



Delta Fixation for High-Grade Spondylolisthesis: Technique, Indications and an Adult Case Report

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Case Report

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ABSTRACT

Introduction: Spondylolisthesis is a condition with 4% prevalence, with high-grade spondylolisthesis (HGS) being 1/5th of total. Majority of HGS cases are reported in children, and uncommonly in adults. High-grade spondylolisthesis is resistant to conservative management and requires surgical fixation. There are multiple options in surgery such as anterior fusion, anterior-posterior fusion, posterolateral bone-only fusion, posterior lumbar interbody fusion, transvertebral pedicle screw fixation, and posterior trans sacral interbody fusion. The main challenge in these surgeries is to achieve adequate decompression, stabilization, and fusion. During these procedures, specially in the reduction of long-standing listhesis, the reduction maneuvers used may lead to neural damage. No reduction needed if sagittal balance balance is present.

Methods: We report a case of a 62 yr old female, presenting with chronic low backache for 18 yrs with radiation to bilateral lower limb. Patient had bilaterally positive SLR and hypoesthesia on the

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left L5 dermatome, with no motor deficit. Xray and MRI showed grade III spondylolisthesis at L4 over L5 with elongated pars interarticularis. The case was treated by Transdiscal fixation and posterior decompression.

Conclusion: On follow-up, for 6 months the patient is asymptomatic with no pain on SLR though paresthesia persisted. The Delta fixation with transdiscal pedicle screws is a good option for adult long-standing high-grade spondylolisthesis with good sagittal balance.

Keywords: Spondylolisthesis; delta fixation; transdiscal fixation; spine surgery; spine fixation.

1. INTRODUCTION

Symptomatic high-grade slips that are resistant to conservative treatment require surgical stabilization in spondylolisthesis [1]. The idea of in situ fusion is a fairly secure and effective method for high-grade spondylolisthesis with a balanced spine even in the cases of the unbalanced pelvis. The following are numerous surgical techniques for achieving in situ fusion in high-grade spondylolisthesis [2]: Posterolateral fusion with or without instrumentation, posterior interbody fusion, combined anterior and posterior procedures, and 360° circumferential fusion. Circumferential fusion has been found to have better outcomes, both clinically and radiologically [3]. Circumferential fusion methods are as follows: transvertebral pedicle screw fixation, posterior trans sacral interbody fusion using a cortical bone graft with pedicle screw implantation, posterior interbody cage, and pedicle screw fixation, and posterior pediculobody fixation alone or supported by superior level fusion [4].

2. CASE REPORT

We report a 63-year-old female who presented with chief complaints of low backache radiating to both lower limbs for 18 years. The pain was gradual in onset, dull in nature, constant, and severe in intensity. The pain was associated with tingling in both lower limbs left more than right. The patient also gave a history of claudication with a claudication distance of 50 meters. The patient had difficulty standing for a long duration on presentation. There was a history of trauma to the back 18 years prior, without the involvement of any other joint. Patient has a past history of non-insulin dependent diabetes mellitus. On examination, inspection revealed an increase in lumbar lordosis and paraspinal muscle spasm was present and was confirmed on palpation. Diffuse tenderness was present over the lumbar spine and a step was felt in the lower back. The straight leg raising test was positive at 50 degrees on both sides. The patient's neurology was intact in both lower limbs.

Xray lumbar spine AP and lateral view showed grade III anterolisthesis of L4 vertebrae over L5.

MRI LS spine showed Grade III anterolisthesis of L4 over L5 vertebrae with diffuse disc bulge at L3L4 and moderate canal stenosis at L4L5. Laboratory investigations were within normal limits.

The patient was taken for surgery after obtaining preoperative physician and anesthetic fitness. Patient was positioned prone, with the lumbar spine exposed by a posterior midline approach. Bilateral pedicular transdiscal screws were inserted from the body of L5 vertebrae to the body of L4 through intervertebral space of L4L5 while maintaining a safe distance between two cancellous screws and avoiding exiting nerve roots. Transpedicular screws were inserted in L3 and L4 vertebrae. The polyaxial screw heads of L3, L4 and L5 were then connected with lordotic titanium rods. Thus, overall posterior stability was achieved in delta fixation mode. Fluoroscopy imaging guidance was used to mark the levels, identify and place the various screws. A final fluoroscopic image was taken intra-operative and screw placement was found to be satisfactory. Decompression was done at L3L4 and L4L5 levels. Standard postero-lateral fusion was done by using locally harvested bone graft. Thorough lavage was given and the wound was closed in layers.

