
Contents

Part I History, Concept and Epidemiology

1 History	3
1.1 Tonometry: Intraocular Pressure	4
1.2 Daily Pressure Curve (DPC)	5
1.3 Ophthalmoscopy	5
1.4 Physiology, Anatomy, and Pathology	6
1.5 History of Optic Nerve Examination	7
1.6 Functional Damage: Visual Field Deficit	8
1.7 Gonioscopy	9
1.8 Treatment	10
1.8.1 Medical	10
1.8.2 Surgical	10
References	11
2 Concept of Glaucoma Pathogenesis	13
2.1 The Concept of Primary Open-Angle Glaucoma	13
2.2 Normal Rates of Ocular Pressure Depending on the Patients' Age	15
2.3 Is Applanation Tonometry Accurate?	15
2.4 IOP Distribution Among the Population	16
2.5 Risk Factors and Open-Angle Glaucoma	23
2.6 Multicentric Studies	24
2.7 Other Concepts of Glaucoma	25
References	26
3 Epidemiology and Etiopathogenia	29
3.1 Frequency	31
3.2 Predisposing Factors	31
3.2.1 Family History	31
3.2.2 Arterial Hypotension	31
3.2.3 Arterial Hypertension	32
3.3 Etiopathogenesis	32
References	34

Part II Normal Structure and Function

4	Structure and Function of the Tissues That Are in Contact with the Aqueous Humor	39
4.1	Ciliary Body	39
4.1.1	Measurements	41
4.1.2	Content	41
4.1.3	Position	41
4.2	Ciliary Muscle	42
4.2.1	Anatomy	42
4.2.2	Physiology	46
4.3	Modifications of the Chamber Angle with Accommodation	47
4.4	Alterations with Age	49
4.4.1	Innervation	50
4.5	Ciliary Epithelium	50
4.5.1	Structure	50
4.6	Iris	52
4.6.1	Ectodermal Pigment Layer	53
4.6.2	Mesodermal Layer	53
4.7	Aqueous Humor Drainage Routes	54
4.8	Conventional Drainage Route of Aqueous Humor	55
4.9	Uveal Trabecular Meshwork and Corneoscleral Trabecular Meshwork	57
4.10	Schlemm's Canal	60
4.10.1	Inner Wall of the Schlemm's Canal	60
4.10.2	Outer Wall of the Schlemm's Canal	60
4.10.3	Drainage Routes Beyond Schlemm's Canal	62
4.11	Drainage of Aqueous Humor: Molecular Bases of Resistance	65
4.11.1	Regulation of Aqueous Humor Drainage	65
4.11.2	Nonconventional Drainage Route of Aqueous Humor	66
4.12	Alterations of the Trabecular Meshwork with Age in Glaucoma	67
4.13	Summary	68
	References	68
5	Genetics, Heredity, and Molecular Biology in Glaucoma	71
5.1	Part I	71
5.1.1	What Is a Chromosome?	71
5.1.2	Chromosome Abnormalities	72
5.1.3	Alterations in the Shape of Chromosomes	73
5.1.4	Gene Abnormalities	73
5.1.5	Classification of Congenital Glaucoma in Heredity	75
5.1.6	Genetic Counseling	76
5.1.7	Genetics and Molecular Biology in Primary Glaucoma: Nomenclature	76

5.2	Part II.....	78
5.2.1	Pathology and Molecular Biology in Glaucoma	78
5.2.2	Anomalous Substances in Specimen of Primary Open-Angle Glaucoma.....	80
	References	83
6	Aqueous Humor: Physiology of the Aqueous Humor	85
6.1	The Aqueous Humor, Transcellular Fluid.....	85
6.2	Physical, Chemical, and Physiologic Concepts That Help to Understand the Formation of the Aqueous Humor	86
6.3	Formation of the Aqueous Humor.....	87
6.3.1	Ultrafiltration.....	87
6.3.2	Secretion	88
6.3.3	Diffusion	89
6.4	Hemato-ocular Barrier.....	90
6.5	Modifications of the Blood-Aqueous Barrier	92
6.5.1	Direct Mechanisms	92
6.5.2	Indirect Mechanisms.....	92
6.6	Regulation of the Formation of Aqueous Humor	92
6.7	Measurement of Volume/Minute.....	93
6.8	Biochemistry of the Aqueous Humor	94
6.8.1	Physical Properties	94
6.8.2	Chemical Composition	94
6.9	Summary.....	95
	References	96

