NAMS Scientific Symposium on Regenerative Medicine
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NEURO-REGENERATION FOLLOWING STROKE AND SPINAL CORD INJURY

(RESTORATIVE THERAPY IN NEUROLOGICAL DISEASES)

SYNOPSIS

The ultimate aim of any therapeutic strategy is the maximum restoration possible and eventual complete normalcy of function. The non – regenerative capability of the injured adult brain has been challenged in recent years and neural plasticity has been observed experimentally in both global and focal brain ischemia in animal models. Neuroimaging studies in stroke patients indicate altered post stroke patterns suggesting functional reorganization. However, whether neurogenesis increases in response to brain lesions and whether same stem cells or progenitor cells present in brain can be used for transplantation are potential questions that need to be answered. Recent studies have shown *in-vivo* differentiation of progenitor cells into neurons in adult human dentate gyrus. Functional recovery may occur in a small or localized brain injury using rehabilitation measures, but for large ischaemic strokes, the restoration may require new synaptic connections within and away from the damaged tissue. Considering the relatively poor capabilities of neural self-regeneration, this seems quite impossible. In an infarcted area, the ischemic core may not respond to any pharmacological or rehabilitative intervention. For these reasons, the prospects of repairing the neuronal networks, using cell transplantation seems promising and may offer a unique approach for brain repair and restoration of function. Considering the fact that the neuronal circuitry is a complex array of neuronal connectivity, the prospects of this technique *prima facie* seems remote, yet, the growing evidence from animal models and small clinical trials has suggested the feasibility of reconstruction of neuronal network, making the role of restorative medicine significantly promising.

Remarkable advances in our understanding of the pathophysiology of spinal cord injury (SCI), structural and functional, magnetic resonance imaging (MRI), image-guided regenerative

micro-neurosurgical techniques, and transplantable cell biology have enabled the use of cell-based regenerative techniques in clinical practice. It is important to note that there are more than a dozen recently completed ongoing or recruiting cell therapy clinical trials for SCI that reflect the views of many key stakeholders. The field of regenerative neuroscience has reached a stage in which the clinical trials are scientifically and ethically justified. Although experimental models and analytical methods and techniques continue to evolve, no model will completely replicate the human condition. It is recognized that more work with cervical models of contusive/compressive SCI are required in parallel with clinical trials.

In conclusion, the clinical translation of advances made through well-established and validated experimental approaches in animal models must move forward to meet the compelling needs of individuals with SCI and to advance the field of regenerative neuroscience. However, it is mandatory that such efforts at translation be done in the most rigorous and informed setting so as to determine safety and possible efficacy, ethically backed up by a robust translationally relevant preclinical research strategy, so as to provide key information to clinicians and basic scientists which will allow improvements in regenerative techniques and validation and refinement of existing interventions.