Journal of Pain Clinicians of India (JPCI)

Official Publication of the Indian Society of Pain Clinicians
Volume 1 · Issue 1 · 2026 · ISSN: Applied For

CASE REPORT

Minimally Invasive Spine Endoscopic Pain Procedure (MisEpp) With Extradiscal Bipolar Radiofrequency Application for Chronic Low Back Pain with Radicular Symptoms Due to a L4-L5 Annular Tear and Dynamic Disc Protrusion: A Case Report

Nishansh Singh Vimal[1], Pankaj N. Surange (Maj.)[1,*], Anusha Arepalli[1], Shalley Singh[1], Sowjanya Kommuri[1], Swati Bhatt[1]

1. Department of Pain Medicine, IPSC Pain and Spine Hospital, Dwarka, New Delhi, India.

Corresponding Author: Dr (Maj.) Pankaj N Surange, Department of Pain Medicine, IPSC Pain and Spine Hospital, Dwarka, New Delhi, India (ceo@ipscindia.com).

Abstract

Background

Annular tears may contribute to chronic axial low back pain and may coexist with radicular symptoms. Minimally invasive spine endoscopic pain procedures (MisEpp) permit direct visualization and treatment of pathological disc and epidural structures. Endoscopically guided extradiscal bipolar radiofrequency (RF) application may provide an additional method of treating tissue associated with an annular defect.

Case Presentation

We report a 52-year-old male with a ten-year history of chronic low back pain and left lower-limb radicular symptoms refractory to conservative treatment. Magnetic resonance imaging demonstrated an L4-L5 posterior annular tear with a high-intensity zone and associated disc protrusion. The patient underwent interlaminar MisEpp with decompression of the affected L5 nerve root, followed by direct extradiscal bipolar RF application to the external surface of the annular defect under local anaesthesia with conscious sedation. A BONSS bipolar RF system operating at 4.2 Hz was used with a cut setting of 6 and coagulation setting of 7. RF was applied under direct endoscopic visualization until visible retraction of the treated annular surface was observed.

Conclusion

This case demonstrates the technical feasibility of combining endoscopic treatment with directly visualized extradiscal bipolar RF application in a carefully selected patient with an annular tear and associated radicular symptoms. The clinical improvement observed in this single patient cannot establish the independent efficacy or safety of either component of the combined intervention. Prospective studies with standardized functional outcomes and longer follow-up are required.

Keywords

Discogenic pain; annular tear; bipolar radiofrequency; lumbar disc protrusion; MisEpp; spine endoscopy.

Introduction

Chronic low back pain (CLBP) is a common cause of disability, and disc-related pathology is one of several potential contributors. Annular fissures may expose nociceptive structures within the outer annulus to inflammatory and mechanical stimuli and may coexist with disc protrusion and radicular symptoms. A high-intensity zone (HIZ) on T2-weighted magnetic resonance imaging (MRI) can support the presence of an annular fissure, although it is not diagnostic of discogenic pain in isolation.

Minimally invasive spine endoscopic pain procedures (MisEpp) allow direct visualization and treatment of pathological epidural and disc-related structures through a small working channel. Radiofrequency (RF) treatment of annular tissue has also been described as a method of thermally modifying tissue associated with annular fissures. The present case is notable for the direct extradiscal application of bipolar RF to the external surface of an annular defect under endoscopic visualization, using visible retraction of the treated annular surface as the procedural endpoint.

We report the clinical course and technical details of this combined intervention in a patient with chronic low back pain, L5 radicular symptoms, an L4-L5 annular tear with HIZ, and associated disc protrusion. Because this is a single case involving two simultaneous interventions, the report is intended to describe technical feasibility and clinical course rather than establish efficacy or determine the independent contribution of RF treatment.

Magnetic resonance imaging studies frequently demonstrate high-intensity zones (HIZ) on T2-weighted sequences at the site of annular fissures, which have been validated as a diagnostically and clinically meaningful imaging correlate of discogenic pain[5]. Despite advances in conservative and interventional pain management, a subset of patients with discogenic low back pain remains refractory to non-operative treatment, requiring procedural intervention.

