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Systematizing an Expanded Lumbar Interlaminar Endoscopic Approach: The 10 Steps of Castro-Brock for Increased Security

Sistematizando uma abordagem endoscópica interlaminar lombar expandida: Os 10 passos de Castro-Brock para maior segurança

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Abstract

Introduction With increasing life expectancy, there is a rising incidence of degenerative spinal pathologies, particularly in the elderly population. Minimally invasive techniques are becoming increasingly attractive due to the higher prevalence of comorbidities in older patients. Endoscopic spine surgery offers advantages such as early rehabilitation, reduced postoperative pain, minimized muscle damage, and shorter hospital stays.

Objectives To enhance the safety of the interlaminar approach and minimize complications, we propose the systematic application of an expanded interlaminar technique, termed the "Castro-Brock technique." Direct visualization of accurate anatomy is emphasized for successful endoscopic navigation.

Methods The Castro-Brock technique is described in a step-by-step manner, comprising 10 steps with illustrative images. The technique involves an initial puncture on the upper lamina, identification of bony structures, drilling and enlarging the interlaminar bone window, en bloc flavectomy, and precise identification of the descending root before accessing the disc.

Results The Castro-Brock technique facilitates improved visualization of anatomy and provides decompression of neurological structures before disc access. This systematic approach reduces the risk of inadvertent neurological injury and other surgical complications associated with interlaminar access.

Conclusions The Castro-Brock technique represents a valuable addition to the armamentarium of lumbar endoscopic spine surgery. Ensuring meticulous anatomical visualization and pre-disc decompression of neural structures enhances surgical safety and optimizes patient outcomes.

Keywords
- endoscopic spine surgery
- interlaminas approach
- minimally invasive

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Resumo

Introdução Com o aumento da expectativa de vida há uma incidência crescente de patologias degenerativas da coluna particularmente na população idosa. Técnicas minimamente invasivas estão se tornando cada vez mais atraentes devido à maior prevalência de comorbidades em pacientes mais velhos. A cirurgia endoscópica da coluna oferece vantagens como reabilitação precoce redução da dor pós-operatória danos musculares minimizados e internações hospitalares mais curtas.

Objetivos Para aumentar a segurança da abordagem interlaminar e minimizar complicações propomos a aplicação sistemática de uma técnica interlaminar expandida denominada "técnica Castro-Brock". A visualização direta da anatomia precisa é enfatizada para uma navegação endoscópica bem-sucedida.

Métodos A técnica Castro-Brock é descrita passo a passo compreendendo 10 etapas com imagens ilustrativas. A técnica envolve uma punção inicial na lâmina superior identificação de estruturas ósseas perfuração e ampliação da janela óssea interlaminar flavectomia em bloco e identificação precisa da raiz descendente antes de acessar o disco.

Resultados A técnica Castro-Brock facilita a visualização aprimorada da anatomia e fornece descompressão de estruturas neurológicas antes do acesso ao disco. Esta abordagem sistemática reduz o risco de lesão neurológica inadvertida e outras complicações cirúrgicas associadas ao acesso interlaminar.

Conclusões A técnica Castro-Brock representa uma adição valiosa ao arsenal da cirurgia endoscópica lombar da coluna. Garantir a visualização anatômica meticulosa e a descompressão pré-disco das estruturas neurais aumenta a segurança cirúrgica e otimiza os resultados do paciente.

Palavras-chave

- cirurgia endoscópica da coluna
- abordagem interlaminar
- minimamente invasiva

Introduction

The increased life expectancy has brought an increase in the incidence of degenerative pathologies of the spine.[1] The increment in comorbidities in the older population makes the use of less invasive techniques attractive and with lower risks.[2,3] Early rehabilitation, less post-operative local pain, minimized muscle damage, and reduced hospital stay are some advantages of endoscopic spine surgery.[4–6]

Endoscopic access to the lumbar spine essentially consists of transforaminal and interlaminar techniques. The more caudal the level, the larger the size of the interlaminar space, making it more favorable to perform the interlaminar approach, especially at the levels L4-5 and L5-S1.[7]

