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Original Research Article

# Comparative Study of Unilateral Pedicle Screw Fixation versus Bilateral Pedicle Screw Fixation for Degenerative Disease in Lumbar Spine

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**Conflict of interest: Nil**

**Abstract:**

**Background:** To compare unilateral pedicle screw fixation is better than bilateral pedicle screw fixation.

**Objectives** To compare Unilateral pedicle screw fixation is better than bilateral pedicle screw fixation in case of degenerative lumbar spine diseases.

**Methods:** The clinical and radiographic outcomes were compared between the UPSF and BPSF group. The post-operative improvements were evaluated in either group. Intraoperative data such as duration of operation and estimated blood loss were compared.

**Results:** A total of 20 cases were included in this study. The current best evidence detected shows no significant differences between unilateral and bilateral PSF for short segment lumbar fusion in the functional scores, length of hospital stay, fusion rate, and complication rate. In all studied patients, 18 months after surgery, completed posterior spinal fusion was detected and recorded on a control CT, which was rated by Glassman. The average follow-up period was 15.2 ±3.7 months, and the average age of patients was 57.2 ± 17.1 years. Both groups were comparable in age, gender (male to female ratio 17:23 [1st group] and 19:21 [2nd group]) ($p > 0.05$), and the operated segments L4-L5: 34 patients (Group 1) and 35 patients (Group 2); and L5-S1: However, unilateral PSF involved a remarkable decrease in operative time and blood loss.

**Conclusions:** According to this systematic review, unilateral PSF is an effective method of fixation for short-segment lumbar fusion, has the advantages of reduced operative time and blood loss over bilateral PSF.

**Keywords:** Degenerative spine disease, unilateral pedicle screw fixation vs bilateral pedicle screw fixation, lumbar spine surgical treatment, spondylitis with surgical treatment, surgical pedicular screw fixation vs/with surgical fusion of spine with pedicular screw fixation.



## Introduction

Lumbar spinal fusion is recognized as an effective surgical procedure for degenerative lumbar diseases [1]. Lumbar fusion can achieve solid arthrodesis, immobilizing the unstable segment and degenerate intervertebraldisc area [2]. Bilateral pedicle screw fixation after inter- body fusion is regarded as a standard surgical method for degenerative lumbar diseases.

However, rigid fixation also has corresponding short- comings. Rigid internal fixation may accelerate the degeneration of adjacent lumbar segments and cause device-related osteoporosis. Moreover, bilateral pediclescrew fixation was associated with greater blood loss, longer operative time, and involving greater costs [3]. However unilateral pedicle screw fixation escapes rigid fixation allowing partial movement on other side in involved segment. Thus rapid degeneration is less as compared to bilateral fixation

In 1991, Goel et al. [4] revealed that unilateral pedicle screw fixation could reduce the effects of stress shielding on the fixed vertebrae and avoid adjacent intervertebral disc degeneration. moreover, some scholars reported that unilateral pedicle screw fixation is sufficient to maintain the stability of the spine. A previous biomechanical study revealed that the initial stability of unilateral pedicle screw fixation may be inadequate to obtain improved surgical outcomes. Lumbar fusion is an effective procedure commonly performed for treating lumbar degenerative disc diseases [1]. usually, bilateral pedicle screw fixation (PSF) is a standard for lumbar fusion. However, the pronounced stiffness of bilateral PSF appears to cause undesired adverse effects such as reduced fusion rate, adjacent segment degeneration, and loss of bone mineral content [2,3]. In response to those concerns, unilateral PSF, which involves less rigidity, has been developed for lumbar fusion. Biomechanical studies have demonstrated that unilateral PSF is able to maintain the initial stability after lumbar fusion and decrease the influence of stress-shielding imposed on the fixed

level and levels adjacent to the fusion [4,5]. In addition, numerous clinical studies have suggested that unilateral PSF is as effective as bilateral PSF for lumbar fusion but has the advantages of reduced operation time, blood loss, and implant cost [6–14]. A 5-year follow-up study by Toyone et al. [15] also found a lower occurrence of adjacent segment degeneration in patients undergoing unilateral PSF than that in patients who underwent bilateral PSF. Reversely, there exist studies indicating that unilateral PSF provided less stability than bilateral PSF for lumbar fusion [16–20]. Due to its inherent asymmetry and reduced strength, unilateral PSF was reported to cause postoperative back pain, implant failure, more cage migration, and a relatively lower fusion rate when compared with bilateral PSF [8,21–23]. Recently, multiple meta-analyses have carried out a comparison of unilateral and bilateral PSF in lumbar fusion. However, those overlapping meta-analyses showed discordant results as well.

