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Stem Cells Rehabilitate Diabetic Neuropathy

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NIDDM= Non-Insulin Dependent
Diabetes Mellitus

HbA1c= glycated haemoglobin

ABSTRACT

To report the effectiveness of stem cell treatment in diabetic neuropathy. This study recruited 83 Iraqi females from 45 to 73 years old who had NIDDM between August 31, 2020 and June 30, 2023. All of them had a "Diabetic neuropathy symptom score (DNS)" (grade 3–4) and a "Diabetic foot sensory neuropathy score" (grade 1-2). They all had HbA1c (10-13%) from 7 to 10 years. The patient/family provided informed permission when they visited the "Al Zahrawy Center for Stem Cells in Baghdad". For four treatment sessions (once every three weeks), Hamad dispersed stem cells around the tibial and deep peroneal nerves. Among 83 Iraqi females, 49 (59.1%) had a grade 4 "Diabetic neuropathy symptom score" upon presentation, which decreased to 24.2% in 20 females after three months of medication. Their "Diabetic foot sensory neuropathy (DNS)" was (54.3%) in 45 females at presentation and decreased to (21.8%) in 18 females after three months of treatment. The satisfaction rate for therapy was 74.6% for the "Diabetic neuropathy symptom score" and 78.3% for "Diabetic foot sensory neuropathy (DNS)". Stem cell therapy is a good treatment option for diabetic neuropathy. The researchers supported it and suggested a greater sample size in other places.

1. Introduction

Stem cells are the raw materials from which all other cells with specialized functions are created. They are a type of unspecialized cell that can differentiate into any type of human cell. This means that they can become bone cells, muscle cells, and nerve cells. Stem cells are into two kinds: adult stem cells and embryonic stem cells. (Al-Massri et al., 2020)

Stem cell therapy is a type of medical treatment that uses stem cells to repair or replace damaged or diseased cells and tissues in the body. It involves the extraction of stem cells from the body, which are then grown or engineered in a laboratory to become specific cell types. Cells are reintroduced into the patient's body to stimulate the healing and regeneration of damaged tissues. Stem cell treatment has been utilized to treat a range of

illnesses, like Diabetes, osteoarthritis, spinal cord injuries, and some forms of cancer. This is a very new and experimental therapy method. (Sloan et al., 2021)

Diabetic neuropathy is a progressive condition that affects the nerves in the arms, hands, legs, and feet, and can cause a range of symptoms, including numbness, tingling, burning, and pain. Blood sugar level control is important to prevent further nerve damage. (Hamad et al., 2022)

There are eighty-one articles about diabetic neuropathy and twenty-two papers concerning stem cells in the "Iraqi Academic Scientific Journals", but there are no reports regarding this topic. (Nalisa, 2022).

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The best of our search, this is an original and pioneer study, not yet used widely in Iraq. This is a significant advance in diabetic foot neuropathy meantime in Iraq.

2. Methodology

This study recruited 83 Iraqi females aged 45-73 with NIDDM between August 31, 2020 and June 30, 2023. All had a "Diabetic neuropathy symptom score (DNS)" (grade 3-4), "Diabetic foot sensory neuropathy score" (grade 1-2), and Diabetic foot motor neuropathy, "Medical Research Council scale" (grades 3-4).

All patients had peripheral polyneuropathy of the lower limbs, were obese (BMI 27-33) with ischemic angiopathy, had poor glycemic control (HbA1c 10-13%), and had type 2 diabetes for 7-10 years. They arrived to the "Al Zahrawy Center for Stem Cells in Baghdad," where Ahmad Alkhyaat (the clinic's manager) clinically evaluated and assessed them,

explained the strategy, and obtained informed consent from the patient/family.

Alkhyaat barred people with foot ulcers and those who refused stem cells. Alkhyaat sent all females for the Doppler examination; nine required preoperative catheterization by a vascular surgeon. He combined "autologous stem cells solution" from the patient's iliac crest bone marrow, adipose tissue, or a delivered placenta "activated by calcium chloride or calcium gluconate" with "laser-activated concentrated platelet rich plasma".

He used the latest laboratory technology to process the material. From his experiences, he applied 10 ml of the processed stem cell solution to the tibial and deep peroneal nerves for four treatment sessions (one every three weeks). The authors then observed the patients every three weeks using clinical and the aforementioned sores. The researchers used Excel program 2019 to handle data.

