International Journal of Research in Orthopaedics
Movva V et al. Int J Res Orthop. 2026 Jul;12(4):1136-1140
https://www.ijoro.org

DOI: https://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20262054

Case Report

Clinical and radiological resolution of multilevel lumbar disc extrusion and spinal stenosis following combinatorial intradiscal bone marrow aspirate concentrate and epidural platelet lysate: a longitudinal case study

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Received: 21 April 2026
Accepted: 05 June 2026

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ABSTRACT

Lumbar disc degeneration and spinal stenosis are the leading causes of chronic low back pain and radiculopathy, often resulting in significant functional impairment and the reduced quality of life. Conventional treatments, surgical interventions add genetic predisposition are the confounding variable outcomes. Orthobiologics like bone marrow aspirate concentrate (BMAC), with their inherent mesenchymal stem cells and growth factors, have been promising as a clinical and therapeutic minimally invasive approach in the management of lumbar disc degeneration and spinal stenosis. A 55-year-old male presented with chronic low back pain radiating to the right lower limb, and was refractory to conservative management. Baseline showed moderate pain (NPRS 6/10), mild spinal listing, Grade II tenderness (L3-S1), dermatomal sensory deficits (L3-S1), mild motor weakness (L5-S1) and positive straight leg raise (SLR) and slump tests. The patient underwent fluoroscopy-guided intradiscal BMAC injection at L4-L5 and L5-S1 levels. At six months follow-up, significant improvement was observed, with pain reduced to NPRS 1/10, minimal spinal listing, and decreased add with grade I at L5-S1. Neurological recovery included normalization of motor strength, minimal residual sensory deficit, and negative SLR and slump tests. The present case demonstrates that intradiscal BMAC therapy can result in significant symptomatic, functional and neurological improvement in lumbar disc degeneration with radiculopathy. The study advocates for regenerative therapy with minimal invasive approach and as an alternative to the surgery, however larger controlled studies with long-term follow-up are warranted.

Keywords: Lumbar disc degeneration, Lumbar spinal stenosis, Chronic low back pain, Bone marrow aspirate concentrate, Orthobiologics

INTRODUCTION

Lumbar disc degeneration and spinal stenosis are among the most prevalent causes of chronic low back pain and radiculopathy, particularly in middle-aged and elderly populations.[1,2] These conditions are characterized by progressive intervertebral disc dehydration, loss of disc height, annular fissuring, and narrowing of the spinal canal, ultimately leading to nerve root compression and neurological deficits.[1-3] Clinically, patients present with axial back pain, radiating leg pain, sensory disturbances, and functional limitations that significantly impair quality of life.[2] Conventional management including medications, physiotherapy and epidural steroid injections focuses

primarily on symptomatic relief rather than reversing the underlying pathology.[4] In refractory or advanced cases, surgical interventions such as discectomy or spinal fusion are often considered; however, these are associated with complications with requiring prolonged recovery and inconsistent outcomes.[4,5]

In recent years, regenerative and orthobiologics therapies have gained increasing attention for their ability to target the underlying disease process.[6,7] BMAC, rich in mesenchymal stem cells, growth factors and anti-inflammatory cytokines, have shown promising results in negate inflammation, promoting tissue repair and improve functional outcomes.[7,8] Emerging evidence supports the safety and efficacy of intradiscal BMAC-based therapies in patients with degenerative disc disease.[7,8]

This report presents the clinical outcome of intradiscal BMAC therapy in a 55-year-old male with lumbar disc degeneration and spinal stenosis, demonstrating significant symptomatic and functional recovery over a period of five months follow-up study.

CASE REPORT

Patient information

A 55-year-old male presented with chronic lumbosacral pain radiating to the right lower limb.

Medical history

The patient reported insidious onset of low back pain that progressively evolved into right-sided radiculopathy. Symptoms were refractory to conservative management, including NSAIDs and physiotherapy. There was no history of trauma, corticosteroid use, or alcohol abuse. The patient had a known history of hypertension, controlled with medication.

Family history

No such cases were reported in the family.

Psychosocial history

Persistent lower back pain significantly limited the patient's mobility and contributed to psychological stress. However, no formal psychiatric consultation was sought.

