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# *Efficacy Analysis of Different Surgical Approaches for Adult Degenerative Scoliosis under "O-arm" Navigation*

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***Keywords:*** Adult degenerative scoliosis; O-arm navigation; OLIF; Posterior osteotomy; Spinal deformity correction; Surgical comparison

***Abstract:*** This study compared posterior osteotomy‑ internal fixation and OLIF combined with posterior fixation under O-arm navigation for adult degenerative scoliosis (ADS). Fifty‑ one patients were enrolled, with 24 in Group A (posterior osteotomy‑ internal fixation) and 27 in Group B (OLIF plus posterior fixation). Clinical and radiological parameters as well as complications were assessed. Both procedures are effective for ADS: posterior osteotomy provides better sagittal correction with higher risks, whereas OLIF combined with posterior fixation achieves faster recovery and fewer complications, supporting individualized treatment.

## 1. Introduction

With population aging, adult degenerative scoliosis (ADS) has become a common spinal disorder affecting elderly quality of life. ADS is defined as a three-dimensional spinal deformity with a coronal Cobb angle >10 ° acquired in adulthood, accompanied by spinal stenosis, sagittal imbalance, and neurological dysfunction. Surgical intervention is indicated when conservative treatment fails, aiming to restore alignment, decompress nerves, and improve function[1-3].

Traditional posterior osteotomy and fixation achieves satisfactory correction but is associated with high invasiveness, considerable blood loss, and prolonged recovery[4]. Minimally invasive techniques, especially oblique lateral interbody fusion (OLIF), have been widely used due to reduced soft tissue injury and faster recovery[5-6]. The O-arm navigation system improves pedicle screw accuracy, reduces radiation, and enhances surgical safety.

This study compared two surgical strategies under O-arm navigation to provide evidence-based selection for ADS surgery.

## 2. Materials and Methods

### 2.1 Ethical Approval

This retrospective study was approved by the Ethics Committee of Jiangnan Hospital Affiliated

to Zhejiang Chinese Medical University (No. 2025008). Informed consent was waived due to the retrospective design.

### 2.2 Inclusion and Exclusion Criteria

Inclusion Criteria:
ADS with Lenke-Silva grade ≥ III, vertebral apex at L1–L4;
Refractory symptoms after ≥3 months of conservative treatment;
Age 40–85 years;
Requirement for long-segment fusion (5–8 vertebrae);
Complete preoperative and follow-up data;
Minimum follow-up of 12 months.
Exclusion Criteria:
Idiopathic scoliosis;
Previous spinal fusion surgery;
Severe osteoporosis (T-score < -3.5);
Active spinal infection, ankylosing spondylitis, or tuberculosis.

### 2.3 Surgical Procedures

All operations were performed under O-arm navigation and intraoperative neurophysiological monitoring.

Group A: Posterior Osteotomy + Internal Fixation

Pedicle screws were inserted under O-arm guidance. SPO or PSO osteotomy was performed according to deformity severity. Decompression, bone graft, and rod fixation were completed routinely.(Fig. 1)

Group B: OLIF + Posterior Internal Fixation

Anterior OLIF was performed via a retroperitoneal approach. Cage was inserted for interbody support and height restoration. Patients were repositioned prone for posterior pedicle screw fixation under O-arm navigation.(Fig. 2)

### 2.4 Outcome Measures

Perioperative parameters: operation time, intraoperative blood loss, postoperative drainage volume, time to ambulation, transfusion rate.

Clinical outcomes: Visual Analog Scale (VAS), Oswestry Disability Index (ODI).

Radiological outcomes: coronal Cobb angle, sagittal vertical axis (SVA), lumbar lordosis (LL), disc height index (DHI).

Complications were recorded and analyzed.

### 2.5 Statistical Analysis

SPSS 19.0 was used for statistical analysis. Continuous data were presented as mean ± standard deviation (SD). Paired t-test, independent t-test, $\chi^2$ test, or Fisher exact test were applied. A P-value <0.05 was considered statistically significant.

## 3. Results

### 3.1 Baseline Characteristics

The baseline characteristics outcome for the 51 patients is shown in Table 1. A total of 51 patients were included (Group A: 24; Group B: 27). Baseline data including age, gender, apex vertebra level, and bone mineral density showed no significant differences between groups (P>0.05).

Table 1. Baseline demographic and radiological characteristics of the two groups.

| Parameter | Group A (n=24) | Group B (n=27) | P value |
|---|---|---|---|
| Age at surgery, yr | 66.4±7.4 | 67.4±8.2 | 0.664 |
| Male, n (%) | 9(37.5%) | 8(29.6%) | 0.495 |
| Bone mineral density, SD | 0.7±1.7 | 0.6±1.5 | 0.741 |
| Apical vertebra, n | | | |
| L2/3 | 8 | 9 | 0.773 |
| L3/4 | 11 | 13 | |
| L4/5 | 1 | 3 | |
| Preoperative Cobb angle, ° | 32.4±5.2 | 31.8±3.2 | 0.658 |
| Preoperative SVA, mm | 51.3±28.0 | 41.9±25.3 | 0.660 |
| Preoperative LL, ° | 23.1±7.2 | 22.1±5.3 | 0.610 |
| Preoperative DHI, mm | 42.9±7.6 | 42.8±4.6 | 0.978 |
| Preoperative VAS score | 6.1±0.8 | 6.1±0.8 | 0.913 |
| Preoperative ODI, % | 62.0±5.0 | 63.8±3.6 | 0.172 |

### 3.2 Perioperative Outcomes

Group A had significantly longer operation time, higher intraoperative blood loss, more postoperative drainage, later ambulation, and higher transfusion rate compared with Group B (all P<0.05). The perioperative outcomes between the two groups can be found in Table 2.

Table 2. Perioperative outcomes and complication rates in the two groups.

| Parameter | Group A (n=24) | Group B (n=27) | P value |
|---|---|---|---|
| Operation time, min | 219.0±25.7 | 169.4±25.6 | <0.001 |
| Intraoperative blood loss, mL | 1087.5±353.1 | 672.5±308.6 | <0.001 |
| Postoperative drainage, mL | 364.7±22.9 | 109.3±25.3 | <0.001 |

### 3.3 Clinical and Radiological Outcomes

Group B had lower VAS and ODI scores at early postoperative follow-up (P<0.05). Group A achieved significantly better SVA correction (P<0.05). Group B showed better intervertebral height restoration (P<0.05). Coronal Cobb angle and lumbar lordosis showed no significant differences between groups. The clinical and radiological outcomes between the two groups can be found in Table 3.

Table 3. Clinical and radiological outcomes preoperatively, postoperatively, and at final follow-up.

| Parameter | Group A (n=24) | Group B (n=27) | P value |
|---|---|---|---|
| Cobb angle, ° | | | |
| Postoperative | 4.7±2.1 | 5.5±2.3 | 0.624 |

| | | | |
|---|---|---|---|
| Final follow-up | 5.4±2.7 | 5.8±2.3 | 0.660 |
| SVA, mm | | | |
| Postoperative | 47.0±11.5 | 35.2±19.9 | 0.019 |
| Final follow-up | 43.9±19.7 | 30.9±19.9 | 0.026 |
| LL, ° | | | |
| Postoperative | 29.8±4.4 | 29.7±6.8 | 0.997 |
| Final follow-up | 30.2±4.8 | 29.4±6.6 | 0.638 |
| DHI, mm | | | |
| Postoperative | 48.1±8.2 | 57.4±5.4 | <0.001 |
| Final follow-up | 46.1±8.5 | 56.3±5.6 | <0.001 |
| VAS score | | | |
| Postoperative | 6.2±0.9 | 4.4±0.9 | <0.001 |
| Final follow-up | 1.8±0.8 | 1.3±0.5 | <0.001 |
| ODI, % | | | |
| Postoperative | 22.8±4.8 | 19.9±2.9 | <0.001 |
| Final follow-up | 16.1±3.4 | 16.5±2.7 | 0.540 |

### 3.4 Complications

The overall complication rate was 37.5% in Group A and 14.8% in Group B (P<0.05). Complications in Group A included cerebrospinal fluid leakage, delayed wound healing, rod breakage, and screw loosening. Complications in Group B were transient thigh pain and hip weakness, which resolved spontaneously. The perioperative outcomes between the two groups can be found in Table 2.

### 3.5 Typical Case


Figure 1. A 56-year-old female with Lenke-Silva grade IV adult degenerative scoliosis. Preoperative anteroposterior and lateral radiographs （a,b） postoperative radiographs (c, d) demonstrated significant correction. Final follow-up radiographs (e, f) confirmed maintained correction, solid osteotomy union, and stable instrumentation.

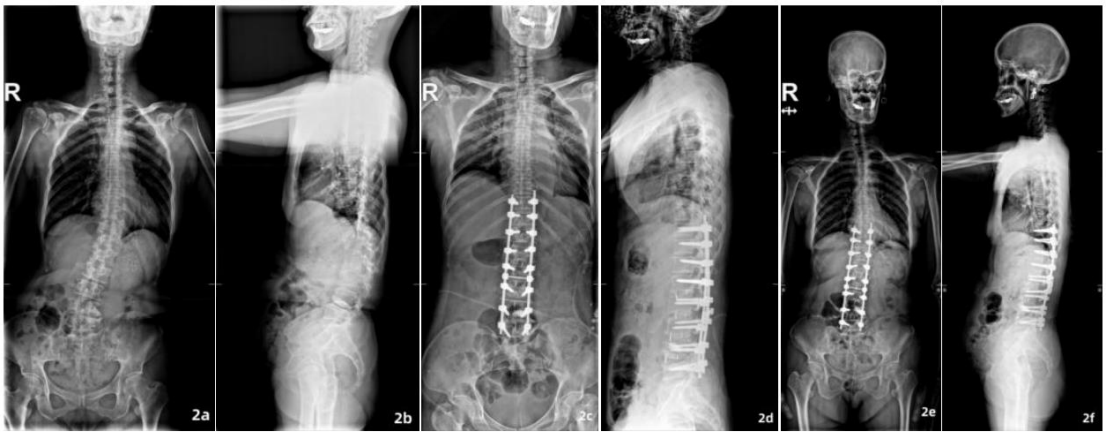


Figure 2. A 61-year-old male with Lenke-Silva grade IV adult degenerative scoliosis. Preoperative standing radiographs (a, b) Postoperative radiographs (c, d) revealed satisfactory correction. Final follow-up radiographs (e, f) showed sustained alignment, solid interbody fusion, and stable implants.

## 4. Discussion

Adult degenerative scoliosis (ADS) is a common spinal deformity in elderly patients, and surgical treatment aims to improve clinical symptoms and restore spinal alignment while reducing surgical risks. In this study, we compared two surgical approaches under O-arm navigation for ADS, and the results showed significant differences in perioperative conditions, correction efficacy, clinical outcomes, and complications[7].

Our results demonstrated that patients in Group A (posterior osteotomy and fixation) had significantly longer operation time, greater intraoperative blood loss, more postoperative drainage, and delayed ambulation compared with Group B (OLIF combined with posterior fixation). These findings are consistent with the characteristics of traditional posterior osteotomy, which requires extensive exposure and bone resection, leading to greater tissue injury and slower recovery[8-9]. In contrast, the OLIF procedure reduces soft tissue dissection and blood loss, which explains the faster recovery and earlier ambulation in Group B.

In terms of radiographic correction, Group A achieved significantly better SVA correction than Group B, confirming that posterior osteotomy can directly release the stiff vertebra and achieve powerful sagittal correction. Meanwhile, Group B showed significantly better disc height index (DHI) restoration due to the interbody distraction effect of the OLIF cage. Coronal Cobb angle and lumbar lordosis improvement were similar between the two groups[10].

Clinical outcomes revealed that Group B had lower VAS and ODI scores in the early postoperative period, suggesting better early pain relief and functional recovery. However, final follow-up ODI was comparable between groups, indicating similar long-term functional outcomes.

Complication analysis showed that Group A had a significantly higher complication rate (37.5% vs 14.8%). Complications in Group B were mostly transient and self-limited. These results confirm that OLIF combined with posterior fixation is safer for elderly patients.

Limitations include the single-center retrospective design and moderate follow-up duration. Future multicenter prospective studies are warranted.

## 5. Conclusion

Posterior internal fixation with osteotomy and OLIF combined posterior fixation are both effective and safe for ADS under O-arm navigation. Posterior osteotomy is superior in sagittal

correction but more invasive with higher complications, suitable for patients with severe sagittal imbalance. OLIF combined posterior fixation provides faster recovery and lower complication rate, suitable for minimally invasive management of ADS. Individualized surgical selection can optimize clinical outcomes.

## Acknowledgement

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## Ethical Approval

Approved by the Ethics Committee of Jiangnan Hospital Affiliated to Zhejiang Chinese Medical University (No. 2025008).

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