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CORRESPONDENCE

How to begin unilateral biportal endoscopy (UBE) for segmental lumbar degenerative disease: a step-by-step guide to perfect patient positioning and surgical approach, avoiding common pitfalls

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Dear Editor,

Decompressive surgery is a well-established treatment for symptomatic lumbar canal stenosis. With the growing demand for minimally invasive procedures, percutaneous endoscopy has emerged as a key technique that preserves spinal structure, reduces soft tissue damage, and shortens hospital stay [1, 8, 13]. A biportal approach, first described by De Antoni in 1996 [4], was recently expanded by Korean scholars [2, 5]. This technique allows surgeons to work with both hands —one for the camera and one for the instruments— under continuous saline irrigation. It eliminates movement restrictions and enables the use of conventional orthopedic systems without additional devices [3]. Additionally, the technique is easier to learn, as the interlaminar camera trajectory is similar to conventional laminectomy.

Due to these advantages, unilateral biportal endoscopy (UBE) has become widely adopted and applied to various degenerative conditions, including primary and recurrent hernias, instrumented fusion surgeries, and cervical decompressions [7, 10–12, 14]. However, proper patient positioning and equipment usage are crucial to avoid common pitfalls, especially for new practitioners. Recognizing this, we aim to provide a standardized and reproducible method for patient positioning and surgical approach. This guide emphasizes the importance of these factors and seeks to influence the practice of surgeons who wish to adopt UBE, by sharing a detailed and protocolized approach to enhance precision and efficiency.

Preoperative planning

The preoperative CT scan is reviewed to identify structures in the surgical path and evaluate potential anatomical challenges. We examine the interlaminar space anatomy to detect any access difficulties. We check for hypertrophy of the articular processes (AP) or spinous processes (SP), and lateral displacement of the SP to identify possible deviations of our trajectory. Calcifications in the ligamentum flavum (LF) that might adhere to the dura are evaluated to determine the need for a diamond drill during flavectomy. MRI is used to assess central and lateral stenosis and estimate nerve root(s) displacement.

Environment

For right-handed surgeons, we suggest standing on the patient's left side to use the endoscope in their dominant hand, regardless of the lesion location (Fig. 1). The table is translated as far as possible to the patient's feet, and the C-arm fluoroscopy is placed on the opposite side, under the table, to take frontal and lateral images. Note that the operating table will be tilted towards the surgeon after camera insertion to prevent water from pooling in the lordotic curve.

