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# Long Term Outcomes of Pain, Disability and Quality of Life in Open vs Minimally Invasive Surgery of Transforaminal Lumbar Interbody Fusion

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**ABSTRACT**

**Objective:** This study aims to evaluate the short- and long-term outcomes—specifically in terms of pain, disability, and quality of life—between minimally invasive surgery (MIS) and open transforaminal lumbar interbody fusion (TLIF) for treating lumbar spondylolisthesis.

**Study Design and Setting:** A prospective cohort study was carried out at Liaquat National Hospital & Medical College, Karachi, and a teaching institution in South Asia. The study included patients with chronic back pain for over three months, unresponsive to medical treatment or accompanied by radicular symptoms, with MRI-confirmed grade I and II degenerative lumbar spondylolisthesis, lateral recess stenosis, and unilateral disc herniation. Patients with spinal metastasis, previous surgeries, inflammatory arthritis, or metabolic bone diseases were excluded.

**Methodology:** The outcomes of MIS-TLIF and open-TLIF were assessed using the Visual Analog Scale (VAS), Oswestry Disability Index (ODI), and SF-36 quality of life scores at 1, 6, and 24 months postoperatively.

**Results:** Among 93 patients, 35 underwent open-TLIF and 58 received MIS-TLIF. MIS-TLIF resulted in significantly less blood loss and faster recovery. At four weeks, the MIS group had lower VAS and ODI scores, and higher SF-36 scores. Similar trends continued at six months, with improvements in ODI and SF-36. By 24 months, the MIS group maintained lower ODI scores, though VAS and SF-36 scores were comparable.

**Conclusion:** MIS-TLIF shows superior outcomes, especially in the early postoperative phase, with reduced morbidity and improved quality of life, making it a preferable option in resource-limited settings.

**Keywords:** MISTLIF; Open-TLIF; Transforaminal lumbar interbody fusion; short and long-term outcomes.

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## INTRODUCTION:

Lumbar interbody fusion can address multiple spinal pathologies, including the degenerative spine, trauma, tumors, and infections[1]. Lumbar interbody fusion techniques tend to improve back pain, fusion rate and help maintain vertebral alignment. Also it can be performed via minimally invasive approach[2].

Open transforaminal interbody fusion was first described by Harms and Rollinger in 1982. Circumferential fusion by posterolateral approach may result in a good outcome[3], but excessive retraction, muscle dissection, prolonged hospital stay, and high treatment cost were the downsides of open TLIF[4, 5, 6]. Therefore, minimally invasive technique (MIS) was introduced by Foley to decrease tissue trauma using a smaller wound leading to quicker recovery[7]. Extensive soft tissue dissection is essential to expose the anatomic landmarks for pedicle screw insertion, to identify a proper screw trajectory, and to resect the facet complex. The degree of iatrogenic muscle and soft tissue injury that occurs during the surgical approach can result in increased postoperative pain, lengthened recovery time, and impaired spinal function.

Recently, MIS techniques have been introduced and preferred over open TLIF. The advantages of MIS TLIF include, small wounds, reduced muscular dissection, early post op recovery and minimal hospital stay.

Outcomes of MIS, when compared with open TLIF assessed at 6 months and 2 years also showed the superiority of MIS in terms of reduced length of hospitalization and cost, although the effectiveness for other outcomes was equivocal[8].

In a developing country like ours, it is important to evaluate the impact of a surgical procedure on the short and long-

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term outcome of a disease, which is an indirect measure of its cost-effectiveness. Long-term usage of narcotics and delayed return to work translates to a loss of early functionality and productivity. Persistent or recurrent back pain increases morbidity leading to poor quality of life. This intends to delineate the comparison of immediate, short, and long-term outcomes of pain and quality of life through three different tools. The scales utilized are Visual analogue scale (VAS) for the evaluation of pain. Oswestry disability index (ODI) for assessing the disability in functionality due to back pain and 36 item Short Form health survey (SF-36) as a general measure of the patient's overall health. Quality of life was also assessed via a QOL score investigating the three parameters, pain, activity limitation, and depression. We also analysed the preoperative metabolic parameters in the two groups including Vitamin D3, Vitamin B12 and Uric acid. These parameter have shown to have effects on the degeneration of spine.

