



## Summary of Manual of Cardiac MRI Operations iMODERN trial

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### Synopsis of Imaging Protocol

**Step 1** localizer and scout images

**Step 2** SSFP cine imaging for 4-, 3- and 2-chamber views

**Step 3** . test run perfusion sequence with 3 short axis slices

*(see text for slice selection)*

. measure blood pressure

. start adenosine 140mcg/kg/min

. measure blood pressure at 2 min

if no HR/symptom response augment adenosine dose to 210mcg/kg/min

. start perfusion sequence at 4 min and inject stress contrast dose

*(breath holding on arrival of contrast in RV cavity)*

**Step 4** Single shot delayed enhancement images (TI 350ms) short axis coverage

**Step 5** SSFP cine imaging for short axis slices

**Step 6** TI scout in mid short axis slice followed by

PSIR delayed enhancement of 3 long and all short axis slices

**Step 7** start rest perfusion sequence and inject rest contrast dose

## Appendix I Sequence parameters

Cine imaging	
pulse sequence	2D steady-state free precession with retrospective ECG gating ( <i>True FISP. balanced FFE. FIESTA</i> )
matrix	256 (base resolution)
spatial resolution	~ 1.5 x 2.0 mm
temporal resolution	< 40 ms
flip angle	60° at 1.5T / 45° at 3T
parallel imaging factor	≤ 2
slice thickness	5 mm
slice gap	5 mm / 100%

First pass perfusion imaging	
pulse sequence	2D saturation recovery, spoiled gradient echo ( <i>TurboFLASH. T<sub>1</sub>-weighted TFE. SPGR</i> ) <b>please NO SSFP</b>
matrix	192 at 1.5T / 256 at 3T (base resolution)
spatial resolution	~ 1.9 x 2.4 mm at 1.5T / ~ 1.4 x 1.8 mm at 3T
saturation time*	130 ms (maximized for heart rate in <b>1 RR</b> interval)
flip angle	15° at 1.5T / 12° at 3T
slice thickness	8 mm
slice gap	2 mm / 25%
number of slices per heart beat	3, equally divided over the heart, excluding the LVOT
temporal resolution	120 ms
parallel imaging factor	2 at 1.5T / 3 at 3T
scan duration	70 heart beats

Single shot Delayed Contrast Enhancement	
pulse sequence	2D, inversion recovery, steady-state free precession
matrix	208 at 1.5T / 256 at 3T (base resolution)
spatial resolution	~ 1.5 x 2.3 mm
ECG trigger	every other heart beat, trigger delay to image in mid diastole
Inversion pulse	non-selective
inversion time (TI)	<b>350 ms</b>
flip angle	25° at 1.5T / 20° at 3T
parallel imaging factor	2 at 1.5T / 3 at 3T
slice thickness	8 mm
slice gap	2 mm / 25%

Delayed Contrast Enhancement	
pulse sequence	2D, inversion recovery, spoiled gradient echo, with PSIR ( <i>FLASH. T<sub>1</sub>-weighted TFE. SPGR</i> )
matrix	256 (base resolution)
spatial resolution	~ 1.5 x 2.0 mm
ECG trigger	every other heart beat, trigger delay to image in mid diastole
Inversion pulse	non-selective
inversion time (TI)	optimize to null signal of normal myocardium
flip angle	25° at 1.5T / 20° at 3T
parallel imaging factor	≤ 2
slice thickness	5 mm
slice gap	5 mm / 100%
band width	140 Hz/pixel at 1.5T / 350 Hz/pixel at 3.0T

## Appendix II Contrast & Stress agent dose

### Contrast agent dosage

During stress and rest perfusion imaging contrast dosage is slightly higher than the rest perfusion contrast dosage. The table below displays the volume of contrast for each acquisition (stress or rest). per patient weight. Contrast dose used is equal at 1.5T and 3T.

ProHance® - gadoteridol 0.5mmol/mL													
weight (kg)	50	55	60	65	70	75	80	85	90	95	100	105	110
stress (mL)	13	14	15	16	18	19	20	21	22	24	26	26	28
rest (mL)	7	8	9	10	11	11	12	12	13	14	14	16	16
Dotarem® - gadoterate meglumine 0.5mmol/mL													
weight (kg)	50	55	60	65	70	75	80	85	90	95	100	105	110
stress (mL)	13	14	15	16	18	19	20	21	22	24	26	26	28
rest (mL)	7	8	9	10	11	11	12	12	13	14	14	16	16
Gadovist® - gadobutrol 1.0mmol/mL													
weight (kg)	50	55	60	65	70	75	80	85	90	95	100	105	110
stress (mL)	6	7	8	8	9	9	10	10	11	12	12	13	14
rest (mL)	4	4	4	5	5	6	6	7	7	7	8	8	8

### Pharmacological stress agent and dosage

Patients should be instructed to avoid consumption of any products containing methylxanthines, including caffeinated coffee, tea or other caffeinated beverages, caffeine-containing drug products, aminophylline and theophylline for at least 12 hours before a scheduled CMR scan.

The dosage for **regadenoson** is **0.4mg/5mL** in a **single dose**, and should be administered in 10 seconds into an intravenous catheter, with 5mL saline flush immediately afterwards. The stress perfusion sequence is started approximately 1 minute after injection of regadenoson. After the acquisition of the stress perfusion images, the effects of regadenoson should be reversed with 50mg aminophylline intravenously.

The dosage for **adenosine** is **140mcg/kg/min** for 2 minutes at which blood pressure and heart rate are measured and in case the patient has no symptoms nor increase in heart rate, the adenosine dose is augmented to **210mcg/kg/min**. Contrast injection and stress imaging starts at 4 minutes after starting adenosine. In the table the different pump settings for administration in relation to body weight are displayed.

adenosine dosage 3mg/mL														
weight (kg)		50	55	60	65	70	75	80	85	90	95	100	105	110
140mcg	mg/min	7.0	7.7	8.4	9.1	9.8	10.5	11.2	11.9	12.6	13.3	14.0	14.7	15.4
	mL/min	2.3	2.6	2.8	3.1	3.3	3.6	3.8	4.1	4.3	4.6	4.8	5.1	5.3
	mL/hr	140	154	168	182	196	210	224	238	252	266	280	294	308
210mcg	mg/min	10.5	11.6	12.6	13.7	14.7	15.8	16.8	17.9	18.9	20.0	21.0	22.1	23.1
	mL/min	3.5	3.9	4.2	4.6	5.0	5.4	5.7	6.1	6.5	6.9	7.2	7.6	8.0
	mL/hr	210	231	252	273	294	315	336	357	378	399	420	441	462