

## Neuroimaging Capabilities of Low-Field Permanent Magnet MR Systems in Resource-Limited Settings

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### Purpose

This educational exhibit will explore the neuroimaging capabilities and challenges of low-field, permanent magnet MR imaging technologies increasingly utilized in developing countries. Limited access to helium and the infrastructure necessary to support superconducting magnets in resource-limited settings has spurred the development of commercially available, low-field permanent magnet MR systems. As the MR community dedicates itself to optimizing neuroimaging at ultra-high field, the challenges of low-field permanent magnet imaging (<0.4T) are infrequently discussed. The advancement of low-field permanent magnet technology is necessary to extend magnetic resonance imaging to a large part of the world's population, and it can also provide unique opportunities to research health concerns of the developing world<sup>1,2</sup>.

### Outline of Content

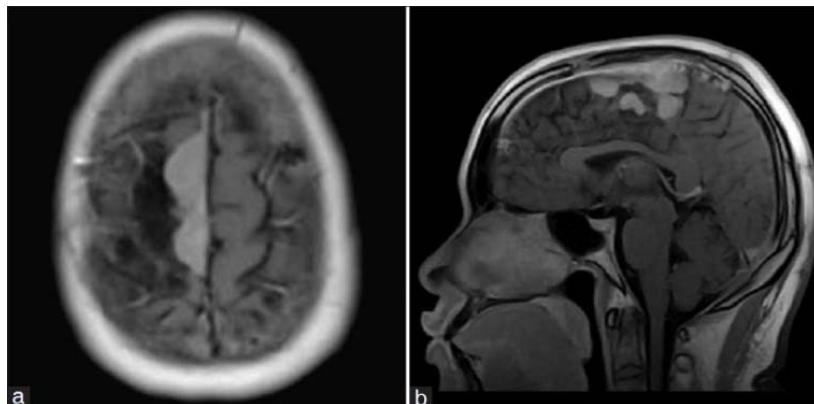
- 1.) State-of-the-art: A review of the technical abilities and limitations of existing low-field MR systems
  - Limitation of the main field ( $B_0$ ) strength for permanent magnets – a weight problem
  - Unique installation challenges for a magnet that is always “on”
  - RF receiver chain design and coil availability
  - Gradient system performance
- 2.) Available MR pulse sequences for clinical neuroimaging and research
  - Structural neuroimaging capabilities and example images (Figure 1)
  - Functional neuroimaging – what we can and cannot do
  - Contrast agent performance considerations at low-field
- 3.) Feasibility of neuroimaging research in resource-limited settings
  - Clinical utilization – experiences from the University College Hospital, Ibadan, Nigeria
  - Image management and post-processing in settings with limited digital infrastructure.
- 3.) The state of quality control procedure for low-field MR systems
  - The state of accreditation for low-field systems
  - Existence of phantoms for low-field Quality Control procedures

### Summary

Low-field permanent magnet MR systems will be increasingly utilized in resource-limited settings due to their independence from helium and power supply infrastructure. Optimization of available systems for clinical neuroimaging will greatly improve diagnostics and lead to unique opportunities to study health concerns in resource-limited settings. This exhibit summarizes the state-of-the art in permanent magnet MRI to encourage interest in the improvement of existing systems and their utilization for collaborative neuroimaging research in the developing world.

### References

1. Ogbole GI, et al. Magnetic resonance imaging: Clinical experience with an open low-field-strength scanner in a resource challenged African state. *J Neurosci Rural Pract.* 2012 May-Aug; 3(2): 137-143.
2. Ogbole GI, et al. Low field MR imaging of sellar and parasellar lesions: experience in a developing country hospital. *Eur J Radiol.* 2012 Feb;81(2):e139-46. Epub 2011 Feb 5.



**Figure 1** MR images from a 0.2T permanent magnet MRI system acquired at the University College Hospital, Ibadan, Nigeria. (a)  $T_1$ -weighted post gadolinium axial and (b) sagittal images showing a right parafalcine meningioma in a 45-year-old male.

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