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Original article

Combined Mini Transforaminal Lumbar inter Body Fusion with Percutaneous Pedicle Screw Fixation in Degenerative Lumbar Diseases

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Abstract

Background : MIS-TLIF (minimally invasive transforaminal lumbar interbody fusion) is a well-known surgical procedure. However, there are just a few instances of MIS-TLIF employing a single cage and a midline approach**. Aim :** to know the results of performing combined mini TLIF fusion with percutaneous pedicle screw fixation for the treatment of degenerative lumbar diseases. **Subjects and Methods :** A total of 12 patients were done at Benha university hospital and tracked for a total of 12 months. The rate of fusion and the change in disc height are among the radiological data. Clinical outcomes were measured using the visual analogue score (VAS) and the Oswestry disability index (ODI). **Results**. The mean age of these patients at operation was 50 years (range, 45–62 years). Evidence of fusion was observed radiologically in 64.71% at 6 months and 87.5% at 12 months after surgery. The mean VAS scores for back and leg pain and ODI scores improved significantly at the final follow-up. **Conclusions :** The clinical and radiologic results of MIS-TLIF employing a midline approach and a banana cage in patients suggest that it is a viable therapeutic option for a variety of degenerative lumbar spine disorders.

Keywords (MIS-TLIF) , ODI ,VAS

Introduction:

The number of people requiring spine surgery increases as the population ages (1).

Comorbidities and decreased bone density are more common in the elderly, which may lead to worse results (2).

Surgery time, comorbidities and a patient's age correlate with posterior spine surgery (3–6).

Patients who receive lumbar spine surgery are more likely to be hospitalised and to die, according to several studies (7).

As people become older, their risk of death and disease rises (5).

Transforaminal lumbar interbody fusion (MIS-TLIF) has been used effectively to treat a variety of lumbar spinal diseases since its introduction in 2002. (8).

MIS-advantages There is less blood loss, a shorter stay in the hospital, fewer complications, less postoperative pain, and a faster recovery time with TLIF's (9-13)

Subjects and methods:

This is a single center, prospective study investigating the clinical and radiological outcomes of MIS-TLIF in patients with degenerative lumbar diseases using midline approach and banana cage at single level. Between mars 2019 and January 2021, 12 MIS-TLIF procedures were performed at Benha university hospital. The patients included in this study were between 45 and 62 years old, who satisfied the clinical and radiological criteria at Benha university hospital.

Clinical and radiological evaluations had been completed on all of the participants, all of whom were between the ages of 45 and 62.

To be considered for **inclusion**, the following must be met:

At the time of surgery, the patient was between the ages of 45 and 62.

tried everything to get rid of the discomfort, but it just won't go away, that fluctuates in intensity and duration A person's neurological deficits are becoming more severe.

Single level degenerative disc disease with spinal instability, spondylolytheis with spinal instability and spinal canal stenosis are the three conditions that need radiographic examinations in order to rule out other conditions.

A patient's clinical symptoms and radiological results must be consistent in order to qualify as having spinal stenosis.

After a three-month trial, the safest and most effective therapeutic options were exhausted.

Only if the following conditions are satisfied may an individual be **exempted**:

Life-threatening medical disorders (high-risk group) and past fusion surgery further increase the risk of spinal infection, trauma, and spinal metastases. Evaluation in the clinical setting:

Data was gathered on 12 patients who underwent one level of MIS-TLIF between March 2019 and January 2021. Preoperative information was obtained up to a year following surgery, and the results were analysed during that time period. Preoperative and postoperative data were collected for less than a month before the procedure, and 3, 6, and 12 months after the procedure, respectively. Clinical data included visual analogue scale (VAS, 0–10) and Oswestry disability index (ODI, 0–100%) values. Perioperative data included the amount of spinal fusion, kind of decompression (unilateral laminectomy vs. bilateral laminectomy), date of drain removal, duration of surgery, and duration of anaesthesia.

Routine X-ray pictures were taken before surgery, as well as two months, four months, six monthes and one year after the procedure, for radiological assessment. The disc height was measured in the middle of the spinal column using conventional standing lateral radiography. Severe spinal stenosis may be caused by misaligned vertebral bodies, which is why it's important to know the segmental lordotic angle for each level that has undergone surgery (15). A CT scan was performed both before and after the procedure. Fusion was defined by using modified Bridwell criteria (16, 17). Observations were made of any sinking or dislodgment of the cages or hardware failures.

