CASE REPORT

Chronic Lumbar Radiculopathy Treated With Autologous Peripheral Blood Stem Cells: A Case Report

Hadyanto Lim[1,2], Alexander P. Marpaung[3], Inda M. Sinaga [1], Julenda I. Sebayang[1], Surjadi Rimbun [4], Adrian Khu[5]

1. Department of Pharmacology and Pharmacy, Faculty of Medicine, Universitas Methodist Indonesia, Medan
2. Biomedical Master Studies, Faculty of Medicine, Universitas Methodist Indonesia, Medan
3. Department of Microbiology, Faculty of Medicine, Universitas Methodist Indonesia, Medan
4. Department of Biochemistry, Faculty of Medicine, Universitas Methodist Indonesia, Medan
5. Department of Surgery, Faculty of Medicine, Universitas Methodist Indonesia, Medan

Correspondence:
lim.hadyanto@gmail.com

ABSTRACT

Background : *Lumbar radiculopathy may arise from the compression of lumbosacral nerve roots, leading to pain and disability. We report a case of chronic lumbar radiculopathy that was successfully treated with peripheral blood stem cells over 24 weeks.*

Case Presentation : *A 62-year-old woman with sharp pain in the back, radiating to both lower legs. Her pain became intense when she was walking about 200 meters, and has been happening for 2 years. She fell and hit her back 7 years ago, and refused to undergo spine surgery in a hospital. Magnetic resonance imaging revealed facet joint hypertrophy and thickening of the ligamentum flavum at L3/L4, L4/L5, and narrowing of the spinal canal. The pretreatment numerical pain rating (NPR) score was 7 (out of 10), and the Oswestry Disability Index (ODI) for low back pain was 19 or 38% (19/50 x100%). She was administered a 5-day course of granulocyte colony-stimulating factor (G-CSF, 5mg/kg/day) subcutaneously, followed by leukapheresis on the fifth day. Circulating and intravenous infusion of autologous peripheral blood stem cells were analyzed using flow cytometry. She also received transforaminal injections of 3 ml of peripheral blood stem cells (PBSCs) at each affected lumbar level. Peripheral blood CD34+ cells increased from 0.71 cells/□L to 151.59 cells/□L after leukapheresis, and mesenchymal stem cells increased from 0.0029 cells/□L to 0.0095 cells/□L. At 24 weeks post-treatment, the percentage reductions in pain and ODI were 100% and 79.0%, respectively. There were no serious adverse effects from the procedure.*

Conclusion: *Autologous peripheral blood stem cells are an effective treatment for chronic lumbar radiculopathy.*

Keywords : lumbar radiculopathy, peripheral blood stem cells, spinal stenosis, granulocyte colony-stimulating factor, leukapheresis

INTRODUCTION

Lumbar radiculopathy may arise from nerve root compression due to mechanical factors such as facet joint hypertrophy and thickening of ligamentum flavum, leading to neuropathic pain and disability. About 15% to 40% of patients with lumbar radiculopathy will have continued pain or frequent relapse after the onset (1). Systematic reviews found that current pharmacologic drugs have limited evidence to support their use in chronic radicular pain. (2) Pregabalin treatment for chronic radiculopathy in a randomized controlled trial was not effective in reducing leg pain. (3,4) Therefore, there is no consensus on chronic lumbar radiculopathy treatment. (5,6) We present a case showing the potential effect of peripheral blood stem cells in treating chronic lumbar radiculopathy.

CASE PRESENTATION

On 1 July 2024, a 62-year-old woman came to the clinic with sharp pain in the back, radiating to both lower legs. She felt more pain in the left lower leg than in the right when walking about 200 meters. This condition has been happening for 2 years. About 7 years ago, she fell and hit her back. The anti-neuropathic pregabalin and epidural steroid injections did not alleviate her symptoms. She rejected spine surgery as suggested by a spine surgeon. She had a history of hyperlipidemia and hypertension. She had undergone a stent insertion in the coronary artery 5 years ago in a hospital after being diagnosed with coronary artery disease. Treatment with angiotensin receptor blockers, bisoprolol, amlodipine, clopidogrel, and rosuvastatin was administered. Other medication, including rivaroxaban, had been started for her atrial fibrillation. Father died of a traffic accident, mother had a stroke, and died 9 years later.

On examination, the blood pressure was 120/80 mmHg, the pulse 88 beats per minute, the respiratory rate 18 breaths per minute, and the temperature 36.3°C. The weight was 75 kg and height 150 cm. The body mass index (the weight in kilograms divided by the square of the height in meters) was 33.3. The straight-leg-raising test (Lasegue's sign) was negative, and reflexes were normal. Lumbosacral x-ray showed osteophytes at the lumbar regions and dextroscoliosis. The axial T2 weight of magnetic resonance imaging revealed disc degeneration at the L1 to S1, and narrowing of facet joint hypertrophy and thickening of ligamentum flavum at L3 to L5, which is consistent with severe spinal stenosis (Fig. 1).