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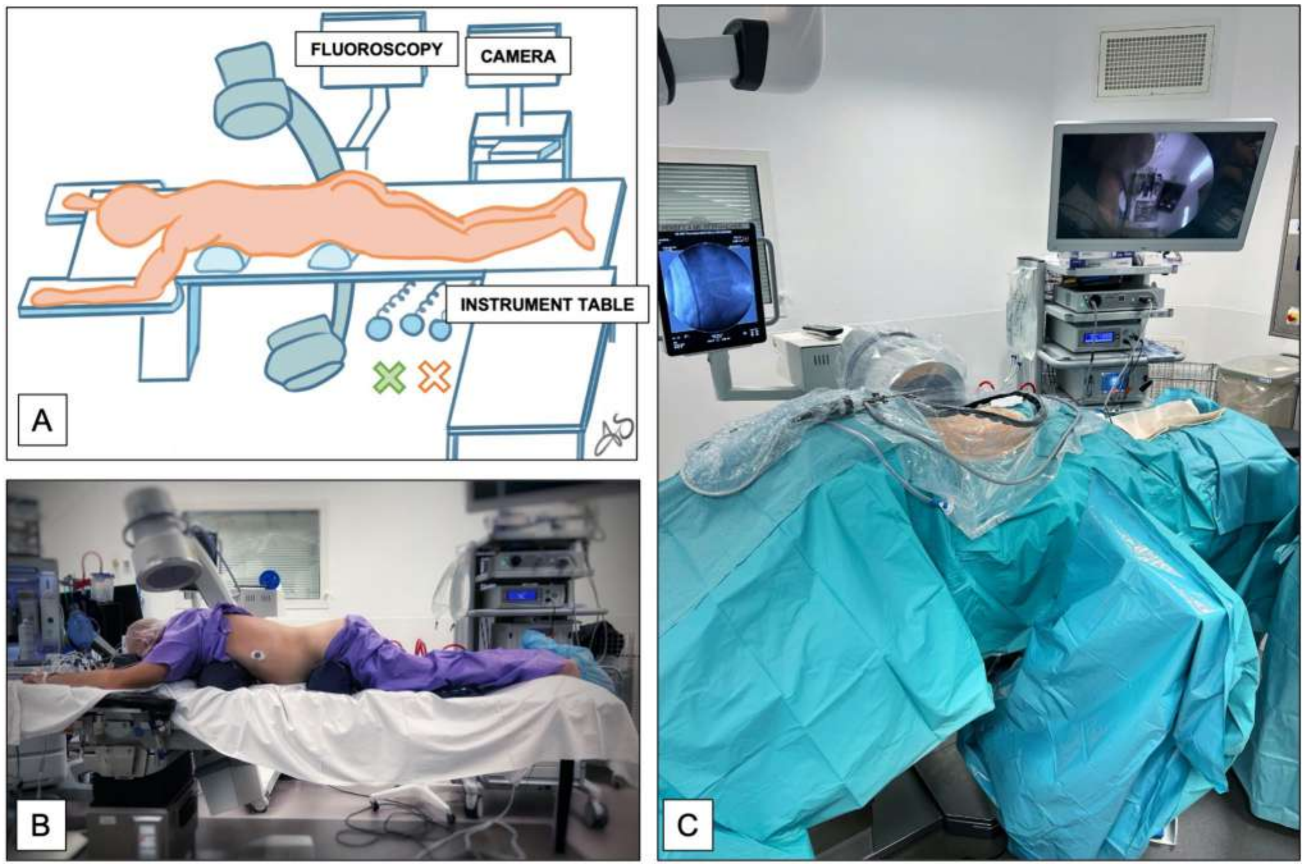

Fig. 1 Artistic view (**A**) and photographs showing the patient's positioning (**B**) and the operating room setup (**C**), viewed from the surgeon's perspective (left side of the patient). The C-arm fluoroscopy unit is placed on the right side of the patient, under the table, for both lateral and anteroposterior X-ray imaging. The screens are positioned on the right side, facing the surgeon. The pedals are arranged at the surgeon's feet in a consistent order to facilitate automated movements (from left to right: the radiofrequency pedal, the motor pedal, and the fluoroscopy pedal). The instrument table is positioned perpendicular to the patient's feet. The filled green cross indicates the surgeon's position, and the orange empty cross indicates the assistant's position. Pencil and digital artwork performed by Aurore Sellier, MD

The instrument table is set perpendicular to the patient's feet. The camera tower, which includes the video equipment, motor shaver, arthroscopy pump irrigation system, and radiofrequency generator, is placed behind the fluoroscopy unit. The pedals should always be arranged consistently to standardize the surgeon's movements. The motor pedal, which provides a more precise use and control during the drilling phase, is placed at the surgeon's right foot. The radiofrequency pedal is positioned at the surgeon's left foot. The fluoroscopy pedal is positioned at the assistant's foot. The bipolar hook, used for precise coagulation, is manually operated.

Anesthesia and patient positioning

The surgery is performed under general anesthesia. The patient is positioned prone with iliac and thoracic supports and a foam headrest. The surgeon must ensure that the head is not lower than the spine, to prevent increased intracranial pressure.

A warming blanket is used to maintain body temperature, as continuous irrigation can cool the patient. However, it should not cover the legs, as the assistant needs to monitor muscle contractions by placing a hand on one leg during the procedure.

Neuromuscular blocking agents are administered to prevent muscle spasms during the radiofrequency ablation phase. *Epinephrine* (2.5 mg) and *tranexamic acid* (1 g) are added intraoperatively to the intravenous fluids to promote hemostasis. A maximal systolic pressure of 100 mmHg is maintained for a clear view during the procedure. Additionally, oral *tranexamic acid* (1500 mg in three doses) is given on the first postoperative day.