With the evolution of spinal endoscopy instruments, especially bone drills, the interlaminar approach has been routinely used for centrolateral disc herniations and spinal canal stenosis. The interlaminar window is the door to all kinds of pathologies and could be opened with the endoscopic burr and Kerrison, widening the interlaminar window and broadening the indications of the endoscopic lumbar spine surgery.[8]

The learning curve for the interlaminar approach requires training and getting used to handling the endoscope independently of the working cannula. Sequentially, the correct exposure and identification of the anatomy of the interlaminar window is crucial for safe access and complication reduction. Direct access with the opening of the ligamentum flavum may result in non-exposure and identification of the shoulder of the descending root, access through the axilla and an increased rate of manipulation, and injury to neurological structures.

Objectives

To increase the safety of the interlaminar approach and minimize complications, the authors propose in this paper the systematization of an expanded interlaminar approach in a pragmatic way through the Castro-Brock technique.

The main point is direct visualization of the correct anatomy is crucial for successful endoscopic navigation.

The technique described is based on 2 principles:

1. Initial puncture is on the bone (upper lamina) and not on the yellow ligament. Subsequently identification of the bone structures (spinous process basis, upper lamina, and inferior articular process in a craniocaudal direction is performed
2. Drilling and enlarging the interlaminar bone window is routinely performed, followed by en bloc flavectomy with customary identification of the descending root shoulder before accessing the disc.

Methods

Here we describe the step-by-step of the Castro-Brock technique, didactically divided into 10 steps and with representative images aiming to increase the safety of the

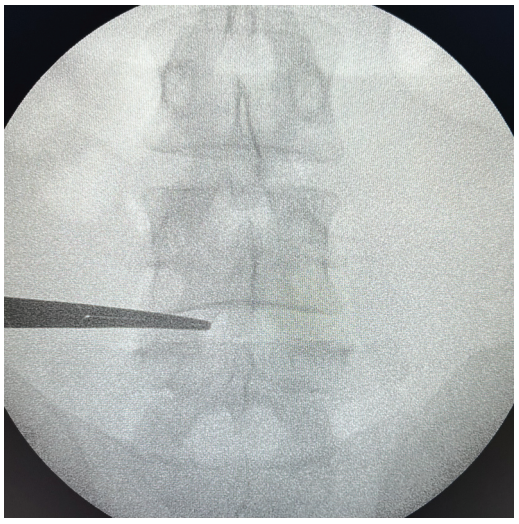

Fig. 1 Upper lamina is marked with radioscopy.

interlaminar approach and reducing the risk of injury to neurological structures.

Results

The description of this new technique for performing what we call an expanded interlaminar approach named the "Castro-Brock technique", is systematized in the following steps:

1. The upper lamina is marked with radioscopy (►**Fig. 1**) and the puncture is carried out towards the upper lamina with the dilator after incision of the skin and muscular fascia (►**Fig. 2**), feeling through the haptic with the dilator the base of the spinous process, moving in a lateral direction until feeling the step between the lamina and the interlaminar window at the junction of the lamina with the IAP (Inferior Articular Process).
2. Introduction of the working cannula and endoscope, identifying the base of the spinous process, upper lamina, and IAP as well as visualization of the interlaminar window medial to these structures (►**Figs. 3** and **4**) and creation of a virtual cavity for the flow of saline solution. The sequence of identification from medial to lateral is therefore: spinous process basis, upper lamina, IAP, interlaminar window
3. The facet capsule in de desinserted medially in a cranial-caudal direction until the tip of the IAP is identified (►**Figs. 5** and **6**), continuing with the drilling of the upper lamina and IAP in a medial-lateral direction for approximately 6 mm (twice the size of the 3mm drill), from cranial to caudal, becoming the flavum ligament and the SAP (Superior Articular Process) more evident (►**Fig. 7**); the SAP is in a deeper anatomical situation than the IAP (►**Fig. 8**).
4. Drilling of the SAP in a cranial-caudal and medial-lateral direction (►**Fig. 9**) until the disinsertion of the flavum ligament from the SAP and the inferior lamina (►**Fig. 10**).

