EDITORIAL

# OLFACTORY ENSHEATHING CELLS IN THE REPAIR OF SPINAL CORD INJURY

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Olfactory Ensheathing Cells (OCEs) are a type of glial cells that ensheath the non myelinated olfactory neurons. They have unique property of assisting regeneration of olfactory neurons after they get injured. These cells are being tested for axonal regeneration. They are the top contenders for cell transplantation based treatment of spinal cord damage. After the animal studies, now a day a number of centres are trying to use the technique in humans. Getting autologous olfactory bulb is cumbersome but getting it from human cadavers has its own limitations due to transplant rejection. After establishing the technique of autologous cell transplantation, a hospital in Poland has reported success in a person with four years old spinal cord injury. There is a need to replicate this technique in various centres so that the procedure is established.

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In October, 2014, British Broadcasting Corporation (BBC) broke exciting news to the world in the simplest possible words that a man who was paralysed chest down due to a knife attack in 2010, was able to walk again after a pioneering surgery in Poland. BBC reported that the procedure involved transplantation of cells from nasal cavity into the spinal cord. The patient expressed his incredible feelings as *"When you can't feel almost half your body, you are helpless, but when it starts coming back it's like you were born again."*[1]

In this particular case the technique developed by University College of London (UCL) was applied by surgeons at Wroclaw University Hospital, Poland. This cell transplantation based treatment involved taking out one of the olfactory bulbs of the patient, getting olfactory ensheathing cells (OECs) from it, and growing them in culture. After achieving a reasonable growth, micro injections of OECs were made above and below the damaged area of the spinal cord. In addition four thin sliced strips of nerve tissue taken from the ankle of the patient were placed across the gap in the spinal cord. Apparently the OECs stimulated the spinal cord cells to regenerate by using the nerve tissue strips as a bridge to move across the severed cord.[2]

For over two decades this technique has been a prime candidate for cell-transplantation based treatment of injury to Central Nervous System (CNS) and in particular to spinal cord.[3] Peripheral nervous system (PNS) is known to support axonal outgrowth throughout the life due to presence of Schwann cells.

This *luxury*, however, is not available to the CNS that has oligodendrocytes and astrocytes in the supporting role.[4] The olfactory cells are special as they have a mix of the tissue of both PNS and CNS. This unique feature allows an axonal outgrowth from PNS into CNS throughout life.[5,6] This characteristic of the olfactory cells is due to olfactory ensheathing cells (OECs) that are specialised glial cells present along the olfactory nerve and outer layer of the olfactory bulbs.[6,7] OECs ensheath the olfactory nerves throughout their course after the point of their exit from the lamina propria. This is one of the unique situations where peripheral axons enter and synapse the adult CNS environment.[6,7] Since the discovery of unique properties, OECs have been showing a promise in repair of CNS lesions by cellular transplant.

The olfactory system comprises of olfactory receptor neurons, sustentacular cells, globose cells (horizontal and basal), Bowman's glands, olfactory nerve, and olfactory bulb.[8] The olfactory tract is made up of unmyelinated small diameter axons. The olfactory epithelium can be damaged quite significantly and still regenerate to form a functional epithelium that can produce new olfactory receptor neurons. OECs support neurogenesis throughout life.[5–7] OECs act as 'pathway cells' that enable nerve fibres in the olfactory system to be continually renewed.

During the normal cell turn over and following any injury, new olfactory receptor neurons are produced from basal stem cells of olfactory epithelium, (which are probably the basal globose cells).[9] The axons from these newly formed neurons pass through the cribriform plate, re-enter the olfactory bulb and re-synapse with the second order neurons in the glomerular layer (the mitral cells in the second layer of the bulb).[8] The special feature that has a potential to help spinal cord repair is that axons of the olfactory nerve do not grow from the cut ends (unlike axons elsewhere). They simply die after an injury or during cell turnover and new nerves are generated from stem cells in the epithelium. The axons of newly formed neurons grow along their original pathway.

Although Geoff Raisman, chair of neural regeneration at University College London's Institute of Neurology, who led the UK research team in this human experiment said about this great achievement that "what had been achieved was more impressive than man walking on the moon",[1] yet, the technique has a long way to go before it is established.

The beauty of scientific writing is this that innovative ideas, indigenous approaches, futuristic techniques, and potential treatments are shared with the readers. The purpose of writing this particular piece is to encourage young scientists to experiment with this technique until it is established. Experiments on animals will help establish procedures for safe removal of olfactory bulb and cellular transplant. In addition to spinal cord injury models, experiments can be designed in other neuronal injuries as well as neurodegenerative diseases.

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