Case Report
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TRANSPEDICULAR ENDOSCOPIC APPROACH IN HIGH-GRADE MIGRATED HERNIA: CASE REPORT

ABORDAGEM ENDOSCÓPICA TRANSPEDICULAR EM HÉRNIA MIGRADA DE ALTO GRAU: RELATO DE CASO

ABORDAJE ENDOSCÓPICO TRANSPEDICULAR EN HERNIA MIGRADA DE ALTO GRADO: REPORTE DE CASO

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ABSTRACT

Extruded disc herniations with a high degree of caudal migration represent a surgical challenge due to the location of the extruded fragment in a difficult-to-access area known as the "hidden zone". Traditional endoscopic approaches, such as interlaminar and transforaminal routes, can be challenging in these cases. This study aims to report a case of a transpedicular endoscopic approach in the treatment of an extruded disc herniation with high-grade caudal migration (Lee's zone 4). We present a 52-year-old male patient with intense pain radiating to the right lower limb and motor deficit. After the failure of conservative treatment, a transpedicular endoscopic discectomy was performed at L4-L5. The procedure was successfully completed without complications, resulting in immediate pain relief and significant functional recovery, maintained over 24 months of follow-up. This case demonstrates that the transpedicular endoscopic approach can be an effective and safe alternative for treating extruded disc herniations with high caudal migration, provided it is performed by experienced surgeons with appropriate planning. ***Level of Evidence IV; Case Report.***

Keywords: Disc Herniation; Endoscopic Surgical Procedures; Spine; Diskectomy.

RESUMO

As hérnias discais extrusas com alto grau de migração caudal representam um desafio cirúrgico devido à localização do fragmento extruso em uma área de difícil acesso, conhecida como "zona oculta". As abordagens endoscópicas tradicionais, como as vias interlaminar e transforaminal, podem ser difíceis nesses casos. Este estudo tem como objetivo relatar um caso de abordagem endoscópica transpedicular no tratamento de uma hérnia discal extrusa com migração caudal de alto grau (zona 4 de Lee). Apresentamos um paciente masculino de 52 anos com dor intensa irradiada para o membro inferior direito e déficit motor. Após falha no tratamento conservador, foi realizada uma discectomia endoscópica transpedicular em L4-L5. O procedimento foi concluído com sucesso, sem complicações, resultando em alívio imediato da dor e recuperação funcional significativa, mantida durante 24 meses de seguimento. Este caso demonstra que a abordagem endoscópica transpedicular pode ser uma alternativa eficaz e segura para o tratamento de hérnias discais extrusas com alta migração caudal, desde que realizada por cirurgiões experientes e com planejamento adequado. ***Nível de Evidência IV; Relato de Caso.***

Descritores: *Hérnia de Disco; Procedimentos Cirúrgicos Endoscópicos; Coluna Vertebral; Discotomia.*

RESUMEN

Las hernias discales extruidas con alto grado de migración caudal representan un desafío quirúrgico debido a la ubicación del fragmento extruido en un área de difícil acceso, conocida como "zona oculta". Los abordajes endoscópicos tradicionales, como las vías interlaminar y transforaminal, pueden ser difíciles en estos casos. Este estudio tiene como objetivo reportar un caso de abordaje endoscópico transpedicular en el tratamiento de una hernia discal extruidas con migración caudal de alto grado (zona 4 de Lee). Presentamos a un paciente masculino de 52 años con dolor intenso irradiado al miembro inferior derecho y déficit motor. Tras el fracaso del tratamiento conservador, se realizó una discectomía endoscópica transpedicular en L4-L5. El procedimiento se completó con éxito, sin complicaciones, resultando en alivio inmediato del dolor y una recuperación funcional significativa, mantenida durante 24 meses de seguimiento. Este caso demuestra que el abordaje endoscópico transpedicular puede ser una alternativa eficaz y segura para el tratamiento de hernias discales extruidas con alta migración caudal, siempre que sea realizado por cirujanos experimentados y con una planificación adecuada. ***Nivel de Evidencia IV; Reporte de Caso.***

Descriptores: *Desplazamiento del Disco Intervertebral; Procedimientos Quirúrgicos Endoscópicos; Columna Vertebral; Discectomía.*

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INTRODUCTION

Disc hernias can be classified as non-migrated or migrated. Migrated hernias, in turn, can shift cranially or caudally and be divided into low-grade or high-grade.

