Development of an experimental model of traumatic brain injury using organotypic hippocampal slice cultures

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INTRODUCTION

Traumatic brain injury (TBI) is currently one of the leading causes of global cognitive disorder and is mainly caused by falls, traffic accidents and sport contacts (Victoria E. Johnson, 2013). Therefore, the comprehension of the pathophysiological mechanisms is a major challenge. Development of robust in vitro models is important for the understanding and apprehension of the molecular and cellular mechanisms of this pathology.

OBJECTIVES

The aim of this work is the development of a relevant model of an indirect traumatic brain injury using organotypic hippocampal slice cultures. The goal was to characterize the injury in terms of cell death, either for necrosis and apoptosis. Then, some characteristics of mild TBI hallmarks were explored to validate this model. Three groups were created: control, sham (handled through the stages of shock protocol but not shocked) and shocked group.

MATERIAL AND METHODS

A. Organotypic hippocampal slice cultures

B. Model of TBI

RESULTS

A. Cell death assessment

Necrosis (Propidium iodide labelling)

Apoptosis (CellEvent™ Caspase 3/7 Detection Reagent)

B. Fluorescent immunohistochemistry

Microglia (IBA1)

Dendrites (MAP2)

Synapses (SYT1)

PERSPECTIVES

These results allow us to validate the model as a relevant traumatic brain injury model which offers the ease of an in vitro platform with the tissue complexity of the organotypic cultures. In this context, diffuse axonal injury, clinical hallmark of traumatic brain injury, could be studied in a dynamic and interactive cellular environment.