Several studies suggested that unilateral and bilateral PSF were equally safe and effective for lumbar fusion [24–28]. However, the results of other studies indicated that unilateral PSF lead to more cage migration or a relatively lower fusion rate than bilateral PSF [29–33]. As a result, the above conflicting findings may bring uncertainty about which method of fixation is better for lumbar fusion. The objectives of this study were to carry out a systematic review on the basis of overlapping meta-analyses regarding unilateral versus bilateral PSF in lumbar fusion to provide recommendations of treatment on this topic according to the current best evidence, and to identify potential limitations within current literature that require future research.

## Materials and Methods

This study was conducted on the patients admitted through orthopaedics OPD between august 2021 to March 2023.

### Inclusion Criteria

1. age below 70yrs
2. single level instability
3. active person with radiculopathy
4. no bowel and bladder involvement

### Exclusion Criteria

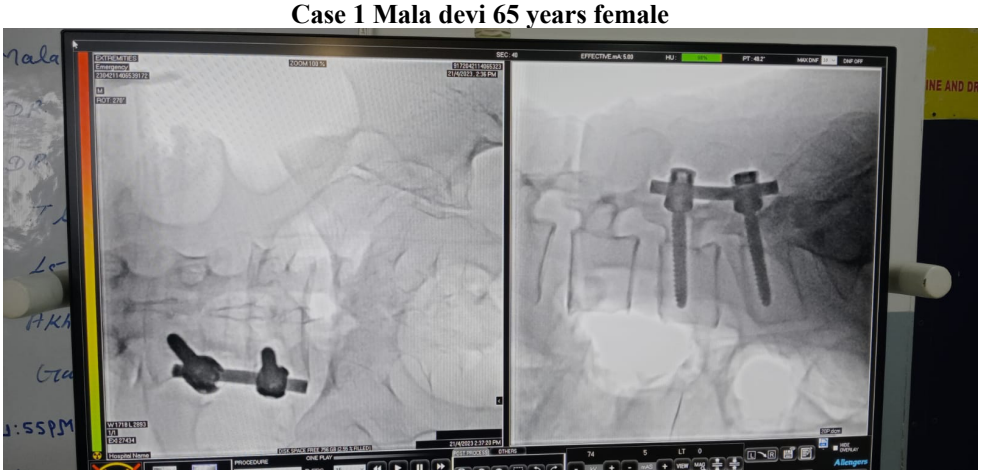
1. No any spine deformity
2. No severe comorbidity
3. below age 55years
4. Multilevel instability
5. Paraparesis with bowel and bladder involvement
6. Paraparesis

The patient was admitted in the ward after thorough investigations

MRI, routine blood investigations, x-ray chest pa view, LFT, KFT, CT, BT, PT -INR. They were posted for the routine ot.

All patients were taken under general Anaesthesia. patients were positioned prone. after proper scrubbing patient were properly prepped and draped. midline skin incision given after marking the location under c arm guidance of around 8 cm. soft tissues erased subperiosteally in one side in unilateral pedicle screw fixation whereas both sides in bilateral pedicles screw fixation. Right or left side were decided on the basis of more instability and compression as well. Hemostasis were secured with the help of cautery. Pedicle screw was applied with the help of c arm guidance and fixation was done along with decompression by laminectomy. Proper washing was done with normal saline. wound closed in layers.

**Case 1 Mala devi 65 years female**



**Case 2 Urmila devi**

**Case 3 Dilip kumar 64 years male**

**Case 4 Geeta devi**

**Case 5 mala devi**


## Results

Based on the results of the pre-operative examinations, all patients were diagnosed with single level instability in the spinal motion segment of the lumbosacral spine. In all studied patients, 18 months after surgery, completed posterior spinal fusion was detected and recorded on a control CT, which was rated by Glassman. The average follow-up period was 15.2 ± 3.7 months, and the average age of patients was 57.2 ± 17.1 years. Both groups were comparable in age, gender (male to female ratio 17:23 [1st group] and 19:21 [2nd group]) ($p > 0.05$), and the operated segments L4-L5: 34 patients (Group 1) and 35 patients (Group 2); and L5-S1:

**Table 1: Intraoperative time**

| UPSF | | BPSF |
|---|---|---|
| Geeta Devi - 45 min | | Ram Lakhan Mahto – 110 min |
| Urmila Devi - 40 min | | yogeshwar Yadav – 125 min |
| Dilip Kumar – 50 min | | Md. Yusuf – 130 min |
| Mala Devi – 50 min | | Rohit Nathany – 115 min |
| Rajesh Kumar – 45 min | | Md. Shareeb – 105 min |