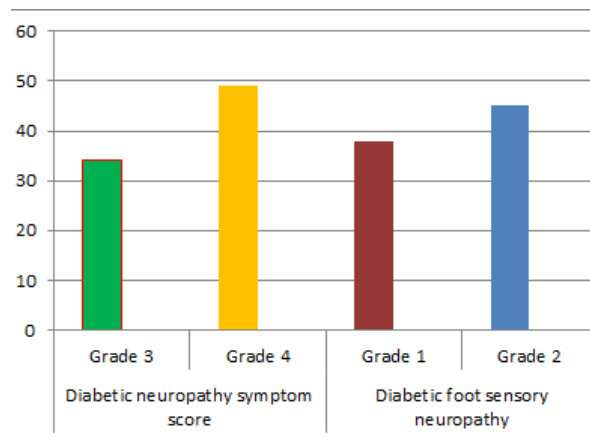


Figure 1. The distribution of females with diabetic neuropathy at presentation. N= 83.

Table 1: The distribution of females with diabetic neuropathy at presentation. N= 83.

Diabetic neuropathy symptom score		Diabetic foot sensory neuropathy (DNS)	
Grade 3	Grade 4	Grade 1	Grade 2
34 (40.9 %)	49 (59.1 %)	38 (45.7 %)	45 (54.3 %)

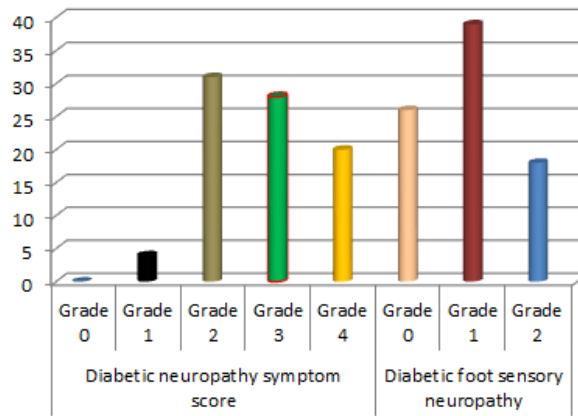


Figure 2. The distribution of females with diabetic neuropathy after three months of stem cell treatment. N= 83

Table 2: The distribution of females with diabetic neuropathy after three months of stem cell treatment. N= 83

Diabetic neuropathy symptom score					Diabetic foot sensory neuropathy (DNS)		
Grade 0	Grade 1	Grade 2	Grade 3	Grade 4	Grade 0	Grade 1	Grade 2
0 (0 %)	4 (4.8 %)	31 (37.3 %)	28 (33.7 %)	20 (24.2 %)	26 (31.3 %)	39 (46.9 %)	18 (21.8 %)

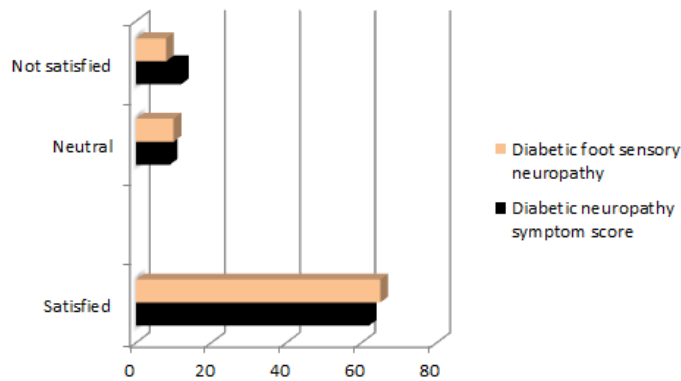


Figure 3. Females with diabetic neuropathy were distributed based on their satisfaction. N= 83.

Table 3: Females with diabetic neuropathy were distributed based on their satisfaction. N= 83.

	Diabetic neuropathy symptom score	Diabetic foot sensory neuropathy (DNS)
Satisfied	62 (74.6 %)	65 (78.3 %)
Neutral	9 (10.8 %)	10 (12 %)
Not satisfied	12 (14.6 %)	8 (9.7 %)

3. Results and discussion

Among 83 Iraqi females, 49 (59.1%) had a grade 4 "Diabetic neuropathy symptom score" upon presentation, which decreased to 24.2% in 20 females after three months of medication. Their "Diabetic foot sensory neuropathy (DNS)" was (54.3%) in 45 females at presentation and decreased to (21.8%) in 18 females after three months of treatment. The satisfaction rate for therapy was 74.6% for the "Diabetic neuropathy symptom score" and 78.3% for "Diabetic foot sensory neuropathy (DNS)".

3.1 Stem cell therapy

Stem cell therapy is a medical procedure that employs stem cells to heal damaged or diseased tissue in the body. Stem cell therapy has the potential to transform medical care by treating diseases that were previously incurable or difficult to control. There have been no known research on stem cells and diabetic neuropathy in Iraq.

