
Fine Needle Aspiration Cytology of the Breast

Gary Tse • Puay Hoon Tan
Fernando Schmitt
Authors

Fine Needle Aspiration Cytology of the Breast

Atlas of Cyto-Histologic Correlates

 Springer

Authors

Dr. Gary Tse
Prince of Wales Hospital
Department of Anatomical
And Cellular Pathology
The Chinese University of Hong Kong
Shatin, NT
Hong Kong SAR

Prof. Dr. Fernando Schmitt
Department of Pathology and Oncology
Medical Faculty of Porto University
and IPATIMUP
Porto
Portugal

Dr. Puay Hoon Tan
Department of Pathology
Singapore General Hospital
Singapore

Contributing author of
Chapter 9 – Nour Sneige and Gary Tse
Chapter 10 – Andrew S. Field and Gary Tse
Chapter 13 – Jill Su Lin Wong, Gay Hui Ho, and Puay Hoon Tan

ISBN 978-3-642-34999-7 ISBN 978-3-642-35000-9 (eBook)
DOI 10.1007/978-3-642-35000-9
Springer Heidelberg New York Dordrecht London

Library of Congress Control Number: 2013932846

© Springer-Verlag Berlin Heidelberg 2013

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)

Foreword

Fine needle aspiration cytology (FNAC) of the breast, although introduced in the 1930, became popular in the 1970s. As with many other techniques in medicine, it started slowly but gained greater acceptance when European investigators reported large series of breast FNAs proving the technique to be useful and accurate. Since then, the technique has gained acceptance throughout the world, although more recently a decline in the utilization of FNAC for some screen-detected lesions and greater reliance on core needle biopsy have taken place.

This book entitled *Fine Needle Aspiration Cytology of the Breast* incorporates state-of-the-art knowledge in the field, and the wealth of information was contributed by Dr. Gary Tse, Dr. Puay Hoon Tan, and Dr. Fernando Schmitt.

Chapters 1 and 2 cover anatomy and physiology of the breast and basic breast pathology. Chapter 3 describes the aspiration techniques emphasizing the aspiration procedure, reporting of results and diagnostic accuracy. Liquid-based cytology and cell block preparations are presented in Chap. 4. The various diagnostic entities are covered in Chaps. 5, 6, 7, 8, 9, 10, 11, 12, and 13. These chapters provide a concise and practical approach to challenges cytologists face in daily practice, with cyto/histologic correlation, differential diagnosis, and management of results.

Immunocytochemistry and molecular techniques, very important parts of current cytopathology practice, are described in detail in Chaps. 14 and 15.

Color photomicrographs provide excellent visual images of a variety of lesions throughout the book.

Comparison between FNAC and core biopsy is presented in Chap. 16, and the authors emphasize that when dealing with non-palpable screen-detected lesion, needle biopsies excel over FNAC as more material and better retrieval of calcifications are achieved.

Let us enjoy this impressive textbook and marvel at the beauty of the illustrations, a book that presents in a lucid fashion the current knowledge in breast FNAC.

Philadelphia, PA, USA

Marluce Bibbo, MD

Preface

We are experiencing extraordinary advances in medicine. Surgery is less invasive, and image guidance has become a fundamental tool in targeting the lesions of interest. The availability of cells or tissues from patients remains crucial for disease diagnosis, and identifying molecular changes or surrogate markers important for prognosis and predicting therapeutic response. With this backdrop, it is not difficult to conclude that cytology continues to play a central role in modern medicine. Currently, breast cytology is being replaced by core needle biopsy (CNB) in many centers of the western world under a perception that CNB is superior to cytology in all respects. In actual fact, fine needle aspiration cytology (FNAC) of the breast is an excellent way to diagnose breast lesions and can be accomplished during a routine doctor's office or clinic visit or at the patient's bedside. It utilizes inexpensive equipment and can be performed, interpreted, and reported in a matter of minutes, expediting the patient's entry into treatment. FNAC and CNB are not mutually exclusive but are complementary methods. This is extensively discussed in this textbook in the different chapters. In the practice of all authors, FNAC still has an important role as a first-line cost-effective method to investigate breast lesions. One of the causes of decline of this technique is the decreasing familiarity and experience of pathologists with breast cytology. This book aims to demonstrate the different aspects of breast cytology, including discussion of the technical aspects, description of the morphological characteristics of diverse lesions, and the harnessing of ancillary techniques on cytologic material that can gather more information for pathologists. Moreover, with the development of new treatment protocols for breast cancer patients, the use of FNAC is increasingly used to rule in or out multicentric disease. In combination with axillary lymph node and distant site aspirations, disease staging and planning of suitable therapy can be more quickly and economically achieved. FNAC is also being used to obtain cells to assess molecular markers that can guide treatment, especially in metastatic lesions. Recently, in recognition of the importance of FNA in assessment of breast cancer, a chapter on this subject was included in the latest 4th edition of the WHO Classification of Tumors of the Breast.

