

Mechanisms underlying functional recovery after subcortical stroke in non-human primates

Muscalu Diana Ionela

Master thesis in Experimental Biomedical Research

Abstract

Stroke is a debilitating disease with many casualties among the adult population. The recovery has poor prognosis when stroke affects a large area of the brain. In subcortical stroke, the degree of motor recovery might correlate with the damage produced to the corticospinal tracts. Lesions of these tracts often lead to a permanent impairment of the hand dexterity. With this work, we aim to develop a non-human primate model of subcortical stroke which will be used to investigate the degree of recovery and its neural correlates. The subcortical stroke is surgically induced by lesioning the internal capsule of the non-human primate, which leads to various degrees of upper limb impairment. During several months after the brain injury, the functional recovery was assessed using behavioural tasks like the reach-and-grasp Kuka robot task, the box-and-blocks task and the modified Brinkman board task. To investigate the changes between the pre- and post-lesion performance, we implemented a broad range of kinematic and brain analysis. The results acquired so far suggest that the gross motor control improved rapidly, whereas the dexterous hand movement remained impaired. The impairment in the fingers seems to be correlated with the amount of corticospinal tract disruption. The animal with small lesion managed to execute the tasks but at a lower performance than the pre-lesion score. When a substantial portion of the internal capsule was damaged, the monkey recovered to some extent, but she was never able to perform fine manual dexterity assessing tasks. Changes were identified mostly in the finger positioning during the tasks, the pre-shaping and the object grasping. Some of the animals have developed new strategies to approach the targets. In the brain analysis, we identified increased activity pre- and post-lesion in the motor and premotor cortex in the lesioned hemisphere. Further investigations should be focused on understanding the involvement of different brain areas in the recovery and to which extent the neural activity can predict the hand movement.

Prof. Eric Rouiller