Beike Stem Cell for Spinal Cord Injury (SCI)

1. What is the disease and how does it affect the body?

The spinal cord is the main relay for signals between the brain and the body. Spinal cord injury (SCI) is most commonly caused by high-energy trauma, for example from sports or traffic accidents, and the majority of patients are 10–40 years old at the time of the injury[1].The annual incidence is 15–40 per million, and since the long-term survival is good in developed countries, there are a large number of people who are chronically disabled by SCI[2].According to the spinal cord injury information network, 300,000 people suffer from spinal cord injury in the United States and nearly 11,000 new cases are reported annually[3].The estimated odds of a traumatic spinal injury in the United States is 40 per million, and the estimated cost of these patients is US$8 billion annually, with the individual cost of up to 1,35 Million over the course of their life. Spinal cord injury often results in long-lasting deficits, with partial or complete paralysis and loss of sensation and autonomic nervous system control below the level of the injury[1].The outcome is determined first by primary damage and later by several secondary processes as ischemia, anoxia, free radical formation and excitotoxicity that occur after injury[4].

2. What happens to the body and patient if the disease remains untreated?

SCI results in inflammation, progressive hemorrhagic necrosis, edema, demyelination and cellular destruction[5].After the initial injury, the damage site expands from the injury epicenter (many centimeters in a human). Analysis of chronic SCI shows that portions of the more external white matter are spared while there is extensive damage of the more internally located grey matter. Within white matter, there is degeneration of both ascending and descending axons, and demyelination due to loss of oligodendrocytes. Chronic, progressive demyelination is a persistent feature of SCI[6,7].Ultimately, a scar-encapsulated cavity many times the size of the initial injury forms. The glial scar presents both a physical barrier and an

inhibitory environment for axonal regeneration and remyelination[8].

3. The efficacy of current therapy and recent research about new treatment for the disease .

There is currently no curative therapy for SCI. In the acute phase, therapy is limited to high-dose corticosteroid to reduce inflammation and surgical stabilization and decompression to reduce further damage. In the subacute to chronic phase, therapy focuses on symptomatic relief (relieve pain and decrease the opportunistic infections) and physiotherapy[9].Spinal cord injury results in enormous personal suffering and substantial cost to family and society.

4. How can stem cells help relieve the disease's symptoms?

Improvement:

Recent studies from multiple laboratories has led to the conclusion that stem cell transplantation has a good result on functional recovery following SCI[10-18].

Most Spinal Cord Injury patients Beike have treated, utilizing the combination of stem cell therapy and rehabilitation, showed visible signs of improvement: regaining sensations and movements, regaining the ability to sweat, increasing muscle strength, decreasing muscle tone of spasticity, and improving bowel and bladder control.

Statistic analysis of efficacy and safety on stem cell therapy in 500 chronic SCI patients Beike have treated concluded: apparent improvements in the ASIA scores of lower/upper limb, total motor function and sensation for light touch and pinprick as well as modified Ashworth scale score; the improvements showed a linear ascending trend by time.

However, when discussing improvements, it is important to remember that improvements might greatly differ from one patient to another. Improvement cannot be guaranteed.

Mechanism:

Stem cell transplantation can replace damaged, diseased or lost cells and play many additional roles through paracrine, including delivery of molecules, such as

prosurvival factors, angiogenic factors, growth factors, stem-cell homing factors, and cytokines, that (1) modulate the immune response; (2) induce the enzymatic breakdown to reduce inflammation, scarring and the elimination of cellular debris; (3) limit the secondary injury by protecting neurons; (4) promote regeneration of endogenous stem cells;(5) angiogenesis with more blood supply that are required for optimal recovery; (6) Enhance wound healing; (7) provide a cell-based electrical 'relay' between neurons above and below the injury; to eventually ameliorate clinical deterioration[3-5].

5.How umbilical cord mesenchymal stem cell(UCMSC) Beike offers can ameliorate the scar tissue?

Before we talk about scar formation in SCI patient, we need to know which kind of cell that plays an important role in scar formation. Astrocyte is such a kind of cell. It is a sub-type of glial cells in the central nervous system . It is also known as astrocytic glial cell, is characteristic star-shaped glial cell in the brain and spinal cord. It performs many functions, including biochemical support of endothelial cells that form the blood–brain barrier, provision of nutrients to the nervous tissue, maintenance of extracellular ion balance, and a role in the repair and scarring process of the brain and spinal cord following traumatic injuries. Recent published papers with SCI model showed that umbilical cord mesenchymal stem cell can inhibit the formation of glial scar by reducing the accumulation of astrocyte cells near the lesion site[19] and making astrocyte cells appeared to be permissive and did not form a prominent glial limitans to completely block regenerative axons[19,20].

6. Combination of physical exercise and stem cell treatment is good for SCI patient.

Body weight supported treadmill training has been used for a number of years to promote the rehabilitation of spinal cord injured patients. It is thought to have an effect on the reorganization of locomotor networks along the spinal cord, generating new patterns of muscle activity [21]. Other favorable effects have been reported, like

the stimulation of serotonergic fiber growth[22,23]. Furthermore, enhanced physical activity has recently been shown to lead to increased ependymal cell proliferation[24].The most updated paper about stem cell and exercise on rat with SCI shows that Exercise,which improved functional recovery and autonomous micturition, maintained nestin expression in both injured and uninjured spinal cords, with a positive correlation between locomotor recovery and the number of nestin-positive cells. Therefore, we think exercise is good for SCI patient with stem cell treatment[25].

7. Beike publications

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