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Appendix E1: MDE Image Acquisition Protocol

Two types of scanners were used in the MDE imaging, 1.5 T and 3 T. The 1.5-T scanners were MAGNETOM Symphony, Siemens Healthcare, Erlangen, Germany (7 cases) or Achieva, Philips Healthcare, Best, Netherlands (98 cases). The 3.0-T scanner was MAGNETOM Skyra, Siemens Healthcare, Erlangen, Germany (95 scanners). All MDE imaging was performed 10–15 minutes after intravenous administration of contrast agent with a dose of 0.15 mmol/kg of body weight (gadopentetate dimeglumine, Magnevist, Bayer-yakuhin, Osaka, Japan; gadoteridol, ProHance, Esai, Tokyo, Japan; or gadodiamide, Omniscan, Daiichi-Sankyo, Tokyo, Japan). Details of each scanner are given below.

MAGNETOM Symphony, 1.5 T

This system features standard fast low-angle shot inversion recovery or true last imaging with steady-state precession sequence with a phase-sensitive inversion recovery and magnitude reconstruction. Detailed parameters are as follows: repetition time, 550 ms; echo time, 1.23 ms; flip angle, 50°; matrix, 162 × 192 pixels; field of view, 160 × 190 mm; slice thickness, 8 mm; and parallel acquisition technique (PAT) factor, 2. The short-axis direction covered the entire left ventricle, the pulse sequence was inversion recovery fast gradient-echo, and the inversion time was optimized to nullify the myocardium.

Achieva, 1.5 T

Specifications are as follows: inversion recovery, two-dimensional gradient echo sequence; repetition time, 5.04 ms; echo time, 2.44 ms; flip angle, 25°; acquisition matrix, 176 × 114 pixels; field of view, 192 × 124 mm; reconstruction matrix, 256 × 256 pixels; slice thickness, 8 mm; and SENSE factor, 2. The short-axis direction covered the entire left ventricle.

MAGNETOM Skyra, 3.0 T

This system features magnitude-and phase-sensitive inversion recovery with a prepared steady-state free precession sequence, with the inversion time adjusted to TI null the myocardium. Specifications are as follows: repetition time, 916 ms; echo time, 1.09 ms; flip angle, 40°; matrix, 192 × 144 pixels; field of view, 340 × 255 mm; and slice thickness, 8 mm. Image acquisition was with generalized autocalibrating partially parallel acquisitions (GRAPPA) with an acceleration factor of 2, and the short-axis direction covered the entire left ventricle.

MDE image acquisition was obtained with breath-hold after inspiration and prospective electro-cardiogram gating using an inversion recovery or phase-sensitive inversion recovery sequence. For all image sets, left ventricular short-axis images were used from the basal to apical levels. The apex image in the short-axis view was not used.

Appendix E2: MDE Image Classification

Image classification relied upon the following definitions and considerations:

• None was defined as no obvious MDE pattern on the left ventricular wall.

• Focal was defined as a patchy pattern that did not reach both the epicardial and endocardial borders.

• Transmural was defined as a pattern appearing transmurally from the endocardium to epicardium. Care was taken to avoid interpreting a high signal area from epicardial fat as epicardial hyperenhancement.

• Subendocardial was defined as a pattern involving the subendocardium but not continuing up to the epicardial edge. When transmural and subendocardial patterns were present simultaneously, the lesion's predominant pattern was adopted as the classification. We also evaluated the presence of microvascular obstructions, which are typically observed as a hypointense area in the hyperenhancement area; these may mimic a normal myocardial signal. A microvascular obstruction was determined to be present if a hypointense core within the hyperenhancement in the subendocardial or transmural patterns was present.

• Nondiagnostic was defined as an image with major noise present, bright ghosting artifacts, massive motion artifacts (cardiac or respiratory motion), or inappropriate inversion time (10,11).

• Epicardial was defined as an apparent pattern appearing beneath the epicardium but not continuing up to the blood pool on the endomyocardial side.

• Midwall was defined as the presence of midwall striae without involvement of the epicardial or endocardial sides.

Appendix E3: Training System and Parameters

The program code was written using Python 2.7 (Python Software Foundation, Beaverton, OR, USA), and the neural network framework was written in Chainer 1.17.0 (Preferred Networks, Tokyo, Japan). The computer system components were as follows: operating system, Linux (Ubuntu 16.04 LTS; Canonical, London, England); central processing unit, Core i7–7700 K 4.20 GHz (Intel, Santa Clara, CA, USA); random access memory, 32 GB, 512 GB solid state drive, 3 TB hard disk space; and graphic processing unit, GeForce 1080Ti, 11 GB RAM (NVIDIA, Santa Clara, CA, USA).

To prepare training images, they were augmented randomly, including vertical flipping, image rotation within ± 14°, and magnification from 0.8 to 1.2, to make the CNNs robust and generalize the training against input image variation (22). Then, training images were randomly cropped to 224 × 224 pixels to fit the CNN input architectures. The following parameters were used for training: for GoogLeNet and AlexNet; optimizer, stochastic gradient descent; base learning rate, 0.01; batch size, 32; epochs, 500, and for ResNet-152; optimizer, Adam; alpha, 0.01; $\beta 1$, 0.9; $\beta 2$, 0.999; ε, 10^{-8}; batch size, 12; epochs, 2000.

Table E1: Confusion matrix between teaching images and AlexNet classification results

		Gold standard								
	CNN image classification	**None**	**Focal**	**Trans-mural**	**Subendo-cardial**	**Nondiag-nostic**	**Epicardial**	**Midwall**	**Total**	**Precision (%)**
CNN classification result	No pattern	831	42	12	52	11	22	22	992	83.8
	Focal	23	72	5	15	0	4	6	125	57.6
	Transmural	7	3	138	14	1	4	3	170	81.2
	Subendocardial	35	19	29	362	8	8	7	468	77.4
	Nondiagnostic	5	0	0	6	49	1	1	62	79.0
	Epicardial	12	3	3	5	1	48	5	77	62.3
	Midwall	13	2	3	4	1	4	74	101	73.3
	Total	926	141	190	458	71	91	118	1995	
	Sensitivity (%)	89.7	51.1	72.6	79.0	69.0	52.7	62.7		
	Overall accuracy (%)	78.9								

Note: Unless otherwise indicated, data are expressed as numbers. CNN = convolutional neural network.

Table E2: Confusion matrix between teaching images and ResNet-152 classification results

		Gold standard								
	CNN image classification	**None**	**Focal**	**Trans-mural**	**Subendo-cardial**	**Nondiag-nostic**	**Epicardial**	**Midwall**	**Total**	**Precision (%)**
CNN classification result	No pattern	863	49	15	37	7	24	26	1021	84.5
	Focal	8	64	3	12	0	5	4	96	66.7
	Transmural	7	8	151	21	3	5	3	198	76.3
	Subendocardial	20	14	17	382	6	6	4	449	85.1
	Nondiagnostic	7	1	3	3	54	1	0	69	78.3
	Epicardial	13	3	0	2	1	48	6	73	65.8
	Midwall	8	2	1	1	0	2	75	89	84.3
	Total	926	141	190	458	71	91	118	1995	
	Sensitivity (%)	93.2	45.4	79.5	83.4	76.1	52.7	63.6		
	Overall accuracy (%)	82.1								

Note: Unless otherwise indicated, data are expressed as numbers. CNN = convolutional neural network.