

Adam I. Riker
Editor

Breast Disease

Comprehensive
Management

 Springer

Breast Disease

Adam I. Riker
Editor

Breast Disease

Comprehensive Management

 Springer

Editor

Adam I. Riker, MD, FACS
Advocate Center for Breast Health
Advocate Cancer Institute
Advocate Christ Medical Center
Oak Lawn
Illinois
USA

ISBN 978-1-4939-1144-8 ISBN 978-1-4939-1145-5 (eBook)
DOI 10.1007/978-1-4939-1145-5
Springer New York Heidelberg Dordrecht London

Library of Congress Control Number: 2014952366

© Springer Science+Business Media New York 2015

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Contents

1	Anatomy of the Breast, Axilla, and Chest Wall	1
	Ramasamy Kalimuthu, S. Sarah Yegiyants, and Christie Brenzek	
2	Breast Ultrasound: Diagnostic Imaging and Biopsy Techniques for the Office Practice	23
	Richard E. Fine	
3	Management of Benign Breast Disease	51
	J. Michael Dixon and E. Jane Macaskill	
4	Management of Breast Pain	79
	Julia A. Files, Summer V. Allen, and Sandhya Pruthi	
5	Management of the High-Risk Breast Lesion	93
	Jared Linebarger, Jon Zellmer, and Monica Rizzo	
6	Current Management of Nipple Discharge	113
	Richard J. Gray and Barbara A. Pockaj	
7	The Initial Consultation: Malignant Disease	121
	Barbara L. Krueger and Adam I. Riker	
8	The Emerging Role of Prophylactic Mastectomy	129
	Pamela R. Portschy and Todd M. Tuttle	
9	Genetically Based Breast Cancer: Risk Assessment, Counseling, and Testing	137
	Mary B. Daly and Andrea Forman	
10	Lobular Neoplasia: Atypical Lobular Hyperplasia and Lobular Carcinoma In Situ	161
	Miraj G. Shah-Khan and James W. Jakub	
11	Current Management of Ductal Carcinoma In Situ (DCIS)	175
	Adam I. Riker, Barbara L. Krueger, and Jami Walloch	
12	Management of Axilla in Invasive Breast Cancer	187
	Paulomi Shroff and Philip Israel	
13	Breast-Conserving Therapy for Breast Cancer	199
	Charles E. Cox, Adela Fernandez, Evan Tummel, Richard Betzold, Wei Wei Zhang, Vanessa Prowler, John Chipko, Michelle Jung, Michelle Vice, and Steven C. Shivers	

14 Mastectomy for Invasive Breast Cancer	215
Tracy-Ann Moo and Rache M. Simmons	
15 Inflammatory Breast Cancer	223
Ricardo Hugo Alvarez, Shaheenah Dawood, and Massimo Cristofanilli	
16 Operative Management of Metastatic Breast Cancer	237
Hannah W. Hazard	
17 A History of Breast Reconstruction Following Mastectomy.	253
Charles Dupin, James Mayo, and M'liss Hogan	
18 Breast Reconstruction with Expanders and Implants	267
Charles Dupin, M'liss Hogan, Haiqiao Jiao, and M. Whitten Wise	
19 Autologous Breast Reconstruction	279
M. Whitten Wise, Hugo St.Hilaire, Ali Sadeghi, M'liss Hogan, and Charles Dupin	
20 Reconstruction for Locally Advanced and Recurrent Breast Cancer.	305
Christopher Sanders and Charles Dupin	
21 Revision Breast Reconstruction and General Complications	313
M'liss Hogan and Charles Dupin	
22 Molecular Medicine and Personalized Therapy for Breast Cancer Patients	321
Pamela N. Munster	
23 Adjuvant Chemotherapy in Breast Cancer.	335
Elgene Lim, Shom Goel, and Eric P. Winer	
24 Adjuvant Therapy for Breast Cancer: Hormonal Therapy	353
William J. Gradishar	
25 Adjuvant Biologic Agents for Breast Cancer	363
Virginia G. Kaklamani and William J. Gradishar	
26 External Beam Radiation Therapy	377
Paul Crossan	
27 Partial Breast Radiation Therapy	399
Peter D. Beitsch and J. Ben Wilkinson	
28 The Emerging Role of Intraoperative Radiation Therapy [IORT] in Breast Cancer.	413
Donald A. Goer and Melvin J. Silverstein	
29 Triple-Negative Breast Cancer	463
Roohi Ismail-Khan, Susan Minton, and Nazanin Khakpour	

