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Case Report

Favorable Clinical and Magnetic Resonance Imaging (MRI) Outcomes Following a Single Epidural Injection of Expanded Stem Cell Therapy in a Patient with a Treatment-Resistant Lumbar Disc Bulge and Nerve Compression: A Case Report

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Abstract

Lumbar disc prolapse remains one of the most frequent causes of chronic low back pain and sciatica, often leading to long-term disability and reduced quality of life. Conventional treatments such as analgesia, physiotherapy, steroid injections, and surgery provide temporary symptom relief but do not reverse the degenerative disc process and are often associated with recurrence or limited functional recovery. Regenerative medicine, particularly the use of Adipose-Derived Mesenchymal Stem Cells (ADSCs), has emerged as a novel therapeutic strategy with both structural and neuroprotective potential.

This article reviews the current evidence and presents a case of a 31-year-old male with chronic, treatment-resistant L5/S1 discogenic pain who underwent autologous ADSC therapy. Stem cells were harvested from abdominal fat, culture-expanded over six weeks, and combined with autologous Platelet-Rich Plasma (PRP). A total of 100 million ADSCs were injected in into the following sites, epidural space, paraspinal deep tissues, facet joint, and interspinous bursae under ultrasound guidance. Six months after treatment, the patient reported significant pain resolution, and Magnetic Resonance Imaging (MRI) confirmed reduced disc bulge without nerve root compression.

ADSCs exert anti-inflammatory, trophic, and extracellular matrix-reparative effects that target both the degenerative disc and radicular inflammation seen in sciatica. While current literature shows promising clinical outcomes and a favourable safety profile, further large-scale randomized studies are necessary to validate long-term efficacy, define optimal dosing protocols, and address regulatory and economic challenges. This case adds to the growing body of evidence supporting ADSC therapy as a viable regenerative option for discogenic back pain unresponsive to standard care.

Keywords: Adipose-Derived Stem Cells; Mesenchymal Stem Cells; Lumbar Disc Prolapse; Sciatica; Regenerative Medicine; Platelet-Rich Plasma; Low Back Pain; Discogenic Pain Therapy

Introduction

Lumbar disc prolapse is a common structural cause of low back pain and sciatica, significantly impacting quality of life and global productivity. While conventional treatments-such as analgesics, physiotherapy, epidural steroid injections, and surgery-offer symptomatic relief, they often fail to reverse the degenerative pathology of the intervertebral disc. Moreover, recurrent herniation and chronic radiculopathy remain persistent challenges post-treatment [1,2].

Regenerative medicine is reshaping the management of discogenic pain, particularly using Mesenchymal Stem Cells (MSCs). Among various MSC sources, Adipose-Derived Stem Cells (ADSCs) are favored due to their ease of harvest, abundant yield,

and potent immunomodulatory and trophic effects [3]. ADSCs secrete cytokines and growth factors that modulate inflammation, stimulate matrix repair, and support neural healing-providing a comprehensive approach to disc regeneration [4].

Recent clinical studies show that intradiscal and paraspinal injections of autologous or allogeneic ADSCs can reduce pain and disability scores and improve disc morphology on MRI [1,2]. The co-administration of ADSCs with bioactive carriers like Platelet-Rich Plasma (PRP) or hyaluronic acid appears to further enhance outcomes [5]. While long-term data remain limited, early evidence supports the safety and feasibility of ADSC-based regenerative interventions [1,3,6].

Case Presentation

A 31-year-old male sustained a spinal injury in 2014 during a head-on collision at a four-wheel-drive competition. He developed persistent lower back pain. Neurological evaluation raised initial clinical suspicions of complex regional pain syndrome.

MRI in 2014 revealed a focal central disc bulge at L5/S1 with mild bilateral nerve root contact but no spinal canal compromise. Conservative management with physiotherapy, Celecoxib 200 mg BID, Tramadol 50 mg BID, and Pregabalin 150 mg BID proved insufficient. In 2021, he underwent L5-S1 radiofrequency ablation with only transient benefit. By 2022, symptoms progressed with central and left-sided back pain, with left thigh and calf fatigue. No motor or sensory deficits were noted.

Repeat MRI demonstrated a slightly progressive central and left paracentral disc protrusion at L5/S1, with annular tear and contact of the descending left S1 nerve root. Interspinous bursitis was noted at L4/5 and L5/S1. Despite epidural steroid and two level L4/5 and L5/S1 interspinous bursae injections, relief was minimal. Surgical decompression was ruled out by the spinal orthopaedic surgeon due to the absence of significant nerve compression. A second radiofrequency ablation failed.

The patient opted for autologous ADSC therapy. Adipose tissue was harvested from the abdomen, enzymatically digested with collagenase (0.2 U/mL), and the stromal vascular fraction (SVF) isolated via centrifugation. Cells were cultured in Dulbecco's Modified Eagle Medium (DMEM) and expanded over six weeks, then cryopreserved. Viability was confirmed.