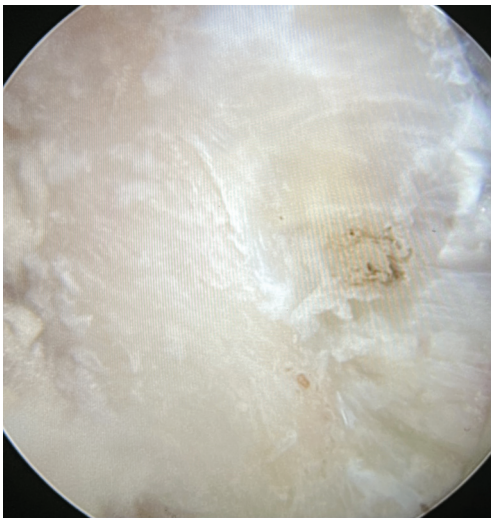

Fig. 3 After introducing the working cannula and endoscope it is crucial to identify from medial to lateral the following structures: 1. spinous process basis / 2. Upper lamina / 3. IAP / 4. interlaminar window.

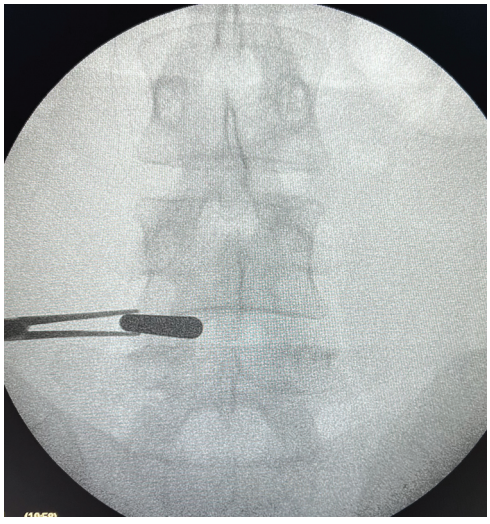

Fig. 2 Puncture of the upper lamina with the dilator.

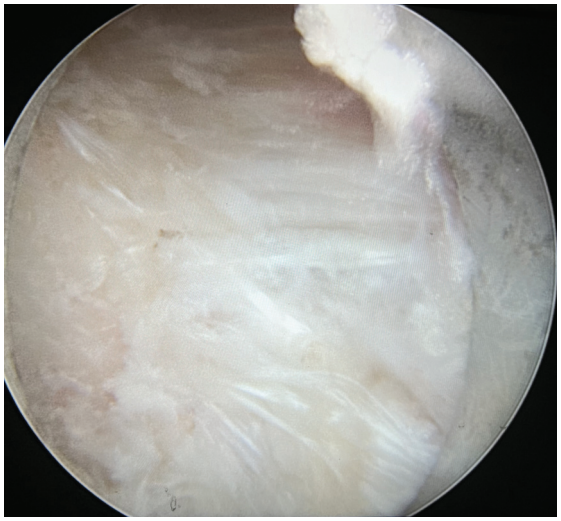

Fig. 4 IAP and facet capsule (*) and the interlaminar window medially (**).

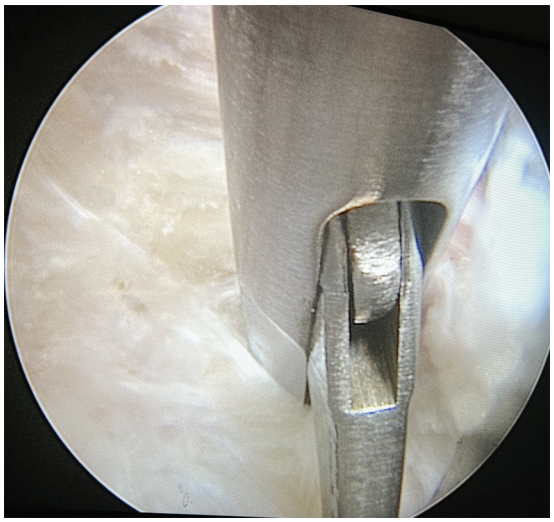

Fig. 5 The facet capsule is desinserted medially in a cranial-caudal direction with scissors.

Fig. 6 The tip of the IAP is identified (*). It is also possible to visualize the inferior lamina (**).

