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PLIF and modified TLIF using the PLIF approach

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Keywords Posterior lumbar interbody fusion · Transforaminal lumbar interbody fusion · Posterolateral fusion · Surgical technique

Learning objectives

- Safe technique of posterior lumbar interbody fusion.
- Insertion of TLIF cage through the PLIF window.
- Technique of hemilaminotomy for decompression using osteotomes.

General information

Posterior lumbar interbody fusion allows for direct decompression of the neural elements and interbody fusion through the same incision [1]. It avoids the morbidity associated with anterior approach and minimizes significant risk of major vascular or visceral injury and sexual dysfunction in males [2]. Obesity, becoming increasingly common, is a relative contraindication for anterior approach. The technique of PLIF was made popular by Cloward in 1953 where he used iliac crest graft for interbody fusion [3]. Modern PLIF involves insertion of two cages made of PEEK or titanium packed with bone graft for interbody fusion. This is always coupled with pedicle screw instrumentation for rigid stability [4, 5]. The window of cage insertion in the PLIF is through the posterior disc after retraction of the traversing nerve root medially. This is performed on both sides, in comparison to the TLIF where a single cage is inserted unilaterally through the window, which is into the neural foramen between the exiting and the traversing nerve roots [6]. Common indications of PLIF include degenerative spondylolisthesis, symptomatic spinal stenosis with discogenic back pain. Addition of graft in the postero-lateral bed allows 360° fusion and increases fusion rates.

Case description

The patient is a 65-year-old lady with a 5 year history of mechanical low back and right leg pain, initially treated by conservative means in the form of physiotherapy, acupuncture, facet injection and nerve root injection with no benefit. The VAS score for back pain was 7/10 and leg pain was 8/10. Oswestry Disability Index was 68%. MRI scan of her lumbar spine showed significant stenosis at the L5–S1 level due to disc bulge and facet joint hypertrophy in addition to bilateral lateral recess stenosis at L4–5 with disc degeneration (Fig. 1). Due to progressive pain and failure of conservative management, decision for decompression and fusion of last two motion segments (L4–S1)

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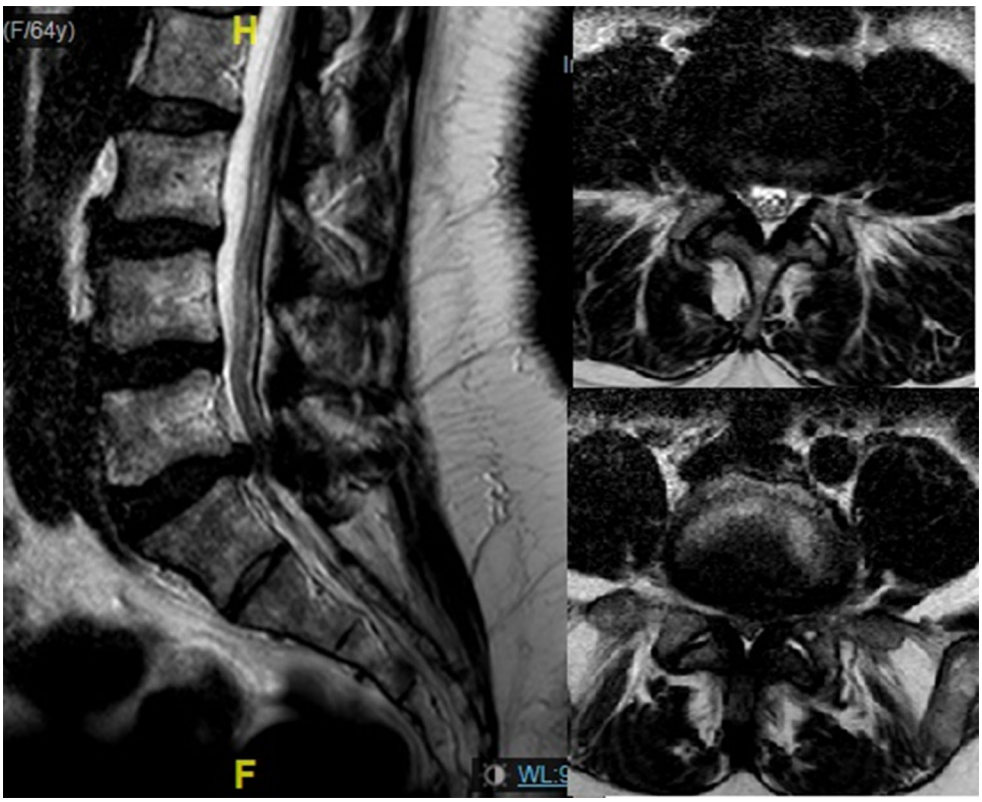


Fig. 1 MRI scan of lumbar spine showed evidence of stenosis and disc prolapse at L5/S1 level associated with bilateral lateral recess stenosis at L4/5 level