Six weeks later, following informed consent, autologous PRP was prepared. Under local anaesthesia ropivacaine 0.2% a total of 100 million ADSCs combined with PRP implants were implanted under ultrasound (USS) guidance as below:

- 25 million cells via interlaminar L5/S1 epidural as in video 1
- 25 million into left L5/S1 paraspinal deep tissue region
- 25 million into the left L5/S1 facet joint
- 25 million into the L4/5 and L5/S1 interspinous bursae and ligaments

We avoided intra-discal stem cell therapy to avoid the risk of discal infection. During regular follow ups, gradual improvement occurred and at six months post-treatment, the patient reported significant symptom resolution. Follow-up MRI showed a reduction in disc bulge and no residual nerve root compression as in Fig. 1.

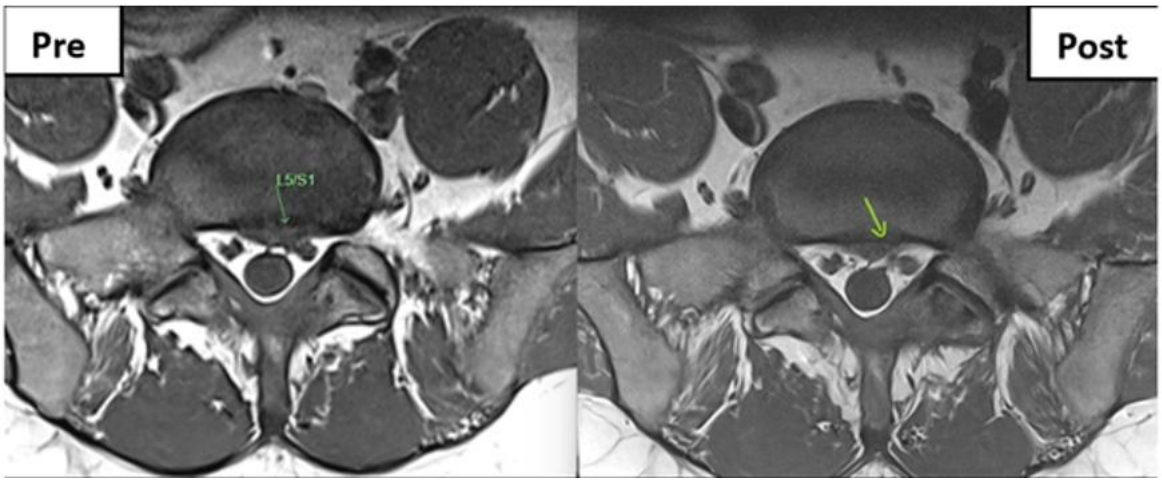

Figure 1: MRI T2 transverse images indicate a decrease in the L5/S1 disc protrusion and associated nerve compression.

Discussion

ADSCs are increasingly being recognized as a therapeutic option for lumbar disc degeneration. Their paracrine secretions modulate inflammation, inhibit catabolic enzymes, and promote disc cell viability [3,4,7]. In Phase I human trials, matrilin-3 primed ADSC spheroids with Hyaluronic Acid (HA) were safe and improved pain scores at 6 million cells per disc [7].

Animal studies provide further support: in canine nucleotomy models, HA-ADSC constructs restored disc structure and matrix composition [8].

Ongoing trials, including a Phase II RCT, aim to standardize cell delivery and dosing [9]. The American Society of Interventional Pain Physicians (ASIPP) cautiously supports biologics in spine care but emphasizes the need for Level I evidence and long-term follow-up [10].

Remaining Challenges

- Dose and route variation: Studies use between 6-40 million cells across intradiscal, epidural, and paraspinal routes [7]
- Durability: Most follow-ups are short-term; long-term structural and functional data are sparse
- Safety: No serious adverse events have been reported to date, but larger trials are needed
- Regulatory and cost barriers: ADSC therapies must meet GMP standards and demonstrate cost-effectiveness for widespread adoption

Our case demonstrated a significant clinical and radiological improvement, which is particularly encouraging given the lack of response to any prior therapies over the ten years since the injury. In this case, intra-discal stem cell therapy was deliberately avoided to minimise the risk of discal infection, although we acknowledge that intra-discal regenerative therapy may offer superior efficacy in treating degenerative disc disease [11].

Conclusion

Adipose-Derived Stem Cell (ADSC) therapy is an emerging regenerative treatment for lumbar disc prolapse and sciatica, addressing the underlying causes of disc degeneration and radicular pain. This case highlights the potential of ADSCs to promote structural repair and achieve symptomatic resolution where conventional therapies have failed. Early clinical data support the safety and efficacy of ADSCs, particularly when combined with Platelet-Rich Plasma (PRP), hyaluronic acid, or both. However, large-scale, controlled trials with standardized protocols and extended follow-up are essential to validate these outcomes and integrate this therapy into mainstream clinical practice.

Conflict of Interests

The author declares no conflict of interest.

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Consent for Publication

Written informed consent was obtained from the patient for publication of this case report and any accompanying images or videos.

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