30	Management of Metastatic Breast Cancer	473
	Sarah Keck, Melanie Majure, and Hope S. Rugo	
31	Anesthetic Considerations for the Patient with Breast Disease	499
	Maria A. Kimovec, Akram Abdoue, and Rebecca Grutsch	
32	The Multidisciplinary Breast Cancer Program: Patient Navigation	515
	Patrice A. Stephens	
33	Cancer Survivorship	523
	Peggy Kupres	
34	Benign Breast Pathology	533
	Gulbeyaz Omeroglu, Atilla Omeroglu, Yanxia Li, Rasheed Hammadeh, and Çağatay H. Erşahin	
35	Atypical and Malignant Breast Pathology	551
	Çağatay H. Erşahin, Gülbeyaz Ömeroğlu, Yanxia Li, Rasheed Hammadeh, and Atilla Ömeroğlu	
	Index	573

Contributors

Akram Abdoue, MD Department of Anesthesia, Advocate Christ Medical Center, University of Illinois College of Medicine at Chicago, Oak Lawn, IL, USA

Summer V. Allen, MD Department of Family Medicine, Mayo Clinic, Rochester, MN, USA

Ricardo H. Alvarez, MD, MSc The Morgan Welch Inflammatory Breast Cancer Research and Clinic Department of Breast Medical Oncology, The University of Texas MD Anderson Cancer Center, Houston, TX, USA

Peter D. Beitsch, MD, FACS Dallas Breast Center, Dallas, TX, USA

Richard Betzold, MD Department of Surgery, University of Arkansas for Medical Sciences, Little Rock, AR, USA

Christie Brenzek, BA, MBA Suburban Plastic Surgery, Oak Lawn, IL, USA

John Chipko, MD Department of General Surgery, Tampa General Hospital, Tampa, FL, USA

Charles E. Cox, MD Department of Surgery, USF Breast Health Program, Morsani College of Medicine, University of South Florida, Tampa, FL, USA

Massimo Cristofanilli, MD Breast Cancer Center, Jefferson Medical College, Thomas Jefferson University-Kimmel Cancer Center, Philadelphia, PA, USA

Paul Crossan, MD Department of Radiation Oncology, Advocate Christ Hospital Medical Center, Oak Lawn, IL, USA

Mary B. Daly, MD, PhD Department of Clinical Genetics, Fox Chase Cancer Center, Philadelphia, PA, USA

Shaheenah Dawood, MRCP, MPH Department of Medical Oncology, Department of Health and Medical Services, Dubai Hospital, Dubai, United Arab Emirates

J. Michael Dixon, OBE, MD, FRCS. FRCEd FRCP The Edinburgh Breast Unit, Western General Hospital, Edinburgh, Scotland, UK

Charles Dupin, MD Division of Plastic Surgery, Department of Surgery, Louisiana State University Health Sciences Center, New Orleans, LA, USA

Çağatay H. Erşahin, MD, PhD Department of Pathology, Silver Cross Hospital, New Lenox, IL, USA

Adela Fernandez, MD Department of General Surgery, Tampa General Hospital, Tampa, FL, USA

Julia A. Files, MD Division of Women's Health Internal Medicine, Mayo Clinic Arizona, Scottsdale, AZ, USA

Richard E. Fine, MD, FACS Division of Oncology, Department of Surgery, University of Tennessee Health Science Center, College of Medicine, Memphis, TN, USA
Education and Research, West Clinic Comprehensive Breast Center, Germantown, TN, USA

Andrea Forman, MS, CGC Department of Clinical Genetics, Fox Chase Cancer Center, Philadelphia, PA, USA

Shom Goel, MBBS, FRACP Division of Women's Cancers, Dana-Farber Cancer Institute, Boston, MA, USA

Donald A. Goer, PhD Intraop Medical Corporation, Sunnyvale, CA, USA

William J. Gradishar, MD Medicine – Division of Hematology/Oncology, Maggie Daley Center for Women's Cancer Care, Robert H. Lurie Comprehensive Cancer Center, Northwestern University Feinberg School of Medicine, Chicago, IL, USA

Richard J. Gray, MD Department of Surgery, Mayo Clinic Arizona, Phoenix, AZ, USA

Rebecca Grutsch, MD Department of Anesthesiology and Critical Care Medicine, The Johns Hopkins Hospital, Johns Hopkins University School of Medicine, Baltimore, MD, USA

Rasheed Hammadeh, MD Department of Pathology, Advocate Christ Hospital and Medical Center, Oak Lawn, IL, USA

Hannah W. Hazard, MD, FACS Department of Surgery, Health Sciences Center – South, West Virginia University School of Medicine, Morgantown, WV, USA

Hugo St.Hilaire, MD, DDS Division of Plastic Surgery, Department of Surgery, Louisiana State University Health Sciences Center, New Orleans, LA, USA

M'liss Hogan, MD Division of Plastic Surgery, Department of Surgery, Louisiana State University Health Sciences Center, New Orleans, LA, USA

Roohi Ismail-Khan, MD, MS Division of Breast Oncology & Experimental Therapeutics, H. Lee Moffitt Cancer Center & Research Institute, Tampa, FL, USA

