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Research Article

# Functional and Fusion Outcomes of Local Autogenous Bone Grafting in Lumbar Spondylolisthesis

**Dr. Md. Hamidul Haque[1*], Dr. Md. Shahidul Islam Akon[2], Dr. Md. Shafiul Ezaz[3], Dr. Abdullah Al Mahmud[1], Dr. Md. Kamruzzaman[3], Dr. Md. Solaiman Hasan[4], Dr. Mohammad Ullah[4], Dr. Muktasid-Al-Mubin[4]**

## Abstract

**Background:** Low-grade isthmic and degenerative lumbar spondylolisthesis are important causes of back pain and disability, often requiring surgical fusion after failed conservative treatment. Although iliac crest autograft is the traditional standard for achieving fusion, donor site morbidity has led to increasing use of local autogenous bone from decompression as an alternative. Therefore, this study aimed to evaluate the functional and radiological fusion outcomes of local autogenous bone grafting in lumbar spondylolisthesis.

**Methods:** This retrospective study was conducted in the Department of Orthopaedic Surgery, IBN Sina Medical College Hospital, Dhaka, Bangladesh, from April 2021 to April 2026, including 38 adults with Meyerding grade I–III lumbar spondylolisthesis treated by posterior decompression and pedicle screw–rod fixation with local autogenous bone graft. Data covered demographics, clinical and radiological findings, with follow-up at 1, 3, 6, and 12 months; outcomes were assessed by VAS, ODI, Bridwell fusion grading, and Modified Lee's criteria, with all patients receiving early mobilization, physiotherapy, and brace-supported rehabilitation.

**Results:** The study included 38 patients (mean age 49.3 ± 14.0 years; 55.3% female), mainly 40–59 years (52.6%) with Grade II disease (73.7%) at L4–L5 (50.0%). Significant improvement was seen in VAS (8.1→1.6) and ODI (50.2%→15.8%) ($p<0.001$). Good-to-excellent outcomes were 84.2%, fusion success 97.4%, and complication rate 5.3% (pseudoarthrosis 2.6%, ASD 2.6%).

**Conclusion:** Local autogenous bone grafting in lumbar spondylolisthesis is an effective technique, providing reliable functional improvement, high fusion rates, and a low complication profile.

**Keywords:** Lumbar Spondylolisthesis; Autogenous Bone Graft; Spinal Fusion

## Introduction

Low-grade isthmic and degenerative lumbar spondylolisthesis represent important clinical conditions of the lower spine. These disorders commonly affect individuals during their most productive years of life, thereby contributing substantially to socioeconomic burden [1-4]. Spinal disorders constitute a leading cause of disability globally, impacting more than a billion individuals [5]. Among musculoskeletal conditions, spinal pain is the most frequently encountered and is the principal contributor to disability

**Affiliation:**

[1]Associate Professor, Department of Orthopaedic Surgery, IBN Sina Medical College Hospital, Dhaka, Bangladesh

[2]Professor of Spine Surgery, Department of Orthopaedic Surgery, Dhaka Medical College, Dhaka, Bangladesh

[3]Registrar, Department of Orthopaedic Surgery, IBN Sina Medical College Hospital, Dhaka, Bangladesh

[4]Medical Officer, Department of Orthopaedic Surgery, IBN Sina Medical College Hospital, Dhaka, Bangladesh

***Corresponding Author:**
Dr. Md. Hamidul Haque, Associate Professor, Department of Orthopaedic Surgery, IBN Sina Medical College Hospital, Dhaka, Bangladesh.

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[5]. Spondylolisthesis refers to the anterior or posterior displacement of one vertebral body relative to the adjacent inferior vertebra in the sagittal plane [6]. Degenerative lumbar spondylolisthesis is characteristically associated with facet joint degeneration and is predominantly seen in individuals above 50 years of age. Patients often present with spinal stenosis accompanied by low back pain and radicular lower limb symptoms [7].

A progressive rise in the incidence of both spondylolisthesis and degenerative disc disease has been observed over time [8]. Low back pain represents a significant global health problem with major socioeconomic implications, and its primary underlying mechanism is considered to be micro- and macro-instability of the spinal column [9,10]. Although the majority of patients with spinal stenosis and degenerative spondylolisthesis can be managed conservatively, only a small proportion, approximately 10–15%, eventually require surgical intervention [11]. This underscores the importance of accurate patient selection and timely surgical decision-making when non-operative treatment fails.

