Section 1: Basics

1. Vitreous and Vitreoretinal Interface
   Cyrus Shroff, Daraius Shroff
   - Development 3
   - Anatomy 4
   - Biochemistry 6
   - Posterior Vitreous Detachment 7
   - Vitreoschisis 7
   - Anomalous Posterior Vitreous Detachment 9
   - Complications from Changes in the Vitreous 9
   - Pharmacologic Vitreolysis 11

2. Role of OCT in Decision Making for Vitreoretinal Surgery
   Jay Kumar Chhablani, Jae Suk Kim, Igor Kozak, Abhishek R Kothari
   - Full Thickness Macular Holes 13
   - Myopic Macular Pathology 16
   - Lamellar Macular Hole 16
   - Epiretinal Membrane 17
   - Macular Pseudoholes 17
   - Vitreomacular Traction Syndrome 17
   - Tractional Retinal Detachment 18
   - Unexplained Visual Disturbances 18

3. Preoperative Considerations
   Tandava Krishna, Jay Kumar Chhablani, Abhishek R Kothari
   - Goal of Surgery and Role of Preoperative Workup 21
   - General Considerations 21
   - Safety First-systemic Evaluation of the Vitreoretinal Patient 21
   - Local Examination 22
   - Instructions to Patients and Ward Staff 24
   - Immediate Postoperative Management 24

4. Anesthesia for Vitreoretinal Surgery
   Jaichandran V, Jagadeesh V, Chandra M Kumar
   - Choice of Anesthetic Technique 26
   - Preoperative Assessment and Preparation 27
   - Orbital Regional Anesthesia 29
   - General Anesthesia 31
   - Postoperative Care 32

5. Vitreoretinal Surgical Suite
   Rohit Patil, Abhishek R Kothari, Rashmin Gandhi
   - Basic Design Considerations 34
   - Basic Operational Considerations 36

6. Tools of the Trade
   Amit Gupta, Abhishek R Kothari
   - Surgical Drapes 41
   - General Extraocular Instruments 42
   - Vitrectomy-related Instruments 43
7. Vitreoretinal Surgery Systems

Steve Charles

• History 53
• The Ocular Connection Machine and the Accurus Vitreoretinal Surgery System 53
• The Constellation Vision System 54

8. Understanding Fluidics and Machine Parameters—Optimizing Performance

Manish Nagpal, Pravin Jain

• History 57
• Fluid Dynamics of Vitrectomy 57
• Fragmentation 65
• Extrusion 66
• Reflux 66
• Viscous Fluid Injection and Extraction 66

9. Irrigating Fluids for Vitrectomy

Abhishek R Kothari

• Tissue Concerns from Intraocular Fluids During Vitrectomy 67
• Components of Infusion Fluids 68
• Commercial Irrigating Fluids 69

10. Viewing Systems for Vitrectomy

Ravi K Murthy, KV Chalam

• Conventional Viewing Systems 71
• Wide Angle Viewing Systems 73
• Recent Advances 76

11. Intraoperative Adjuncts

Saravanan VR

Dyes 78

• Early Developments 78
• Indocyanine Green 78
• Infracyanine Green 79
• Trypan Blue 79
• Brilliant Blue G 80
• Triamcinolone Acetonide (TA) 80
• Patent Blue 81

Perfluorocarbon Liquids 83

• Physical Properties and their Implications for Surgical Use 83
• Use in Vitreoretinal Surgery 84

Section 2: Vitreous Surgery: Basics

12. 20-Gauge Vitrectomy

George J Manayath, Saurabh Arora, Abhishek R Kothari

• Equipment for Pars Plana Vitrectomy 91
• Basic Vitrectomy Technique 92
• Complications 97

