

Mesenchymal Stem Cell Therapy in Cervical Spine Compression: A Case Report

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ABSTRACT

The remarkable properties of Mesenchymal Stem Cells (MSC) have been recently investigated in a variety of clinical conditions with promising outcomes. Downregulation of the overproduction of proinflammatory cytokines through immunomodulation, along with the secretion of growth factors are perhaps the most investigated mechanisms of action of MSC. Recently, MSC therapy has received great attention while dealing with degenerative arthropathy-related ailments, including spinal cord-associated conditions, such as Cervical Spine Compression (CSC). Clinical diagnosis of CSC is often developed laterally with other pathologies, degeneration of tissue, and other related complications. Though surgery is often recommended in these sceneries, the invasiveness of this procedure is clear, and some patients are not candidates due to other diagnosed conditions. In this case report, a patient presenting a notorious case of CSC came to our clinic on August 2022 at Playa del Carmen, Mexico, to receive allogenic MSC therapy. Spinal stenosis at C5-C6 with mild cord compression was observable through Magnetic Resonance Imaging (MRI) during the first medical consultation. The medical protocol involved local infiltrations of adipose derived-MSC, MSC derived exosomes and Platelet Rich Plasma (PRP) within a 5-day period. Additionally, as part of a multidisciplinary approach, intravenous (IV) nutrition and O2 therapy were performed. Three days after the MSC infiltration, improvement in joint pain and straighter standing was reported along with enhanced balance, supporting the anti-inflammatory properties of MSC. Five months after MSC therapy, a subsequent MRI showed noteworthy improvement in the spinal stenosis in C5-C6; along with a clinically significant decrease in muscle cramps and muscle spasms, which was attributable to the regenerative properties of MSC therapy. Overall, the patient's quality of life improved and clinical evaluation stated spine surgery was no longer necessary.

Keywords: Cervical Spine, Disc Degenerative Disease, Immunomodulation, Inflammation, Mesenchymal Stem Cells.

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INTRODUCTION

Cervical spine compression (CSC) is considered to be the consequence of a degenerative condition, in which the gradual deterioration of the intervertebral discs (IVDs) results in the overproduction of pro-inflammatory cytokines, ultimately leading to anatomic changes. Normally, IVDs act as shock absorbers during spinal mobilization, however, the overactivation of the immune system contributes to accelerate the loss of the main function [1]. Nowadays, the prevalence of CSC, according to the Global Burden of Disease (GBD) is 10.5 per 100,000 people, resulting in an estimated of 768,473 new cases worldwide annually [2-4]. As a consequence, CSC appears to be a common healthcare problem that could seriously affect the quality of life (QoL) of patients, creating a huge economic pressure [5]. Conventional treatment for CSC generally includes the use of steroids, local anesthetics, and other blocking agents directed for pain relief; however, the results are often ineffective since the afore mentioned drugs are not fully designed to promote the regeneration of degenerated cervical discs [5-7]. Although surgical intervention is frequently performed with moderate results, this clinical approach could lead to increased odds of complications and morbidities. Moreover, it is important to recall that not all patients are candidates due to other related health problems, including the use of anticoagulants for cardiovascular conditions [8-10]. Therefore, the need for safe and efficient options for CSC's treatment seems imperative.

In recent years, Regenerative Medicine in combination with intravenous (IV) nutrition and oxygen (O₂) therapy, has been found as a viable option to slow down degenerative conditions, including orthopedic and neurological disorders [11,12]. One promising therapeutic strategy to reduce the expression of pro-inflammatory cytokine profiles and promote IVDs regeneration might be the therapeutic use of MSC which attempt to reestablish a normal and healthy environment within the affected areas. Even though MSC can be easily isolated from bone marrow and umbilical cord [3,13-14], Adipose-derived-MSC (ADMSC) have been widely studied for therapeutic purposes as they have the potential to immunomodulate and control the upregulation of the immune response, contributing to reduce damage of the affected tissues, ultimately allowing their regeneration through the secretion of anti-inflammatory cytokines and bioactive molecules. Moreover, multiple studies have proven that MSC therapy can be combined with MSC derived exosomes in order to enhance their paracrine signaling communication [3,13-14].