Pedicle screw fixation (PSF) combined with transforaminal lumbar interbody fusion (TLIF) is widely accepted as a standard operative approach following unsuccessful conservative management [12,13]. TLIF remains one of the most commonly utilized surgical techniques in degenerative lumbar pathology, performed with pedicle screw instrumentation [14]. This procedure enhances spinal stability by reinforcing the load-bearing anterior column, restoring intervertebral disc height, decompressing neural structures, and improving segmental stability [15]. Decompression combined with fusion is generally preferred over isolated decompression, as decompression alone may further destabilize the spinal segment and contribute to progression of vertebral slip [16]. Posterolateral fusion plays a crucial role in achieving arthrodesis, and selection of an appropriate bone graft is influenced by multiple factors, including patient characteristics, disease pattern, and surgeon preference [17,18].

Interbody fusion has long been established as a safe and effective surgical procedure, commonly performed using intervertebral cages in combination with bone grafts harvested from the iliac crest. Autologous iliac crest bone graft remains the most frequently used graft material due to its well-established fusion potential. However, despite its favorable biological and structural properties, including adequate bone volume and quality, its use is limited by associated donor site morbidity [19]. Iliac crest autograft is regarded as an optimal graft option for spinal fusion because of its histocompatibility, absence of immunogenic reaction, rich cancellous bone content, growth factors, and the presence of pluripotent cells that support osteogenesis and bone regeneration [20]. Nevertheless, harvesting from the iliac crest has been associated with a range of complications, varying from minor to significant adverse effects [21], including infection, donor site pain, thrombotic events, prolonged operative time, and increased intraoperative blood loss [20].

In order to address these limitations, local autograft obtained from resected laminae and facet joints during decompression has increasingly been recognized as a viable alternative. Bone obtained from lamina and facet excision during surgery can be utilized in sufficient quantity and offers an effective substitute, as it eliminates donor site morbidity and avoids the need for a secondary surgical wound. Furthermore, this locally harvested bone serves as a natural and physiological source containing viable osteoblasts and osteocytes. It possesses osteoconductive, osteoinductive, and osteogenic properties comparable to iliac crest bone graft, although the quantity and quality may vary [22]. It is proposed that successful fusion can be achieved without the need for iliac crest graft or interbody cages, utilizing instead the bone fragments obtained from spinous processes and posterior elements during decompression to fill the intervertebral space.

Despite posterior decompression with instrumented fusion being the standard treatment for lumbar spondylolisthesis and iliac crest autograft being traditionally regarded as the gold standard for fusion, donor site morbidity has encouraged the use of local autogenous bone harvested during decompression. However, reported outcomes of local bone grafting remain variable, and there is limited consolidated evidence evaluating both functional improvement and radiological fusion outcomes together using standard criteria. This inconsistency highlights the need for further evaluation. Therefore, the present study was conducted to evaluate the functional and radiological fusion outcomes of local autogenous bone grafting in patients with lumbar spondylolisthesis.

## Objective

To evaluate the functional and radiological fusion outcomes of local autogenous bone grafting in patients with lumbar spondylolisthesis.

## Methodology & Materials

This retrospective observational study was conducted in the Department of Orthopaedic Surgery, IBN Sina Medical College Hospital, Dhaka, Bangladesh, from April 2021 to April 2026. A total of 38 patients diagnosed with lumbar spondylolisthesis and treated with posterior decompression and instrumented fusion using pedicle screw–rod fixation with local autogenous bone graft were included in the final analysis based on predefined eligibility criteria.

### Inclusion Criteria

i. Radiologically confirmed lumbar spondylolisthesis

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ii. Age ≥ 18 years

iii. Both male and female patients

iv. Meyerding grades I–III

### Exclusion Criteria

i. Patients managed conservatively (non-operative treatment only)

ii. Spondylolisthesis associated with prolapsed intervertebral disc at other spinal levels

iii. Spondylodiscitis or active spinal infection

iv. Significant medical comorbidities increasing surgical risk or limiting follow-up

Data were collected using a structured proforma, including demographic characteristics, clinical presentation, operative details, radiological parameters, and postoperative outcomes. Preoperative assessment included detailed clinical history, neurological examination, and radiological evaluation using X-ray and MRI. Patients were followed postoperatively at 1, 3, 6, and 12 months, and functional, clinical, and radiological outcomes were assessed at each follow-up visit.

