UNDERSTANDING WHITE MATTER LESIONS: POINT-TO-POINT CORRELATIONS BETWEEN IN SITU POST-MORTEM MRI AND HISTOLOGY

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This talk will cover the capabilities of the latest quantitative techniques based on Magnetic Resonance imaging (MRI) to show brain structure and function in neurodegenerative disease. We will also present the current results obtained by a method for point-to-point correlation allowing precise spatial matching between histology (including molecular and immunochemistry-based methods) and high-resolution MRI.

The School of Medicine of the University of Sao Paulo (FMUSP) performs around 14,000 autopsies annually at the Death Verification Service (SVO - Serviço de Verificação de Óbitos) of Sao Paulo. In recent years, approximately the 40 studies published by the medical community have stressed the need to revisit autopsies as a source to improve the quality of medical practice, scientific development, and integration to teaching in all levels. At the same time, the progressive development of technologies in medical imaging techniques has resulted in an increase in spatial, contrast and functional resolution to deal with medical diagnosis. Although it seems logical that the increased capacity to observe biological alterations results in better correlation, validations are, in general, based on technical image capabilities and proof-of-concept studies based on daily routine during clinical use of imaging equipment. There is a need for studying in depth the clinical correlation and notably, histological validation. In this talk we'll show a test-bed platform for validation of these new technologies using not only clinical correlations, but also integrate it with molecular and pathological basis.

We will cover a few relevant points to disclosure the potential of this platform in the field of neurology and the main clinical applications from the findings will be explored and illustrated with examples of both normal and diseased human brain.

In particular, preliminary results from a recent multicenter initiative illustrating the potential to translate results from this platform to *in vivo* neurological markers of white matter hyperintensities (WMH) will be depicted. We have used diffusion-tensor (DTI) images to probe white matter properties from both short post-mortem interval brain specimens imaged *in cranium*. The DTI parameters were analysed comparing WMH areas with normal appearing white matter regions (NAWM) in the same specimens. The results are compared to *in vivo* DTI images obtained in the same 3.0T MR system as well as the *post mortem* data. We show that the information obtained by post-mortem data can be directly co-located to histological information in both WMH and NAWM. Moreover, we also show that the DTI differences between WMH and NAWM are similar in both *in vivo* and *post mortem* data. This result indicates that the results from MRI-histology correlated data obtained in this platform can be directly applicable to living human brains, and potentially guide routine clinical assessment of neurological biomarkers.

Finally, we will comment on the perspectives of a core-facility in Brazil equipped with a Multi-slice Computed Tomography, 7T MR whole body system and ultrasound installed at one of the Worlds largest autopsy centers.