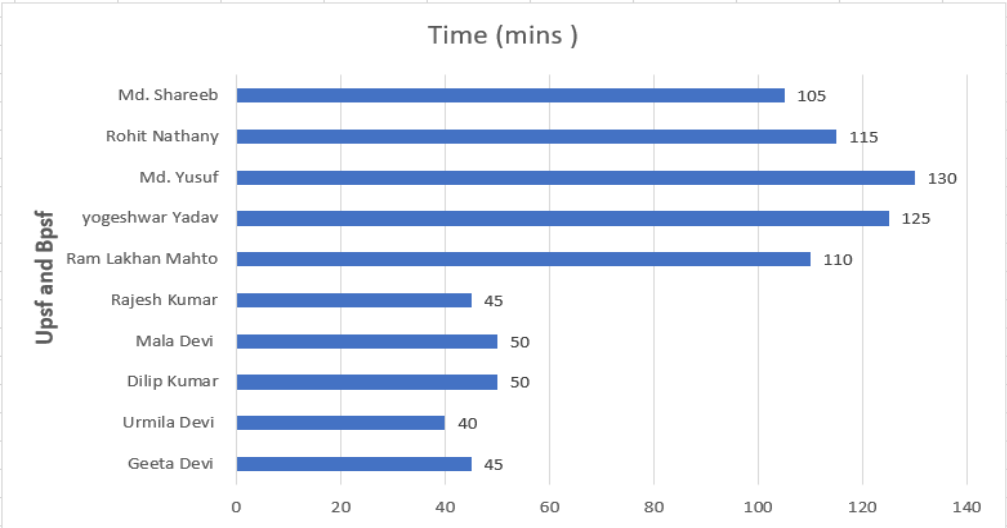
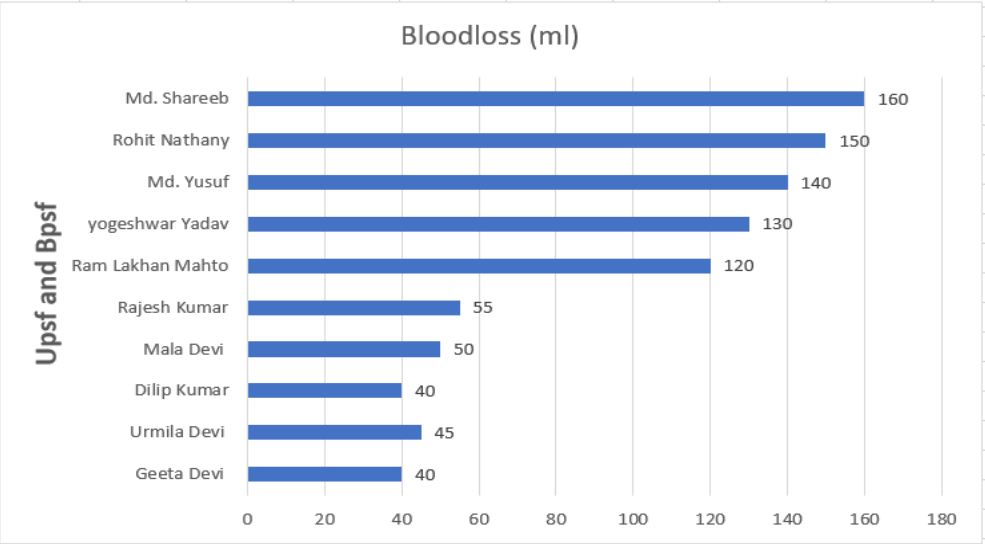



**Table 2: Blood loss**

| UPSF | | BPSF |
|---|---|---|
| Geeta Devi – 40 ml | | Ram Lakhan Mahto – 120 ml |
| Urmila Devi – 45 ml | | yogeshwar Yadav – 130 ml |
| Dilip Kumar – 40 ml | | Md. Yusuf – 140 ml |

| | | |
|---|---|---|
| Mala Devi – 50 ml | | Rohit Nathany – 150 ml |
| Rajesh Kumar – 55 ml | | Md. Shareeb – 160 ml |




