

MEDICAL RADIOLOGY

Diagnostic Imaging

Editors:
A. L. Baert, Leuven
K. Sartor, Heidelberg

Springer-Verlag Berlin Heidelberg GmbH

S. Grampp (Ed.)

Radiology of Osteoporosis

With Contributions by

J. E. Adams · R. Barkmann · P. M. Bernecker · D. Diacinti · K. Engelke
H. K. Genant · C.-C. Glüer · G. Guglielmi · S. Grampp · R. Gruber · G. Holzer · H. Imhof
M. Jergas · C. Krestan · T. M. Link · M. Peterlik · P. Pietschmann · S. Prevrhal
H. Resch · R. R. van Rijn · C. van Kuijk

Foreword by

A. L. Baert

Preface by

H. Imhof

With 138 Figures in 178 Separate Illustrations, 5 in Color and 14 Tables



Springer

STEPHAN GRAMPP, MD
Professor, Universitätsklinik für Radiodiagnostik
Abteilung für Osteologie
Allgemeines Krankenhaus
Währinger Gürtel 18–20
1090 Wien
Austria

MEDICAL RADIOLOGY · Diagnostic Imaging and Radiation Oncology
Series Editors: A. L. Baert · L. W. Brady · H.-P. Heilmann · F. Molls · K. Sartor

Continuation of
Handbuch der medizinischen Radiologie
Encyclopedia of Medical Radiology

ISBN 978-3-662-05237-2

Library of Congress Cataloging-in-Publication Data

Radiology of osteoporosis / S. Grampp with contributions by J. Adams ... [et al.].

p. ; cm. -- (Medical radiology)

Includes bibliographical references and index.

ISBN 978-3-662-05237-2 ISBN 978-3-662-05235-8 (eBook)

DOI 10.1007/978-3-662-05235-8

1. Osteoporosis--Radiography. 2. Osteoporosis. I. Grampp, S. (Stephan), 1963-II.

Adams, J. (Judith) III. Series.

[DNLN: 1. Osteoporosis--diagnosis. 2. Densitometry. 3. Diagnostic

Imaging--methods. 4. Osteoporosis--physiopathology. WE 250 R129 2002]

RC931.O73 R33 2002

616.7'16--dc21

2001049141

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitations, broadcasting, reproduction on microfilm or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer-Verlag Berlin Heidelberg GmbH.

Violations are liable for prosecution under the German Copyright Law.

<http://www.springer.de>

© Springer-Verlag Berlin Heidelberg 2003

Originally published by Springer-Verlag Berlin Heidelberg New York in 2003

Softcover reprint of the hardcover 1st edition 2003

The use of general descriptive names, trademarks, 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.

Product liability: The publishers cannot guarantee the accuracy of any information about dosage and application contained in this book. In every case the user must check such information by consulting the relevant literature.

Cover-Design and Typesetting: Verlagsservice Teichmann, 69256 Mauer

SPIN: 10753516

21/3130 – 5 4 3 2 1 0 – Printed on acid-free paper

Foreword

Due to the aging population in the Western world, osteoporosis has become a major problem which is of interest to several medical disciplines: not only radiologists but also gynecologists, endocrinologists, rheumatologists, and orthopedic surgeons are involved in the management of this widespread condition.

Functional imaging is becoming rapidly an important area of diagnostic radiology. Imaging of osteoporosis is another application of this recent addition to the armory of radiology.

It is important that radiologists should be fully aware of the range of diagnostic modalities – conventional radiologic methods, dual X-ray absorptiometry, quantitative computed tomography, quantitative ultrasound, magnetic resonance imaging, etc. – that are now available for the diagnosis and the follow-up of osteoporosis, and know how to apply these sophisticated methods in daily clinical practice.

Dr. S. Grampp is a radiologist with a longstanding interest in osteoporosis, and his previous publications on this condition are internationally known. He has been very successful in engaging several outstandingly qualified experts to contribute to the individual chapters of this superb book, which provides a comprehensive overview of our current knowledge of osteoporosis.

I am confident that this volume will meet with great interest from radiologists and all other clinicians involved in the care of patients with osteoporosis and will encounter the same success as many previous volumes in this series.

Leuven

ALBERT L. BAERT

Preface

The drastic increase in the incidence of osteoporosis in our population requires up-to-date knowledge on the newest perspectives in pathophysiology and the most recent developments in diagnosis and therapy. This textbook sets out to provide such a perspective with the help of prominent, world-renowned scientists in these disciplines. The reader will find comprehensive and detailed information on the aging of bone, on abnormal findings in rheumatoid disorders, and on the latest therapeutic strategies.

Today's highly sophisticated diagnostic modalities involve conventional radiography as well as quantitative methods, DXA, QCT and pQCT, vertebral morphometry, and quantitative ultrasound. The section on diagnosis concludes with the very promising techniques of MRI and different high-resolution methods.

The last chapter of the book brings us back to our daily clinical practice and outlines the advantages of the different diagnostic methods and also their pitfalls.

I have to congratulate all of the authors for their excellent contributions, but particularly I have to thank also my colleague Prof. Stephan Grampp for putting together such an absolutely necessary volume. I warmly recommend it to all radiologists and clinicians involved in the research, diagnosis, and treatment of osteoporosis.

Vienna

H. IMHOF

Contents

What Can we Expect to Find?	1
1 Pathophysiology and Aging of Bone	3
P. PIETSCHMANN, R. GRUBER, and M. PETERLIK	
2 Pathophysiology in Rheumatoid Arthritis and Other Disorders	25
H. RESCH	
3 Therapeutic Approaches and Mechanisms of Drug Action	35
P. M. BERNECKER	
4 Orthopedic Surgery	51
G. HOLZER	
How Should we See and Measure?	59
5 Conventional Radiographs and Basic Quantitative Methods	61
M. JERGAS	
6 Dual-Energy X-Ray Absorptiometry	87
J. E. ADAMS	
7 Vertebral Morphometry	101
G. GUGLIELMI and D. DIACINTI	
8 Spinal Quantitative Computed Tomography	111
C. VAN KUIJK and R. R. VAN RIJN	
9 Peripheral Quantitative Computed Tomography	115
S. PREVRHAL, K. ENGELKE, and H. K. GENANT	
10 Quantitative Ultrasound	131
R. BARKMANN and C.-C. GLÜER	
11 Magnetic Resonance Imaging	143
T. M. LINK	
12 Structure Analysis Using High Resolution Imaging Techniques	153
T. M. LINK	

What do we Use in Practice?	165
13 Densitometry in Clinical Practice	167
S. GRAMPP	
14 Practical Cases	175
C. KRESTAN and H. IMHOF	
Subject Index	197
List of Contributors	201