

Supplemental Table S1. Overview of MRI techniques used in monitoring cancer immunotherapy.

Biological Phenomenon	MRI Techniques	Application	Stage of Testing	References
Tissue characterization	T ₁ -weighted MRI T ₂ -weighted MRI	Tissue characterization	Clinical	5, 39
Tumor Cellularity	DWI, IVIM, DKI	Tumor cell death or cell loss following immune checkpoint blockade, dendritic cell vaccination, and adenoviral gene therapy	Clinical	5, 46, 48, 49
Vascular Permeability and Inflammation	Contrast enhanced MRI	Qualitative assessment of tissue vascularity	Clinical	40
	DCE-MRI	Quantitative measures of vascular permeability following immune checkpoint blockade	Clinical	5, 54
	Antibody-conjugated MPIO e.g. VCAM-1	Vascular inflammation following PD-L1 monotherapy	Preclinical	56
Tumor Metabolism	¹ H-MRS	<i>In vivo</i> assessment of metabolites	Clinical	73
	CEST MRI	Measurement of targeted metabolites	Clinical	74
	Hyperpolarized ¹³ C-MRI [1- ¹³ C]pyruvate [1,4- ¹³ C ₂]fumarate	Glycolysis Cell Death	Preclinical / Clinical Preclinical	84, 85, 86 85

Tracking Labeled Leukocytes	SPIO	Therapies targeting tumor-associated macrophages e.g. anti-CD47 monoclonal antibodies	Preclinical / Clinical	96, 97, 98, 99
	¹⁹ F-PFC	Cell-based therapies e.g. T cells, NK cells, DCs	Preclinical / Clinical	107, 108, 109
Reporter Gene Imaging	Lysine-rich protein	Oncolytic viral therapy	Preclinical	122
	Ferritin	Dendritic cell vaccination	Preclinical	123
	Nucleoside kinase	Dendritic cell vaccination	Preclinical	124
Immune-related Adverse Events	T ₁ -weighted MRI	Encephalomyelitis	Clinical	141
	T ₂ -weighted MRI			
	T ₁ /T ₂ -mapping	Colitis	Clinical	142, 143, 144
	Late gadolinium enhancement			
	DCE-MRI	Hepatitis	Clinical	145
	DWI			
Hybrid Imaging	MRE	Inflammatory Arthritis	Clinical	146
		Myocarditis	Clinical	147
	DWI + [¹⁸ F]FDG PET (Tumor cellularity + glucose metabolism)	Immune checkpoint inhibitors	Clinical	160, 161
	T ₂ -weighted MRI, Contrast enhanced T ₁ -weighted MRI, DWI + [¹⁸ F]CFA PET	Dendritic cell vaccination	Preclinical / Clinical	162

(Tumor cellularity and
vascularity + deoxycytidine
kinase activity)

[64]Cu labeled SPIO
nanoparticles for cell tracking

CAR T cell therapy

Preclinical

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MRI = magnetic resonance imaging; DWI = diffusion-weighted imaging; IVIM = intravoxel incoherent motion; DKI = diffusion kurtosis imaging; DCE-MRI = dynamic contrast-enhanced MRI; MPIO = microparticles of iron oxide; MRS = magnetic resonance spectroscopy; CEST MRI = chemical exchange saturation transfer (CEST); SPIO: superparamagnetic iron oxide; ¹⁹F-PFC = Fluorine-19 perfluorocarbon; PET = positron emission tomography; [¹⁸F]FDG = Fluorine-18 fluorodeoxyglucose; [¹⁸F]CFA = 2-chloro-2'-deoxy-2'-[¹⁸F]fluoro-9-b-D-arabinofuranosyl-adenine.

N.B. The MRI techniques described in this review were updated till July 2022. The focus is on clinical application and highlighting MRI methods investigated in cancer immunotherapy.