More than 50 years after the reintroduction of FNAC as a diagnostic method by the "Karolinska Hospital" school, this method still represents a near-perfect test. It is relatively easy to perform requiring no "high-tech" gadgetry; costs are low and are substantially less expensive than open biopsy. The procedure is safe, yielding material that provides for a high-diagnostic accuracy in an

extremely short time frame. The ability to perform either FNA and/or CNB, based on a given set of clinical/radiological/pathologic findings, allows one to take advantage of the benefits that both procedures have to offer.

Our wish is that you, the reader, for which this book is written, can use it in daily practice. We hope this book can serve as a ready resource for obtaining helpful information to solve cases and to help your patients.

Gary Tse
Puay Hoon Tan
Fernando Schmitt

With contributions by

Andrew S. Field, MB, BS(Hons), FRCPA, FIAC, Dip Cytopath (RCPA)
Department of Tissue and Molecular Pathology
St Vincent's Hospital, Sydney
NSW
Australia

Gay Hui Ho, FRCS
Department of Surgical Oncology
National Cancer Centre Singapore
Singapore

Nour Sneige, MD
Department of Pathology
The University of Texas MD Anderson Cancer Center
Houston
USA

Jill Su Lin Wong, FRCR
Department of Oncologic Imaging
National Cancer Centre Singapore
Singapore

Acknowledgements

The authors wish to acknowledge the personnel of our laboratories, from secretaries, technical colleagues, and fellow pathologists, especially:

Yunbi Ni, Department of Anatomical and Cellular Pathology, The Chinese University of Hong Kong

Maribel Lacambra, Department of Anatomical and Cellular Pathology, The Chinese University of Hong Kong

Rene Gerhard, Institute of Pathology and Immunology of Porto University (IPATIMUP)

Staff of Cytology Section, Department of Pathology, Singapore General Hospital

We are also very grateful to our families for being so understanding and supportive during this period.

Contents

1	Anatomy and Physiology of the Breast	1
1.1	Anatomy of the Breast	1
1.2	Physiology of the Breast	1
1.2.1	Development	1
1.2.2	Puberty and Menarche	2
1.2.3	Menstrual Cycle	2
1.2.4	Pregnancy and Lactation	3
1.2.5	Menopause	4
	References	5
2	Basic Histopathology of Breast Lesions	7
2.1	Introduction	7
2.2	Inflammatory Breast Lesions	7
2.3	Benign Breast Lesions and Benign Breast Tumors	9
2.4	Epithelial Proliferative Lesions	15
2.5	Malignant Breast Tumors	18
2.5.1	Carcinoma In Situ	18
2.5.2	Papillary Carcinoma	19
2.5.3	Invasive Carcinoma	21
	References	29
3	Aspiration Techniques	31
3.1	Introduction	31
3.2	Role of Breast FNAC in the Clinical Practice	31
3.3	Breast FNAC Procedure	32
3.3.1	Equipment	32
3.3.2	Lesion Localization	34
3.3.3	Aspiration Procedure	35
3.3.4	Preparation of Smears	37
3.3.5	Fixation and Staining	39
3.3.6	Reporting of the Results	39
3.4	Clues to Enhance Diagnostic Accuracy	40
3.5	Complications of Breast FNAC	41
	References	41
4	Liquid-Based Cytology and Cell Block in Breast Lesions	43
4.1	Liquid-Based Cytology	43
4.1.1	Advantages	43
4.1.2	Disadvantages	44