Functional outcomes were evaluated using the Visual Analog Scale (VAS) for pain and the Oswestry Disability Index (ODI) for disability, with preoperative and postoperative scores compared to assess improvement in pain and functional status. Radiological fusion was assessed using dynamic radiographs and computed tomography (CT) when required, and graded according to the Bridwell fusion criteria, where Grade I–II indicated successful solid fusion and Grade III–IV indicated incomplete or failed fusion (pseudoarthrosis). Additional radiological parameters, including slip correction and disc height changes, were evaluated where applicable. Functional outcomes were further classified using Modified Lee's criteria into excellent, good, fair, and poor categories.

All patients underwent posterior decompression with pedicle screw–rod fixation under general anesthesia in the prone position. Local autogenous bone graft harvested from the decompressed lamina and facet joints was morselized and used for posterolateral fusion. Postoperatively, patients were discharged within 3 to 4 days after drain removal. Early mobilization was encouraged with physiotherapy, including isometric exercises and assisted ambulation with lumbar bracing. Patients were advised regarding brace use, activity modification, and scheduled follow-up visits.

## Results

The majority of patients were aged 40–59 years (20 patients, 52.6%), followed by patients aged 60 years or older (10 patients, 26.3%) and those younger than 40 years (8 patients, 21.1%), with a mean age of 49.3 ± 14.0 years (range: 25–80 years). Female patients slightly predominated (21 patients, 55.3%). Grade II spondylolisthesis was the most common Meyerding grade (28 patients, 73.7%), followed by Grade I (6 patients, 15.8%) and Grade III (4 patients, 10.5%). The most frequently involved fusion level was L4–L5 only (19 patients, 50.0%), followed by L5–S1 only (13 patients, 34.2%). Single-level fusion was performed in the majority of patients (33 patients, 86.8%), while two-level fusion was required in 5 patients (13.2%). The mean duration of symptoms was 8.4 ± 5.7 years, and the mean postoperative hospital stay was 3.6 ± 0.5 days (Table 1,2).

**Table 1:** Baseline Demographic and Clinical Characteristics of the Study Population (n = 38).

| Category | Characteristic | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Age groups | < 40 years | 8 | 21.1 |
| | 40–59 years | 20 | 52.6 |
| | ≥ 60 years | 10 | 26.3 |
| | Mean ± SD (years) | 49.3 ± 14.0 | |
| | Range (years) | 25–80 | |
| Sex | Male | 17 | 44.7 |
| | Female | 21 | 55.3 |
| Meyerding Grade | Grade I | 6 | 15.8 |
| | Grade II | 28 | 73.7 |
| | Grade III | 4 | 10.5 |
| Fusion level | L4–L5 only | 19 | 50.0 |
| | L5–S1 only | 13 | 34.2 |
| | L3–L4 only | 1 | 2.6 |
| | L3/L4 + L4/L5 | 1 | 2.6 |
| | L4/L5 + L5/S1 | 4 | 10.5 |
| Number of fused levels | Single-level | 33 | 86.8 |
| | Two-level | 5 | 13.2 |
| Duration of symptoms (years) | Mean ± SD | 8.4 ± 5.7 | |
| Postoperative hospital stay (days) | Mean ± SD | 3.6 ± 0.5 | |

**Table 2:** Comparison of Preoperative and Postoperative Functional Outcome Scores.

| Outcome | Preoperative (Mean ± SD) | Postoperative (Mean ± SD) | Mean Change (95% CI) | p-value |
|---|---|---|---|---|
| VAS (0–10) | 8.1 ± 0.9 | 1.6 ± 0.7 | 6.5 (6.2–6.8) | < 0.001 |
| ODI (%) | 50.2 ± 8.9 | 15.8 ± 6.4 | 34.4 (31.5–37.3) | < 0.001 |

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There was significant postoperative improvement in both pain and functional disability scores following surgery. The mean Visual Analog Scale (VAS) score improved from 8.1 ± 0.9 preoperatively to 1.6 ± 0.7 postoperatively, with a mean reduction of 6.5 points (95% CI: 6.2–6.8) (Table 3). Similarly, the mean Oswestry Disability Index (ODI) score improved from 50.2 ± 8.9% preoperatively to 15.8 ± 6.4% postoperatively, with a mean reduction of 34.4 percentage points (95% CI: 31.5–37.3).

