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Biological Markers to Study the Morphological Modifications Induced by Perinatal Asphyxia

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Statement of the Problem: Perinatal asphyxia (PA), a neurodevelopmental impairment that leads to neonatal mortality and is a determinant factor for short- and long-term disorders. Since pathophysiological mechanisms triggered by PA are not still totally unveiled, we investigated the changes in the cytoskeleton organization, synapse, and astrocytes in the nervous tissue.

Methodology & Theoretical Orientation: For this study, we used a well-established murine model of PA [1]. After one, 2, 4 and 6 months of severe PA (21 min) rats were sacrificed and their brains were analyzed by combining photooxidation, conventional electron microscopy and electron tomography 3-D reconstruction techniques in two areas hypoxia sensible: neostriatum and hippocampus [1]. Findings: After one month of PA, we found an increase in the F-actin staining in neostriatal and hippocampal dendritic spines together with some filopodia-likes structures, a typical embryonic type of spines in photooxidated tissue [2] [Fig 1 A). In contrast, after second month of PA, spines were less consistent stained. In addition, we observed an increment of marker for neuronal and glial dysfunction such as GFAP, neurofilament and MAP-2 [3]. These modifications were more clearly defined after 4 months of PA [3]. After 6 months of PA postsynaptic densities (PSDs) in neostriatum were highly modified. Using three-D reconstructions and electron tomography we were able to find clear signs of degeneration in the asphyctic PSDs (Fig 1 B and C) [3]

Conclusion & Significance: Therefore, we hypothesize that the cytoskeletal changes induced by PA in the rat CNS could lead to the severe modifications in synapse and related structures that trigger neuronal damage. In addition, electron tomography, 3-D reconstruction and photooxidation contributed to dissect critical alterations generated by PA that are not easily displayed using conventional microscopic techniques. These findings might contribute to generate new therapeutic tools.

References:

[1] Udovin LD et al (202). Front Neurosci.13:1345. doi: 10.3389/fnins.2019.01345.
[2] Saraceno GE et al (2016) Exp Neurol. 286:116-123. doi: 10.1016/j.expneurol.2016.08.017.
[3] Herrera MI, Kobiec T, Kölliker-Frers R, Otero-Losada M, Capani F (2020. Front Synaptic Neurosci. 23; 12:35. doi: 10.3389/fnsyn.2020.00035.

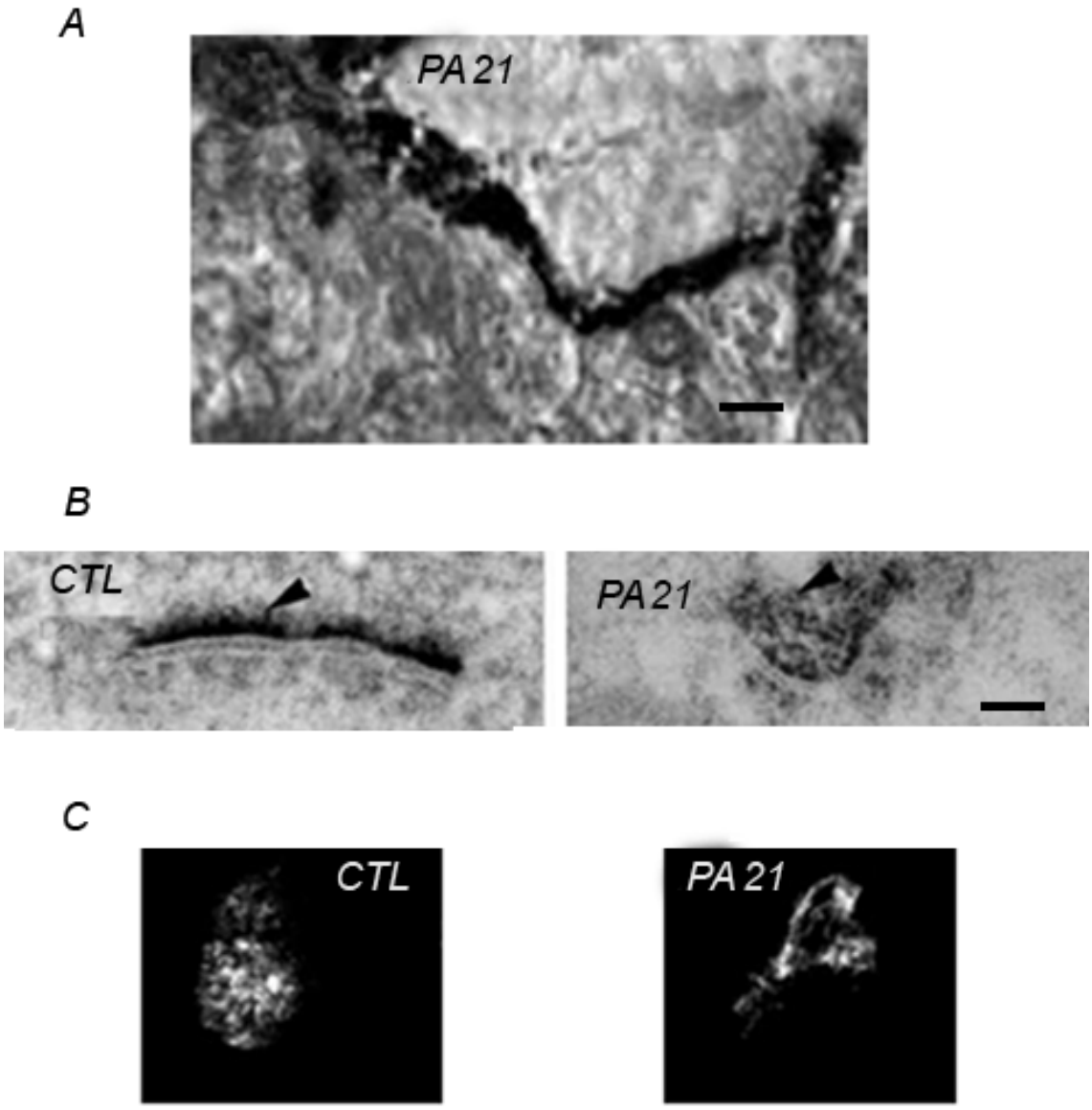

Fig 1. Synaptic Modification induced by Perinatal Asphyxa: A- Neostriatal synapse photo-oxidated with phalloidin-eosin (arrows). The long structure shared the features of the filopodia. B-Neostriatal synapses staining with E-PTA. Strong E-PTA precipitation was observed in the postsynaptic density (arrowhead) after 21 minutes of perinatal asphyxia (PA 21). C- 3-D Reconstruction volumes showing synapsis with perforation after 21 days of PA Scale Bar 0.5 µm. PA: Perinatal Asphyxia.

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