

Preface

According to the World Health Organisation, cardiovascular diseases (CVD) are the leading cause of death worldwide—with a substantial increase of mortalities expected over the next decades in conjunction with epidemics of diabetes and obesity. CVD pathologies range from arteriosclerosis affecting arteries in coronary and peripheral circulation, aortic aneurysms, ischemic heart disease including myocardial infarction, heart valve diseases and heart diseases such as arrhythmia and heart failure.

Tissue engineering, biomaterials and mechanobiology are playing an increasingly important role in the treatment and management of CVD. Therapeutic devices aim more and more at facilitating regenerative and integrative approaches—with biomechanical and mechanobiological concepts being keys to improvement and optimisation of therapies.

This volume aims at providing an insight in the state of the art, current research developments and challenges in the area of implantable devices for treatment and management of cardiovascular and cardiac diseases. The selected contributions report on computational as well as experimental research to advance therapeutic devices and overcome existing shortcomings.

The first three chapters are concerned with treatment of vascular diseases, i.e. the design optimization of endovascular stents for percutaneous interventions in diseased coronary arteries, small-diameter tissue-engineered vascular prostheses for coronary artery bypass procedures required when percutaneous treatment such as balloon angioplasty and stenting renders insufficient, and large-diameter vascular grafts and stent grafts used in open surgical and endovascular treatment of aortic aneurysms.

The following two chapters focus on prosthetic heart valves—providing a review of the state-of-the-art in polymeric heart valves with flexible leaflets and patient-specific computational modelling of biological heart valve prostheses towards treatment decision support for surgical and percutaneous implantation. Although the emphasis of the computational modelling is on biological heart valves, the same or similar approaches are very likely to provide benefits for development and treatment optimisation of non-biological prosthetic valves.

The treatment of cardiac pathologies is the topic of the last two chapters. Myocardial infarction (commonly known as heart attack) leads to an adverse remodelling of the heart—primarily the left ventricle. This remodelling often leads

to heart failure for which organ transplant is the only possible treatment at present. “Cardiac Restraint and Support Following Myocardial Infarction” presents concepts of mechanical support and restraint of the infarcted heart to inhibit the pathological remodelling and prevent the development of heart failure. The final “In Vivo Mechanical Loading Conditions of Pectorally Implanted Cardiac Pacemakers” deals with research into the in vivo biomechanics of cardiac pacemakers. The main focus of previous research and development has been directed towards structural reliability of the pacemaker leads. In contrast, the present contribution describes the assessment of mechanical loadings on the implanted pacemaker body—information that is important in the context of smaller sizes of implantable devices that have become possible with advancing technologies.

Thomas Franz

Cardiovascular and Cardiac Therapeutic Devices

Franz, Th. (Ed.)

2014, VIII, 243 p. 91 illus., Hardcover

ISBN: 978-3-642-53835-3