To the best of our knowledge, this is the only prospective study in the English language from the South Asian region, comparing outcomes (pain, disability, and quality of life) of open versus MIS -TLIF, with a 2-year follow-up. A similar prospective study from India evaluating the outcomes of the two procedures was performed half a decade back with 6 months follow-up[9].We also compared the complications and adverse effects, duration of analgesia, duration of surgery, blood loss, hospital stay, and need for re-do surgery as other variables.

## METHODOLOGY

This was a prospective cohort study in which all patients were followed for a post-operative period of 2 years. An institutional review board approved the study. Written informed consent was taken from participants (20-75 years) who were advised open TLIF or MIS for the following indications:

Patients with intractable chronic backache unresponsive to medical management or backache with radicular symptoms for more than 3 months, with Magnetic Resonance Imaging (MRI) showing grade I and II degenerative lumbar spondylolisthesis, lateral recess stenosis, and unilateral postero-lateral disc.

Patients were excluded if they had metastasis, pre-existing spinal pathology, redo surgery, patients with inflammatory arthritis, or metabolic bone disease.

Patients were reviewed for eligibility by the principal investigator. Socio-demographics were determined through a questionnaire. Neurosurgical trainees filled up the Visual Analogue Scale (VAS) to assess for pain, ODI to assess for disability, and SF-36 to determine the quality of life for all participants at baseline and on their follow-up visit 1, 6, and 24 months.

Quality of Life (QOL) was also assessed in these patients separately. Its questionnaire (QOL)had three categories (mild, moderate, and severe) to estimate pain, depression, and activity limitation. For analysis of variables, scores of mild, moderate, and severe symptoms of pain, depression, and activity limitation were scored as 1 point for mild symptoms, 2 for moderate, and 3 points for severe symptoms. The average was then compared among TLIF and MIS groups at baseline,1,6, and 24 months.

Both the procedures were performed by a single surgeon for standardization. Postoperatively, all the patients were encouraged discharge from the hospital the next day. Postoperative analgesics were tapered according to the patient's symptoms after both surgical procedures. Both groups were encouraged to return to work once given fitness.

### Surgical Technique MIS-TLIF

The procedure was performed on the most symptomatic side and with obvious pathology. Pedicles were marked with fluoroscopy, and small incisions are given 3-4 cm from the midline on each pedicle. Jamshidi needle is passed into the pedicle under the c arm, and K wire is passed through the Jamshidi needle into the pedicle and vertebral body, which is confirmed with the C arm. Bone tap is done and followed by the passing of cannulated screws over the guidewire. The guidewire is removed after the passing of screws. Rod is applied on the non-pathological side, and distraction is done to open the disc space.

An incision is given on the symptomatic side 3 to 4 cm from the midline using an Image intensifier, subcutaneous tissue dissected, dorsolumbar fascia opened, and sequential dilators inserted down the facet joint until the desired diameter is obtained.

Facetectomy is done using a high-speed drill and chisel, and bone is saved for grafting, ligamentum flavum excised. Kambin's triangle was identified, discectomy performed, disc space prepared with different instruments. An appropriate size cage is placed in disc space, keeping in mind the contralateral indirect decompression. In cases where a contralateral decompression of traversing or exiting nerve root is required, extensive decompression was done through the same side by drilling through the base of the spinous process and opposite lamina. The rod is then applied percutaneously to connect the screws. Compression is done before ?nal tightening to compress disc space and maintain lumbar lordosis.

### Open-TLIF

The incision is marked in the prone position, with C arm over the appropriate level using the midline. Incision is given, fascia is incised, and subperiosteal dissection is done. Entry points for the screws are exposed and confirmed with the help of fluoroscopy. Screws are passed on the non-pathological side, rod connected with screws, and distraction is done. The lower third of the lamina and facet joint taken

on the pathological side, and ligamentum flavum was excised. Traversing and exiting roots identified in Kambin's triangle, after discectomy and disc preparation, appropriate size cage is placed, screws are inserted and connected with the rod, and compression done.