Over the past two decades, minimally invasive spine endoscopic pain procedures have evolved significantly. MisEpp allows direct visualization and removal of pathological disc material through a small working channel with minimal damage to paraspinal musculature and ligamentous structures[6]. Bipolar radiofrequency (RF) annuloplasty, applied under direct endoscopic visualization, offers a complementary strategy to coagulate annular fibers, seal the fissure, and ablate nociceptive nerve endings within the annulus[7,8].

Rationale

We present a case of chronic discogenic low back pain with left L5 radiculopathy, arising from a coexisting annular tear and dynamic lumbar disc protrusion at L4-L5, successfully managed with MisEpp combined with extradiscal bipolar RF annuloplasty. This report aims to document the clinical course, technical approach, and outcome of this combined minimally invasive technique, and to contextualize the findings within the current published literature.

Case Presentation

Clinical History

A 52-year-old male presented to our hospital with a ten-year history of chronic low back pain. The pain was predominantly axial, associated with morning stiffness and localized lumbar tenderness, and radiated into the left lower limb to the great toe. Axial pain was aggravated by prolonged sitting and improved with walking, whereas the radicular component worsened progressively with walking and markedly reduced his ambulatory distance. He denied any bowel or bladder dysfunction.

Prior conservative treatment had been comprehensive and included non-steroidal anti-inflammatory drugs (NSAIDs), structured physiotherapy, and activity modification. Despite adherence to these interventions over an extended period, the pain persisted with a Numerical Rating Scale (NRS) score of 6-8/10, consistent with moderate-to-severe chronic pain significantly limiting functional capacity.

Clinical Examination

On examination, paraspinal muscle spasm and midline tenderness over the L4-L5 region were present. Neurological examination of the lower limbs showed no objective sensory or motor deficit, with preserved deep tendon reflexes. Straight leg raise testing was negative bilaterally. The absence of a fixed neurological deficit did not exclude symptomatic intermittent L5 nerve-root irritation.

Imaging Findings

MRI of the lumbar spine demonstrated a posterior annular tear at L4-L5 with a high-intensity zone on T2-weighted sequences. The disc height was relatively preserved, and there was no significant central canal stenosis or spondylolisthesis. The clinical and imaging findings were considered consistent with a L4-L5 annular lesion with associated disc protrusion and L5 radicular symptoms.

HIZ was interpreted as a supportive imaging finding rather than a standalone diagnostic test for discogenic pain. Provocative discography was not performed. The presence of radicular symptoms was considered an additional symptom due to a possible disc protrusion happening when the patient started walking and was addressed during the endoscopic intervention.

