

Contents

Preface	x
Acknowledgements	xi
1 Introduction	1
1.1 General Remarks	2
1.2 Recommendations	2
2 Biology of Fracture Healing	5
2.1 Secondary Indirect Fracture Healing ..	6
2.2 Primary Fracture Healing	6
3 Nonoperative Fracture Management	9
4 Surgical Fracture Management	11
4.1 Atraumatic Technique	12
4.1.1 The Ten Commandments of Atraumatic Surgery	12
4.2 Common Injuries, Consequences of Trauma, Deformities	12
4.2.1 Fractures of the Distal, Middle, and Proximal Phalanges	12
4.2.2 Metacarpal Fractures	14
4.2.3 Fractures in Children	18
4.2.4 Wrist Fractures	19
4.3 Indication for Surgery	20
4.4 Contraindications	20
5 Differential Indication	21
5.1 Introduction	22
5.2 Distal Phalanx Fractures	23
5.2.1 Fractures of the Distal Phalanx, Distal	23
5.2.2 Fractures of the Distal Phalanx Shaft	24
5.2.3 Extra-articular Fractures of the Distal Phalanx, Proximal	25
5.2.4 Intra-articular Fractures of the Distal Phalanx, Proximal	26
5.3 Middle Phalanx and Proximal Phalanx Fractures	30
5.3.1 Intra-articular Fractures of the Middle/Proximal Phalanx, Distal	30
5.3.2 Extra-articular Fractures of the Middle/Proximal Phalanx, Distal	32
5.3.3 Fractures of the Middle/Proximal Phalanx Shaft	35
5.3.4 Extra-articular Fractures of the Middle/Proximal Phalanx, Proximal	38
5.3.5 Intra-articular Fractures of the Middle/Proximal Phalanx, Proximal	41
5.4 Metacarpal Fractures	46
5.4.1 Intra-articular Fractures of the Metacarpals, Distal	46
5.4.2 Extra-articular Fractures of the Metacarpals, Distal	48
5.4.3 Fractures of the Metacarpal Shaft	51
5.4.4 Extra-articular Fractures of the Metacarpals, Proximal	53
5.4.5 Intra-articular Fractures of the Second to Fifth Metacarpals, Proximal	55
5.4.6 Intra-articular Fractures of the First Metacarpal, Proximal	56
5.5 Fractures of the Proximal Carpal Bones	60
5.5.1 Scaphoid Fractures	60
5.5.2 Lunate Fractures	65
5.5.3 Triquetrum Fractures	67
5.5.4 Pisiform Fractures	69
5.6 Fractures of the Distal Carpal Bones	71
5.6.1 Trapezium and Trapezoid Fractures	71
5.6.2 Capitate Fractures	73
5.6.3 Hamate Fractures	76

6	Principles of Surgical Management of Hand Fractures	79
7	Postoperative Treatment	81
8	Implants and Instruments	83
8.1	General Remarks	84
8.2	Fixed-Angle Locking Fixation	84
8.3	Screws	85
8.4	Plates	86
9	Surgical Approaches	91
9.1	General Remarks	92
9.2	Palmar Approach to the Distal Phalanx, Distal Interphalangeal Joint, and Distal Middle Phalanx	92
9.3	Dorsal Approach to the Distal Phalanx, Distal Interphalangeal Joint, and Distal Middle Phalanx	93
9.4	Palmar Approach to the Middle Phalanx, Proximal Interphalangeal Joint, and Proximal Phalanx	94
9.5	Dorsal Approach to the Middle and Proximal Phalanx, Proximal Interphalangeal Joint, and Metacarpophalangeal Joint	96
9.6	Mediolateral Approach to the Shaft of Middle Phalanx and Proximal Phalanx, and to the Proximal Interphalangeal Joint	100
9.7	Dorsal Approach to the Metacarpals	102
9.8	Approaches to the Thumb	102
9.9	Approach to the Carpo(trapezio-)metacarpal Joint (According to Moberg, Gedda and Wagner)	105
9.10	Palmar Approach to the Wrist	107
9.11	Dorsal Approach to the Wrist	109
9.12	Radiopalmar Approach to the Wrist and Scaphoid	112
9.13	Radiodorsal Approach to the Wrist / Proximal Scaphoid Pole	114
9.14	Dorsal Ulnar Approach to the Wrist (Triquetrum, Hamate, Ulnar Midcarpal Joints)	117
10	Surgical Procedures	121
10.1	Overview	122
10.2	Wire Suture	123
10.2.1	Procedure	123
10.3	Tension Band Wiring	124
10.3.1	Shaft Fractures	124
10.3.2	Intra-articular Avulsion or Traction Fractures	124
10.4	Lag Screw	127
10.4.1	Procedure	127
10.5	Lag Screw plus Neutralization Plate	131
10.5.1	Procedure	131
10.6	Percutaneous Lag Screw	132
10.6.1	Procedure	132
10.7	Plate Fixation	134
10.7.1	Interfragmental Compression	134
10.8	Fixed-Angle Locking Plate—Internal Fixator	139
10.8.1	Principles	139
10.8.2	Procedure	141
10.9	Condylar Plate	145
10.9.1	Procedure	145

