

# Surgical and Medical Management of Male Infertility

Cambridge University Press  
978-0-521-88109-8 - Surgical and Medical Management of Male Infertility  
Marc Goldstein and Peter N. Schlegel  
Frontmatter  
[More information](#)

---

Cambridge University Press  
978-0-521-88109-8 - Surgical and Medical Management of Male Infertility  
Marc Goldstein and Peter N. Schlegel  
Frontmatter  
[More information](#)

---

# Surgical and Medical Management of Male Infertility

---

Edited by

## **Marc Goldstein MD, DSc (Hon), FACS**

Professor of Reproductive Medicine and Urology, Weill Cornell Medical College of Cornell University;  
Director of the Center for Male Reproductive Medicine and Microsurgery, New York Presbyterian Hospital, Weill Cornell Medical Center;  
Senior Scientist, Center for Biomedical Research, The Population Council, New York, NY, USA.

## **Peter N. Schlegel MD, FACS**

Professor and Chairman of Urology and Professor of Reproductive Medicine, Weill Cornell Medical College of Cornell University, New York;  
Senior Scientist, Center for Biomedical Research, The Population Council, New York, NY, USA.

Cambridge University Press  
978-0-521-88109-8 - Surgical and Medical Management of Male Infertility  
Marc Goldstein and Peter N. Schlegel  
Frontmatter  
[More information](#)

CAMBRIDGE UNIVERSITY PRESS  
Cambridge, New York, Melbourne, Madrid, Cape Town,  
Singapore, São Paulo, Delhi, Mexico City

Cambridge University Press  
The Edinburgh Building, Cambridge CB2 8RU, UK

Published in the United States of America  
by Cambridge University Press, New York

[www.cambridge.org](http://www.cambridge.org)  
Information on this title: [www.cambridge.org/9780521881098](http://www.cambridge.org/9780521881098)

© Cambridge University Press 2013

This publication is in copyright. Subject to statutory exception  
and to the provisions of relevant collective licensing agreements,  
no reproduction of any part may take place without the written  
permission of Cambridge University Press.

First published 2013

Printed in the United Kingdom at the University Press, Cambridge

*A catalog record for this publication is available from the British Library*

*Library of Congress Cataloging in Publication data*  
Surgical and medical management of male infertility / [edited by]  
Marc Goldstein, Peter N. Schlegel.  
p. ; cm.  
Includes bibliographical references and index.  
ISBN 978-0-521-88109-8 (hardback)  
I. Goldstein, Marc. II. Schlegel, Peter N.  
[DNLM: 1. Infertility, Male. WJ 709]  
616.6'921-dc23 2011049974

ISBN 978-0-521-88109-8 Hardback

Cambridge University Press has no responsibility for the persistence or  
accuracy of URLs for external or third-party internet websites referred  
to in this publication, and does not guarantee that any content on such  
websites is, or will remain, accurate or appropriate.

All material contained within the CD-ROM is protected by copyright and  
other intellectual property laws. The customer acquires only the right to use  
the CD-ROM and does not acquire any other rights, express or implied, unless  
these are stated explicitly in a separate licence.

Every effort has been made in preparing this book to provide accurate and  
up-to-date information which is in accord with accepted standards and  
practice at the time of publication. Although case histories are drawn from  
actual cases, every effort has been made to disguise the identities of the  
individuals involved. Nevertheless, the authors, editors and publishers can  
make no warranties that the information contained herein is totally free from  
error, not least because clinical standards are constantly changing through  
research and regulation. The authors, editors and publishers therefore  
disclaim all liability for direct or consequential damages resulting from the  
use of material contained in this book. Readers are strongly advised to pay  
careful attention to information provided by the manufacturer of any drugs or  
equipment that they plan to use.

