Cardiovascular Magnetic Resonance Imaging

Textbook and Atlas

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Foreword

Cardiovascular magnetic resonance has evolved at enormous pace over the last decades. Starting from early experiments to probe cardiac high-energy phosphate metabolism by spectroscopic methods in the 1970s, the development of zeugmatography led to first attempts producing pictures of the heart in 1982. The potential of magnetic resonance imaging started to emerge and the assessment of cardiac morphology and function gained momentum. Important methodological improvements have been added to the fundamental concept over the years enabling a steady growth of cardiovascular applications.

Among the various imaging modalities available to assess the cardiovascular system, magnetic resonance imaging stands out. Besides its fully non-invasive principle permitting imaging without the use of ionizing radiation, it is the great versatility that makes magnetic resonance so attractive. Various tissue-related properties including water concentration, composition, perfusion and diffusion can be imaged. Moreover, methods encoding quantitative information of the dynamics of cardiac function and blood flow are at hand. Further advances now even permit to interrogate aspects of microstructure including myofiber arrangement. And, the range of applications continues to grow with hyperpolarization methods enabling insights into cardiac metabolism in real-time. Alongside there is an increasing number of clinical indications and routine use of cardiovascular magnetic resonance imaging is spreading word-wide.

The ability to resolve high-resolution anatomical and functional detail and the option to perform repeated measurements and longitudinal studies in conjunction with the wealth of contrast options have also triggered significant progress in experimental applications. These include the use of magnetic resonance imaging to guide cardiovascular interventions. Beyond application in humans, imaging of animal models has attracted considerable attention as part of a bench-to-bedside approach to understanding disease onset, progression and therapeutic options.

Considering the complexity of the magnetic resonance principle, advances have been and continue to be the result of very close interaction between physicians and scientists. Adoption of new methods and their translation into clinical reality necessitate forward thinking, expertise and enthusiasm. It is not surprising that major contributors in the field speak both scientific and medical "language".

The present book exemplifies the interdisciplinarity of the field and the collaboration across disciplines bringing together contributions from physicists and clinical colleagues. Covering the fundamentals including the magnetic resonance principle, hardware and safety considerations, to the full portfolio of clinical applications, the book also addresses innovative techniques and experimental methods.

Acknowledging the steady development and progress in diagnostic modalities other than magnetic resonance imaging, an overview of the principles and applications of state-of-the-art computed tomography is part of the content.

The authors of the different chapters are world-experts in their respective fields. It is a challenge to bring together such expertise and it is even more challenging to form a congruent and consistent essay of the different topics. Thanks to the excellent work of the authors and the editors this task has been accomplished.

In view of other textbooks available, the present work is comprehensive and unique in that it also includes topics beyond the standard portfolio of applications of cardiovascular magnetic resonance. Areas such as the measurement of myocardial blood flow and myocardial oxygenation, heart failure and cardiac transplantation, follow-up of cardiovascular interventions, pulmonary circulation, incidental findings on routine examinations, experimental studies in animals, and the role of cardiac computed tomography in clinical routine are included.

The book will appeal to users new to the field and experienced researchers and clinicians alike. References to the relevant literature including the key and most recent publications make it easy to connect to the much wider spectrum that is impossible to cover in a single textbook.

We are convinced the reader will enjoy the clarity and quality of the text, the description of the many routine applications in patients with all types of cardiovascular disease and the outlook of the innovations ahead.

It is our pleasure to congratulate the editors and authors for their efforts in providing this comprehensive summary and review of the exciting and rapidly evolving field of cardiovascular magnetic resonance imaging.

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