Preoperative fluoroscopy guidance

The lumbar disc at the level of stenosis is identified using lateral fluoroscopy. This view is essential because hyperlordosis can shift the instruments' trajectory downward if the disc axis is identified using only frontal fluoroscopy, complicating instruments triangulation. Indeed, the technique was first described in Korea, where many patients have low pelvic incidence and lordosis (Roussouly type 2).

Next, the junction between the lamina and the SP of the superior vertebra, known as the docking point, is identified using anteroposterior fluoroscopy. Note that this point is below the disc level in the upper lumbar spine (L2 to L4) and above the disc level in the lower lumbar spine (L4 to S1) (Fig. 2). The "*Napoleon hat*" shape of the interlaminar space on anteroposterior radiograph can help surgeons during this crucial step.

Two ipsilateral skin incisions are then marked to form an isosceles triangle with the docking point. The endoscope will go through the shorter cranial incision and form the camera portal, while the longer caudal incision will be the working portal. Maintaining a 1 cm distance from the midline, these incisions are typically 3 cm apart along the pedicular inner edge line. This can be adjusted based on the patient's body mass index (BMI) and the thickness of subcutaneous adipose tissue, widening as needed for better access (Fig. 3). We choose horizontal incisions to help with transverse surgical maneuvers.

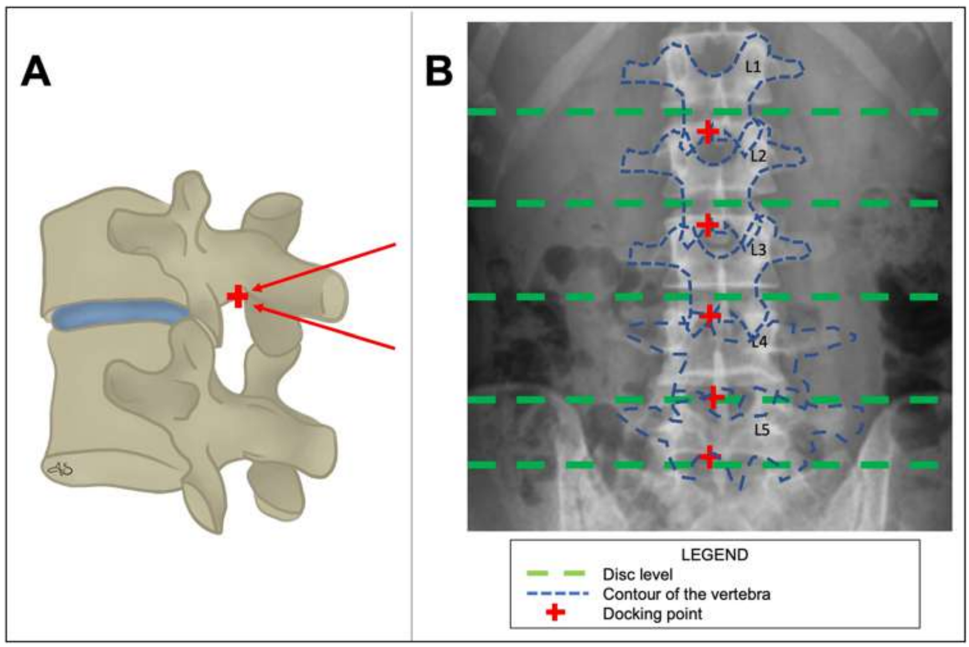

Fig. 2 Docking point and portal positions. **A**) Artistic view of the lumbar spine showing the docking point (red cross) at the spinous-laminar junction, with the camera portal axis parallel to the disc axis (superior arrow), and the working portal axis parallel to the intervertebral space (inferior arrow). **B**) Anteroposterior radiograph of the lumbar spine showing the contour of the lumbar vertebrae with docking points (red crosses) at the spinous-laminar junction of the superior vertebra relative to the disc level. For L2-L4, the docking point is below the disc level; for L4-S1, it is above the disc level). Note the "Napoleon hat" shape of the interlaminar space. Pencil and digital artwork performed by Aurore Sellier, MD