13. 23-Gauge Vitrectomy

Abhishek R Kothari

• Indications 99
• Wound Construction Techniques and Microcannula Placement 100
• Instrumentation 101
• Differences Between 23-Gauge and 20-Gauge/25-Gauge 102
• Surgery 102
• Microcannula Removal and Wound Closure 103
• Complications of 23-Gauge Vitrectomy 104
14. 25-Gauge Sutureless Transconjunctival Vitrectomy
Steve Charles
- Case Selection 106
- Trocar Cannula System and Incisions 106
- Fluidics 107
- Tool Issues 108
- Wound Leak Issues 108
- Postoperative Endophthalmitis and Retinal Detachments 109
- Cannula Withdrawal and Wound Closure 109

15. Interfacial Tension Agents, Exchanges and Subretinal Fluid Drainage
Steve Charles
- Surface Tension Management and Exchanges 110
- Physical Consideration 110
- Interfacial Tension Agents 111
- Nomenclature 111
- Drainage of Subretinal Fluid 111
- Intraocular Lens (IOLs) Fogging During Fluid-Air Exchange 113
- Air-Gas Exchange 113
- Liquid Perfluorocarbon 113
- Air-Silicone Exchange 114
- Silicone Oil Removal 115
- Silicone Reoperations 115

16. Hemostasis during Vitreoretinal Surgery
Jatinder Singh
- Basics 116
- Preoperative Considerations 117
- Intraoperative Factors 120
- Intraoperative Hemostasis 120
- Postoperative Vitreous Hemorrhage (Vitreous Cavity Hemorrhage) 125
- Suprachoroidal Hemorrhage 127

17. Endolaser
Jaishree Arunaprakash, Upendra Babu M, Abhishek R Kothari
- Laser Tissue Interactions 131
- Laser in Surgery 131
- Endolaser Probes 131
- Laser Filters 132
- Intraoperative Use 132
- Indications 134
- Complications 134

18. Intraocular Gases
Sarath Ravi
- Historical Background 136
- Physicochemical Properties of Gases 136
- Kinetics of Intraocular Gases 137
- Clinical Use 138
- Postoperative Positioning and Care 141
- Complications 142

19. Long-term Intraocular Tamponade with Silicone Oil
Wico W Lai, Widad Yusof, Amy Lo, Ian Y Wong, David Wong
- Properties of Silicone Oil 145
- Clinical Indications 148
- Surgical Techniques in the Use of Silicone Oil 150
- Complications of Silicone Oil 154
- Future Developments 157
20. Vitreous Surgery—Complications and their Management 163
   William E Smiddy
   • Intraoperative Complications 163
   • Postoperative Complications 164

Section 3: Special Considerations

21. Anterior Segment Concerns in Vitreoretinal Surgery 169
   Jay Kumar Chhablani, Abhishek R Kothari
   • Corneal Issues 169
   • Pupil Management 170
   • Managing the Lens 171

22. Temporary Keratoprosthesis: Retinal Surgery in the Presence of an Opaque Cornea 172
   Maurice B Landers, Jessica S Watson, Thanh-Thu T Tran
   • The Temporary Keratoprosthesis 172
   • Surgical Technique 173
   • Outcomes 174
   • Specialized Temporary Keratoprostheses 174
   • New Developments 175

23. Vitreoretinal Surgery in Eyes with Permanent Keratoprosthesis 177
   Pukhraj Rishi, Harshali Yadav
   • Commonly Used Permanent Keratoprosthesis 177
   • Vitreoretinal Complications Associated with KPro 179
   • Challenges in Vitreoretinal Surgery in Eyes with Keratoprosthesis 180

24. Vitreoretinal Surgical Diseases and Refractive Surgery 184
   J Fernando Arévalo
   • Retinal Detachment 184
   • Macular Hemorrhage, Lacquer Cracks and Choroidal Neovascular Membranes 186
   • Macular Hole 187
   • Displacement of Corneal Cap during Vitrectomy 187
   • Final Considerations 188

Section 4: Retinal Detachment: Basics
   (Section Editor: Ingrid Kreissig)

25. Peripheral Retinal Lesions, Breaks and their Treatment 193
   Kasinathan Nachiappan
   • History 193
   • Basics 193
   • Pathophysiology of Retinal Detachment 194
   • Predisposing Lesions 195
   • Benign Peripheral Lesions 197
   • Symptoms and Signs: Associated with Peripheral Retinal Pathology 198
   • Examination Techniques 198
   • Management 199