Patient was mobilized with a lumbar brace and walking aid on postoperative day 2. Suture removal was done at post-op day 11 and the surgical scare was found to be healthy. Lumbar brace was continued for 3 months post-operatively, along with physical rehabilitation.

Patient was followed up monthly for 6 months. From the first month follow up itself, patient had complete relief in her back pain as well as leg pain. SLR test was negative bilaterally. No motor deficit was found post-operatively but the paresthesia persisted.

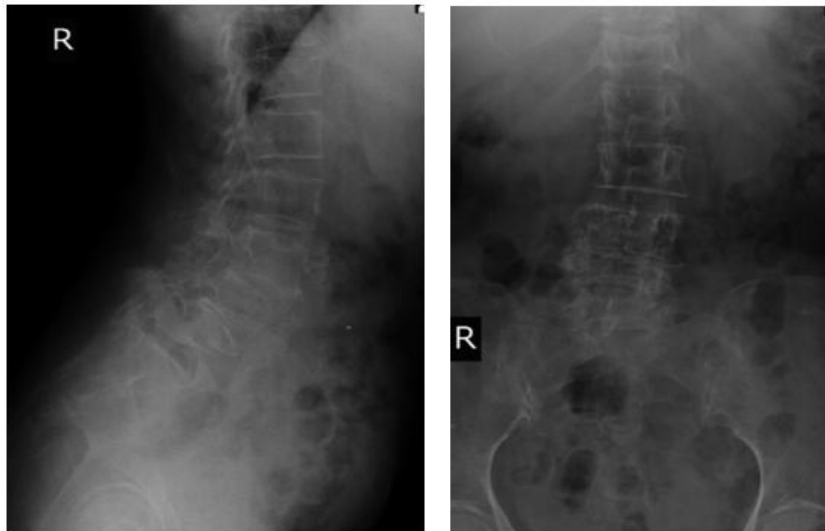


Fig. 1. Pre-op X-ray lumbosacral spine antero-posterior and lateral view

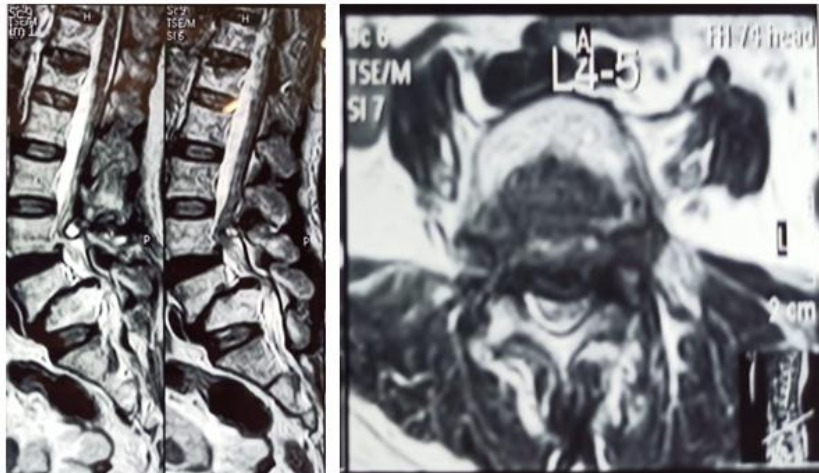


Fig. 2. MRI LS spine T2 weighted sagittal and axial images

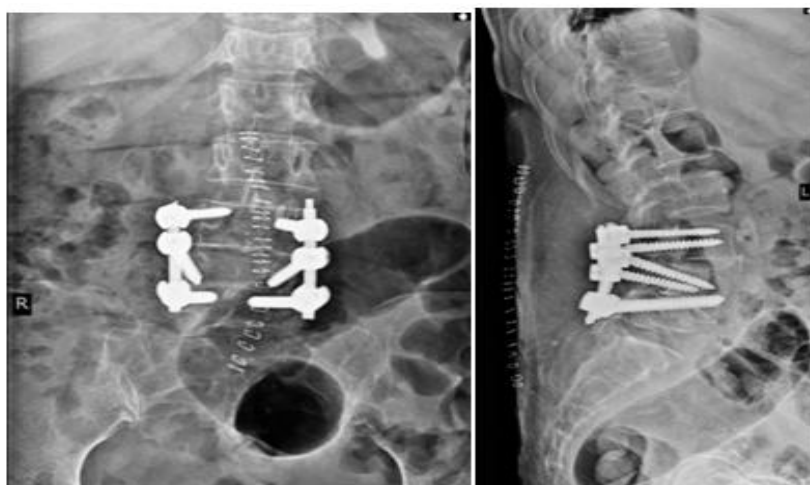


Fig. 3. Postoperative X-ray of lumbosacral spine showing implant in-situ

3. DISCUSSION

In the case of high-grade listhesis, the primary objective is to achieve sufficient fusion with surgical decompression when symptomatic spinal stenosis is present [5]. This goal can be accomplished using various surgical approaches, each of which has its benefits and demerits [6]. Pseudoarthrosis is the most common long-term complication that can complicate the clinical image and extend the recovery time and may result in the development of new slip and implant failure. In the presence of high-grade listhesis, not much literature evidence exists to prove the efficacy of transdiscal or pediculobody fixation [7]. These screws are as powerful as traditional 360° circumferential techniques, with the added advantage that they are easy and fast. Furthermore, this approach greatly decreases the neurological risks associated with partial or complete reduction of listhesis thus making delta fixation a more beneficial option than in interbody fusion patients [8].

In our case report, greater mechanical stability and fusion rate was achieved by posterior transdiscal (pediculobody) fixation supplemented by a superior level fusion by three-column stabilization along with rapidity and procedural simplicity [9]. With this procedure, compared with interbody fusion approaches, there is reduced operative time, blood loss and perioperative anesthetic complications, with equivalent postoperative outcomes [7].