**Table 3:** Magnitude of Improvement in Functional Outcome Measures Following Surgery.

| Variable | Mean Improvement ± SD | Range |
|---|---|---|
| VAS improvement (points) | 6.5 ± 1.1 | 3–9 |
| ODI improvement (percentage points) | 34.4 ± 10.3 | 15–54 |

The mean improvement in VAS score was 6.5 ± 1.1 points, ranging from 3 to 9 points. The mean ODI improvement was 34.4 ± 10.3 percentage points, with a range of 15–54 points (Figure 1).

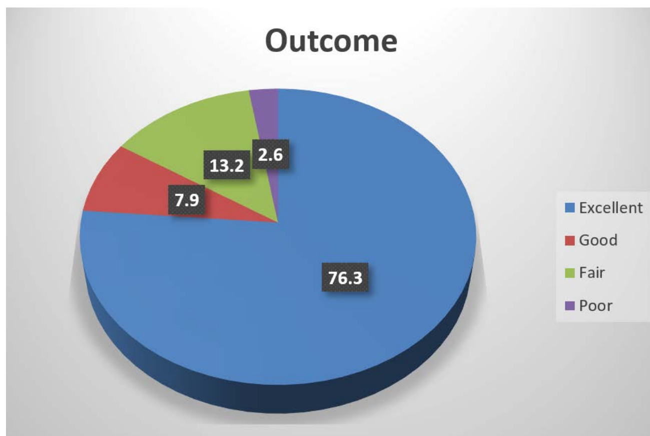


**Figure 1:** Distribution of Functional Outcomes According to Modified Lee's Criteria.

According to Modified Lee's criteria, excellent functional outcome was achieved in 29 patients (76.3%), while good outcome was observed in 3 patients (7.9%). Fair outcome was noted in 5 patients (13.2%), and poor outcome was observed in 1 patient (2.6%). Overall, good-to-excellent functional outcome was achieved in 32 patients (84.2%) (Figure 2).

Radiological assessment based on Bridwell fusion criteria demonstrated Grade I fusion in 29 patients (76.3%) and Grade II fusion in 8 patients (21.1%). One patient (2.6%) developed Grade IV fusion status consistent with pseudoarthrosis, while no patients demonstrated Grade III fusion. The overall successful fusion rate (Grade I + II) was 97.4% (Table 4).

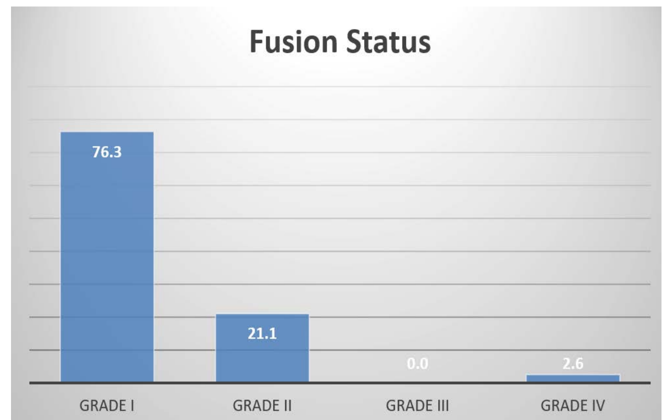


**Figure 2:** Radiological Fusion Outcomes According to Bridwell Fusion Criteria.

Overall, acceptable functional outcome (excellent, good, or fair according to Modified Lee's criteria) was achieved in 37 patients (97.4%). Successful radiological fusion based on Bridwell Grade I or II was also observed in 37 patients (97.4%), whereas failed fusion occurred in 1 patient (2.6%) (Table 5).

Postoperative complications were minimal. Adjacent segment disease was observed in 1 patient (2.6%), and pseudoarthrosis occurred in 1 patient (2.6%). The overall complication rate was 5.3%. No major intraoperative or implant-related complications were encountered.