Meanwhile, in Iraq, this represents a substantial advancement in diabetic foot neuropathy. This research included 83 Iraqi ladies over the course of 34 months because this therapy is novel and unique in Iraq according to the best of our knowledge. As a result, building popularity and trust among Iraqi residents takes time. In Iraq, some stem cell therapy research clinics treated a variety of medical disorders, including cerebral palsy. (Kubiak et al., 2020)

The researchers employed a "Diabetic neuropathy symptom score," a grading system used to quantify the degree and development of nerve damage in persons with diabetes. The DNSS is a basic questionnaire that questions patients about the intensity of their symptoms, which include pain, numbness, burning sensations, and tingling.

The questionnaire is graded on a scale of 0 to 4, with higher scores indicating more severe symptoms and adding the values for each individual symptom. The DNSS can help

healthcare practitioners monitor the course of diabetic neuropathy and evaluate therapy success. It is a straightforward, low-cost, and non-invasive approach for assessing diabetic neuropathy symptoms that may be applied in both clinical and research contexts. (Hamad et al., 2022)

The researchers used the "Diabetic foot sensory neuropathy (DNS)" score to evaluate sensory nerve function in diabetes patients' feet and identify the degree of neuropathy. This scoring method is crucial because diabetic neuropathy affects the nerves in the feet, causing feeling loss and potentially leading to foot ulcers and other foot problems. The DNS score evaluates a patient's capacity to detect several stimuli in their foot, including touch, warmth, and vibration.

3.2 The scoring system

The scoring system consists of a set of sensory tests rated from 0 to 2. Zero indicates no reaction, while two indicates a significant response, and the detailed results for each patient's test are then added together. The maximum possible score is ten, and the higher the score, the worse the sensory loss. The DNS score can be used to predict the risk of diabetic foot ulceration and amputations. The DNS score is a useful instrument for monitoring diabetic neuropathy development and therapy success.

Diabetic neuropathy can be detected and treated early, lowering the risk of serious diabetes consequences such as foot ulcers and amputations. (Hamad et al., 2023)

Table 1 and Figure 1 show that females in grades 4 and 2 had higher rates of "Diabetic neuropathy symptom score" and "Diabetic foot sensory neuropathy (DNS)" than those in grades 3 and 1. Table 2 and Figure 2 demonstrate a considerable drop in these grades. Stem cell therapy is a therapeutic option for diabetic neuropathy that uses stem cells to repair or replace damaged nerves.

This treatment employs stem cells taken from bone marrow, adipose tissue, and umbilical cord blood. Stem cell therapy for diabetic neuropathy seeks to promote repair and regeneration by enabling cells to differentiate into nerve cells. (Røikjer et al., 2021), and (Jensen et al., 2021)

Stem cells can also reduce inflammation and promote blood vessel development, both of which are essential for nerve recovery. More study is needed to determine the safety and efficacy of stem cell therapies for diabetic neuropathy. The long-term consequences of stem cell treatment are not entirely understood, and further clinical trials are needed to discover the best stem cell source, dose, and delivery route. The introduction of grades 0, 1, and 2 is due to a fall in scores, not new instances. The reduced symptoms in previously treated females demonstrate the great efficacy of stem cell treatment in diabetic neuropathy. (Staff et al., 2021)

Many validated research found that six months of stem cell treatment resulted in considerable improvements in sensory nerve function and pain reduction. Overall, stem cell therapy shows significant potential for the treatment of diabetic neuropathy. (Pantazis et al., 2022)

According to Table 3 and Figure 3, 62 females (74.6%) were happy with stem cell therapy in the "Diabetic neuropathy symptom score" and 65 females (78.3%) in the "Diabetic foot sensory neuropathy (DNS)". The brain and spinal cord contain neural stem cells, which may differentiate into neurons and glial cells. These cells can develop into neurons capable of replacing those that have been injured or destroyed as a result of injury or illness. Stem cells can also release trophic factors, which help existing neurons survive and perform better. (Hamad et al., 2021)

FDA approved in 2011, stem cell therapy is an investigational treatment that is now being tested in clinical studies to establish its safety and efficacy for a variety of illnesses.

While some stem cell treatments have been licensed for use in certain medical disorders, many are still experimental and require further study before they can be generally used. Clinical trials are well structured research investigations that collect data on the safety and efficacy of novel medicines.

