Three-dimensional voxel-based signal intensity quantification of symptomatic intracranial plaques

Carlos Dier, Andres Gudino, Navami Shenoy, Elena Sagues, Martin Cabarique, Ruben Calle, Domenica Cifuentes, Sebastian Sanchez, Connor Aamot, Minako Hayakawa, Bruno A. Policeni, Edgar A. Samaniego

1. University of Iowa, Department of Neurology.
2. Yale University, Department of Neurology.
3. University of Iowa, Department of Neurosurgery.
4. University of Iowa, Department of Radiology.

1. Introduction

- Intracranial plaque enhancement (IPE) serves as a biomarker for symptomatic plaques.
- Voxel-based quantification can improve the characterization of plaque enhancement

2. Methods

- Prospective imaging with 7T HR-MRI.
- Plaques were segmented using 3D Slicer
- IPE was analysed using an in-house MATLAB code after normalization to the corpus callosum
- **Three IPE metrics:**
  - Mean enhancement ratio (MER: mean SI post / mean SI CC)
  - Gadolinium uptake ([mean SI post - mean SI pre] / standard deviation SI pre)
  - Contrast-enhancement ratio (CER: [mean SI post - mean SI pre] / mean SI post).
- ROC curve analysis was conducted to evaluate the accuracy of IPE metrics in detecting symptomatic plaques.

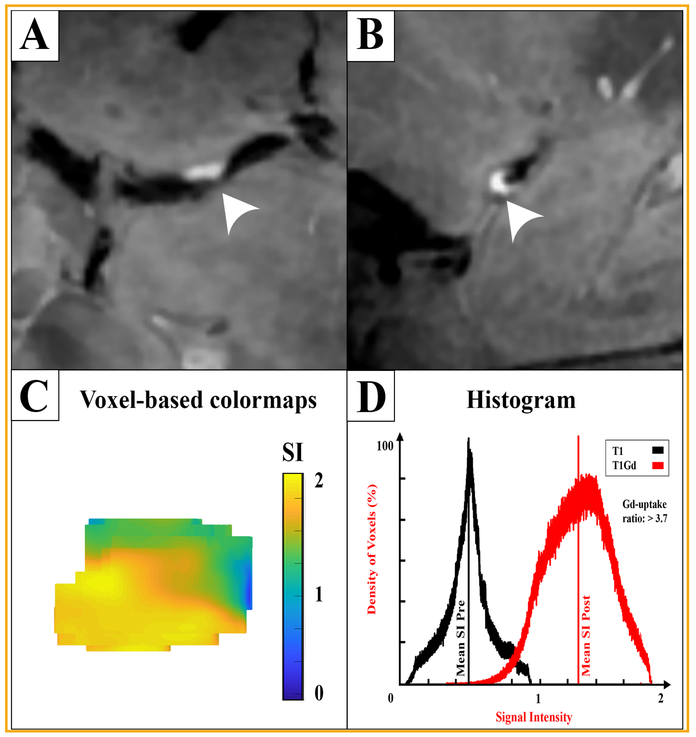


Figure 1. Voxel-based IPE quantification

3. Results

- A total of 41 patients with 75 plaques, 40 plaques (53%) were symptomatic.

IPE metrics	Symptomatic	Asymptomatic
MER	1.16 ± 0.48	0.97 ± 0.33
Gd-uptake ratio	5.6 ± 4.13	3.43 ± 2.48
CER	1.09 ± 0.69	0.77 ± 0.67

$p < 0.05$

- Symptomatic plaques were more likely to exhibit increased gadolinium uptake ratio (OR 1.25, p *0.01*).
- A gadolinium uptake ratio above 3.7 demonstrated an area under the curve of 0.70 for detecting symptomatic plaques

4. Conclusion

- **Voxel-based SI quantification** may improve symptomatic stratification of intracranial plaques by characterizing enhancement patterns.

UNIVERSITY OF IOWA HEALTH CARE

Carlos Dier, MD, Research Fellow UIHC
fcdier@hotmail.com
@dier_carlos