10.10	Intraosseous Compression Screw, Headless Bone Screw, and Compression Wire	148	10.13.3	Procedure for Ender–Hintringer Hooked Wire	162
10.10.1	Principle and Indications	148	10.13.4	Procedure for Ender–Hintringer Plug Method	163
10.10.2	Procedure with Intraosseous Compression Screws	148	10.13.5	Retrograde Single-Wire Technique	165
10.10.3	Procedure with the Percutaneous Compression Wire	150	10.13.6	Ishiguro Operation / Extension Block Pinning	166
10.11	Intramedullary Kirschner Wire Splinting or Pinning	152	10.13.7	Transfixation with Kirschner Wires	166
10.11.1	Procedure for Metacarpal Fractures	152	10.14	Temporary Percutaneous Joint Transfixation	168
10.11.2	Antegrade Intramedullary Procedure for Proximal and Middle Phalanx Fractures	152	10.14.1	Procedure	168
10.11.3	Retrograde intramedullary Procedure for Proximal and Middle Phalanx Fractures	152	10.15	Dynamic Distraction External Fixation	168
10.12	External Fixator	155	10.15.1	Suzuki Operation / Dynamic Distraction External Fixation	168
10.12.1	Indications, Advantages, and Disadvantages	155	10.16	Pull-out Barbed Wire Suture / Lengemann	170
10.12.2	Construction Possibilities and Placement	156	10.16.1	Procedure	170
10.12.3	Procedure	156	10.17	Hook Plate / Pronged Plate	172
10.13	Adaptive Fixation	160	10.17.1	Procedure	172
10.13.1	Overview	160	10.18	Absorbable pins	173
10.13.2	Percutaneous Kirschner Wire Fixation	160	10.18.1	Procedure	173
11	Further Reading	175			
11.1	Chapter 1: Introduction	176	11.9	Chapter 10: Surgical Procedures	179
11.2	Chapter 2: Biology of Fracture Healing	176	11.9.1	Wire Suture, Tension Band Wiring	179
11.3	Chapter 3: Non-operative Fracture Treatment	177	11.9.2	Lag Screw, Plate Fixation	179
11.4	Chapter 4: Surgical Fracture Management	177	11.9.3	Fixed-angle Locking Plate	180
11.5	Chapter 5: Differential Indication	178	11.9.4	Hybrid Plate	180
11.6	Chapter 7: Postoperative Management	178	11.9.5	Condylar Plate	181
11.7	Chapter 8: Implants and Instruments	178	11.9.6	Far locking / Dynamic Screw Technique	181
11.8	Chapter 9: Surgical Approaches	178	11.9.7	Headless Bone Screw (HBS)	181
	Index	185	11.9.8	External Fixator	182
			11.9.9	Adaptive Fixation	183
			11.9.10	Dynamic Distraction External Fixation	184
			11.9.11	Hook Plate	184
			11.9.12	Absorbable Pins	184