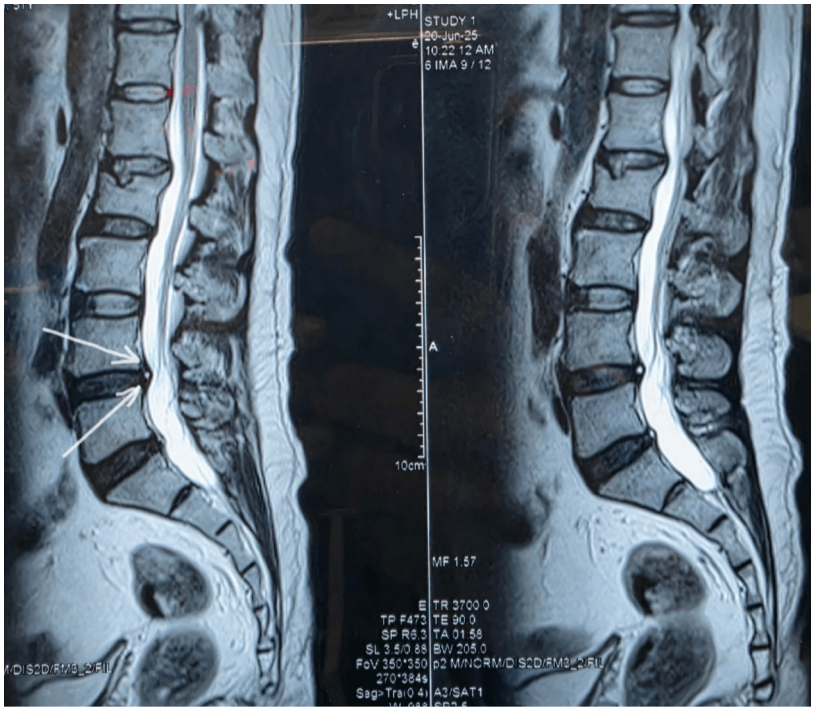


Fig. 1. Sagittal section T2W MRI of patient showing annular tear at L4-L5 region (white arrows).

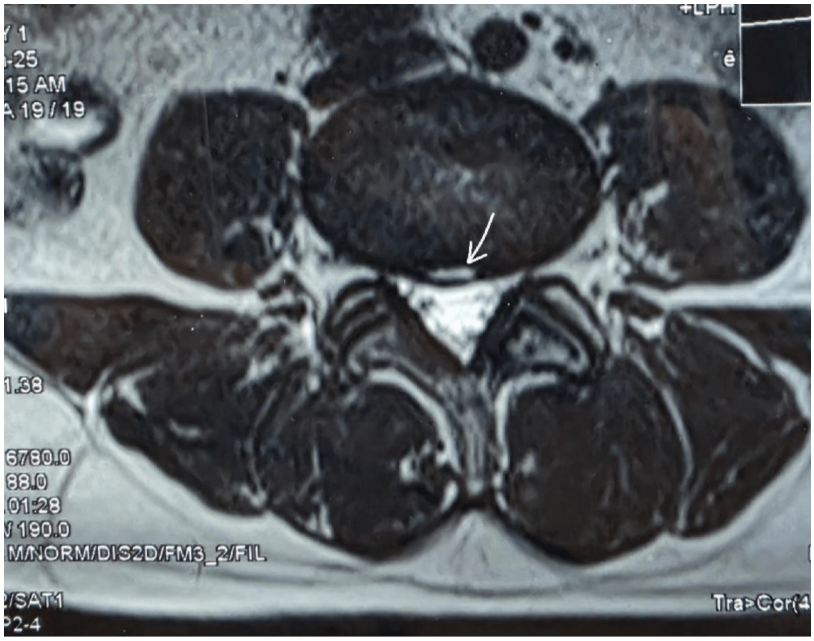


Fig. 2. Axial section taken at L4-L5 disc showing HIZ in the centre of disc (white arrow).

Based on the clinical presentation, examination findings, and MRI findings, the working diagnosis was an L4-L5 disc protrusion associated with a posterior annular tear/HIZ and left L5 radicular symptoms. Given the prolonged symptoms and failure of conservative treatment, an interlaminar endoscopic intervention was planned. The absence of provocative discography and the possibility of multiple pain generators were considered limitations of the diagnostic assessment.

Procedural Technique

Anaesthesia and Patient Positioning

The procedure was performed under local anaesthesia with conscious sedation and continuous cardiorespiratory monitoring. The patient was positioned prone on a radiolucent table with a Wilson's frame beneath the abdomen to facilitate interlaminar access. The operative field was prepared and draped using standard sterile technique.



Fig. 3. Depicting patient positioning with Wilson's frame.

Step 1: Fluoroscopic Localization and Cannula Placement

The L4-L5 interlaminar window was identified under fluoroscopic guidance in the anteroposterior (AP) orientation. Local anaesthesia was administered to the skin, subcutaneous tissues, and periosteum of the lamina and facet region using a 22-gauge Quincke spinal needle with lignocaine 1% and 2% sequentially. A 5-mm vertical skin incision was made at the target level. A dilator was introduced through the interlaminar window under AP fluoroscopic guidance, followed by placement of a 10 mm outer diameter working sleeve in the lateral fluoroscopic orientation, docking just proximal to the ligamentum flavum.

