

国外经典医学教材改编/影印系列

供医学各专业本科生、研究生、长学制学生、留学生用

原版影印

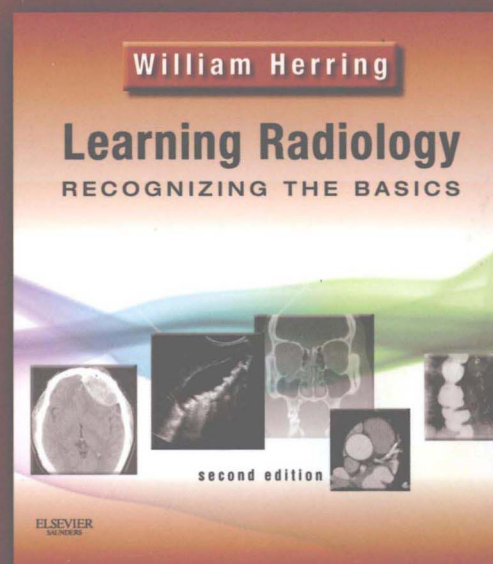
Learning Radiology

RECOGNIZING THE BASICS

影像诊断学基础教程

(第2版)

William Herring



This edition is for sale in P. R. China, excluding Hong Kong SAR and Taiwan. Sale and purchase of this book outside of P. R. China is illegal and punishable by law.



北京大学医学出版社

国外经典医学教材改编 / 影印系列

影像诊断学基础教程

(第2版)

Learning Radiology

Recognizing the Basics

(Second Edition)

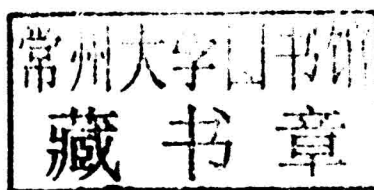
William Herring, MD, FACR

Vice Chairman and Residency Program Director

Department of Radiology

Albert Einstein Medical Center

Philadelphia, Pennsylvania



北京大学医学出版社
Peking University Medical Press

图书在版编目 (CIP) 数据

影像诊断学基础教程 = Learning radiology:
recognizing the basics : 第2版 : 英文 / (美) 郝林
(Herring, W.) 主编. --影印本. --北京 : 北京大学医学
出版社, 2014. 7

ISBN 978-7-5659-0802-6

I. ①影… II. ①郝… III. ①影像诊断—教材—英文
IV. ①R445

中国版本图书馆CIP数据核字 (2014) 第043506号

北京市版权局著作权合同登记号: 图字: 01—2014—2493

Learning Radiology:Recognizing the Basics, the second edition

William Herring

ISBN-13:9780323074445

ISBN-10:0323074448

Copyright©2012, 2007 by Mosby, Inc. an affiliate of Elsevier Inc.

Authorized reprint edition from English language edition published by Elsevier Inc.

Copyright©2014 by Elsevier(Singapore)Pte Ltd and Peking University Medical Press All rights reserved.

Elsevier(Singapore) Pte Ltd.

3 Killiney Road #08-01 Winsland House I, Singapore 239519

Tel:(65)6349-0200,Fax:(65)6733-1817

First Published 2014

2014年初版

Published in China by Peking University Medical Press under special arrangement with Elsevier(Singapore)Pte Ltd.This edition is authorized for sale in China only,excluding Hong Kong SAR and Taiwan.Unauthorized export of this edition is a violation of the Copyright Act.Violation of this Law is subject to Civil and Criminal Penalties.

本书英文影印版由北京大学医学出版社与Elsevier(Singapore)Pte Ltd.在中国境内 (不包括香港特别行政区及台湾) 合作出版及标价销售。未经许可之出口, 视为违反著作权法, 将受法律之制裁。

影像诊断学基础教程 (第2版)

主 编: William Herring

出版发行: 北京大学医学出版社

电 话: 发行部: 010-82802230 图书邮购: 010-82802495

地 址: (100191) 北京市海淀区学院路38号 北京大学医学部院内

网 址: <http://www.pumpress.com.cn>

E-mail: booksale@bjmu.edu.cn

印 刷: 北京圣彩虹制版印刷技术有限公司

经 销: 新华书店

责任编辑: 冯智勇 责任印制: 张京生

开 本: 889mm×1194mm 1/16 印张: 21 字数: 650千字

版 次: 2014年7月第1版 2014年7月第1次印刷

书 号: ISBN 978-7-5659-0802-6

定 价: 87.00元

版权所有, 违者必究

(凡属质量问题请与本社发行部联系退换)

