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Recommended DSC-MRI Perfusion Acquisition Protocol

There are two recommended options for the acquisition of DSC (dynamic susceptibility contrast)-MRI data[1] that are schematized in Figure 1.

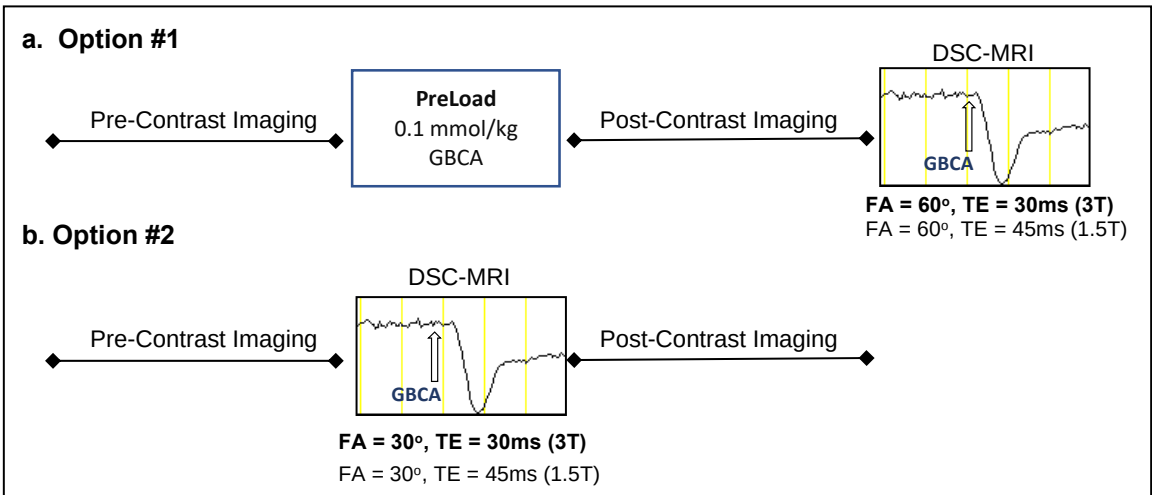

Figure 1. DSC-MRI Acquisition Protocol Options. (a) Option #1 is comprised of standard pre- and post-contrast brain tumor imaging, followed by the collection of DSC-MRI data during administration of a 2nd dose of GBCA. GRE-EPI with a flip angle (FA) of 60° and TE=30ms is recommended. (b) Option #2 consists of DSC-MRI data collection during a single dose of GBCA, using a low FA (30°) and no contrast agent preload.

Option #1 includes the collection of standard pre- and post-contrast imaging, using a standard, single dose of gadolinium-based contrast agent (GBCA), followed by the collection of DSC-MRI data during the administration of a second equivalent dose of GBCA (0.1mmol/kg).

With **option #2** the DSC-MRI data is collected during the first and only dose of GBCA, after which standard post-contrast images are collected. The imaging parameters recommended for each option are listed in Tables 1 and 2 for both 1.5T and 3.0T MRI field strengths. (Note, though studies have demonstrated agreement between option #1 and option #2[2], option #1 is considered more robust as it is less sensitive to variations in image parameter settings.[3])

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Table 1. DSC-MRI Acquisition Option #1 (Preload Dose + DSC Dose)*

	Field Strength	
	1.5T	**3.0T**
Imaging Sequence	GRE-EPI	GRE-EPI
Plane	Axial (Oblique, Axial)	Axial (Oblique, Axial)
Mode	2D	2D
Flip Angle (FA)	60º (60 º-65 º) or 30º (30 º-35 º)	60º (60 º-65 º) or or 30º (30 º-35 º)
TE (msec)	45 (40-50)	30 (20-35) for 60º FA 30 (25-35) for 30º FA
TR (sec)	1-1.5s	1-1.5s
Total Timepoints	120	120
Baseline Timepoints	50 (30-50)	50 (30-50)
Field of View (mm)	220-240	220-240
Acquisition Matrix	128x128 (96-128 x 96-128)	128x128 (96-128 x 96-128)
Slice Thickness (mm)	3 (3-5), as needed for tumor coverage	3 (3-5) as needed for tumor coverage
Slice Gap (mm)	0 (0-1), as needed for tumor coverage	0 (0-1), as needed for tumor coverage
Parallel Imaging	≤2x	≤2x

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Table 2. DSC-MRI Acquisition Option #2 (NO Preload Dose + DSC Dose)*

	Field Strength	
	1.5T	**3.0T**
Imaging Sequence	GRE-EPI	GRE-EPI
Plane	Axial (Oblique, Axial)	Axial (Oblique, Axial)
Mode	2D	2D
Flip Angle (FA)	30º (30º-35º)	30º (30º-35º)
TE (msec)	45 (40-50)	30 (25-35)
TR (sec)	1-1.5s	1-1.5s
Total Timepoints	120	120
Baseline Timepoints	50 (30-50)	50 (30-50)
Field of View (mm)	220-240	220-240
Acquisition Matrix	128x128 (96-128 x 96-128)	128x128 (96-128 x 96-128)
Slice Thickness (mm)	3 (3-5), as needed for tumor coverage	3 (3-5) as needed for tumor coverage
Slice Gap (mm)	0 (0-1), as needed for tumor coverage	0 (0-1), as needed for tumor coverage
Parallel Imaging	≤2x	≤2x

Note, for Option #1 both low and mid-range flip angles can be used. For Option #2, only the low FA setting is recommended. At 1.5T the recommended TE is longer (45ms) compared to 3T (30ms), but it is acceptable to use a TE=30ms at 1.5T. (See Semmineh et al.[3]) All other settings are the same for both 1.5T and 3.0T.

*The administration and total dose of the contrast agent used must be in accordance with FDA guidelines.

Literature Cited:

1. Schmainda KM, Rand SD, Joseph AM, et al. Characterization of a first-pass gradient-echo spin-echo method to predict brain tumor grade and angiogenesis. Am J Neuroradiol 2004; 25:1524-1532.
2. Boxerman J, Schmainda KM, Weisskoff RM. Relative cerebral blood volume maps corrected for contrast agent extravasation significantly correlate with glioma tumor grade whereas uncorrected maps do not. Am J Neuroradiol 2006; 27:859-867.
3. Semmineh NB, Bell LC, Stokes AM, Hu LS, Boxerman JL, Quarles CC. Optimization of acquisition and analysis methods for clinical dynamic susceptibility contrast MRI using a population-based digital reference object. AJNR Am J Neuroradiol 2018 Oct 11 [Epub ahead of print.]