

# Contents

## I Imaging Modalities

<b>1 Conventional Radiography</b> ... 3	Pressure Gradients ... 49
<i>M. Thelen</i>	Valve Orifice Area ... 49
<b>Clinical Manifestations of Heart Diseases</b> ... 3	Intracardiac Pressures ... 50
<b>Radiographic Anatomy</b> ... 4	<b>Assessment of Left Ventricular Function</b> ... 51
Radiographic Technique ... 5	Global Left Ventricular Function ... 51
Enlargement of the Cardiac Chambers ... 5	Assessment of Regional Ventricular Function ... 52
Radiographic Determination of Cardiac Size ... 10	<b>Diastolic Ventricular Function</b> ... 54
Cardiac Hypertrophy and Dilatation ... 11	Grade I Diastolic Dysfunction ... 54
Importance of Pulmonary Vasculature in Cardiac Diagnosis ... 11	Grade II Diastolic Dysfunction ... 54
Lymphatic System ... 16	Grade III Diastolic Dysfunction ... 54
Pleural Effusion ... 16	Grade IV Diastolic Dysfunction ... 55
Cardiac Malposition ... 17	
Heart Failure ... 17	
Coronary Heart Disease ... 22	<b>3 Angiography</b> ... 59
Cardiomyopathies ... 22	<i>H. Eggebrecht</i>
Systemic Hypertension ... 23	<b>Cardiac Catheterization Technique for Pressure and Oxygen Measurements and for Angiocardiography</b> ... 59
Pulmonary Arterial Hypertension (Cor pulmonale) ... 25	<b>Cardiac Catheterization Measurements</b> ... 60
Pericardium ... 25	Pressure Measurements ... 60
Aorta ... 28	Oxygen Saturation Measurements ... 60
<b>2 Echocardiography</b> ... 34	Cardiac Output and Derivative Parameters ... 60
<i>R. Erbel</i>	Detection of Shunt Lesions ... 61
<b>Basic Principles of Echocardiography</b> ... 34	<b>Selective Angiocardiography</b> ... 61
Basic Principles of Ultrasound Imaging ... 35	<b>Coronary Angiography</b> ... 63
Types of Echocardiography ... 35	<b>Special Invasive Imaging Techniques</b> ... 64
<b>Specific Applications of Echocardiography</b> ... 37	Intravascular Ultrasound ... 64
Contrast Echocardiography ... 37	Intracoronary Doppler ... 65
Stress Echocardiography ... 38	Intracoronary Pressure Wire ... 66
Transesophageal Echocardiography ... 39	
Intraoperative Echocardiography ... 39	<b>4 Nuclear Medicine Imaging</b> ... 68
Intracardiac Echocardiography ... 39	<i>A. Bockisch, K. Sattler, and S. J. Rosenbaum-Krumme</i>
<b>Examination Techniques</b> ... 40	<b>Basic Principles</b> ... 68
Transthoracic Echocardiography ... 40	<b>Myocardial Scintigraphy</b> ... 68
Transesophageal Echocardiography ... 40	Examination Technique ... 68
<b>Quantification Using M-Mode and 2D Echocardiography</b> ... 41	Tracers ... 69
M-Mode Echocardiography ... 41	Interpretation of Scintiscans ... 70
Two-Dimensional Echocardiography ... 42	Clinical Significance of Myocardial Scintigraphy ... 70
<b>Principles of Doppler Echocardiography</b> ... 44	<b>Positron Emission Tomography</b> ... 71
Pulsed Doppler ... 44	Examination Technique ... 71
Continuous-Wave Doppler ... 44	Tracers ... 72
Color Doppler ... 45	Interpretation of PET ... 73
Color Doppler M-Mode Echocardiography ... 45	Clinical Significance of PET ... 73
Tissue Doppler Echocardiography ... 45	<b>Special Nuclear Medicine Studies</b> ... 73
Reference Values for Doppler Echocardiography ... 46	MIBG Scintigraphy ... 73
Strain Rate Imaging ... 47	Plaque Imaging ... 73
<b>Echocardiographic Assessment of Hemodynamics</b> ... 48	
Stroke Volume ... 48	<b>5 Computed Tomography</b> ... 76
Regurgitant Volume ... 48	<b>Coronary Calcium Determination</b> ... 76
Shunt Flow ... 49	<i>A. Schmermund, Th. Schlosser, A. Magedanz, and Th. Voigtlander</i>
	Examination Techniques ... 76
	Interpretation ... 78
	Scanning Protocol ... 79

