



CASE REPORT

Three cases of adjacent segment disease post-posterior spinal fusion, treated successfully by oblique lateral interbody fusion: A clinical series

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Key Clinical Message

The incidence of spinal fusion surgery and associated adjacent segment disease (ASD) is steadily increasing. We report three cases of ASD after posterior fixation, treated by oblique lateral interbody fusion (OLIF). All cases had a good postoperative course. Altogether, OLIF surgery may be a viable option for treating ASD.

KEY WORDS

adjacent segment disease, complication, oblique lateral interbody fusion, salvage surgery, spinal fusion surgery

1 | INTRODUCTION

The number of spinal fusion surgeries in Japan is reported to have doubled over 10 years,¹ and the annual incidence of adjacent segment disease (ASD) in cases undergoing decompression and stabilization procedures has been reported at 2%-3% per year.² Accordingly, the incidence of ASD is almost certain to increase substantially. Primary open posterior procedures involving decompression and fusion expose and disrupt the normal anatomy of the adjacent levels, including the epidural soft tissues.³ Conventional revision surgeries for ASD have been performed posteriorly, which sometimes presents challenges because of the adhesions in the adjacent soft tissue due to the primary surgery, especially in cases where the previous operation was performed via a much wider opening. This may result in a longer operation time and greater blood loss. Furthermore, past surgical history in the operated area is an independent risk factor for incidental

durotomy.⁴ Against this background, some surgeons suggested that the use of lumbar lateral interbody fusion may provide effective treatment of symptomatic ASD.^{3,5,6} Here, we report three cases with symptomatic ASD after posterior fixation, which were salvaged by oblique lateral interbody fusion (OLIF) surgery.

2 | CASE REPORTS

2.1 | Case 1

2.1.1 | History and examination

A 69-year-old man who had undergone L4-5 and L5-S1 posterolateral fusion (PLF) 5 years previously, visited our hospital presenting with discomfort and pain in his left leg. The pain in his left leg had a visual analogue scale (VAS) score of 70 mm.

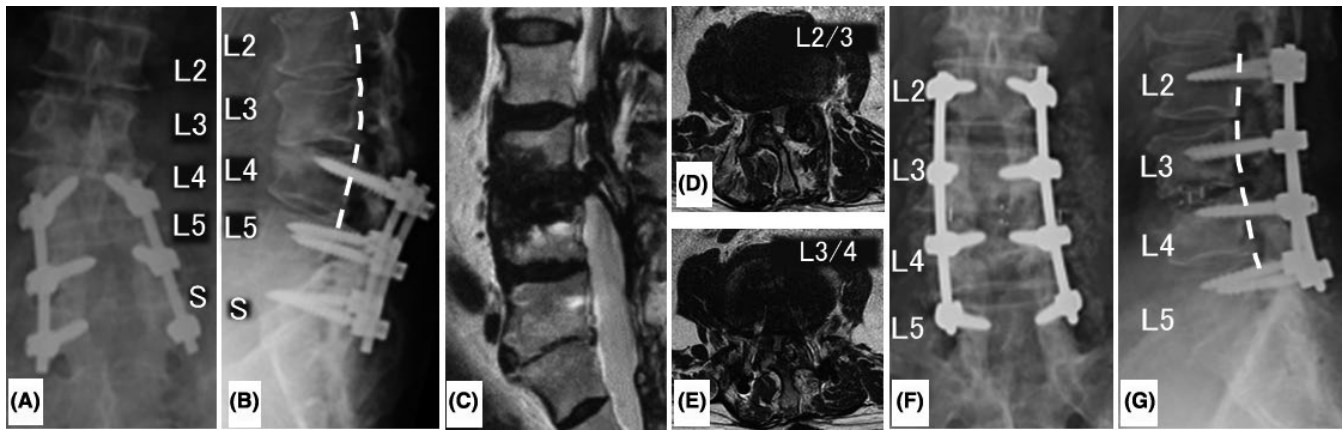


FIGURE 1 Case 1: (A, B) and (F, G) Antero-posterior and lateral views at first visit and post-OLIF surgery, respectively. The local scoliosis shown at the first visit was corrected to some extent post-OLIF (F). The white dashed line at L2-3-4 in (B) indicates the local kyphosis, which improved post-OLIF surgery as seen in (G). (C-E) Presurgical T2-weighted sagittal magnetic resonance imaging (MRI) and axial sections at L2-3 and L3-4, respectively. Modic type 3 change at L3-4 and severe canal stenoses were detected at both L2-3 and L3-4