Informed consent was obtained after the patient was informed of the stem cell transplantation procedure. She was administered granulocyte colony-stimulating factor (G-CSF, 5 mg/kg/day) subcutaneously for 5 days, followed by leukapheresis on the fifth day. The circulating and intravenous infusion of autologous peripheral stem cells was measured using flow cytometry. The total infusion of CD34+ cells was 277 x 10^3/kg, and mesenchymal stem cells were 181 x 10^3/kg. She also received a 3 ml transforaminal injection of peripheral blood stem cells at L4/L5 and L5/S1 on the right, and at L3/L4 on the left. The number of CD34 cells injected was 900×10^3/3ml, and the number of mesenchymal stem cells was 590×10^3/3ml at each site. The total volume of PBSCs lumbar injections was 9 ml. During the apheresis procedure, no perioral paresthesia was recorded, as the supplementation of calcium was given. The concentration of calcium before and after the procedure was 10.4 mmol/L and 9.63 mmol/L.

On follow-up, she reported that the NRS and ODI pain scores were reduced to 4 and 7 (1 4%) at 1 week, 4 and 7 at 4 weeks, 2 and 6 (6%) at 12 weeks, and 0 and 4 (8%) at 24 weeks, respectively. At 24 weeks post-treatment, the percentage of pain and ODI reduction was 100% and 79.0%, respectively.

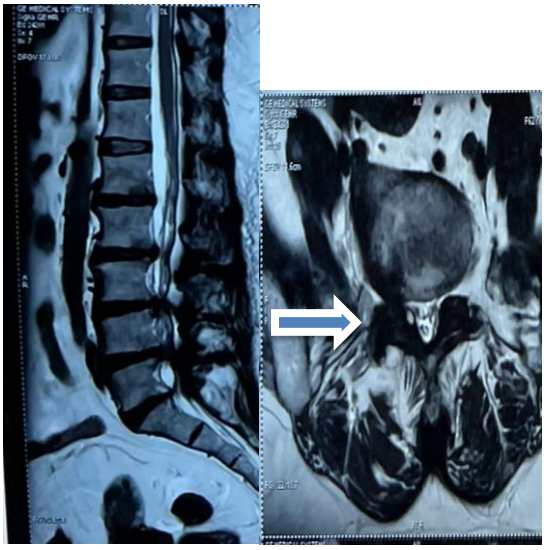

Fig 1. The sagittal T2 weighted shows posterior protruding disc of lumbosacral spines, and degenerative disc disease. The axial T2 weighted lumbar MRI showing narrowing of spinal canal at L2/L3, L3/L4, L4/L5, with facet joint hypertrophy, and thickening of ligamentum flavum at L3/L4, and L4/L5 bilaterally.

DISCUSSION

This is the first case report to demonstrate the potential of autologous peripheral blood stem cells (PBSCs) to modulate pain scores and improve functional status in chronic lumbar radiculopathy due to severe spinal stenosis. The results showed a significant 100% reduction in pain and 79% reduction in ODI with autologous PBSC infusion followed by palpation-guided transforaminal lumbar injection over 24 weeks. Pettine et al. described an open-label pilot study involving 26 patients who received autologous bone marrow concentrate disc injection. Subsequently, they reported functional improvement on the Oswestry Disability Index (ODI) and significant reductions in pain scores at 3, 6, and 12 months of follow-up. (7) The results are in agreement with ours, though the routes of stem cell administration were different.

Peripheral blood stem cells contain CD34+ cells, mesenchymal stem cells (MSCs), and very small embryonic-like cells. We collected PBSCs via leukapheresis after granulocyte colony-stimulating factor mobilization. (8,9) It is postulated that CD34+ cells and mesenchymal stem cells in the bone marrow have anti-inflammatory effects in patients with degenerative disc disease through the secretion of cytokines, chemokines, and various growth factors such as neurotrophic growth factor (10–12). In the experimental models, MSCs have been shown to stimulate nerve repair and regeneration. (13–15) Using the electron microscope, Yilmaz et al were able to detect the axonal and myelin sheath regeneration with CD34 stem cells obtained from human umbilical cord blood in the sciatic nerve injury model. (16) Moreover, Chung et al conducted a preclinical and clinical trial in patients with degenerative disc disease. They reported that intradiscal injection of autologous peripheral blood mononuclear cells reduced the average pain score to 75.0% and the ODI to 79% after 6 months post-treatment. (17)

Mesenchymal stem cells can also be obtained from bone marrow, though the procedure is more invasive than peripheral blood stem cell apheresis. In a prospective controlled trial involving 80 patients with severe lumbar spinal degeneration, Atluri et al reported significant functional improvement (ODI) in 67% of patients who achieved minimally clinically important differences (MCID) with bone marrow-derived mesenchymal stem cells, compared with 8% in the control group. (18) Similarly, the pain relief greater than 2 points was seen in 56% of patients in 12 months of follow-up. The average volume of bone marrow cells (BMCs) injected into the affected lumbar regions was 9.1 ml, which was comparable to the dosages we administered. However, in the intervention group, BMCs were injected into several lumbar regions, including each affected lumbar disc, the epidural space, the facet joints, and the sacroiliac joints. In contrast, the control group received peroral nonsteroidal anti-

inflammatory drugs, opioids, epidural steroid injection, and physical therapy.

In the present case study, the CD34+ and CD90, CD105 markers of hematopoietic stem cells and mesenchymal stem cells, respectively, in peripheral blood stem cells (19,20) show beneficial effects on functional improvement and pain reduction in chronic severe spinal stenosis. Both stem cell populations might exert synergistic anti-inflammatory, angiogenic, and neurogenic effects via paracrine mechanisms, thereby modulating pain in patients with lumbar radiculopathy. This hypothesis generation needs to be tested in a well-designed randomized controlled trial involving large samples.

In conclusion, peripheral blood stem cells are an effective treatment for chronic lumbar radiculopathy.

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