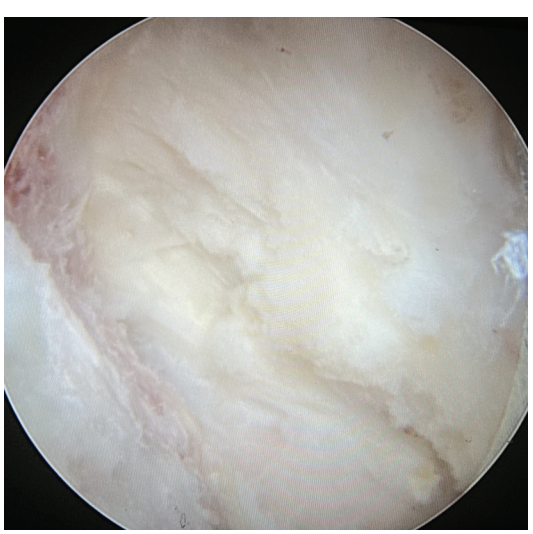

Fig. 7 Upper lamina drilled (1); IAP drilled (2); SAP bellow IAP (3); Yellow ligament exposed (4).

Fig. 8 IAP drilled (1); SAP deeper than IAP (2); Articular cartilage (3).

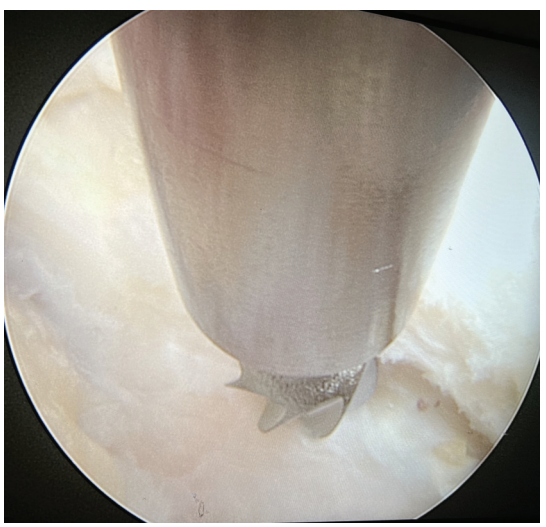

Fig. 9 SAP is drilled from medial to lateral and cranial to caudal in the direction of the inferior lamina.

Fig. 10 Disinsertion of the yellow (flavum) ligament from the inferior lamina by drilling.

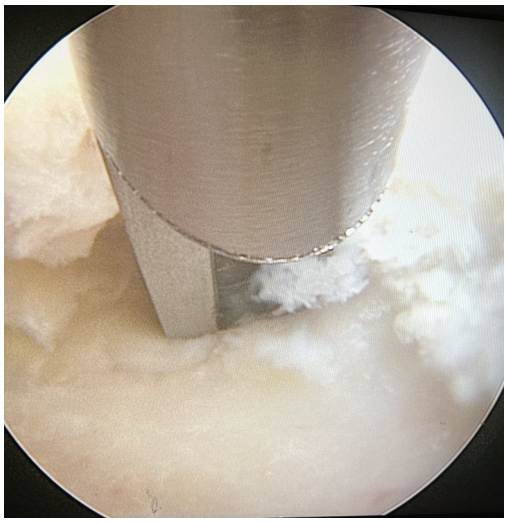

Fig. 11 Foraminotomy is performed using a Kerrison.

5. After yellow ligament disinsertion it is possible to identify the descending root and proceed with the foraminotomy using a Kerrison (►**Fig. 11**) to promptly release the compression on the descending root and locate it to avoid injury (►**Fig. 12**).
6. Opening the flavum ligament next to the superior lamina (►**Fig. 13**) in a medial to lateral direction (►**Figs. 13**–**15**) and cranial to caudal until finding the previous opening performed at the level of the SAP and inferior lamina (►**Fig. 16**)
7. Opening the flavum ligament in its medial portion in a cranio-caudal direction to the inferior lamina (►**Fig. 17**)
8. Removal of the flavum ligament en bloc (►**Fig. 18**) allowing to visualize the dural sac and descending nerve root (►**Fig. 19**), including its axila and shoulder (►**Fig. 20**)
9. The approach is mandatorily performed through the shoulder of the descending nerve root (►**Fig. 21**), with its detachment along the entire length exposed (►**Fig. 22**)

Fig. 12 Descending nerve root promptly decompressed and identified (1); SAP drilled (2); Inferior laminar drilled (3).