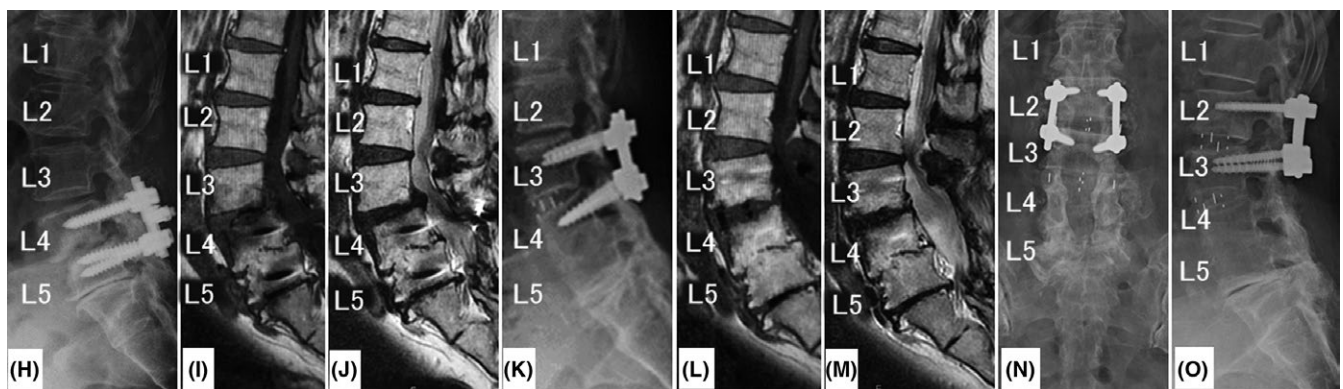


FIGURE 2 Case 2: (H) Lateral view at first visit. (I, J) Initial T1 and T2-weighted sagittal MRI. Severe canal stenosis and some mild signal changes like the Modic type 3 on endplate of the caudal side were detected at L3-4. (K) Lateral view at 2 y after first OLIF. (L, M) T1 and T2-weighted sagittal MRI at 2 y post-OLIF showed canal stenosis and no obvious Modic change at L2-3. (N, O) Antero-posterior and lateral views after second OLIF at L2-3

2.1.2 | Diagnosis and treatment

Imaging studies showed lumbar spinal canal stenoses at L2-3 and L3-4, intervertebral degeneration classified as Modic type 3, and local kyphoscoliosis at L2-3-4 intervertebral levels (Figure 1A-E).⁷ Conservative therapy did not alleviate his symptoms. The clinical decision was taken to perform OLIF at L3-4, posterior decompression at L2-3 and L3-4, and fixation by extended rods with pedicle screws (PS). Intraoperative bleeding was 250 g in a total of 4 hours and 19 minutes.

2.1.3 | Outcome and follow-up

After the surgery, his severe leg pain improved (VAS: 20 mm) and the imaging studies showed correction of the kyphoscoliosis and recovered foraminal height at the L3-4 level (Figure 1F,G).

2.2 | Case 2

2.2.1 | History and examination

A 79-year-old woman had undergone L4-5 PLF for L4-5 spondylolisthesis. Five years later, she consulted us with a gait problem due to muscle weakness in her left leg and fecal and urinary incontinence.

2.2.2 | Diagnosis and treatment

Radiological evaluation showed canal stenosis and some mild signal changes like the Modic type 3 on endplate of the caudal side at L3-4 were detected. (Figure 2H-J) We performed OLIF surgery at the L3-4 level accompanied by posterior decompression and fixation using PS. After the operation, her symptoms had mostly improved, and she regained the ability