The therapeutic potential of ADMSCs has been described in various studies due to the significant improvement in

patients with spinal cord-associated conditions. Clinical trials have been conducted to demonstrate that MSC could halt the degeneration process of IVDs [13,15]; for example, Yoshikawa T, et al. [10]. reported for the first time a significant reduction in pain and rehydration of the treated disc after percutaneous injection of autologous MSC [16]. Similar results were obtained by Kumar and collaborators, reporting a significant improvement in pain reduction and disc rehydration in 6 out of 10 patients [17]. Likewise, Orozco L, et al. [18]. reported in a study of 10 patients which 90% informed a reduction in their clinical symptoms and disability, which was greatly reduced three months after transplantation [18]. Noteworthy, none of the mentioned clinical trials reported significant side effects, thus, confirming the safety and good tolerability of MSC therapy.

In this manuscript, we present a notorious case of CSC with spinal stenosis at C5-C6 and mild compression with important paresthesia. The Stem Cell Therapy (SCT) protocol consisted on paravertebral and IV infiltration of ADMSC, in combination with MSC derived exosomes and Platelet Rich Plasma (PRP); along with IV nutrition and O₂ therapy. Three days after the infiltration of MSC an overall improvement was reported; and only five months later, a subsequent MRI showed noteworthy improvement in the spinal stenosis in C5-C6, along with the enhancement of the patient's QoL.

CASE REPORT

A 66-year-old man with a medical history of diagnosed Spinal Cord Compression, Spinal Stenosis and Cervical & Lumbar Facet Arthropathy was admitted to our clinic at GIOSTAR Mexico-Playa del Carmen, Mexico in August 2022, to receive ADMSC Transplant, due to generalized paresthesia from torso down, gait disturbance and reduced mobility.

His condition began in October 2019, when he attempted to dive into a pool and landed on his feet as he entered the water. He immediately experienced cramping and numbness in his back and arms. Days later, he developed drop foot, an abnormal gait, and restricted mobility, accompanied by numbness from the neck down. A cervical MRI was performed revealing compression of C7-T1. In December of 2019, he underwent a cervical discectomy at C7-T1 due to spinal fusion. Although he regained the ability to walk, his recovery was slow, and he experienced hypersensitivity. The post-surgery cervical MRI showed degenerative changes, neural foraminal narrowing and spinal stenosis at C5-6 with mild cord compression. Additionally, postsurgical changes in C7-T1 were observed (Figure 1-A). Due to a reduction in mobility, loss of balance and the need of walking assistance, his QoL was in severe decline by mid-2022, leading the patient to pursuit different therapeutic options.

The patient, previously diagnosed by his regular physician with Spinal Stenosis & Facet Arthropathy in C5-C6 and lumbar spine, was admitted at our clinic to receive SCT. His symptoms upon admission included paresthesia mainly in arms and legs, manifested by numbness from neck down, more pronounced in torso, legs, a lumbar spine. Additional symptoms included gait disturbance, poor balance, and the need of a mobility walker. On physical examination the patient showed normal muscle tone, incomplete motion ranges of the neck and limbs with normal reflexes.

As part of his SCT protocol, the patient received IV ADMSC in combination with local paravertebral infiltrations of ADMSC, PRP and MSC derived exosomes in C5-C6 and lumbar spine; additionally, the patient received IV nutrition and O₂ therapy through a five-day course treatment as depicted in Table 1. At the end of the protocol, he was discharged.

Three days after completion of the SCT protocol, the patient reported an improvement in the arthritic pain in his arms, improved ability to stand up straighter and enhanced balance, along with reduction in blood pressure levels.

In January 2023, five months after receiving SCT at GIOSTAR Mexico – Playa del Carmen, it is stated that muscle cramps ceased, muscle spasms were greatly reduced, stable blood pressure levels were achieved, and strength in mobility was reported. An additional cervical MRI showed significant improvement in spinal stenosis in C5-C6, specifically on the local area of SCT infiltration (Figure 1-B). No additional information on the lumbar spine was collected. Further evaluation of his regular physician stated that spine surgery was no longer necessary since the compression of the IVDs was relieved.