Part III Intraocular Pressure

7	Intraocular Pressure Measurement: Tonometry	101
7.1	Measurement of Ocular Pressure: Tonometry.....	101
7.2	History.....	101
7.3	Summary	104
	References	104
8	Indentation Tonometry	105
8.1	Depression Tonometry	105
8.2	Pressure Measurement with Depression Tonometer.....	109
8.2.1	Example.....	110
8.3	Summary	110
	References	111
9	Ocular Rigidity or Resistance to Distension	113
9.1	Relationship Between Ocular Pressure and Volume.....	114
9.1.1	How Is Knowledge of Ocular Rigidity Important in Practice?.....	116
9.2	The Clinical Measurement of Scleral Rigidity	117
9.2.1	Differential Tonometry	117

9.3	Measurement of Scleral Rigidity Using the Friedenwald Nomogram	117
9.4	Measurement of Scleral Rigidity Using Combined Tonometry	118
9.4.1	Using the Friedenwald Nomogram	118
9.5	Measurement of Scleral Rigidity Using the Calixto and Soares Method	119
9.5.1	Using the Calixto and Soares Tables.	119
9.6	Summary	121
	References	121
10	Applanation Tonometry.	123
10.1	Applanation Tonometers for Use with the Slit Lamp	125
10.2	Technique for Measuring Ocular Pressure with Applanation.	125
10.2.1	Anesthesia and Fluorescein Solution	125
10.2.2	Preparation of the Slit Lamp and the Tonometer.	126
10.2.3	Patient Instructions	127
10.2.4	Checking the Satisfactory Operation of the Tonometer	130
10.3	Goldmann and Schmidt Handheld Applanation Tonometer for Supine Patients	131
10.4	Draeger Handheld Applanation Tonometer for Supine and Seated Patients	132
10.5	Perkins Handheld Applanation Tonometer	133
10.6	Applanation Tonometer of Mackay and Marg	134
10.6.1	Self-Tonometers	136
10.7	Zeimer Self-Tonometer to Home Tonometry	137
10.7.1	Description of the Home Tonometer.	137
10.8	Draeger Self-Tonometer	139
10.8.1	Instruction for the Patients	139
10.9	Goldmann-Sampaolesi J-Setton Applanation Tonometer	141
10.9.1	Intended Use	141
10.9.2	Indications for Use	141
10.9.3	Device Description	142
10.9.4	System Components	142
10.9.5	Miscellaneous	142
10.10	Tonometer Control	145
10.10.1	Disinfection for Applanation Tonometer	146
	References	146
11	The Role of Pachimetry.	149
11.1	History	150
11.2	Corneal Thickness and Daily Pressure Curve	150
11.3	Glaucoma and Refractive Surgery.	150
11.4	Corneal Sensitivity and Intraocular Pressure	151
	References	151

12	Pascal Tonometer: Dynamic Contour Tonometry	153
12.1	Description of the Tonometer	153
12.2	Measurement Technique	154
	Recommended References	159
13	Continuous IOP Monitoring Devices:	
	The Micro-ocular Glaucoma Holter	161
	References	166
	Recommended References	166
14	Episcleral Venous Pressure	167
14.1	Drainage Routes of Aqueous Humor:	
	Internal Resistance and External Resistance	167
14.2	Measurement Methods of the Pressure	
	of the Aqueous Veins	169
14.3	Results	174
	References	178
15	Daily Pressure Curve	179
15.1	History	179
15.2	Diurnal Variation of Intraocular Pressure	
	in Healthy, Suspected, and Glaucomatous Eyes:	
	Sampaolesi's Algorithm	180
	15.2.1 Second Group: (Suspected Glaucoma)	182
	15.2.2 Indication for the Patients	185
	15.2.3 Conclusions	187
15.3	Papers Published by the School of Chicago	188
15.4	Examples of Diurnal Curves	189
15.5	Balder Gloor's Strategy for Finding Peaks of Pressure	
	and Laszlo Bito: On the Physiopathology	
	of Peaks of Pressure	193
15.6	Correlation Between the Intraocular Pressure According	
	to Daily Pressure Curves and Optic Disk Changes	
	in Patients with Open-Angle Glaucoma	
	with Normal Visual Field in Preperimetric Period	194
	15.6.1 Introduction	194
	15.6.2 Material	195
	15.6.3 Methods	195
	15.6.4 Results	196
	15.6.5 Conclusions	198
15.7	What Is Seen and What Is Not Seen in the DPC	202
	15.7.1 Impact of Diurnal Intraocular Pressure	
	Fluctuations on Optic Nerve Topography,	
	Vascular Flow and Visual Field. Their	
	Neutralization with Pharmacotherapy	202
	15.7.2 Material	203
	15.7.3 Methods	203
	15.7.4 Conclusions	216
	15.7.5 Discussion	217
	References	221