Abdu WA et al. [10] described this surgical technique in their article titled "Pedicular transvertebral screw fixation of the lumbosacral spine in spondylolisthesis." The procedure originally described was as follows: Routine midline exposure is to be done from L4 to sacrum. After posterior decompression, pedicle screws are placed obliquely in S1 pedicles, in antero-medial direction through the sacral promatory. Then pedicle screws are directed from L5-S1 disc space, anteriorly into L5 vertebral body, under fluoroscopy guidance. Additionally, two screws are placed in L4 pedicles and connected to L5 and S1 using rods and plates. Iliac crest bone graft is harvested and then used for postero-lateral fusion from L4 to S1. This procedure was typically described for L5-S1 listhesis, but in this case report similar technique has been used for L4-L5 HGS.

Another noteworthy study was by Juan Delgado-Fernandez et al. [11] in which they studied posterior transdiscal fusion in HGS cases in their tertiary care center. Six Meyerding grade III spondylolisthesis and 2 with Meyerding grade IV cases were enrolled. Five cases were managed with L4-S1 fixation and three with L5-S1 fixation, under image guidance. Spinopelvic parameters didn't show much changes pre-operatively and post-operatively, but VAS scores and Oswestry Disability Index scores showed statistical improvement. They concluded that posterior transdiscal pedicle screws fixation with in situ fusion gained good clinical and radiological outcomes in patients with HGS and good sagittal spinal balance, and the use of image guidance helped improving the results.

4. CONCLUSION

The Delta fixation with transdiscal pedicle screws is a good option for adult long-standing high-grade spondylolisthesis with good sagittal balance. It is a familiar procedure that does not require the use of any special instrumentation but image guidance useful to reduce operative time and morbidity.

CONSENT AND ETHICAL APPROVAL

As per university standard guideline, participant consent and ethical approval have been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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