Table 1: Modified Bridwell fusion criteria

Grade	Description
I	Fused with remodelling and trabeculae present
II	Graft intact, not fully remodelled and incorporated, but no lucency present
III	Graft intact, potential lucency present at top and bottom of graft
IV	Fusion absent with collapse or resoroption of graft

Surgical technique:

Decompression and cage insertion were accomplished using a tubular retractor.

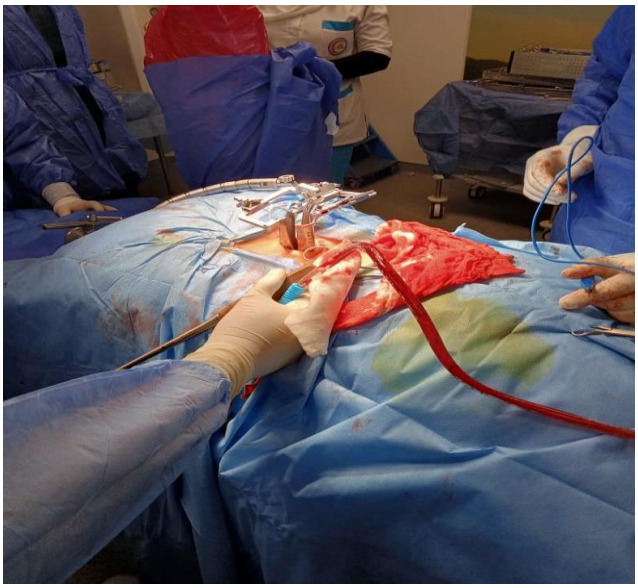

Fig 1: Decompression and cage insertion using a tubular retractor

Under loop guidance, total facetectomy and partial laminectomy were done. The ligamentum flavum was resected. Complete discectomy was done and grinding of the central and contralateral endplates was done with angled ring curettes.

Fig 2: Under C-arm fluoroscopic supervision, the cage was introduced.

Bilateral decompression was performed at the unilateral laminofacetectomy site. The contralateral inferior articular process, lamina, and ligamentum flavum were dissected along the corridor established by the ipsilateral laminofacetectomy site. The tubular retractor had to be positioned so that the distal end was facing the base of the spinous process, away from the surgeon, in order to get a better viewing field on the contralateral side. The cage was installed once the discectomy and foraminal decompression were completed. In this investigation, banana cages were used. The cage was filled with a mixed variety of autologous cancellous bone collected locally. Under C-arm fluoroscopic supervision, the screws were introduced percutaneously. Irrigation was applied to the wounds, drainage catheters were implanted, and the wounds were closed layer by layer.

Percutaneous pedicle screw insertion:

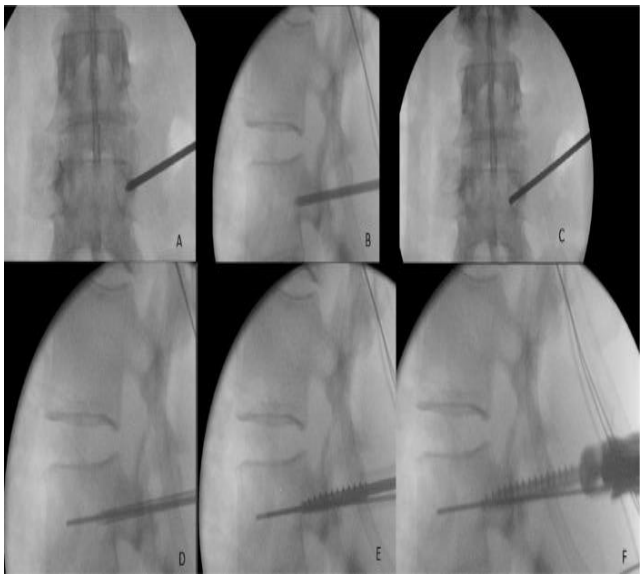

Fig 3: Technique for screw insertion using fluoroscopy. (A) Entry point on the AP fluoroscopy; (B, C) When only the Jamshidi needle passes the posterior wall of the vertebral body, it is allowed to touch the inner border of the pedicle on the AP image; (D) The guide wire is then inserted in the cannula with care not to pass the anterior wall of the vertebral body; (E) After the insertion of all guidewires, taping is carried out with caution not to remove the guidewires; (F) Screw insertion is carried out and the guidewire may be removed when the screw tip reaches the posterior vertebral wall**.**