Reporting of Coronary Calcium Findings ...	<b>79</b>	<b>Function ... 104</b>
Outlook ...	<b>79</b>	<i>S. Ley and K.-F. Kreitner</i>
<b>CT Coronary Angiography ... 80</b>		Analysis of Cardiac Function ... <b>104</b>
<i>Th. Schlosser</i>		Flow Measurement ... <b>108</b>
Principle of Computed Tomography ...	<b>80</b>	<b>Myocardial Perfusion ... 111</b>
Patient Preparation ...	<b>80</b>	<i>W. G. Schreiber</i>
Planning the Examination ...	<b>81</b>	Physiology ... <b>111</b>
Contrast Media ...	<b>81</b>	Principle of Perfusion MRI ... <b>112</b>
Examination Technique ...	<b>82</b>	Applications ... <b>116</b>
Interpretation ...	<b>82</b>	Comments on Methodology ... <b>116</b>
Clinical Applications ...	<b>83</b>	<b>Delayed Enhancement ... 116</b>
<b>CT Angiography of the Great Vessels ... 84</b>		<i>P. Hunold</i>
<i>K. Koch</i>		Pathophysiology of Delayed Enhancement ... <b>117</b>
Basic Physical Principles ...	<b>84</b>	Pulse Sequences ... <b>117</b>
Methodological Requirements ...	<b>84</b>	Protocol for Delayed-Enhancement Imaging ... <b>119</b>
Examination and Analysis Techniques ...	<b>84</b>	Delayed Enhancement—From Image to Differential
Clinical Applications ...	<b>86</b>	Diagnosis ... <b>120</b>
<b>6 Magnetic Resonance Imaging ... 91</b>		<b>Magnetic Resonance Angiography of the Coronary</b>
<i>K. Nassenstein</i>		<b>Arteries ... 121</b>
<b>Planning the Examination ... 91</b>		<i>C. U. Herborn</i>
System Requirements ...	<b>91</b>	Planning the Examination ... <b>121</b>
Patient Preparation ...	<b>91</b>	Compensation for Cardiac Motion ... <b>122</b>
Pulse Sequences ...	<b>91</b>	Compensation for Respiratory Motion ... <b>123</b>
Planning the Examination ...	<b>92</b>	Contrast Mechanisms in Coronary Magnetic Resonance
Basic Protocol for Cardiac MRI ...	<b>92</b>	Angiography ... <b>124</b>
Extended Scan Protocol ...	<b>96</b>	Contrast Agents for Coronary Magnetic Resonance
<b>Morphology ... 98</b>		Angiography ... <b>125</b>
<i>K.-U. Waltering</i>		Clinical Applications ... <b>126</b>
Pulse Sequences ...	<b>98</b>	<b>Magnetic Resonance Angiography of the Great Vessels ...</b>
Steady-State Free-Precession Sequences ...	<b>100</b>	<b>127</b>
Normal Anatomy ...	<b>101</b>	<i>K.-F. Kreitner</i>
Variants and Anomalies ...	<b>101</b>	Basic Technical Principles ... <b>128</b>
		Techniques of Examination and Interpretation ... <b>129</b>
		Clinical Applications ... <b>131</b>

## II Imaging of Specific Cardiac Diseases

<b>7 Heart Defects and Endocarditis ... 141</b>	<b>8 Coronary Heart Disease ... 171</b>
<i>T. Buck, B. Plicht, T. Schlosser, and R. Erbel</i>	<b>Subclinical Signs of Coronary Atherosclerosis</b>
<b>Congenital Heart Disease in Adults ... 141</b>	<b>(Prevention, Screening, and Risk Stratification) ... 171</b>
Atrial Septal Defect ... <b>141</b>	<i>R. Erbel</i>
Patent Foramen Ovale ... <b>143</b>	Early Detection of Coronary Heart Disease ... <b>171</b>
Ventricular Septal Defect ... <b>144</b>	Pathogenesis of Atherosclerosis ... <b>171</b>
<b>Acquired Valvular Heart Disease ... 146</b>	Detection of Subclinical Atherosclerosis ... <b>174</b>
Mitral Stenosis ... <b>147</b>	Detection of Complicated Plaques ... <b>175</b>
Mitral Insufficiency ... <b>150</b>	Preventive Cardiology ... <b>176</b>
Aortic Stenosis ... <b>155</b>	<b>Acute Ischemia ... 181</b>
Aortic Insufficiency ... <b>158</b>	<i>G. Horstick, N. Abegunewardene, M. Vosseler, and K.-F. Kreitner</i>
Combined Mitral and Aortic Valve Disease ... <b>161</b>	Pathophysiology of Myocardial Ischemia in Relation to
Tricuspid Stenosis ... <b>162</b>	Cardiac MRI ... <b>181</b>
Tricuspid Insufficiency ... <b>163</b>	Viability Assessment in Cardiac MRI ... <b>184</b>
Pulmonary Valve Stenosis ... <b>165</b>	<b>Chronic Coronary Artery Disease ... 187</b>
Pulmonary Insufficiency ... <b>165</b>	<i>P. Hunold and F. Breuckmann</i>
Prosthetic Heart Valves ... <b>166</b>	Pathophysiology of Chronic Coronary Artery Disease ... <b>187</b>

