

Submission ID #: 68452

Scriptwriter Name: Sulakshana Karkala

Project Page Link: <https://review.jove.com/account/file-uploader?src=20877908>

Title: Lateral-PLIF for Lumbar Spinal Arthrodesis: A Detailed Step-By-Step Surgical Technique

Authors and Affiliations:

Donato Creatura^{1,2}, Maria Rossella Fasinella³, Alberto Benato^{3,4}, Alexis Morgado³, Gabriele Capo², Cédric Y. Barrey^{3,5}

¹ Department of Biomedical Sciences, Humanitas University

² Neurosurgery Department, IRCCS Humanitas Research Hospital

³ Department of Spine and Spinal Cord Surgery, Pierre Wertheimer Hospital, HE, Hospices Civils de Lyon and University Claude Bernard of Lyon

⁴ Department of Neurosurgery, Fondazione Policlinico Universitario "A. Gemelli" IRCCS

⁵ Laboratory of Biomechanics, ENSAM, Arts Et Metiers ParisTech

Corresponding Authors:

Donato Creatura (donatocreatura@gmail.com)

Maria Rossella Fasinella (maria-rossella.fasinella@chu-lyon.fr)

Email Addresses for All Authors:

Donato Creatura (donatocreatura@gmail.com)

Maria Rossella Fasinella (maria-rossella.fasinella@chu-lyon.fr)

Alberto Benato (benato.alberto@gmail.com)

Alexis Morgado (alexis.morgado@chu-lyon.fr)

Gabriele Capo (gabriele.capo@humanitas.it)

Cédric Y. Barrey (cedric.barrey@chu-lyon.fr)

Author Questionnaire

Microscopy: Does your protocol require the use of a dissecting or stereomicroscope for performing a complex dissection, microinjection technique, or something similar? **Yes, all done**

SCOPE: 2.4.2, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.12, 2.13, 2.14, 2.15, 2.16

2. Software: Does the part of your protocol being filmed include step-by-step descriptions of software usage? **No**

3. Filming location: Will the filming need to take place in multiple locations? **No**

Current Protocol Length

Number of Steps: 16

Number of Shots: 31

Introduction

Videographer: Obtain headshots for all authors available at the filming location.

INTRODUCTION

- 1.1. **Cédric Barrey:** Our research details the Lateral-PLIF technique, promoting its wider use and confirming its safety and effectiveness to enhance surgical outcomes.

1.1.1. INTERVIEW: Named Talent says the statement above in an interview-style shot, looking slightly off-camera.

What are the most recent developments in your field of research?

- 1.2. **Cédric Barrey:** Recent developments include safer access corridors, minimally invasive techniques, and improved instruments and devices, enhancing fusion success and reducing complications.

1.2.1. INTERVIEW: Named Talent says the statement above in an interview-style shot, looking slightly off-camera.

CONCLUSION

What advantage does your protocol offer compared to other techniques?

- 1.3. **Cédric Barrey:** Lateral-PLIF enables safer cage placement with minimal neural retraction, offers bilateral decompression, and achieves high fusion rates by combining PLIF and TLIF advantages.

1.3.1. INTERVIEW: Named Talent says the statement above in an interview-style shot, looking slightly off-camera.

How will your findings advance research in your field?

- 1.4. **Cédric Barrey:** We have demonstrated a valuable balance between arthrodesis performance and a well-controlled risk profile.

1.4.1. INTERVIEW: Named Talent says the statement above in an interview-style shot, looking slightly off-camera.

What new scientific questions have your results paved the way for?

- 1.5. **Cédric Barrey:** Our results open new questions about combining Lateral-PLIF with minimally invasive methods and biologics to enhance fusion quality and long-term spinal alignment.

1.5.1. INTERVIEW: Named Talent says the statement above in an interview-style shot, looking slightly off-camera.

Videographer: Obtain headshots for all authors available at the filming location.