Step 2: Endoscopic Visualization

A 10 mm outer diameter and 160 mm length endoscope was introduced through the working channel, allowing direct visualization of the ligamentum flavum and other anatomical structures. The ligamentum flavum was carefully incised and removed using the available endoscopic instruments, exposing the traversing L5 nerve root and the L4-L5 disc.

Step 3: Endoscopic Identification

The protruded annulus fibrosus was identified under direct endoscopic visualization after retracting the traversing nerve root.

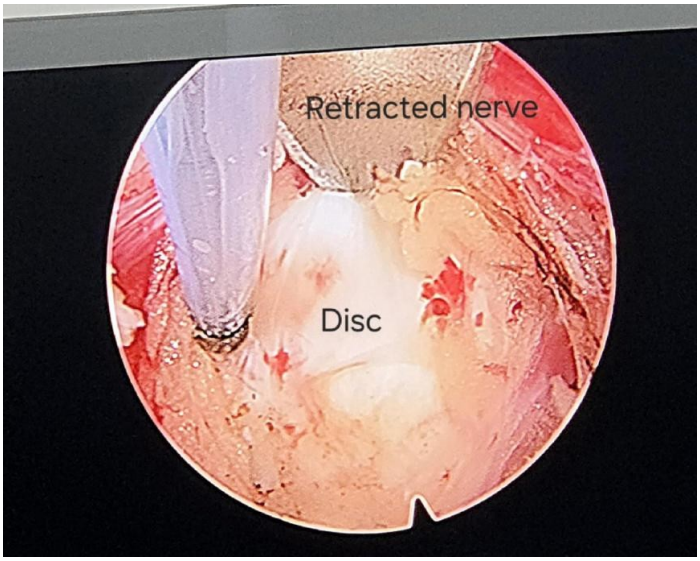


Fig. 4. Showing retracted nerve root behind the separator, the L4-L5 intervertebral disc in the middle (white fibrillar structure).

Step 4: Bipolar Radiofrequency Annuloplasty

Following appropriate nerve-root retraction, a bipolar RF probe was positioned directly on the external surface of the identified annular defect under continuous endoscopic visualization. A BONSS bipolar RF system operating at 4.2 Hz was used with a cut setting of 6 and a coagulation setting of 7. RF energy was applied in a controlled fashion to the annular defect while observing the tissue directly. The procedural endpoint was visible contraction of the treated annular surface. Complete anatomical closure of the annular fissure was not independently demonstrated by post-treatment imaging or histology.

Haemostasis was confirmed under endoscopic visualization. All instruments were then removed and the wound was closed.

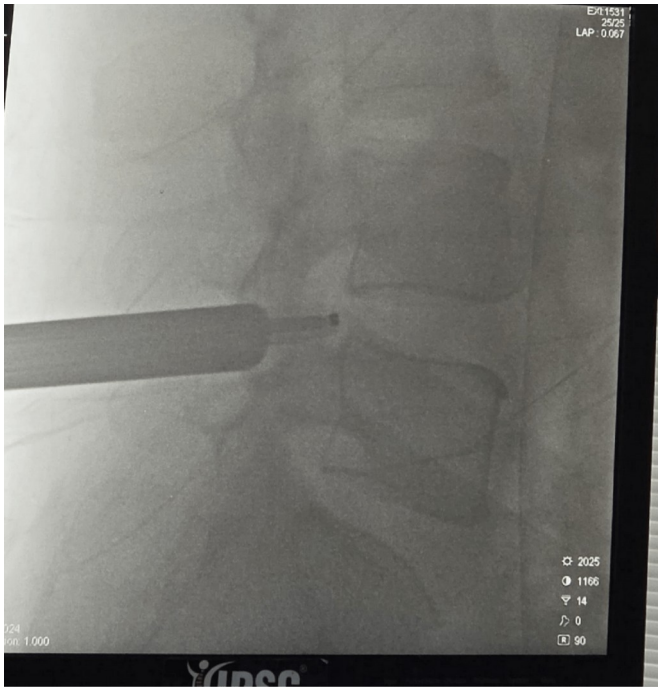


Fig. 5. Showing position of RF probe on lateral view of fluoroscopy.

