

A Comprehensive Review on the Use of Arterial Spin Labelling MRI for Localization of the Epileptogenic Zone in Drug-Resistant Epilepsy

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Epilepsy is a chronic neurological disease. The mainstay of treatment of epilepsy is Anti-Seizure Medication (ASM). Thirty per cent of individuals develop Drug-Resistant Epilepsy (DRE), necessitating the use of Epilepsy Surgery (ES) or other alternative therapies. Precise anatomical and functional localization of the area of the brain generating seizures—Epileptogenic Zone (EZ) is essential to proceed with ES. Magnetic Resonance Imaging (MRI) can be used to identify anatomic lesions in the brain. However, MRI findings can be inconclusive in some, and cerebral perfusion scans are used in such cases to complement. This comprehensive review focused on the use of Arterial Spin Labelling (ASL) perfusion MRI-paradigm as a highly efficient, non-invasive, non-ionizing, less expensive, imaging technique that is a potential alternative to Positron Emission Tomography (PET). ASL determines Cerebral Blood Flow (CBF) which is altered in the EZ. Compared to PET, ASL does not use radioactive substances, offering a higher safety profile to the patient. Previous research using ASL-derived CBF maps has shown that quantitative analysis provides more accurate EZ localization than qualitative analysis. ASL quantification can be amalgamated with other presurgical investigations in the multimodal reconstruction of the surgical map. Unfortunately, larger studies on the presurgical use of ASL quantification with solid scientific data are currently unavailable in the literature. Therefore, this comprehensive review highlights the increasing importance of ASL perfusion MRI as a valuable and safe method for EZ identification in DRE patients with negative MRI findings, providing a detailed comparison with existing imaging techniques.

Keywords: *Arterial Spin Labelling (ASL), Drug-resistant Epilepsy (DRE), Epileptogenic Zone (EZ)*