Data were entered and analyzed on SPSS Version 21. Means and SD for quantitative variables like age, duration of pain, duration of surgery, and metabolic parameters were reported and compared between the two groups by unpaired t-test. Mann Whitney U test was applied if data was not normally distributed. Percentages and proportions were calculated for categorical variables like co-morbid diseases and compared between groups by Chi-square. To compare VAS, ODI, SF-36, and Qol scores between the two groups at baseline, 1, 6, and 24 months unpaired t-test or Mann Whitney U test was applied. A paired t-test or Wilcoxin signed-rank test (for data not normally distributed) was used to compare the scores within groups. Comparison of scores at baseline, 1, 6, and 24 months was done between and within-group through ANOVA statistics. P <0.05 was considered statistically significant, and 95% Confidence intervals (CI) were reported.

**RESULTS:**

A total of 58 patients underwent single level MIS, while 35 patients were operated on through open TLIF. table 1 shows the comparison of the baseline characteristics of participants. There were no differences in gender, presenting symptoms, duration of pain, duration of surgery, co-morbids, and metabolic parameters in both groups. Age was significantly lower in MIS than open TLIF group (p 0.004).

Table 2 shows postoperative parameters and complications in both groups. Blood loss was almost four times more in the open TLIF group (p <0.001). Return to work was delayed by 3 days in the open TLIF group compared to the MIS (p<0.001). The probability of mobility on the same postoperative day was significantly higher in the MIS group (p<0.001). The rate of postoperative complications and infections was more in the open TLIF but the difference was not significant compared to the MIS group (p 0.058 and 0.08, respectively).

Table 3 and figure 1 show a comparison of MIS with open TLIF. VAS, ODI, SF-36, and Qol scores at baseline, 1, 6, and 24 months. There was no significant difference between the baseline scores of MIS and TLIF groups. At 1 month, the VAS and ODI scores were significantly lower in the MIS group, whereas the SF-36 score was significantly higher (p < 0.001). At 6 months, ODI was significantly lower (p <0.001), whereas SF-36 was higher in the MIS group (p0.002). There was no difference in VAS between the two groups at 6 months. At 24 months, the ODI was significantly lower in the MIS group (0.007), whereas the VAS and SF-36 were not different at 24 months between the two groups. VAS, ODI, and SF-36 scores of both the groups were significantly different at baseline, 1, 6, and 24 months. It shows that the QoL score for pain and depression was significantly higher at baseline in the TLIF group than MIS. However, postoperatively, the pain, depression, and activity limitation scores were significantly more among TLIF than the MIS group at week 4, 6 months, and 2 years.

Table 4 and figure 1 show a comparison of VAS, ODI, and SF-36 scores at baseline, 1, 6, and 24 months among patients undergoing MIS TLIF with open TLIF. In the MIS TLIF group, the VAS was significantly lower at 1,6 and 24 months (p <0.001), however it remained static at 6 and 24 months. The ODI was significantly lower at 1,6 and 24 months from baseline (p <0.001). The SF-36 score was significantly higher at 1, 6, and 24 months from baseline (p <0.001). hence, this brings us to the conclusion, that among MIS, the scores were significantly low at 1,6 and 24 months for pain, depression, and activity limitation compared to baseline.

The VAS and ODI was significantly lower within the open TLIF group at 1, 6 and 24 months (p <0.001). The SF-36 score was significantly higher at 6 and 24 months from baseline (p <0.001).

Figure 1a Comparison of VAS at baseline, 4 weeks, 6 months, and 2 years among patients who underwent minimally invasive surgery (MIS) and open Transforaminal Lumbar Interbody Fusion (TLIF)

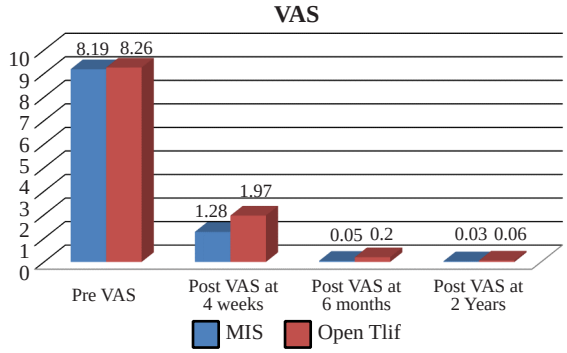


Figure 1b Comparison of ODI at baseline, 4 weeks, 6 months, and 2 years among patients who underwent minimally invasive surgery (MIS) and open Transforaminal Lumbar Interbody Fusion (TLIF)