## Contents

*List of Contributors* vii  
*Preface* xi

---

### Section 1. Anatomy and Physiology of the Male Reproductive System

1. **Anatomy and physiology of the male reproductive system** 1  
Ray Costabile

### Section 2. Evaluation

2. **History and physical examination of the infertile male** 8  
Moshe Wald
3. **Basic laboratory evaluation of the infertile male** 13  
Mark Sigman
4. **Genetic evaluation of male infertility** 19  
Robert D. Oates
5. **Auto-immunity to spermatozoa: its effect on male fertility, diagnosis and treatment** 27  
Richard A. Bronson
6. **Imaging of the male reproductive system** 38  
Elias Kazam and J. Jacob Kazam
7. **Testis biopsy** 61  
John J. McGill and Robert E. Brannigan
8. **Vasography** 68  
Vairavan S. Subramanian and Edmund Sabanegh
9. **Evaluation for ejaculatory duct obstruction** 73  
Jonathan P. Jarow

### Section 3. Treatment of Obstructive Azoospermia

10. **Vasovasostomy** 79  
Peter N. Kolettis and Marc Goldstein
11. **Vasopididymostomy** 85  
Matthew T. Roberts, Keith Jarvi, and Peter Chan

- 
12. **Ejaculatory duct obstruction** 94  
Paul J. Turek
  13. **Epididymal sperm aspiration** 100  
Cigdem Tanrikut and Marc Goldstein

### Section 4. Ejaculatory Disorders

14. **Anejaculation** 105  
Raymond Sultan, Laurent Vaucher, Alexander Bolyakov, and Darius A. Paduch
15. **Penile vibratory stimulation** 119  
Nancy L. Brackett, Charles M. Lynne, Jens Sønksen, and Dana A. Ohl
16. **Treatment of ejaculatory dysfunction** 130  
Dana A. Ohl, Susanne A. Quallich, Jens Sønksen, Nancy L. Brackett, and Charles M. Lynne

### Section 5. Varicocele, Hydrocele, and Retractable Testes

17. **Varicocele** 137  
Armand Zini and Jason M. Boman
18. **Hydrocele** 150  
Paul Tonkin and Jay Sandlow
19. **Scrotal orchiopexy for adult retractile testis** 157  
Marc Goldstein and Howard H. Kim

### Section 6. Non-Obstructive Azoospermia

20. **Non-obstructive azoospermia: evolution of clinical concepts and treatment** 161  
Peter N. Schlegel

### Section 7. Non-Surgical Treatments

21. **Specific medical therapy** 169  
Rebecca Z. Sokol

## Contents

### 22. **Klinefelter syndrome** 179

Elena Gimenez, Michael Herman, Laurent Vaucher,  
Alexander Bolyakov, and Darius A. Paduch

### 23. **Empirical and complementary treatment of male infertility** 187

Jeremy A. Davis and Ajay K. Nangia

## Section 8. Sexual Disorders

### 24. **Male sexual dysfunction and infertility** 193

Raanan Tal and John P. Mulhall

### 25. **The role of sex therapy for male infertility** 204

Michael A. Perelman and Elizabeth A. Grill

## Section 9. Assisted Reproduction for Male Infertility

### 26. **In vitro fertilization** 219

Zev Williams, Hey-Joo Kang, and Zev Rosenwaks

### 27. **Intrauterine insemination** 233

Owen Davis

### 28. **Intracytoplasmic sperm injection** 237

Queenie V. Neri, Roberta Maggiulli, Devin Monahan,  
Eugene Ermolovich, Zev Rosenwaks, and Gianpiero  
D. Palermo