4.2	Cell Block	44
4.3	Summary	48
	References	48
5	Inflammatory Lesions of the Breast	49
5.1	Clinical Findings	49
5.2	Breast Abscess and Acute Mastitis	49
5.3	Subareolar Abscess	50
5.4	Duct Ectasia.	50
5.5	Chronic Granulomatous Mastitis.	51
5.6	Diabetic Mastopathy	54
5.7	Fat Necrosis.	54
5.8	Summary	55
	References	56
6	Fibrocystic Changes and Cysts	57
6.1	Clinical Findings	57
6.2	Radiologic Findings.	57
6.3	Cytologic Findings	58
	6.3.1 General Findings	58
	6.3.2 Non-proliferative Lesions	58
	6.3.3 Proliferative Lesions	60
6.4	Histologic Correlations	61
	6.4.1 Gross Findings	61
	6.4.2 Histology: General Considerations	62
6.5	Summary	64
	References	64
7	Fibroadenoma	65
7.1	Clinical and Epidemiological Findings	65
7.2	Cytologic Findings	65
7.3	Differential Diagnosis	69
	7.3.1 Fibrocystic Changes.	69
	7.3.2 Pseudoangiomatous Stromal Hyperplasia (PASH).	69
	7.3.3 Mucocele-Like Lesions	69
	7.3.4 Phyllodes Tumors.	69
	7.3.5 Hamartoma.	69
	7.3.6 Tubular Adenoma.	69
	7.3.7 Adenomyoepithelioma.	70
	7.3.8 Pleomorphic Adenoma.	70
	7.3.9 Papillary Lesions	70
	7.3.10 Carcinoma	70
7.4	Histologic Correlations	70
7.5	Management	71
	References	71
8	Other Fibroepithelial Lesions.	73
8.1	Phyllodes Tumors	73
	8.1.1 Cytologic Grading in Phyllodes Tumors	73

8.2	Hamartoma	78
8.2.1	Clinical and Epidemiological Findings	78
8.2.2	Cytologic Findings.	78
8.2.3	Differential Diagnosis	78
8.2.4	Management.	78
8.3	Pseudoangiomatous Stromal Hyperplasia (PASH).	78
8.3.1	Clinical and Epidemiological Findings	78
8.3.2	Cytologic Findings.	78
8.3.3	Differential Diagnosis	80
8.3.4	Management.	81
	References	81
9	Cytology of Epithelial Proliferative Lesions and High-Grade Ductal Carcinoma In Situ	83
9.1	Introduction	83
9.2	Non-proliferative Breast Disease.	83
9.2.1	Clinical and Epidemiological Findings	83
9.2.2	Cytologic Findings.	83
9.2.3	Histologic Correlations	84
9.3	Benign Breast Proliferative Lesions	85
9.3.1	Moderate and Florid Epithelial Hyperplasia	85
9.3.2	Sclerosing Adenosis.	87
9.3.3	Columnar Cell Changes	87
9.4	Atypical Epithelial Proliferations	90
9.4.1	Atypical Ductal Hyperplasia	91
9.4.2	Ductal Carcinoma In Situ, Low Grade.	94
9.4.3	Lobular Neoplasia	96
9.5	Ductal Carcinoma In Situ, High Grade	99
9.5.1	Cytologic Findings.	99
9.5.2	Differential Diagnosis	99
	References	101
10	Papillary Lesions of the Breast.	103
10.1	Introduction	103
10.2	Intraduct Papilloma	104
10.2.1	Clinical and Epidemiological Findings	104
10.2.2	Cytologic Findings.	104
10.2.3	Differential Diagnosis	108
10.2.4	Histologic Correlations	110
10.3	Papillary Carcinoma In Situ	112
10.3.1	Clinical and Epidemiological Findings	112
10.3.2	Cytologic Findings.	112
10.3.3	Differential Diagnosis	114
10.3.4	Histologic Correlations	115
10.4	Solid Papillary Carcinoma.	116
10.4.1	Clinical and Epidemiological Findings	116
10.4.2	Cytologic Findings.	116