16 Early Diagnosis of Intraocular Hypertension:	
Ibopamine Test	225
16.1 History	225
16.1.1 Provocation Test	225
16.2 The Role of Ibopamine in the Pathophysiology of Intraocular Pressure and in the Early Diagnosis of Ocular Hypertension: Correlation with the Diurnal Pressure Curve (DPC)	226
16.2.1 Purpose	226
16.2.2 Results	226
16.2.3 Conclusion	226
16.3 Introduction	226
16.3.1 Diurnal Pressure Curve	228
16.4 Material and Methods	229
16.4.1 Material	229
16.4.2 Method	229
16.5 Results	231
16.5.1 Statistical Processing and Analysis	231
16.6 Discussion	231
16.7 Examples	233
16.8 Addendum	240
References	241
17 Normal-Pressure Glaucoma. Vasospasm and Glaucoma	245
17.1 Normal-Pressure Glaucoma	245
17.1.1 History	245
17.2 Differential Diagnosis When Normal-Pressure Glaucoma Is Suspected	246
17.3 Personal Review of 13,850 Eyes (1951–2002)	247
17.3.1 Conclusion of the Study	248
17.3.2 Frequency of Normal-Pressure Glaucoma According to Different Authors	248
17.4 True Normal-Pressure Glaucomas (Cases)	248
17.4.1 Examples	248
17.4.2 Pseudo-normal-Pressure Glaucoma (Examples)	251
17.5 Other Authors' Studies on Pseudo-normal-Pressure Glaucoma	264
17.6 Vasospastic Glaucomas and Pseudo-normal-Pressure Glaucomas	265
17.6.1 Flammer's Test of the Visual Field	265
17.6.2 Subungual Capillaroscopy	266
17.7 Therapy in Vasospastic Pseudo-normal-Pressure Glaucomas	266
17.7.1 Examples	268
17.8 Vasospastic Glaucoma with Normal Optic Disk, Severe Visual Field Defect and Very Severe Vasospasm	270
References	273

Part IV Chamber Angle

18 Ocular Embryology with Special Reference to Chamber Angle Development. 277

18.1 Embryological Development of the Chamber Angle: The Normal and Abnormal Chamber Angle in Newborns up to 1 Year of Age and Its Importance with Respect to Pathology. 277

18.2 Chromodynamics of Normal Anterior Segment Development. 280

References 285

19 The Anatomy of the Chamber Angle 287

19.1 Anatomy of the Chamber Angle 287

19.1.1 Boundaries. 290

19.1.2 Constituents. 290

19.2 Anatomic Components of the Chamber Angle 290

19.2.1 Scleral Area. 290

19.2.2 Schwalbe's Line 291

19.2.3 Scleral Channel 291

19.2.4 Scleral Spur. 292

19.2.5 Schlemm's Canal. 292

19.3 Scleral Trabecular Meshwork 292

19.3.1 Uveal Area 293

19.3.2 Boundaries. 294

19.3.3 Constituents. 294

19.3.4 Ciliary Body 294

19.3.5 Iris Zone 294

19.4 Summary 295

References 296

20 Examination of the Chamber Angle. 297

20.1 Gonioscopic Contact Lenses 297

20.2 Sterilization of Gonioscopic Contact Lenses 297

20.3 Placing the Lens 297

20.4 Examination with the Slit Lamp or Biomicroscope 299

20.5 Summary 300

Reference 300

21 Normal Chamber Angle in the Adult: Gonioscopic Images 301

21.1 Lenses for Gonioscopy 301

21.2 Examination of the Chamber Angle 301

21.3 The Shape of the Chamber Angle 304

21.4 The New Gonioscopic Lens of Roussel and Fankhauser 306

21.5 Optical Properties 307

21.6 Goniophotographs Taken with the Roussel and Fankhauser Lens. 309

21.7 Narrow Angle Glaucoma. 311

21.8 Summary 312

References 313

22 Slit-Lamp Optical Coherence Tomography of the Anterior Segment (SL-OCT)	315
22.1 Description of SL-OCT	315
Reference	319

