

Stem Cells for Spinal Cord Injury – Frequently Asked Questions

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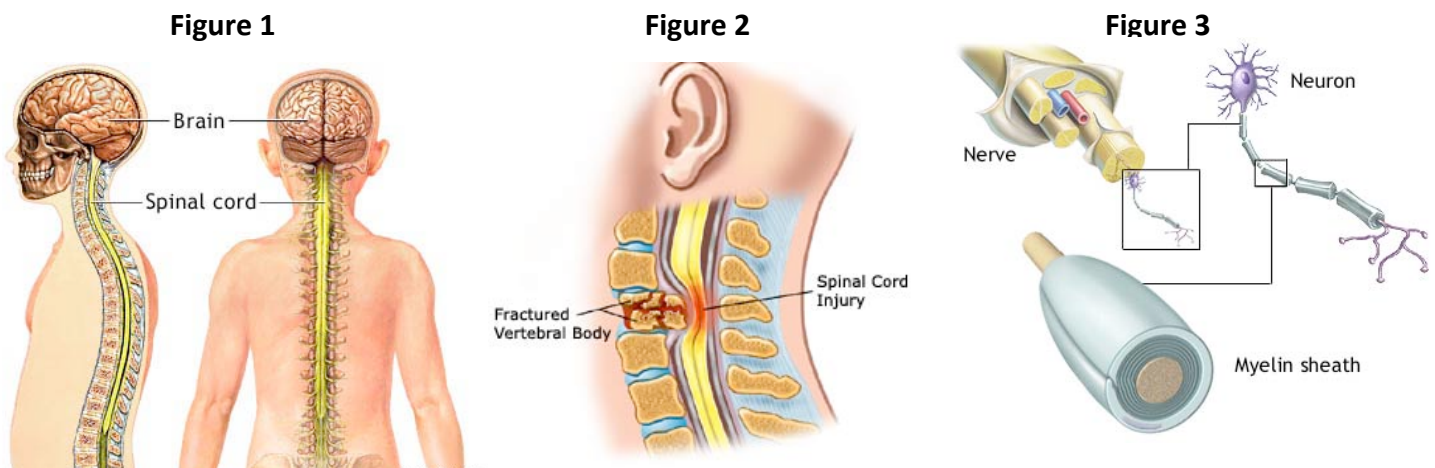
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What Do We Know about Stem Cell Research and Spinal Cord Injury?

We have all heard about the promise that stem cell research holds for the treatment of a wide range of diseases, including spinal cord injuries. Stem cell therapies are nearly all new and experimental. Like a new drug, stem cell therapies must be assessed and meet certain standards before receiving approval from national regulatory bodies to be used to treat people.

What Happens When the Spinal Cord Is Injured?

The spinal cord runs from the brain down to the tailbone (Figure 1), and is made up of billions of tiny, delicate nerve fibers that transmit signals from the brain to the arms and legs, and vice versa. A spinal cord injury occurs when bones from the spine fracture and are pushed into the cord (Figure 2). The force of the injury tears many of the nerve fibers within the cord, even though the cord itself is not completely cut into two pieces. For some of the nerve fibers that withstand the initial force and are not torn, the injury additionally destroys the “myelin sheath” that insulates the nerve (Figure 3). This insulation is much like the insulation around electrical wires - without it, the nerve will not conduct electrical signals effectively. The paralysis that results from spinal cord injury is caused by the inability to send the electrical signals across the injury site, where the nerves are either torn or have lost their insulation. Unfortunately, these nerve fibers do not regenerate, and so the paralysis is typically permanent. Therefore, it is only natural to ask if stem cells might be beneficial for spinal cord injury.



Why Use Stem Cells as a Treatment for Spinal Cord Injury?

In theory, transplanting stem cells might help spinal cord injuries in a number of ways:

- #1 Form new cells that insulate the remaining nerve fibers, helping them to transmit electric signals across the injury site effectively,
- #2 Form new nerves or new nerve fibers to regenerate across the injury site,
- #3 Secrete growth factors that might help torn nerves regenerate.

Animal studies have shown that most stem cells do #1 – that is, they form new cells to re-insulate nerve fibers that have escaped being torn completely. Most researchers grow the stem cells in the laboratory to specifically become the types of cells that form this myelin insulation. Such cells do not become new nerves or nerve fibers (#2). They may, however, still secrete growth factors that are beneficial to the injured spinal cord (#3).

Have Stem Cells Shown Promise in Spinal Cord Injury?

Stem cells have generated a great deal of interest and excitement in spinal cord injury research. However, a lot of work is still needed to take this research and turn it into safe and effective treatments. The vast majority of research studies are performed on rat or mouse models. Many scientists have published scientific articles that describe how transplanted stem cells have improved the outcome of animals. Although a growing number of physicians have begun to transplant some form of stem cell into human patients with spinal cord injuries, results of these treatments are difficult to interpret. In general, these stem cell therapies are being offered to people at a high cost (tens of thousands of dollars), and while the actual cell transplantation may be done carefully, the treatment and its results are not studied and reported in a systematic manner. Therefore, the scientific community is not able to tell whether or not the treatment is actually working.

Most research has studied cell transplantation that occurs one to two weeks after the spinal cord is injured. Only a handful of studies have examined the effectiveness of these cells in a more “chronic” time point (i.e. weeks to months after injury). In general, it appears that stem cells are less effective when transplanted into the injured spinal cord at these time points.

What are the Risks of Having a Stem Cell Transplant?

Several risks are associated with stem cell transplantation for spinal cord injury:

1. A surgical incision is needed to put the stem cells into the spinal cord. This incision involves an opening of the covering of the spinal cord and opens up the risk for leaking spinal fluid or for developing an infection.
2. Patients who receive stem cells that are derived from foreign donors will require immunosuppressive drugs to prevent rejection and these can increase the chance of infection.
3. The injection of cells into the spinal cord may damage parts of the spinal cord that are actually intact. Patients who suffer spinal cord injuries will often regain some degree of function over the first 12-18 months after their injury. Recovery is not large in patients who are completely paralyzed, but any amount of recovery is valuable. For patients who are partially paralyzed, the amount of recovery can be substantial. Because cell transplant therapy requires direct manipulation of the spinal cord and the injection of a “foreign” substance into it, there is a risk of damaging the cord further and preventing or reducing this recovery.
4. Once in the spinal cord, stem cells may not behave in predictable ways. They may do what we want them to do, but they may also induce growth of nerve fibers that transmit pain signals – resulting in increased pain. Additionally, because stem cells are inherently good at developing into many different things, they may unintentionally develop into cancers within the spinal cord.

What Role Do Patients and Family Members Play in Stem Cells and Spinal Cord Injury?

As important stakeholders in spinal cord injury, it is important that patients and their family members think about and discuss their views about stem cells as a potential emerging therapy and what they believe are the potential benefits and risks in the context of their own lives.