Summary

Mesenchymal stem cells (MSCs) are self renewing progenitor cells that have the potential to differentiate into nervous tissue cells, chondrocytes, osteoblasts, adipocytes, fibroblasts and other tissues of mesenchymal origin. Stem cells have generated a great deal of excitement and promise as a potential source of cells for cell-based therapeutic strategies, primarily owing to their intrinsic ability to self renew and differentiation into multiple functional cell types. Stem cells have been utilized to regenerate viable nervous tissue, which lacks the ability to self-repair or regenerate itself.

This present study was done to investigate the healing capacity of autologous bone marrow derived mesenchymal stem cells and to compare this with mesenchymal stem cells undergoing neurogenic differentiation in neuronal regeneration in encephalomyelitis.

The present experimental study was performed on thirty five male albino rabbits which were divided into three groups according to the disease affection and treatment protocol as follows:

Group I:

Five rabbits were used as negative controls and each one leaved without any treatment.

Group II:

Ten rabbits were used as positive controls and encephalomyelitis was induced by injection of 0.3 ml/ kg of ethidium bromide 0.01% solution intrathecally and leaved without any treatment.

Group III:

Twenty rabbits, encephalomyelitis was induced in each rabbit then divided into two subgroups (10 rabbits for each):

Subgroup (IIIA): Each rabbit received autologous mesenchymal stem cells in a dose ranged from 2-3 million cells in 0.5 ml sterile normal saline intrathecally one week after disease induction.

Subgroup (IIIB): Each rabbit received differentiated mesenchymal stem cell (neurogenic cells) in a dose ranged from 2-3 million cells in 0.5 ml sterile normal saline intrathecally one week after disease induction.

The animals were evaluated two weeks after intrathecal injection of ethidium bromide (one week after intrathecal injection of stem cells).

Evaluations based on:

-Clinical observation, for motor weakness, paraplegia and quadriplegia.

-Histological examination: The animals were scarified one week after intrathecal injection of stem cells and specimens of cerebral cortex, spinal cord and nerve trunk were obtained for histological examination, the histological methods used were H&E stain to demonstrate the general architecture of examined tissue and toluidine blue stain to demonstrate the myelin sheaths.

-Clinically the diseased group showed quadriplegia. On the other hand differentiated mesenchymal stem cells transplanted group and mesenchymal stem cells transplanted group showed low grade movement (quadriparisis).

- Haematoxylin and eosin stained sections of the diseased group which did not have any treatment showed severe inflammation, vacuolations and neural degeneration in the cerebral cortex and the spinal cord. On the other hand the groups treated with differentiated and undifferentiated mesenchymal stem cells showed decrease in the inflammatory cells and vacuolation.

- Toluidine blue stained sections of the diseased group which did not have any treatment showed demyelination and neural degeneration in the cerebral cortex and the spinal cord, the nerve trunk emerged from the spinal cord of the cervical region showed demyelination in its nerve fibers. On the other hand the groups treated with differentiated and undifferentiated mesenchymal stem cells showed decreased vacuolations and demyelination, the nerve trunk emerged from the spinal cord showed beginning of remyelination.

- The results obtained from the scoring system revealed that results of MSCs undergoing neurogenic differention better than results obtained by MSCs.

CONCLUSION

Mesenchymal stem cells are one of the stem cells that are being introduced in the clinic for treatment of several degenerative diseases. If stem cells succeed in treatment of encephalomyelitis they subsequently may be used in treatment of MS.

Based on this study, the transplantation of autologous differentiated mesenchymal stem cells (neurogenic cells) which injected intrathecally in rabbits is an effective method of neuronal regeneration and showed results better than the transplantation of autologous undifferentiated mesenchymal stem cells. We observed decreased inflammation and demyelination with beginning of remyelination after one week from injection of autologous mesenchymal stem cells transplantation in rabbits.

This study was designed for small animals and we believe this information can be examined for large animals. Future studies with longer follow-up, possibly with the use of growth factors and/or cultured neuronal aids may improve rates of neuronal remyelination and decrease neuronal degeneration.