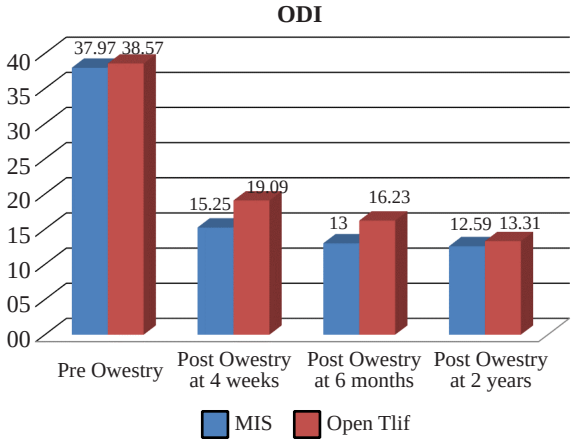

Figure 1c Comparison of SF-36 at baseline, 4 weeks, 6 months, and 2 years among patients who underwent minimally invasive surgery (MIS) and open Transforaminal Lumbar Interbody Fusion (TLIF)

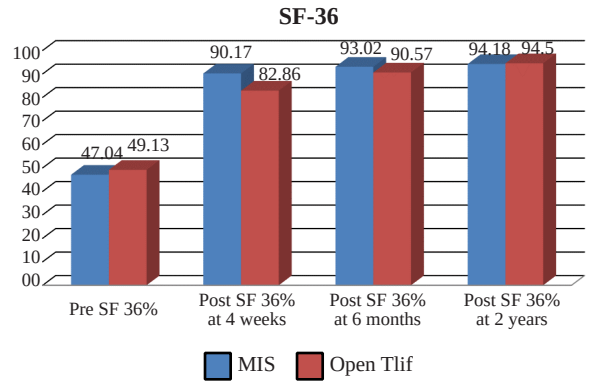


Table 2: Comparison of postoperative parameters of patients undergoing Minimally Invasive surgery (MIS) and open Transforaminal Lumbar Interbody Fusion (TLIF)

| | MIS n= 58 | Open TLIF n=35 | p-value |
|---|---|---|---|
| **Blood loss in ml** | 86.34±18.47 | 315.71±54.7 | <0.001*** |
| **Return to work** | 4.00±0.00 | 7.06±2.36 | <0.001*** |
| **Mobilization Day** | | | |
| Next Morning | 17(29.3) | 27(77.1) | <0.001*** |
| Same Day | 40(69) | 0(0) | |
| Next Day | 1(1.7) | 4(11.4) | |
| **Complications** | | | |
| Yes | 4(6.9) | 7(20) | 0.058 |
| No | 54(93.1) | 28(80) | |
| **Infections** | | | |
| Yes | 1(1.7) | 5(14.3) | 0.080 |
| No | 57(98.3) | 30(85.7) | |

(VAS, ODI, SF-36 at baseline, 4 weeks, 6 months, and 2 years)

## DISCUSSION:

Conventional lumbar fusion is generally associated with extensive soft tissue dissection and increased morbidity.[4,5,10,11] Inter and supraspinous ligaments along with paraspinal muscles on the opposite sides are preserved in MIS-TLIF. Hence, the posterior natural tension band remains intact. Ipsilateral paraspinous muscle injury is limited in the muscle splitting tubular retractor system used in MIS-TLIF, contributing to decreased postoperative pain and facilitating earlier mobilization**.** This approach preserves the contralateral facet instead of the open-TLIF approach in which facet joint may be taken. The ipsilateral facetectomy helps complete intervertebral disc space exposure far laterally, and minimal retraction is applied on thecal sac or nerve roots while placing the interbody graft. Intraoperative retraction contributes to postoperative pain and dysesthesia. In MIS-TLIF, retractors are merely placed to protect the neural structures during the graft placement. Soft tissues at adjacent levels are minimally affected by percutaneous pedicle screw fixation.