26. The 8 Rules: How to Find the Retinal Break 202
   Ingrid Kreissig
   • Preoperative Search for the Break in a Retinal Detachment 202
   • Preoperative Search for a Missed Break in Reoperation 208
   • Differential Diagnosis Between Rhegmatogenous Detachment and Retinoschisis 210
   • Rhegmatogenous Retinal Detachment "without" a Break 210
   • The Search for a Retinal Break in an Acute Vitreous Hemorrhage 211
27. Primary Retinal Detachment: Review of Techniques for Repair
Applied Over the Past 80 Years—A Personal Odyssey 216
Ingrid Kreissig, Harvey Lincoff
- Review 216
- Evolution of Surgical Technique 222
- Discussion 227

Paul E Tornambe
- The Philosophy of Pneumatic Retinopexy 230
- The Procedure 231
- Clinical Results 232

29. Scleral Buckling 242
PN Nagpal
Principles, Technique and Outcomes 242
- Buckling Principles 242
- Reattachment Forces Influenced by Scleral Buckles 242
- Preoperative Management 243
- Preparation of the Site 245
- Pupillary Dilatation and Corneal Clarity 245
- Exposure of the Operative Field 245
- Localization and Intraoperative Examination 246
- Treating the Breaks 247
- Methods of Buckling 248
- Subretinal Fluid Drainage 253
- Adjustment of the Scleral Buckle 256
- Assuring Perfusion of Central Retinal Artery 256
- Nondrainage Procedure 256
- Closure of Incisions 257
- Postoperative Management 257
- Outcomes 258
- Scleral Buckling versus Primary Vitrectomy 259

Complications of Scleral Buckling 262
- Intraoperative Complications 262
- Postoperative Complications 265

30. Minimal Extraocular Surgery with Sponge(s) and Balloon for Repair of
Rhegmatogenous Retinal Detachment 281
Ingrid Kreissig
- Historical Background of Minimal Extraocular Surgery [Segmental Sponge Buckle(s) without Drainage] 281
- Difficulties in Acceptance of the Cryosurgical Detachment Operation 282
- Minimal Extraocular Surgery with Segmental Sponge Buckle(s) without Drainage 283
- Minimal Extraocular Surgery with a Temporary Balloon Buckle without Drainage 289
- Clinical Results of Minimal Extraocular Surgery with Sponge Buckle(s) or Balloon 291

31. Primary Vitrectomy for Rhegmatogenous Retinal Detachment 312
J Garcia-Arumi, A Boixadera, V Martinez Castillo, MA Zapata
- Indications 312
- Techniques 312
- Complications Unique to this Surgical Technique 316

32. Repair of Primary Retinal Detachment: Comparison of Present Surgical Techniques 320
Ingrid Kreissig
- Comparison of Present Surgical Techniques for Repair of a Primary Rhegmatogenous Retinal Detachment 320
Section 5: Retinal Detachment: Advanced
(Section Editor: Saravanan VR)

33. Proliferative Vitreoretinopathy
   Joseph Tseng, Gaetano Barille, William M Schiff
   • Epidemiology and Risk Factors 329
   • Pathophysiology 330
   • Classification 330
   • Diagnosis 331
   • Management 331
   • Prevention 336

34. Retinal Detachment Secondary to Giant Retinal Tear
   Jay Kumar Chhablani
   • Cause 341
   • Vitreoretinal Relationship 341
   • Management 341
   • Results 344
   • Complications 344
   • Management of the Fellow Eye 345

35. Management of Rhegmatogenous Retinal Detachment with Inferior Breaks
   Vicente Martinez-Castillo, A Boixadera, A Céspedes, J García-Arumí
   • Historical Perspective 346
   • Relevant Pathophysiology 346
   • Brief Clinical Features 346
   • Brief Summary of Surgical Options with Vitrectomy Techniques 347
   • Patient Preparation 348
   • Surgical Technique 349
   • Postoperative Follow-up 350
   • Complications 350