Trials are often undertaken in steps, beginning with short studies to assess safety and dose, then proceeding to bigger studies to assess effectiveness against known therapies or a placebo. Before being licensed for clinical usage, stem cell treatment must go through extensive testing to guarantee that it is both safe and beneficial for patients. (Lopes et al., 2021)

Nine ladies (10.8%) were neutral on "Diabetic neuropathy symptom score" and ten girls (12%) were neutral on "Diabetic foot sensory neuropathy (DNS)". This is due to the chronicity of their problems, hard labor, or a poor sensitivity to pain, particularly in women. Although some data implies that girls have a stronger pain tolerance than males, research on female pain sensitivity is divided. Some studies indicate that females are more sensitive to pain than males, whereas others report no difference or even stronger sensitivity in females. Pain sensitivity can be influenced by heredity, hormones, cultural and societal expectations, and individual variances.

As a result, it is critical to recognize that pain sensitivity varies widely across people and should be handled on an individual basis. (Seghieri et al., 2023).

4. Conclusions

Stem cell therapy is a good treatment option for diabetic neuropathy. In our study, both the "Diabetic neuropathy symptom score" and "Diabetic foot sensory neuropathy (DNS)" decreased in our patients after this therapy. Moreover, the satisfaction rate for the "Diabetic neuropathy symptom score" plus "Diabetic foot sensory neuropathy (DNS)" was

better. The researchers supported it and suggested bigger samples in different doses in Iraq.

References

- Al-Massri, K. (2020). Mesenchymal stem cells in chemotherapy-induced peripheral neuropathy: A new challenging approach that requires further investigations. *Journal of Tissue Engineering and Regenerative Medicine*, 14(1), 108-122. doi: <https://doi.org/10.1002/term.2972>
- Sloan, G. (2021). Pathogenesis, diagnosis and clinical management of diabetic sensorimotor peripheral neuropathy. *Nat Rev Endocrinol*, 17(7), 400-420. doi: <https://doi.org/10.1038/s41574-021-00496-z>
- Hamad, A.M., & Alhiti, H.A. R. (2022). Non-Obstructive Azoospermia Aided by Autologous Stem Cells. *J Medical Case Repo*, 4(1), 1-3. DOI: <https://doi.org/10.47485/2767-5416>
- Nalisa, D.L. (2022). Stem Cell Therapy for Diabetic Foot Ulcers: Theory and Practice. *J Diabetes Res*, 6;2022:6028743. <https://doi.org/10.1155/2022/6028743>.
- Kubiak, C. (2020). Stem-cell-based therapies to enhance peripheral nerve regeneration. *Muscle Nerve*, 61(4), 449-459. doi: <https://doi.org/10.1002/mus.26760>
- Hamad, A., & Alhiti, H. A. (2022). Stem Cell Therapy Modulates Cerebral Palsy: Case Report. *J. Archives of Medical Case Reports and Case Study*, 5(3), 118-122. <https://doi.org/10.31579/2692-9392/118>
- Hamad, A., & Alhiti, H. A. (2023). Stem Cells and Nanosilver Saved Diabetic Foot. *Journal of Liaquat University of Medical & Health Sciences*, 21(5), 20-23. DOI: <https://doi.org/10.22442/jlumhs.2023.00991>
- Røikjer J. (2021). Diabetic Peripheral Neuropathy: Diagnosis and Treatment. *Curr Drug Saf*, 16(1), 2-16. <https://doi.org/10.2174/1574886315666200731173113>
- Jensen T. (2021). Painful and non-painful diabetic neuropathy, diagnostic challenges and implications for future management. *Brain*, 144(6), 1632-1645. doi: <https://doi.org/10.1093/brain/awab079>
- Staff N. (2020). Pathogenesis of paclitaxel-induced peripheral neuropathy: A current review of in vitro and in vivo findings using rodent and human model systems. *Exp Neurol*, 324, 113121. doi: <https://doi.org/10.1016/j.expneurol.2019.113121>
- Pantazis C. (2020). A reference human induced pluripotent stem cell line for large-scale collaborative studies. *Cell Stem Cell*, 29(12), 1685-1702.e22. doi: <https://doi.org/10.1016/j.stem.2022.11.004>.
- Hamad, A., & Alhiti, H. A. (2021). Baghdad's first success in Bone Marrow Aspirate Concentrate procedure. *Journal of Oran Faculty of Medicine*, 5(2), 695-700. <https://doi.org/10.51782/jfmo.v5i2.126>
- Lopes B. (2021). Peripheral Nerve Injury Treatments and Advances: One Health Perspective. *Int J Mol Sci*, 23(2), 918. doi: <https://doi.org/10.3390/ijms23020918>
- Seghieri G. (2023). Metrics of Gender Differences in Mortality Risk after Diabetic Foot Disease. *J Clin Med*, 12(9), 3288. doi: <https://doi.org/10.3390/jcm12093288>