Genetic information

No relevant genetic testing was performed.

Relevant past interventions

Patient add had reported pain with pain in lower back which was radiating down towards right leg.

Clinical findings

At initial presentation, the patient reported moderate pain with a Numerical pain rating scale (NPRS) score of 6/10. On observation, he exhibited a mesomorphic, muscular build with a mild listing of the spine towards the left. Palpation revealed grade II tenderness over the L3 to S1 spinal and paraspinal regions. Neurological examination demonstrated involvement of the right-sided dermatomes (L3, L4, L5, and S1) with diminished sensation, along with mild motor weakness in the corresponding myotomes (L5 and S1). Nerve tension tests, including the straight leg raise (SLR) and slump test, were positive on the right lower limb, indicating nerve root irritation. The neurological examination was highly suggestive of multilevel nerve root involvement, as detailed in the following baseline metrics (March 2025) (Table 1).

Table 1: Baseline clinical metrics (March 2025).

Clinical parameters	Measurement/observation
Pain score (NPRS)	6/10
Antalgic posture	Mild listing of spine towards the left
Palpatory tenderness	Grade - II (L3 to S1)
Dermatomal deficit	Right L3, L4, L5, and S1 - diminished sensation
Myotomal weakness	L5 and S1-mild weakness
Neurodynamic testing	SLR and slump test - positive (right)

Diagnostic assessment

Lumbar disc degeneration and lumbar stenosis with a NPRS score of 6/10. On observation, he exhibited a mesomorphic, muscular build with a mild listing of the spine towards the left.

Palpation revealed grade II tenderness over the L3 to S1 spinal and paraspinal regions indicating significant mechanical and inflammatory irritation of the traversing and exiting nerve roots. The diminished sensation in the L3-S1 dermatomes suggested a broad field of neural compromise, probably secondary to the multilevel disc pathology confirmed on imaging.

The extrusion at L4-L5 was particularly pathological, as it involved the displacement of nucleus pulposus material beyond the confines of the annulus fibrosus, occupying a significant volume of the central canal and leading to frank spinal canal stenosis. While the primary extrusion was paracentral to the left, the resulting stenosis and diffuse bulge significantly impacted the right-sided lateral recess and neural foramen, correlating with the patient's right-sided radicular symptoms.

Furthermore, the paracentral fissure at L5-S1 indicated a breach in the annulus, allowing inflammatory nuclear material to approximate the thecal sac and neural elements.

Table 2: MRI findings: pre-impression-March 2023.

Spinal segment	Radiological findings	Pathological implications
L4-5	Diffuse bulge with posterior central and left paracentral disc extrusion	Severe spinal canal stenosis; compression of left traversing nerve root; bilateral neural foraminal narrowing
L5-S1	Posterior, left paracentral fissure with protrusion	Mild thecal sac indentation; neural foraminal narrowing; no acute nerve root compression initially
L3-4	Screening changes noted in later reports	Initial broad-based bulge
D5-6	posterior disc herniation	Thecal sac compression and mild cord indentation.
General	Lumbar spondylosis	Global degenerative changes with loss of disc hydration.

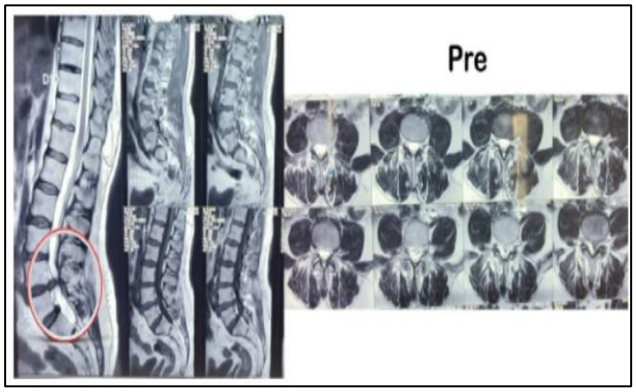

Figure 1: MRI findings: pre-impression-March 2023.

Therapeutic intervention

Following the failure of conservative management, the patient underwent a two-staged regenerative intervention in March 2025. The procedure was designed to address both the internal disc disruption and the secondary neural inflammation through targeted delivery of autologous biologics.