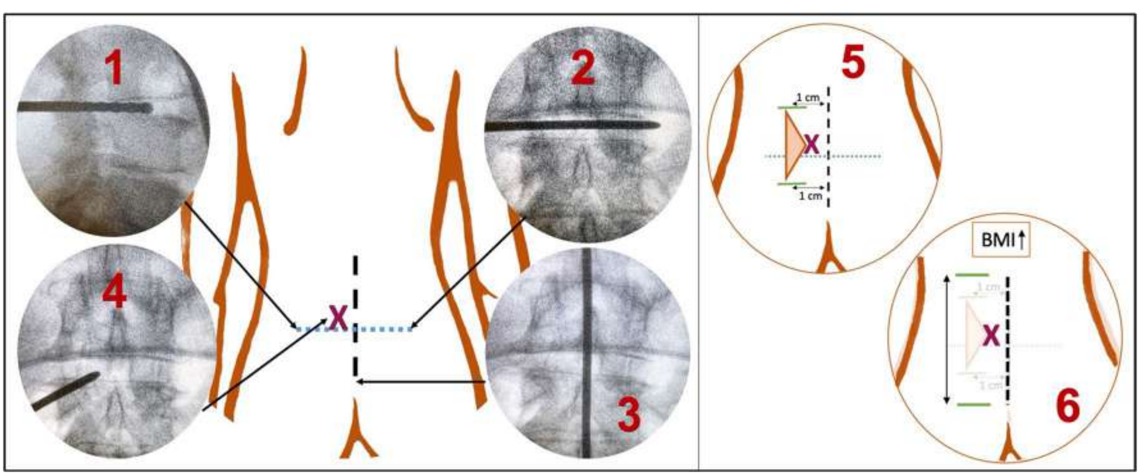

Fig. 3 Preoperative marking: fluoroscopy guidance. Step-by-step fluoroscopy guidance to ensure proper placement of the portal incisions 1) Disc level location (lateral fluoroscopy) 2) Disc level location (anteroposterior fluoroscopy) 3) Median line identification (anteroposterior fluoroscopy) 4) Docking point at the spinous-laminar junction (anteroposterior fluoroscopy) 5) Incisions marking, 1 cm lateral to the midline, forming an isosceles triangle with the docking point 6) Increased interval between incisions in patients with high BMI