Ethics Title Card

This research has been approved by the Institutional Ethics Committee at the Pierre Wertheimer Neurological Hospital, Hospices Civils de Lyon, France

Protocol

2. Minimally Invasive Posterior Lumbar Interbody Fusion with Bilateral Facetectomy and Interbody Cage Placement

Demonstrator: Cédric Barrey

- 2.1. To begin, make a standard posterior midline skin incision, on the patient, centered on the operative level [1]. Incise the lumbar fascia [2] and carefully expose the posterior bony elements subperiosteally including the lamina of the two adjacent vertebrae posterior facets and pedicular entry zones [3].
 - 2.1.1. WIDE: Talent beginning skin incision along the midline with scalpel.
 - 2.1.2. Talent incising the lumbar fascia.
 - 2.1.3. Talent peeling back tissue to expose the lamina, posterior facets, and pedicular entry zones.
- 2.2. Using an osteotome, perform a subtotal facetectomy by bilaterally resecting the inferior facet of the upper vertebra [1]. Partially remove the superior facet of the lower vertebra flattening it to facilitate pedicle screw insertion [2].
 - 2.2.1. Talent using an osteotome to cut away the inferior facet of the upper vertebra.
 - 2.2.2. Talent trimming and flattening the superior facet of the lower vertebra.
- 2.3. Now, insert multiaxial pedicle screws at the appropriate levels [1]. Confirm correct placement using biplanar fluoroscopy or CT guided navigation [2].
 - 2.3.1. Talent placing multiaxial pedicle screws carefully.
 - 2.3.2. Shot of biplanar fluoroscopy or CT navigation confirming correct screw placement.

Videographer: Please capture the screen of the instrument for this shot
- 2.4. Apply an interlaminar distractor at the base of the spinous processes to improve exposure and enlarge the working space [1]. Resect the midline ligamentous structures while keeping the adjacent spinous processes intact [2].
 - 2.4.1. Talent positioning and applying interlaminar distractor between spinous processes.
 - 2.4.2. SCOPE: Talent cutting away midline ligaments with adjacent spinous processes remaining in place.

NOTE: Please use the videographer's filmed footage if it is easily identifiable
- 2.5. Remove the tip and medial part of the superior facet to expose the proximal intervertebral foramen located at the transition zone between the central and lateral canal just above the lateral recess [1].

- 2.5.1. SCOPE: [VIDEO-1-\(2.5-to-2.7-right-side\).mp4](#) 03.00 to 03.40
- 2.6. When necessary, use a Kerrison rongeur to further open the lateral recess and decompress the passing nerve root [1]. If additional central decompression is required perform partial laminectomy and flavectomy [2].
- 2.6.1. SCOPE: [VIDEO-1-\(2.5-to-2.7-right-side\).mp4](#) 04:00- 04:18
- 2.6.2. SCOPE: [VIDEO-1-\(2.5-to-2.7-right-side\).mp4](#) 04:20- 04.35
- 2.7. Next, remove the lateral ligamentum flavum and underlying fatty tissue preserving the fatty tissue surrounding the nerve root to facilitate exposure of the underlying disc space [1-TXT]. ~~Control epidural bleeding as needed using bipolar coagulation and hemostatic agents [2].~~
- 2.7.1. SCOPE: [VIDEO-1-\(2.5-to-2.7-right-side\).mp4](#) 05.00-05:30
TXT: Control epidural bleeding as needed
- ~~2.7.2. SCOPE: [VIDEO 2 \(2.8 to 2.10 left side\).mp4](#)~~
NOTE: Converted to on-screen text
- 2.8. Once hemostasis is achieved, expose the disc between the dural sac medially and the foraminal root laterally with minimal or no retraction of neurological structures [1].
- 2.8.1. SCOPE: [VIDEO-2-\(2.8-to-2.10-left-side\).mp4](#) 05.15- 05.55
- 2.9. Now create a rectangular window in the annulus using a scalpel blade positioning it in the transitional zone between the lateral part of the central canal and the medial part of the intervertebral foramen [1].
- 2.9.1. SCOPE: [VIDEO-2-\(2.8-to-2.10-left-side\).mp4](#) 06:00- 06.37
- 2.10. Use a nerve root retractor to protect the dural sac applying only limited retraction [1]. Then use specialized straight and angled osteotomes pituitary rongeurs rasps and curettes to elevate and remove disc material [2].
- 2.10.1. SCOPE: [VIDEO-2-\(2.8-to-2.10-left-side\).mp4](#) 06.56: 07:15
- 2.10.2. SCOPE: [VIDEO-2-\(2.8-to-2.10-left-side\).mp4](#) 07:50-08:10
- 2.11. Apply intervertebral distraction on one side starting at 6 to 7 millimeters [1]. Gradually increase to 11 to 12 millimeters allowing safe and controlled discectomy on the contralateral side [2].

