

CONTENTS

Dedication, v

Foreword, xi

Preface, xiii

SECTION 1 Definition, Epidemiology, and Implications of Male Infertility

1 Definition, Epidemiology, and Implications of Male Infertility, 2

Eric Chung

Introduction, 2

Epidemiology of Male Infertility, 3

Health Implications of Male Infertility, 4

Summary, 5

SECTION 2 Causes of Male Infertility

2 Pretesticular Causes of Male Infertility, 10

Osvaldo Rajmil and Lluís Bassas

Introduction, 10

Physiopathology of the Hypothalamic-Pituitary-Gonadal Axis, 10

Clinical Picture and Diagnosis, 11

Physical Features, 11

Endocrine Diagnostics, 11

Etiologies of Hypogonadotropic

Hypogonadism, 13

Genetic Causes, 13

Drug-Induced Hypogonadotropic

Hypogonadism, 13

Additional Nongenetic Causes, 14

Partial Hypogonadism and Age-Related Conditions, 15

Toxins and Lifestyle, 15

Obesity and Associated Conditions, 15

Medical Treatment of Hypogonadotropic Hypogonadism, 15

Clinical Case Scenarios, 16

Summary, 19

3 Testicular Causes of Male Infertility, 23

Raghavender Kosgi and Vineet Malhotra

Introduction, 23

Congenital Causes of Male Infertility, 23

Cryptorchidism, 23

Pathophysiology, 24

Genetic Causes, 24

Klinefelter Syndrome, 24

XX Male Syndrome, 25

47,XYX Syndrome, 25

Translocations and Inversions, 25

Y-Chromosome Microdeletions, 25

Gene Mutations, 25

Infective Causes, 25

Orchitis, 25

Disorders of Spermatogenesis, 26

Germ Cell Aplasia (Sertoli Cell-Only Syndrome), 26

Structural Sperm Defects, 26

Testicular Tumors, 26

Trauma to the Testis, 26

Torsion of the Testis, 26

Testicular Microcalcifications, 27

Cell Phone Radiation, 27

Heat Exposure, 27

Secondary Testicular Causes of Male Infertility, 27

Varicocele, 27

Gonadotoxins, 27

Management of Testicular Causes of Male Infertility, 28

Basic Clinical Evaluation of the Infertile Male, 28

Physical Examination, 28

Semen Analysis, 29

Leukocytospermia Testing, 29

Semen Culture, 29

Antisperm Antibody Testing, 29

Endocrine Evaluation, 29

Genetic Evaluation, 30

Imaging, 30

Testicular Biopsy, 30

Treatment, 30	
Preventive Measures, 31	
Medical Treatment, 31	
Surgical Intervention, 31	
Surgical Sperm Retrieval, 31	
Clinical Case Scenarios, 32	
Summary, 33	
4 Posttesticular Causes of Male Infertility, 36	
Marlon Pedrozo Martinez and Ranjith Ramasamy	
Introduction, 36	
Posttesticular Causes of Male Infertility, 36	
Obstruction of the Male Reproductive Tract, 37	
Sexual Dysfunction, 43	
Clinical Scenarios, 44	
Summary, 45	
5 Environmental/Lifestyle Factors and Male Infertility, 49	
Pallav Sengupta, Sulagna Dutta, Damayanthi Durairajanayagam, and Ashok Agarwal	
Introduction, 49	
Environmental/Occupational Factors and Male Infertility, 50	
Potential Exposure Routes for Environmental/Occupational Factors, 50	
Lifestyle Factors and Male Infertility, 58	
Summary, 62	
6 Idiopathic Male Infertility, 68	
Mohit Butaney and Amarnath Rambhatla	
Introduction, 68	
Definitions—Idiopathic Versus Unexplained Male Infertility, 68	
Epidemiology of Idiopathic Male Infertility, 68	
Etiology and Prevailing Theories, 69	
Immunologic Causes, 69	
Endocrine Disruption, 69	
Role of the Environment and Lifestyle Factors, 70	
Molecular Underpinnings of Idiopathic Male Infertility (i.e., Genetics and Epigenetics), 71	
Male Oxidative Stress Infertility, 72	
Diagnosis of Idiopathic Male Infertility, 73	
Beyond a Basic Semen Analysis, 73	
Endocrine Evaluation, 73	
Measuring Oxidative Stress, 74	
Molecular Genetics and Cytogenetic Analysis, 75	
Other Testing, 76	
Postejaculatory Urine Analysis, 76	