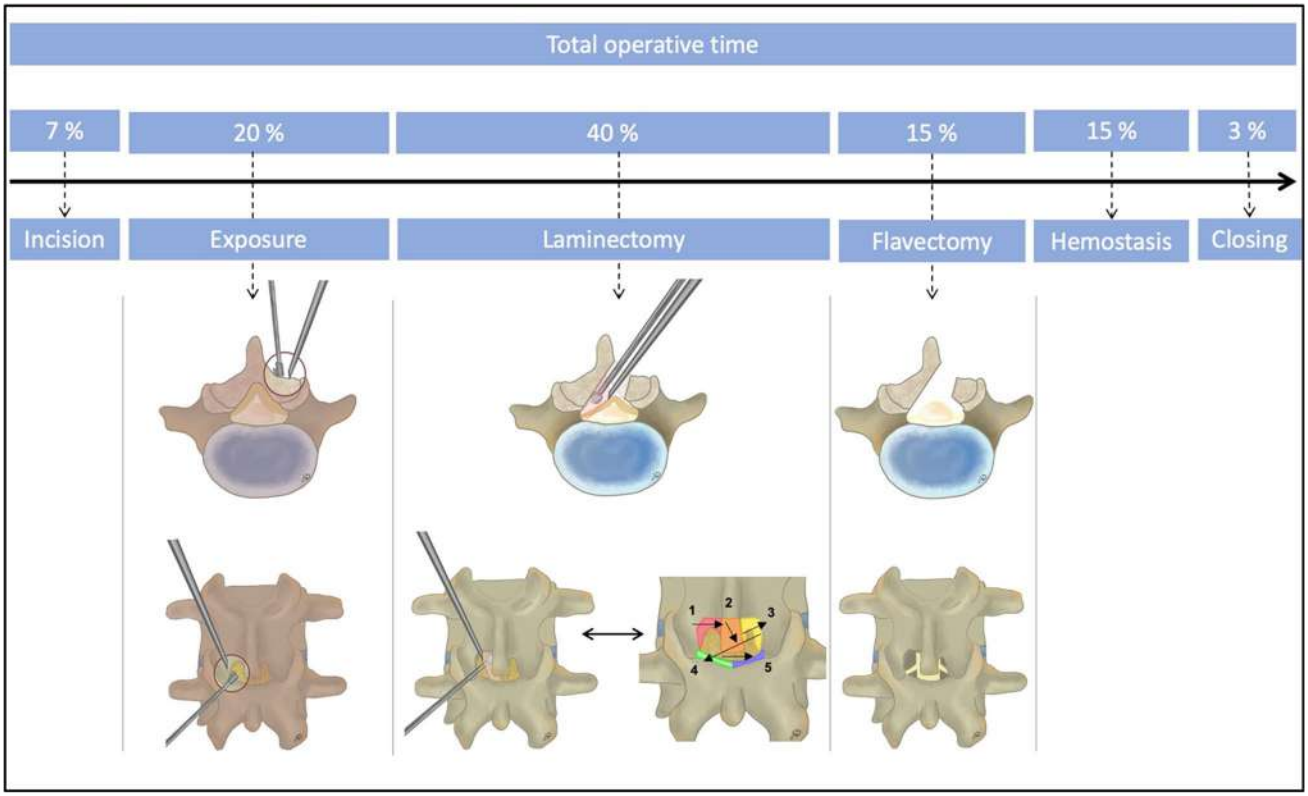

Fig. 4 Distribution of operating time. Diagram depicting the six operative steps and their relative time distribution within the total procedure. Artistic representations in axial (above) and frontal (below) views illustrate the three major stages: exposure stage using of the radiofrequency probe, over-the-top laminectomy via unilateral approach according to the Z-sequence (see text for more details), and flavectomy. Pencil and digital artwork performed by Aurore Sellier, MD

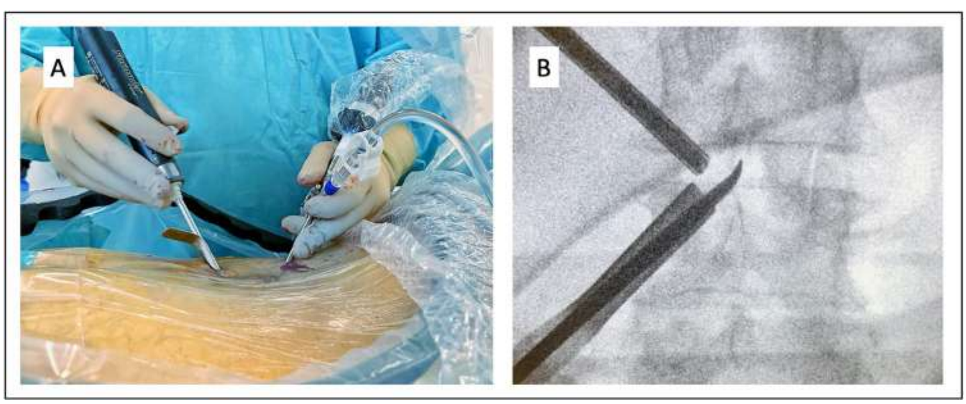

Fig. 5 Surgical approach: camera and instruments portals. A) Photograph showing the placement of the camera (left hand) and radiofrequency ablator (right hand). The patient's feet are at the left side of the image. B) Anteroposterior fluoroscopic control confirming the triangulation of the camera and the spatula at the docking point level. Pencil and digital artwork performed by Aurore Sellier, MD

During draping, a cesarean drape with a collection pouch connected to suction around the surgical field is used to avoid flooding.

Step-by-step operative procedure

The surgical steps and the optimal distribution of operative times are described in Fig. 4.

Incision and portals creation (7% of the operative duration)

The skin and muscular fascia are incised simultaneously. In overweight patients, the muscle fascia is incised obliquely to reduce mechanical stress on the soft tissues and allow easier instrument introduction and use. In patients with a normal BMI, the fascia is incised parallel to the skin to avoid early crossing and interference in portals triangulation.

Serial dilators are inserted through the intermuscular septum between the erector spinae and multifidus muscles until contact with the superior vertebra lamina is achieved, initiating subperiosteal dissection [2]. Generally, three dilators of increasing sizes are used in the camera portal and four in the working portal.

