

Extended ELIF

ELIF at L5-S1 with composite cages* Extra-foraminal lumbar interbody fusion

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GR O U P E
H O S P I T A L I E R
D U H A V R E



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Background

Our previous series demonstrated the outcome and low morbidity for the ELIF procedure that uses an extra-canal and extra-articular approach. However, most surgeons considered the ELIF to be possible only at L4-L5 and above, although much of the pathology we wish to treat is located at L5-S1. At this level the ELIF's 30 degree access is blocked by the iliac ala. Furthermore, at the intertransverse space, the surgeon's access to the L5-S1 disc is reduced by a large L5 transverse process and the sacral alae.

Purpose

In our pursuit of a less invasive arthrodesis, our study was to determine if an ELIF procedure in conjunction with composite cages, can be practiced at L5-S1 with a low rate of complication, a reliable fusion and an acceptable clinical outcome, which is comparable to other series in the literature.

ELIF surgical technique

- A prone knee-chest position is utilized. Bilateral cutaneous incisions, approximately 10 cm in length, are made just inside the posterior iliac crest, in a curved fashion. This allows harvesting of cancellous bone graft, typically from the left side. The lumbar aponeurosis is resected down to the iliac crest. The internal iliac wing, then the sacral ala, are followed up to the L5-S1 articular mass. At this level the approach regains the intermuscular plane, between the longissimus and the multifidus, freeing the L5 transverse process. Approaching the disk requires a resection of the external part of the articular mass and especially of the sacral ala. In the first eight surgeries, this was not done, causing a transient foraminal radiculagia. At this moment, screws are inserted in the L5 and S1 pedicles, these will be used to hold the interspace open. These temporary screws could be used for further fixation, although none were employed in this series. The L5 root, thus freed is gently retracted without tension laterally to perform discectomy. The surgeon's goal is to slightly restore disc height just enough for cage insertion, not to achieve correction. Disc height restoration is achieved with the help of interspace spreaders, gradually opening with larger and larger sizes. The proper restored disc height is determined by the tension of the surrounding anatomy. Care must be taken not to over distract and seven, nine to eleven millimeters is sufficient. A self-retaining retractor, resting upon the temporary pedicle screws, keeps the interspace open. Meticulous care is taken to remove all disc material along with the cartilaginous endplate, while at the same time, preserving the mechanical integrity of the vertebral body's chondral

plate, which will support the cage. This provides optimal mechanical conditions, progenitor host cells and vascularization for the bone graft to fuse in and around the cage. An interbody composite cage* 7 mm to 11 mm in height, is filled with cancellous bone and inserted into the vertebral interspace. If not used for further fixation, the temporary pedicle screws are removed. This same process is repeated on the opposite side. The patient is weight-bearing the day after surgery and returns home in 5 to 6 days.

The ELIF compared to so-called "foraminal" approaches

Many have described the extra-foraminal approach. The ELIF is distinguished from others by its external obliquity, from lateral to medial and posterior to anterior, angled about 30 degrees from the sagittal plane. It is different from those exposing the articular mass or the transverse processes from a median or para-median incision. These are oblique, from medial to lateral, and do not allow access to the disc or the extra-foraminal root, except when performing a total facetectomy.

The ELIF compared to ALIF and PLIF

1. Surgical risks

A PLIF procedure, especially in revision surgery, presents the risks inherent to the approach of the cauda equina: hematoma or postoperative fibrosis. The anterior approach presents risks inherent in retroperitoneal surgery: such as digestive; and more importantly, vascular and neurological. By avoiding the vascular and nerve structures, the more lateral ELIF technique avoids the risk of hemorrhagic and dangerous dissection in the middle of a fibrous sheath. Only the foraminal root can be traumatized. There were no neurological deficits. Foraminal radiculalgia was not due to displacement of graft or cage, as confirmed in the post-operative CT scan. Possible causes could be stretching of a root by excessive distraction of the interspace, or a direct intra-operative lesion of the root or spinal ganglion at the time of retraction.

