ESMI Study Group on STANDARDIZATION in SMALL ANIMAL IMAGING

UPDATE October 2022

MAGNETIC RESONANCE IMAGING (MRI)

Chairs: Giovanna D. Ielacqua (MDC, Berlin) & Markus Aswendt (University Hospital, Cologne)

MRI, well known for its clinical use, has become a key technology also for preclinical imaging. In the last 20 years, there have been critical developments in MRI hard- and software to apply MR sequences - first developed for human MRI - also in laboratory animals. Compared to other imaging modalities, MRI combines high spatial resolution with high tissue contrast and temporal resolution. It delivers anatomical and functional information without the need of contrast agents. A variety of quantitative tissue properties can be extracted using MR sequences sensitive to relaxation properties (T1, T2, and T2*), diffusion, perfusion, and fat content. Molecular probes have been designed to target these MRI-related tissue properties and to quantify specific cellular or molecular processes *in vivo*. Lastly, for brain imaging, sequences exist to extract brain activity (fMRI), neuronal wiring (DTI) and whole brain maps of functional and structural connectivity changes in health and disease models.

Standardization

The fast development in MRI technology has led to a huge heterogeneity in terms of imaging hardware (i.e., field strength, scanner, coils), acquisition and reconstruction protocols (Mandino et al. 2020). Furthermore, there has been no agreement on how to perform quality control and how to report imaging protocols (Mannheim et al. 2018). There is consensus, however, that there needs to be a change which incorporates both aspects, the experimental freedom to develop new MRI methods and at the same time make data reproducibility and clinical translation more effective (Keenan et al. 2019).

Approach

Previously the group focused on phantom measurements acquired in different preclinical MRI sites to determine the variability of main imaging parameters (T1 & T2 relaxation times, and temporal stability during EPI image acquisition for fMRI). Currently, we are collecting ideas, needs, and solutions to harmonize quality control procedures and reporting of acquisition parameters. For this we are connecting with other scientists but also vendors and standardization initiatives from other imaging societies (ESMRMB, ISMRM). We aim to raise the awareness of standardization in MRI, educate scientists on best practices to acquire, process and share MRI data, and lead a community-based consensus on how to run quality checks and report imaging parameters in publications to reduce bias and improve reproducibility. There are examples e.g. from magnetic resonance spectroscopy that have used that approach successfully to reach a consensus on acquisition and reporting standards (Lanz et al. 2021; Lin et al. 2021). The application of standardized imaging protocols (at least for phantoms) has been sufficient to generate highly reproducible apparent diffusion coefficient values across seven centers (Doblas et al. 2015).

If you are interested in receiving updates and getting involved in the discussion as well as international collaborative studies, please follow us on Twitter @ESMI_STANDARD and contact us!

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