

Contents

1.	Ocular Hypertension	1
	<i>Shibal Bhartiya, Parul Ichhpujani</i>	
	 Case 1: No treatment required for ocular hypertension 1	
	 Case 2: Treatment for ocular hypertension required depending on age 1	
	 Case 3: Treatment for ocular hypertension required depending on central corneal thickness 1	
	• <i>How to manage this patient if his central corneal thickness measured 480 microns? or 610 microns?</i> 2	
	 Case 4: Treatment for ocular hypertension required depending on dv and high peak pressures 2	
	• <i>Investigations</i> 3	
	• <i>Follow-up Protocol</i> 3	
	• <i>Commentary</i> 3	
2.	Glaucoma Suspect	6
	<i>Augusto Vieira, Tiago Prata, Fabio Kanadani, Syril Dorairaj</i>	
	Who is a Glaucoma Suspect? 6	
	 Case 1: Strong risk factors 6	
	 Case 2: Disc hemorrhage 6	
	 Case 3: Low central corneal thickness 7	
	 Case 4: Disc asymmetry 7	
	 Case 5: Diurnal variation of intraocular pressure 8	
	 Case 6: Glaucoma suspect at a young age 9	
	Literature review 10	
	• <i>Intraocular Pressure</i> 10	
	• <i>Optic Nerve Head</i> 10	
	• <i>Central Corneal Thickness</i> 10	
	• <i>Risk Factors for Glaucoma</i> 11	
3.	Primary Open-Angle Glaucoma	13
	<i>Shibal Bhartiya, Parul Ichhpujani</i>	
	 Case 1: No treatment required for early primary open-angle glaucoma 13	
	 Case 2: Treatment for early primary open-angle glaucoma required depending on age 14	
	 Case 3: Treatment for early primary open-angle glaucoma required depending on central corneal thickness 16	
	 Case 4: Treatment for moderate primary open-angle glaucoma requiring more than one antiglaucoma medication 19	
	 Case 5: Treatment of severe primary open-angle glaucoma requiring surgery since not controlled on maximal tolerable medical therapy 19	
	 Case 6: Treatment of severe primary open-angle glaucoma requiring surgery at first diagnosis due to severe visual field loss 20	

Investigations 20
 Follow-up Protocol 21
 What is the Natural Course of the Disease? 21
 Broad Guidelines for Management 22

4. **Medical Therapy: Monotherapy, Fixed Combinations, Side Effects and Quality of Life Implications**

25

Simon Skalicky, Ivan Goldberg

-  **Case 1:** Monotherapy 25
-  **Case 2:** Fixed drug combinations 25
-  **Case 3:** Side effects and quality of life 28

- *Investigations* 29
- *Follow-up Protocol* 29
- Brief Review of Literature 29
- Summary 30
- *Pharmacological Classes* 30
- *Fixed Combination Medications* 30
- *Preserved versus Preservative Free Preparations* 30
- *Drop Instillation Technique (Instructions for New Patients)* 31
- *Commentary* 31

5. **Laser Trabeculoplasty**

33

Shibal Bhartiya, Parul Ichhpujani

Indications 33
 Contraindications 34

-  **Case 1:** SLT for drug induced ocular surface disease 34
-  **Case 2:** SLT for patient unable to instill drugs 34
-  **Case 3:** SLT for angle closure 34
-  **Case 4:** Repeat SLT 35
- *Repeatability of Selective Laser Trabeculoplasty* 35
- *Selective Laser Trabeculoplasty versus Argon Laser Trabeculoplasty* 35

6. **Angle-Closure Glaucoma**

36

Sushmita Kaushik, Pankaj Kataria

- Stages of Angle-Closure Disease 36
- *Primary Angle-Closure Suspect* 36
 - *Primary Angle Closure* 36
 - *Primary Angle-Closure Glaucoma* 36
 - *Acute Angle Closure* 36
- Epidemiology 37
- Risk Factors 37
- *Demographic Factors* 37
 - *Anatomic Factors* 37
 - *Precipitating Factors* 38

Diagnosis 38

- *External Examination* 38
- *Penlight Examination* 38
- *Slit-Lamp Examination* 38
- *Gonioscopy* 38
- *Other Imaging Techniques* 39

Management 39

- *Primary Angle-Closure Suspect* 39
- *Primary Angle Closure* 39
- *Primary Angle-Closure Glaucoma* 39