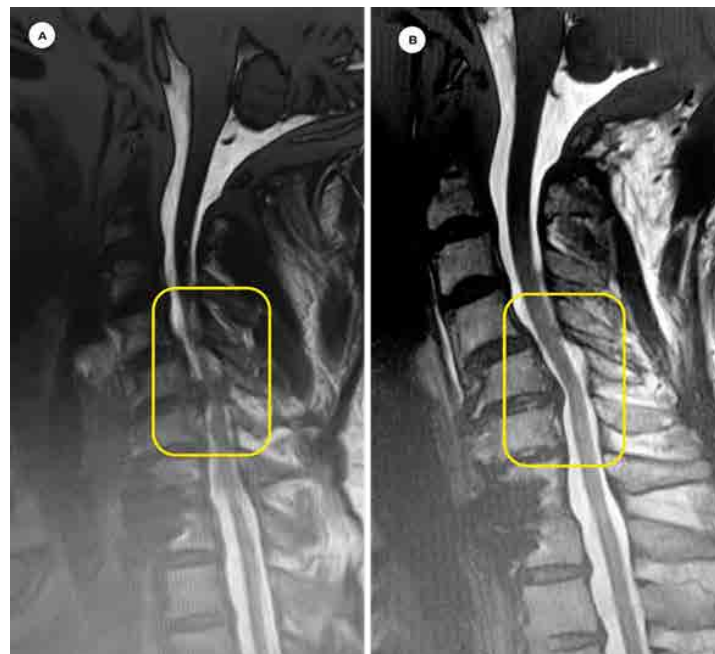


Figure 1. A) A cervical MRI showing degenerative changes, neural foraminal narrowing and spinal stenosis at C5-6 with spinal cord compression. **B)** Post-SCT cervical MRI showing significant improvement in spinal stenosis in C5-C6.

Table 1. SCT protocol. Five-day course SCT with IV and local ADMSC in combination with PRP and MSC derived exosomes, IV nutrition and O₂ therapy.

| Day 1 | Day 2 | Day 3 | Day 4 | Day 5 |
|---|--|-------|---|--|
| IV nutrition + O ₂ Therapy | Local paravertebral infiltration: <ul style="list-style-type: none"> • ADMSC (35 million) • Exosomes • PRP IV infiltration: <ul style="list-style-type: none"> • ADMSC (35 million) | Rest | IV nutrition + O ₂ Therapy | Local paravertebral infiltration: <ul style="list-style-type: none"> • ADMSC (25 million) • Exosomes • PRP IV infiltration: <ul style="list-style-type: none"> • ADMSC (10 million) • Exosomes |

DISCUSSION AND CONCLUSION

A significant pain reduction along with improvement in mobility was observed during the first days after SCT, presumably due to the synergic action of MSCs and exosomes in modulating the immune system. This downregulation of the proinflammatory cytokines has been previously reported in similar cases with promising outcomes [13-20]. The combination of IV nutrition and O2 therapy seems to be a viable option contributing on halting the degenerative process observed in SCC conditions; promoting a further regenerative process.

Although different studies have considered the use of autologous MSC derived from bone marrow and adipose tissue, our results support the use of allogenic source of MSC as a feasible option, without any further complications. Moreover, this eliminates the need to isolate MSCs from the patient, who can delay the therapy for several weeks; and in most cases, the MSC retrieved from patients deal with low quality. Additionally, it is possible to store allogenic MSC through cryopreservation without compromising their properties [21], thus allowing multiple infiltrations as reported in this manuscript.

Once the inflammatory process has been halted, the regenerative properties of MSC would contribute on regaining normal function of the IVDs, increasing mobility and, ultimately improving the QoL of the patient. Furthermore, the case presented here, to the best of our knowledge, is the first case of CSC approached with regenerative medicine, with both clinical and morphological improvements (Figure 1-B). Although, findings of the SCT in lumbar region were not documented in this case report, similar clinical trials have been reported to show improvement in the entire spinal cord [13,17-19]. Nevertheless, while no secondary effects were reported, it is necessary to continue documenting the long-term outcomes as well as the safety of STC. Finally, we suggest that MSC therapy could be a novel therapeutic strategy for patients who present with clinical symptoms related to the deterioration of IVDs as well as other spinal cord associated conditions.

AUTHORS CONTRIBUTION

SL and CS have participated in the analyses and draft of the manuscript. CS, DG have made significant contribution with the collection of data. DE, RM, AS participated in the design, concept and revision of the manuscript. All authors read and approved the final version of the case report.

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None.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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INFORMED CONSENT

Written informed consent was obtained from the patient for publication of his case and any accompanying images.

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