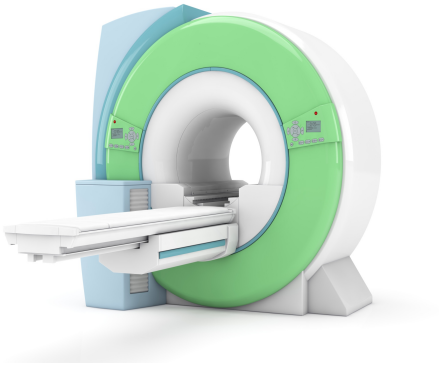
Cardiac MRI Essentials

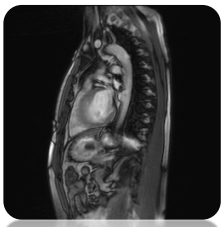
The standard CMR study

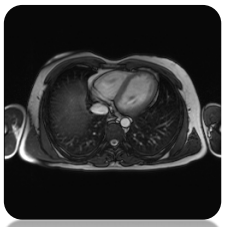
CMR is a *dynamic* and *interactive* process, requiring careful thought and planning by the operator at every step



Localisers

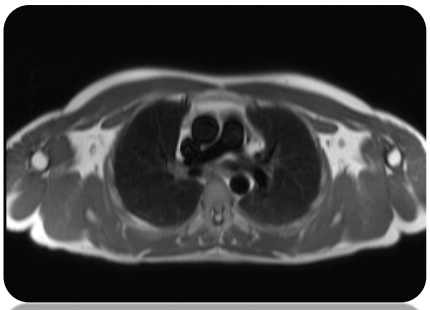
To get a quick initial 'orientation' for the position of the patient in the scanner:





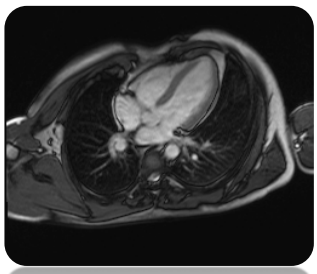
Transverse 'HASTE' slices

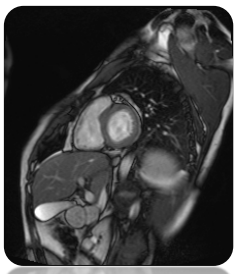
To image the chest in a series of transverse slices from lung apices to diaphragm:



Pilot views

To gradually 'home in' on the standard transthoracic echo views of the heart:





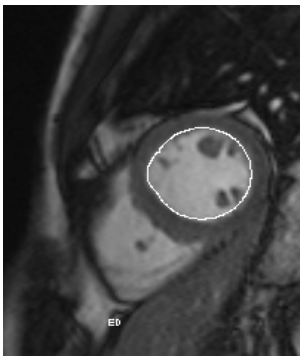
Cine CMR views

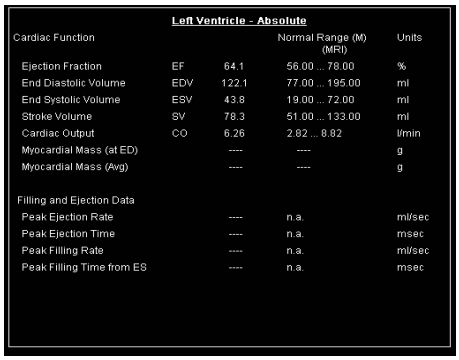
Once the appropriate imaging planes have been established, a set of detailed cine images are obtained in the standard 'echo' views:

- 4-chamber, 3-chamber, 2-chamber views
- Short axis views of the aortic valve, and LV from base to apex
- Plus a coronal LVOT view that doesn't have an echo equivalent

Quantification of LV and RV size & function

The volumes and systolic function of LV and RV can be quantified using the stack of short axis views:



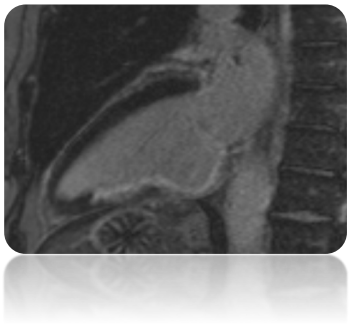


Left Ventricle - Absolute

Cardiac Function			Normal Range (M) (MRI)	Units
Ejection Fraction	EF	64.1	56.00 ... 78.00	%
End Diastolic Volume	EDV	122.1	77.00 ... 195.00	ml
End Systolic Volume	ESV	43.8	19.00 ... 72.00	ml
Stroke Volume	SV	78.3	51.00 ... 133.00	ml
Cardiac Output	CO	6.26	2.82 ... 8.82	l/min
Myocardial Mass (at ED)		----	----	g
Myocardial Mass (Avg)		----	----	g
Filling and Ejection Data				
Peak Ejection Rate		----	n.a.	ml/sec
Peak Ejection Time		----	n.a.	msec
Peak Filling Rate		----	n.a.	ml/sec
Peak Filling Time from ES		----	n.a.	msec

Late gadolinium enhancement

Finally, a set of long axis and short axis images are obtained 10 minutes after giving intravenous gadolinium contrast to look for late enhancement (myocardial infarction/fibrosis):



Additional CMR sequences

- Flow CMR
- Perfusion CMR
- CMR coronary angiography
- RV transaxial stack/RV inflow-outflow/RVOT
- Iron CMR
- Strain CMR
- Edema CMR

Further reading

Standardized cardiovascular magnetic resonance (CMR) protocols 2013 update. *Journal of cardiovascular magnetic resonance* 2013; **15**: 91 [click here to access online]