## Section 10. Other

### 29. **Male infertility and the environment: a plethora of associations based on a paucity of meaningful data** 253

Gary R. Klinefelter

### 30. **Fertility issues in pediatric urology** 262

Yefim Sheynkin

### 31. **Preservation of male fertility** 269

Kirk C. Lo and Matthew T. Roberts

### 32. **Testis-preserving surgery for testis tumor** 276

Cigdem Tanrikut and Marc Goldstein

### 33. **Sperm cryopreservation** 280

Danielle L. Gilbert, Jennifer T. Anger, and Bruce R. Gilbert

### 34. **Microsurgical training, animal models, and research** 303

Philip S. Li, Howard H. Kim, and Marc Goldstein

### 35. **Nursing considerations for the treatment of male infertility** 324

Sam Finkelberg, Peggy King, Joseph Kiper, Kim McGee,  
and Kathleen Hart

### 36. **Cost-effectiveness of male infertility treatments** 328

Richard Lee, Philip S. Li, and Peter N. Schlegel

### 37. **Future of male infertility research and treatment** 337

Antoine A. Makhlof and Craig S. Niederberger

---

*Index* 345

## Contributors

### **Jennifer T. Anger, MD**

Assistant Professor of Urology, University of California Los Angeles, Frank Clark Urology Center, Santa Monica, CA, USA

### **Alexander Bolyakov, MSc**

Research Associate, Department of Urology and Reproductive Medicine, Weill Cornell Medical College, New York, NY, USA

### **Jason M. Boman, MD, FRCSC**

Staff Urologist, Department of Surgery, Hopital Regional du Suroit, Salaberry-de-Valleyfield, QC, Canada

### **Nancy L. Brackett, PhD, HCLD**

Research Associate Professor, The Miami Project to Cure Paralysis, University of Miami Miller School of Medicine, Miami, FL, USA

### **Robert E. Brannigan, MD**

Associate Professor of Urology, Department of Urology, Northwestern University Feinberg School of Medicine, Chicago, IL, USA

### **Richard A. Bronson, MD**

Professor of Obstetrics & Gynecology and Pathology, Director of Reproductive Endocrinology, Stony Brook University Medical Center, Stony Brook, NY, USA

### **Peter Chan, MD**

Associate Professor of Urology, Director of Male Reproductive Medicine, Department of Urology, Royal Victoria Hospital, McGill University Health Center, Montreal, QC, Canada

### **Ray Costabile, MD**

Senior Associate Dean for Clinical Strategy, Jay Y. Gillenwater Professor of Urology and Vice Chairman, University of Virginia, Charlottesville, VA, USA

### **Jeremy A. Davis, MD**

Department of Urology, University of Kansas Medical Center, Kansas City, KS, USA

### **Owen Davis, MD, FACOG**

Professor of Reproductive Medicine, Obstetrics and Gynecology, The Center for Reproductive Medicine and Infertility, Weill Cornell Medical Center, New York, NY, USA

### **Eugene Ermolovich, BS**

New York Presbyterian Hospital – Weill Cornell Medical College; The Ronald O. Perelman and Claudia Cohen Center for Reproductive Medicine, Weill Cornell Medical College, New York, NY, USA

### **Sam Finkelberg, RN, MSN**

New York Presbyterian Hospital – Weill Cornell Medical College, New York, NY, USA

### **Bruce R. Gilbert, MD, PhD, PC**

Associate Clinical Professor of Urology and Reproductive Medicine, Cornell University Medical College, New York, NY, USA

### **Danielle L. Gilbert, MD, MPH**

Jefferson Medical College, Johns Hopkins School of Public Health, Baltimore, MD, USA

### **Elena Gimenez, MD**

Montclair Urological Group, Montclair, NJ, USA

### **Marc Goldstein, MD, DSc (Hon), FACS**

Matthew P. Hardy Distinguished Professor of Reproductive Medicine and Urology, Weill Medical College of Cornell University, New York, NY; Surgeon-in-Chief, Center for Male Reproductive Medicine and Microsurgery, Cornell Institute for Reproductive Medicine, New York, NY; Attending Urologist, New York Presbyterian Hospital, New York, NY; Senior Scientist, Center for Biomedical Research, Population Council, New York, NY, USA

### **Elizabeth A. Grill, PsyD**

Assistant Professor of Psychology, Ronald O. Perelman and Claudia Cohen Center for Reproductive Medicine, Weill Medical College of Cornell University, New York, NY, USA

### **Kathleen Hart, RN, MA**

Nurse Clinician, New York Presbyterian Hospital – Weill Cornell Medical College, New York, NY, USA