10.4.3	Differential Diagnosis	116
10.4.4	Histologic Correlations	116
10.5	Encapsulated Papillary Carcinoma (Intracystic Papillary Carcinoma, Encysted Papillary Carcinoma) . . .	119
10.5.1	Clinical and Epidemiological Findings	119
10.5.2	Cytologic Findings	119
10.5.3	Differential Diagnosis	120
10.5.4	Histologic Correlations	121
	References	121
11	Mucinous Lesions	123
11.1	Introduction	123
11.2	Mucocele-Like Lesions	123
11.2.1	Clinical and Epidemiological Findings	123
11.2.2	Cytologic Findings	123
11.2.3	Histologic Correlations	123
11.2.4	Management	124
11.3	Mucinous Carcinoma	124
11.3.1	Clinical and Epidemiological Findings	124
11.3.2	Cytologic Findings	124
11.3.3	Histologic Correlations	125
11.3.4	Management	126
11.4	Mucinous Papillary Neoplasms	127
11.4.1	Clinical and Epidemiological Findings	127
11.4.2	Cytologic Findings	127
11.4.3	Histologic Correlations	128
11.4.4	Management	129
11.5	Differential Diagnosis	129
11.5.1	Myxoid Fibroadenoma	129
11.5.2	Fibrocystic Changes with Luminal Mucin	129
11.5.3	Polyacrylamide Gel Injection	129
	References	129
12	Carcinoma and Variants	131
12.1	Clinical Findings	131
12.2	Radiologic Findings	131
12.3	Pathologic Findings	131
12.3.1	Gross Findings	131
12.3.2	Histologic Findings	131
12.4	Cytologic Findings	133
12.4.1	General Findings	133
12.4.2	Invasive Breast Carcinoma of No Special Type (Ductal)	134
12.4.3	Invasive Lobular Carcinoma	136
12.4.4	Tubular Carcinoma	136
12.4.5	Invasive Cribriform Carcinoma	137
12.4.6	Mucinous Carcinoma	138
12.4.7	Carcinoma with Medullary Features	139
12.4.8	Invasive Micropapillary Carcinoma	141

	12.4.9 Metaplastic Carcinoma	142
	12.4.10 Apocrine Carcinoma	144
	12.4.11 Papillary Carcinoma	145
	12.4.12 Secretory Carcinoma	146
	12.4.13 Acinic Cell Carcinoma	146
	12.4.14 Glycogen-Rich Carcinoma	147
	12.4.15 Lipid-Rich Carcinoma	147
	12.4.16 Adenoid Cystic Carcinoma	147
	12.4.17 Paget’s Disease	148
	References	149
13	Assessment of Axillary Nodes	151
	13.1 Background	151
	13.2 Sentinel Node Biopsy	151
	13.3 Normal Versus Abnormal Nodes: Imaging Appearances	152
	13.4 Ultrasound-Guided Needle Biopsy of Axillary Nodes	156
	13.5 Fine Needle Aspiration Cytology	156
	13.6 Accuracy of the Preoperative Ultrasound-Guided Needle Biopsy	158
	References	158
14	Special Ancillary Techniques: Immunohistochemistry	159
	14.1 Markers Useful for Differentiating Between Benign and Malignant Aspirates	159
	14.2 Markers Useful for Classification of Breast Cancers	163
	14.3 Markers Useful for Prognostication and Prediction to Response to Treatment	163
	14.4 Markers Useful for Correlation with Response to Treatment and Outcome	166
	References	166
15	Molecular Studies	169
	15.1 Introduction	169
	15.2 Molecular Classification of Breast Cancer	170
	15.3 Molecular Studies on FNAC from Primary Breast Tumors	171
	15.4 Molecular Studies on FNAC from Metastatic Breast Tumors	173
	15.5 Molecular Studies on FNAC Material Used for Frozen Tissue Banking of Breast Cancer	174
	References	174
16	Comparison of Aspiration and Core Needle Biopsy	177
	16.1 Introduction	177
	16.2 Comparison Between FNAC and Core Biopsy	177
	16.3 Non-palpable, Screen-Detected Calcifications	178
	16.4 Low-Grade Malignancy and Borderline Lesions	179
	16.5 Ductal Carcinoma In Situ and Invasive Carcinoma	179

16.6	Papillary Lesions	180
16.7	Fibroepithelial Lesions	181
16.8	Summary	181
	References	182
17	Future Directions.	185
	References	187
	Index.	189