients had degenerative spondylolisthesis, 5 patients were diagnosed with spinal canal stenosis, 10 patients had disc prolapse, 7 patients had degenerative disc disease, 2 patients were diagnosed as adjacent segment disease and 5 cases were revision surgeries. The mean segmental lordosis angle pre-operative was 12.1° while at last follow up the mean segmental lordosis angle was 19.39°, there was a highly statistically significant difference between segmental lordosis angle pre-operative and at last follow-up, regarding cage position, the mean posterior gap ratio was 22.84%, there was a moderate positive correlation between change in segmental lordosis and cage position with correlation coefficient of 0.5996 and this correlation was statistically significant. In this

study there was a highly statistically significant difference between segmental lordosis angle pre-operative and at last follow-up where at the last follow up the mean segmental lordosis angle was 19.39°, this is in occurrence with the study of Saadeh et al [7] who reported similar results, as well Kakadiya et al [1] reported a statistically significant difference between segmental lordosis angle pre-operative and at last follow up, In contrast to this study Lee et al [10] reported an increase in the segmental lordosis angle however this increase was not statistically significant and as well the study of Champagne et al.,<sup>[8]</sup> showed a non-statistically significant correction in the segmental lordosis angle. Concerning the cage position: the mean posterior gap ratio was calculated to be 22.84% and there was a moderate positive correlation between change in segmental lordosis and cage position and this correlation was statistically significant, This is in occurrence with the study of Lovecchio et al [13] where anterior position of the cage in the disc space was also associated with a significantly greater gain in segmental lordosis on the contrast DiMaria et al [14] concluded that cage position is an independent predictors of change in segmental lordosis angle.



**Figure 1:** Mean segmental lordosis angle preoperative and at last follow up.



**Figure 2:** Correlation between change in segmental lordosis and cage position

## 5. Conclusions

Transforaminal lumbar interbody fusion (TLIF) is a simple, safe and effective technique in management of different pathologies in the lumbar spine that achieves good functional and radiological outcome with significant correction of the segmental lordosis which is also affected by the cage position.

## References

- [1] G. Kakadiya, K. Gohil, Y. Soni & A. Shakya. (2020). Clinical, radiological and functional results of transforaminal lumbar interbody fusion in degenerative spondylolisthesis. *North American Spine Society Journal (NASSJ)*. 2, 100011.
- [2] M.R. Farrokhi, M. Lotfi, M.S. Masoudi & M. Gholami. (2016). Effects of methylene blue on postoperative low-back pain and functional outcomes after lumbar open discectomy: a triple-blind, randomized placebo-controlled trial. *Journal of Neurosurgery: Spine*. 24(1), 7-15.
- [3] M. Serry & E.S. Abd El-Latif. (2015). Clinical and radiological outcomes of unilateral transforaminal lumbar interbody fusion. *The Egyptian Orthopaedic Journal*. 50(4), 234-242.
- [4] S.G. Balasubramanian, S. Sonone, A.A. Dahapute, S. Muni, R. Gala, N. Marathe, K. Sakhare and S. Bhaladhare. (2019). A comparative prospective study of clinical and radiological outcomes between open and minimally invasive transforaminal lumbar interbody fusion. *Indian Spine Journal*. 2(2), 138-145.
- [5] Y. Aoki, A. Nakajima, H. Takahashi, M. Sonobe, F. Terajima, M. Saito, K. Takahashi, S. Ohtori, A. Watanabe, T. Nakajima & M. Takazawa. (2015). Influence of pelvic incidence-lumbar lordosis mismatch on surgical outcomes of short-segment transforaminal lumbar interbody fusion. *BMC musculoskeletal disorders*. 16(1), 1-7.
- [6] R.J. Mobbs, K. Phan, G. Malham, K. Seex & P.J. Rao. (2015). Lumbar interbody fusion: techniques, indications and comparison of interbody fusion options including PLIF, TLIF, MI-TLIF, OLIF/ATP, LLIF and ALIF. *Journal of spine surgery*. 1(1), 2.
- [7] Y.S. Saadeh, J.R. Joseph, B.W. Smith, M.J. Kirsch, A.M. Sabbagh & P. Park. (2019). Comparison of segmental lordosis and global spinopelvic alignment after single-level lateral lumbar interbody fusion or transforaminal lumbar interbody fusion. *World Neurosurgery*. 126, e1374-e1378.
- [8] P.O. Champagne, C. Walsh, J. Diabira, M.E. Plante, Z. Wang, G. Boubez & D. Shedid. (2019). Sagittal balance correction following lumbar interbody fusion: a comparison of the three approaches. *Asian spine journal*. 13(3), 450.
- [9] M. Uysal, M. Ozalay, A. Derincek, A. Kochai & M. Turker. (2018). Effect of PLIF and TLIF on sagittal spinopelvic balance of patients with degenerative spondylolisthesis. *Acta Orthopaedica et Traumatologica Turcica*. 52(4), 272-276.
- [10] Y.S. Lee, S.W. Park & Y.B. Kim. (2014). Direct lateral lumbar interbody fusion: clinical and radiological outcomes. *Journal of Korean Neurosurgical Society*. 55(5), 248-254.
- [11] P.R. Landham, A.S. Don & P.A. Robertson. (2017). Do position and size matter? An analysis of cage and placement variables for optimum lordosis in PLIF reconstruction. *European Spine Journal*. 26, 2843-2850.
- [12] A. Shah, J.V. Lemans, J. Zavatsky, A. Agarwal, M.C. Kruyt, K. Matsumoto, H. Serhan, A. Agarwal, K.V. Goel. (2019). Spinal balance/alignment—clinical relevance and biomechanics. *Journal of biomechanical engineering*. 141(7), 070805.

- [13] F.C. Lovecchio, A.S. Vaishnav, M.E. Steinhaus, Y.A. Othman, C.H. Gang, S. Iyer & S.A. Qureshi. (2020). Does interbody cage lordosis impact actual segmental lordosis achieved in minimally invasive lumbar spine fusion?. *Neurosurgical Focus*. 49(3), E17.
- [14] S. DiMaria, B.A. Karamian, N. Siegel, M.J. Lambrechts, L. Grewal, H.R. Jeyamohan, W.A. Robinson, A. Patel, J.A. Canseco, I.D. Kaye & B.I. Woods. (2022). Does interbody cage lordosis and position affect radiographic outcomes after single-level transforaminal lumbar interbody fusion?. *Clinical Spine Surgery*. 35(9), E674-E679.