**Table 4:** Combined Functional and Fusion Outcomes After Lumbar Fusion with Local Autogenous Bone Grafting.

| Outcome Category | Number | Percentage (%) |
|---|---|---|
| Good-to-excellent functional outcome (Modified Lee's criteria) | 32 | 84.2 |
| Acceptable functional outcome (Excellent + Good + Fair) | 37 | 97.4 |
| Successful fusion (Bridwell Grade I + II) | 37 | 97.4 |
| Failed fusion (Bridwell Grade IV) | 1 | 2.6 |

**Table 5:** Postoperative Complications and Special Events.

| Complication | Number | Percentage (%) |
|---|---|---|
| Adjacent segment disease | 1 | 2.6 |
| Pseudoarthrosis | 1 | 2.6 |
| Overall complication rate | 2 | 5.3 |

## Discussion

This retrospective observational study was conducted in the Department of Orthopaedic Surgery, IBN Sina Medical College Hospital, Dhaka, Bangladesh, from April 2021 to April 2026, involving patients with lumbar spondylolisthesis treated with posterior decompression and instrumented fusion using pedicle screw–rod fixation with local autogenous bone

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graft. The study aimed to evaluate the functional improvement and radiological fusion outcomes following the use of local autogenous bone grafting in lumbar spondylolisthesis, demonstrating its effectiveness in achieving significant pain relief, disability reduction, and a high rate of solid fusion with minimal complications.

The baseline demographic and clinical profile observed in the present study is broadly consistent with previously published literature on degenerative lumbar spondylolisthesis managed with instrumented fusion using local autogenous bone grafting. The mean age of the study population was 49.3 ± 14.0 years, with the majority of patients belonging to the 40–59-year age group (52.6%), indicating that lumbar spondylolisthesis predominantly affects middle-aged and older adults. These findings are comparable to those reported by Lehr et al. [23], who described a similar age distribution among patients undergoing instrumented fusion for lumbar spondylolisthesis, with mean ages generally ranging between 50 and 60 years, reflecting the progressive degenerative pathology associated with spinal instability. A slight female predominance was observed in the current series (55.3%), which also corresponds with the observations of Kakadiya et al. [24], who reported a higher prevalence among female patients. This female predominance has frequently been attributed to degenerative changes associated with postmenopausal hormonal alterations, ligamentous laxity, and biomechanical stress across the lumbosacral junction. In the present study, Grade II spondylolisthesis constituted the majority of cases (73.7%), followed by Grade I (15.8%) and Grade III disease (10.5%). This pattern closely resembles the findings of Abou-Madawi et al. [25], who similarly demonstrated that low-grade (Grade I–II) spondylolisthesis represents the predominant surgical subgroup in most lumbar fusion series. Regarding the level of involvement, L4–L5 was the most commonly affected segment (50.0%), followed by L5–S1 (34.2%), which is also in accordance with previously published studies describing L4–L5 as the principal site of degenerative instability due to its increased mobility and biomechanical loading. Furthermore, most patients in the present study underwent single-level fusion (86.8%), whereas only a minority required two-level fixation (13.2%), again reflecting the observations reported in earlier series. The mean duration of symptoms was 8.4 ± 5.7 years, suggesting that many patients experienced prolonged symptomatic disease before surgical intervention, while the mean postoperative hospital stay remained relatively short at 3.6 ± 0.5 days, indicating favorable perioperative recovery. Collectively, these demographic and clinical characteristics demonstrate that the present cohort is comparable to populations described in prior studies and therefore represents a typical surgical population with degenerative lumbar spondylolisthesis treated using fusion procedures with autogenous bone grafting.