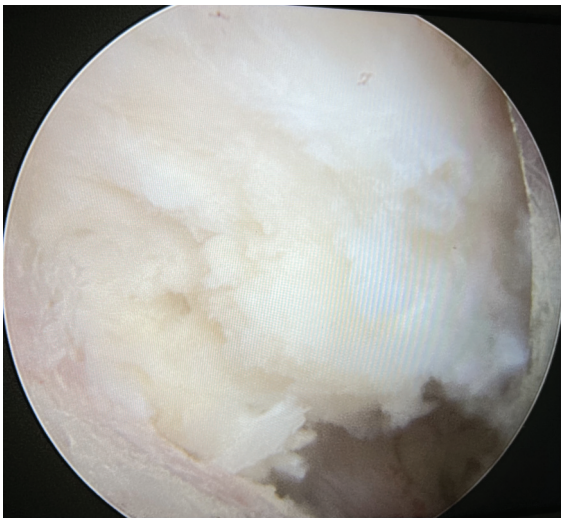

Fig. 13 Superior and medial portion of the yellow ligament will be opened (1); previous opening and descending nerve root foraminotomy (2).

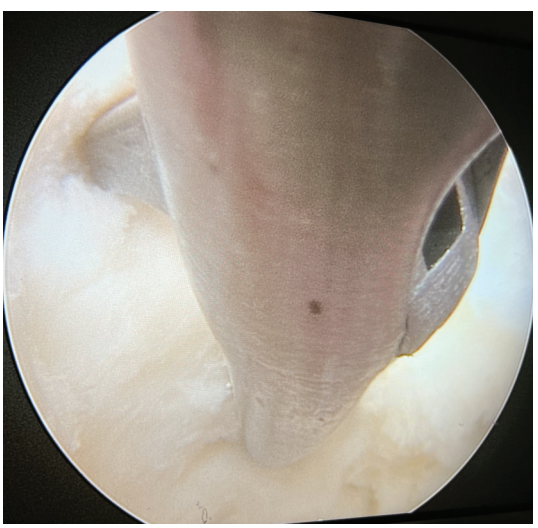

Fig. 14 The tip of the scissors must be visualized.

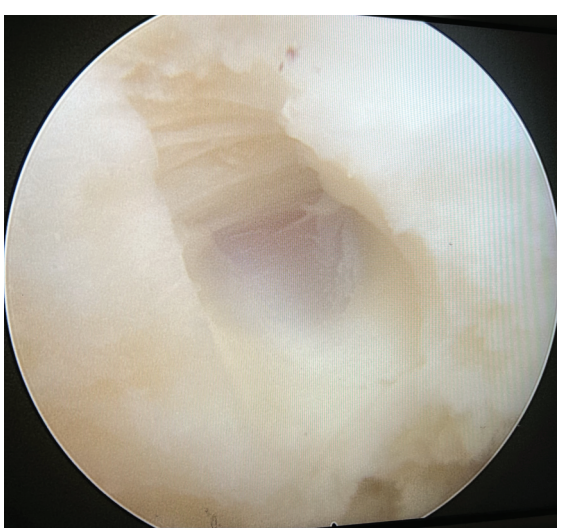

Fig. 15 The thicker superficial layer (1) and thinner deeper layer (2) of the flavum ligament.

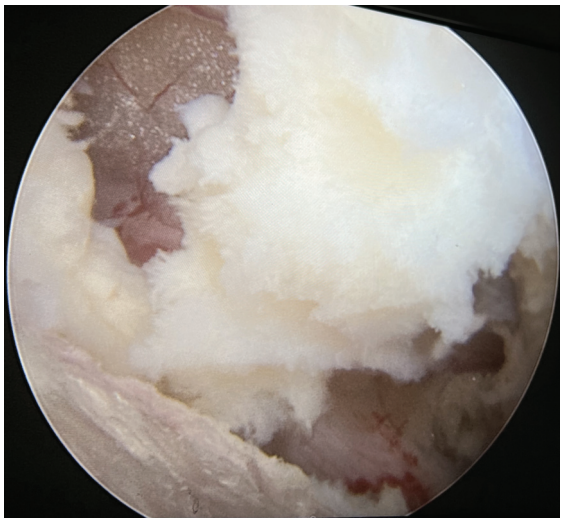

Fig. 16 The two openings are connected.