Clinical Features ... 188	Aneurysms ... 242
Diagnosis of Chronic Coronary Artery Disease ... 188	Anatomical Variants ... 242
Differential Diagnosis of Stenotic Coronary	
Heart Disease ... 200	
<b>Postoperative and Postinterventional Imaging ... 201</b>	<b>11 Diseases of the Pericardium ... 243</b>
<i>K.-F. Kreitner and G. Horstick</i>	<i>C. U. Herborn, C. Bruch, and R. Erbel</i>
Postoperative Imaging ... 201	Anatomy ... 243
Postinterventional Imaging ... 208	Imaging Modalities ... 243
<b>9 Cardiomyopathies and Myocarditis ... 215</b>	Chest Radiographs ... 243
<i>O. Bruder, R. Erbel, and K.-F. Kreitner</i>	Echocardiography ... 243
<b>Cardiomyopathies ... 215</b>	Computed Tomography ... 243
Hypertrophic Cardiomyopathy ... 218	Magnetic Resonance Imaging ... 243
Restrictive Cardiomyopathy ... 221	Specific Diseases ... 244
Arrhythmogenic Right Ventricular Cardiomyopathy ... 225	Pericardial Cysts and Diverticula ... 244
Unclassified Cardiomyopathies ... 227	Pericarditis ... 245
<b>Myocarditis ... 227</b>	Constrictive Pericarditis ... 247
	Malignant Pericardial Diseases ... 250
	Pericardial Aplasia ... 250
<b>10 Cardiac Tumors ... 232</b>	<b>12 Diseases of the Great Pulmonary Vessels ... 252</b>
<i>J. Barkhausen and H. Eggebrecht</i>	<i>S. Ley, K.-F. Kreitner, and G. Horstick</i>
<b>Diagnostic Techniques ... 233</b>	<b>Pulmonary Arterial Disorders ... 252</b>
<b>Benign Primary Cardiac Tumors ... 233</b>	Acute Pulmonary Embolism ... 252
Myxoma ... 233	Chronic Recurrent Pulmonary Embolism ... 255
Cardiac Lipoma ... 234	Other Forms of Pulmonary Arterial Hypertension ... 256
Papillary Fibroelastoma ... 236	<b>Tumors of the Pulmonary Vessels ... 256</b>
Cardiac Hemangioma ... 237	Pulmonary Capillary Hemangioma ... 259
Pheochromocytoma ... 237	<b>Arteriovenous Malformations ... 260</b>
Rhabdomyoma ... 237	<b>Pulmonary Venous Disorders ... 260</b>
Fibroma ... 238	Congenital Anomalies ... 260
Lymphangioma ... 238	Acquired Pulmonary Venous Disorders ... 261
Teratoma ... 238	<b>Extravascular Disorders ... 261</b>
<b>Malignant Primary Cardiac Tumors ... 238</b>	
Angiosarcoma ... 238	<b>13 Diseases of the Thoracic Aorta ... 264</b>
Other Primary Cardiac Sarcomas ... 239	<i>H. Eggebrecht, J. Barkhausen, and K.-F. Kreitner</i>
Primary Cardiac Lymphoma ... 239	<b>Congenital Anomalies ... 264</b>
Pericardial Mesothelioma ... 239	Right Descending Aorta ... 264
Rhabdomyosarcoma ... 240	Double Aortic Arch ... 264
<b>Secondary Cardiac Tumors ... 240</b>	Aortic Arch Anomalies ... 264
Metastases ... 240	Coarctation of the Aorta ... 265
Direct Extension ... 240	<b>Acquired Aortic Diseases ... 265</b>
<b>Nonneoplastic Cardiac Masses ... 240</b>	Degenerative Aortic Diseases ... 265
Intracardiac Thrombi ... 240	Acute Aortic Syndrome ... 271
	Inflammatory Aortic Diseases ... 280
<b>Index ... 283</b>	