Table 1: Baseline characteristics of patients undergoing Minimally Invasive surgery (MIS) and open Transforaminal Lumbar Interbody Fusion (TLIF)

| | MIS n= 58 | Open Tlif n=35 | p-value |
|---|---|---|---|
| Age | 45.49±16.31 | 54.61±12.32 | 0.004** |
| Pain duration in months | 36.44±41.90 | 30.53±51.34 | 0.565 |
| Duration of surgery in hours | 2.99±0.91 | 3.21±0.56 | 0.165 |
| Gender | | | |
| Male | 17(29.3) | 16(45.7) | 0.109 |
| Female | 41(70.7) | 19(54.3) | |
| Presenting complains | | 0.31 | |
| BP/LP | 56(96.5) | 32(91.4) | |
| BP | 1(1.7) | 0(0) | |
| Numbness in leg | 1(1.7) | 0(0) | |
| Metabolic parameters | | | |
| Uric acid level | 5.06±1.78 | 5.02±1.34 | 0.909 |
| Vitamin B 12 level | 461.3±330.7 | 486.2±539.3 | 0.806 |
| Vitamin D level | 25.34±15.04 | 25.95±13.08 | 0.839 |

Table 3: Comparison of Minimally Invasive Surgery (MIS) with open Transforaminal Lumbar Interbody Fusion (TLIF) (VAS, ODI, SF-36 at baseline, 4 weeks, 6 months, and 2 years)

| | MIS | Open TLIF | P-value[1] | P-value[2] |
|---|---|---|---|---|
| **VAS** | | | | |
| **Baseline** | 8.19±1.27 | 8.26±1.19 | 0.801 | <0.001*** |
| **4 weeks** | 1.28±0.48 | 1.97±0.74 | <0.001*** | |
| **6 months** | 0.05±0.22 | 0.20±0.47 | 0.089 | |
| **24 months** | 0.03±0.18 | 0.06±0.23 | 0.606 | |
| **ODI** | | | | |
| **Baseline** | 37.97±4.77 | 38.57±3.78 | 0.524 | <0.001*** |
| **4 weeks** | 15.25±1.66 | 19.09±1.86 | <0.001*** | |
| **6 months** | 13.00±0.97 | 16.23±1.92 | <0.001*** | |
| **24 months** | 12.59±0.77 | 13.31±1.38 | 0.007** | |
| **SF-36** | | | | |
| **Baseline** | 47.04±6.39 | 49.13±4.10 | 0.058 | <0.001*** |
| **4 weeks** | 90.17±5.98 | 82.86±3.47 | <0.001*** | |
| **6 months** | 93.02±3.46 | 90.57±3.85 | 0.002** | |
| **24 months** | 94.18±2.78 | 94.50±2.74 | 0.590 | |

1 Independent t-test is applied to obtain a p-value between MIS and TLIF groups
2 ANOVA applied to calculate p-value between more than two unpaired groups

*Significant at p 0.05 -0.01
** Significant at p 0.01-0.001
*** Significant at p<0.001

We prospectively compared MIS TLIF with open TLIF for 2 years and also observed the quality of life in these patients. It was seen, there was a significant decrease in VAS at 1 month post-operatively, which was maintained at 6 and 24 months. VAS is a subjective analysis, so immediate post-operative pain improvement is to be expected. SF-36, a general health questionnaire, revealed improvement at 1 and 6 months, but it showed no difference at 24 months.

Table 4: Comparison of VAS, ODI, SF-36 scores at baseline, 4 weeks, 6 months, and 2 years among patients undergoing Minimally Invasive surgery (MIS) with open Transforaminal Lumbar Interbody Fusion (TLIF)

