Summary

The development of spinal cord injury treatment is focused on new methods of regenerative medicine such as the administration of growth factors, and An emerging strategy for replacing and/or regenerating damaged tissue is the implantation of stem cells and/or artificial biomaterials such as scaffolds to form tissue bridges between damaged spinal cord stumps**.**

The use of autologous (Bone Marrow Cells) BMCs for stem cell therapy in (Spinal Cord Injury) SCI patients has more advantages. First, one can avoid all problems associated with the immunological rejection or graft-versus-host reactions**,** which are frequently caused in allogenic cell transplantation. Second, autologous BMC therapy is considered safe by not being associated with carcinogenesis [Beachy etal 2004]. Third, extensive scientific data on BMCs have been accumulated from previous experiences in BMC transplantation for hematological diseases. These advantages have made cell therapy using BMCs widely applicable and investigated clinically
in various neurologic diseases**.**

However, it also has some disadvantages. First, the procedure requires open surgery to approach the injury area in direct method of delivery, which results in the increase in the potential adverse effects. Second, the sorting of BMCs needs to be done in vitro, thus increasing the risk of contamination. Third, it is still unclear whether some BMC components may have a deleterious effect on the functional improvement. Also When bone marrow was aspirated from the iliac bone, and mononuclear cells were sorted and concentrated.

Theoretically and clinically, lumbar puncture delivery of stem cells is extremely attractive. Lumbar puncture is a minimally invasive

procedure that can be performed at the bedside after injection of a local anesthetic. In humans lumbar puncture is performed at the L3–4 level, far away from the cervical or thoracic spinal cord, which are the regions most commonly effected by SCI. This makes lumbar puncture delivery of stem cells relatively safe and unlikely to worsen compromised patients as a direct result of the intervention **.**

Additional advantages of lumbar puncture delivery are related to several factors:

4) The cells are delivered across the blood brain barrier into the CSF, making it far more efficient than intravenous delivery.
5) CSF circulates within the CNS, allowing transplanted cells to home into the injured tissues, and cells are preserved in a relatively immune-privileged environment.
6) Because the transplanted cells are delivered away from the hostile environment of the injured tissue, they are given a greater opportunity to survive and migrate to the injury site

Intravenous Route: Least Efficient

Very few to no cells were present within the injured spinal segments in rats that received BMSCs intravenously. In contrast, considerably more cells were detected in the injured tissues after both intrathecal and intraventricular delivery . These data confirm the hypothesis that transplanting cells into the CSF leads to more successful grafting when injection is via an intrathecal or -ventricular rather than intravenous route. It should be noted that the same cell dosage (2 million cells) was used for all routes and varying cell dosages might lead to improved grafting efficacy.

The application of bone marrow derived leukocyte suspension, including stem cells is a safe medical procedure with acceptable adverse reactions. Improvement in the sensory function occurs in almost all of the

patients.

Improvement was recorded even in patients with lumbar infusion of the stem cells, suggesting direct effect of stem cell implantation on sensory improvement.

Very minor changes in motor function were noted in several of the patients. Improvement initiated around the 90th day following implantation of the stem cells and fully developed after the 8th month from the procedure. Repetition of the stem cell implantation had a lesser effect if any.

The most recent study done by Hadjianev in2008 show that

93.2% of the patients had improvement in the sensory function .

The improvement was noted in patients who had either laminectomy or interlaminotomy

Few of the patients, mostly those with existing motor function (14.8%), had improvement in movements. These improvements were registered as an increase of the existing voluntary movements (abduction, adduction, flexion and extension) or new activities in certain muscular groups that were lost after the injury.

In some of the patients (9.5%), an absolute increase in the muscle mass of the lower extremities (~1-1.5 cm in circumference) was registered. Three of the patients who had partial sphincter control following the accident regained full control after the procedure.***(Hadjianev A etal.,2008).***

Conclusion

Of all types of implantation, Direct injection of stem cells gives the best results

BMC implantation is promising, as regard, sensory function has been improved, Also it shows some motor function improvement, as regard the post traumatic existing voluntary movement, there is increase in the muscle mass of the lower and regaining full sphincter control in patients who had partial sphincter control.

A further more comprehensive multicenter study is recommended to establish the therapeutic effect of stem cell implantation.