Extruded hernias with a high degree of caudal migration represent a challenge for the spine surgeon because the extruded fragment is located in a hard-to-reach area, the hidden zone. Endoscopic approaches to these hernias can be difficult, both through interlaminar access and transforaminal access. In this context, transpedicular access is possible to resect disc fragments located medially to the pedicle.

Our goal is to report a case of transpedicular endoscopic access in treating extruded disc herniation with a high degree of caudal migration[1].

CASE REPORT

The patient signed the informed consent form (ICF), and the report was approved by the Ethics Committee (CAAE 70416223.8.0000.5487, opinion number 6.339.106).

The 52-year-old male patient presented with intense pain radiating to the right lower limb (RLL), accompanied by tingling in the leg and right foot. The pain intensity was assessed by the visual analog scale (VAS), 6/10 in the lumbar region and 9/10 in the RLL, and multimodal clinical medication treatment and physical rehabilitation with physiotherapy for 8 weeks, without improvement. During clinical treatment, the patient progressed with loss of extension strength of the right big toe (muscle strength grade III) and a positive Lasegue test, indicating surgical treatment. Functional incapacity was assessed using the Oswestry Disability Index (ODI), which obtained a score of 58%, indicating a severe disability. The Magnetic resonance imaging (MRI) of the lumbar spine showed at L4-L5 an extruded right ventrolateral disc herniation with a high degree of caudal migration (Figure 1). Simple X-rays of the lumbar spine showed no changes; dynamic X-rays showed no signs of instability; and the computed tomography (CT) did not reveal disc or yellow ligament calcification.

Due to the neurological deficit and compression of the right L5 root, the right transpedicular endoscopic approach was chosen for direct access to the extruded fragment without manipulating the L5 root. The procedure was performed with conscious sedation and local anesthesia. The marking was made 8cm from the midline with the help of radioscopy. The punch needle was positioned at the lateral edge of the center of the pedicle. The pedicle drilling was performed with sequential percutaneous drills and under fluoroscopic vision up to the anteromedial edge of the pedicle, next to the posterior edge of the vertebral body of L5 (Figure 2).

An endoscope with a working channel 4.3mm in diameter and 30 degrees of angulation was used, with continuous irrigation of saline elevated 1.5m above the patient's level. After the endoscope was introduced, a cutting drill and Kerrison were used to enlarge the bony tunnel and the opening of the medial cortex of the pedicle until the extruded fragment was visualized (Figure 3).

Under direct endoscopic visualization, a large extruded disc fragment was removed through the bony tunnel of the right pedicle of L5 (Figure 4). A small inspection can still be performed through the bony tunnel, with visualization of the root without compression.

The surgical time was 41 minutes, and the patient was discharged four hours after the procedure was completed. In the immediate

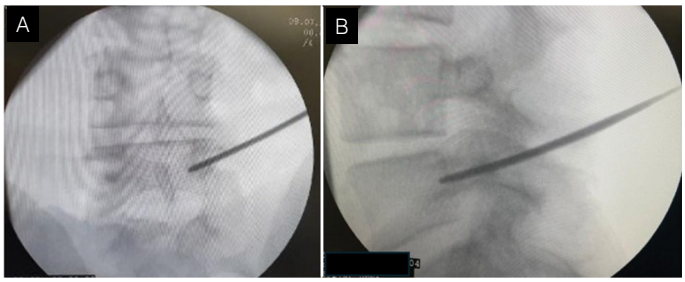

Figure 2. Path of the initial drilling of the right pedicle of L5. Images of radioscopy, anteroposterior incidence (A), and in profile (B).