Part V Optic Nerve

23 The Optic Disk, Optic Nerve Head, or Papilla	323
23.1 Vessels of the Optic Nerve and Papilla	324
23.2 Embryology	325
23.3 Correlation Between Pathological Anatomy and Optic Nerve Computerized Tomography (HRT): New Definition of the Histological Nomenclature	325
23.3.1 Introduction	325
23.4 Parameters Used for Glaucoma Staging	332
23.5 Correlation Between the Parameters of the Optic Disk in HRT with the Anatomy	334
23.6 Correlation Between Histology and HRT in a Normal and Glaucomatous Optic Disk	334
23.7 Correlation Between Histology and HRT in a Glaucomatous Optic Disk	335
23.8 Evolution of the Optic Disk from Normal to Glaucomatous Cupping	335
References	339
24 Ophthalmoscopy	341
24.1 Generalities	341
24.2 Ophthalmoscopes and Lenses for Studying the Fundus Oculi	342
24.3 Alterations of the Optic Nerve Head	342
24.4 Evolution of the Optic Disk from Normal to Glaucomatous Cupping	342
References	351
25 Confocal Tomography of the Optic Nerve Head, the HRT ...	353
25.1 Part I: Confocal Tomography of the Optic Nerve Head, the HRT	353
25.1.1 History of Optic: Nerve Examination	353
25.1.2 Laser Ophthalmoscope for Fundus Examination	355
25.1.3 Confocal Microscopy	356
25.1.4 The Heidelberg Retina Tomograph	359
25.1.5 Imaging Technique	360
25.1.6 The Contour Line	365
25.1.7 Final Images in the HRT: Analysis and Description	376
25.1.8 Map of HRT Software Version 2.01	379
25.1.9 Parameters	387
25.1.10 The Normal Optic Nerve	394
25.1.11 Normal Parameters by Sectors	399

25.1.12	The Optic Disk in Glaucoma: Parameter Modifications	401
25.1.13	The Optic Disk in Glaucoma: Fiber Defects. . .	405
25.1.14	The Optic Disk in Glaucoma: A Longitudinal Study	414
25.2	Part II: Optic Nerve – HRT	424
25.2.1	Parameters Used for Glaucoma Staging	424
25.2.2	Correlation Between the Parameters of the Optic Disk in HRT with the Anatomy . .	425
25.2.3	Concept and Limits of Normality with the Buenos Aires Staging System (BASS) of Sampaolesi R. and Sampaolesi JR	429
25.2.4	Comparison Between the Three Nerve Staging Systems: Sampaolesi-Sampaolesi, Moorfields, and Burk	436
25.2.5	Examples in Patients in Which We Compare the Results of Moorfields Regression Classification (England) and BASS (Buenos Aires)	438
25.2.6	Moorfields Regression Analysis	447
25.2.7	HRT III: In the Diagnosis and Follow-Up of Optic Glaucomatous Neuropathy	447
	References	452
26	Heidelberg Retina Flowmeter (HRF)	457
26.1	Part I: Measurement of the Ematic Flow of the Retina and the Disc with Heidelberg Retina Flowmeter	457
26.1.1	Examples	459
26.2	Part II: Perfusion-Map Variations Demonstrate the Activity of the Retinal Autoregulation System in the Human Retina	460
26.2.1	Introduction	460
26.2.2	Materials	461
26.2.3	Method	461
26.2.4	Results	463
26.2.5	Conclusions	466
26.2.6	Discussion	466
	References	466
	Part VI Conventional and Nonconventional Visual Field	
27	Photometry	469
27.1	Point Light Source = A	470
27.2	Illuminated Plane = S	471
27.3	Propagation of Light Energy	471
27.4	Non-spot Light Source	473
27.4.1	Magnitude: Luminance	473
27.5	Summary	474
	References	474

28	Physiological Concepts Related with the Visual Field	475
28.1	Absolute Threshold of Vision	476
28.2	Differential Vision	476
28.3	Summary	477
	Reference	477
29	Campimetry and Perimetry	479
29.1	History	479
29.2	Classification of Techniques	480
29.3	Static and Kinetic Techniques	481
29.4	Summary	483
	References	483
30	Campimetry and Perimetry with a Single Variable	485
30.1	Bjerrum Screen (Campimetry)	485
30.2	ARC Perimeters	487
30.2.1	Measurements of Normal Visual Field	488
30.3	Summary	488
	References	489
31	Campimetry and Perimetry with Two Variables:	
	Quantitative Kinetic.	491
31.1	Goldmann Perimeter	491
31.1.1	Theoretical Foundations	491
31.2	Practice of Kinetic Perimetry: Procedure for Performing a Kinetic Visual Field with Goldmann's Dome Perimeter.	493
31.2.1	Preparation of the Perimeter	493
31.2.2	Regulating the Dome (Background) Luminance.	493
31.2.3	Positioning of the Patient	496
31.2.4	Goldmann Perimeter Model 940-K7	497
31.2.5	Static Perimetry	498
31.3	Summary	499
	References	501
32	The Practice of Perimetry with the Bjerrum Screen or Goldmann Perimeter.	503
32.1	Pupil	503
32.2	Ametropias	504
32.2.1	Myopia	504
32.2.2	Hypermetropia.	504
32.3	Opacity of the Lens	504
32.4	Summary	505
	References	505
33	Static Perimetry	507
33.1	Technique	508
33.2	Technique of Exposure of the Target and Progressive Variation of Its Luminance	509