7A. Trabeculectomy versus Tube

41

Giovanna Casale-Vargas, Oscar Albis-Donado, Gabriel Lazcano-Gómez



Case 1: Trabeculectomy with mitomycin C 41



Case 2: Trabeculectomy with biodegradable collagen matrix implant, ologen 41



Case 3: EX-PRESS mini glaucoma shunt 41



Case 4: Primary Ahmed valve implant 44



Case 5: Ahmed valve implant and neovascular glaucoma 44

Investigations 44

- *Follow-up Protocol* 44

Brief Review of Literature 45

Summary 46

7B. Choice of Surgery: Nonpenetrating Deep Sclerectomy

48

Sylvain Roy, André Mermoud



Case 1: Primary open-angle glaucoma 48



Case 2: Pseudoexfoliative glaucoma 49



Case 3: Normal tension glaucoma 49



Case 4: Angle-closure glaucoma and neovascular glaucoma 50



Case 5: Traumatic glaucoma 50



Case 6: Uveitic glaucoma 51



Case 7: Pigmentary glaucoma 52

Investigations 52

Follow-up Protocol 53

Brief Review of Literature 53

Summary 53

7C. Transscleral Cyclophotocoagulation

55

Monica Gandhi, Suneeta Dubey, Julie Pegu, Nishtha Singh

Mechanism of Action 55

Indications 55

-  **Case 1:** TSCPC for NVG 56
-  **Case 2:** TSCPC for postkeratoplasty glaucoma 57
-  **Case 3:** TSCPC for failed glaucoma surgery 57
- How to Use a G-Probe? 58
- How many Quadrants to Treat? 58
- Complications 58

7D. Endocyclophotocoagulation

59

Parul Ichhpujani, Shibal Bhartiya

- Indications 59
- Contraindications 60
- Technique 60
 - *Equipment* 60
-  **Case 1:** Endocyclophotocoagulation with phacoemulsification 60
-  **Case 2:** Endocyclophotocoagulation in angle closure 61
-  **Case 3:** Endocyclophotocoagulation-plus 61

8. Complications after Trabeculectomy

62

Oana Stirbu, Jorge Vila Arteaga

-  **Case 1:** Overfiltering bleb 62
-  **Case 2:** Corneal dellen 62
-  **Case 3:** Wound leak 63
-  **Case 4:** Fistula obstruction 64
-  **Case 5:** Postoperative hyphema 64
-  **Case 6:** Malignant glaucoma 65
-  **Case 7:** Blebitis and bleb-related endophthalmitis 65
-  **Case 8:** Ischemic bleb 66
-  **Case 9:** Tenon cyst 66
-  **Case 10:** Dysesthetic bleb 67

9. Tube Complications

68

Nadia Ríos-Acosta, Oscar Albis-Donado

-  **Case 1:** Hypotony resolved without treatment 68
-  **Case 2:** Hypotony that requires treatment 68
-  **Case 3:** Tube exposure 68
-  **Case 4:** Aqueous misdirection 69
-  **Case 5:** Corneal decompensation 69
-  **Case 6:** Tube blockage 70

Follow-up Protocol	70
Brief Review of Literature	70
Shallow or Flat Anterior Chamber	71
Hypertensive Phase	72
Corneal Decompensation	73
Motility Disorders	73
Tube Exposure	73
Endophthalmitis	73
Complications of Ahmed Valve Implant on Children	73

10. Complications of Nonpenetrating Deep Sclerectomy 75

Sylvain Roy, André Mermoud

 Case 1: Rupture of the thin trabeculo-Descemet's membrane	75
 Case 2: Leak of the filtering bleb (Seidel's sign)	76
 Case 3: Hypotony	77
 Case 4: Bleb fibrosis and encystment of the bleb	77
 Case 5: Secondary rise in the intraocular pressure	78
Investigations	78
Follow-up Procedure	79
Brief Review of Literature	79
Summary	79

11. Complications of Newer Surgeries 80

Youssef Abdelmassih, Sylvain el-Khoury, Ziad Khoueir, Tarek Shaarawy

Classification	80
Complications	80
 Case 1: Medical management of shallow anterior chamber after EX-PRESS glaucoma filtration device	81
 Case 2: XEN Gel-stent implant combined with cataract surgery	81
 Case 3: CyPass Micro-stent implantation with postoperative hyphema	81
 Case 4: Hypertony following iStent implantation	83
Management of Complications	84
• Intraocular Pressure Increase	84
• Hyphema	84
• Hypotony/Shallow Anterior Chamber	84
• Stent Occlusion	84
• Bleb Leak	85

12A. Glaucoma in Children 86

Alejandra Hernandez-Oteyza, Oscar Albis-Donado

 Case 1: Primary congenital glaucoma	86
 Case 2: Juvenile open-angle glaucoma	86
 Case 3: Glaucoma associated with nonacquired ocular anomalies	87
 Case 4: Glaucoma associated with nonacquired systemic disease or syndrome	87

