SEMINAR

CIC biomaGUNE
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

Advanced Biomaterials for Brain Repair and Imaging Following Ischemic Stroke

Maria Eduarda Oliveira

Postdoctoral Researcher of the **Magnetic Resonance Imaging** group. CIC biomaGUNE

Tuesday, 27th June 2023
12.00 pm

CIC biomaGUNE - Seminar Room

Stroke is one of the most debilitating neurological disorders worldwide. The most common type is ischemic stroke, characterized by an obstruction of the brain's vascular structures, resulting in a lack of blood supply to the affected area. At a cellular level, neuronal cells start to die and release inflammatory or apoptotic factors that further exacerbate the damage cascade. In the end, a fluid-filled cavity is left, surrounded by a glial scar, which acts as a barrier for neural recovery. Current treatment includes reperfusion via intravenous thrombolysis for clot removal but is often ineffective and might result in hemorrhagic complications, besides being limited by a narrow therapeutic time window[1].

Crucial targets for the successful repair of an infarcted brain involve ameliorating the harsh lesion site environment and protecting and stimulating endogenous cells. Mesenchymal Stem Cells (MSCs) are known to secrete numerous beneficial molecules such as anti-inflammatory, neurotrophic, and angiogenic factors and their therapeutic use in CNS pathologies has shown promising results, leading to functional improvements following injury. Nonetheless, their low survival and ineffective engraftment following transplantation are major hurdles regarding clinical applications[2].

Tissue engineering strategies using biocompatible hydrogels can overcome this issue by providing both mechanical support and more permissive conditions for cell survival/differentiation. Mn2+ will be incorporated into the produced hydrogels, allowing its imaging and tracking, through a magnetic resonance imaging (MRI)-based approach. However, Mn2+ in its free form has a short half-life and is easily cleared from the body, which limits its application in the long term. Therefore, we attached the Mn2+ to carboxymethyl chitosan dendrimers (CMCht/PAMAM-Mn) that allowed its release in a prolonged manner[3].

The current work aims to develop a hybrid hydrogel to improve the engraftment and survival of transplanted cells while providing structural support for endogenous cells. Moreover, incorporating Mn2+-based dendrimers into the hydrogels will allow their imaging and tracking throughout time, giving insight into the biomaterials' behavior in vivo.

Bibliography

1. Gorenkova, N., et al., In Vivo Evaluation of Engineered Self-Assembling Silk Fibroin Hydrogels after Intracerebral Injection in a Rat Stroke Model. ACS Biomater Sci Eng, 2019. 5(2): p. 859-869.
2. Fernandez-Garcia, L., et al., Cortical Reshaping and Functional Recovery Induced by Silk Fibroin Hydrogels-Encapsulated Stem Cells Implanted in Stroke Animals. Front Cell Neurosci, 2018. 12: p. 296.
3. Chowdhury, H.H., et al., The uptake, retention and clearance of drug-loaded dendrimer nanoparticles in astrocytes - electrophysiological quantification. Biomater Sci, 2018. 6(2): p. 388-397.