33.3	Selective Perimetry with Goldmann's Perimeter: Armaly and Drance's Technique	511
33.4	Summary	512
	References	512
34	Visual Field Changes in Glaucoma	513
34.1	Paracentral and Pericentral Scotomas	513
34.2	Scotomas in the Circular Area Between 10° and 20° (Isolated from the Blind Spot).	515
34.3	Exclusion of the Blind Spot	515
34.4	Arcuate Scotoma	515
34.5	Ronne's Step	517
34.6	Practical Classification of the Visual Fields Obtained in the Goldmann Perimeter	518
34.7	Normal Field	518
	34.7.1 Grade I	518
	34.7.2 Grade II	519
	34.7.3 Grade III	519
34.8	Correlation Between Visual Field Alterations and the Optic Disk.	520
34.9	Optic Disk Drusen or Hyaline Verrucosities	523
34.10	Papillary Pit	526
34.11	Summary	526
	References	529
35	Value of the Visual Field in Clinical Glaucoma	531
35.1	Significance of the Visual Field.	531
35.2	Correlation Between Visual Field and Ocular Pressure . .	532
35.3	Extreme Rarity of Normal-Tension Glaucoma	532
	35.3.1 Glaucoma in Its Early Stages	533
35.4	Summary	535
	References	535
36	Static, Automated, and Computerized Perimetry	537
36.1	Introduction	537
36.2	Determining the Threshold of Each Retinal Point Examined	541
36.3	Octopus 2000 Programs	542
36.4	The Octopus Perimeter	544
36.5	Octopus 2000R: Perimetry Unit	548
36.6	Exam Procedure	552
	36.6.1 Monitoring Fixation (Automatic)	552
	36.6.2 Attention Monitoring	553
	36.6.3 Repetitions.	553
36.7	Different Print Modes	553
36.8	Humphrey Field Analyzer	553
	References	560

37	Program for Glaucoma: G1 Visual Indices	561
37.1	Program G1: Global 1 (Octopus 2000)	561
37.2	Program G1	562
37.2.1	Geometry	562
37.2.2	Strategy	563
37.2.3	Phase I	564
37.2.4	Phase II	564
37.2.5	Phase III	564
37.3	Forms of Expressing the Results Obtained with the G1 Program	565
37.3.1	Gray Scale	565
37.3.2	Comparison Symbols	565
37.3.3	Numerical List	565
37.4	Interpreting the Result of the Indices	565
37.5	Visual Indices	567
37.5.1	MS: Mean Sensitivity	568
37.5.2	MD: Mean Defect	569
37.5.3	CLV: Corrected Loss Variance	572
37.5.4	M3: Central Third Moment	572
37.6	Summary Program G1	573
37.6.1	Analysis of the G1 Program with the Octosoft 2EZ System (Data Reduction)	574
37.7	Results Presentation Module	574
37.7.1	Composition, Sequence, and Summary	574
37.7.2	Octosmart Module: Bebie Cumulative Defect Curve	574
37.8	Octopus Perimeter 1-2-3	580
37.8.1	Modes of Utilization	580
37.8.2	Exam Time	581
37.8.3	Forms of Visualization on Screen	581
37.9	Standard Programs for Use	582
37.9.1	Program Geometry by Stage	582
37.10	Mode of Presentation of the Results	582
	Recommended Reading	586
37.11	Haag-Streit Octopus Introduces the PolarGraph: A Bridge Between Structure and Function	587
37.12	PolarGraph and ClusterTrend	587
37.12.1	Because Glaucoma Management Asks for It	587
37.13	Science Made Understandable	588
37.13.1	Global Trend	588
37.13.2	PolarGraph	589
37.13.3	Global Trend	590
37.13.4	Progression Rate	591
37.13.5	Probability	591
37.13.6	DD and LD Based on the Bebie or Defect Curve	591
37.13.7	Diffuse Defect (DD)	591