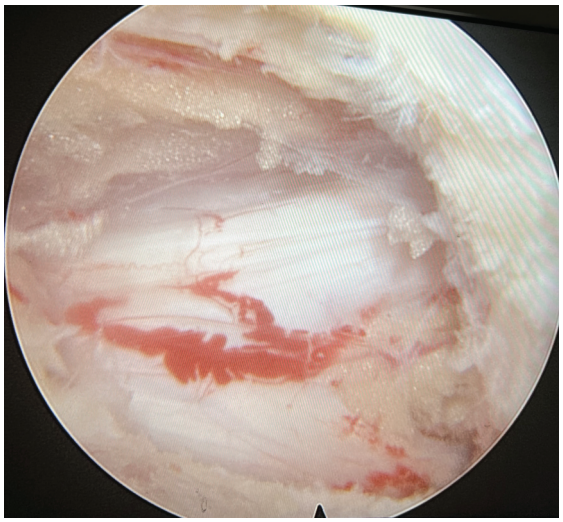

Fig. 19 After flavum ligament removal it is possible to identify the dural sac (1) the descending nerve root (2).

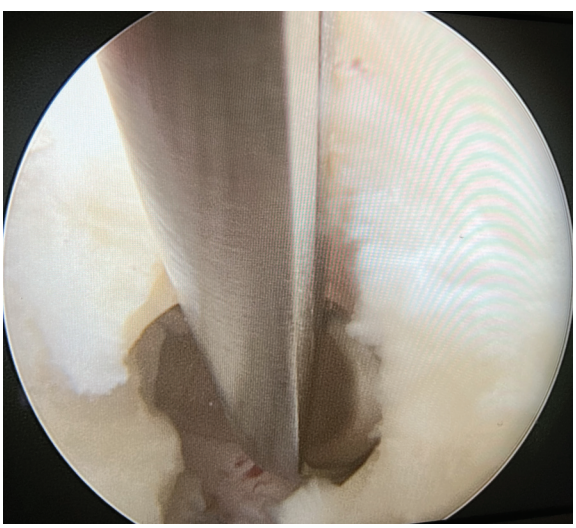

Fig. 17 The flavum ligament is divided in its medial portion in a craniocadal direction until the inferior lamina.

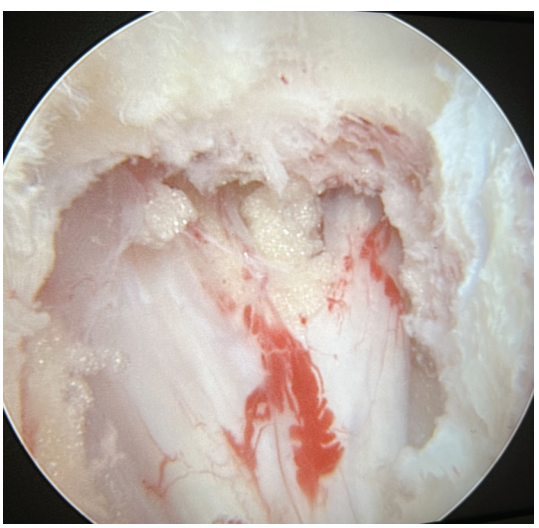

Fig. 20 Dural sac (1); descending nerve root (2) and its axila (3) and shoulder (4).

