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Application of stem cells in brain diseases: Lessons from stroke and amyotrophic lateral sclerosis

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Abstract

Brain diseases represent the greatest global disease burden of human society. Faced with such a challenge, regeneration of nervous tissue based on transplantation of stem cells has attracted a significant attention in efforts to develop a successful cell therapy. Among numerous brain diseases, here we focus on two of them: while stroke stands as the most significant and most common cause of a life-long disability, amyotrophic lateral sclerosis (ALS) represents a fatal progressive neurodegenerative disease defined by very fast deterioration of motoneurons and inevitable death of the patient within few years after the first appearance of symptoms.

Here we present an overview of current state of the art in experimental application of stem cells in stroke and amyotrophic lateral sclerosis. While for stroke our group uses a mouse middle carotid artery occlusion model, ALS is successfully modeled by animal mutants of superoxide dismutase 1 (SOD1). Here we describe our experience with both direct intraparenchymal and intravascular transplantation of mouse neural stem cells and our observation about rates of survival, migration and differentiation of the transplanted cells.

Based on our and similar experiences from preclinical studies, many clinical trials with stem cells have been launched. Although characterized by rather heterogeneous conclusions in patients, many measurable benefits have been observed. It is obvious that parallel and coordinated work on both preclinical models and patient trials will help to gradually increase therapeutic effects of stem cells transplanted to the brain tissue affected by these fatal diseases.

Biography

Dinko Mitrecic has completed his MD in 2000 and Ph.D. in 2005 from University of Zagreb. He was a guest scientist at several universities, including two-years period at Universite Libre de Bruxelles where he developed specific protocols for application of neural stem cells in brain diseases. Currently, he is the head of the Laboratory for Stem Cells at Croatian Institute for Brain Research, a member of the Management Board of the Joint European Programme on Neurodegenerative Diseases and the secretary general of the Croatian Brain Council. He has published more than 30 papers in the field of neuroscience and stem cell technology and he has been invited speaker at more than 20 conferences in the field of neurology and stem cells.