A 30-degree endoscope is inserted through the camera portal, and a continuous saline irrigation system is started to control bleeding and keep the view clear. Fluoroscopic imaging is performed to ensure proper triangulation of the two portals at the docking point (Fig. 5). A low-pressure pump, typically below 40 mmHg (35 mmHg if there is CSF leakage), is used. The surgeon must ensure proper fluid drainage using a tong-shaped skin retractor in the caudal portal to avoid fluid pressure on the dura. A new dilation can be performed during surgery whenever the water flow decreases, particularly in very muscular patients.

Segmental arteries are coagulated under magnified vision with a radiofrequency wand to keep the surgical field clear. Note that subcutaneous bleeding may be underestimated at

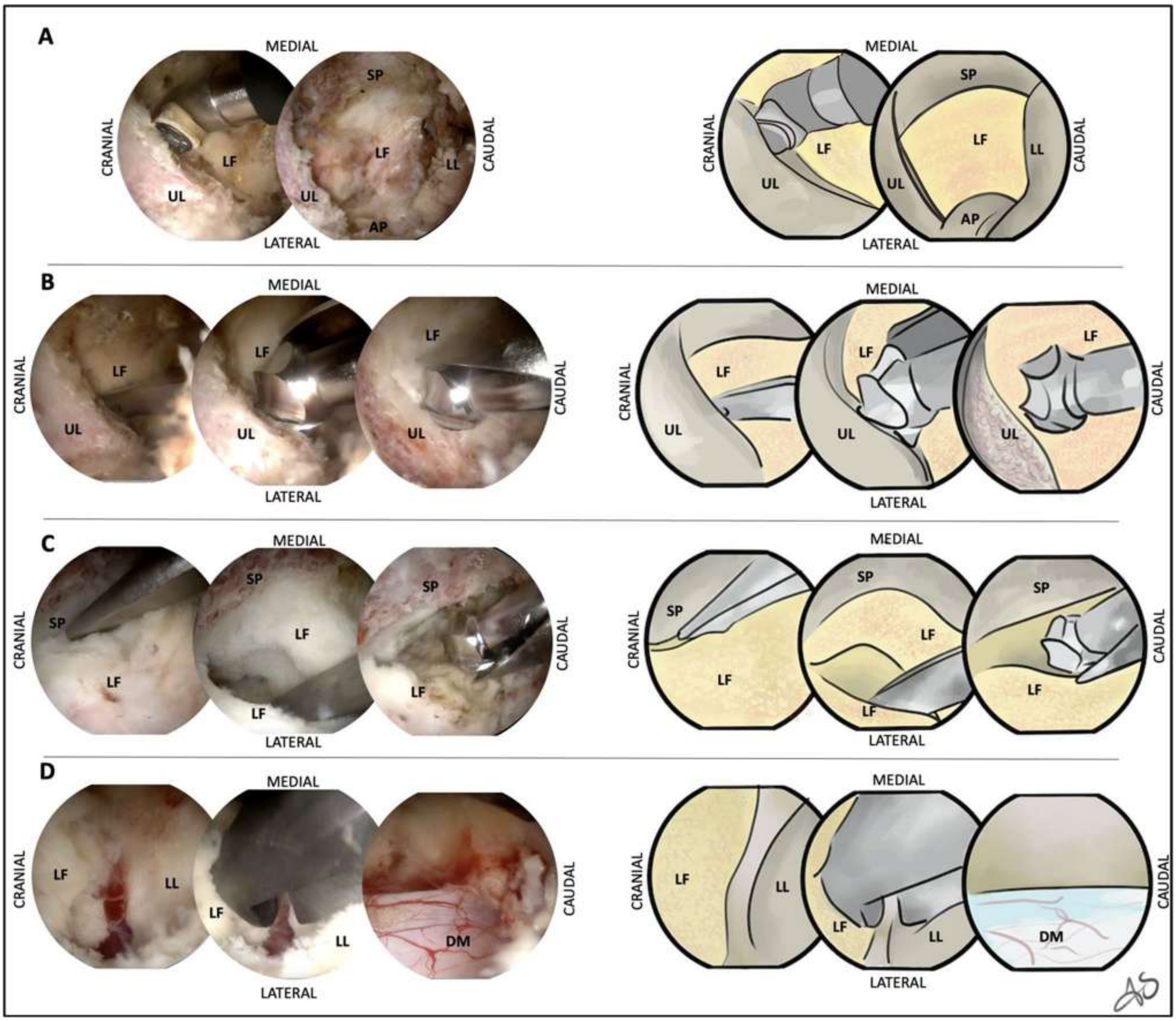

Fig. 6 Surgical decompression. Intraoperative photographs (left side panel) and corresponding artistic views (right side panel) showing: A) Creation of the working space: use the radiofrequency probe under the UL (left image) and final view of the four cardinal points (UL, LL, SP, AP) (right image). B) Ipsilateral laminectomy: dissection of the LF from the UL with a smooth spatula (left), introduction of a multi-fluted burr (center) and drilling of the inferior edge of the UL (right). C) Over-the-top decompression: identifying the LF cleft at the midline (left), dissecting the LF from the SP base and contralateral UL (center), and drilling of the SP base and contralateral inferior edge of the UL. D) LF removal: identification of the inferior border of the LF (left), removing it with a Kerrison rongeur (center), and final view of the dural sac after LF removal (right). Upper lamina (UL), lower lamina (LL), spinous process (SP), articular process (AP), dura-mater (DM). Pencil and digital artwork performed by Aurore Sellier, MD

this stage by less experienced practitioners who are focusing primarily on the camera. Effective control of this bleeding is also essential.

Exposure (20% of the operative duration)

The surgeon's assistant monitors muscle contractions throughout the procedure by placing a hand on the leg. A radiofrequency ablator is used to form the working chamber within the fatty space above the lamina. This continues until a clear view of the laminas, SP, AP, and LF is obtained (Fig. 6A). The first layer of the ipsilateral LF can be removed at this stage, using the inferior lamina as a depth reference while moving upward tangentially.

Laminectomy (40%) and flavectomy (15%)