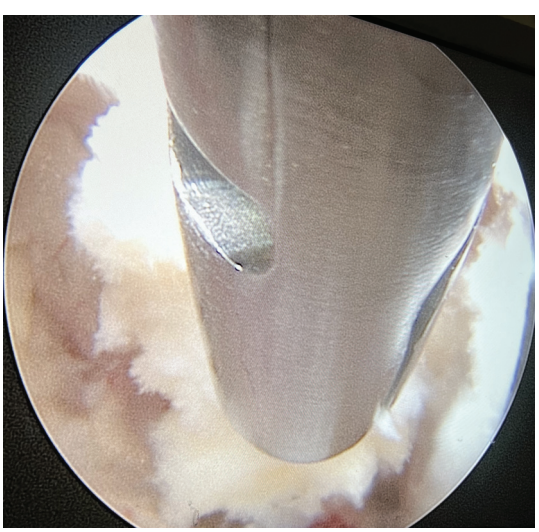

Fig. 18 After detachment, the flavum ligament is removed en bloc.

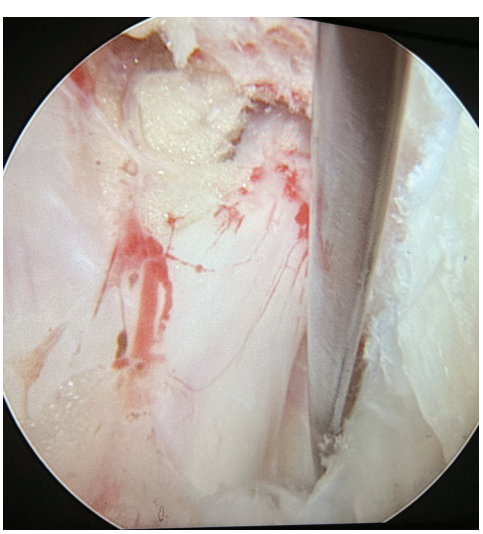

Fig. 21 A detacher/dissector is inserted through access to the descending nerve root shoulder.

10. The descending root is dislocated medially with the working cannula (the lamina is gently and cautiously rotated 180 degrees) and the disc/hernia is exposed (►**Fig. 23**)

Conclusions

The Castro-Brock technique described here provides two main advantages through an expanded interlaminar approach: it allows good visualization of the anatomy and promotes itself decompression of neurological structures before accessing the disc/herniation.

In this way, inadvertent injury to neurological structures as well as unwanted surgical complications are avoided, increasing the safety of performing the interlaminar approach.

Conflict of Interest
None declared.

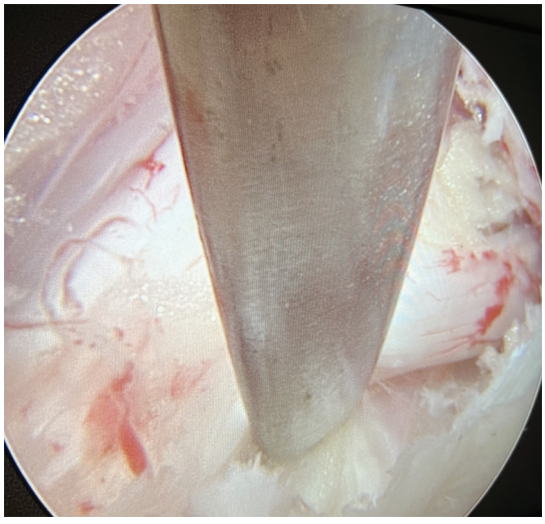

Fig. 22 The descending nerve root is detached and mobilized along its entire length.

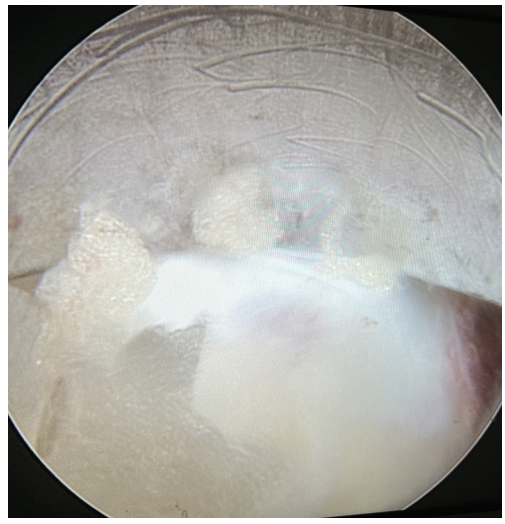

Fig. 23 Disc / herniation exposed after the root dislocation maneuvers.

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