The present study demonstrated marked and statistically significant improvement in both pain intensity and functional disability following lumbar fusion with local autogenous bone grafting. The mean Visual Analog Scale (VAS) score improved from 8.1 ± 0.9 preoperatively to 1.6 ± 0.7 postoperatively, while the Oswestry Disability Index (ODI) improved from 50.2 ± 8.9% to 15.8 ± 6.4%, with both changes reaching strong statistical significance ($p < 0.001$). The mean reduction in VAS was 6.5 points, whereas the mean ODI reduction was 34.4 percentage points, indicating substantial postoperative pain relief and restoration of daily functional capacity. These findings closely correspond with the observations of Kakadiya et al. [24], who also reported significant postoperative reductions in VAS and ODI scores with p-values less than 0.001, alongside ODI improvements averaging approximately 35–45%. Their study further emphasized that improved radiological fusion status was associated with better functional recovery, supporting the close relationship between successful arthrodesis and postoperative clinical improvement. Similarly, Prasad et al. [26] demonstrated significant symptomatic and functional recovery following lumbar fusion surgery, reporting a reduction in VAS scores from approximately 7.4 to 2.1 and ODI improvement from nearly 74% to 9.5%, with overall functional recovery exceeding 70–85% and all postoperative improvements reaching statistical significance ($p < 0.001$). Although the degree of ODI reduction in the present study was slightly lower than that described by Prasad et al. [26], the overall trend of marked postoperative improvement remains highly comparable. The significant improvement in both pain and disability scores observed in the current study therefore reinforces the established role of instrumented lumbar fusion using local autogenous bone grafting in restoring spinal stability, relieving neural compression, and improving quality of life among patients with lumbar spondylolisthesis.

Further evaluation of postoperative recovery in the present study demonstrated substantial improvement in overall functional outcome measures. The mean VAS improvement was 6.5 ± 1.1 points, with improvements ranging from 3 to 9 points, while the mean ODI improvement was 34.4 ± 10.3 percentage points, ranging from 15 to 54 points. These results indicate that most patients experienced clinically meaningful symptomatic recovery following surgery. Comparable findings were reported by Sleem et al. [27], who observed significant postoperative pain reduction, with VAS scores improving from 8.48 preoperatively to 2.91 postoperatively, corresponding to an average improvement of approximately 5.6 points. Their study also demonstrated marked enhancement in disability and work-related functional scores following lumbar stabilization procedures, with all improvements reaching statistical significance ($p < 0.001$). The magnitude of pain relief observed in the present study is slightly greater than that reported by Sleem et al. [27], which may

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reflect differences in patient characteristics, disease severity, surgical technique, or follow-up duration. Nevertheless, the overall pattern of substantial postoperative symptomatic and functional recovery remains highly consistent between the studies. These findings collectively suggest that lumbar fusion with local autogenous bone grafting provides reliable and durable clinical improvement in appropriately selected patients with lumbar spondylolisthesis.

Functional outcome assessment based on Modified Lee's criteria further demonstrated favorable postoperative recovery in the present study. Excellent outcomes were achieved in 76.3% of patients, good outcomes in 7.9%, fair outcomes in 13.2%, and poor outcomes in only 2.6%, resulting in an overall good-to-excellent functional outcome rate of 84.2%. These findings are highly comparable with those reported by Saccomanni et al. [28], who documented excellent outcomes in approximately 80–85% of patients, good outcomes in 5–10%, fair outcomes in 5–10%, and poor outcomes in 2–5%, with overall good-to-excellent results ranging between 85% and 90%. Similarly, Hegde et al. [29] also observed excellent functional outcomes in approximately 70–80% of patients, good outcomes in 10–15%, fair outcomes in 5–10%, and poor outcomes in only 1–5%, yielding an overall good-to-excellent outcome rate of approximately 80–90%. The close similarity between the present findings and these published series supports the effectiveness of local autogenous bone grafting combined with pedicle screw fixation in achieving satisfactory postoperative functional recovery. The relatively low proportion of poor outcomes in the present study additionally indicates that most patients derived meaningful symptomatic and functional benefit from surgical intervention.

Radiological fusion assessment using Bridwell fusion criteria demonstrated a high rate of successful arthrodesis in the present series. Grade I fusion was achieved in 76.3% of patients, while Grade II fusion was observed in 21.1%, resulting in an overall successful fusion rate (Grade I + II) of 97.4%. Only one patient (2.6%) developed Grade IV fusion status consistent with pseudoarthrosis, and no patient demonstrated Grade III fusion. These findings are comparable with the long-term observations reported by Roh et al. [30], who documented an initial Bridwell Grade I–II fusion rate of 77.1% at 1 year, which progressively increased to 91.4% at 5 years and 94.3% at 10 years, highlighting the progressive maturation and consolidation of spinal fusion over time. Their study also noted pseudarthrosis rates of approximately 6–8% during early follow-up, which decreased clinically over subsequent years. Similarly, Said et al. [31] reported fusion success rates ranging from 90–95%, accompanied by relatively low pseudoarthrosis rates of approximately 3–6%, and concluded that pedicle screw–assisted lumbar fusion using autologous grafting provides consistently high rates of solid arthrodesis regardless of graft source. The fusion success rate observed in the present study is therefore comparable to, and in some aspects slightly higher than, previously published reports. This high fusion rate may be attributable to adequate posterior stabilization, meticulous surgical technique, and the osteogenic potential of locally harvested autogenous bone grafts. The findings of the present study therefore further support the reliability and effectiveness of local autogenous bone grafting in achieving durable spinal fusion in patients with lumbar spondylolisthesis.