Once the working chamber is cleaned, drilling begins on the superior lamina to perform a partial hemilaminectomy (Fig. 6B) and continues on the inferior lamina to free the craniocaudal part of the ipsilateral LF. If there is hypertrophy of the AP, the medial and inferior parts of the facet are also burred. Experienced surgeons may use a multi-fluted burr, but we advise young practitioners to begin with a diamond burr. In all cases, a diamond burr will be used later if there is LF calcification on the dura.

A laminectomy rongeur finishes exposing the cranial and caudal parts of the LF. The midline is visualized at the V-shaped retraction of the superior part of the LF, known as the LF cleft, where it splits into two sheets (Fig. 6C).

If the contralateral side must be accessed, the base of the SP is resected to create sufficient working space. The contralateral LF is dissected from the ventral contralateral lamina using a smooth spatula, allowing the passage of the diamond burr and the start of contralateral *over-the-top* decompression (Fig. 6C). A five-step Z technique has been described for bilateral decompression [6], involving drilling the ipsilateral superior lamina, the SP base, and the contralateral superior lamina, followed by the ipsilateral and the contralateral inferior laminas, and finishing with the lateral insertions of the LF.

Partial resection of the contralateral superior AP is performed to reach the lateral and lower margin. Special attention is given during bone drilling to flatten the ventral lamina, making it easier to apply wax during hemostasis. The contralateral outer edge of the ligament can also be thinned and retracted using the bipolar hook.

In case of foraminal compression, the bone of the lateral recess can be skeletonized with a burr and finally ablated with a Kerisson rongeur. A chisel can also be used for this step. The plane between the ligament and the dura must be dissected to release any adhesion.

Once bone decompression is sufficient, the LF is removed *en bloc* using pituitary forceps or Kerisson rongeurs (Fig. 6D). This step is performed bilaterally in case of canal stenosis leading to the well-known *butterfly challenge* (Fig. 7). The ipsilateral and/or contralateral nerve roots are gently exposed, noting that they can be very lateralized at the L5-S1 level.

In case of disc herniation, a nerve root retractor is used to secure the nerve during the standard discectomy process with pituitary forceps. The bipolar hook can be used to retract the disc and the posterior longitudinal ligament. The hook is also used to retrieve migrated fragments. A chisel can help in cases of calcified hernia.