Ultrasonography, 76	
Antisperm Antibodies, 76	
Treatment of Idiopathic Male Infertility, 76	
Lack of Guidelines, 76	
Treatment Options, 76	
Lifestyle Modification, 77	
Empiric Medical Therapy Including Hormone-Modulating Treatment and Associated Outcomes, 78	
Nutraceuticals, Vitamins, and Antioxidants, 79	
Assisted Reproductive Technologies, 79	
On the Horizon, 80	
Summary, 80	

SECTION 3 Diagnosis of Male Infertility

7 Medical History and Physical Examination of Infertile Males, 86	
Kareim Khalafalla and Mohamed Arafa	
Introduction, 86	
History, 86	
Objectives, 86	
Fertility Evaluation History List, 86	
Physical Examination, 91	
Objectives, 91	
General Examination, 91	
Abdominal Examination, 91	
Genital Examination, 91	
Telehealth and Male Infertility Assessment, 93	
Summary, 93	
8 Basic Semen Analysis, 97	
Marion Bendayan and Florence Boitrelle	
Introduction, 97	
Basic Semen Examination—Changes in the World Health Organization Manual, 6th Edition, 98	
Macroscopic Parameters, 98	
Quantitative and Qualitative Study of Sperm Motility and Determination of the Presence of Agglutinates and Aggregates, 99	
Sperm Vitality, 100	
Sperm Concentration, Sperm Count, and Round Cell Concentration, 100	
Quantitative and Qualitative Study of Sperm Morphology, 100	
Reference Values, 101	
Conclusion, 102	
Summary, 102	

9 Sperm DNA Fragmentation Tests, 104*Hussein Kandil and Ralf Reinhold Henkel***Introduction, 104****Sperm DNA Structure, 104****Types of Sperm DNA Fragmentation, 105****DNA Repair, 105****Causes of Sperm DNA Fragmentation, 106****Impact of SDF on Reproductive Outcomes, 107***Natural Pregnancy, 107**Assisted Reproductive Technology, 107**Assessment Tools for Sperm DNA**Fragmentation, 108***Terminal Deoxynucleotidyl Transferase Dntp***Nick-End Labeling Assay, 108***Sperm Chromatin Structure Assay, 108****Sperm Chromatin Dispersion Test, 109****Comet Assay (Single-Cell Gel***Electrophoresis), 109***Current Recommendations of Sperm Dna***Fragmentation Testing by Professional**Societies, 109***Challenges of Sperm DNA Fragmentation***Testing in Clinical Practice, 109***Clinical Scenarios, 110****Summary, 111****10 Genetic and Genomic Tests of Infertile Males, 116***Paraskevi Vogiatzi, Ana Navarro-Gomezlechón,**Evangelini Evgeni, and Nicolas Garrido Puchalt***Introduction, 116****Genetic Tests, 117***Chromosomal Abnormalities and**Karyotype Analysis, 117**Y-Chromosome Microdeletion Screening, 120**Monogenic Diseases, Gene Mutations,**Polymorphisms, and Copy Number**Variations, 121**Genetic Testing Recommendations, 125**Genetic Counseling and Management, 125***Genomic Tests, 126***Genomics, 127**Transcriptomics, 130**Epigenomics, 131**Counseling and Management, 132***Clinical/Laboratory Scenarios, 133****Summary, 134****Funding, 134****11 Computer-Assisted Semen Analysis, 141***Hanae Pons-Rejraji, Marion Bendayan, and Florence Boitrelle***Introduction, 141****Description of Different Types of Computed-Assisted Semen Analysis Systems, 141***Systems Using Phase-Contrast Microscopy, 141**Systems Using Electrooptics, 142***Semen Examinations Using Computer-Assisted Semen Analysis, 143***Computer-Assisted Semen Analysis Systems**User Guide, 143**Comparison of Automated and Manual**Analysis Methods, 146***Recommendations, Advantages, and****Disadvantages of Computer-Assisted Semen****Analysis Systems, 149***International Recommendations, 149**Advantages, 149**Disadvantages, 150***Perspectives and Emerging Technologies, 150***Sperm DNA Fragmentation and Acrosome**Reaction Tests using Computer-Assisted**Semen Analysis Systems, 150**Emerging Technologies, 150***Summary, 153****12 Seminal Oxidative Stress and Reactive Oxygen Species Testing, 157***Faith Tebatso Moichela, Ralf Reinhold Henkel, and**Kristian Leisegang***Introduction, 157****Sources of Reactive Oxygen Species in the Male****Reproductive Tract, 158***Endogenous Reactive Oxygen Species, 158**Exogenous Reactive Oxygen Species, 159***Antioxidant Regulation of Reactive Oxygen****Species in the Male Reproductive Tract, 160***Endogenous Antioxidants in the Male**Reproductive Tract, 160**Exogenous Antioxidants, 161**Overdosage of Antioxidants and Reductive**Stress, 161***Physiological Role of Reactive Oxygen Species in****Male Reproduction and Fertility, 161****Pathological Effects of Oxidative Stress in Male****Reproduction, 162***Lipid Peroxidation, 162**Chromatin and DNA Damage, 162**Apoptosis, 162*