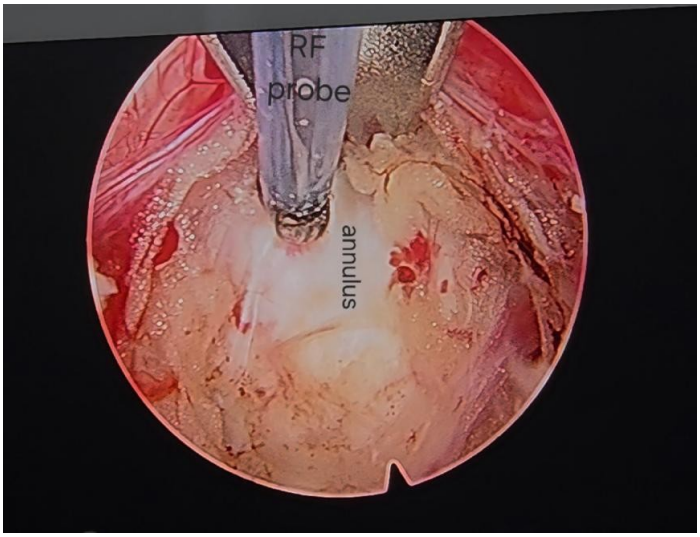


Fig. 6. Endoscopic view of annulus and RF probe.

Outcomes

The patient reported subjective improvement after the procedure. Because the intervention was performed under local anaesthesia with conscious sedation, the immediate postoperative response was not considered a definitive measure of treatment efficacy. Serial follow-up assessments were therefore used to evaluate the subsequent clinical course.

Pain scores, assessed using the Numerical Rating Scale (NRS, 0–10), were as follows:

Assessment Timepoint	NRS Score (0–10)
Pre-procedure (baseline)	8/10
1 day post-procedure	2/10
10 days post-procedure	0/10
3 months post-procedure	0/10
6 months post-procedure	0/10

Table 1. Postoperative NRS pain scores at serial follow-up timepoints.

By the 10-day follow-up visit, the patient reported sufficient improvement to resume activities of daily living without significant discomfort. The same NRS outcome was reported at 3 and 6 months. No immediate procedural complications, including neurological deficit, dural tear, infection, or haematoma, were observed.

Formal ODI, PGIC, prospectively standardized separate axial and radicular pain scores, and analgesic-consumption measures were not collected as standardized outcome instruments at the time of treatment. This is acknowledged as a limitation of the case report.

Review of Literature

Epidemiology and Burden of Discogenic Low Back Pain

Chronic low back pain is multifactorial, and annular pathology represents one possible pain generator. The present case is clinically relevant because an annular tear and HIZ coexisted with symptoms of L5 radicular irritation and an L4-L5 disc protrusion. The diagnostic interpretation

therefore required correlation of the imaging findings with the patient's clinical presentation rather than reliance on HIZ alone.

Pathophysiology of Annular Tears and Discogenic Pain

Annular fissures can be associated with inflammatory changes and nociceptive ingrowth in the outer annulus. Thermal treatment of annular tissue has been proposed to modify collagen and affect nociceptive tissue; however, the precise clinical mechanism of benefit remains uncertain and cannot be established from the present case.

Disc degeneration is initiated by a cascade of biochemical, structural, and biomechanical changes including extracellular matrix imbalance, proteoglycan loss, reduced disc hydration, and progressive annular fatigue failure[4]. As degeneration advances, radial annular fissures develop, allowing nucleus pulposus material to migrate toward the posterior annulus. This disruption exposes nociceptive nerve endings in the outer annulus to pro-inflammatory cytokines including interleukin-1β, tumor necrosis factor-α, and phospholipase A2 released by the NP[9]. Concurrently, pathological neovascularization and hyperinnervation occur, with nerve fibers growing along annular fissures into normally aneural regions[5]. This aberrant ingrowth, mediated principally by the sinuvertebral and basivertebral nerves, substantially amplifies nociceptive signaling and contributes to central sensitization[10].