36. Retinal Detachment due to Macular Hole
   Jay Kumar Chhablani, Abhishek R Kothari
   • Etiopathogenesis 356
   • Preoperative Evaluation 356
   • Vitreous Surgery Technique 356
   • Prognosis 357
   • Macular Buckling 358
   • Primary Rhegmatogenous Retinal Detachment with Associated Macular Hole 358

37. Surgery for Recurrent Retinal Detachment
   Saravanan VR
   • Assessment: The First Step 360
   • Resurgery Considerations 360
   • Timing of Resurgery 360
   • Techniques 361
   • Choice of Tamponade 363
   • Postoperative Use of Steroids 363

Section 6: Diabetic Retinopathy Complications
(Section Editor: Steve Charles)

38. Vitreous Surgery in Diabetic Retinopathy
   Lalit Verma
   • Indications 367
   • Representative Clinical Situations 368
43. Epiretinal Membranes
   Harshali Yadav
   - Epidemiology 423
   - Pathophysiology 423
   - Classification 423
   - Risk Factors and Etiology 423
   - Diagnosis 424
   - Surgery 426
   - Complications 427

44. Macular Holes
   William E Smiddy
   - Historical Perspective 429
   - Pathophysiology 429
   - Clinical Features 430
   - Management 430
   - Results 432
   - New Developments 432

45. Premacular Hemorrhage
   Arindam Chakrabarti, Priyank Garg, Nazimul Hussain, S Natarajan
   - Anatomy and Pathophysiology 438
   - Clinical Features 439
   - Management 439
<table>
<thead>
<tr>
<th>Section 8: Lens and IOL-related Disorders</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>47. Lensectomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upendra Babu M, Abhishek R Kothari</td>
</tr>
<tr>
<td>Indications 455</td>
</tr>
<tr>
<td>Preoperative Evaluation 455</td>
</tr>
<tr>
<td>Surgical Technique 455</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>48. Management of Retained Lens Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>William E Smiddy</td>
</tr>
<tr>
<td>Pathophysiology and Risk Factors 458</td>
</tr>
<tr>
<td>Clinical Features 458</td>
</tr>
<tr>
<td>Indication and Timing of Surgical Interv</td>
</tr>
<tr>
<td>envention 459</td>
</tr>
<tr>
<td>Vitreoretinal Surgical Technique 459</td>
</tr>
<tr>
<td>Postoperative Management and Complications 460</td>
</tr>
<tr>
<td>Results of Vitrectomy Management 461</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>49. Management of Dislocated Intraocular Implants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dhanashree Ratra</td>
</tr>
<tr>
<td>Factors Associated with IOL Dislocation 463</td>
</tr>
<tr>
<td>Management 463</td>
</tr>
<tr>
<td>Techniques 464</td>
</tr>
<tr>
<td>Complications of Scleral Fixation 468</td>
</tr>
<tr>
<td>Sutureless Fixation of the Dislocated Implant 468</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>50. Surgical Management of Aphakia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pramod Bhende, Swapnesh Sawant</td>
</tr>
<tr>
<td>Optics of Aphakia 471</td>
</tr>
<tr>
<td>Options for Aphakic Correction 471</td>
</tr>
<tr>
<td>Case Selection for Secondary IOL Implant 473</td>
</tr>
<tr>
<td>Preoperative Evaluation 473</td>
</tr>
<tr>
<td>Surgical Techniques 473</td>
</tr>
<tr>
<td>Postoperative Management 479</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>51. Management of Postoperative Endophthalmitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stephen G Schwartz, Harry W Flynn, Roy D Brod</td>
</tr>
<tr>
<td>Pathophysiology and Classification 481</td>
</tr>
<tr>
<td>Clinical Features 482</td>
</tr>
<tr>
<td>Incidence Rates and Risk Factors 483</td>
</tr>
<tr>
<td>Surgical Principles 484</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section 9: Trauma and Complications</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>52. Anterior Segment Management in Eyes with Trauma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abhishek R Kothari</td>
</tr>
<tr>
<td>Conjunctival Laceration 493</td>
</tr>
<tr>
<td>Corneal and Scleral Lacerations 493</td>
</tr>
<tr>
<td>Iris Reconstruction 496</td>
</tr>
<tr>
<td>Pupil Repair 498</td>
</tr>
</tbody>
</table>
53. Traumatic Vitreous Hemorrhage
Manisha Agarwal
- Brief Historical Perspective 500
- Anatomy 500
- Etiopathogenesis 500
- Clinical Features 502
- Imaging Studies 502
- Medical Therapy 503
- Surgical Management 503
- Prognosis 504