When both clinical and radiological parameters were considered together, the present study demonstrated highly favorable combined outcomes following lumbar fusion surgery. Good-to-excellent functional outcome according to Modified Lee's criteria was achieved in 84.2% of patients, while acceptable functional recovery (excellent, good, or fair outcome) was observed in 97.4% of cases. Similarly, successful radiological fusion based on Bridwell Grade I and II criteria was achieved in 97.4% of patients, whereas failed fusion occurred in only one patient (2.6%). These findings correspond closely with the long-term results reported by Roh et al. [30], who demonstrated very high radiological fusion success rates exceeding 90% during prolonged follow-up, accompanied by sustained functional improvement and low rates of pseudoarthrosis. The strong correlation between successful fusion and favorable clinical outcome observed in the present study further supports the importance of achieving stable arthrodesis in optimizing postoperative recovery. The very low rate of failed fusion additionally indicates that local autogenous bone grafting provides adequate biological support for fusion while simultaneously avoiding the morbidity associated with iliac crest graft harvesting. Overall, the combined clinical and radiological findings of the present study reinforce that instrumented lumbar fusion using local autogenous bone grafting is an effective and reliable treatment option for lumbar spondylolisthesis.

The postoperative complication profile observed in the present study was low and comparable to previously published literature. Adjacent segment disease and pseudoarthrosis were each observed in only one patient (2.6%), resulting in an overall complication rate of 5.3%. No major intraoperative complications, neurological deterioration, implant-related failure, or deep wound infection were encountered. These findings are consistent with the observations of Schroeder et al. [32], who reported adjacent segment disease rates ranging from 2–10%, pseudoarthrosis rates between 2–8%, and overall complication rates of approximately 5–12% following lumbar fusion procedures, with reoperation rates varying between 3% and 10%. Similarly, Bademci et al. [33] documented symptomatic adjacent segment disease in approximately 2–6% of patients, pseudoarthrosis in 3–5%, and overall complication rates ranging from 5–8%,

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while neurological complications remained rare (<2%). The relatively low complication and pseudoarthrosis rates observed in the present study therefore compare favorably with existing literature and further support the safety profile of local autogenous bone grafting in lumbar fusion surgery. The absence of donor-site morbidity, which is commonly associated with iliac crest bone graft harvesting, may represent an additional advantage of utilizing locally harvested autogenous bone grafts. Overall, the findings of the present study suggest that local autogenous bone grafting combined with pedicle screw fixation can provide excellent functional recovery and high fusion success with minimal postoperative morbidity in patients undergoing surgery for lumbar spondylolisthesis.

## Limitations of the Study

The study had several limitations:

- Single-center retrospective design with a relatively small sample size, which may limit generalizability of the findings.
- Short-to-moderate follow-up duration, which may not fully capture long-term fusion integrity or late complications.

## Conclusion

In this study, local autogenous bone grafting with instrumented fusion for lumbar spondylolisthesis resulted in marked improvement in pain and functional disability, along with a strong radiological fusion outcome. Patients demonstrated significant postoperative clinical recovery with substantial reduction in pain and improvement in functional status. The majority achieved good-to-excellent functional outcomes, while almost all patients attained satisfactory overall functional recovery. Radiological assessment showed a very high rate of successful spinal fusion with only a minimal proportion of failed fusion. The overall complication rate was low, with few adverse events and no major intraoperative complications. These findings suggest that local autogenous bone grafting is an effective and reliable option for achieving favorable functional improvement and solid fusion in lumbar spondylolisthesis.

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