

High Field MR Imaging of Mice Brain – Basic Requirements and Considerations.

The mouse is a near ubiquitous animal model for the study of basic physiology and anatomy and a plethora of human related diseases. The relatively small size of the animal, rapid reproduction, and availability of a wide variety of disease models and now genetic variations makes it an indispensable research tool. Fortunately, the small size of the animal also makes it very amenable to high quality MR studies. However there nevertheless are considerable technical concerns that must be addressed for successful and optimized studies. In the presentation, the basic requirements and considerations will be presented for optimized MRI of mice.

1. SNR/Field Strength/RF coils.

Although higher magnetic field strengths generally offer better sensitivity that can usually be translated into improved resolution and/or imaging time, compromises exist regarding image artifacts, sample access, sample orientation and cost to name a few. For mice, a few centimeters is required to accommodate the animal – however sample access, positioning and ancillary equipment are concerns. Magnets may be horizontal or vertical, making sample support and access an issue. These issues will be discussed. RF concerns will be introduced.

2. Animal Monitoring/Maintenance.

Animal support is of course a vital concern for successful studies. Methods for animal monitoring, temperature control and anesthesia etc will be outlined. Many options for anesthesia exist depending on the type of study. Although anatomical studies may be satisfactory in vertical bore magnet studies, the animals vertical orientation may lead to stress and physiological consequences for functional and metabolic studies.

3. Imaging Sequences.

Analogous sequences to conventional imaging are usually adequate, though the improved gradient performance usually available on animal machines may be use to optimize and refine sequences. Multislice is common, though full three dimensional imaging is preferred for volumetrics.

4. Multiple Mouse Imaging/Throughput

Especially for genetic studies, large numbers of animals may be required and subsequently throughput becomes a significant issue. Several groups have offered variations on techniques enabling multiple mouse imaging. The technical requirements and compromises will be discussed.

5. Ex vivo Considerations

Although this talk focuses on in vivo studies, ex vivo studies offer complementary and in some ways provide superior information. Excised fixed tissue may be imaged for longer periods without motion artifacts etc. However the image contrast differs (depending on fixation technique) and there may be sample distortions. These will be discussed.

6. Multi-modality Issues.

Finally, the options and future development of multimodality approaches will be introduced.