The sinuvertebral nerve arises from both a somatic branch of the ventral ramus and a sympathetic branch from the grey rami communicantes, innervating the posterior longitudinal ligament, outer annulus fibrosus, and vertebral body periosteum[11]. Its dual somatic-sympathetic composition underlies the characteristic poorly localized, deep axial nature of discogenic pain worsened by sitting, forward flexion, and prolonged loading, as exemplified by the clinical presentation in this case.

Role of Magnetic Resonance Imaging and the High-Intensity Zone

The HIZ on T2-weighted MRI is an imaging correlate of annular fissure and has been associated with discographic abnormalities in published studies. Nevertheless, HIZ may also occur in individuals without pain, and its presence should therefore be interpreted in conjunction with the clinical history and examination. In the present case, HIZ was considered supportive of the annular lesion but was not treated as an independent diagnostic confirmation of discogenic pain.

A meta-analysis by Chen et al., examining 11 controlled studies, demonstrated a robust association between HIZ and abnormal discography (OR = 47.79; 95% CI: 17.07–133.77) and between HIZ and positive pain provocation (OR = 8.65; 95% CI: 6.01–15.23), supporting the diagnostic relevance of the HIZ sign[13]. However, HIZ can be present in approximately 24% of asymptomatic individuals, and its sensitivity is modest (approximately 49% in some analyses)[14]. The current consensus recommends interpreting HIZ findings in conjunction with clinical history and examination rather than as a standalone diagnostic criterion. In the present case, HIZ at L4-L5 combined with classical discogenic pain symptoms and radiculopathy provided a compelling composite indication for endoscopic intervention.

Radiofrequency Annuloplasty: Mechanism of Action

RF treatment of annular tissue has been proposed to produce thermal modification of collagen and to affect nociceptive tissue within or around annular fissures. These mechanisms provide a biological rationale for RF treatment, but collagen contraction, annular closure, and denervation were not directly demonstrated in this patient. The directly observed procedural finding was contraction and sealing of the treated external annular surface.

Unique Learning Point

A notable technical feature of this case was the extradiscal application of bipolar RF directly to the external surface of the annular defect under endoscopic visualization. Direct visualization permitted localization of the abnormal annular tissue and continuous observation of the tissue response during RF application. This differs from techniques in which thermal energy is delivered without direct visualization of the external annular surface.

The principal novelty of the present report is therefore the description of this endoscopically guided extradiscal bipolar RF application and its observed visual endpoint, rather than a claim that the technique has established efficacy or that complete annular sealing or denervation was demonstrated.

Discussion

This case describes a patient with long-standing axial low back pain and left L5 radicular symptoms associated with an L4-L5 annular tear/HIZ and disc protrusion. Following failure of conservative treatment, an interlaminar endoscopic procedure was performed, with decompression of the affected neural structures followed by direct application of bipolar RF to the external annular defect.

The patient's NRS decreased from 8/10 at baseline to 0/10 by day 10 and remained 0/10 at the 3- and 6-month assessments. The patient also reported recovery of activities of daily living. These findings represent a favourable clinical course in this individual patient; however, they cannot establish efficacy of the combined intervention or determine the independent contribution of endoscopic decompression and RF treatment.

The interlaminar approach provided direct access to the L4-L5 region and permitted visualization of the traversing L5 nerve root and the pathological annular region. The use of local anaesthesia with conscious sedation also allowed clinical interaction during the procedure. However, the favourable outcome should not be interpreted as proof of a superior safety profile because a single uncomplicated case cannot establish procedural safety.

A key technical distinction was the application of bipolar RF directly to the external annular defect under endoscopic visualization. The RF electrode was placed on the pathological annular surface and energy was applied until visible retraction and contraction of the treated tissue occurred. This direct visual endpoint is an important technical observation of the case.