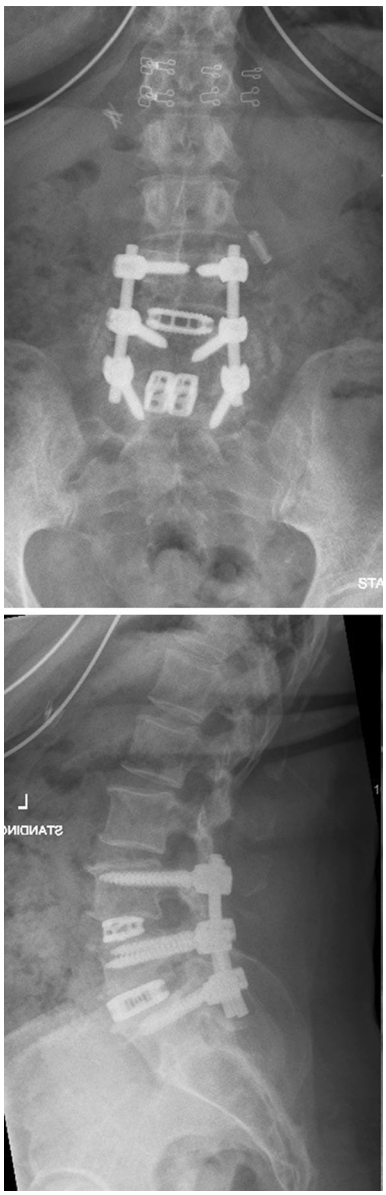
was made. She underwent L5–S1 PLIF and L4–5 modified TLIF through PLIF approach and instrumented postero-lateral fusion L4–S1 (Figs. 2, 3). Two titanium cages were used at L5–S1 and one TLIF cage at L4–5 level. Decompression was also performed at both levels. Postoperatively the patient recovered well from her back and leg pain.

Surgical procedure

The operation was performed under GA. The patient was carefully positioned in prone position on bolsters to keep the abdomen free, which minimizes epidural bleeding. A midline incision was made from L3 to S1. The spine was exposed subperiosteally to the tip of the transverse processes of L4, L5 and ala of the sacrum. Pilot holes were made in the pedicles of L4, L5 and S1 and the position of the guide pins were checked by intraoperative X-ray.

Decompression A 15 mm straight osteotome was initially used for laminotomy at L4/5 and L5/S1 levels. However, due to severe stenosis at L5/S1 level, complete L5 laminectomy was carried out. It is not necessary to perform laminectomy in all cases for two level interbody fusion unless there is severe central canal, lateral recess and foraminal stenosis or spondylolisthesis. In the technique of using osteotome for laminotomy, the surgeon should consider great care to avoid injury to the thecal sac. Good control of hand and gradual advancement of osteotome is essential until the resistance is reduced. The laminar osteotomy is then pried open. When the laminotomy is completed, ligamentum flavum is removed from its attachment to the lamina to expose the thecal sac. Any overlying fats should also be removed. Next, foraminotomy is carried out using 3 mm up-cutting rongeur to expose the nerve root. This will allow the surgeon to feel the pedicle and retract the nerve root medially with the help of Watson chain followed by placement of the nerve root retractor. With the nerve root retracted safe undercutting facetectomy is performed.

Preparation for interbody fusions With the help of peanut on curved forceps, gradual separation of the thecal sac from disc is carried out. To avoid damage to the nerve root, gently allow the thecal sac to be retracted medially by the peanut itself. This technique allows you to expose two-third of the disc safely. Cottonoids are now packed in the foramen above and below the disc to protect the nerve roots from injury and prevent bleeding. At this stage a specially designed semi-circular nerve root retractor is used to protect the thecal sac and nerve root. A rectangular



Figs. 2, 3 Postop. anteroposterior and lateral X-rays of lumbar spine show a satisfactory position of PLIF cages at L5/S1 and TLIF cage at L4/5 level

annulotomy is performed and disc preparation initiated using pituitary rongeur. In order to get a good access to the disc space the posterior lip of end plates should be removed using specifically designed straight and angled osteotomes. Complete visualization of end plate is possible when a combination of box and Chow curettes are used. Clearance of the end plates should be performed sequentially on either side using the same steps, when one side is completely cleaned an appropriate sized spacer (size 12) is placed, this will facilitate the clearance of the opposite side by opening and distracting the disc space. This procedure is repeated on the other side.

Interbody fusion At this stage the appropriate sized cage is inserted while the temporary spacer is still on the opposite side. The temporary spacer is then removed and second permanent cage is placed. Satisfactory position of the cages was confirmed by intraoperative X-ray.

Then the L4/5 level is approached unilaterally for modified TLIF through PLIF approach. The exposure of the disc is the same as for PLIF but just from one side without complete destruction of the facet. Disc is removed and clearance of the disc space is completed and TLIF cage is filled with bone and inserted, position is now checked again by X-ray.

Posterolateral fusion Decortication was carried out on both paravertebral gutters and a combination of local bone taken from laminectomy and artificial bone were laid down in bilateral gutters. Appropriate sized screws and rods are inserted. Final X-ray is taken and shows a satisfactory position of implants. Wound is closed under gravity drain and skin was closed by subcutaneous sutures.

Postoperative course

The patient usually made to sit up the next day after adequate analgesia. Mobilization is started with a physiotherapist. The patient was discharged 7 days after surgery. At 1-year follow-up the patient reported significant improvement in pain and function.

Compliance with ethical standards

Conflict of interest The authors declare that they have no competing interests.

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