2. Risks associated with injured peri-spinus musculo-ligamentary structures

For the PLIF and ALIF procedure, a longitudinal ligament must be cut, which is a stabilizing the structures. The PLIF leads to significant degradation of posterior para spinus musculature and ligaments. As one must also resect a portion of the facet, which is another stabilizing structure, it is most often associated with a posterior osteosynthesis. The ELIF merely cuts the disc's postero-lateral annulus leaving the vertebral ligaments, the para spinus musculature and the articular mass intact. The partial resection of the lateral mass of a hypertrophic facet is non-de-

stabilizing. Fusion and CT scans demonstrate the ELIF construct's stability with or without complementary osteosynthesis.

Material and methods

Twenty three patients (12 men, 11 women, mean age 39,5 years) underwent the ELIF procedure at L5-S1. Patients presented with radicular and low back pain. Radicular pain was intra-canalal (S1) or foraminal (L5). There were 16 global discopathies or asymmetric discopathies, all displayed foraminal stenosis, and 7 included bilateral isthmic spondylolisthesis. Patients presenting with canalal stenosis or herniated disc were excluded. All patients were seen pre-op, at one, three, six months post-op and some at one year post-op according to Lickert Scale. Fusion was determined by sagittal reconstructive CT scans for all patients.

Results

Fusion was observed at six months in the 23 cases. One cage required re-implanting by anterior approach following an accidental perforation of the anterior longitudinal ligament when inserting the cage. No vascular, visceral or other neurological complications were observed except one transient SPE.

Conclusion

The L5-S1 extra foraminal procedure with composite cages provides a reliable and good quality interbody fusion (ELIF) with few complications. Our results are to be compared to thus of other procedures (PLIF and ALIF). We believe ELIF with composite cages is a viable technique at L5-S1. Further study is warranted.

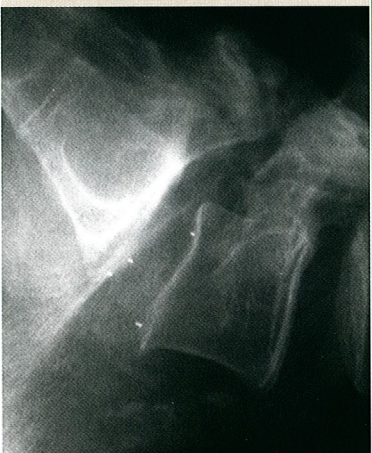
| Clinical outcome | Pre-op N = 23 | 3 months N = 23 | 6 months N = 23 | 12 months N = 13 |
|---|------------------|--------------------|--------------------|---------------------|
| Back pain | 4.21 | 1.85 | 1.40 | 1.45 |
| Leg pain | 3.73 | 0.78 | 0.52 | 0.38 |
| Medication | | | 14/23 9/23 | 12/13 1/13 |
| – No – Paracetamol | | | | |
| Normal daily activity | 0 | | 19 | |
| At 6 months, on the 14 patient who were employed prior to the ELIF surgery, 11 returned to work. All except 4 patients were improved. | | | | |

* Composite cages in Osta-Pek®, long carbon fiber reinforced PEKEKK, Co-Ligne AG, Zurich Switzerland.

Mr D. 56 years old, L5-S1 spondylolisthesis with lumbo radicular pain

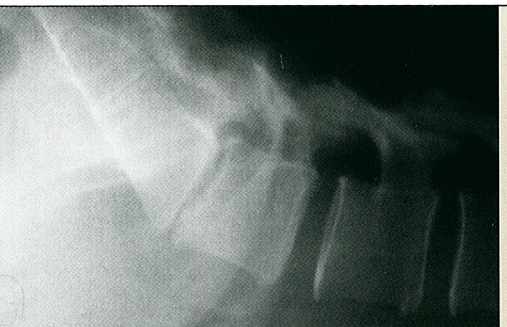


Lateral pre-op: Discopathy and slipping L5-S1



Lateral post-op with cages in place

Mrs P. 45 years old, degenerative post discectomy discopathy L5-S1 with lumbo radicular pain



