

Research and development of pre-clinical OMRI.

Abstract

Significance: Imaging free radicals, including reactive oxygen species and reactive nitrogen species, can be useful for understanding the pathology of diseases in animal disease models, as they are related to various physiological functions or diseases. Among the methods used for imaging free radicals, Overhauser-enhanced magnetic resonance imaging (OMRI) has a short image acquisition time and high spatial resolution. Therefore, OMRI is used to obtain various biological parameters. In this study, we review the methodology for improving the biological OMRI system and its applications. **Recent Advances:** The sensitivity of OMRI systems has been enhanced significantly to allow the visualization of various biological parameters, such as redox state, partial oxygen pressure, and pH, in different body parts of small animals, using spin probes. Furthermore, both endogenous free radicals and exogenous free radicals present in drugs can be visualized using OMRI. **Critical Issues:** To acquire accurate biological parameters at a high resolution, it is essential to increase the electron paramagnetic resonance (EPR) excitation efficiency and achieve a high enhancement factor. In addition, the size and magnetic field strength also need to be optimized for the measurement target. **Future Directions:** The advancement of in vivo OMRI techniques will be useful for understanding the pathology, diagnosis, and evaluation of therapeutic effects of drugs in various disease models. *Antioxid. Redox Signal.* 37, 1094-1110.