- Seminal Biomarkers of Reactive Oxygen Species and Oxidative Stress, 163
Direct Methods, 163
Indirect Methods, 167
 Summary, 170
- 13 Assessment of Reproductive Hormones in Infertile Males, 175**
Gianmaria Salvio, Francesca Firmani, and Giancarlo Balercia
 Introduction, 175
 Gonadotropins, 176
 Testosterone and Testicular Androgens, 179
 The Human Spermatogenesis, 180
 Pretesticular Causes: The Hypothalamus-Pituitary-Gonadal Axis, 181
 Testicular Causes: Primary Testicular Failure, 183
 Laboratory Assessment, 185
 Clinical Case Scenarios, 187
 Summary, 189
- 14 Imaging in Male Factor Infertility, 192**
Parviz K. Kavoussi
 Introduction, 192
 Male Reproductive Gross Anatomy, 192
Testis, 192
Epididymis, 192
Vas Deferens, 194
Seminal Vesicles and Ejaculatory Ducts, 195
Prostate Gland, 195
 Basic Principles of Ultrasonography, 196
 Basic Principles of Computed Tomography, 196
 Basic Principles of Magnetic Resonance Imaging, 196
 Testis Imaging, 196
Doppler Ultrasonography, 196
Magnetic Resonance Imaging, 197
 Epididymis Imaging, 197
Ultrasonography, 197
Magnetic Resonance Imaging, 197
 Vas Deferens Imaging, 198
Vasogram, 198
 Seminal Vesicle and Ejaculatory Duct Imaging, 198
Transrectal Ultrasonography, 198
Computed Tomography, 198
Magnetic Resonance Imaging, 198
 Summary, 198

SECTION 4 Medical Treatment of Male Infertility

- 15 Hormonal Therapy of Male Infertility, 202**
Rossella Cannarella, Rosita A. Condorelli, Sandro La Vignera, and Aldo E. Calogero
 Introduction, 202
 Hormonal Therapy of Infertile Males, 202
Gonadotropin-Releasing Hormone, 202
Follicle-Stimulating Hormone, 203
Human Chorionic Gonadotropin, 206
Selective Estrogen Receptor Modulators, 207
Aromatase Inhibitors, 208
 Clinical Case Scenarios, 208
Example of Hormonal Treatment of a Patient with Central Hypogonadism, 208
Example of Hormonal Treatment of a Patient with Idiopathic Oligozoospermia, 209
 Summary, 209
- 16 Antioxidants Therapy of Male Infertility, 214**
Ramadan Saleh and Ashok Agarwal
 Introduction, 214
 Protective Action of Antioxidants, 214
 Impact of Antioxidant Therapy of Infertile Males on Semen Parameters, 214
 Impact of Antioxidant Therapy of Infertile Males on Pregnancy Outcomes, 215
 Practice Patterns of The Use of Antioxidant Therapy in Male Infertility, 215
 Professional Societies' Guidelines of Antioxidant Therapy in Male Infertility, 215
 Limitations of Antioxidant Therapy In Male Infertility, 215
 Summary, 216
- 17 Antibiotic Therapy of Male Infertility, 218**
Taymour Mostafa, Ibrahim Abdel-Hamid, and Wael Zohdy
 Introduction, 218
 Semen and Testicular Microbiomes, 219
 Seminal Microbiome and Assisted Reproductive Technique Outcome, 220
 Diagnosis of Genital Tract Infection, 221
Assessment of Seminal Round Cells, 221
Immunochemistry, 221
Seminal Granulocyte Elastase Test, 221
Peroxidase Test, 222
 Impact of Leukocytospermia on Male Fertility, 222