2.11.1. SCOPE: [VIDEO-3-\(2.10-+-and-2.11-left-side\).mp4](#) 01:44-01:50

2.11.2. SCOPE: [VIDEO-3-\(2.10-+-and-2.11-left-side\).mp4](#) 01:57-02:10.

~~2.12. Perform distraction progressively, alternating sides by 1 millimeter increments until satisfactory disc height restoration is achieved according to preoperative planning [1].~~

~~2.12.1. SCOPE: Talent alternating distraction sides by 1 mm increments until proper disc height is restored.~~

AUTHOR'S NOTE: Not recorded

2.13. Remove the cartilaginous layer until the bony endplate of the adjacent cranial and caudal vertebrae is clearly exposed to complete endplate preparation [1-TXT]. Measure the disc space for an appropriately sized interbody cage [2].

2.13.1. SCOPE: [VIDEO-3-\(2.10-+-and-2.11-left-side\).mp4](#) 00:27 to 00:50

TXT: Measure disc space for appropriately sized interbody cage

~~2.13.2. SCOPE: Talent using a measuring tool to determine disc space dimensions.~~

NOTE: Converted to on-screen text

2.14. Next, pack the anterior disc space and both cages with bone graft using either local bone or bone substitutes depending on the clinical situation [1-TXT]. Insert the two cages into the interbody space [2] and advance them using a straight impactor [3].

2.14.1. SCOPE: [VIDEO-4-\(2.14-left-side\).mp4](#) 00:30-01:00

TXT: Fill each cage with 1.0 cm³ pack of synthetic bioactive bone substitute

2.14.2. SCOPE: [VIDEO-4-\(2.14-left-side\).mp4](#) 01:38-01:49

2.14.3. SCOPE: [VIDEO-4-\(2.14-left-side\).mp4](#) 01:50-02:10

~~2.15. Contour the rods in slight lordosis [1] and place them inside the screw heads [2]. Apply segmental compression to optimize restoration of local lordosis [3].~~

AUTHOR'S NOTE: Not recorded

~~2.15.1. SCOPE: Talent bending rods into slight lordosis.~~

~~2.15.2. SCOPE: Talent placing the contoured rods into pedicle screw heads.~~

~~2.15.3. SCOPE: Talent compressing segmentally to achieve desired lordotic curvature.~~

~~2.16. Protect the dura with a collagen sponge [1]. Place additional bone graft along the rods with some bone chopsticks allograft positioned in the bridge against the two adjacent decorticated lamina [2].~~

AUTHOR'S NOTE: Not recorded

~~2.16.1. SCOPE: Talent placing collagen sponge over dura.~~

~~2.16.2. SCOPE: Talent applying bone graft along rods and bridging with bone chopsticks allograft across lamina~~

Results

3. Results

3.1. Postoperative computed tomography imaging confirmed successful bilateral cage placement with restored anatomical alignment at the L4-L5 (*L-Four-to-L-Five*) level following Lateral-PLIF(*Pliff*) [1], along with complete neural decompression of the spinal canal [2].