Hemostasis (15%) and closure (3%)

Routine hemostasis is achieved using a bipolar hook, and wax is applied to the flattened edges created by the burr to ensure adhesion. Flowable gelatin-based matrices with thrombin can be used for hemostatic control, and we recommend their systematic use in case of stenosis decompression. In routine practice, we stop the irrigation when applying the product, and resume the flow after an arbitrary period of 3 min to allow the product to rinse off. Finally, we apply oxidized regenerated cellulose to achieve hemostasis. A *stop test* (of the irrigation) is performed to ensure the absence of residual bleeding. Retrograde hemostasis of the muscular tissue is performed when removing the instruments to avoid blood contamination of the surgical field. The subcutaneous layer is closed with absorbable interrupted sutures, followed by skin closure with adhesive strips. Careful hemostasis avoids the need for a drain, which can paradoxically stimulate bleeding.

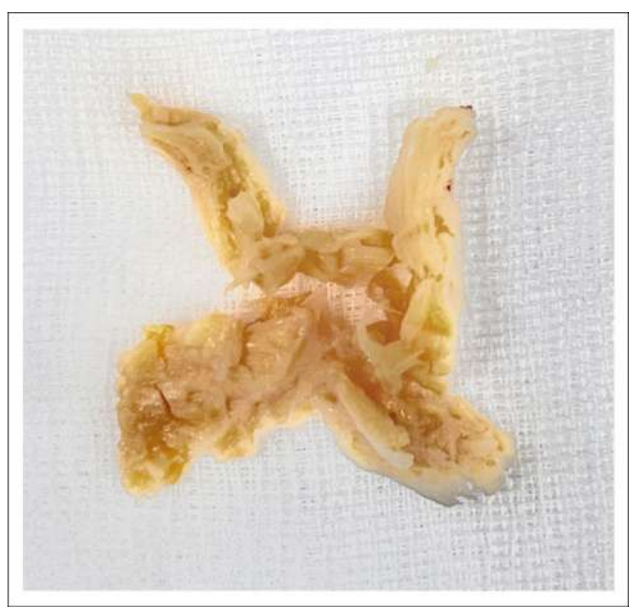

Fig. 7 Butterfly challenge. The ligamentum flavum is removed "en bloc"

Specific indications and technical variations

-Right hernia

For right-handed surgeons, the practitioner still stands on the patient's left side, but the incisions are placed on the right side, closer to the midline, to counteract the natural tendency for the surgeon's hands to diverge. For the same reason, the table is tilted towards the surgeon. The incisions are moved 0.5 cm caudally to avoid early contact of the camera with the superior lamina, which could induce a larger laminectomy.

-Migrated downwards hernia

There is no need for superior laminectomy or complete flavectomy in this case. The ligament is incised and dissected at its inferior portion, to avoid extensive fibrosis of the LF in case of recurrent surgery.

-Migrated upwards hernia

A more extensive drilling of the superior lamina is performed until the LF cleft is visualized.

-Articular cyst

In the case of a right cyst, if it is calcified, a left-sided approach allows for more precise dissection from a downward view. Spatula and water dissection are very effective for this pathology, with an impression of less neurotoxicity compared to open surgery.

-Foraminal hernia

In the case of a right foraminal hernia, a left approach is performed with the incision slightly moved caudally to operate along the foramen axis.

In the case of a left foraminal hernia, the authors choose to stay on the left side and proceed with a "retrograde discectomy", using instruments in reverse. In cases of foraminal extrusion, the hook can help to retrieve migrated fragments.

Conclusion

The UBE technique offers a magnified view of the epidural and foraminal areas while allowing a wide range of movements thanks to its two portal accesses [9]. This approach also preserves laminar and isthmic continuity, limits muscular injuries, minimizes hospital stay, and improves immediate postoperative recuperation [15]. These benefits underline the importance of refining and standardizing the surgical technique to minimize intraoperative difficulties and improve patient outcomes. Our methods provide a comprehensive and reproducible guide to facilitate the learning curve of spine surgeons wishing to enter this promising field.

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Declarations

Ethics approval Not applicable.

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Competing Interests The authors declare no competing interests.

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