- Seminal Biomarkers of Reactive Oxygen Species and Oxidative Stress, 163
Direct Methods, 163
Indirect Methods, 167
 Summary, 170
- 13 Assessment of Reproductive Hormones in Infertile Males, 175**
Gianmaria Salvio, Francesca Firmani, and Giancarlo Balercia
 Introduction, 175
 Gonadotropins, 176
 Testosterone and Testicular Androgens, 179
 The Human Spermatogenesis, 180
 Pretesticular Causes: The Hypothalamus-Pituitary-Gonadal Axis, 181
 Testicular Causes: Primary Testicular Failure, 183
 Laboratory Assessment, 185
 Clinical Case Scenarios, 187
 Summary, 189
- 14 Imaging in Male Factor Infertility, 192**
Parviz K. Kavoussi
 Introduction, 192
 Male Reproductive Gross Anatomy, 192
Testis, 192
Epididymis, 192
Vas Deferens, 194
Seminal Vesicles and Ejaculatory Ducts, 195
Prostate Gland, 195
 Basic Principles of Ultrasonography, 196
 Basic Principles of Computed Tomography, 196
 Basic Principles of Magnetic Resonance Imaging, 196
 Testis Imaging, 196
Doppler Ultrasonography, 196
Magnetic Resonance Imaging, 197
 Epididymis Imaging, 197
Ultrasonography, 197
Magnetic Resonance Imaging, 197
 Vas Deferens Imaging, 198
Vasogram, 198
 Seminal Vesicle and Ejaculatory Duct Imaging, 198
Transrectal Ultrasonography, 198
Computed Tomography, 198
Magnetic Resonance Imaging, 198
 Summary, 198

SECTION 4 Medical Treatment of Male Infertility

- 15 Hormonal Therapy of Male Infertility, 202**
Rossella Cannarella, Rosita A. Condorelli, Sandro La Vignera, and Aldo E. Calogero
 Introduction, 202
 Hormonal Therapy of Infertile Males, 202
Gonadotropin-Releasing Hormone, 202
Follicle-Stimulating Hormone, 203
Human Chorionic Gonadotropin, 206
Selective Estrogen Receptor Modulators, 207
Aromatase Inhibitors, 208
 Clinical Case Scenarios, 208
Example of Hormonal Treatment of a Patient with Central Hypogonadism, 208
Example of Hormonal Treatment of a Patient with Idiopathic Oligozoospermia, 209
 Summary, 209
- 16 Antioxidants Therapy of Male Infertility, 214**
Ramadan Saleh and Ashok Agarwal
 Introduction, 214
 Protective Action of Antioxidants, 214
 Impact of Antioxidant Therapy of Infertile Males on Semen Parameters, 214
 Impact of Antioxidant Therapy of Infertile Males on Pregnancy Outcomes, 215
 Practice Patterns of The Use of Antioxidant Therapy in Male Infertility, 215
 Professional Societies' Guidelines of Antioxidant Therapy in Male Infertility, 215
 Limitations of Antioxidant Therapy In Male Infertility, 215
 Summary, 216
- 17 Antibiotic Therapy of Male Infertility, 218**
Taymour Mostafa, Ibrahim Abdel-Hamid, and Wael Zohdy
 Introduction, 218
 Semen and Testicular Microbiomes, 219
 Seminal Microbiome and Assisted Reproductive Technique Outcome, 220
 Diagnosis of Genital Tract Infection, 221
Assessment of Seminal Round Cells, 221
Immunochemistry, 221
Seminal Granulocyte Elastase Test, 221
Peroxidase Test, 222
 Impact of Leukocytospermia on Male Fertility, 222