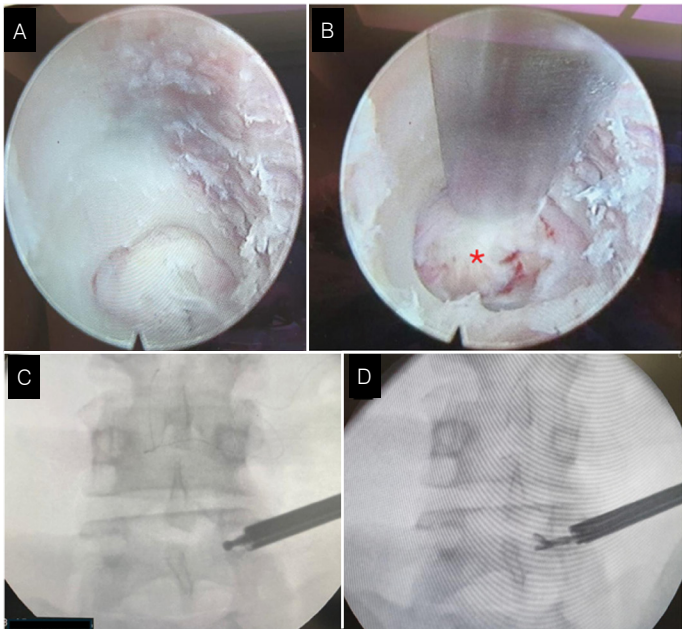

Figure 3. Bone tunnel in the right pedicle of L5 (A, B), with visualization of the extruded disc fragment (red asterisk). Image of the radioscopy of the use of the drill in the bone tunnel (C) and during the removal of the extruded fragment (D).

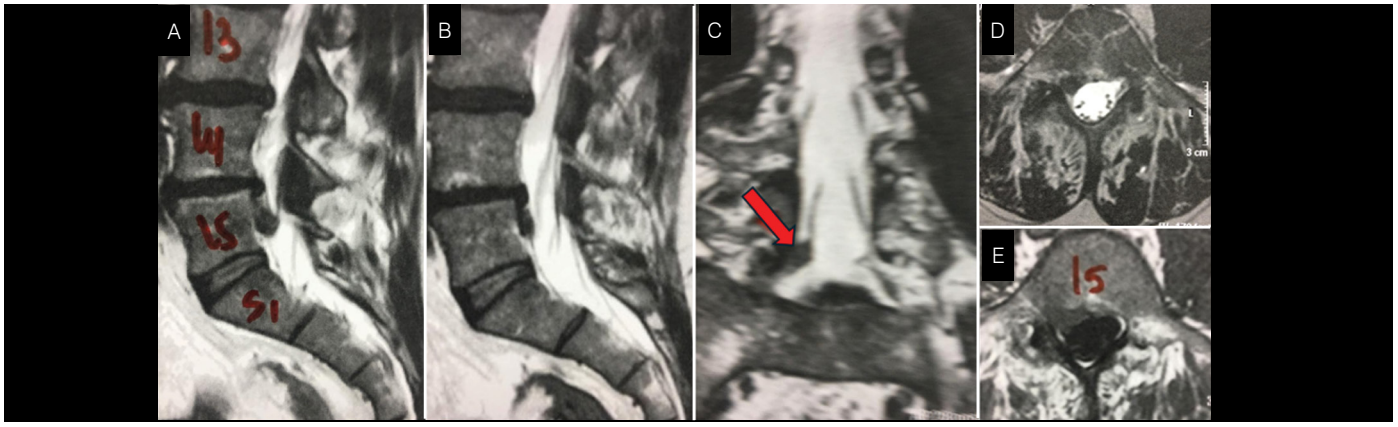

Figure 1. Sagittal cuts (A, B), coronal (C), and axial (D) of the MRI show right ventrolateral extruded disc herniation, with a high degree of caudal migration at the L4-L5 level (red arrow).

postoperative period, the VAS already observed an improvement in pain intensity, being 2/10 in the lumbar region and 0/10 in the RLL, which was maintained in the first month of follow-up. After this period and until the last evaluation at 24 months of follow-up, the patient was asymptomatic (zero VAS). The functional incapacity by ODI was 14, 12, 12, 4, and 4 in the follow-up periods of 1, 3, 6, 12, and 24 months, respectively.

Figure 5 shows a postoperative CT scan evaluating the bony tunnel of the right pedicle of L5.

DISCUSSION

Spinal surgery has experienced significant advancements in recent years. Among minimally invasive techniques, endoscopic surgery has demonstrated remarkable versatility and effectiveness in treating various spinal pathologies.

The main endoscopic accesses for the treatment of spinal diseases include the interlaminar (IL) and transforaminal (TF) routes. The choice of access depends on the type and location of the pathology, as well as the surgeon's experience. However, certain conditions, such as extruded disc hernias with a high degree of migration or anatomically unfavorable iliac crest, may limit the viability of these traditional approaches. The possibility of transpedicular access can overcome this difficulty in cases of extruded disc hernias with a high degree of caudal migration[1–3].

Anatomically, the vertebral pedicle defines the vertebral canal laterally and, through its articular processes, connects to the adjacent vertebrae. The vertebral body forms the anterior limit of the canal, while the vertebral lamina constitutes the posterior limit. The dimensions of these structures vary according to the analyzed vertebral level[4].