54. Intraocular Foreign Body
Raj Vardhan Azad
- Epidemiology 506
- Evaluation 506
- Mechanisms of Injury 507
- Management 509
- Prognosis and Outcome 511

55. Post-traumatic Endophthalmitis
Naveen Kumar Naik, Abhishek R Kothari
- Epidemiology 513
- Risk Factors for Post-traumatic Endophthalmitis 513
- Clinical Diagnosis 514
- Factors Affecting Visual Prognosis 514
- Management 515
- Complications 517
- Outcomes 517

Section 10: Pediatric Retinal Surgery
(Section Editor: Parag K Shah)

56. Principles of Pediatric Retinal Detachment Surgery
Subhadra Jalali, Padmaja Kumari Rani, Jay Kumar Chhablani
- Challenges Unique to Pediatric Retinal Detachment 521
- Developmental Considerations 521
- Clinical Presentation 522
- Surgical Approach 522
- Specific Clinical Situations 523
- Decision-making for Prophylactic Treatment in Pediatric Retinal Disorders 526
- Postoperative Management 526

57. Surgical Management of Stages 4 and 5 Retinopathy of Prematurity
Parag K Shah, Naveen Kumar Naik, Narendran V
- Options for Treatment 527

58. Surgery for Choroidal Coloboma and Retinal Detachment
Lingam Gopal
- Anatomical Considerations 531
- Clinical Presentation of Retinal Detachment 531
- Management 532

Section 11: Posterior Segment Tumors

59. Intraocular Biopsy Techniques
Mahesh P Shanmugam
- Prerequisites 537
- Biopsy Techniques 538
60. Resection of Intraocular Tumors 546
Mahesh P Shanmugam
• Indications for Resection 546
• Surgical Technique 547

61. Ophthalmic Brachytherapy 555
Parag K Shah, V Narendran, U Selvaraj, P Guhan, Sanjay K Saxena, Ashutosh Dash, Melvin Astrahan
• Brachytherapy Steps 555
• Ophthalmic Brachytherapy 555
• Our Surgical Results 557
• Complications 558

62. Enucleation Technique, Orbital Implants and Complications 559
Hakan Demirci, David H Abramson
• Procedure Rates and Indications 559
• Surgical Techniques 560
• Complications 561
• Orbital Implant Selection 565

Section 12: Vitreoretinal Intervention in Uveitic Disorders

63. Management of Viral Retinitis 571
Igor Kozak
• Cytomegalovirus Retinitis 571
• Acute Retinal Necrosis Syndrome 576
• Herpes Simplex Virus Retinitis 578
• Surgical Approach to Retinitis 579

64. Vitrectomy in Non-infective Uveitis 585
Pradeep Venkatesh
• Indications 585
• Role of Vitreous Surgery in Uveitis 586
• Considerations in Uveitic Vitrectomy 587
• Outcomes 590

Section 13: Intravitreal Injections and Lasers

65. Intravitreal Injections: Procedure and Protocol 593
Daraius Shroff, Neelam Arri, Abhishek R Kothari
• Guidelines 593
• Complications of Intravitreal Injection Procedure 594
• Special Considerations 595