37.13.8	Local Defect (LD).....	592
37.13.9	Cluster Graph	592
37.13.10	Cluster Trend.....	592
37.13.11	PolarGraph	593
37.13.12	PolarTrend.....	594
	References	594
38	Value of the Computed Visual Field in Clinical Glaucoma	597
38.1	Errors in Performing Computed Visual Field	598
38.2	Miosis	598
38.3	Reliability (RF), Lack of Cooperation of the Patient	598
38.4	Incorrect Instructions.....	598
38.5	Change of Occlusion in the Eye of a Patient Without Notifying the Perimeter.....	601
38.6	Learning Effect	602
38.7	Summary	602
	Reference	603
39	Other Psychophysical Tests.....	605
39.1	Contrast Sensitivity (Modulation Transfer Function)	605
39.2	Sensitivity Contrast Function Curve	606
39.3	Alterations of Color Vision in Glaucoma	610
39.4	Electrophysiology: Electroretinogram and Evoked Occipital Potentials	610
	References	611
40	Nonconventional Perimetry.....	613
40.1	Ganglion Cells: Structure Functions, Relationships for Clinical Perimetry	613
40.1.1	General Points About Nonconventional Perimetry.....	616
40.2	Optic Nerve Head Confocal Tomography, Standard Automated Perimetry, and Frequency-Doubling Technology Perimetry for the Early Diagnosis of Glaucoma (100 Eyes)	616
40.2.1	Introduction.....	616
40.2.2	Frequency-Doubling Technology (FDT)	617
40.2.3	Material and Methods	618
40.2.4	Parameters Used for Optic Nerve Head Damage Staging System	618
40.2.5	Visual Field Staging System	620
40.2.6	Statistical Processing and Analysis.....	622
40.2.7	Results	622
40.2.8	Case Reports	622
40.2.9	Discussion.....	628
40.2.10	Conclusions.....	631
40.2.11	Statistic	632

40.3	Pulsar Perimetry from De la Rosa	634
40.3.1	Features of the Equipment	635
40.3.2	Examined Areas	635
40.3.3	Stimulus	636
40.3.4	Characteristics of the Pulsar Stimulus	636
40.3.5	The Way to Proceed in the Staging System 2 and the FDT Staging System to Obtain the Stage of the Visual Field	638
40.4	Examination Method	638
40.4.1	Performing the Visual Acuity Test with the Pulsar	639
40.4.2	Presentation of the Results	640
40.5	Examples	640
40.6	Progression Test	656
40.7	Pulsar Perimetry in the Diagnosis of Early Glaucoma	656
40.7.1	Methods	657
40.7.2	Results	661
40.7.3	Discussion	661
40.8	Addendum	670
40.8.1	FDT Visual Field Instrument (Humphrey)	670
40.8.2	Instrument Overview	670
40.8.3	Operating Procedures	671
40.8.4	Results	673
40.8.5	FDT Humphrey Matrix Zeiss (Welch Allyn)	676
40.8.6	Octopus 600 Pulsar of Haag-Streit	677
	References	677
41	Diagnostic and Progression Criteria: Staging of the Visual Field with Conventional and Nonconventional Perimetry	683
41.1	The Glaucoma Staging System 2 from P. Brusini, First Version	684
41.2	The Glaucoma Staging System from P. Brusini, Second Version	689
41.3	Glaucoma Staging System for Frequency Double Technique (Paolo Brusini)	692
41.4	New Perspectives on Progression of the Glaucomatous Visual Field (Manuel Gonzalez de la Rosa and col.)	692
41.4.1	The Learning Effect	692
41.4.2	Threshold Fluctuation	693
41.5	Traditional Diagnostic Criteria of Progression	693
41.6	New Programs for Detecting Progression: Threshold Noiseless Trend (TNT)	694
41.7	New Programs for Detecting Progression: New Humphrey GPA	695
41.8	New Programs for Detecting Progression: Version 2 of Threshold Noiseless Trend (TNT2)	695
41.9	The Coincidence Between Progression of Glaucoma and Cataracts	697
	References	698