3.1.1. LAB MEDIA: Figure 1 *Video Editor: Please highlight images B to D*

3.1.2. LAB MEDIA: Figure 1 *Video Editor: Please highlight image A*

3.2. The PLIF method accessed the disc *via* the central canal [1]. The TLIF (*T-Liff*) method utilized a more lateral trajectory through the foramen [2] and the lateral-PLIF trajectory allowed for direct access to the disc space while avoiding both the central canal and neuroforamen [1].

3.2.1. LAB MEDIA: Figure 3. *Video editor: Highlight the yellow arrow labeled "PLIF"*

3.2.2. LAB MEDIA: Figure 3. *Video editor: Highlight the red arrow labeled "TLIF"*

3.2.3. LAB MEDIA: Figure 3. *Video editor: Highlight the orange arrow labeled "Lateral-PLIF"*

3.3. The final position of the interbody cages in Lateral-PLIF was symmetrical across the midline [1], and graft material was densely packed around and within the cages to support fusion [2].

3.3.1. LAB MEDIA: Figure 3. *Video editor: Highlight the star symbols*

3.3.2. LAB MEDIA: Figure 3. *Video editor: Highlight the area with the semicircle labeled "vertebral body"*

Pronunciation Guide:

🔍 Arthrodesis

Pronunciation link: <https://www.merriam-webster.com/dictionary/arthrodesis>

IPA: /ˌɑːrθroʊˈdiːsɪs/

Phonetic Spelling: ahr-throh-dee-suhs

🔍 Lateral-PLIF

Pronunciation link: No confirmed link found

IPA: /ˈlætərəl ˈpliːf/

Phonetic Spelling: lat-uh-rul pleef

🔍 Lumbar

Pronunciation link: <https://www.merriam-webster.com/dictionary/lumbar>

IPA: /ˈlʌmbɑːr/

Phonetic Spelling: lum-bar

🔍 Neurosurgery

Pronunciation link: <https://www.merriam-webster.com/dictionary/neurosurgery>

IPA: /ˌnʊroʊˈsɜːdʒəri/

Phonetic Spelling: noo-roh-sur-juh-ree

🔍 Facetectomy

Pronunciation link: <https://www.merriam-webster.com/dictionary/facetectomy>

IPA: /ˌfæsiˈtɛktəmi/

Phonetic Spelling: fa-suh-tek-tuh-mee

🔍 Interbody

Pronunciation link: <https://www.merriam-webster.com/dictionary/interbody>

IPA: /ˌɪntərˈbɑːdi/

Phonetic Spelling: in-ter-bah-dee

🔍 Pedicle

Pronunciation link: <https://www.merriam-webster.com/dictionary/pedicle>

IPA: /ˈpɛdɪkəl/

Phonetic Spelling: ped-ih-kuhl

🔍 Multiaxial

Pronunciation link: <https://www.merriam-webster.com/dictionary/multiaxial>

IPA: /ˌmʌltiˈæksiəl/

Phonetic Spelling: mul-tee-ak-see-uhl

🔍 Fluoroscopy

Pronunciation link: <https://www.merriam-webster.com/dictionary/fluoroscopy>

IPA: /ˌflʊroʊˈskaːpi/

Phonetic Spelling: floor-oh-skah-pee

🔍 Interlaminar

Pronunciation link: <https://www.merriam-webster.com/dictionary/interlaminar>

IPA: /ˌɪntərˈlæmɪnər/

Phonetic Spelling: in-ter-lam-ih-ner

🔊 Ligamentum flavum

Pronunciation link: <https://www.merriam-webster.com/dictionary/ligamentum%20flavum>

IPA: /ˌlɪɡəˈmentəm ˈfleɪvəm/

Phonetic Spelling: lig·uh·men·tum flay·vum

🔊 Foramen

Pronunciation link: <https://www.merriam-webster.com/dictionary/foramen>

IPA: /fəˈreɪmən/

Phonetic Spelling: fuh·ray·men