影像诊断学基础教程

(第2版)

Learning Radiology

Recognizing the Basics

(Second Edition)

**To my wife, Patricia,
and our family**

Contributor

Daniel J. Kowal, MD

Computed Tomography Division Director

Radiology Elective Director

Department of Radiology

Saint Vincent Hospital

Worcester, Massachusetts

Chapter 20, Magnetic Resonance Imaging

Preface to the First Edition

If you're the kind of person, like I am, who reads the preface after you've read the book, I hope you enjoyed it. If you're the kind of person who reads the preface before reading the book, then you're in for a real treat.

Suppose for a moment that you wanted to know what kind of bird with a red beak just landed on your windowsill (don't ask why). You could get a book on birds that listed all of them alphabetically from albatross to woodpecker and spend time looking at hundreds of bird pictures. Or you could get a book that lists birds by the colors of their beaks and thumb through a much shorter list to find that it was a cardinal.

This is a red-beak book. Where possible, groups of diseases are first described by the way they *look* rather than by what they're *called*. Imaging diagnoses frequently, but not always, rest on a recognition of a reproducible visual picture of that abnormality. That is called the *pattern recognition approach* to identifying abnormalities, and the more experience you have and more proficient you become at looking at imaging studies, the more comfortable and confident you'll be with that approach.

Before diagnostic images can help you decide what disease the patient may have, you must first be able to differentiate between what is normal and what is not. That isn't as easy as it may sound. Recognizing the difference between normal and abnormal probably takes as much, if not more, practice than deciding what disease the person has.

In fact, it takes so much practice, some people—I believe they are called *radiologists*—have actually been known to spend their entire life doing it. You won't be a radiologist after you've completed this book, but you should be able to recognize abnormalities and interpret images better. By so doing, perhaps you can participate in the care of patients with more assurance and confidence.

In this text, you'll spend time in each section learning how to recognize what is normal so that you can differentiate between such things as a skin fold and a pneumothorax or so that you can recognize whether that fuzzy white stuff at the lung bases is pneumonia or the patient simply hasn't taken a deep breath.

Where pattern recognition doesn't work, we'll try whenever possible to give you a logical *approach* to reaching a diagnosis based on simple yet effective decision trees. These will be little decision trees—saplings with only a few branches—so that they are relatively easy to remember.

By learning an approach, you'll have a method you can apply to similar problems again and again. Have you ever heard the saying "Give a man a fish; you have fed him for today. Teach a man to fish, and you have fed him for a lifetime"? Learning an imaging approach is like learning how to fish, except a lot less smelly. An approach will enable you to apply a rational solution to diagnostic imaging problems.

This text was written, in part, to make complementary use of the medium for which radiologic images are ideally suited: the computer screen. The web is ideal for accessing and displaying images, but many people do not want to read large volumes of text from their computer screens. So we've joined the text in the printed book with photos, quizzes, and tutorials available online at StudentConsult.com in a series of *web enhancements* that accompany every chapter.

This text is not intended to be encyclopedic. There are many wonderful radiology reference texts available, some of which contain thousands of pages and weigh slightly less than a Volkswagen. This text is oriented more towards students, interns, and residents or residents-to-be.

Not every imaging modality is covered equally in this book, and some are not covered at all. This book emphasizes conventional radiography because that is the type of study most patients have first and because the same imaging principles that apply to recognizing the diagnosis on conventional radiographs can be applied to making the diagnosis on more complex modalities.

With a better appreciation and understanding of why images look the way they do, you'll soon be recognizing abnormalities and making diagnoses that will impress your mentors and peers and astound your friends and relatives.

Let's get started.

William Herring, MD

Preface to the Second Edition

This second edition of *Learning Radiology: Recognizing the Basics* includes numerous changes and additions. There are additional chapters, over a hundred new photos, reorganization of key material throughout the text, and an increased emphasis on the cross-sectional imaging modalities of computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound.

Two entirely new chapters have been added to help you understand the basic principles and fundamental observations of ultrasound and MRI. Trauma has moved to its own chapter, bringing together related material to provide cohesive coverage of this important subject. A new and helpful appendix has been added, which lists the most appropriate imaging study to order for each of a myriad of clinical scenarios. This information should prove indispensable on clinical rounds.

