

MRI: Brain

Image quality in the multicenter setting can be greatly influenced by variances in acquisition protocols. These variances may be related not only to equipment manufacturer and model, but also technique.

The study may permit imaging per institutional standard-of-care. However, aligning image acquisition to established standards is essential for robust quality data.

The table below is provided as a guideline and overview for MRI Brain exams at either 1.5T or 3T. Please refer to your site's specific MRI manufacturer's imaging protocols for the optimal scanning protocol.

The Brain Tumor MRI examination should contain, at a **minimum**, the following sequences but not limited to:

1. Localization scan
2. Axial 3D T1 **Pre-Contrast**
3. Axial T2 FLAIR
4. Axial 3D T1 **Post Contrast** (parameters and images should match the Axial 3D T1 pre-contrast)

Advanced imaging sequences are frequently used such DWI, post contrast Axial T2 for tissue quantification (prior to Axial 3D T1 *post contrast*), and DSC.

Exam and Patient Preparation

Magnet Strength	1.5T or 3T		
Coil	Vendor Head Coil		
FOV	2D Sequences = 256 mm x 256 mm 3D Sequences = 240 mm x 240 mm		Adjust to patient body.
Patient Position	Supine		Position head as straight as possible and immobilize for a good quality scan.
Contrast Injection	Dual-chamber recommended	power injector	Insertion of intravenous catheter in upper extremity prior to the start of imaging.
	Contrast Bolus =	0.1 mmol/kg body weight	
	Bolus Rate =	3-5 mL/s	
	Saline Flush =	20 mL	
Slice Plane	Axial/Coronal/Sagittal planes (orthogonal to area of interest)		Scan direction based on site preference.

Image Acquisition

Localization Scan	3-plane localization scan	
Pre-Contrast Axial 3D T1w IR- GRE	<u>Siemens</u>	
	Slice thickness ≤ 1.5 mm	
	TR = 2100 ms	
	TE = min	
	TI = 1100 ms	
	Flip angle = 10°–15°	
	Acceleration = 2X	Must match Ax 3D T1 post contrast parameters and locations.
	<u>GE and Philips</u>	
	Slice thickness ≤ 1.5 mm	
	TR < 15 ms	
	TE < min	
	TI = 400–500 ms	
	Flip angle = 10°–15°	
	Acceleration = 2X	
Pre-Contrast Axial T2 2D FLAIR	Orthogonal high-resolution	
	Slice thickness = 3 mm	
	Gap = 0 mm	
	TR ≥ 6000 ms	
	TE = 100–140 ms	
	TI = 2500 ms (3T)	
	= 1100 ms (1.5T)	
	Flip angle = 90–160°	
	Acceleration up to 2X	3D T2 FLAIR is acceptable as well.
Post-Contrast Axial 3D T1w IR- GRE	<u>Siemens</u>	
	Slice thickness ≤ 1.5 mm	
	TR = 2100 ms	
	TE = min	
	TI = 1100 ms	
	Flip angle = 10°–15°	
	Acceleration = 2X	Must match Ax 3D T1 post contrast parameters and locations.
	<u>GE and Philips</u>	
	Slice thickness ≤ 1.5 mm	
	TR < 15 ms	
	TE < min	
	TI = 400–500 ms	
	Flip angle = 10°–15°	
	Acceleration = 2X	

Additional Image Acquisition

Axial 2D DWI (SS-EPI)	Slice thickness ≤ 4 mm Gap = 0 mm TR ≥ 5000 ms TE = min TI = 1100 ms Flip angles = 90°/180° Acceleration = up to 2X <i>b</i> -values = 0, 500, 1000 s/mm ² Diffusion directions at least 3	Performed prior to contrast administration.
Ax 2D T2w	Slice thickness ≤ 4 mm Gap = 0 mm TR ≥ 2500 ms TE = 80–120 ms Flip angles = 90°/180° Acceleration = Up to 2X	Acquired post contrast and before postcontrast 3D T1-weighted images to control timing of images after contrast administration.
DSC	Slice thickness ≤ 3–5 mm Gap = 0–0.25 mm TR = 1000–1500 ms TE = 30–35 ms Flip angles = 60° Acceleration = Up to 2X	DSC is done post injection. Only the tumor needs to be covered, not the entire head.

References

1. ACR–ASNR–SPR Practice Parameter for the Performance and Interpretation of Magnetic Resonance Imaging (MRI) of the Brain, Res. 17 – 2019. <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/MR-Brain.pdf>, accessed February 16, 2021.
2. Indications for MRI brain. <https://mrmaster.com/index-3.html>, accessed February 16, 2021.
3. MR Brain WO [contrast] Neuro Protocol. <https://www.ohsu.edu/school-of-medicine/diagnostic-radiology/mr-brain-wo-neuro-protocol-0>, accessed February 16, 2021.