The observed tissue retraction should not be equated with complete closure of the annular fissure. No post-treatment imaging or histological examination was performed to demonstrate anatomical sealing. Likewise, the contribution of thermal denervation to pain relief cannot be established from this report.

The absence of neurological deficits despite radicular symptoms indicates that the patient did not have a fixed neurological deficit at presentation. The negative SLR did not exclude symptomatic radicular irritation. The HIZ supported the presence of an annular lesion, but the absence of provocative discography and the coexistence of radicular symptoms limit the certainty with which a single pain generator can be assigned.

The relatively preserved disc height and absence of severe degenerative changes were clinical features of this individual case. However, conclusions regarding predictors of response cannot be drawn from a single patient. Such factors would require evaluation in prospective cohorts.

Conclusion

Strengths and Limitations

The principal strength of this report is the detailed description of an endoscopically guided extradiscal bipolar RF technique, including direct visualization of the annular tissue response. Important limitations include the single-patient design, absence of a comparator, and the combined nature of the intervention, which prevents attribution of the clinical improvement to either endoscopic decompression or RF treatment independently. The diagnosis of discogenic pain was not confirmed with provocative discography, and HIZ was used only as a supportive imaging finding.

The patient also had L5 radicular symptoms, representing a potential additional pain generator. Objective dynamic imaging was not performed, and therefore dynamic instability cannot be established. Standardized functional outcome measures such as ODI and PGIC and prospectively quantified analgesic consumption were not collected. Finally, follow-up was limited to six months and no post-treatment imaging or histological assessment was performed to demonstrate annular closure or denervation.

This case demonstrates the technical feasibility of combining minimally invasive endoscopic treatment with directly visualized extradiscal bipolar radiofrequency application in a carefully selected patient with an L4-L5 annular tear and associated disc protrusion and radicular symptoms. The patient experienced substantial and sustained clinical improvement through six months; however, the contribution of the individual components of the combined intervention cannot be determined from this single case, and the mechanisms of annular contraction and denervation were not directly demonstrated. Prospective studies using standardized functional and patient-reported outcomes, clearly defined procedural parameters, appropriate comparison groups, and longer follow-up are required to determine the efficacy, safety, durability, and appropriate indications of this technique.

References

1. Manchikanti L, Singh V, Pampati V, et al. Evaluation of the relative contributions of various structures in chronic low back pain. Pain Physician. 2001;4(4):308–316.

2. DePalma MJ, Ketchum JM, Saullo T. What is the source of chronic low back pain and does age play a role? Pain Med. 2011;12(2):224–233. doi:10.1111/j.1526-4637.2010.01045.x

3. Shayota B, Wong TL, Fru D, David G, Iwanaga J, Loukas M, Tubbs RS. A comprehensive review of the sinuvertebral nerve with clinical applications. Anat Cell Biol. 2019;52(2):128–133. doi:10.5115/acb.2019.52.2.128

4. Mohd Isa IL, Teoh SL, Mohd Nor NH, Mokhtar SA. Discogenic low back pain: anatomy, pathophysiology and treatments of intervertebral disc degeneration. Int J Mol Sci. 2022;24(1):208. doi:10.3390/ijms24010208

5. Kim HS, Wu PH, Jang IT. Lumbar degenerative disease part 1: anatomy and pathophysiology of intervertebral discogenic pain and radiofrequency ablation of basivertebral and sinuvertebral nerve treatment. Int J Mol Sci. 2020;21(4):1483. doi:10.3390/ijms21041483

6. Ahn Y. Percutaneous endoscopic decompression for lumbar spinal stenosis. Expert Rev Med Devices. 2014;11(6):605–616. doi:10.1586/17434440.2014.940314

7. Saal JA, Saal JS. Intradiscal electrothermal treatment for chronic discogenic low back pain: a prospective outcome study with minimum 1-year follow-up. Spine. 2000;25(20):2622–2627. doi:10.1097/00007632-200010150-00010