Phase I: epidural platelet lysate administration (24-03-2025)

The initial phase focused on modulating the neuro-inflammatory environment of the lumbar epidural space. Platelet Lysate (PL) was injected into the lumbar epidural space to target the "hot" nerve roots and facilitate an immediate reduction in radicular pain.

Phase II: intradiscal BMAC and disc repair (31-03-2025)

The second phase involved the definitive treatment of the L4-5 and L5-S1 discs. Under fluoroscopic guidance and after confirming the internal disc architecture via discography with dye, the BMAC was injected directly into the nucleus pulposus of the symptomatic segments.[9,10]

Follow-up and outcomes

Clinical outcomes were evaluated at baseline (day of treatment) and at six months post-procedure using the NPRS for pain assessment and nerve tension tests, including the Straight Leg Raise (SLR) and Slump test, for functional evaluation. The NPRS score demonstrated a marked reduction in pain from 6/10 at baseline to 1/10 at six months post-procedure represents an 83% improvement, which is significantly higher than the standard 30-50% improvement often cited in orthopaedic literature for successful outcomes.

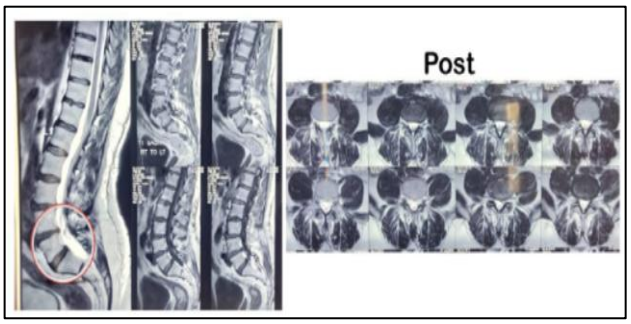

Figure 2: MRI findings: post-impression-August 2025.

On observation, the patient initially exhibited a mesomorphic, muscular build with mild left-sided spinal listing, which became negligible at follow-up, indicating improved postural alignment. Palpation findings improved from grade II tenderness over the L3-S1 spinal and paraspinal regions at baseline to grade I tenderness localized to the L5-S1 region at six months. Neurological examination at baseline revealed diminished sensation in the right L3, L4, L5, and S1 dermatomes, along with mild weakness in the L5 and S1 myotomes, and positive SLR and Slump tests on the right side, suggestive of neural involvement. At six months post-procedure, there was substantial neurological recovery, with only minimal residual sensory deficit in the right L5 and S1 dermatomes and normalization of myotomal strength suggesting that the physiological environment around the L5 and S1 nerve roots had stabilized enough to allow for full motor unit recruitment. Furthermore, both SLR and Slump tests were negative, indicates that the mechanical or inflammatory irritation of the nerve roots has been largely abolished. Overall, our findings demonstrate significant symptomatic, functional and neurological improvement over the course of treatment and the patient demonstrated

a remarkable clinical recovery, characterized by the rapid resolution of radicular pain and the restoration of neurological function (Table 3). The clinical success was mirrored by a profound transformation in the structural appearance of the lumbar spine on follow-up imaging (Table 4). The most significant radiological change was observed at the L4-5 level. The pre-operative report explicitly identified "spinal canal stenosis" secondary to a disc extrusion. The post-operative report definitively stated there was "No central canal stenosis," representing a complete radiological resolution of the stenotic condition. This transition from a central canal-occupying extrusion to a simple broad-based bulge indicates a massive reduction in the volume of the herniated material. Similarly, at L5-S1, the previously noted "indentation" and "narrowing" resolved to a state of "no significant nerve root compression," explaining the clinical normalization of the S1 myotomes and dermatomes.

Table 3: Comparative longitudinal clinical outcomes.

Clinical metrics	Baseline (March 2025)	Follow-up (August 2025)	Clinical significance
Pain score (NPRS)	6/10	1/10	Exceeds MCID for lumbar pain
Spine listing	Mild (left)	Negligible	Restoration of normal axial posture
Tenderness	Grade-II (L3-S1)	Grade-I (L5-S1)	Marked reduction in local inflammation
Myotomes (L5/S1)	Mild weakness	Normal	Functional recovery of motor units
Dermatomes (L5/S1)	Diminished sensation	Very mild involvement	Improved sensory nerve conduction
Neurodynamics	SLR/slump positive	SLR/slump negative	Resolution of neural mechanosensitivity

Table 4: Comparative radiological findings (pre-op vs. post-op).