Many chapters have been reorganized. The chapter on Recognizing Adult Heart Disease has been restructured to include relevant material featuring CT and MRI. The chapters on Diseases of the Chest and Diseases of the GI and Urinary Tracts have been updated with increased emphasis on CT,

ultrasound, and MRI. The chapters on Recognizing Arthritis and Common Causes of Neck and Back Pain incorporate more MRI imaging. The chapter on Recognizing Bowel Obstruction and Ileus now includes additional CT imaging.

There are enhancements to the printed text again available to registered users on the StudentConsult.com website, including access to the full text and all of its photos. Also available on the website are 24 interactive modules to help you learn radiologic anatomy. An algorithm for diagnosing adult heart disease using conventional radiography is available online. A new section on nuclear medicine has also been added to StudentConsult.com.

The first edition suggested that you'd soon be recognizing abnormalities and making diagnoses that would impress your mentors and peers and astonish your friends and relatives. With this edition, you hold the potential to be even more astounding.

Prepare to amaze.

William Herring, MD

Acknowledgments

First, I am grateful to the many thousands of you whom I have never met but who found a website called Learning Radiology helpful, and made it so popular it played a role leading to the first edition of this book, which was so popular that it led to this second edition.

For their help and suggestions, I would like to thank my colleague Mindy Horrow, MD, who read and critiqued several chapters with her usual expert eye and fine mind, and Thomas Reilly, MD, one of our radiology residents, who made invaluable suggestions about how the first edition could be changed. Daniel Kowal, MD, a radiologist who graduated from our program, did an absolutely wonderful job in simplifying the complexities of MRI for a great new chapter he wrote for this edition.

I want to thank Shuchi Rodgers, MD, Jenifer Slone, MD, Susan Summerton, MD, Mindy Horrow, MD, Morrie Kricun,

MD, Huyen Tran, MD, Joanne Lee, MD, Jeffrey Weinstein, MD, and Michael Chen, MD for supplying additional photos for this edition. Thanks to Ryan Smith, MD for reviewing the StudentConsult chapter on nuclear medicine.

I certainly want to recognize and again thank Jim Merritt and Andrea Vosburgh from Elsevier for their continued support and assistance.

I also want to acknowledge the hundreds of radiology residents and medical students who, over the years, have provided me with an audience of motivated learners without whom no teacher could teach.

Finally, I want to thank my wonderful wife, Pat, who has encouraged me throughout the project, and my family.

Contents

Chapter 1

Recognizing Anything: An Introduction to Imaging Modalities 1

- Let There Be Light . . . and Dark, and Shades of Gray 1
- Conventional Radiography (Plain Films) 1
- Computed Tomography (CT or CAT Scans) 1
- Ultrasound (US) 2
- Magnetic Resonance Imaging (MRI) 2
- Terminology 3
- The Best System Is the One That Works 6
- Conventions Used in This Book 7

Chapter 2

Recognizing Normal Chest Anatomy and a Technically Adequate Chest Radiograph 8

- The Normal Frontal Chest Radiograph 8
- The Lateral Chest Radiograph 8
- Five Key Areas on the Lateral Chest X-Ray 8
- Evaluating the Chest Radiograph for Technical Adequacy 12

Chapter 3

Recognizing Airspace Versus Interstitial Lung Disease 18

- Classifying Parenchymal Lung Disease 18
- Characteristics of Airspace Disease 18
- Some Causes of Airspace Disease 18
- Characteristics of Interstitial Lung Disease 20
- Some Causes of Interstitial Lung Disease 22

Chapter 4

Recognizing the Causes of an Opacified Hemithorax 27

- Atelectasis of the Entire Lung 27
- Massive Pleural Effusion 27
- Pneumonia of an Entire Lung 27
- Postpneumonectomy 28

Chapter 5

Recognizing Atelectasis 32

- What Is Atelectasis? 32
- Signs of Atelectasis 32
- Types of Atelectasis 32
- Patterns of Collapse in Lobar Atelectasis 37
- How Atelectasis Resolves 39