66. Intraocular Anti-vascular Endothelial Growth Factor Therapy 597
Naresh Mandava, Carolyn Pan
• Background and Introduction 597
• VEGF Inhibitors 597
• Landmark Clinical Trials 598
• Non-age-related Macular Degeneration (AMD) and Future Applications of Anti-VEGF Agents 599
• Procedure 600

67. Intravitreal Corticosteroids 603
Jatinder Singh
• Mechanism of Action 603
• Triamcinolone Acetonide 604
• Dexamethasone 610
• Sustained Release Drug Delivery 611
68. Lasers in Choroidal Neovascular Membranes
   Vivek Dave, Jay Kumar Chhablani, Chinmaya Sahu, R Narayanan
   • Thermal Laser 621
   • Transpupillary Thermotherapy 623
   • Photodynamic Thermotherapy 624

Section 14: Vitreoretinal Surgery and Glaucoma

69. Management of Postvitrectomy Glaucoma
   Jatinder Singh
   • Mechanism of Glaucoma 631
   • Surgical Procedures for Postvitrectomy Glaucoma 636

70. Choroidal Detachment
   Madhusudan Davda, Rajul Parikh
   • Causes of Choroidal Detachment 645
   • Diagnosis and Assessment of a Typical Case of Serous Choroidal Drainage 645
   • Management of Serous Choroidal Detachments 646
   • Complications 648

71. Suprachoroidal Hemorrhage
   Raj Vardhan Azad
   • Pathophysiology 650
   • Incidence 650
   • Predisposing Factors 650
   • Prophylaxis 650
   • Recognition (Intraoperative Diagnosis) 650
   • Emergency Management (Intraoperative Management) 652
   • Postoperative Management 652
   • Surgical Management 653
   • Prognosis 653

72. Malignant Glaucoma
   Naveen Kumar Naik
   • Eyes at Risk 656
   • Pathophysiology 656
   • Management Principles 656

73. Neovascular Glaucoma: Vitreoretinal Perspective
   Saket Arya, Abhishek R Kothari
   • Etiology 659
   • Pathogenesis 659
   • Presentation 660
   • Treatment 660

Section 15: Emerging Techniques

74. Surgery for Age-related Macular Degeneration
   Errol W Chan, Kab-Guan Au Eong
   • Historical Background 667
   • Pneumatic Displacement of Submacular Hemorrhage 668
   • Surgical Evacuation of Subretinal Hemorrhage 668
   • Submacular Surgery 669
   • Macular Translocation 671
   • RPE Transplantation and Macular Reconstruction 676
   • Epiretinal Brachytherapy 680
   • Retinal Prosthesis 681
75. Surgery for Retinal Vein Occlusions  
   Manish Nagpal  
   • Anatomical Considerations 686  
   • Causes of Visual Loss in Patients with Vein Occlusion 686  
   • Use of Intravitreal Steroids and Anti-VEGFs 686  
   • Surgery in Retinal Vein Occlusions 687

76. Endoscopic Vitreoretinal Surgery  
   Priyank Garg, Arindam Chakravarti, Nazimul Hussain, S Natarajan  
   • Applications 692  
   • Instrumentation 692  
   • Surgical Technique 693

77. Enzymatic Vitreolysis  
   Melissa Neuwelt, Michael T TREE  
   • Background 696  
   • Vitreous Anatomy and Molecular Structure 696  
   • Plasmin-induced Vitreolysis 697  
   • Future Directions 697

Section 16: Learning and Teaching

78. Vitreoretinal Surgical Training—Role of the Eyesi Simulator  
   Abhishek R Kothari, Narender V, Saurabh Arora  
   • Learning Theory 701  
   • Virtual Reality Simulators 702  
   • Results 705

79. Recording Surgical Videos, Film Making and Dissemination of Skills  
   Vatsal Parikh, Samar Basak, Suresh K Pandey, Abhishek R Kothari  
   “I Can See Clearly But cannot Record as Well”—Understanding the Basics of Recording Surgical Videos 708  
   • The Equipment 708  
   • Basics of Recording 709  
   Telling Your Story—Film Making 711  
   • Personal Preparedness 711  
   • Production Process 711

Index 715