### **Michael Herman, MD**

Instructor in Urology/Assistant Attending, Department of Urology, Weill Cornell Medical College, New York, NY, USA

### List of Contributors

#### **Jonathan P. Jarow, MD**

Professor of Urology, Radiology, Pathology, and Molecular Biology and Biochemistry, Department of Urology, Johns Hopkins University School of Medicine, Baltimore, MD, USA

#### **Keith Jarvi MD, FRCS**

Director of the Murray Koffler Urologic Wellness Center and Head of Urology, Division of Urology, Mount Sinai Hospital, University of Toronto, Toronto, ON, Canada

#### **Hey-Joo Kang, MD**

Assistant Professor of Reproductive Medicine, Obstetrics and Gynecology, The Ronald O. Perelman and Claudia Cohen Center for Reproductive Medicine, Weill Cornell Medical College, New York, NY, USA

#### **Elias Kazam, MD**

Professor Emeritus of Radiology, Weill Cornell Medical College, New York, NY, USA

#### **J. Jacob Kazam, MD**

Resident, Department of Radiology, New York Presbyterian Hospital, New York, NY, USA

#### **Howard H. Kim, MD**

Director of Male Reproductive Medicine and Microsurgery, Department of Urology, Cedars-Sinai Medical Center, Los Angeles, CA, USA

#### **Peggy King, RN, BSN**

New York Presbyterian Hospital – Weill Cornell Medical College, New York, NY, USA

#### **Joseph Kiper, RN**

The James Buchanan Brady Foundation, Department of Urology, Weill Cornell Medical College, New York, NY, USA

#### **Gary R. Klinefelter, PhD**

GS-15 Research Biologist for the US EPA (Reproductive Toxicology Branch, Reproductive Toxicology Assessment Division, National Health and Environmental Effects Research Laboratory), United States Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Toxicology Assessment Division, Research Triangle Park, NC, USA

#### **Peter N. Kolettis, MD**

Professor of Surgery, Division of Urology, Department of Surgery, University of Alabama at Birmingham School of Medicine, Birmingham, AL, USA

#### **Richard Lee, MD, MBA**

Assistant Professor of Urology, James Buchanan Brady Foundation, Department of Urology, Weill Medical College of Cornell University, New York, NY, USA

#### **Philip S. Li, MD**

Associate Research Professor of Urology and Reproductive Medicine, Center for Male Reproductive Medicine and

Microsurgery, Director of Microsurgical Research and Training, James Buchanan Brady Foundation, Department of Urology, Weill Medical College of Cornell University, New York; Population Council, Center for Biomedical Research, New York, NY, USA

#### **Kirk C. Lo, MD, CM, FRCS**

Assistant Professor of Urology, Murray Koffler Urologic Wellness Center, Mount Sinai Hospital, University of Toronto, Toronto, Ontario, Canada

#### **Charles M. Lynne, MD**

Professor of Urology, Department of Urology, University of Miami Miller School of Medicine, Miami, FL, USA

#### **Kim McGee, RN, BSN**

New York Presbyterian Hospital – Weill Cornell Medical College, Department of Peri-operative Services New York, NY, USA

#### **John J. McGill, MD**

Department of Urology, University Hospitals Case Medical Center, Case Western Reserve University, Cleveland, OH, USA

#### **Roberta Maggiulli, MS**

Researcher, New York Presbyterian Hospital – Weill Cornell Medical College; The Ronald O. Perelman and Claudia Cohen Center for Reproductive Medicine, Weill Cornell Medical College, New York, NY, USA

#### **Antoine A. Makhoul, MD, PhD**

Assistant Professor, Department of Urologic Surgery, University of Minnesota, Minneapolis, MN, USA

#### **Devin Monahan, BS**

Research Associate, New York Presbyterian Hospital – Weill Cornell Medical College; The Ronald O. Perelman and Claudia Cohen Center for Reproductive Medicine, Weill Cornell Medical College, New York, NY, USA