Philip Israel, MD Department of Surgery, The Breast Center, Marietta, GA, USA

James W. Jakub, MD Department of Surgery, Mayo Clinic, Rochester, MN, USA

Haiqiao Jiao, MD Department of Surgery, Louisiana State University Health Sciences Center, New Orleans, LA, USA

Michelle Jung, BS Department of Surgery (USF), University of South Florida (Morsani), Tampa, FL, USA

Virginia G. Kaklamani, MD Department of Medicine Hematology/Oncology, Northwestern University, Chicago, IL, USA

Ramasamy Kalimuthu, MD, FACS Department of Plastic, Hand, and Reconstructive Surgery, Advocate Christ Medical Center, University of Illinois Chicago, Oak Lawn, IL, USA

Sarah Keck, MD Santa Rosa Medical Group, University of California San Francisco, Santa Rosa, CA, USA

Nazanin Khakpour, MD, FACS Department of Women's Oncology, H. Lee Moffitt Cancer Center & Research Institute, Tampa, FL, USA

Maria A. Kimovec, MD Department of Anesthesia, Advocate Christ Medical Center, University of Illinois College of Medicine at Chicago, Oak Lawn, IL, USA

Barbara L. Krueger, MD, FACS Breast Cancer Program, Advocate Cancer Institute, Advocate Christ Medical Center, Oak Lawn, IL, USA

Peggy Kupres, BSN, MA Advocate Christ Medical Center, Cancer Institute, Oak Lawn, IL, USA

Yanxia Li, MD, PhD Department of Pathology, Loyola University Medical Center, Maywood, IL, USA

Elgene Lim, MBBS, FRACP, PhD Division of Women's Cancers, Dana-Farber Cancer Institute, Boston, MA, USA

Jared Linebarger, MD Department of General Surgery, Gunderson Health System, La Crosse, WI, USA

Norma J Vinger Center for Breast Care (NJVCBC), La Crosse, WI, USA

E. Jane Macaskill, MBChB, MD, FRCSEd Department of Breast Surgery, Ninewells Hospital, Dundee, Scotland, UK

Melanie Majure, MD Department of Medicine, University of California San Francisco, San Francisco, CA, USA

James Mayo, MD Division of Plastic Surgery, Department of Surgery, Louisiana State University Health Sciences Center, New Orleans, LA, USA

Susan Minton, DO Division of Breast Oncology & Experimental Therapeutics, H. Lee Moffitt Cancer Center & Research Institute, Tampa, FL, USA

Tracy-Ann Moo, MD Department of Breast Surgery, Memorial Sloan Kettering Cancer Center, Evelyn H Lauder Breast Center, New York, NY, USA

Pamela N. Munster, MD Division of Hematology and Oncology, Department of Medicine, Helen Diller Family Cancer Center, University of California, San Francisco, San Francisco, CA, USA

Atilla Ömeroğlu, MD Department of Pathology, McGill University, Montreal, QC, Canada
Department of Pathology Duff Medical Building, Montreal, QC, Canada

Gülbeyaz Ömeroğlu, MD Department of Pathology, McGill University, Montreal, QC, Canada
Department of Pathology Duff Medical Building, Montreal, QC, Canada

Barbara A. Pockaj, MD Department of Surgery, Mayo Clinic Arizona, Phoenix, AZ, USA

Pamela R. Portschy, MD Department of Surgical Oncology, University of Minnesota, Minneapolis, MN, USA

Vanessa Prowler, MD Department of Surgery, Tampa General Hospital, Tampa, FL, USA

Sandhya Pruthi, MD General Internal Medicine, Mayo Clinic, Rochester, MN, USA

Adam I. Riker, MD, FACS Advocate Center for Breast Health, Advocate Cancer Institute, Advocate Christ Medical Center, Oak Lawn, IL, USA

Monica Rizzo, MD, FACS Division of Surgical Oncology, Department of Surgery, Emory University School of Medicine, Winship Cancer Institute, Atlanta, GA, USA

Hope S. Rugo, MD Department of Medicine, University of California San Francisco Helen Diller Family Comprehensive Cancer Center, San Francisco, CA, USA

Ali Sadeghi, MD Division of Plastic Surgery, Department of Surgery, Louisiana State University Health Sciences Center, New Orleans, LA, USA

Christopher Sanders, MD Division of Plastic Surgery, Department of Surgery, Louisiana State University Health Sciences Center, New Orleans, LA, USA

Miraj G. Shah-Khan, MD Division of Surgical Oncology, Medical College of Wisconsin, Milwaukee, WI, USA

Steven C. Shivers, PhD Department of Surgery, USF Breast Health Program, Morsani College of Medicine, University of South Florida, Tampa, FL, USA