8. Li Z, Wei W, Cao Y, et al. Percutaneous bipolar radiofrequency thermocoagulation for the treatment of lumbar disc herniation. J Clin Neurosci. 2016;32:77–81. doi:10.1016/j.jocn.2015.11.034

9. Adams MA, Roughley PJ. What is intervertebral disc degeneration, and what causes it? Spine. 2006;31(18):2151–2161. doi:10.1097/01.brs.0000231761.73859.2c

10. Candan B, Comert A. A review of the sinuvertebral nerve in discogenic pain: advances in diagnosis and management. J Turkish Spinal Surg. 2024;35(3):162–166.

11. Bogduk N. The innervation of the lumbar spine. Spine. 1983;8(3):286–293. doi:10.1097/00007632-198304000-00009

12. Aprill C, Bogduk N. High-intensity zone: a diagnostic sign of painful lumbar disc on magnetic resonance imaging. Br J Radiol. 1992;65(773):361–369. doi:10.1259/0007-1285-65-773-361

13. Chen L, Ye L, Liu H, Yang P, Bai W. The correlation between the high-intensity zone on T2-weighted MRI and positive discography outcomes: a meta-analysis. J Orthop Surg Res. 2017;12(1):26. doi:10.1186/s13018-017-0527-5

14. Cao P, Jiang L, Zhuang C, et al. Does the high-intensity zone of lumbar intervertebral disc at MRI have diagnostic value for discogenic low back pain? A meta-analysis. BMC Musculoskelet Disord. 2024;25(1):910. doi:10.1186/s12891-024-07878-8

15. Saal JA, Saal JS. Management of chronic discogenic low back pain with a thermal intradiscal catheter. Spine. 2000;25(3):382–388. doi:10.1097/00007632-200002010-00021

16. Freeman BJ, Walters RM, Moore RJ, Fraser RD. Does intradiscal electrothermal therapy denervate and repair experimentally induced posterolateral annular tears in an animal model? Spine. 2003;28(23):2602–2608. doi:10.1097/01.BRS.0000101445.17482.3A

17. Choy DSJ. Percutaneous endoscopic laser annuloplasty for discogenic low back pain. Photomed Laser Surg. 2009;27(4):571–574. doi:10.1089/pho.2008.2368

18. Ahn Y, Lee SH. Outcome predictors of percutaneous endoscopic lumbar discectomy and thermal annuloplasty for discogenic low back pain. Acta Neurochir (Wien). 2010;152(10):1695–1702. doi:10.1007/s00701-010-0726-2

Declarations

Patient Perspective

The patient reported substantial improvement in his back and leg pain after the procedure and was able to resume routine activities of daily living by the early follow-up period. He remained clinically improved at the 3- and 6-month follow-up visits. A formal written patient-perspective statement was not prospectively collected at the time of treatment.

Patient Consent

Written informed consent was obtained from the patient for publication of this case report and any accompanying clinical data. A copy of the written consent is available for review by the Editor-in-Chief of this journal upon request.

Ethics Approval

Formal institutional ethics committee approval was not required for this single-patient case report, in accordance with standard journal policy for case reports.

Conflict of Interest

The authors declare no conflicts of interest relevant to this publication. No financial or personal relationships exist that could inappropriately influence or bias the content of this report.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Author Contributions

Dr Nishansh Singh Vimal: Literature review, clinical assessment, procedural assistance, data collection, manuscript drafting, and critical revision of the manuscript. Dr (Maj.) Pankaj N. Surange: Conceptualization, supervision, procedural expertise, critical review of the manuscript, and final approval of the version to be published. Dr Anusha Arepalli: Literature review, clinical assessment, data collection, manuscript drafting, and critical revision of the manuscript. Dr Shalley Singh: Manuscript drafting and critical revision of the manuscript. Dr Sowjanya Kommuri: Manuscript drafting and critical revision of the manuscript. Dr Swati Bhatt: Conceptualization, supervision, procedural expertise, critical review of the manuscript, and final approval of the version to be published.