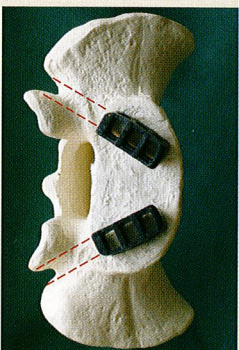
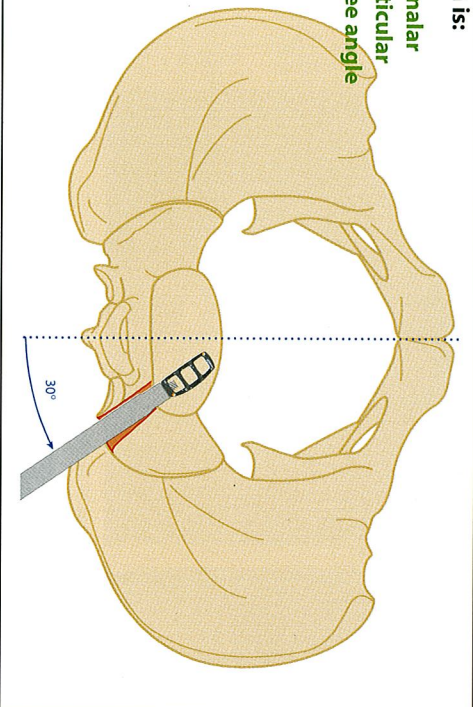
AP + lateral pre-op: Degenerative discopathy



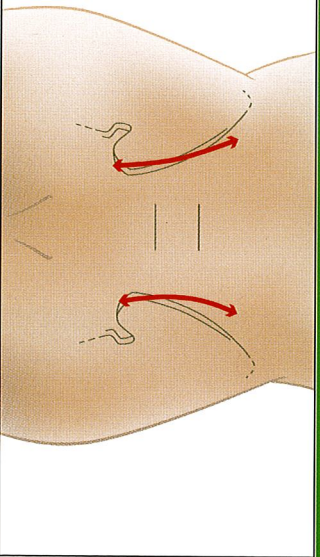
AP + lateral post-op with cages in place

Approach is:

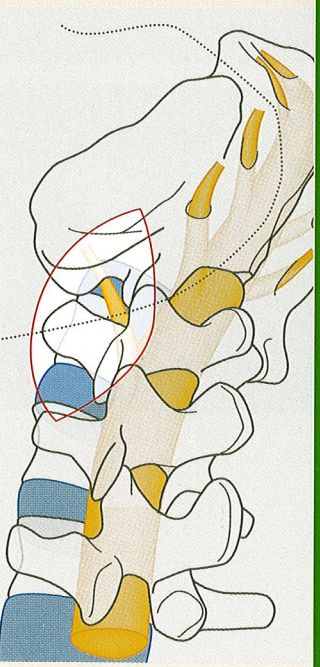
- Extra canal
- Extra articular
- 30 degree angle



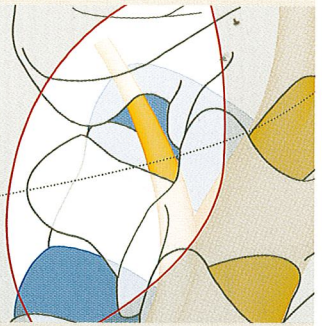
ELIF technique L5-S1 right side



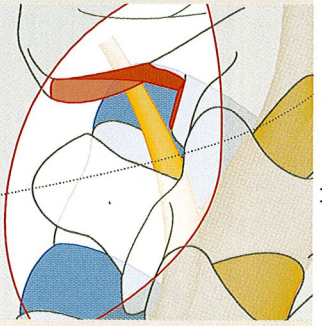
Skin incisions



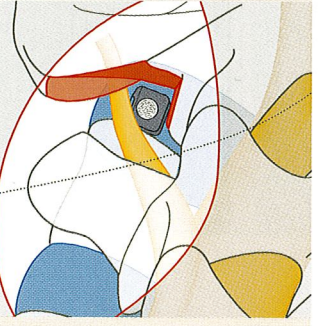
Approach at 30°



Initial inter transverse space



Resection of the external part of the articular mass and especially of the sacral ala



Composite cage in place

ELIF vs. ALIF and PLIF

| | ELIF | ALIF | PLIF |
|------------------------|--|--|---|
| Surgical risks | <ul style="list-style-type: none"> - Foraminal nerve root | <ul style="list-style-type: none"> - Retrograde ejaculation - Vascular & digestive | <ul style="list-style-type: none"> - Cauda Equina Syndrom |
| Destabilization | <ul style="list-style-type: none"> - Bone & ligament intact muscles preserved | <ul style="list-style-type: none"> - Incision of the anterior longitudinal ligament | <ul style="list-style-type: none"> - Laminectomy - Partial facetectomy - Incision of the posterior longitudinal ligament - Muscle mass injury |

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