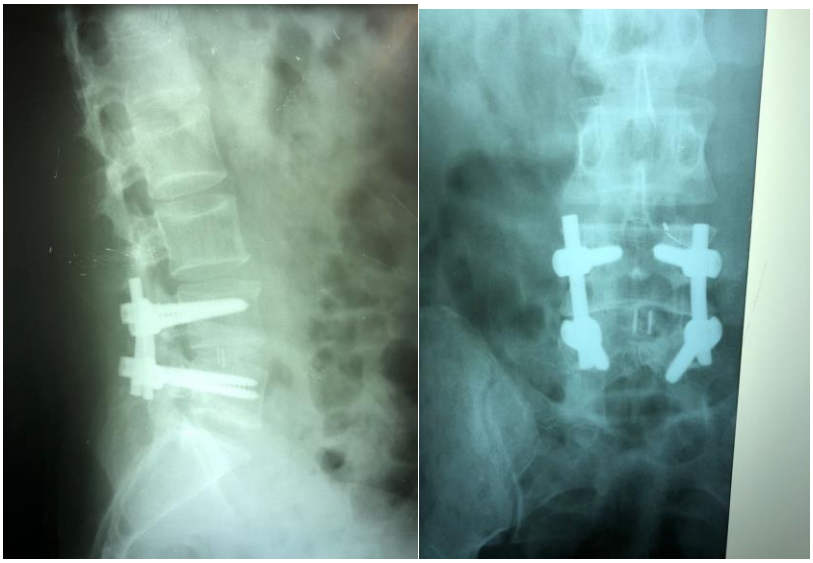

Fig 4 : Post-operative x-ray (AP) & (Lat.) after 6 months showing complete fusion of the graft with restoration of lumbar lordosis

Ethical considerations

The study was conducted after approval of the protocol by the Local Research Committee and the Studies Committee as well as the Research Ethics Committee of Faculty of Medicine, Benha University.

An informed written consent was obtained from all patients.

Statistical analysis

- Gathered data were processed using SPSS version 26.0 (SPSS Inc., Chicago, IL, USA).
- Quantitative data were expressed as means ±SD while qualitative data were expressed as numbers and percentages (%).
- Student t-test was used to compare statistical difference for quantitative data while Chi Square will be used for qualitative data.
- A probability value (p-value) < 0.05 was considered statistically significant.
- Collected data were presented in a suitable tables and suitable graphs after statistically analyzed by computer Software using appropriate statistical methods.

Results:

Pain in the back and legs reduced from 6.7 to 2.5 on the visual analogue scale. Oswetry dis ability index scores went from 55.6 to 25.2 during the course of the study. Radioactive fusion was detected in 88.5 percent of the samples. The average disc height rose from 9.1 to 12.3 millimetres. Six instances were graded as grade 1, four were grade 2, one was grade 3, and one was grade 4 based on the modified bridwell criterion.

The following is the subject of our conversation:

Those with degenerative lumbar illnesses were treated using a single-level banana cage and a midline approach in this clinical experiment.

During the months of March 2019 through January 2020, our facility performed 12MIS-TLIF procedures.

Clinical and radiological evaluations had been completed on all of the participants, all of whom were between the ages of 45 and 62.

To be considered for inclusion, the following must be met:

Practicing Clinical Medicine

At the time of surgery, the patient was between the ages of 45 and 62.

you've tried everything to get rid of the discomfort, but it just won't go away,

that fluctuates in intensity and duration

A person's neurological deficits are becoming more severe.

Degenerative disc disease and spinal instability are the three conditions that need radiographic examinations in order to rule out other conditions.

A patient's clinical symptoms and radiological results must be consistent in order to qualify as having spinal stenosis.

After a three-month trial, the safest and most effective therapeutic options were exhausted.

Only if the following conditions are satisfied may an individual be exempted:

Life-threatening medical disorders (high-risk group) and past fusion surgery further increase the risk of spinal infection, trauma, and spinal metastases.

A banana cage approach to MIS-TLIF yields in favourable clinical and radiological outcomes in patients.

Patients over the age of 60 seem to have a slower fusion process with MIS-TLIF using the midline technique with a banana cage.

Conclusions:

The clinical and radiologic results of MIS-TLIF employing a midline approach and a banana cage in patients suggest that it is viable therapeutic option for a variety of degenerative lumbar spine disorders.

References:

1. R. A. Deyo, M. A. Ciol, D. C. Cherkin, J. D. Loeser, and S. J. Bigos, "Lumbar spinal fusion. A cohort study of complications, reoperations, and resource use in the medicare population," *Spine*, vol. 18, no. 11, pp. 1463–1470, 1993.