Chapter 6

Recognizing a Pleural Effusion 40

- Normal Anatomy and Physiology of the Pleural Space 40
- Causes of Pleural Effusions 40
- Types of Pleural Effusions 40
- Side Specificity of Pleural Effusions 40
- Recognizing the Different Appearances of Pleural Effusions 41
- Loculated Effusions 45

Chapter 7

Recognizing Pneumonia 50

- General Considerations 50
- General Characteristics of Pneumonia 50

- Patterns of Pneumonia 50
- Aspiration 54
- Localizing Pneumonia 55
- How Pneumonia Resolves 57

Chapter 8

Recognizing Pneumothorax, Pneumomediastinum, Pneumopericardium, and Subcutaneous Emphysema 59

- Recognizing a Pneumothorax 59
- Recognizing the Pitfalls in Overdiagnosing a Pneumothorax 59
- Types of Pneumothoraces 61
- Causes of a Pneumothorax 62
- Other Ways to Diagnose a Pneumothorax 62
- Pulmonary Interstitial Emphysema 63
- Recognizing Pneumomediastinum 64
- Recognizing Pneumopericardium 65
- Recognizing Subcutaneous Emphysema 66

Chapter 9

Recognizing Adult Heart Disease 68

- Recognizing an Enlarged Cardiac Silhouette 68
- Pericardial Effusion 68
- Extracardiac Causes of Apparent Cardiac Enlargement 68
- Effect of Projection on Perception of Heart Size 68
- Identifying Cardiac Enlargement on an Anteroposterior Chest Radiograph 68
- Recognizing Cardiomegaly on the Lateral Chest Radiograph 69
- Recognizing Cardiomegaly in Infants 70
- Normal Cardiac Contours 70
- Normal Pulmonary Vasculature 70
- General Principles of Cardiac Imaging 71
- Recognizing Common Cardiac Diseases 71

Chapter 10

Recognizing the Correct Placement of Lines and Tubes: Critical Care Radiology 86

- Endotracheal and Tracheostomy Tubes 86
- Intravascular Catheters 88
- Pulmonary Drainage Tubes (Chest Tubes, Thoracotomy Tubes) 91
- Cardiac Devices 93
- Gastrointestinal Tubes and Lines 95

Chapter 11

Computed Tomography: Understanding the Basics and Recognizing Normal Anatomy 98

- Introduction to CT 98
- Intravenous Contrast in CT Scanning 99
- Oral Contrast in CT Scanning 99
- Normal Chest CT Anatomy 100
- Cardiac CT 103
- Abdominal CT 105

Chapter 12

Recognizing Diseases of the Chest 109

- Mediastinal Masses 109
- Anterior Mediastinum 109
- Middle Mediastinum 112
- Posterior Mediastinum 113

Solitary Nodule/Mass in the Lung 113
 Bronchogenic Carcinoma 116
 Metastatic Neoplasms in the Lung 119
 Pulmonary Thromboembolic Disease 120
 Chronic Obstructive Pulmonary Disease 120
 Blebs and Bullae, Cysts and Cavities 122
 Bronchiectasis 123

Chapter 13

Recognizing the Normal Abdomen: Conventional Radiographs 127

What to Look For 127
 Normal Bowel Gas Pattern 127
 Normal Fluid Levels 127
 Differentiating Large from Small Bowel 128
 Acute Abdominal Series: The Views and What They Show 129
 Calcifications 133
 Organomegaly 133

Chapter 14

Recognizing Bowel Obstruction and Ileus 138

Abnormal Gas Patterns 138
 Laws of the Gut 138
 Functional Ileus, Localized: Sentinel Loops 138
 Functional Ileus, Generalized: Adynamic Ileus 139
 Mechanical Obstruction: Small Bowel Obstruction (SBO) 139
 Mechanical Obstruction: Large Bowel Obstruction (LBO) 144
 Volvulus of the Colon 146
 Intestinal Pseudo-obstruction (Ogilvie Syndrome) 146

Chapter 15

Recognizing Extraluminal Air in the Abdomen 148

Signs of Free Intraperitoneal Air 148
 Causes of Free Air 149
 Signs of Extraperitoneal Air (Retroperitoneal Air) 150
 Causes of Extraperitoneal Air 150
 Signs of Air in the Bowel Wall 151
 Causes and Significance of Air in the Bowel Wall 153
 Signs of Air in the Biliary System 154
 Causes of Air in the Biliary System 154

