
Contents

Abbreviations *viii*

Contributors *xiii*

SECTION 1

Physics

- 1 The MR scanner in a nutshell** 3
Sebastian Kozerke, Redha Boubertakh, and Marc Miquel
- 2 Basic MR physics** 6
Sebastian Kozerke, Redha Boubertakh, and Marc Miquel
- 3 Spatial encoding and image reconstruction** 11
Sebastian Kozerke, Redha Boubertakh, and Marc Miquel
- 4 Scan acceleration** 14
Sebastian Kozerke, Redha Boubertakh, and Marc Miquel
- 5 Basic pulse sequences** 17
Sebastian Kozerke, Redha Boubertakh, and Marc Miquel
- 6 Motion compensation** 26
Sebastian Kozerke, Redha Boubertakh, and Marc Miquel
- 7 MR angiography** 34
Sebastian Kozerke, Redha Boubertakh, and Marc Miquel
- 8 CMR applications** 38
Sebastian Kozerke, Redha Boubertakh, and Marc Miquel
- 9 Image quality and artefacts** 47
Sebastian Kozerke, Redha Boubertakh, and Marc Miquel

SECTION 2

Safety in cardiovascular MRI

- 1 MRI set-up and safety** 55
Roger Luechinger and Torsten Sommer

2 MRI contrast agents 63

Kim-Lien Nguyen and J Paul Finn

3 MRI interactions with medical devices 70

Federica Censi, Eugenio Mattei, and Giovanni Calcagnini

SECTION 3

CMR methodology

- 1 Morphology** 79
A John Baksj, Milind Y Desai, and Raad H Mohiaddin
- 2 Global and regional cardiac function** 92
Alicia M Maceira and Alistair A Young
- 3 Dynamic contrast-enhanced perfusion CMR** 103
Eike Nagel, Juerg Schwitter, and Andrew Arai
- 4 Early and late gadolinium enhancement** 119
Joseph Selvanayagam and Gaetano Nucifora
- 5 Mapping techniques** 133
Vanessa M Ferreira and Daniel Messroghli
- 6 Blood flow and phase contrast CMR** 146
Walter RT Witschey and Michael Markl
- 7 Coronary imaging** 164
Claudia Prieto, René M Botnar, Hajime Sakuma, Masaki Ishida, and Marcus R Makowski

SECTION 4

Ischaemic heart disease

- 1 Chronic ischaemic heart disease** 179
Bernhard L Gerber, Mouaz H Al-Mallah, Joao AC Lima, and Mohammad R Ostovaneh
- 2 Acute ischaemic heart disease** 202
Holger Thiele, Nuno Bettencourt, Michael Salerno, and Erica Dall'Armellina

SECTION 5 Myocardial disease

- 1 Hypertrophic cardiomyopathy** 243
Carmen Chan and Martin S Maron
- 2 Dilated cardiomyopathy** 253
Pier Giorgio Masci, Viviana Maestrini, and Deborah Kwon
- 3 Takotsubo syndrome** 265
Ingo Eitel, Albert van Rossum, Thomas Stiermaier, and Holger Thiele
- 4 Arrhythmogenic cardiomyopathy** 271
Frank I Marcus, Harikrishna Tandri, Martina Perazzolo Marra, and Aiden Abidov
- 5 Non-compaction or excessive trabeculation cardiomyopathy** 282
Steffen Petersen, Ana G Almeida, Annalisa Angelini, and Yuchi Han
- 6 Myocarditis** 290
Vanessa M Ferreira, Juliano L Fernandes, Cristina Basso, and Matthias G Friedrich
- 7 Chagas' cardiomyopathy** 309
Carlos Eduardo Rochitte and Otávio Rizzi Coelho-Filho
- 8 Transplant cardiomyopathy** 321
Christopher A Miller, Jennifer H Jordan, Annalisa Angelini, W Gregory Hundley, and Matthias Schmitt
- 9 Cardiac involvement in oncologic patients** 329
Jennifer H Jordan, Matthias Schmitt, Christopher A Miller, Annalisa Angelini, and W Gregory Hundley
- 10 Cardiac involvement in systemic diseases and secondary cardiomyopathies** 343
Amit Patel, Tomasz Miszalski-Jamka, Sophie Mavrogeni, and Jeanette Schulz-Menger
- 11 Infiltrative cardiomyopathy** 354
James Moon, Milind Y Desai, and Marianna Fontana
- 12 Myocardial iron overload** 364
John P Carpenter, John C Wood, and Dudley J Pennell
- 13 Cardiovascular magnetic resonance in cardiac resynchronization therapy** 375
Francisco Leyva and Charlotte Manisty
- 14 Athlete's heart and prevention of sudden cardiac death in athletes** 387
Jürgen Scharhag, Katherine C Wu, Philipp Bohm, and Cristina Basso