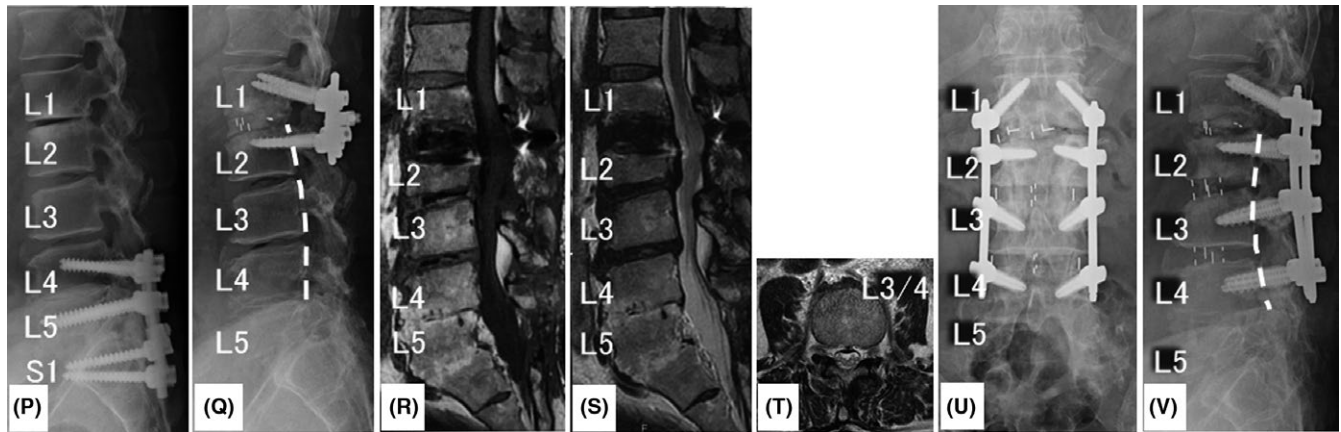


FIGURE 3 Case 3: (Q) Lateral lumbar plain radiograph at first visit. (R) Lateral view at 2 y post-L1-2 transforaminal lumbar interbody fusion (TLIF). (S, T) T1 and T2-weighted sagittal section and T2-weighted axial section of MRI at L3-4, 2 y post-TLIF showed Modic type 3 at L1-2 level and no obvious signal change on endplates at L2-3 nor L3-4. No significant canal stenosis was detected. (V, W) Antero-posterior and lateral views after oblique lateral interbody fusion (OLIF). The dashed line at L2-3-4 in (R) indicates the local kyphosis, which improved after OLIF surgery as seen in (W)

to walk with a cane. Intraoperative bleeding was 180 g in a total of 2 hours and 15 minutes. However, 2 years later, she again complained of severe low back pain (VAS: 80 mm). X-ray showed relatively narrowed intervertebral space, and magnetic resonance imaging (MRI) revealed spinal canal stenosis and no obvious Modic change (Figure 2K,M). We performed another OLIF (on the same side as the previous OLIF surgery), posterior decompression, and insertion of PS (Figure 2N,O) at L2-3. Intraoperative bleeding was 50 g in a total of 2 hours and 4 minutes.

2.2.3 | Outcome

After this surgery, her low back pain improved (VAS: 50 mm) and she was able to walk holding onto a supporting rail. She has retained this walking ability 2 years postoperatively.

2.3 | Case 3

2.3.1 | History and examination

A 69-year-old man who had undergone L4-5 and L5-S1 PLF surgery at a local civilian hospital 5 years previously visited our hospital complaining of severe low back and right leg pain, which was refractory to conservative therapy (Figure 3P). Radiological examination showed L1-2 intervertebral disk degeneration, moderate L2-3 canal stenosis, and bony fusion of L4-5-S1. Intervertebral transforaminal lumbar interbody fusion (TLIF) at L1-2, decompression laminectomy at L2-3, and removal of the L4-5-S1 screws and rods reduced his symptoms. However, he presented with severe low back pain (VAS: 80 mm) again 2 years later.

2.3.2 | Diagnosis and treatment

Imaging studies showed relatively narrowed intervertebral spaces, local kyphosis, and no significant canal stenosis at L2-3-4. The Modic type 3 change was detected only at L1-2, and no obvious signal changes at L2-3-4 were observed (Figure 3R-T). We diagnosed local malalignment as the cause of his severe pain and performed OLIF surgery for L2-3 and L3-4 via a single incision about 6 cm wide in the left lateral abdominal wall, supplemented by posterior percutaneous pedicle screws (PPS) and an extended rod system (Figure 3V,W). Intraoperative bleeding was 210 g in a total of 3 hours and 31 minutes (omitting repositioning time).

2.3.3 | Outcome and follow-up

After the surgery, his low back pain VAS improved to 20 mm. At one year after the last operation, the patient's chief complaint was fully resolved.

In these three cases, mean operation time was 198 ± 55 minutes (range, 124-259 minutes, excluding repositioning time), and mean blood loss was 170 ± 86 g (range, 50-250 g). Mean hospital length of stay was 13 ± 2.2 days (range, 11-16 days). Mean improvement after surgery on the VAS was 47 ± 15.2 (20-50) compared with the scores before surgery. There were no complications during the intraoperative periods or hospital stays.