2. W.-J. Wu, Y. Liang, X.-K. Zhang, P. Cao, and T. Zheng, "Complications and clinical outcomes of minimally invasive transforaminal lumbar interbody fusion for the treatment of one- or two-level degenerative disc diseases of the lumbar spine in patients older than 65 years," *Chinese Medical Journal*, vol. 125, no. 14, pp. 2505–2510, 2012.

3. A. J. Schoenfeld, L. M. Ochoa, J. O. Bader, and P. J. Belmont Jr., "Risk factors for immediate postoperative complications and mortality following spine surgery: a study of 3475 patients from the National Surgical Quality Improvement Program," *Journal of Bone and Joint Surgery A*, vol. 93, no. 17, pp. 1577–1582, 2011.

4. L. Y. Carreon, R. M. Puno, J. R. Dimar II, S. D. Glassman, and J. R. Johnson, "Perioperative complications of posterior lumbar decompression and arthrodesis in older adults," *Journal of Bone and Joint Surgery A*, vol. 85, no. 11, pp. 2089–2092, 2003.

5. R. A. Deyo, D. C. Cherkin, J. D. Loeser, S. J. Bigos, and M. A. Ciol, "Morbidity and mortality in association with operations on the lumbar spine. The influence of age, diagnosis, and procedure," *Journal of Bone and Joint Surgery A*, vol. 74, no. 4, pp. 536–543, 1992.

6. T. Fujita, J. P. Kostuik, C. B. Huckell, and A. N. Sieber, "Complications of spinal fusion in adult patients more than 60 years of age," *Orthopedic Clinics of North America*, vol. 29, no. 4, pp. 669–678, 1998.

7. N. B. Oldridge, Z. Yuan, J. E. Stoll, and A. R. Rimm, "Lumbar spine surgery and mortality among Medicare beneficiaries, 1986," *American Journal of Public Health*, vol. 84, no. 8, pp. 1292–1298, 1994.

8. K. T. Foley and M. A. Lefkowitz, "Advances in minimally invasive spine surgery," *Clinical Neurosurgery*, vol. 49, pp. 499–517, 2002.

9. P. Park and K. T. Foley, "Minimally invasive transforaminal lumbar interbody fusion with reduction of spondylolisthesis: technique and outcomes after a minimum of 2 years' follow-up," *Neurosurgical Focus*, vol. 25, no. 2, article no. E16, 2008.

10. I. O. Karikari and R. E. Isaacs, "Minimally invasive transforaminal lumbar interbody fusion: a review of techniques and outcomes," *Spine*, vol. 35, supplement 26, pp. S294–S301, 2010.

11. S. S. Dhall, M. Y. Wang, and P. V. Mummaneni, "Clinical and radiographic comparison of mini-open transforaminal lumbar interbody fusion with open transforaminal lumbar interbody fusion in 42 patients with long-term follow-up: clinical article," *Journal of Neurosurgery: Spine*, vol. 9, no. 6, pp. 560–565, 2008.

12. S. Fan, X. Zhao, F. Zhao, and X. Fang, "Minimally invasive transforaminal lumbar interbody fusion for the treatment of degenerative lumbar diseases," *Spine*, vol. 35, no. 17, pp. 1615–1620, 2010.

13. N. R. Khan, A. J. Clark, S. L. Lee, G. T. Venable, N. B. Rossi, and K. T. Foley, "Surgical outcomes for minimally invasive vs open transforaminal lumbar interbody fusion: an updated systematic review and meta-analysis," *Neurosurgery*, vol. 77, no. 6, pp. 847–874, 2015.

14. P. Lee and R. G. Fessler, "Perioperative and postoperative complications of single-level

minimally invasive transforaminal lumbar interbody fusion in elderly adults," *Journal of Clinical Neuroscience*, vol. 19, no. 1, pp. 111–114, 2012.

15. W.-S. Choi, J.-S. Kim, K.-S. Ryu, J.-W. Hur, and J.-H. Seong, "Minimally invasive transforaminal lumbar interbody fusion at L5-S1 through a unilateral approach: technical feasibility and outcomes," *BioMed Research International*, vol. 2016, Article ID 2518394, 8 pages, 2016.

16. K. H. Bridwell, L. G. Lenke, K. W. McEnery, C. Baldus, and K. Blanke, "Anterior fresh frozen structural allografts in the thoracic and lumbar spine: do they work if combined with posterior fusion and instrumentation in adult patients with kyphosis or anterior column defects?" *Spine*, vol. 20, no. 12, pp. 1410–1418, 1995.