Part VII Primary Open-Angle Glaucoma

42 Classification of Primary Glaucomas 703

43 Primary Open Angle Glaucoma 709

 43.1 The Concept of Primary Open-Angle Glaucoma 709

 43.2 Diagnosis: Symptomatology 710

 43.3 Current Concept of Open-Angle Glaucoma 710

 43.3.1 Chamber Angle in Pure Open-Angle
 Glaucoma 711

 43.4 Goniodysgeneses or Late Congenital Glaucoma 711

 43.5 Clinical Forms of Open-Angle Glaucoma 719

 43.5.1 First Clinical Form (Scotomatous Defects) ... 723

 43.5.2 Second Clinical Form (Diffuse Defects) 723

 43.5.3 Third Clinical Form (Combined) 724

 43.6 Etiopathogenesis of POAG and Goniodysgenesis 725

 43.6.1 Ibopamine Test 728

 43.7 Histology (Molecular Biology) of Trabeculectomy
 Specimens in a Primary Open-Angle
 Glaucoma (POAG) 2009 729

 43.8 Histology (Molecular Biology) of Trabeculectomy
 Specimen in Goniodysgenesis: Late Congenital
 Glaucoma 2009 729

 43.9 Cellularity and Interstitial Trabecular Tissue
 in Primary Open-Angle Glaucoma (POAG) 731

 43.10 Summary 731

 References 733

Part VIII Medical and Laser Treatment

44 Medical Therapy in Glaucoma 737

 44.1 Medical Treatment of Glaucoma 737

 44.2 When We Start Treating a Patient 738

 44.3 Beta-Blockers 739

 44.4 Topical Carbonic Anhydrase Inhibitors 740

 44.5 Alpha-2 Adrenergic Agonists 740

 44.6 Prostaglandin Analogs 741

 44.6.1 Why Start with a Prostaglandin Analog
 and Not Do so with a Fixed Combination
 of Timolol-CAI 743

 44.7 Simplified Medical Therapy in the Treatment
 of Glaucoma 746

 44.8 New Plan for Maximum Tolerated Medical
 Therapy (MTMT) Based on the New Triple Fixed
 Combination: BB + CAI + A2AA (KrytanteK) 749

 44.9 Compliance 750

 44.10 Benzalkonium Chloride (BAK)-Free Medications 751

 44.11 Slow-Drug Release Devices 751

44.12	Glaucoma Treatment and Pregnancy.	753
44.13	Drugs Contraindicated in Patients with Glaucoma	755
44.14	Addendum	756
44.14.1	Miotics.	756
44.14.2	Mechanism of Hypotensive Action.	756
44.14.3	Contraindications	757
44.14.4	Forms of Administration.	757
44.14.5	Tolerance.	757
44.14.6	Action of Miotics on the Visual Field.	758
44.14.7	Pilocarpine.	758
44.15	Osmotic Agents	760
44.15.1	History.	760
44.16	Location of the Alpha (α) and Beta (β) Receptors at Ocular Level and Systemic Level	762
44.16.1	Location of Receptors at Eye Level	762
44.17	Concept of Agonist, Antagonist, and Partial Agonist	763
44.17.1	Agonist	763
44.17.2	Antagonist.	764
44.17.3	Partial Agonist.	764
44.18	Normative or Target Intraocular Pressure	765
44.19	Summary	766
	References	774
45	Laser Treatment in Glaucoma: General Aspects, Indication, and Different Techniques.	775
45.1	Iridotomy (in Angle-Block Glaucoma).	776
45.1.1	Argon Laser Iridotomy: Continuous Wave Argon Laser.	776
45.1.2	Neodymium Laser Iridotomy: NQ	777
45.2	Trabeculoplasty (in Open-Angle Glaucoma)	777
45.3	Goniopuncture with YAG Laser in NPDS (Non-penetrating Deep Sclerectomy)	779
45.4	Selective Trabeculoplasty (LST).	781
45.5	Anterior or Posterior Capsulotomy After Glaucoma and Cataract Surgery	781
45.5.1	Transcleral Cyclophotocoagulation.	781
45.5.2	Suturolysis	782
	References	782
 Part IX Surgical Treatment		
46	Glaucoma Surgery	785
46.1	Pathophysiological Foundations	786
46.1.1	Manometrics Experiments	786
46.1.2	Perfusion Experiments	787
46.1.3	Enzyme Experiments	787
46.1.4	Surgical Experiments	787
46.2	Indications for Filtering Surgery	788
46.3	History of Glaucoma Surgery	788