Chapter 16

Recognizing Abnormal Calcifications and Their Causes 156

Patterns of Calcification 156
 Rimlike Calcification 156
 Linear or Tracklike Calcification 156
 Lamellar or Laminar Calcification 156
 Cloudlike, Amorphous, or Popcorn Calcification 158
 Location of Calcification 159

Chapter 17

Recognizing the Imaging Findings of Trauma 164

Chest Trauma 164
 Aortic Trauma 164
 Abdominal Trauma 167
 Pelvic Trauma 169

Chapter 18

Recognizing Gastrointestinal, Hepatic, and Urinary Tract Abnormalities 172

Barium Studies of the Gastrointestinal Tract 172
 Esophagus 172
 Stomach and Duodenum 174
 Small and Large Bowel 176
 Pancreas 183
 Hepatobiliary Abnormalities 184
 Urinary Tract 189

Pelvis 190
 Urinary Bladder 190

Chapter 19

Ultrasonography: Understanding the Principles and Recognizing Normal and Abnormal Findings 193

How it Works 193
 Doppler Ultrasonography 193
 Adverse Effects and Safety Issues 194
 Medical Uses of Ultrasonography 194
 Biliary System 194
 Urinary Tract 197
 Abdominal Aortic Aneurysms 198
 Female Pelvic Organs 198
 Appendicitis 203
 Pregnancy 203
 Vascular Ultrasound 206
 Deep Venous Thrombosis 207

Chapter 20

Magnetic Resonance Imaging: Understanding the Principles and Recognizing the Basics 209

DANIEL J. KOWAL

How MRI Works 209
 Hardware That Makes Up an MRI Scanner 209
 What Happens Once Scanning Begins 210
 Pulse Sequences 210
 How Can You Identify a T1-Weighted or T2-Weighted Image? 211
 MRI Contrast: General Considerations 213
 MRI Safety Issues 215
 Diagnostic Applications of MRI 217

Chapter 21

Recognizing Abnormalities of Bone Density 218

Normal Bone Anatomy 218
 The Effect of Bone Physiology on Bone Anatomy 218
 Recognizing a Generalized Increase in Bone Density 219
 Recognizing a Focal Increase in Bone Density 221
 Recognizing a Generalized Decrease in Bone Density 223
 Recognizing a Focal Decrease in Bone Density 226
 Pathologic Fractures 229

Chapter 22

Recognizing Fractures and Dislocations 232

Recognizing an Acute Fracture 232
 Recognizing Dislocations and Subluxations 232
 Describing Fractures 232
 Avulsion Fractures 237
 Salter-Harris Fractures: Epiphyseal Plate Fractures in Children 238
 Child Abuse 240
 Stress Fractures 241
 Common Fracture Eponyms 241
 Some Easily Missed Fractures or Dislocations 241
 Fracture Healing 244

Chapter 23

Recognizing Joint Disease: An Approach to Arthritis 249

Anatomy of a Joint 249
 Classification of Arthritis 249
 Hypertrophic Arthritis 249
 Erosive Arthritis 255
 Infectious Arthritis 259

Chapter 24

Recognizing Some Common Causes of Neck and Back Pain 261

Conventional Radiology, MRI, and CT 261
 The Normal Spine 261
 Back Pain 263
 Herniated Disks 264

Degenerative Disk Disease 264
Osteoarthritis of the Facet Joints 265
Diffuse Idiopathic Skeletal Hyperostosis 266
Compression Fractures of the Spine 266
Spondylolisthesis and Spondylolysis 267
Spinal Stenosis 267
Malignancy Involving the Spine 268
MRI in Metastatic Spine Disease 269
Infections of the Spine: Diskitis and Osteomyelitis 271
Spinal Trauma 271

Chapter 25

Recognizing Some Common Causes of Intracranial Pathology 276

Normal Anatomy 276
MRI and the Brain 276

Head Trauma 278
Intracranial Hemorrhage 281
Diffuse Axonal Injury 283
Increased Intracranial Pressure 285
Stroke 285
Ruptured Aneurysms 288
Hydrocephalus 289
Cerebral Atrophy 293
Brain Tumors 293
Multiple Sclerosis 296
Terminology 297

Appendix: **Recognizing What to Order 299**

Bibliography 304

Last Printed Page 318

