

# Percutaneous Treatment of Left Side Cardiac Valves

A Practical Guide for the  
Interventional Cardiologist

Third Edition

Corrado Tamburino  
Marco Barbanti  
Davide Capodanno *Editors*

 Springer

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UNIVERSITÀ  
degli STUDI  
di CATANIA

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Corrado Tamburino • Marco Barbanti  
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Editors

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The previous editions of this book were edited by Corrado Tamburino and Gian Paolo Ussia

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## Preface

The field of transcatheter therapies for valvular heart disease is a never-ending source of technical and device innovation, novel indications and new treatment solutions. The interest of the scientific community in this sub-discipline of interventional cardiology is demonstrated by the extraordinary volume of literature on the field, as well as the variety of national and international meetings, symposia and teaching courses focusing on this topic. This book – now at its third edition – represents a practical guide addressing the rapidly expanding and innovative field of transcatheter therapies for left-side valvular heart disease. The table of contents has been uniquely built to update the reader with the latest practical and scientific advances in the field.

The first section is dedicated to mitral valve disease, with a focus on the latest interventional strategies of mitral valve repair and replacement. The subsequent section is dedicated to aortic interventions, including a step-by-step guide to newer-generation devices for transcatheter aortic valve implantation. Special attention has been paid to the devices that carry the most interesting novel elements in the field. Each section includes a number of authoritative review articles and accompanying illustrations dealing with various aspects of valvular heart disease, from anatomy to pathophysiology, from pre-procedural planning to in-lab technique.

This third edition would not have been possible without the enthusiastic participation and support of many extraordinary colleagues and friends who have shared their knowledge and experience with us all.

February 2018  
Catania, Italy

Corrado Tamburino  
Davide Capodanno  
Marco Barbanti

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## Preface to the Second Edition

At the time of publication of this handbook, percutaneous treatment of left side cardiac valves represented just an exciting and promising opportunity. The lack of outcome data at medium and long term, however, required some caution, since there were still too many unknowns related to a minimally invasive treatment of valvular heart disease, including durability of acute results, long-term impact of procedural complications, patient selection, and so on. After two years since our first publication, the literature has produced substantial data supporting particularly transcatheter aortic valve implantation, in parallel with a considerable increase of the procedures around the world, as well as operators' experience and procedural success. These data allow now to consider these procedures not only a promise for the future, but a solid reality of our present. Not surprisingly, the enthusiasm for these achievements has prompted the industry to continuously improve their own devices. The scenario has therefore changed dramatically in recent years, necessitating a substantial update of the first edition of this volume. Once again, the goal of this practical handbook is to give interventional cardiologists an advanced understanding and the current state of the art of the percutaneous treatment of left side cardiac valves.

April 2012  
Catania, Italy

Corrado Tamburino  
Gian Paolo Ussia

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## Preface to the First Edition

Transcatheter therapy of cardiac valve diseases is a rediscovery by interventional cardiologists. Treating cardiac valve diseases with alternative techniques to cardiac surgery using prosthetic devices has rekindled interest in the field of hemodynamics, which has been neglected in recent years. Within this framework, two sectors can be distinguished: valvuloplasty techniques using a balloon alone to treat mitral, aortic, and pulmonary stenoses, and those using prosthetic heart valves or repair devices. Valvuloplasty techniques should be considered as palliative, as the duration of their effectiveness varies from just a few weeks, as in the case of aortic valvuloplasty for degenerative stenoses, to years, as in the case of mitral and pulmonary valvuloplasty. By contrast, transcatheter implantation of biological prosthetic valves or repair techniques using dedicated devices aim to provide a definitive therapeutic solution or at least a solution offering results that are equal to or just as good as those of cardiac surgery. The advent of devices for the percutaneous treatment of left chamber valve diseases is one of the greatest breakthroughs in interventional cardiology. The goal of this handbook is to give interventional cardiologists the means to understand the context of the percutaneous treatment of valve diseases and the state of the art of the techniques and procedures currently available.

April 2010  
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Corrado Tamburino  
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# Contents

## Part I Mitral Valve Disease

- 1 Anatomy of the Mitral Apparatus . . . . . 3**  
Francesca Indorato, Silvio Gianluca Cosentino,  
and Giovanni Bartoloni
- 2 Mitral Stenosis . . . . . 13**  
Davide Capodanno, Marco Barbanti, and Corrado Tamburino
- 3 Mitral Regurgitation: Epidemiology, Etiology and  
Physiopathology . . . . . 49**  
Salvatore Scandura, Sarah Mangiafico, and Sandra Giaquinta
- 4 Mitral Regurgitation: Diagnosis and Timing of Intervention. . . . . 63**  
Marta Chiarandà, Sarah Mangiafico, and Salvatore Scandura
- 5 Computed Tomography Imaging for Mitral Valve Regurgitation . . . . 101**  
Rominder Grover, Philipp Blanke, Shaw-Hua Kueh, Stephanie Sellers,  
and Jonathon A. Leipsic
- 6 Imaging Modality-Independent Anatomy of the Left Heart. . . . . 125**  
Pascal Thériault-Lauzier and Nicolò Piazza
- 7 Transcatheter Repair of Mitral Regurgitation:  
Abbott Vascular MitraClip . . . . . 137**  
Carmelo Grasso, Maria Elena Di Salvo, Salvatore Scandura,  
and Sergio Buccheri
- 8 Transcatheter Repair of Mitral Regurgitation:  
Edwards Cardioband . . . . . 161**  
Carmelo Grasso, Sebastiano Immè, Sarah Mangiafico,  
and Giuseppe Ronsivalle
- 9 Transcatheter Repair of Mitral Regurgitation: Kardia Carillon. . . . . 171**  
Sebastiano Immè, Antonio Popolo Rubbio, Stefano Cannata,  
and Salvatore Scandura