46.4	Iris Surgery	789
46.4.1	General Points About Iris Surgery	791
46.5	Trabeculectomy	793
46.5.1	Purpose of Trabeculectomy	793
46.5.2	Surgical Technique Steps	794
46.5.3	Dissection of the Scleral Flap	795
46.5.4	Results of Trabeculectomy	800
46.5.5	Complications and Their Treatment	800
46.5.6	Intraoperative and Postoperative Complications	801
46.5.7	Malignant Glaucoma	802
46.5.8	Dellen, Corneal Fostas, and Fuchs's Dimples	804
46.5.9	Encapsulated Filtering Bleb	808
46.5.10	Gonioscopy in Trabeculectomy	808
46.6	Non-penetrating Deep Sclerectomy: Koslow Surgery	810
46.6.1	History	810
46.6.2	Early Indication of NPDS in Open-Angle Glaucomas	812
46.6.3	Anatomical Landmarks	812
46.6.4	Non-penetrating Deep Sclerectomy: Surgical Technique	812
46.7	Complications of Surgery	814
46.7.1	Triangular Flap Dissected Too Superficially	814
46.7.2	Triangular Flap Dissected Too Deeply	819
46.7.3	Gonioscopy After NPDS	820
46.7.4	Nd:Yag Laser Goniopuncture	823
46.7.5	Results	825
46.7.6	Clinical Cases	827
46.8	Valves Implants in Adults	830
46.8.1	Different Types of Implants	832
46.8.2	Construction and Operation of the Ahmed Valve Device	832
46.8.3	Surgical Indication	837
46.8.4	Surgical Technique	837
46.8.5	The Surgery Step by Step	840
46.8.6	Target IOP	843
46.8.7	Postoperative Management	844
46.8.8	Complications	844
46.8.9	Clinical Cases	846
46.9	Canaloplasty	848
46.9.1	Introduction	848
46.9.2	Canaloplasty: Surgical Technique	848
46.9.3	Results	854
46.10	Annex: Iridencleisis	862
46.10.1	Limbus-Based Incision of Conjunctiva and Tenon	862
46.10.2	Location of Scleral Incision	862
46.10.3	Fornix-Based Incision of Conjunctiva and Tenon	862

46.10.4	Complications	865
46.10.5	Results	866
46.11	Cyclodialysis (Interne Filtering)	868
46.11.1	Method	868
46.12	Addendum Ocular Cicatricial Pseudopemphigoid Related with Eye Local Treatment in Conjunctiva of Open-Angle Glaucoma	870
46.12.1	Variables of Inflammation	871
46.12.2	Variables in Drug Response	872
46.12.3	Essential Retraction of Conjunctiva or Pseudopemphigoid Produced by Glaucomatous Therapeutics	872
	References	875

Part X Angle-Closure Glaucoma

47	Angle-Closure Glaucoma	881
47.1	Introduction	881
47.2	Symptomatology	885
47.3	Frequency	885
47.4	Treatment	885
47.5	Differential Diagnosis	887
47.6	Differential Diagnostics in Narrow-Angle Glaucoma, with Gonioscopy and SL-OCT: Different Ways to Approach Treatment	889
47.6.1	Gonioscopy	889
47.7	Ultrasound Biomicroscopy of the Anterior Segment (UBM)	889
47.7.1	Evaluation of the UBM	892
47.7.2	Study of Narrow-Angle Glaucoma with UBM	892
47.7.3	UBM in Primary and Secondary Plateau Iris.	892
47.7.4	UBM in Pigmentary Glaucoma Pupillary Block	893
47.7.5	UBM in Malignant Glaucoma.	893
47.7.6	UBM in Monitoring Peripheral Laser Iridectomy and Trabeculectomy	894
47.8	Slit Lamp OCT (SL-OCT)	894
47.8.1	Narrow Angle with Organic Block	895
47.8.2	Plateau Iris.	899
47.8.3	Mixed Pathogenesis Glaucoma	900
47.9	Eye Growth in Pathological Conditions: Its Relationship to Angle-Closure Glaucoma Biometry	902
47.9.1	Normal Eye Growth	902
47.9.2	Growth in Pathological Conditions	903
47.10	Summary	907
	References	912

Part XI Glaucoma and Cataract

48 Glaucoma and Cataract 917

 48.1 General 917

 48.1.1 Principle of Operation 918

 48.2 Associations of Cataract and Glaucoma 921

 References 924

Part XII Cataract and Myopia

49 Glaucoma and Myopia 929

 49.1 Prevalence 929

 49.2 Functional Examination of the Myopic Eye 930

 49.3 Intraocular Pressure and Myopia 930

 49.4 The Optic Disk in Myopia 930

 49.5 Visual Field in Myopia 932

 49.6 Retinal Detachment, Myopia and Glaucoma 932

 49.6.1 Frequency of Myopia and Retinal
 Detachment in Pigmentary Glaucomas 932

 49.7 Schwartz Syndrome 933

 49.8 Glaucoma Secondary to Scleral Indentation
 in Retinal Surgery 933

 49.9 Buphthalmos and Retinal Detachment 934

 References 934

Part XIII Apoptosis

50 Apoptosis 939

 References 943

Index 945