SUPPLEMENTARY DATA

Cardiovascular Magnetic Resonance Imaging in Suspected Cardiac Tumour: A Multicentre Outcomes Study

Supplementary Methods

Details of CMR protocol

Single-shot morphologic imaging was performed in the axial, sagittal, and coronal planes through the chest. Both dark-blood double-inversion recovery (HASTE) and bright-blood (SSFP) images were acquired. Typical parameters at 1.5T were: slice thickness, 5 mm; gap, 2.5 mm; matrix, 256; and in-plane resolution, 1.7 x 1.4 mm.

Cine imaging was performed using a segmented SSFP sequence, with short-axis images acquired every 1 cm (slice thickness, 6 mm; gap, 4 mm) throughout the entire left ventricle. Long-axis images were obtained in standard 2-, 3-, and 4-chamber orientations. Typical parameters at 1.5T were: matrix, 256; repetition time, 3.0 ms; echo time, 1.5 ms; flip angle, 60°; temporal resolution, 35 to 40 ms/phase; in-plane resolution, 1.7 x 1.4 mm.

T_1-weighted imaging was performed using a black-blood double inversion recovery fast spin-echo sequence with typical parameters at 1.5T of: effective echo time, 35-40 ms; trigger delay set to mid diastole; TR set at <1 R-R interval. T_2-weighted imaging was also performed using a black-blood double inversion recovery fast spin echo sequence with typical parameters at 1.5T of: echo time, 120 ms; flip angle, 90°, 180°; TR, 2 R-R intervals (1200-2400 ms).

First-pass perfusion imaging was performed in the imaging planes that optimally depicted the mass using a saturation recovery, gradient-echo sequence, and typical parameters at 1.5T were: matrix, 192; echo time, 1.1 ms; in plane resolution, 3.1 x 2.2 mm.

Gadolinium-based contrast (0.10-0.15 mmol/kg) was injected followed by a saline flush (40 mL).

Late gadolinium enhancement (LGE) imaging was performed for tissue characterization using a standard segmented inversion-recovery sequence and were obtained in short- and long-axis locations matching those of the cine images 10 min after contrast administration. Typical parameters at 1.5 T were: matrix, 256; slice thickness, 6 mm; in-plane spatial resolution, 1.8 x 1.3 mm. A set of standard LGE images were obtained

with inversion times adjusted in the standard fashion to null normal myocardium. Additionally, in nearly all cases, LGE imaging using an inversion recovery, single-shot, SSFP sequence that does not require breath holding was also performed. These sequences were typically acquired using both a short inversion time (280-360 ms) chosen to null viable myocardium. A second set was obtained with the inversion time set longer (long-TI LGE) to null thrombus (approximately 500-550 ms at 1.5T, 850-900 ms at 3T).

Supplementary Tables

Table S1. Patients with CMR diagnosis of Other Mass (n = 32)

Type	Number of patients
Vegetation from infective endocarditis	14
Tricuspid valve	6
Pulmonic valve	4
Mitral valve	3
Aortic valve	1
Coronary aneurysm	5
Right coronary artery	2
Saphenous venous graft	2
Left circumflex coronary artery	1
Pericardial hematoma	3
Pericardial effusion – loculated	2
Aneurysm of the mitral-aortic intervalvular fibrosa	1
Blood cyst - mitral valve	1
Calcification at the junction of the SVC and the RA	1
Bone cement from vertebroplasty, in the PA	1
Coronary sinus aneurysm	1
Fibrosing mediastinitis	1
Left ventricular aneurysm	1
Left ventricular pseudoaneurysm	1

Table S2. Patients with CMR diagnosis of Pseudomass (n = 149)

Type	Number of patients
Lipomatous hypertrophy of the interatrial septum	44
Prominent epicardial fat	25
Prominent eustachian valve	17
Prominent crista terminalis	12
Hiatal hernia	11
Caseous mitral annular calcification	9
Mitral annular calcification	9
Complex pericardial effusion	4
Prominent coumadin ridge	3
Atrial septal aneurysm	2
Pericardial hematoma	2
Retrosternal goiter	2
Calcified pericardium	1
Fat in the posterior RA wall	1
Focal LV hypertrophy	1
Lung tissue	1
LV diverticulum	1
Membranous ventricular septal aneurysm	1
Mitral valve calcific thickening	1
Morgagni hernia	1
RV trabecular calcifications	1