Investigations	91
• General Appearance/General Examination	91
• Visual Acuity and Refraction	91
• Tonometry	91
• Corneal Diameter Measurement	91
• Gonioscopy	91
• Optic Nerve Assessment	92
• Ultrasound	92
• Anterior Segment Images	92
• Automated Perimetry	92
• Ocular Coherence Tomography with Retinal Nerve Fiber Layer and Ganglion Cell Complex Analysis	92
Follow-up Protocol	92
Summary	92

12B. Postrefractive Surgery Glaucoma

96

Mona Khurana, Aditya Neog

Investigations	96
• Prerefractive Surgery Screening	96
• Postrefractive Surgery	96
 Case 1: Steroid-induced glaucoma postrefractive surgery	97
 Case 2: Primary open-angle glaucoma in the postrefractive surgery period	97
 Case 3: Late detection of secondary glaucoma following laser-assisted in-situ keratomileusis	97
 Case 4: Bilateral acute angle-closure glaucoma following hyperopic laser-assisted in-situ keratomileusis	98
 Case 5: Unilateral acute angle-closure glaucoma following phakic intraocular lens implantation	98
Management of Glaucoma	98
• Medical Management	98
• Laser	98
• Surgery	98
• Follow-up	99
Review of Literature	99
• Intraocular Pressure Measurement	99
• Steroid Response	99
• Acute Optic Neuropathy Postlaser-assisted in-situ Keratomileusis	99
• Acute Angle-Closure Glaucoma	100

12C. Glaucoma after Vitreoretinal Surgery

102

Gowri J Murthy, Praveen R Murthy

Classification	102
Risk Factors for Postvitrectomy Glaucoma	102
 Case 1: Postsilicone oil-removal glaucoma	102
 Case 2: Postoperative steroid-induced glaucoma-managed medically	104
 Case 3: Multiple mechanisms for raised intraocular pressure requiring surgical management	105
 Case 4: Iris bombe causing secondary angle closure and silicone oil overfill	107
 Case 5: Silicone oil-induced glaucoma in a high myope managed with silicone oil removal with endoscopic cyclophotocoagulation	108

Investigations	110
Management	112
• Medical Management	112
• Laser Iridotomy	113
• Surgical Management	113
Follow-up Protocol	114
Brief Review of Literature	114
Summary	114

12D. Neovascular Glaucoma

117

Jasleen Dhillon

Etiopathogenesis	117
• Diabetes	117
• Ischemic Central Retinal Vein Occlusion	117
• Carotid Artery Obstructive Disease	117
Clinical Features	117
Management	118
• Grades of Neovascular Glaucoma	118
• Panretinal Photocoagulation	118
• Antivascular Endothelial Growth Factor	118
• Medical Management of Neovascular Glaucoma	119
• Surgical Management of Glaucoma	119
 Case 1: NVG in a diabetic with PDR	119
 Case 2: NVG in vascular occlusion	119
 Case 3: Anti VEGF for NVG	120
 Case 4: PRP for NVG	120
 Case 5: PPV with GDD for NVG	121
 Case 6: TSCPC for NVG	121

12E. Cataract and Glaucoma

123

M Chockalingam

 Case 1: Cataract surgery alone in an eye with no prior glaucoma filtration surgery	123
 Case 2: Cataract and glaucoma surgery	123
 Case 3: Sequential glaucoma and cataract (cataract surgery post-trabeculectomy)	125
Workup of a Patient before Decision Making and Surgery	126
Follow-up Protocol	126
Key Points to be Considered in Decision-making	127
• Cataract Surgery Alone with No Previous Glaucoma Filtration Surgery	128
• Combined Cataract and Glaucoma Surgery	129
• Two-staged Cataract and Glaucoma Surgery	130

12F. Compliance

131

Shibal Bhartiya, Parul Ichhpujani, Suresh Kumar

 Case 1: White coat adherence	131
 Case 2: Drug induced nocturnal hypotension	133
 Case 3: Drug induced ocular surface disease	134

13. Informed Consents**137***Shibal Bhartiya, Parul Ichhpujani, Suresh Kumar*

Who can Give Consent? 137

Ethics of Consent 138

- *Exemptions to Disclosure* 138

Special Consents 138

- *Informed Consent for Trabeculectomy* 138
- *Informed Consent for Glaucoma Drainage Implant Surgery* 139
- *Informed Consent for Cataract Surgery* 140
- *Informed Consent Form for Neodymium-doped: Yttrium Aluminum Garnet Laser Capsulotomy* 141
- *Neodymium-doped: Yttrium Aluminum Garnet Laser Iridotomy* 142
- *Informed Consent for Selective Laser Trabeculoplasty* 142
- *Informed Consent for Diode Laser Cyclophotocoagulation* 143