#### **John P. Mulhall, MD**

Director, Male Sexual & Reproductive Medicine Program, Urology Service, Department of Surgery, Memorial Sloan-Kettering Cancer Center, New York, NY, USA

#### **Ajay K. Nangia, MBBS**

Associate Professor of Urology, Department of Urology, University of Kansas Medical Center, Kansas City, KS

#### **Queenie V. Neri, MS**

Research Associate in Reproductive Medicine, New York Presbyterian Hospital – Weill Cornell Medical College; The Ronald O. Perelman and Claudia Cohen Center for Reproductive Medicine, Weill Cornell Medical College, New York, NY, USA

#### **Craig S. Niederberger, MD, FACS**

Clarence C. Saelhof Professor and Chairman, Department of Urology, University of Illinois at Chicago College of Medicine;



## List of Contributors

Professor, Department of Bioengineering, University of Illinois at Chicago College of Engineering, Chicago, IL, USA

**Robert D. Oates, MD**

Professor of Urology, Vice-Chairman, Department of Urology, Boston Medical Center, Boston, MA, USA

**Dana A. Ohl, MD**

Professor of Urology, Department of Urology, University of Michigan, Ann Arbor, MI, USA

**Darius A. Paduch, MD, PhD**

Associate Professor of Reproductive Medicine and Urology, Department of Urology and Reproductive Medicine, Weill Cornell Medical College, New York, NY, USA

**Gianpiero D. Palermo, MD, PhD**

Professor of Reproductive Medicine, and Embryology in Obstetrics and Gynecology, Blavatnik Distinguished Professor of Reproductive Biology, The Ronald O. Perelman and Claudia Cohen Center for Reproductive Medicine, Weill Cornell Medical College, New York, NY, USA

**Michael A. Perelman, PhD**

Clinical Professor of Psychiatry, Reproductive Medicine and Urology, The New York Presbyterian Hospital, Weill Medical College of Cornell University, New York, NY, USA

**Susanne A. Quallich, NP**

Nurse Practitioner, Department of Urology, University of Michigan, Ann Arbor, MI, USA

**Matthew T. Roberts, MD, FRCSC**

Assistant Professor, Division of Urology, Department of Surgery, University of Ottawa, and Fellow, Male Reproductive Medicine and Surgery, Mount Sinai Hospital, University of Toronto, Toronto, ON, Canada

**Zev Rosenwaks, MD**

Director and Physician-in-Chief, The Ronald O. Perelman and Claudia Cohen Center for Reproductive Medicine, Weill Cornell Medical College, New York, NY, USA

**Edmund Sabanegh, Jr., MD**

Chairman, Department of Urology, Director of the Center for Male Fertility, Glickman Urological and Kidney Institute, Cleveland Clinic, Cleveland, OH, USA

**Jay Sandlow, MD**

Professor of Urology, Medical College of Wisconsin, Milwaukee, WI, USA

**Peter N. Schlegel, MD**

James J. Colt Professor & Chairman, Department of Urology, Professor of Reproductive Medicine, Weill Cornell Medical College; Population Council, Center for Biomedical Research, New York; Urologist-in-Chief, New York Presbyterian Hospital/Weill Cornell Medical Center, New York, NY, USA

**Yefim Sheynkin, MD, FACS**

Associate Professor of Urology, Director, Male Infertility and Microsurgery, Department of Urology, SUNY at Stony Brook, New York, NY, USA

**Mark Sigman, MD**

Professor of Surgery (Urology), The Warren Alpert Medical School of Brown University, Providence, RI, USA

**Rebecca Z. Sokol, MD, MPH**

Professor of Medicine and Obstetrics and Gynecology, Department of Obstetrics and Gynecology, University of Southern California Keck School of Medicine, Los Angeles, CA, USA

**Jens Sønksen, MD, DMSci, PhD**

Professor of Urology, Department of Urology, Herlev Hospital, University of Copenhagen, Herlev, Denmark