According to intraoperative estimates, the time of surgical intervention for the 1st group (90.2 min) was significantly shorter than for the 2nd group (129.4 min; $p < 0.05$), and the average blood loss for the 1st group (152.7 ml.) was lower than for Group 2 (230.1 ml., $p < 0.05$; Table 1). Regarding clinical results, the ODI index significantly improved within 1 year after surgery in both groups (from 69.5% to 23.8% for Group 1, and from 70.1% to 23.2% for Group 2, $p < 0.05$). Table 1: Characteristics of the observed patients groups Groups Age, years' Time of observation, months Timing of operation, minutes Intraoperative blood loss, ml 1Group I (unilateral fixation)(57.1 ± 17.2)(15.5 ± 2.1) (90.2 ± 28.7) (152.7 ± 38.4) Group II (bilateral fixation) (56.8 ± 16.8)*(14.9 ± 2.3)*(129.4 ± 31.2)**(230.1 ± 36.7)**(*): No significant differences between groups, $p > 0.05$, (**): Differences between groups are significant, $p < 0.05$, 1ml: Milliliter. The EQ-5D index in patients of Group 1 was 0.091 and 0.041 in Group 2; a year after surgery, the index value was 0.835 and 0.799, respectively ($p < 0.05$). In each group the indicators significantly improved 1 year after surgery compared to the clinical state before surgery. The VAS score for back pain significantly improved 6 months after surgery (from 84 mm to 22 mm for Group 1, and from 82 mm to 23 mm for Group 2, $p < 0.05$), and the VAS score for leg pain also improved significantly (from 76 mm to 18 mm for Group 1, and from 75 mm to 19 mm for Group 2, $p < 0.05$). There were no statistically significant differences between the groups ($p > 0.05$, Figure 3).0123456789 before surgery 3 months6 months12 months Visual Analogue Scale of Pain I Group (UPSF) Back Pain II group (BPSF) Back Pain I group (UPSF) Leg Pain II group (BPSF) Leg Pain 01020304050607080 before surgery 3 months 6 months12 months Oswestry Disability Index I group (UPSF)II group (BPSF) 00.10.20.30.40.50. 60.70.8 0.9 before surgery 3 months 6 months 12 months EQ-5DI group (UPSF) II group (BPSF) Figure 3: Dynamics of clinical and functional indicators: (a) Visual analog scale; (b) EQ-5D; (c) Oswestry Disability Index; $p < 0.05$cba of all 80 patients, one case of complications associated with the operation with the performance of intervention due to infectious postoperative complications was identified. The patient underwent repeated surgery in the amount of primary surgical treatment of the wound with excision of the post-operative scar, removal of suture material, and treatment of the wound with antiseptic solutions. During revision surgery, it was decided to keep the pedicle screw fixation system. During 1 year follow-up after revision surgery, there was no difference in the clinical assessment with other included patients.

## Discussion

We hypothesized that not only bilateral but also unilateral pedicle screw fixation can be used in the treatment of clinical instability of the lumbar spine with similar clinical results. Fernández-Fairen et al. compared unilateral and bilateral pedicle screw fixation in 82 patients with high-grade spondylolisthesis. The authors claim similar clinical results in the two groups of patients, with reduced duration of surgical treatment, reduced blood loss, and lower cost of implants [19]. Recently, several systematic reviews have been performed based on meta-analyses [20], [21], which can provide information that can help an operating surgeon. However, the conclusions of most of the studies are inconsistent and oftentimes contradictory. For example, a meta-analysis by Lu et al. [22] did not reveal any obvious differences between the two methods of fixation of the lumbar spine in terms of functional parameters,

length of hospital stay, rate of fusion, and the frequency of complications. In addition, unilateral pedicle screw fixation has an advantage over bilateral fixation in terms of the duration of surgery and blood loss, but it increases the risk of interbody cage migration. Based on the above findings, the researchers concluded that unilateral fixation is recommended as the optimal fixation method in the formation of lumbar fusion. According to some studies, unilateral fixation causes adverse effects due to the asymmetry of the spine and reduced stability of the operated segment; however, it should be noted that there were no differences in the rate of fusion formation, the risk of revision intervention or post-operative complications in comparison with bilateral pedicle screw fixation [23]. Moreover, most of the available works describe the use of unilateral transpedicular fixation exclusively in the surgical treatment of one- or two-level degenerative diseases of the lumbar spine [5], [24]. Some studies have shown that unilateral pedicle screw fixation significantly reduces surgery time and blood loss compared to bilateral pedicle screw fixation during decompression and stabilization operations on the lumbar spine, and less trauma associated with surgical access performed on one side was noted [25], [26]. Our study and the results obtained allowed us to show the absence of significant differences in the clinical and functional results of both types of surgical treatment, as well as to confirm the available data on the low volume of intraoperative blood loss and the shorter duration of the operation. It is useful to extend the follow-up period and continue further trials on the use of unilateral pedicle screw fixation in the treatment of lumbar spine instability.

## Conclusions

Unilateral and bilateral pedicle screw fixation showed similar clinical and functional results. However, the timing of surgical treatment, the number of implants used and intraoperative blood loss are lower in the unilateral fixation group, which indicates that the use of unilateral fixation can be the choice of performing posterior stabilization in case of a single-level instability of the spine without using an interbody implant.

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