# Contents

Contributors xiii  
Foreword xvii  
Acknowledgments xix  

Chapter 1  Introduction  
Werner Zimmerli  

Chapter 2  Microbiology of Bone and Joint Infections  
Seong Yeol Ryu and Robin Patel  
Microorganisms in Osteomyelitis 5  
Microorganisms in Implant-Associated Bone and Joint Infection 7  
Microorganisms in Native Joint Arthritis 10  
Diagnostic Approach in Osteomyelitis 11  
Diagnostic Approach in Foreign Body–Associated Infection 12  
Diagnostic Approach in Native Joint Infection 15  
Novel Diagnostic Procedures 17  
Acknowledgment 17  
References 17  

Chapter 3  Pharmacokinetics and Pharmacodynamics of Antibiotics in Bone  
Cornelia B. Landersdorfer, Jürgen B. Bullita, and Fritz Sörgel  
Pharmacokinetics 21  
Bone Sample Preparation and Analysis 22  
Pharmacokinetic Sampling and Data Analysis 23  
Penetration of Antibiotics into Bone 24  
Pharmacodynamics and Monte Carlo Simulations 31  
Conclusions 34  
Key Points 34  
References 35
<table>
<thead>
<tr>
<th>Chapter 4</th>
<th>Preclinical Models of Infection in Bone and Joint Surgery</th>
<th>39</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lorenzo Calabro, R. Geoff Richards, and T. Fintan Moriarty</td>
<td>Introduction</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>Influence of Species in Preclinical Models of Bone and Joint Infection</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Overview of Animal Models</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Direct Inoculation with Minimal Trauma</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Animal Osteomyelitis Models Incorporating Trauma</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>Hematogenous Models</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>Future Directions</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>Conclusion</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>Key Points</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>References</td>
<td>49</td>
</tr>
</tbody>
</table>

| Chapter 5 | Native Joint Arthritis in Children | 55 |
| Pablo Yagupsky | Introduction | 55 |
| | Epidemiology | 55 |
| | Microbiology | 56 |
| | Pathogenesis | 61 |
| | Clinical Presentation | 62 |
| | Laboratory Investigation | 63 |
| | Imaging Studies | 66 |
| | Differential Diagnosis | 66 |
| | Treatment | 67 |
| | Prognosis | 71 |
| | Key Points | 72 |
| | References | 72 |

| Chapter 6 | Native Joint Arthritis | 77 |
| Ilker Uçkay, Mohamed Al-Mayahi, Domizio Suvà, Daniel Lew, and Pierre Vaudaux | Introduction | 77 |
| | Pathogenesis, Epidemiology, and Microbiology | 77 |
| | Diagnosis | 79 |
| | Treatment | 81 |
| | Outcome of Native Joint Septic Arthritis | 87 |
| | Key Points | 88 |
| | Acknowledgments | 88 |
| | References | 88 |

| Chapter 7 | Septic Arthritis of Axial Joints | 93 |
| Werner Zimmerli | Septic Arthritis of the Sternoclavicular Joint | 93 |
| | Key Points | 98 |
| | Septic Arthritis of the Symphysis Pubis | 98 |
| | Key Points | 103 |
| | Septic Arthritis of the Sacroiliac Joint | 103 |
| | Key Points | 107 |
| | References | 107 |
Chapter 8  Periprosthetic Joint Infection: General Aspects
Werner Zimmerli  
Introduction 113  
Definition 114  
Classification 115  
Pathogenesis 115  
Diagnostic Algorithm 118  
Laboratory Investigation 119  
Therapeutic Management 121  
Prophylaxis 122  
Errors in the Management of PJI 123  
Key Points 124  
References 124

Chapter 9  Periprosthetic Joint Infection after Total Hip and Knee Arthroplasty
Werner Zimmerli and Martin Clauss  
Introduction 131  
Risk Factors 131  
Microbiology 132  
Clinical Features 133  
Laboratory Investigation 133  
Imaging Procedures 134  
Management 135  
Instructive Cases 142  
References 146

Chapter 10  Periprosthetic Joint Infection after Shoulder Arthroplasty
Parham Sendi, Beat K. Moor, and Matthias A. Zumstein  
Introduction 151  
Risk Factors 151  
Microbiology 153  
Pathogenesis 154  
Clinical Features 154  
Laboratory Investigation 155  
Imaging Procedures 157  
Management 158  
Instructive Cases 162  
References 163

Chapter 11  Periprosthetic Joint Infection after Elbow Arthroplasty
Yvonne Achermann and Michael C. Glanzmann  
Introduction 167  
Microbiology 168  
Clinical Features 168  
Diagnostic Procedures 169  
Instructive Cases 176  
References 179
Chapter 12  Periprosthetic Joint Infection after Ankle Arthroplasty  
Parham Sendi, Bernhard Kessler, and Markus Knupp

Introduction 183
History of Total Ankle Arthroplasty 184
Risk Factors 185
Microbiology 186
Management 189
Instructive Cases 192
References 194

Chapter 13  Osteomyelitis: Classification  
Werner Zimmerli

Classification According to Pathogenesis 197
Classification According to the Duration of Infection 199
Classification According to the Localization 200
Classification According to the Presence of an Implant 200
Classification According to Anatomy and Comorbidity 200
References 201

Chapter 14  Osteomyelitis in Children  
Priya Sukhtankar, Saul N. Faust, and Nicholas M.P. Clarke

Introduction 205
Epidemiology 205
Pathophysiology 206
Clinical Presentation, Diagnosis, and Microbiology 207
Treatment 214
Complications 217
Key Points 217
References 217

Chapter 15  Acute Osteomyelitis in Adults  
Werner Zimmerli

Introduction 221
Pathogenesis 221
Epidemiology 223
Microbiology 224
Risk Factors 225
Clinical Features 227
Laboratory Investigation 229
Imaging Procedures 231
Clinical and Imaging Differential Diagnosis 232
Treatment 233
Key Points 236
References 236

Chapter 16  Subacute Osteomyelitis: Tuberculous and Brucellar Vertebral Osteomyelitis  
Juan D. Colmenero and Pilar Morata

Introduction 241
Epidemiology 241
Chapter 17  Chronic Osteomyelitis in Adults
Silvin Lito, Antoine Lomessy, Pierre Vaudaux, and Ilker Uçkay

- Introduction 257
- Epidemiology and Pathogenesis 259
- Diagnosis 260
- Treatment 262
- Future Perspectives 268
- Key Points 268
- Acknowledgments 269
- References 269

Chapter 18  Diabetic Foot Osteomyelitis
Eric Senneville and Sophie Nguyen

- Introduction 273
- Classification 273
- Microbiology 276
- Risk Factors 278
- Clinical Features 279
- Inflammatory Parameters 279
- Imaging Procedures 280
- Management 281
- Prevention 284
- References 284

Chapter 19  Osteomyelitis of the Jaws
Werner Zimmerli

- Introduction 289
- Classification 289
- Microbiology 291
- Risk Factors 292
- Clinical Features 292
- Laboratory Investigation 294
- Imaging Procedures 296
- Management 297
- Key Points 299
- References 299

Chapter 20  Implant-Associated Osteomyelitis of Long Bones
Martin McNally and Parham Sendi

- Introduction 303
- Classification and Risk Factors 304
- Microbiology 306