Treatment of Peripheral Neuropathy with Stem Cells

Introduction

Peripheral neuropathy is the term used for damage to the nerves of the peripheral nervous system, which may be caused either by diseases of the nerve or from the side-effects of systemic illness.

The four cardinal patterns of peripheral neuropathy are polyneuropathy, mononeuropathy, mononeuritis multiplex and autonomic neuropathy. The most common form is (symmetrical) peripheral polyneuropathy, which mainly affects the feet and legs. The form of neuropathy may be further broken down by cause, or the size of predominant fiber involvement, i.e., large fiber or small fiber peripheral neuropathy. Frequently the cause of a neuropathy cannot be identified and it is designated idiopathic.

Signs and symptoms

Those with diseases or dysfunctions of their peripheral nerves can report problems in any of the normal peripheral nerve functions.

In terms of sensory function, the most common symptoms are loss of function (negative), which include numbness, tremor, and gait abnormality.

Gain of function (positive) symptoms include tingling, pain, itching, crawling, and pins and needles. Pain can become intense enough to require the use of opioid (narcotic) drugs (i.e., morphine, oxycodone).

Skin can become so hypersensitive that patients must refrain from having anything touch certain parts of their body, especially the feet. People with this degree of sensitivity cannot have a bedsheets touch their feet or wear socks or shoes, and eventually become housebound.

Motor symptoms include loss of function (negative) symptoms of weakness, tiredness, heaviness, and gait abnormalities; and gain of function (positive) symptoms of cramps, tremor, and muscle twitch (fasciculations).

There is also pain in the muscles (myalgia), cramps, etc. and there may also be autonomic dysfunction.
During physical examination, those with generalized peripheral neuropathies most commonly have distal sensory or motor and sensory loss, though those with a pathology (problem) of the peripheral nerves may be perfectly normal. They may show proximal weakness, as in some inflammatory neuropathies like Guillain–Barré syndrome; or may show focal sensory disturbance or weakness, such as in mononeuropathies. Ankle jerk reflex is usually absent in peripheral neuropathy.

**Causes**

The causes are broadly grouped as follows:

1. Genetic diseases: Friedreich's ataxia, Charcot-Marie-Tooth syndrome
2. Metabolic/Endocrine: diabetes mellitus, chronic renal failure, porphyria, amyloidosis, liver failure, hypothyroidism.
3. Toxic causes: Drugs (vincristine, phenytoin, nitrofurantoin, isoniazid, ethyl alcohol), organic metals, heavy metals, excess intake of vitamin B6 (pyridoxine)
4. Fluoroquinolone toxicity: Irreversible neuropathy is a serious adverse reaction to fluoroquinolone drugs.
7. Physical trauma: compression, pinching, cutting, projectile injuries (i.e. gunshot wound), strokes including prolonged occlusion of blood flow. Others causes include shingles, malignant disease, HIV, radiation and chemotherapy.

**Method of Treatment**

*Preparation of stem cells*

Stem cell containing tissues are extracted from the fetus’s umbilical cord before undergoing a process to isolate, purify and finally culture the stem cells, so that they can be used in a clinical environment.
Transplantation of stem cells

There are three ways in which stem cells can be injected into a patient:
1. Intravenous Injection: stem cells are injected into the patient’s vein.
2. Lumbar puncture: also known as a spinal tap, is a procedure used where stem cells can be injected directly into the spinal column.
3. Direct injection into target tissues

Results

The mean age of the treated patients was 24.6 years. The oldest patient was 76 years old. Gender distribution rate was 1.4:1 (male:female). 63.3% of cases reported improvements in their condition (Refer to figure below).

The type of improvements included Less Pains, better myodynamia, sensory recovery (complete), and able to take care of his/herself in improved communication (Refer to figure below).
Most improvements started within 5 months after the transplantation of fetal neurostem cells. (Refer to figure below).

<table>
<thead>
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<th>Months after Treatment</th>
<th>Cases</th>
<th>Cumulative Percentage</th>
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</tr>
<tr>
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</tr>
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</table>

**Conclusion**

In summary, fetal Neural Stem Cells (NSCs) injected to treat the Peripheral Neuropathy have shown to have a strong positive effect on the health status of 63.3% of the treated patients. Stem cell transplantation seems to be a safe and potentially powerful therapy for this group of patients.