- Antibiotics Therapy of Male Infertility, 223
Treatment of Leukocytospermia:
Pros and Cons, 223
Aminoglycosides, 223
Trimethoprim/Sulfamethoxazole, 223
Tetracycline, 224
Fluoroquinolones, 224
 Overview of the Current Guidelines, 224
 Antibiotics as Adjuvants in Assisted
 Reproductive Technique, 225
 Clinical Case Scenarios, 226
 Antibiotic Alternatives, 226
 Summary, 227
- 18 Alternative Therapy of Male Infertility, 231**
Tan V. Le, Phu V. Pham, and Hoang P.C. Nguyen
 Introduction, 231
 Nutrition and Male Fertility, 231
 Malnutrition/Nutrient Deficiencies and Male
 Infertility, 232
 Herbal Treatment for Male Infertility, 233
 Herbs with Positive Effects on Sperm
 Quality, 233
 Herbs with Negative Effects on Sperm
 Quality, 234
 Physical Exercise and Male Fertility, 234
 The Positive Impact of Exercise on Male
 Fertility, 235
 The Negative Impact of Exercise on Male
 Fertility, 236
 Psychological and Behavioral Therapy, 237
 Effects of Psychological Stress on Reproductive
 Function, 237
 Treatment of Psychological Stress-Related
 Disease, 238
 Clinical/Laboratory Case Scenario, 239
 Summary, 239
- SECTION 5 Surgical Treatment
 of Male Infertility**
- 19 Varicocele Repair in Infertile Males, 244**
*Kanha Charudutt Shete, Megan McMurray, Edmund
 Yuey Kun Ko, and Nicholas N. Tadros*
 Introduction, 244
 Pathogenesis of Varicocele, 244
 Diagnosis and Grading of Varicocele, 244
- Impact of Varicocele on Male Fertility, 245
*Mechanisms of Varicocele-Induced
 Male Infertility, 245*
*Impact on Sperm Parameters and Sperm DNA
 Integrity, 245*
 Society Guidelines, 245
 Types of Intervention, 246
Percutaneous Repair, 246
Surgical Repair, 246
 Outcomes of Intervention, 248
Impact on Semen Analysis Parameters, 248
Impact on Reproductive Hormones, 249
Impact on Spontaneous Pregnancy Rates, 249
*Impact on Assisted Reproductive Technology
 Outcomes, 249*
 Complications of Varicocelectomy, 250
 Summary, 250
 Clinical Case Scenarios, 250
- 20 Management of Ejaculatory Duct Obstruction, 254**
*Taha Abo-Elmagd Abdel-Meguid Hamoda,
 Hassan Mohammed Aljifri, and Mahmoud Fareed Qutub*
 Introduction, 254
 Epidemiology of Obstruction of Male
 Reproductive Tract, 254
 Anatomical Considerations, 255
 Functional Considerations, 256
 Etiology and Pathophysiology of Ejaculatory
 Duct Obstruction, 257
 Evaluation of Ejaculatory Duct Obstruction, 258
History and Physical Examination, 258
Laboratory Testing, 259
*Imaging Studies and Other Diagnostic
 Procedures, 259*
 Differential Diagnosis of Ejaculatory Duct
 Obstruction, 262
Causes of Low-Volume Ejaculate, 262
*“Taha’s Lows” in Seminal Vesicle Hypofunction
 Disorders, 262*
 Treatment of Ejaculatory Duct Obstruction, 262
*Transurethral Resection of Ejaculatory
 Duct, 262*
Other Procedures, 264
*Treatment of Functional Ejaculatory Duct
 Obstruction, 265*
*Sperm Retrieval and Assisted Reproduction
 Techniques, 266*
 Clinical Case Scenario, 266
 Summary, 267

