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HOW I DO IT - SPINE DEGENERATIVE

How I do it? Oblique lumbar interbody fusion at L5S1(OLIF51)

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Abstract

Background OLIF51 retains the advantages of traditional ALIF procedure with good fusion rates and improvement in radiographic parameters and reduces its drawbacks. It has the added advantage of being a minimal access technique.

Methods Preoperative analysis of the vascular anatomy using CT angiography is mandatory. OLIF51 is done in right lateral position using specialized retractor blades and Thompson retractor system. The procedure is similar to OLIF at other levels except for the differences described here. The instruments are specialized for OLIF at L5S1.

Conclusion OLIF51 provides an excellent alternative to traditional ALIF.

Keywords OLIF · Oblique lumbar interbody fusion · OLIF51 · Ante-psoas approach · ALIF · Lumbar interbody fusion · Minimal invasive spine · Spondylolisthesis · Spinal stenosis · Degenerative spine

Relevant anatomy

Familiarity with these structures is necessary [2, 8]:

a) The abdominal wall comprising external oblique, internal oblique, and transversus abdominis muscles and fascia transversalis
b) The iliohypogastric and ilioinguinal nerves running vertically downwards from abdomen to pelvis in subcutaneous plane in a zone of 2-cm medial to anterior superior iliac spine
c) The retroperitoneal structures including iliacus muscle, psoas muscle, ureter, and left common-iliac vasculature that are encountered during blunt dissection from skin to disc space
d) The hypogastric plexus as it courses over L5S1 disc space to innervate pelvic viscera

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Description of the technique

I. Analysis of the vascular corridor

Analyze local vascular anatomy on CT angiography (Fig. 1). Important consideration is given to two aspects: (1) vertical distance between inferior end-plate of L5 and aortic-bifurcation/confluence of common-iliac veins, whichever is encountered first and (2) horizontal distance of left common-iliac vein from midsagittal line at a level of L5S1 disc space. These two measurements define the oblique L5S1 corridor which is available in about 70% cases [3].

II. Positioning

As is done in OLIF procedures, the approach is from the left side. We position the patient in right dead-lateral decubitus with left side up. We flex the right lower limb to about 45° at the hip and 90° at the knee. The left leg is kept in only slight flexion to keep psoas muscle taut. We place a bolster below the waist and properly pad all bony prominences including greater trochanter, knee, ankle, etc. We secure the patient firmly to the table using sticking tapes over the chest and pelvis.

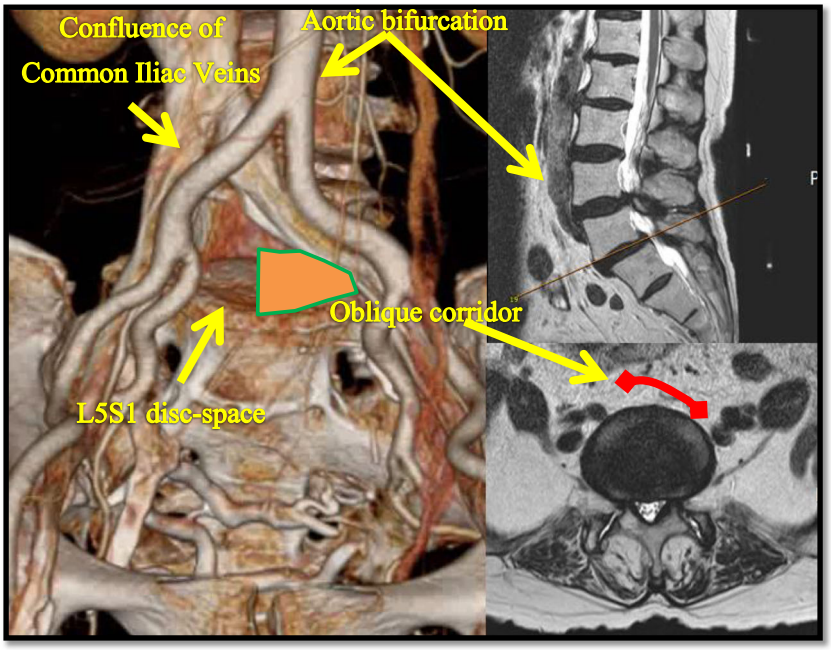

Fig. 1 CT angiography and MRI depicting the vascular anatomy and the available corridor

