Microtomography of cerebral microcirculation in murine models of chronic pain

Chronic pain (CP) is a severe and disabling condition which affects hundreds of millions of people worldwide and it is a significant contributor to the rising opioid crisis, a public health emergency with societal and financial burdens. CP is commonly characterized by alldynia, dysesthesia and hyperalgesia, symptoms poorly managed by current interventions and that have been recently associated with increased mortality rate and suicide risk. Therefore, the search for an effective, non-addictive treatment becomes increasingly important. CP is the result of a central or peripheral injury or disease within the pain processing circuitry [6]. Interestingly, CP may become independent from the cause originated it. For example, involved neurons become hyperexcited, a condition that triggers profound long-term changes at the level of both neuronal and glial cells in several spinal, cortical and subcortical regions. In addition to the search for an efficient pharmacological non-opioid treatment for full-blown chronic pain patients, an early window of opportunity is envisaged for patients who experienced traumatic or post-surgical injuries. In these cases, the temporal structure of the processes that bring to chronic pain onset can be assessed with precision and the leading mechanisms could be inhibited or blocked. Preliminary, has been found that in rat models of neuropathic pain (i.e. persistent sciatic nerve ligature), abundant microvascular angiogenesis is observed in the primary somatosensory cortex, specifically on the hindlimb projection (S1HL). Therefore, CP development could be concurrently sustained by pro-angiogenic factors which orchestrate the formation of novel microvessels in relevant brain regions, molecular processes that could be inhibited, which would block the development of CP.

References:
Arttu Miettinen*, Antonio G. Zippo*, Alessandra Patera, Anne Bonnin, Gabriele E. M. Biella and Marco Stampanoni, Micrometer-resolution reconstruction and analysis of whole mouse brain vasculature by X-ray microtomography, in revision, (* these authors equally contributed to the work).


Alessandra Patera*, Antonio G. Zippo*, Anne Bonin, Marco Stampanoni, Gabriele E. M. Biella, Brain micro-vasculature imaging: an unsupervised deep learning algorithm for segmenting mouse brain volume probed by high-resolution phase- contrast X-ray tomography, accepted, International Journal of Imaging Systems and Technology. (* these authors equally contributed to the work).

Keywords: X-ray nanotomography, chronic pain, neurovascular coupling

Contacts: Antonio G. Zippo, IN; Virginia Borsa, Università di Bergamo; Alberto Bravin, European Synchrotron Radiation Facility (Grenoble, France); Paola Coan, Ludwig-Maximillian University of Munich (Germany); Carlo V. Cannistraci, Dresen Technical University (Germany); Arttu Miettinen, University of Jyvaskyla (Finland); Anne Bonin, Paul Scherrer Institute (Switzerland); Valentina Carozzi, Università Milano Bicocca

Website(s):
Other: