Contents

Chapter 1  A General Review of Microsurgery ................................. 1
   I. A Brief History of Microsurgery ...................................... 1
   II. Clinical Application of Microsurgery .............................. 3
      A. Muscular Transplantation with Vascular and Nerve Anastomosis 3
      B. Segmental Transplantation of the Intestine with Vascular Anastomosis 3
      C. Transplantation of Bone with Vascular Anastomosis .......... 4
      D. Transplantation of Joints with Vascular Anastomosis ........ 4
      E. Free Omentum Transplantation .................................. 4
      F. Free Skin Flap and Subcutaneous Tissue Transplantation 5
      G. Brain Surgery ...................................................... 5
      H. Urological Surgery ................................................. 5
      I. Obstetrics and Gynecology ...................................... 5
      J. Surgery of the Lymphatic System ............................... 6

   III. The Importance of Microsurgical Technique in the Development of Surgical Science 6

Chapter 2  The Operating Microscope and Magnifying Loupes ............... 8
   I. Structure, Principles, Types, and Features ........................ 9
      A. Structure and Principle of the Operating Microscope .......... 9
      B. The Types and Features of Operating Microscopes ........... 17
      C. Magnifying Glasses and Loupes .................................. 26

   II. Methods of Application ............................................. 29
      A. Application of the Operating Microscope ...................... 29
      B. The Application of the Magnifying Loupe ..................... 33

   III. Fields of Application .............................................. 33
   IV. Maintenance of the Operating Microscope and Magnifying Loupes 35

Chapter 3  The Instruments and Sutures of Microsurgery .................... 37
   I. General Requirements of Microinstruments ....................... 37
   II. Features and Requirements of the More Commonly Used Microsurgical Instruments ......................... 39
      A. Tissue Forceps .................................................. 39
      B. Scissors ......................................................... 40
| C. Needle Holders                     | 41 |
| D. Microvascular Clamps             | 43 |
| E. Needles and Sutures              | 46 |
| F. Counter Pressor                   | 48 |
| G. Microdissecting Forceps          | 48 |
| H. Instruments for Fixing Irrigated Vessels | 48 |
| I. Irrigating Needles               | 48 |
| J. Microcoagulation and Low-Pressure Suction Apparatus | 49 |
| III. Maintenance of the Microsurgical Instruments | 50 |
| IV. The Refinement of Microsurgical Instruments | 50 |

Chapter 4  **Basic Microsurgical Technique**  .................................................. 52

I. Basic Technical Training in Microsurgery  ............................................... 52
   A. The Surgical Microscope  .......................................................... 53
   B. Microsurgical Instruments  ....................................................... 54
   C. Experimental Training in Microsurgery  ....................................... 58

II. Preoperative Preparation for and Requirements of Microsurgery  .................... 63

III. Cooperation Between the Surgeon and the Assistant  ................................ 66

Chapter 5  **Microsurgical Suturing Technique** ............................................. 68

I. Microvascular Anastomosis  ............................................................... 68
   A. Exposure and Preparation for Anastomosis  .................................... 68
   B. Principles of Anastomosis  ......................................................... 69
   C. Suturing Techniques for Small Blood Vessels  ................................ 72
   D. Transplantation of Small Blood Vessels  ....................................... 84
   E. Use of Anticoagulants  ............................................................ 86

II. Microneural Anastomosis  ................................................................. 87
   A. Exposure  .................................................................................. 88
   B. Principles of Neural Anastomosis  ............................................... 88
   C. Technique of Microneural Anastomosis  ....................................... 89

III. Microlymphatic Anastomosis  .................................................................. 91
   A. Lympho-venous Anastomosis  ...................................................... 91
   B. Anastomosis Between Lymph Node and Vein  ................................... 92

Chapter 6  **Microsurgery and Pathology** ..................................................... 93

I. Pathological Changes After Anastomosis of Small Arteries  ......................... 93
   A. Pathological Changes in Different Parts of the Artery  .................... 93
   B. Discussion  ................................................................................ 97
   C. Conclusion  ............................................................................. 99

II. Pathological Changes After Venous and Lymphatic Anastomosis  ................... 99

III. Injury and Repair of Peripheral Nerves  .............................................. 100
   A. Histology of the Peripheral Nerves and Their Degeneration and Regeneration | 100
   B. Types of Nerve Injury  .............................................................. 102
   C. Repair and Transplantation of the Nerve  ...................................... 103
Chapter 7  Replantation of Severed Limbs and Digits  

I. Operative Indications  
II. Debridement  
   A. General Management  
   B. Debridement of Skin, Muscles, Tendons, and Bone  
   C. Assessment of the Vascular Bed  
   D. Debridement of the Blood Vessels  

III. Replantation Technique  
   A. Reconstitution of Skeletal Framework  
   B. Reestablishment of Circulation  
   C. Muscle and Tendon Repair  
   D. Nerve Repair  
   E. Skin Covering  

IV. Postreplantation Management  
   A. Systemic Reaction  
   B. Local Circulatory Impairment  
   C. Swelling of the Replanted Limb or Digit  
   D. Postreplantation Infection  
   E. Anticoagulant Therapy  
   F. Application of Hyperbaric Oxygen  

Chapter 8  Free Toe Transfer  

I. Requirements of a Reconstructed Thumb or Finger  
II. Indications  
III. Planning the Operation  
IV. Selection of the Donor Toe  
V. Anesthesia  
VI. Operation Teams  
VII. Preparation of the Recipient Site  
   A. Preparation of the Site of the Lost Thumb  
   B. Preparation of the Site of the Lost Finger  
VIII. Isolating the Second Toe  
IX. Steps and Methods of Transferring the Second Toe  
   A. Isolation of the Second Toe  
   B. Perfusion of the Second Toe  
   C. Verification of the Planning of the Operative Procedure  
   D. Insertion of a Kirschner’s Wire  
   E. Coaptation of the Bone  
   F. Suturing the Articular Capsule  
   G. Prevention of Kinking  
   H. Anastomosis of the Vessels  
   I. Rubber Tissue Drainage  
   J. Suturing the Tendon  
   K. Suturing the Nerve  
   L. Suturing the Skin  
   M. Ischemic Time of the Free Toe  

X. Thumb Reconstruction  
   A. Simple Total Loss of the Thumb  
   B. Total Loss of the Thumb with Partial or Total Loss of Its Metacarpal Bone  

Contents  IX
Contents

C. Total Loss of the Thumb and All Fingers 170
D. Loss of the Thumb and Most of the Fingers 170
E. Loss of the Thumbs and All Fingers on Both Hands 172

XI. Finger Reconstruction ................................... 172
XII. Intraoperative Prevention and Treatment of Vascular Spasm 174
XIII. Intraoperative Thrombosis and Its Management .... 175
XIV. General Postoperative Management ...................... 176
XV. Postoperative Complications and Their Management .... 178
A. Impediment of the Venous Return 178
B. Impediment of the Arterial Blood Supply 179
C. Atrophy and Thinning of the Transferred Toe 180
D. Infection .............................................. 180
E. Edema of the Foot ..................................... 180

XVI. Exercise ............................................. 181
A. Active Flexion-Extension of the Metacarpophalangeal Joint and Digital Joint 182
B. Passive Flexion-Extension of the Joints 182
C. Counterresistance Exercise 182
D. Spreading of the First Web Space 182
E. Technical Exercise ..................................... 183

XVII. Key to Success of the Operation: A Summary .......... 184

Chapter 9 Free Thumb Transfer ................................ 186
I. Indications for Selection .................................. 189
II. Planning the Operation ................................... 190
III. Anesthesia ............................................. 190
IV. Operation Teams ........................................ 190
V. Preparation of the Recipient Finger Site .................. 190
VI. Method for Isolating the Thumb ......................... 191
VII. Method of Transfer ..................................... 194
VIII. Postoperative Management ............................. 195
IX. Case Presentation ....................................... 195

Chapter 10 Free Skin Flap Transfer .............................. 198
I. Surgical Indications ...................................... 200
II. Planning of the Operation ................................ 200
III. Requirements of the Recipient Area ....................... 201
IV. Selection of the Donor Site ............................... 201
V. Free Skin Flaps from the Commonly Used Donor Sites .... 201
A. Lower Abdominal Skin Flap .............................. 201
B. Groin Skin Flap ........................................ 205
C. Skin Flap from the Dorsum of the Foot ..................... 206
D. Deltpectoral Flap ....................................... 207

VI. Anesthesia ............................................. 207
VII. Operation Teams ....................................... 207
VIII. Preparation of the Recipient Region ..................... 208
A. Fresh Wound After Trauma .............................. 208
B. Chronic Wounds with Exposed Bone ....................... 208
C. Management of an Aseptic Wound .......................... 208
Chapter 11  Free Muscle Transplantation
I. History ........................................ 232
II. Operative Indications ........................ 234
III. Selection of Donor Muscles .............. 237
   A. Selection of Simple Muscle Grafts .... 237
   B. Selection of Free Muscle Grafts with Attached Skin 254
IV. Operative Procedure ...................... 255
   A. Free Pectoralis Major Grafting in the Treatment of
      Ischemic Contracture of the Flexors of the Forearm  255
   B. Treatment of Facial Palsy by Free Gracilis Grafting ... 257
   C. Treatment of Brachial Paralysis by Free Gracilis Grafting 258
   D. Treatment of Facial Palsy by Transplantation of Free Extensor Digitorum Brevis 258
   E. Treatment of Facial or Leg Defects by Free Gracilis Grafting with Attached Skin .... 259
   F. Treatment of Flexor Defects of the Forearm by Grafting of Free Rectus Abdominis with Attached Skin 259
V. Postoperative Management ............... 260

Chapter 12  Free Bone Grafting .............. 261
I. Operative Indications ...................... 261
   A. Inflammatory Diseases .................. 262
   B. Bone Tumors ............................. 263
   C. Trauma .................................. 263
   D. Failure of Conventional Large-Sized Bone Grafting 264
   E. Congenital Pseudarthrosis of the Tibia 264
II. Donor Selection and Techniques of Removal 266
   A. Fibula .................................. 266
   B. Rib .................................... 269
   C. Ilium .................................. 270
III. Operative Procedure ..................... 270
   A. Preoperative Requisitions and Preparation 270
   B. Preparation of the Recipient Region .... 270
   C. Bone Fixation ........................... 271
   D. Reestablishment of Circulation .......... 272
   E. External Fixation ........................ 273
IV. Postoperative Management ............................................. 273
A. Roentgenography ......................................................... 273
B. Angiography ............................................................... 273
C. Isotopic Examination .................................................... 274
D. Tetracycline Fluorescence ............................................. 276
E. Ultrasonic Doppler Effect .............................................. 276

V. The Evaluation and Future of Free Bone Grafting .............. 276

Chapter 13 Transplantation of Intestinal Segment and Great Omen-
tum ................................................................. 280

Application of Microsurgical Techniques in the Transplantation
of an Intestinal Segment for Repair of Esophageal Defects 280

I. A Historical Review of Reparative Surgery of the Esophagus 280
II. Experimental Study of Autogenous Free Transplantation of
a Segment of Jejunum .................................................... 283
A. Animals Used ............................................................ 283
B. Anesthesia ............................................................... 283
C. Experimental Method ................................................... 283
D. Results ................................................................. 284

III. Indications and Methods of Clinical Application of Autogen-
ous Graft of Intestinal Segments ...................................... 284
A. Selection of Blood Vessels in the Recipient Region ........ 284
B. Orientation of the Intestinal Segment ............................ 285
C. Complications After Transplantation of an Intestinal Seg-
ment ................................................................. 286
D. Operative Procedures .................................................. 286

IV. Postoperative Care of Cases of Transplantation of the Intestinal
Segment ................................................................. 299

V. Evaluation of the Operative Procedure for Reconstructing ..... 300

Transplantation of Great Omentum .................................. 301

I. Surgical Anatomy of the Great Omentum .......................... 302
II. Method of Free Graft of the Great Omentum .................... 305

Chapter 14 Application of Microsurgical Technique in Tumor Surgery 308

I. Resection of Benign Tumors of Important Viscera or Nervous
Tissue ................................................................. 309
II. Resection of Hemangiomas or Aneurysms ....................... 310
III. Functional Reestablishment After Tumor Resection .......... 311
A. Free Skin Flap Grafting After Tumor Resection ............ 312
B. Tumor Resection and Segmental Free Grafting of the Intes-
tine ................................................................. 312
C. Tumor Resection and Free Bone Grafting ...................... 312

IV. Replantation of the Distal Portion of the Limb After Resection
of a Tumor-Bearing Segment ........................................... 313
A. Indications for Segmental Resection and Replantation .... 314
B. Principles of the Operation .............................................. 314
C. Types of Segmental Resection and Replantation .............. 315

Chapter 15  **Microsurgical Techniques in Neurosurgery** ............ 322

Application of Microsurgical Techniques in the Central Nervous System .................................................. 322

I. General Review ............................................................ 322
   A. Cerebrovascular Diseases ............................................ 322
   B. Brain Tumors .......................................................... 324
   C. Cranial Nerve and Peripheral Nerve Surgery .................. 326
   D. Spinal Cord ............................................................ 326
   E. Congenital Diseases and Others ................................. 327

II. Extra – Intracranial Artery Bypass Surgery ......................... 327
   A. Indications ............................................................. 327
   B. Contraindication of Bypass Operations ......................... 328
   C. Preoperative Examinations ........................................... 329
   D. Operative Procedures ................................................ 332
   E. Timing of the Operation ............................................. 333
   F. Anesthesia ............................................................. 333
   G. Operative Technique ................................................ 333
   H. Postoperative Management ........................................... 336
   I. Complications and Mortality ....................................... 337
   J. Results ..................................................................... 337

III. Facial Nerve – Spinal Accessory Nerve Anastomosis ............... 339
   A. Indications for Surgery .............................................. 339
   B. Operative Techniques ................................................ 339
   C. Postoperative Management ......................................... 340

Application of Microsurgical Techniques in Peripheral Nerve Injuries ................................................................. 340

I. Structure of the Peripheral Nerve ....................................... 341
II. Regeneration of the Nerve Fiber ....................................... 343
III. Types of Nerve Injury .................................................... 344
   A. Severance of the Nerve ............................................... 344
   B. Swelling of the Nerve ................................................ 344
   C. Adhesion and Compression of the Nerve ......................... 344
   D. Transposition and Slipping of the Nerve ......................... 345
   E. Injury Due to Drugs .................................................. 345

IV. Surgical Indications ....................................................... 345
   A. Emergency Operation ................................................ 345
   B. Early Operation ...................................................... 345
   C. Late Operation ....................................................... 346

V. Operative Technique ....................................................... 346
   A. Suture of Epineurium ............................................... 347
   B. Suture of Perineurium ............................................... 349
   C. Nerve Graft .............................................................. 352
   D. Pedicle Nerve Graft .................................................. 354
   E. Neurolysis .............................................................. 355
   F. Decompression of the Nerve ........................................ 355
   G. Splitting the Branch from the Nerve Trunk ..................... 356
VI. Application of Microsurgery in Replantation of Severed Limbs and Digits and Transplantation of Limbs and Other Tissues 356
VII. Postoperative Management 357

Chapter 16 **Application of Microsurgical Techniques in Otolaryngology** 359

I. Stapedectomy 359
   A. A Brief History 359
   B. Indications and Selection of Patients for Surgery 359
   C. Types of Operative Technique 360
   D. Operative Procedure 361
   E. Preparation and Installation of Stapes Prosthesis 366

II. Myringoplasty 370
   A. Indications 370
   B. Operative Technique 370
   C. Postoperative Management 375
   D. Results of Therapy 375

III. Ossicular Chain Reconstruction 376
   A. Indications 376
   B. Operative Procedure 377
   C. Postoperative Management 381
   D. Causes of Failure 382
   E. Results 382

IV. Facial Nerve Operations 382
   A. Indications 383
   B. Operative Procedure 384
   C. Postoperative Management 389
   D. Therapeutic Effect 391

V. Operations of the Internal Acoustic Meatus 392
   A. Indications 392
   B. Preoperative Preparation 393
   C. Operative Instruments 394
   D. Operative Procedure 394
   E. Postoperative Care 399

VI. Repair of the Recurrent Laryngeal Nerve 400
   A. Indications 400
   B. Operative Procedure 401
   C. Results 404
   D. Case Presentation 405

Chapter 17 **Microsurgery in Ophthalmology** 407

I. Glaucoma Surgery 407
   A. Goniomaty 408
   B. Smith’s Method of Trabeculotomy 410
   C. Allen and Burian’s Method (1962) of Trabeculotomy 411
   D. Externalization of Schlemm’s Canal (Sinusotomy) 414
   E. Trabeculectomy 416
Chapter 18 Application of Microsurgical Techniques in Urological Surgery

I. Transplantation of the Testis
   A. Autotransplantation of the Testis
   B. Allotransplantation of the Testis

II. Replantation of the Penis
    A. Indications
    B. Operative Procedure
    C. Postoperative Management

III. Anastomosis of the Vas Deferens
    A. Operative Indications
    B. Factors Influencing the Success of Vasovasostomy
    C. Operative Procedure
    D. Problems Related to the Anastomosis
    E. Postoperative Management

IV. Anastomosis of the Vas Deferens and Epididymis

V. Lymphangiography
   A. Indications
   B. The Technical Procedure
   C. Complications and Their Prevention
   D. Postoperative Management

VI. Lumbar Lymphatic Trunk – Internal Spermatic or Ovarian Vein Anastomosis
    A. Operative Indications
    B. Operative Technique

VII. Anastomosis of the Inferior Epigastric Artery and Cavernous Artery of the Penis
    A. Operative Indications
    B. Operative Technique
    C. Postoperative Management
VIII. Subcutaneous Arteriovenous Fistulas ........................................ 455
   A. Selection of Vessels for Creating an Internal Fistula and
       the Method of Anastomosis ........................................ 455
   B. Operative Technique .................................................. 456
   C. Postoperative Management ........................................... 458

References ............................................................................. 461

Subject Index ......................................................................... 473