21 Surgical Sperm Retrieval and Processing for Assisted Reproductive Technology, 269

Edson Borges Jr., Amanda Souza Setti, and Daniela Paes de Almeida Ferreira Braga

Introduction, 269

Narrative Review, 270

Surgical Sperm Retrieval Methods, 270

Timing of Sperm Retrieval, 271

Processing Surgically Retrieved Sperm for

Intracytoplasmic Sperm Injection, 272

Selection of Surgically Retrieved Sperm for

Intracytoplasmic Sperm Injection, 273

Artificial Oocyte Activation, 274

Mechanical Activation, 275

Electrical Activation, 275

Chemical Activation, 276

Sperm Selection Methods, 279

Summary, 279

SECTION 6 Assisted Reproduction, 283

22 Intrauterine Insemination With Homologous Semen, 284

Willem Ombelet and Hassan Sallam

Introduction, 284

Diagnostic Work-Up Before Intrauterine

Insemination and When to Start with

Intrauterine Insemination, 287

Indications for Intrauterine Insemination with

Partner Semen, 288

Retrograde Ejaculation, 288

Cervical Factor Infertility, 288

Male Factor Infertility, 288

Immunologic Male Infertility, 289

Unexplained Infertility, 289

Minimal and Mild Endometriosis, 290

Human Immunodeficiency Virus and

Hepatitis C Virus in Discordant

Couples, 290

Sex Preselection, 291

Factors Influencing Intrauterine Insemination

Outcome, 291

Duration of Infertility, 291

Male and Female Age, 291

Semen Quality and Oxidative Stress, 291

Sperm Preparation Techniques, 291

Ovarian Hyperstimulation or Natural Cycle, 292

Luteal Phase Support, 292

Lifestyle, 293

Site of Insemination, 293

Timing and Number of Intrauterine

Insemination Cycles, 293

Immobilization after Intrauterine

Insemination, 294

The Effect of the Abstinence Period, 294

Human Papilloma Virus, 294

Insemination Technique, 294

Perinatal Outcome After Intrauterine

Insemination/Prevention of Multiple

Pregnancies, 295

Cost Effectiveness of Intrauterine

Insemination, 295

Recommendations for the Future, 296

Summary, 297

23 In Vitro Fertilization/Intracytoplasmic Sperm Injection, 302

Melissa A. Mathes, Achilleas Papatheodorou, Chara Oraiopoulou,

Erlisa Bardhi, Samantha B. Schon, and Panagiotis Drakopoulos

Introduction, 302

History of In Vitro Fertilization, 302

Indications for In Vitro Fertilization, 303

Tubal Disease, 303

Ovulatory Dysfunction, 303

Male Factor, 304

Endometriosis, 304

Unexplained Infertility, 304

Fertility Preservation, 305

Oocyte and Sperm Donation, 305

Gestational Surrogates, 305

Current Technique of In Vitro Fertilization, 305

Current Success Rates of In Vitro Fertilization, 306

Improvements in In Vitro Fertilization

Techniques Over the Past 30 Years, 306

Stimulation Protocols, 306

Oocyte Retrievals, 307

Assisted Hatching, 307

Preimplantation Genetic Testing—A and

Preimplantation Genetic Testing—M, 307

Laboratory Equipment, Culture Media, and

Environment, 308

Cryopreservation and Vitrification, 309

Single Embryo Transfer Versus Double Embryo

Transfer, 309

Endometrium, 309

Embryo Transfer, 310

- Advances of Intracytoplasmic Sperm Injection—
Improvements Over the Last 30 Years, 311**
*The Development of Intracytoplasmic Sperm
Injection, 311*
*Intracytoplasmic Sperm Injection for Male
Factor Infertility, 311*
*Factors Affecting Intracytoplasmic Sperm
Injection Outcomes, 312*
*Intracytoplasmic Sperm Injection: Recent
Advances, 313*
*Intracytoplasmic Sperm Injection and Perinatal
Outcomes, 314*
Clinical Case Scenarios, 315
Summary, 315
- 24 Techniques for Selection of Surgically Retrieved
Sperm for Intracytoplasmic Sperm Injection, 324**
*Rafael Favero Ambar, Filipe Tenorio Lira Neto, and Thais
Serzedello de Paula*
Introduction, 324
Surgically Retrieved Sperm Selection, 324
Dissection Methods, 324
Erythrocyte Lysis, 325
Enzymatic Digestion, 325
Primordial Cell Identification, 326
Sperm Selection Methods, 326
Pentoxifylline, 326
Theophylline, 327
Calcium Ionophore, 327
Hypoosmotic Swelling Test, 328
Sperm Tail Flexibility Test, 328
Laser-Assisted Immotile Sperm Selection, 329
**Intracytoplasmic Morphologically Selected
Sperm Injection, 329**
Magnetic-Activated Cell Sorting, 330