| | Baseline | 4 weeks | 6 months | 24 months | P value[1] | Baseline | 4 weeks | 6 months | 24 months | P value |
|---|---|---|---|---|---|---|---|---|---|---|
| **Baseline** | - | <0.001*** | <0.001*** | <0.001*** | <0.001*** | - | <0.001*** | <0.001*** | <0.001*** | <0.001*** |
| **4 weeks** | <0.001*** | - | <0.001*** | <0.001*** | | 0.001*** | - | 0.001*** | 0.001*** | |
| **6 months** | <0.001*** | <0.001*** | - | 0.322 | | <0.001*** | <0.001*** | - | 0.058 | |
| **24 months** | <0.001*** | <0.001*** | 0.322 | - | | <0.001*** | <0.001*** | 0.058 | - | |
| **ODI** | | | | | | | | | | |
| **Baseline** | - | <0.001*** | <0.001*** | <0.001*** | <0.001*** | - | <0.001*** | <0.001*** | <0.001*** | <0.001*** |
| **4 weeks** | <0.001*** | - | <0.001*** | <0.001*** | | <0.001*** | - | <0.001*** | <0.001*** | |
| **6 months** | <0.001*** | <0.001*** | - | <0.001*** | | <0.001*** | <0.001*** | - | <0.001*** | |
| **24 months** | <0.001*** | <0.001*** | <0.001*** | - | | <0.001*** | <0.001*** | <0.001*** | - | |
| **SF-36** | | | | | | | | | | |
| **Baseline** | - | <0.001*** | <0.001*** | <0.001*** | <0.001*** | - | <0.001*** | <0.001*** | <0.001*** | <0.001*** |
| **4 weeks** | <0.001*** | - | <0.001*** | <0.001*** | | <0.001*** | - | <0.001*** | <0.001*** | |
| **6 months** | <0.001*** | <0.001*** | - | 0.002** | | <0.001*** | <0.001*** | - | <0.001*** | |
| **24 months** | <0.001*** | <0.001*** | 0.002** | - | | <0.001*** | <0.001*** | <0.001*** | - | |

Paired t-test is applied to obtain a p-value within each paired group
[1] ANOVA applied to calculate p-value between more than two paired groups
*Significant at p 0.05 -0.01
** Significant at p 0.01-0.001
*** Significant at p<0.001

Similarly, ODI was less with the MIS group at 1 and 6 months, and it continued to show improvement at 24 months. ODI Disability Index, compared to SF 36, is more specific for better functionality. The Quality of life (QOL) scores were also lower postoperatively in the MIS TLIF group when compared with open. It was seen that baseline scores in both groups were significantly different, with higher scores in open TLIF and lower scores in the MIS group. However, like all other parameters assessed in this study, QOL scores also converged at the 2-year follow-up.

Both cohorts showed improvement in the pain score at 2 years (VAS) and disability (ODI), consistent with earlier studies[12]. Advantages of the MIS technique are evident in the early recovery phase, as is shown by a meta-analysis that reviewed 12 studies from 2009-2017.These 6 studies showed an improvement in VAS-B (Visual Analogue Scale-Back) with MIS-TLIF at 6 months follow-up. They reflected no difference in outcome at 2 years except for the study by Wong, which showed no difference in outcome at 24 and 36 months postoperatively, but at 4 years, the ODI and VAS-B showed improvement compared with baseline open-TLIF.[12]

The surgery duration while comparing open versus minimally invasive approaches depends upon the surgeon's learning curve. Initially, MIS might be associated with increased operative time. Interestingly, the duration of surgery was less in our study, which may be due to our surgeons reaching their learning curve prior to this study. Kulkarni et al.[13] conducted a prospective study examining 61 patients and showed a longer operative time for MISTLIF, which was secondary to the learning curve. Hey and Peng also showed a longer operative time for MISTLIF, which was explained by the technically demanding MISTLIF due to the limited visibility of the surgical field.[14] Once the learning curve of 15 cases is achieved, it results in a significant decrease in the operative time (1.8 to 3.2 hours).[15]

The preoperative mental health of the patient undergoing spine surgery also plays an important role in his outcome. SF-36 is a commonly used instrument to ensure generic health-related quality of life. A systematic review noted that one of the most frequently investigated predictor variables was depression (5 times), followed by the SF-36 (3 times).[16]

Return to work was earlier in the MIS group, suggesting occupational benefits. The postoperative narcotic use for MIS-TLIF patients was only half, despite similar preoperative pain and disability scores. Economic and social productivity is markedly associated with earlier return to work in the MIS-TLIF group. However, both groups had similar long-term improvement.[17, 18, 19]