III. Skin and superficial dissection

The surgeon stands over the abdominal side of the patient. We draw iliac crest, ASIS, and two lines (Fig. 2). The first line is along L5S1 disc space extending anteriorly to midline and second line starts from center of disc-space and extends straight to midline perpendicular to the ground. The skin is incised obliquely from caudomedial direction to craniolateral direction between these two lines, about two finger-breadths medial to ASIS to avoid injury to iliohypogastric and ilioinguinal nerves. The length of incision is about 4–6 cm. Following this, either external oblique muscle or aponeurosis is dissected with a bipolar cautery and Metzenbaum scissors. Subsequently, internal oblique and transversus abdominis are dissected. It is necessary to split the fibers along the length and not cut them. After this, a very thin layer of transverse fascia is encountered which is cut with scissors.

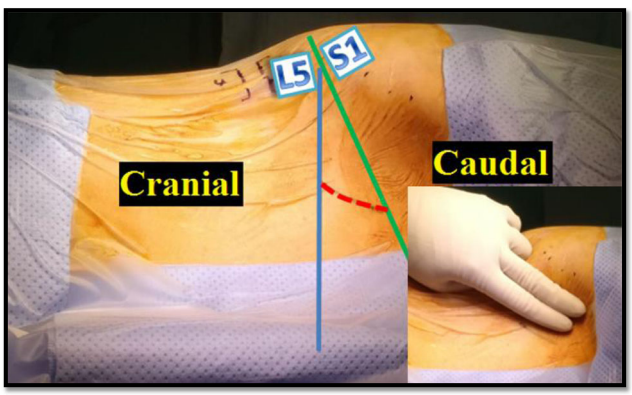

Fig. 2 Skin marking for incision; PIP shows two finger distance from iliac crest

IV. Deep dissection to the disc space

From this point onwards until disc space, only blunt dissection with fingers is done (Fig. 3). The direction of dissection is important along with palpation of structures. First, direct the finger into retroperitoneal fat straightaway to the left of the patient towards ASIS. Then, slide finger posteriorly along iliacus muscle and then psoas muscle gently elevating off the peritoneum. The ureter is reflected with peritoneum during this blunt dissection. The psoas is followed by left iliac vasculature; the pulsations of the artery can be distinctly felt. Continue medial to the vasculature to reach disc space. The level can be confirmed with C-arm. With two finger dissection, clear adventitious tissue from right side, cranial and caudal side of disc-space.

V. Retractor placement

Amongst the wide armamentarium, two important components are (1) the Thompson self-retaining table attachment and (2) three color-coded long retractor blades which attach to Thompson retractor (Fig. 4a, b). The three color-coded blades of various sizes are (a) a dark-blue blade applied to left of disc space for retracting the vasculature and psoas muscle and it has a flange at lower end which protects left iliac vessels, (b) a green blade applied to right of disc slightly to right of the midline, and (c) an optional light blue blade which can be applied cranially to protect midline vasculature. After retractors are placed, a fiber optic light source is attached to slots provided in the blades.