14A. How to Overcome Imaging Artifacts and Prevent Misinterpretation of Imaging Results**145***Gábor Holló*

Background 145

Technical Evidences 145

Interpretation Evidences 146

- *Parameter Types and their Practical Clinical Value* 147

**Case 1:** Red disease due to healthy macrodiscs 148**Case 2:** Green disease due to macula edema 148**Case 3:** Blink artifact 149**Case 4:** Segmentation error due to a vitreoretinal surface abnormality 150**Case 5:** Segmentation error caused by a vitreous floater 150

How to Avoid Misinterpretation of RNFLT and Inner Macular Retina

Thickness Changes during Long-term Follow-up? 151

Summary 152

14B. Sources of Errors While Interpreting Perimetry**153***Parul Ichhpujani, Sahil Thakur, Suresh Kumar***Case 1:** Error due to pupil size 153**Case 2:** Error due to drooping lid 154**Case 3:** Error due to incorrect ocular aid 154**Case 4:** Error due to fatigue 155**14C. Sources of Errors While Performing and Interpreting Tonometry****159***Nikhil S Choudhary, Paaraj Dave, Parul Ichhpujani*

Goldmann Applanation Tonometer 159

- *How to Perform Applanation Tonometry using Goldmann Applanation Tonometer?* 159
- *Procedure and Instrumentation* 159
- *Common Sources of Error and Ways to Avoid Them* 160

- *What to Do in a Patient with Marked Astigmatism?* 160
- *How to Detect Calibration Error of the Goldmann Applanation Tonometer?* 162
- Schiotz Indentation Tonometer 162
 - *How to Perform Indentation Tonometry using Schiotz's Tonometer?* 163
 - *Sources of Errors with a Schiotz Indentation Tonometer* 163
 - *Pearls for the Care of Schiotz Tonometer* 163
- Noncontact Tonometer 163
 - *How to Perform Noncontact Tonometry?* 164
 - *Sources of Errors with Noncontact Tonometer* 164

15A. Clinical Trials in Glaucoma

165

Suneeta Dubey, Madhu Bhoot, Nishtha Singh, Dushyant Sharma, Monica Gandhi

- Ocular Hypertension Treatment Study 165
- Early Manifest Glaucoma Trial 166
- Collaborative Initial Glaucoma Treatment Study 167
- Collaborative Normal-tension Glaucoma Study 168
- Advanced Glaucoma Intervention Study 169
- Glaucoma Laser Trial 170
- Trabeculectomy versus Tube Study 170
- Ahmed-Baerveldt Comparison Study 172
- Ahmed versus Baerveldt Study 173

15B. Basics of a Trial Design for Glaucoma

175

Shibal Bhartiya, Parul Ichhpujani

- Levels of Evidence for Clinical Application (Choosing the Study Design) 175
- Definition of Disease (Type and Severity) 175
- Definition of Cohort Demographics 177
- Definition of Data Points Evaluated and End Point 177
 - *Baseline Intraocular Pressure Measurement* 177
 - *Visual Acuity* 177
 - *Visual Field* 177
 - *Ocular Hypotensive Medication* 178
- Follow-up and Reporting Time Windows 178
- Evaluation (Criteria for Success and Failure) 178
 - *For Diagnostic Modalities* 178
 - *For Therapeutic Modalities (Surgical and Medical)* 178
- Ethical Considerations 179
 - *Randomization to Nontreatment Arm* 179
 - *Clear Definition of Acceptable Outcomes* 179
 - *Informed Consent* 179
 - *Approval from Institutional Review Board or Ethics Committee* 179
 - *Adherence to Tenets of Declaration of Helsinki* 179
 - *Declaration of Sources of Funding (Financial and Nonfinancial Support and Conflicts of Interest)* 179
- Statistical Considerations 179
 - *Calculation of Sample Size* 179
 - *Statistical Significance* 179
 - *Software for Data Analysis* 179
 - *Randomization* 179
 - *Data Analysis* 179
 - *Eyes versus Patients* 179

- *Interim Analysis and Stopping Rules* 180
 - *Data Representation* 180
- Special Considerations 180
- *Methods of Economic Evaluation of Glaucoma* 180
 - *Methods of Quality of Life Assessments* 180

Index

183