Also, while assessing the quality of life in such patients, the parameters analyzed in our manuscript include pain, depression, and limitation of activity. On various occasions, it has been documented that minimally invasive procedures do shorten the length of stay by an average of 1 or 2 days and thus results in early ambulation when compared with its open counterparts.[20]

Smaller incisions decreased muscle retraction, and early mobilization are the major advantages of MIS TLIF. It leads to early discharge and hence is cost-effective. It has a lesser risk of reoperation and infections. Wong found a significantly lower rate of infections with MISTLIF, attributed to patients' overall earlier mobilization and ambulation.[21]

MIS TLIF is associated with significant improvement in the

overall mental health of patients with psychological distress, especially in the early post operative phase. Despite poorer patient-related outcome measures preoperatively, patients with depressed mood or increased stress levels undergoing MIS-TLIF still achieved comparable outcomes from 3 months onward. A greater proportion of these patients experienced a clinically meaningful improvement in pain, function, function, and quality of life.[22]

Another significant observation in the MIS TLIF group was decreased intraoperative blood loss. Mobilization on the same day encourages early discharge from the hospital, resulting in decreased exposure to nosocomial pathogens, ultimately minimizing hospital costs and medical resources. We observed that only one patient in the MIS group and five patients in the open-TLIF developed an infection. It is speculated that the major contributing factors to these complications are the longer duration of surgery, late mobilization, increased blood loss, excessive dissection, and delayed discharge of the patient. The reoperation rate of open compared to MIS-TLIF is higher and is reported to be approximately 20% compared to 8%.

Both MIS-TLIF and open-TLIF were associated with marked improvements in long-term pain, disability, and function. Only one other prospective cohort study has compared 2-year outcomes between MIS-TLIF and open-TLIF.[6] As compared to our observation, Peng[6] reported VAS (2.2 vs. 2.0) and ODI (18.2 vs. 19.7) scores at both 6 months and 2 years (VAS: 1.0 vs. 1.2; ODI: 16.2 vs. 17.5) after MIS-TLIF versus open- TLIF. Wong et al. [21] showed better ODI, VAS-B, and VAS-L outcomes with MIS-TLIF at 6 months postoperatively. Those clinical outcomes were not different at 24 and 36 months postoperatively, but ODI and VAS-B were better with MIS-TLIF than with open-TLIF at 4 years postoperatively.[21] Therefore, it is inferred that mental health improvement in distressed patients post MIS TLIF could be due to improved pain and functional mobility. In contrast, poorer preoperative mental status could be due to chronic low back pain, limited functionality and spinal instability.

We also evaluated certain metabolic parameters between the two groups, Vitamin D3 levels, Vitamin B12 and uric acid, which have a proven role in degenerative spine. However, our results did not show any significant difference between the two groups. It has been observed, that Vitamin D3 has a protective role in disc degeneration because of its effect on inhibition on NF-KB signaling pathway which is a major contributor in the activation of inflammatory pathways.[23] Also, of note is the role of hyperuricemina, it is observed that it plays a significant role in accentuating the narrowing of disc spaces in lumbosacral spine and degenerative spondylolisthesis resulting in chronic low back pain.[24] These are the reasons, that our patients were worked up in this domain and their deficiencies were corrected prior to procedure.

The results of our study suggest that both techniques are equally useful for long-term pain relief, thus reducing disability and improving quality of life. However, the advantage of MISTLIF is more in the early period.

## CONCLUSION:

Minimally invasive TLIF manifests its advantages in the immediate postoperative phase with a shorter hospital stay, early mobilization, return to work, decreased risk of reoperation and infections. These factors result in reduced morbidity and hence may be cost-effective in the long term. Compared with open-TLIF, it reflects similar pain, disability, and quality of life at long-term follow-up.

**Authors Contribution:**
**Aman Ullah Khan:** Drafting the article, Data Collection
**Afifa Afsar:** Data Analysis
**Salman Sharif:** Conception and Design
**Faridah Amir Ali:**Analysis and Interpretation/ Revision of the Article

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