Paulomi Shroff, MD Department of Surgery, The Breast Center, Marietta, GA, USA

Melvin J. Silverstein, MD Gross Family Foundation Endowed Chair in Oncoplastic Surgery, Hoag Breast Program, Hoag Memorial Hospital Presbyterian, Newport Beach, CA, USA

Clinical Professor of Surgery, Keck School of Medicine, University of Southern California, Los Angeles, CA, USA

Rache Simmons, MD, FACS Department of Surgery, New York Presbyterian Hospital, New York, NY, USA

Patrice A. Stephens, MSN, APN, AOCN-BC Advocate Christ Medical Center, Cancer Institute, Oak Lawn, IL, USA

Evan Tummel, MD Department of Surgery, Tampa General Hospital, Tampa, FL, USA

Todd M. Tuttle, MD Department of Surgical Oncology, University of Minnesota, Minneapolis, MN, USA

Michelle Vice, BS Department of General Surgery, Morsani College of Medicine, Tampa, FL, USA

Jami Walloch, MD Department of Pathology, Advocate Cancer Institute, Advocate Christ Medical Center, Oak Lawn, IL, USA

J. Ben Wilkinson, MD Department of Radiation Oncology, Willis-Knighton Health System, LSU Feist-Weiller Cancer Center, Shreveport, LA, USA

Eric P. Winer, MD Division of Women's Cancers, Dana-Farber Cancer Institute, Boston, MA, USA

M. Whitten Wise, MD Division of Plastic Surgery, Department of Surgery, Louisiana State University Health Sciences Center, New Orleans, LA, USA

S. Sarah Yegiyants, MD, MS Division of Plastic, Reconstructive, and Cosmetic Surgery, Department of Surgery, Division of Plastic, Reconstructive, and Cosmetic Surgery, Department of Surgery, University of Illinois, Chicago, Chicago, IL, USA

Jon Zellmer Department of Medical Education, Gunderson Lutheran Medical Foundation, La Crosse, WI, USA

Wei Wei Zhang, MD Department of General Surgery, University of South Florida, Tampa, FL, USA

Anatomy of the Breast, Axilla, and Chest Wall

1

Ramasamy Kalimuthu, S. Sarah Yegiyants,
and Christie Brenzek

Introduction

The breast is an organ that has captured the imagination of mankind since the beginning of our existence. It serves the dual function of an end organ, influenced by the endocrine system, with the ability to produce milk in mammals, sustaining the offspring, and functioning as a secondary sex organ in humans. The breast is evaluated and treated by a multitude of specialists, for both aesthetic and disease processes. In this chapter, we will focus on the anatomy of the breast with respect to the treatment of breast disease. The breast aesthetics, while an important aspect of the breast evaluation, is beyond the scope of discussion in this chapter.

R. Kalimuthu, MD, FACS (✉)
Department of Plastic,
Hand, and Reconstructive Surgery,
Advocate Christ Medical Center,
University of Illinois Chicago,
5346 West 95th Street, Oak Lawn, IL 60453, USA
e-mail: kali@suburbanplastic.com

S.S. Yegiyants, MD, MS
Division of Plastic, Reconstructive, and Cosmetic Surgery,
Department of Surgery, University of Illinois, Chicago,
820 South Wood Street, 515 CSN,
Chicago, IL 60612, USA
e-mail: syegiyants@yahoo.com

C. Brenzek, BA, MBA
Suburban Plastic Surgery, 5346 West 95th Street,
Oak Lawn, IL 60453, USA
e-mail: christie@suburbanplastic.com

Evolution and Comparative Anatomy of the Breast

To fully appreciate the anatomy and physiology of the human breast, one must delve into the evolution and comparative anatomy of the organ. The mammary glands, closely tied to reproduction, are unique features of mammals and their evolutionary development. The Anamniota, the “lower vertebrates,” are a group comprising the fish and the amphibians. Their eggs lack an amnion, which serves to transport oxygen and expel carbon dioxide, causing the anamniotes to lay eggs in water which helps in the diffusion of waste products. In contrast, the amniotes are a group of “higher vertebrates” whose eggs possess an amnion, allowing for an adaptation to lay eggs on land.

Amniotes, like reptiles, lay eggs away from water and maintain egg moisture by secretion from sweat glands [1–3]. The amniotic egg represents a critical divergence within the vertebrates, which allowed for terrestrial reproduction. The monotremes, like the platypus and echidna, are mammals that lay eggs instead of giving birth. Monotremes have mammary gland, which they have derived from an ancestral apocrine-like gland that lactates through mammary hair follicle openings. This provides moisture and other nutrients which permeate to hatch the eggs. This association is retained by monotreme mammary glands and is evident as vestigial mammary hair during development of marsupials.

The nipple has evolved from the vestigial hair opening seen in marsupials. There is evidence