A Step in the Right Direction for Spinal Cord Injuries

Spinal cord injuries (SCIs) are devastating to individuals both physically and mentally. They also impose a substantial financial burden on their carers and healthcare systems, yet an effective treatment for this severe condition is still lacking. Prof. Franklin and colleagues at the University of Cambridge have led the first successful cell transplant clinical trial treating dogs with spinal cord injuries unable to move their rear legs. Strikingly, dogs which received treatment regained movement in their back legs and had improved walking coordination. Prof. Franklin hopes that his research, in combination with other therapies, will help restore some body function to human patients with SCIs.

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Jasper the dachshund is trotting along on a treadmill, wagging his tail, in what appears at first to be a quirky YouTube video, however rewind to 6 months prior and Jasper is dragging his hind legs behind his torso like heavy weights, paralysed by a spinal cord injury (SCI). The video illustrates the striking results of the first successful cell transplant clinical trial in the treatment of SCIs in dogs headed by Prof. Robin Franklin and colleagues at the University of Cambridge.

There are approximately 50,000 people in the UK living with paralysis, with 3 new cases occurring daily. SCIs are the leading cause of paralysis and are devastating to individuals both physically and mentally. Paralysis occurs from the site of injury downwards, so the higher up the spine the injury, the greater the loss of body function. SCIs are often fraught with additional complications- muscle wasting, depression, respiratory failure, deep vein thrombosis and more. Taking into consideration the wider community as well, there is an incredible emotional burden on family and carers and the annual financial cost of SCIs to society is approximated to be more than a billion pounds in the UK alone- yet an effective treatment is still lacking.

Treating spinal cord injuries to restore body function has been notoriously challenging for several reasons. Firstly, once the nervous system is fully developed, adult nerve cells in the spinal cord have very limited growth abilities. Inflammation and scar formation at the site of a SCI physically restrict nerve growth. Another obstacle is that any new nerve cells that grow need to not only bridge the lesion but actually grow all the way out to re-establish the correct synapses (connections) with other nerve cells and with muscles which may be as far away as the tips of our toes.

Jasper was one of 34 dogs with SCIs which took part in a clinical trial run by Prof. Robin Franklin and colleagues. All the dogs had severe SCIs for at least three months and had no voluntary movement or pain sensation in their back legs. Twenty three dogs were randomly selected to receive cell therapy treatment- special cells called olfactory ensheathing cells were extracted through their noses, multiplied in the

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lab and injected into their spines at the site of injury. The remaining 11 dogs received a placebo liquid injection. The study was double-blinded, meaning that neither the owners nor the researchers knew whether the dogs were receiving treatment or placebo.

Six months later, dogs which received treatment had a significant improvement in the movement of their rear legs and in the coordination of their front and back legs compared to the placebo group. In addition to being effective, the therapy was also found to be safe, with only transient, mild side-effects. However, the dogs which received treatment still had problems balancing and wobbled from side to side and did not show any improvement in their bladder control. This indicates that the repair occurred locally and did not connect all the way to the brain. Nevertheless, the results are a breakthrough in the treatment of SCIs and will no doubt serve as the foundation for treatments to come.

This research has several important implications. Firstly, it validates the use of cell transplant therapy in the treatment of canine spinal cord injuries, a common condition in pet dogs. Secondly, the treatment shows a large, striking effect which has enabled the results to be used as a gateway to advancing to human clinical trials. Importantly, the study also highlights the significance of using veterinary models for human medical research to bridge artificial scenarios in the experimental laboratory and human clinical trials. In contrast to laboratory experiments, the SCIs in the dogs represent a variety of different, naturally occurring injuries which more closely reflect human SCIs. Moreover, the fact that the results were so striking and robust is a promising indication that when trials are carried out in the highly varied human SCIs, an effect could still be detected. (That is to say that the natural variation between individual humans and the types of injuries they have should hopefully not completely obscure any positive effect).

What do these findings mean for human SCI in the long-term?

These very exciting clinical trial results in pet dogs are a 'proof of concept' which has enabled clinical trials in humans with SCIs to commence. Prof. Franklin and colleagues are cautiously optimistic that cell transplant therapy should show some improvements in SCI patients, but point out that there is still a long way to go before full functionality is restored, particularly for processes which require communication via the brain, such as bowel and bladder control. Nevertheless, this groundbreaking work is a very promising step in the right direction for both man and man's best friend!

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