**Vairavan S. Subramanian, MD**

Glickman Urological and Kidney Institute, Cleveland Clinic, Cleveland, OH, USA

**Raymond Sultan, MD**

Chief Resident, Urology, Robert Wood Johnson Medical School Picataway, NJ, USA

**Raanan Tal, MD**

Male Sexual & Reproductive Medicine Program, Urology Service, Department of Surgery, Memorial Sloan-Kettering Cancer Center, New York, NY, USA

**Cigdem Tanrikut, MD**

Assistant Professor of Surgery, Harvard Medical School, Boston, MA; Assistant in Urology, Massachusetts General Hospital, Boston, MA, USA

**Paul Tonkin, MD**

Resident, Department of Urology, Medical College of Wisconsin, Milwaukee, WI, USA

**Paul J. Turek, MD, FACS, FRSM**

Director, The Turek Clinic, San Francisco, CA, USA

**Laurent Vaucher, MD**

Department of Urology, Centre Hospitalier Universitaire Vaudois, Lausanne, Switzerland

**Moshe Wald, MD**

Associate Professor, Male Infertility and Andrology, Department of Urology, The University of Iowa, Iowa City, IA, USA

**Zev Williams, MD, PhD**

Clinical Fellow, Center for Reproductive Medicine and Infertility, Weill Cornell Medical Center, New York, NY, USA

**Armand Zini, MD, FRSCS**

Associate Professor, Department of Surgery, Division of Urology, McGill University, St. Mary's Hospital, Montreal, QC, Canada

Cambridge University Press  
978-0-521-88109-8 - Surgical and Medical Management of Male Infertility  
Marc Goldstein and Peter N. Schlegel  
Frontmatter  
[More information](#)

---

## Preface

Dramatic advances in the diagnosis and treatment of male infertility allow conception for couples previously considered untreatable. Elucidation of the genetics of male infertility and new tests of sperm function have led to better understanding of the etiologies and prognosis for treatment of the infertile male. The advent of in vitro fertilization combined with intracytoplasmic sperm injection (IVF/ICSI) has revolutionized the treatment of male factor infertility. Although this has allowed gynecologists/reproductive endocrinologists to treat couples with even severe male factor infertility, recent studies have shown that the incidence of testicular cancer and of genetic abnormalities is dramatically higher in infertile men, emphasizing the importance of evaluating the male, even when enough sperm are present for IVF/ICSI. Furthermore, treatment by urologists trained in male infertility can induce sperm production in men and/or extract sperm from men who have zero sperm counts. In addition, urologists trained in male infertility can often provide treatments that upgrade the fertility of infertile men from nothing to candidates for IVF/ICSI, from only IVF/ICSI to intrauterine insemination, and often to enable naturally conceived pregnancies. The advances in sperm retrieval techniques as well as refinements in the microsurgical management of obstructive azoospermia and varicocele have made pregnancies possible that were unimaginable only a decade ago.

In addition, many conditions associated with infertility, in particular varicocele, have now been shown to be associated with a more rapid decline in testosterone levels compared with age matched men without varicocele. Thus treatment of conditions that are risk factors for infertility not only can help treat infertility, but also treat and prevent androgen deficiency in the aging male.

Finally, treatment of adolescent varicocele has now been shown to restore testicular growth lag and may prevent both future infertility and androgen deficiency, which would be far more cost-effective than treating infertility and androgen deficiency after it occurs. Prior to this volume, there has been no single textbook that comprehensively covers the evaluation, treatment, and prevention of male infertility. The inclusion of a high-quality surgical atlas with live CD-ROM footage makes this book especially valuable and unique.

Each chapter will conclude with a section on “Pearls”. Throughout the volume, the most important points will be in bold face type. We would like to thank our operating room staff, in particular, Margarita Rivera, RN and OR tech Clarence Sidney, who have worked with us for over two decades at New York Presbyterian Hospital Weill Cornell Medical Center and were key to achieving the outstanding results we report in.

Cambridge University Press  
978-0-521-88109-8 - Surgical and Medical Management of Male Infertility  
Marc Goldstein and Peter N. Schlegel  
Frontmatter  
[More information](#)

---