17. K. H. Bridwell, M. F. O'brien, L. G. Lenke, C. Baldus, and K. Blanke, "Posterior spinal fusion supplemented with only allograft bone in paralytic scoliosis: does it work?" *Spine*, vol. 19, no. 23, pp. 2658–2666, 1994.

18. E. J. Carragee, "The increasing morbidity of elective spinal stenosis surgery: is it necessary?" *JAMA*, vol. 303, no. 13, pp. 1309–1310, 2010.

19. M. D. Daubs, L. G. Lenke, G. Cheh, G. Stobbs, and K. H. Bridwell, "Adult spinal deformity surgery: complications and outcomes in patients over age 60," *Spine*, vol. 32, no. 20, pp. 2238–2244, 2007.

20. K. H. Lee, W. M. Yue, W. Yeo, H. Soeharno, and S. B. Tan, "Clinical and radiological outcomes of open versus minimally invasive transforaminal lumbar interbody fusion," *European Spine Journal*, vol. 21, no. 11, pp. 2265–2270, 2012.

21. M. F. McDonnell, S. D. Classman, J. R. Dimar II, R. M. Puno, and J. R. Johnson, "Perioperative complications of anterior procedures on the spine," *The Journal of Bone & Joint Surgery—American Volume*, vol. 78, no. 6, pp. 839–847, 1996.

22. C. Seng, M. A. Siddiqui, K. P. L. Wong , "Five-year outcomes of minimally invasive versus open transforaminal lumbar interbody fusion: a matched-pair comparison study," *Spine*, vol. 38, no. 23, pp. 2049–2055, 2013.

23. M. A. Pelton, F. M. Phillips, and K. Singh, "A comparison of perioperative costs and outcomes in patients with and without workers' compensation claims treated with minimal invasive or open transforaminal lumbar interbody fusion," *Spine*, vol. 37, no. 22, pp. 1914–1919, 2012.

24. Wong AP, Smith ZA, Stadler JA 3rd, Hu XY, Yan JZ, Li XF, et al. Minimally invasive transforaminal lumbar interbody fusion (MI-TLIF): surgical technique, long-term 4-year prospective outcomes, and complications compared with an open TLIF cohort. Neurosurg Clin N Am. 2014 Apr;25(2):279-304.

25. M. Y. Wang, G. Widi, and A. D. Levi, "The safety profile of lumbar spinal surgery in elderly patients 85 years and older," *Neurosurgical Focus*, vol. 39, no. 4, article E3, 2015.

26. F. Ringel, M. Stoffel, C. Stüer, and B. Meyer, "Minimally invasive transmuscular pedicle screw fixation of the thoracic and lumbar spine," *Neurosurgery*, vol. 59, no. 4, supplement 2, pp. ONS-361–ONS-367, 2006.

27. L. T. Khoo and R. G. Fessler, "Microendoscopic decompressive laminotomy for the treatment of lumbar stenosis," *Neurosurgery*, vol. 51, no. 5, pp. 146–154, 2002.

28. O. Righesso, A. Falavigna, and O. Avanzi, "Comparison of open discectomy with microendoscopic discectomy in lumbar disc herniations: results of a randomized controlled trial," *Neurosurgery*, vol. 61, no. 3, pp. 545–549, 2007.

29. V. K. Podichetty, J. Spears, R. E. Isaacs, J. Booher, and R. S. Biscup, "Complications associated with minimally invasive decompression for lumbar spinal stenosis," *Journal of Spinal Disorders and Techniques*, vol. 19, no. 3, pp. 161–166, 2006.

30. Z. J. Tempel, G. S. Gandhoke, D. O. Okonkwo, and A. S. Kanter, "Impaired bone mineral density as a predictor of graft subsidence following minimally invasive transpsoas lateral lumbar interbody fusion," *European Spine*

Journal, vol. 24, supplement 3, pp. 414–419, 2015.

31. F. Galbusera, D. Volkheimer, S. Reitmaier, N. Berger-Roscher, A. Kienle, and H.-J. Wilke, "Pedicle screw loosening: a clinically relevant complication?" *European Spine Journal*, vol. 24, no. 5, pp. 1005–1016, 2015.

32. F. Chen, Z. Dai, Y. Kang, G. Lv, E. T. Keller, and Y. Jiang, "Effects of zoledronic acid on bone fusion in osteoporotic patients after lumbar fusion," *Osteoporosis International*, vol. 27, no. 4, pp. 1469–1476, 2016

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