Spinal segment	Pre-op MRI (February 2023)	Post-op MRI (July 2025)	Radiological significance
L4-L5	Diffuse bulge+extrusion; spinal canal stenosis	Broad-based bulge; no central canal stenosis	Resorption of extruded material; widening of central canal
L5-S1	Fissure+protrusion; mild thecal sac indentation	Diffuse bulge; no significant nerve root compression	Reduction in focal protrusion volume; relief of thecal sac pressure
General	Extrusion/protrusion	Annular tears noted	Progression from "displaced tissue" to

DISCUSSION

The present case demonstrates a marked clinical improvement following intra-discal BMAC therapy, as evidenced by significant reduction in pain (NPRS score from 6/10 to 1/10), improvement in neurological function, and restoration of daily activity. The patient initially presented with classical features of lumbar disc degeneration with radiculopathy, including radiating pain, dermatomal sensory deficits, mild motor weakness and positive nerve tension signs (SLR and slump test), which are indicative of nerve root compression secondary to disc pathology and spinal canal narrowing.[11] Following BMAC treatment, there was a substantial reduction in pain intensity along with improvement in both sensory and motor deficits. The transition from positive to negative SLR and slump tests further supports the resolution of neural irritation. These findings are consistent with recent evidence demonstrating that intradiscal regenerative therapies significantly improve pain and functional outcomes in chronic low back pain patients.[4] The therapeutic benefits observed in this case can be attributed to the biological properties of BMAC. Mesenchymal stem cells (MSCs) present in BMAC exert strong paracrine effects by secreting anti-inflammatory cytokines and growth factors that regulate inflammation, promote tissue repair and enhance extracellular matrix remodelling.[12,13] These mechanisms contribute to reduced nerve root irritation, improved disc microenvironment, and potential regeneration of degenerated disc tissue. Recent systematic reviews and meta-analyses have further confirmed that MSC-based intradiscal therapies are safe and effective, with sustained improvements in pain and disability scores.[7] Emerging clinical evidence, including recent randomized trials, has demonstrated that intradiscal stem cell therapies can improve disc integrity, increase disc height, and provide long-term symptomatic relief in degenerative disc disease.[14] Furthermore, advances in regenerative medicine highlight the potential of orthobiologic therapies to modify disease progression rather than merely alleviating symptoms.[6] An important clinical implication of this case is the avoidance of major spine surgery, which is often considered in patients with persistent symptoms. The significant improvement achieved with a minimally invasive orthobiologic intervention highlights its potential as an effective alternative or adjunct to conventional therapies. This is particularly relevant for patients seeking to avoid surgical risks or those with comorbidities such as hypertension, as seen in the present case. However, despite the encouraging outcome, this report represents a single case and the findings cannot be generalized. Long-term follow-up and

larger controlled studies are required to establish the efficacy, optimal dosing, and safety profile of intra-discal BMAC therapy. Additionally, imaging correlation (e.g., MRI-based disc regeneration assessment) would further strengthen the clinical observations.

CONCLUSION

Intradiscal BMAC therapy Add containg MSCs, Growth factors and anti-inflammatory cytokines demonstrated significant an improvement in the, neurological function and overall clinical outcomes in this patient with lumbar disc degeneration and radiculopathy. By addressing the underlying pathology, this regenerative approach offers a promising alternative to conventional therapies and may delay or prevent the need for surgery. However, large-scale studies are essential to translate these findings and to optimize treatment strategies.

Funding: Regen Ortho Sport Movva Health Care Hospital
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee (EC/NEW/INST/2024/TE/0518)

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Cite this article as: Movva V, Alluru A, Shah M, Khaleel S, Mudhu SM, Venkatesan V. Clinical and radiological resolution of multilevel lumbar disc extrusion and spinal stenosis following combinatorial intradiscal bone marrow aspirate concentrate and epidural platelet lysate: a longitudinal case study. Int J Res Orthop 2026;12:1136-40.