<b>10</b>	<b>Transcatheter Repair of Mitral Regurgitation: Other Devices and Novel Concepts</b> . . . . .	183
	Ted Feldman, Mayra Guerrero, Michael H. Salinger, and Justin P. Levisay	
<b>11</b>	<b>Transcatheter Mitral Valve Implantation</b> . . . . .	205
	Adrian Attinger-Toller, Anson Cheung, and John G. Webb	
<b>12</b>	<b>Transcatheter Therapy for Mitral Regurgitation: A Review of the Literature</b> . . . . .	223
	Sergio Buccheri and Davide Capodanno	
<b>Part II Aortic Valve Disease</b>		
<b>13</b>	<b>Anatomy of the Aortic Valve</b> . . . . .	239
	Francesca Indorato, Silvio Gianluca Cosentino, and Giovanni Bartoloni	
<b>14</b>	<b>Aortic Stenosis: Epidemiology and Pathogenesis</b> . . . . .	245
	Simona Gulino, Alessio Di Landro, and Antonino Indelicato	
<b>15</b>	<b>Aortic Stenosis: Diagnosis</b> . . . . .	253
	Ines Monte, Rita Sicuso, and Vera Bottari	
<b>16</b>	<b>Computed Tomography Imaging for Aortic Valve Disease</b> . . . . .	277
	Mickaël Ohana, Anthony Shaw, Romi Grover, John Mooney, Jonathon Leipsic, and Philipp Blanke	
<b>17</b>	<b>Echocardiographic Imaging for Transcatheter Aortic Valve Replacement</b> . . . . .	303
	Wanda Deste, Denise Todaro, and Gerlando Pilato	
<b>18</b>	<b>Vascular Access Management in Transcatheter Aortic Valve Implantation</b> . . . . .	317
	Marco Barbanti, Gerlando Pilato, and Carmelo Sgroi	
<b>19</b>	<b>Preparation for Transcatheter Aortic Valve Implantation</b> . . . . .	347
	Marco Barbanti, Claudia Ina Tamburino, and Simona Gulino	
<b>20</b>	<b>Transcatheter Aortic Valve Implantation: Edwards SAPIEN 3</b> . . . . .	365
	Marco Barbanti, Martina Patanè, and Ketty La Spina	
<b>21</b>	<b>Transcatheter Aortic Valve Implantation: Medtronic CoreValve Evolut R</b> . . . . .	385
	Sebastiano Immè, Denise Todaro, and Alessio La Manna	
<b>22</b>	<b>Transcatheter Aortic Valve Implantation: Boston Lotus</b> . . . . .	405
	Lennart van Gils and Nicolas M. Van Mieghem	
<b>23</b>	<b>Transcatheter Aortic Valve Implantation: Boston ACURATE and ACURATE-neo TF</b> . . . . .	421
	Carmelo Sgroi, Claudia Ina Tamburino, and Gerlando Pilato	

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<b>24</b>	<b>Transcatheter Aortic Valve Implantation: Abbott Portico</b> . . . . .	431
	Carmelo Sgroi, Claudia Ina Tamburino, and Martina Patanè	
<b>25</b>	<b>Transcatheter Aortic Valve Implantation: Other Devices</b> . . . . .	443
	Martina Patanè, Ketty la Spina, and Alessio La Manna	
<b>26</b>	<b>Complications Post-TAVI</b> . . . . .	453
	Chekrallah Chamandi and Josep Rodés-Cabau	
<b>27</b>	<b>TAVI Postprocedural Management</b> . . . . .	483
	Piera Capranzano and Corrado Tamburino	
<b>28</b>	<b>Transcatheter Therapy for Aortic Stenosis: A Review of the Literature</b> . . . . .	501
	Davide Capodanno and Simona Gulino	
<b>29</b>	<b>Aortic Regurgitation</b> . . . . .	521
	Piera Capranzano and Corrado Tamburino	

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**Part I**

**Mitral Valve Disease**



# Anatomy of the Mitral Apparatus

# 1

Francesca Indorato, Silvio Gianluca Cosentino,  
and Giovanni Bartoloni

The mitral valve had its name by Andreas Vesalius (*De Humani Corporis Fabrica*, 1543) due to its shape similar to the bishop's hat (*miter*).

The mitral valve lies in the floor of the left atrium, separating the inflow from the outflow tract of the left ventricle (Fig. 1.1).

The mitral valve is part of the left ventricular outflow tract and of the aortic root; it facilitates the accommodation of blood, eventually followed by its rapid, efficient, and forceful ejection through the left ventricular outflow tract into the aortic root [1, 2].

The mitral valve apparatus and the left ventricle are so interdependent that there is no mitral valve defect that does not affect the left ventricle in some way, and, in turn, there is no morphological or functional alteration of the left ventricle that has no consequence, to a greater or lesser extent, for the mitral valve. Therefore, the mitral valve is not a passive structure that moves solely as a result of the forces generated by cardiac activity, but rather a structure with its own sphincteric activity concentrated mainly in the annulus, which contributes to the ventricle's contractility and, in turn, is heavily affected by it.

The mitral valve apparatus comprises the annulus and portion of myocardium located above and below it, the leaflets, the *chordae tendineae*, and the papillary muscles (Figs. 1.2 and 1.3).

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