3 | DISCUSSION

In the present cases, although some endplates in the intervertebral lesion treated by OLIF showed Modic changes

preoperatively (Figures 1C and 2I-,J) and others did not (Figure 2L-M,3R-S.), the symptoms of all cases improved after surgery. Additionally, the definition of the term ASD, which may include adjacent segment “degeneration” detectable just on imaging tests or adjacent segment “disease” accompanied by clinical phenomena,^{2,8} is debatable. Therefore, needless to say, the indication of surgery for ASD should be determined carefully based on both symptoms and diagnostic imaging. Regardless, with the increasing prevalence of spinal fusion surgeries, the incidence of ASD is undeniably increasing.^{1,2} Accordingly, the demand for salvage surgery for ASD has been expanding. Due to previous surgery, insufficient normal structure and severe tissue adhesion in the surgical pathway to the intervertebral space in the posterior approach are the frequent problems. The process of traversing the spinal canal, which may have formed adhesions to surrounding tissues, is an especially difficult phase. The incidences of neurological complications and dural tearing are not influenced by empirical considerations, but rather are common intraoperative complications experienced by both senior surgeons as well as trainees.^{1,9} Therefore, we should all strive to avoid surgical manipulation of this area to the greatest extent possible.

Against this background, we recently successfully managed three cases of ASD using OLIF surgery, which leads us to the firm belief that OLIF surgery can be useful as a salvage procedure for ASD. OLIF surgery has three points in its favor as a treatment option for salvage of ASD.

First, owing to improvements in surgical techniques and instruments, OLIF helps us to reach the intervertebral space via an anterior approach, the so-called “OLIF corridor,” which is composed of previously untouched tissue. There are few delicate structures such as vessels or nerves in this approach, and if any exist, we can see them under direct visualization by using a specially designed retractor, almost always with no bleeding. Therefore, even if another ASD occurs after the primary salvage surgery, additional surgery can be performed via almost the same anterior pathway, as shown in Case 2.

Second, OLIF can use a larger cage than posterior lumbar interbody fusion (PLIF) or TLIF, producing rigid stabilization and also correction of lordosis to some extent, as shown in the Cases 1 and 3 (Figure 1G and 3V).¹⁰ These effects are important in patients who have spinal malalignment as seen in Cases 1 and 3. Furthermore, the much larger cage size results in a low rate of pseudarthrosis with robust circumferential fusion, bridging the edge of the apophyseal ring bilaterally.⁶

Third, OLIF has an indirect decompressive effect, owing to ligamentotaxis and thinning of the ligamentum flavum caused by distraction of the intervertebral space. In some cases, with neither bony stenosis nor leg muscle weakness, we find it advantageous to exploit the indirect decompressive effect of

OLIF surgery accompanied by the PPS procedure (shown in Case 3) to reduce the dilemma to go through adhered soft tissue due to previous operation. In contrast, for other cases that present with motor weakness, fecal and urinary incontinence, or severe bony stenosis on radiographical examination, we should choose direct decompression procedure at the ASD level. However, even though we need to implement laminectomy as the direct decompression procedure via posterior approach in such cases, the OLIF procedure has an advantage compared to PLIF or TLIF, because OLIF can accomplish interbody fusion without extensive intracanal manipulation.⁶

Additionally, intervertebral lesions at the L5-S1 level are still sometimes difficult to treat using OLIF, although a new device (OLIF 51TM) has proven useful.¹¹ However, ASD reportedly tends to occur at the cephalic rather than the caudal side of the fused intervertebral segments,¹² which gives OLIF an advantage. We treated only three cases and followed them up for a short period; therefore, it will be necessary to accumulate other cases before making any firm recommendations or conclusions.

In summary, although we treated only three patients and should follow them up for a longer duration to reach a final conclusion, we believe that the findings of this case series tentatively show that OLIF surgery is a viable option for salvage surgery in at least some cases of ASD.

4 | CONCLUSION

Based on the observations described in this case series, OLIF surgery can potentially be a viable option for salvage surgery of ASD.

CONFLICT OF INTEREST

None declared.

AUTHOR CONTRIBUTION

TS: main author. KA: was responsible for writing and reviewing the manuscript. SO: performed critical revisions of the text. KI: was responsible for writing and reviewing the manuscript. MS and KF: were responsible for literature review. SO, YS, and HK: provided direct care to the patient. MI, HK, MN, and TU: were responsible for writing and reviewing the manuscript. YE, KT, and SO: coordinated and supervised the writing process.

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How to cite this article: Sakamoto T, Abe K, Orita S, et al. Three cases of adjacent segment disease post-posterior spinal fusion, treated successfully by oblique lateral interbody fusion: A clinical series. *Clin Case Rep.* 2019;7:206–210. <https://doi.org/10.1002/ccr3.1957>