Table S3. Patients with CMR Diagnosis of Thrombus (n = 146)

Type	Number of patients*
Left ventricle	73
Right atrium	49
Left atrium (not including appendage)	22
Left atrial appendage	10
Right ventricle	13
Thoracic aorta	4
Pulmonary artery	3

*16 patients had thrombus in >1 location

Table S4. Patients with CMR Diagnosis of Benign Tumour (n = 159)

Type	Number of patients
Myxoma	67
Papillary fibroelastoma	36
Pericardial cyst - simple	32
Lipoma	10
Fibroma	4
Pericardial cyst - complex	3
Haemangioma	2
Benign tumour without a specific diagnosis	5

Table S5. Patients with Final Diagnosis of Malignant Tumour (n = 211)

Type	Number of patients
Sarcoma	82
Lymphoma	23
Melanoma	14
Renal cell carcinoma	12
Thymoma/thymic carcinoma	11
Lung cancer – unspecified	10
Lung cancer – non-small cell	5
Neuroendocrine tumour – paraganglioma	4
Squamous cell carcinoma – unknown origin	4
Neuroendocrine tumour – carcinoid	3
Neuroendocrine tumour – unspecified	3
Adenocarcinoma – unknown origin	2
Colon cancer – unspecified	2
Oesophageal adenocarcinoma	2
Neuroendocrine tumour – pheochromocytoma	2
Plasma cell neoplasm/plasmacytoma	2
Poorly differentiated carcinoma – unknown origin	2
Teratoma	2
Urothelial carcinoma	2
Adrenal cortical carcinoma	1
Gastric adenocarcinoma	1
Germ cell tumour	1
Granular cell tumour	1
Lung cancer – small cell	1
Malignant epithelioid haemangioendothelioma	1
Mesothelioma	1
Pericardial mesothelioma	1
Rosai Dorfman disease*	1
Malignant tumour by CMR without pathology	15

*Although not neoplastic, Rosai-Dorfman disease, also known as sinus histiocytosis with massive lymphadenopathy - a rare disorder of unknown cause characterized by abundant histiocytes in the lymph nodes or other locations throughout the body - was classified as a malignant tumour due to the similarities in treatment including surgery, chemotherapy, and radiation therapy.

Table S6. Mass-directed Clinical Management after the CMR

	CMR Diagnosis						P value
	All patients (n = 903)	**No cardiac mass (n = 236)**	**Pseudomass (n = 149)**	**Thrombus (n = 146)**	**Benign tumour (n = 159)**	**Malignant tumour (n = 213)**	
Anticoagulation, n (%)	149 (16.5)	2 (0.8)	1 (0.7)	137 (93.8)	5 (3.1)	4 (1.9)	**<0.001**
Biopsy/surgery, n (%)	226 (25.0)	1 (0.4)*	11 (7.4)	12 (8.2)*	74 (46.5)*	128 (60.1)	**<0.001**
Chemotherapy, n (%)	113 (12.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	113 (53.1)	**<0.001**
Radiation therapy, n (%)	39 (4.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	39 (18.3)	**<0.001**
None, n (%)	487 (53.9)	233 (98.7)	138 (92.6)	9 (6.2)	82 (51.6)	25 (11.7)	**<0.001**

*All patients had surgery.

Table S7. Comparison between CMR diagnosis (blinded), CMR diagnosis (unblinded), and Final Diagnosis for the Subgroup of n = 200

		CMR diagnosis (unblinded)				Final diagnosis			
		No mass/ pseudo mass	Thrombus	Benign tumour	Malignant tumour	No mass/ pseudo mass	Thrombus	Benign tumour	Malignant tumour
CMR diagnosis (blinded)	No mass/ pseudo mass	75	0	2	0	75	0	2	0
	Thrombus	0	34	2	1	0	34	2	1
	Benign tumour	0	4	28	2	0	3	27	4
	Malignant tumour	0	0	0	52	0	0	0	52