**Microfluidics-Based Sperm Selection
Techniques, 331**
Clinical Case Scenarios, 332
Summary, 332
- 25 Sperm Banking, 337**
*Israel Maldonado-Rosas, Liliana Ramirez-Dominguez,
Christina Anagnostopoulou, and Ashok Agarwal*
Introduction, 337
Indications of Sperm Cryopreservation, 337
Cryopreservation Media, 338
Sperm cryopreservation, 338
Slow Cryopreservation, 339
Sperm Vitrification, 339
*Options for Sperm Storage Following
Cryopreservation, 339*
*Thawing and Preparation of Cryopreserved
Sperm, 339*
*Assisted Reproductive Outcomes of Male Cancer
Survivors, 340*
**Assisted Reproductive Technique Outcomes with
Frozen Donor Sperm, 340**
**Emergence of Field of Oncofertility and its
Importance in Assisted Reproductive
Technique, 340**
**Management of Cryobanking Services and
Facilities, 341**
General Requirements for Sperm Banking, 341
Conclusions, 341
Summary, 342
- SECTION 7 Clinical Practice Guidelines
for Male Infertility**
- 26 Guidelines of the American Society for
Reproductive Medicine, American Urological
Association, and European Association of
Urology, 346**
Kadir Bocu and Murat Gül
Introduction, 346
Causes and Risk Factors of Male Infertility, 347
Diagnosis of Male Infertility, 348
*History of Male Partners for Initial Infertility
Evaluation, 348*
Physical Examination, 348
Semen Analysis, 349
Hormonal Evaluation of the Male Partner, 351
Genetic Assessment, 352
Imaging, 353
**Management of Male Infertility Before the
Assisted Reproductive Technology Stage, 354**
*Noninvasive Treatment Modalities for Male
Infertility, 354*
*Surgical Treatment Modalities for Male
Infertility, 356*
Management of Obstructive Azoospermia, 356
Management of Nonobstructive Azoospermia, 358
**Male Infertility Management With Assisted
Reproductive Techniques, 359**
Clinical/Laboratory Case Scenario, 360
Summary, 361

27 Expert Opinion: Management of Male Infertility in the Postintracytoplasmic Sperm Injection Era, 365

Rupin Shah and Armand Zini

Introduction, 365

The Importance of Evaluating and Treating Male Infertility, 365

Controversies in Evaluation of an Infertile Male, 366

Interpretation of Semen Analysis, 366

Testing for Sperm DNA Fragmentation, 366

Genetic Testing, 367

Varicocele, 367

Azoospermia, 367

Conclusion, 367

Summary, 367

SECTION 8 Insights Into the Future of Male Infertility

28 Clinical Perspective in the Postintracytoplasmic Sperm Injection Era, 370

Hussein Kandil and Ramadan Saleh

Introduction, 370

Role of Epigenetics in the Management of Male Infertility, 370

Methylation, 371

Acetylation, 371

Phosphorylation, 371

Ubiquitination (Ubiquitylation), 371

Epigenetics and Male Infertility-Associated Conditions, 371

Role of Proteomics in the Management of Male Infertility, 372

Techniques of Sperm Proteomics, 372

Diagnostic and Prognostic Potentials of Sperm Proteomics in Male Infertility, 372

Optimizing Sperm Selection Techniques for Intracytoplasmic Sperm Injection, 373

Molecular Markers for Predicting Sperm

Retrieval in Nonobstructive Azoospermia, 374

Future Modalities of Sperm Retrieval for Patients with Nonobstructive

Azoospermia, 375

Multiphoton Microscopy, 375

ORBEYE, 375

Raman Spectroscopy, 375

Full-Field Optical Coherence Tomography, 375

The Future of Stem Cell Therapy in Male Infertility, 376

Fertility Preservation in Cancer Patients, 376

Role of Artificial Intelligence in the Practice of Male Infertility, 377

Summary, 377

29 Research Perspectives in the Postintracytoplasmic Sperm Injection Era, 382

Mausumi Das, Suks Minhas, and Ralf Reinhold Henkel

Introduction, 382

New Developments in Androurological

Diagnostics, 383

Artificial Intelligence in Semen Analysis, 383

Measurement of Seminal Redox Stress, 384

Utility of Artificial Intelligence in Reproductive Medicine, 385

Sperm Separation for Assisted Reproductive Technology, 385

Artificial Intelligence for Ovarian Stimulation, Oocyte Collection, and Embryo Culture, 387

Oocyte Collection, 388

Embryo Culture, 388

Applications of Stem Cell Research in Male Fertility Preservation, 389

Summary, 389

Index, 397