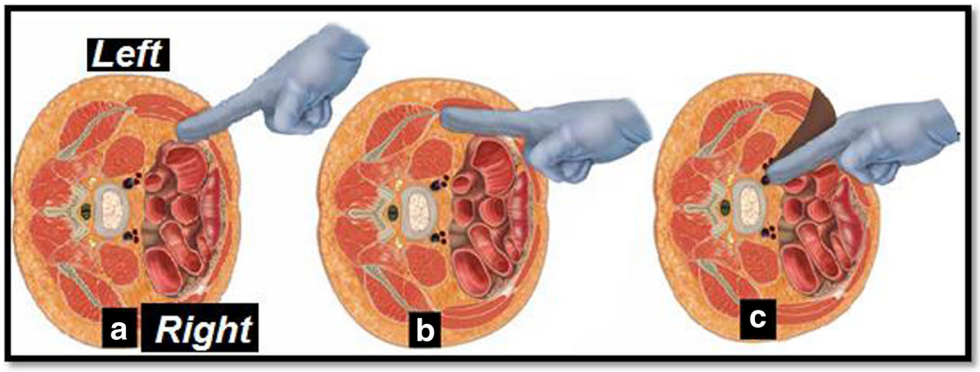

Fig. 3 **a** Blunt dissection to ASIS. **b** Palpation of iliacus and psoas. **c** Dissection extended to left iliac vessels

VI. Annulotomy and disc preparation

After retractor placement, one may visualize the median sacral vein at the promontory that can be safely coagulated with bipolar forceps (Fig. 4c). Use a bipolar cautery rather than monopolar near disc to minimize thermal injury to hypogastric plexus and sympathetic chain. With a D-knife, a wide annulotomy beginning from the left side and extending at least up to right of the midline is done. Then with graduating shavers and disc forceps, the disc material is cleared off. C-arm visualization of shavers in both anteroposterior (AP) and lateral views is essential to get an adequate clearance of disc space. The endplates are gently scraped using a curette. We infiltrate Iobrix (radio-opaque) dye into disc space to confirm adequate discectomy under C-arm. If the dye does not show adequate spread, it indicates remnant disc material which needs to be removed.

VII. Trialing and cage placement

Once the disc space is prepared, trials of graduating sizes are inserted to find the optimal fitting size. After that, we use a PEEK cage and fill it with demineralized bone matrix. We attach the handle of the inserter to the right oblique slot on the cage to facilitate insertion from oblique window In OLIF51, even though the angle of the approach is oblique, the cage placement is similar to ALIF. We do not require a dedicated cage, the same cage used in ALIF L5S1 can be used. The final position is confirmed with C-arm. The postoperative X-ray is shown in Fig. 5.

VIII. Posterior instrumentation

After cage placement, the wound is closed in layers. Then, the patient is turned prone and posterior pedicular screws put. In some cases, instead of posterior fixation with screws, a standalone OLIF51 with a plating system can be used.

Indications

Degenerative/lytic listhesis, failed back, pseudoarthrosis L5S1, and combined with OLIF L2-L5 (OLIF25) for multi-level degenerative scoliosis/listhesis/instability/stenosis.

Limitations

Experience with traditional ALIF procedure is necessary to carry out this procedure. In some cases, such as low lying bifurcation of the aorta, a posterior procedure will be a better choice. Caution is warranted in cases of spondylodiscitis,

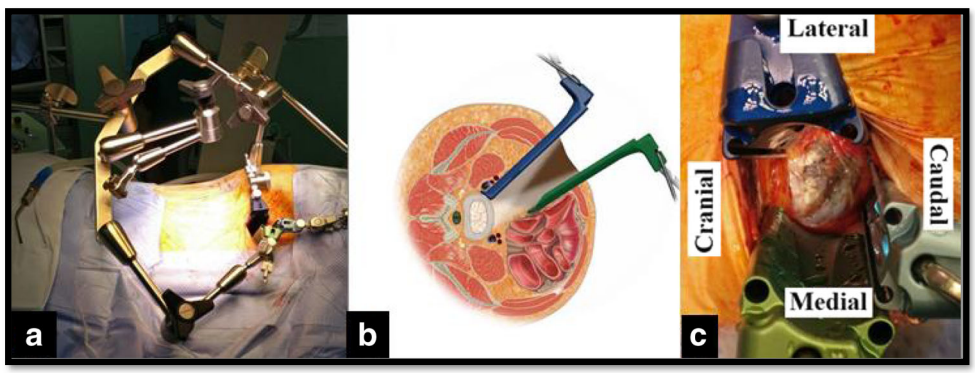

Fig. 4 **a** Thompson table attachment with retractor. **b** Schematic diagram of retractor system. **c** Final view of the L5S1 disc after retractor placemen; note the sky blue blade is placed caudally here