SECTION 6 Pericardial disease

- 1 Pericardial disease** 399
Deborah Kwon, Helen She, Herbert Frank, and Teresa Sykora

SECTION 7 Vascular disease

- 1 CMR of vascular disease** 415
Francisco Alpendurada, Christoph A Nienaber, and Raad H Mohiaddin

SECTION 8 Valve disease

- 1 Valve disease** 443
João L Cavalcante, Florian von Knobelsdorff, and Saul Myerson

SECTION 9 Masses and tumours

- 1 Epidemiology and classification** 463
Cristina Basso, Peter T Buser, Stefania Rizzo, Massimo Lombardi, and Gaetano Thiene
- 2 CMR approach in cardiac tumours** 466
Cristina Basso, Peter T Buser, Stefania Rizzo, Massimo Lombardi, and Gaetano Thiene
- 3 Benign cardiac tumours** 469
Cristina Basso, Peter T Buser, Stefania Rizzo, Massimo Lombardi, and Gaetano Thiene
- 4 Malignant tumours** 474
Cristina Basso, Peter T Buser, Stefania Rizzo, Massimo Lombardi, and Gaetano Thiene
- 5 Metastatic tumours** 478
Cristina Basso, Peter T Buser, Stefania Rizzo, Massimo Lombardi, and Gaetano Thiene
- 6 Pericardial tumours** 480
Cristina Basso, Peter T Buser, Stefania Rizzo, Massimo Lombardi, and Gaetano Thiene
- 7 Cardiac thrombi** 482
Cristina Basso, Peter T Buser, Stefania Rizzo, Massimo Lombardi, and Gaetano Thiene

SECTION 10**Congenital heart disease**

- 1 Introduction** 487
Emanuela R Valsangiacomo Buechel and Vivek Muthurangu
- 2 Segmental approach to congenital heart disease** 489
Carla Frescura and Gaetano Thiene
- 3 Adapting CMR sequences for CHD and imaging small patients** 496
Vivek Muthurangu
- 4 Novel CMR techniques for advanced surgical planning** 502
Mark A Fogel
- 5 Assessing shunts** 509
Lars Grosse-Wortmann
- 6 The pulmonary circulation: assessing pulmonary arteries and pulmonary veins** 516
Deane Yim and Lars Grosse-Wortmann
- 7 Ebstein's malformation of the tricuspid valve** 524
Sonya V Babu-Narayan
- 8 Congenital aortic disease** 531
Francesca R Pluchinotta and Vivek Muthurangu
- 9 CMR for transposition of the great arteries** 538
Sonya V Babu-Narayan
- 10 Tetralogy of Fallot** 549
Andrew J Powell
- 11 Double-outlet right ventricle** 560
Shi-Joon Yoo and Willem A Helbing
- 12 The single ventricle and surgical palliation** 566
Mark A Fogel and Willem A Helbing

SECTION 11**Extra-cardiac findings**

- 1 Extra-cardiac findings** 579
Jonathan Carl Luis Rodrigues, Francesco Secchi, Massimo Lombardi, Chiara Bucciarelli-Ducci, and Francesca Pugliese

SECTION 12**CMR in the multi-modality environment**

- 1 CMR in the multi-modality environment: status and perspectives** 597
Frank Rademakers, Massimo Lombardi, and Christopher Kramer

SECTION 13**Future perspectives**

- 1 Introduction: general considerations on the future of CMR** 613
Stefan Neubauer
- 2 Magnetic resonance spectroscopy** 615
Damian Tyler
- 3 7 T cardiac imaging** 620
Matthew Robson
- 4 Diffusion tensor magnetic resonance imaging** 624
David Sosnovik
- 5 Four-dimensional flow CMR** 629
Malenka Bissell
- 6 Molecular and cellular imaging in cardiovascular disease** 633
David Sosnovik
- 7 Interventional CMR (MRI catheterization)** 639
Robert Lederman
- 8 Summary** 643
Stefan Neubauer and Victor Ferrari
- Index** 644