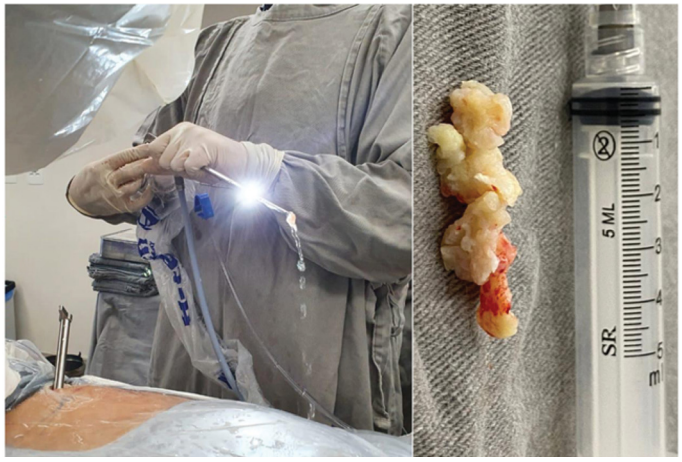

Figure 4. The extruded disc fragment was removed.

Figure 5. The sagittal cut of the postoperative CT is used to evaluate the bony tunnel in the right pedicle of L5.

The transpedicular performance of the procedure requires a deep knowledge of vertebral anatomy, especially of the pedicle. Matuoka and Basile Jr. conducted a morphometric study on 14 adult male cadavers, evaluating the longitudinal and transverse diameters of the vertebral pedicles. They observed a gradual increase in these diameters from L2 to L5, with the longitudinal diameter always larger. In addition, the study examined the relationship of the pedicles with the neural structures, measuring the distance between the dura mater and the medial edge of the pedicle and the distance between the most distal portion of the pedicle and the emerging nerve root. The results indicated no increase in these distances between levels L2 to L5. Furthermore, it was observed that the spinal ganglion was located in the foraminal zone in 87% of the analyzed cases[4]. In this sense, the lower lumbar pedicles with a longitudinal diameter of more than 12 mm would be the most suitable for performing the transpedicular access and drilling the bone tunnel of up to 8 mm[5].

Krzok *et al.* published several works on the subject, reporting 21 surgeries performed via transpedicular approach with significant improvement in pain intensity according to the VAS and low complication rates. They highlighted the importance of preoperative analysis of the size of the pedicle, noting that these structures tend to be smaller in women. They also stated that this route should be considered exceptional access, used only for extruded hernias with high caudal migration, and mentioned other accesses as alternatives to the transpedicular.[6]

Evidence in the literature indicates that the transpedicular approach can be used in endoscopic surgery in all spine segments. However, there is an increased risk of fracture in pedicles with a diameter smaller than 10 mm[3 7].

Giordan *et al.* presented a case report with a literature review demonstrating the efficacy and safety of the transpedicular technique. They described a 76-year-old male patient with an extruded hernia at L3-L4 on the right, with high-grade caudal migration (Lee zone 4). They stated that the technique could be safely used from L1 to S1, suggesting an entry point in the skin 10 to 11 cm from the midline and highlighting the importance of fluoroscopy to assist in the positioning and trajectory of the instruments. They listed absolute contraindications (hernia in the axilla of the root) and relative contraindications (neurological deficits, severe osteoporosis, hypoplastic pedicles, severe canal stenosis, calcified hernias). They suggested avoiding the pedicles of L1 and L2 due to their smaller width and higher risk of fracture and that pedicular tunnels larger than 8 mm should not be performed to avoid increasing the risk of fracture[8].

Uniyal et al. demonstrated that this technique can also be used in treating hematomas, biopsies, drainage of abscesses, and other pathologies located intracanally along the medial border of the pedicle. They emphasized the importance of radiological planning and the correct positioning of the needle as fundamental for the success of the procedure to avoid injury to the descending root or the dural sac[9].

Krzok *et al.* described the treatment of synovial cysts adjacent to the pedicles of L4 and L5 via the transpedicular endoscopic approach, emphasizing that the technique should be performed by surgeons with extensive experience in endoscopic surgery[10].

In the reported case, transpedicular access was performed at L5 by a surgical team experienced in endoscopic surgery, without incidents and without complications. The addressed pedicle had a longitudinal diameter greater than 12mm and there was no violation of its superior and inferior cortices.

CONCLUSION

Transpedicular endoscopic access can be considered an alternative route in cases of high-grade extruded disc herniations with caudal migration and should be performed by experienced surgeons. New studies should be encouraged to prove the safety and efficiency of the technique.

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