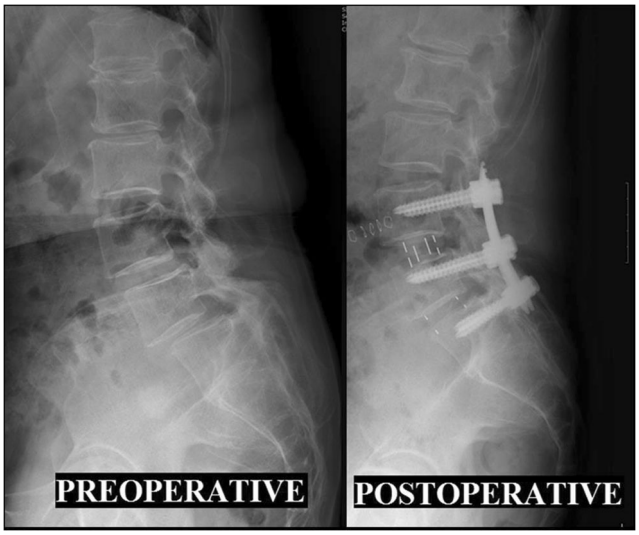

Fig. 5 Preoperative and postoperative X-rays showing excellent reduction of listhesis and restoration of disc height. This patient had undergone OLIF L4L5 and L5S1

revision cases or where there is a high chance of vascular injury since the field is constrained.

How to avoid complications

1. Thorough analysis of the vascular anatomy on preoperative CT angiography
2. Meticulous soft tissue dissection using bipolar cautery and "sponge on forceps"
3. Fluoroscopic visualization during disc space preparation and implant placement

Specific perioperative considerations (pre and postop workup, instructions for the postop care)

The patient is mobilized on the next day as per the pain tolerance. Physiotherapy in form of static quadriceps exercises and ankle pumps are started first followed by mobilization out of bed with a brace.

Specific information to give to the patient about surgery and potential risks

The need for an additional posterior decompression in case of insufficient indirect decompression is a possibility and should be explained to the patient. A ventral dural tear and ureteric injury are reported complications [1, 6] and should be informed to the patient.

Conclusion

In properly selected cases, OLIF51 can produce excellent outcomes in terms of sagittal alignment and indirect decompression from a gain in disc height with minimal tissue trauma and blood loss.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee (name of institute/committee) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Key points

i. OLIF51 provides an excellent alternative to ALIF as a minimally invasive option [4, 9, 10], retaining its advantages including sagittal balance correction and large fusion area [5]
ii. Careful evaluation of the vascular structures is essential for case selection
iii. Lateral positioning makes the abdominal contents move away from the surgical field making retraction easier. This translates into a lower chance of hypogastric plexus injury [7].
iv. The self-retaining retractor system is an indispensable component of the procedure
v. The iliohypogastric and ilioinguinal nerves should be safeguarded during exposure
vi. Bipolar cautery usage minimizes plexus injury near the disc
vii. The extent of discectomy can be aided by C-arm and Iobrix dye
viii. OLIF51 can be combined with OLIF25 for multilevel conditions
ix. Vascular injury is a conceivable and ghastly complication. Avoid at all costs.
x. Posterior instrumentation with pedicular screws should be supplemented for a better rigidity of the construct

Authors' declaration The authors declare that the article has not been submitted, in part or whole, elsewhere for review.

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