Spinal IL-10 Gene Delivery Using Synthetic Polymers to Treat Neuropathic Pain

Pain is a significant national health problem. More than 25% of adult Americans have had a problem with persistent pain regardless of age (20-65), race, gender, and economic background. Although acute pain (weeks to several months) from an identifiable trauma is considered a symptom of disease or injury, chronic and recurrent pain, which persists for more than 3 months, is itself a disease condition. Recently, non-neuronal glial cells have emerged as key contributors to chronic pathological pain mechanisms. Upon activation, both astrocytes and microglia respond to and release a number of pro-inflammatory signaling molecules, exerting pathological functions. A newly discovered spinal cord anti-inflammatory gene therapeutic protocol, which requires multiple peri-spinal (intrathecal) injections, controls chronic neuropathic pain in animal models. Given the high clinical therapeutic potential of this gene delivery approach, a synthetic co-polymer formulation of poly(lactic-co-glycolic) acid (PLGA; 50:50), encapsulating the interleukin-10 gene and leading to interleukin-10 sustained release, was examined. Enhanced interleukin-10 gene uptake by immune cells in the spinal cord subarachnoid matrix (meninges) to control neuropathic pain after a single injection is the goal in these studies. Data from animal models of neuropathic pain reveal substantially improved gene delivery using PLGA for chronic pain control. Improved dose efficacy by 40 fold supports its future clinical utility after further development.