Abstract

Focal cortical dysplasia is a structural and functional malformation of cortical development caused by mutations in mTOR signalling cascade that can result in pharmacoresistant epilepsy. Parvalbumin interneurons are probably the most important inhibition force in the brain that can help to stop epileptic seizures and it is possible that there are changes in function of these interneurons that are dependent on focal cortical dysplasia. This thesis had the aim to create a murine model of focal cortical dysplasia type II with labeled parvalbumin interneurons. This model was created by injecting plasmid with mutated mTOR gene during *in utero* electroporation. Cranial window implantation was then performed over created lesion together with calcium indicator injection for measuring neuronal activity under two-photon microscope. Our results confirm the same morphological characteristics as other studies has shown and also occurence of spontaneous seizures. We have shown statistically significant differences in size of pyramidal neurons depending on lesional or non-lesional position. For parvalbumin interneurons there was no such difference. Counting these two types of neurons in lesion and outside of lesion shown a trend towards reduced numbers in lesion, however it was not significant. Data from pentylentetrazol-induced seizures show slower decay of calcium signal fluorescence in parvalbumin interneurons compared to pyramidal neurons suggesting depolarization block of these interneurons. This was proven as statistically significant. Other results show moderate activation of parvalbumin interneurons before the onset of seizures, spreading depolarization after seizure termination and activation of some neurons in front of the spreading wave. These results were just discussed as there was not enough of data to statistically evaluate any of them.

Keywords: focal cortical dysplasia, parvalbumin interneurons, mTOR signalling cascade, epilepsy, calcium imaging