Imaging of Vertebral Trauma

Third Edition

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CAMBRIDGE
UNIVERSITY PRESS

CAMBRIDGE UNIVERSITY PRESS
Cambridge, New York, Melbourne, Madrid, Cape Town,
Singapore, São Paulo, Delhi, Dubai, Tokyo, 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
Information on this title: www.cambridge.org/9780521897013

First Edition published by Aspen Publishers 1988
Second Edition published by Lippincott–Raven Publishers 1996
Third Edition published by Cambridge University Press 2011

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

ISBN 978-0-521-89701-3 Hardback

In remembrance of Morris M. Daffner, William F. Barry, Jr., MD, and George J. Baylin, MD – teachers, scholars, and friends – and Earl L. Weaver III, whose example inspired all

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Preface to the Third Edition

The imaging methods used to evaluate patients with suspected vertebral injuries have undergone radical changes since the publication of the second edition of *Imaging of Vertebral Trauma* in 1996. The most significant of these changes has been the ascendency of computed tomography (CT) to become the primary tool for studying these patients. Radiography now assumes a secondary role, serving mainly for follow-up of known injuries or as a tool to solve problems with CT studies, such as motion or metallic artifacts. Furthermore, there has been an ongoing dialog in the radiologic and trauma literature regarding the indications for imaging in trauma patients, as well as the methods of choice. Of most recent note are the issues of high-radiation dose associated with CT studies as well as the continuing debates on health care reform and cost containment.

The first edition dealt mainly with radiography supplemented with polydirectional or computed tomography and magnetic resonance (MR) imaging. The second edition expanded the discussion of the roles of MR in vertebral injuries. This new edition presents an in-depth discussion on the indications and methods of imaging the spine based on the evidence available in the current literature. Each chapter has been revised with those precepts in mind and the majority of the illustrations have been changed to represent state-of-the-art imaging. There are still a large number of radiographs since they present teaching points on principles that transfer directly to CT studies. Furthermore, this book is used in parts of the world where high-speed multislice CT scanners may not be available, as they are in the United States. The section on imaging has been divided into three chapters: an introduction, radiography and CT, and MR imaging. A new chapter on pediatric injuries has been added by Drs. George El-Khoury and Geetika Khanna. Dr. Bryan Smith has revised and updated the chapter on MR imaging.

I hope that the third edition of *Imaging of Vertebral Trauma* will continue to fill the gaps that were present in the first two editions and that it will provoke a thoughtful reassessment of the imaging of patients with suspected vertebral or spinal cord injury.

Richard H. Daffner, MD, FACR

Preface to the Second Edition

Since the publication of the first edition of *Imaging of Vertebral Trauma* in 1988, major developments have been made in the evaluation of patients with suspected vertebral injury. Most of these have been in the realm of magnetic resonance imaging, but new reports have also given us a better understanding of some important anatomic relationships. There is a greater awareness of the subtle signs of injury, and there has been a reassessment of exactly how "significant" many of them may be. The current emphasis on health care reform and cost containment has prompted a reassessment of indications for radiography and computerized imaging of the vertebral column.

The first edition dealt mainly with plain film radiography supplemented with polydirectional or computed tomography and magnetic resonance imaging. This edition continues that focus by addressing some of the new issues that have surfaced since 1988. In addition, two contributing authors have written chapters. Dr. Andrew L. Goldberg, a neuroradiologic colleague of mine at Allegheny General Hospital, has written an indepth review of the use of magnetic resonance imaging in the diagnosis of vertebral and spinal cord injuries. Dr. Stanley P. Bohrer, a musculoskeletal radiologist at Bowman Gray School of Medicine, has written a chapter on the use of flexion and extension radiographs in patients with suspected ligamentous injuries in the cervical region. A third new chapter deals with the biomechanics of the vertebral column and biomechanical considerations in vertebral injury. The topic of vertebral stability and instability is now described in a chapter of its own. Finally, each chapter has been carefully reviewed and revised to reflect the state of the art in vertebral imaging, and the index has been expanded and made more user friendly. As the centennial of the discovery of the roentgen ray is celebrated, we should be cognizant of how far we have come in so short a time.

I hope that the second edition of *Imaging of Vertebral Trauma* will fill the gaps that were present in the first edition and that it will provoke a thoughtful reassessment of the imaging of patients with suspected vertebral or spinal cord injury.

Richard H. Daffner, MD

Preface to the First Edition

Vertebral trauma is a major cause of permanent disability. Although there has been an increasing number of vertebral injuries due to motor vehicle accidents, improved medical technology has salvaged the lives of individuals who suffer what were once considered uniformly fatal injuries. The key to the administration of prompt therapy and rehabilitation is the ability to properly diagnose the full extent of these injuries. The discovery of the roentgen ray was the first major technological breakthrough in diagnosing vertebral trauma, and this method remained the chief method for diagnosis until the development of computed tomography and magnetic resonance imaging. With these methods it is now possible to define the full extent of injury and, in the latter method, to determine the extent of spinal cord involvement.

I became interested in the subject of vertebral injury through my long and close association with Dr. John A. Gehweiler, Jr., who described many signs of subtle injury to the cervical vertebrae. The advent of multiplanar imaging confirmed the validity of the signs described by Dr. Gehweiler and other individuals interested in vertebral trauma. This book grew out of a series of lectures that I have given over the past decade and represents a systematic and practical approach to the radiography of vertebral trauma. This book is not encyclopedic in scope and does not describe every variation of every type of vertebral injury. It does, however, provide a working basis for the practicing radiologist in the community hospital as well as in the large medical center, who is often the first person called on to interpret radiographs of a patient with vertebral injury. The book relies on the premise that all injuries (vertebral and nonvertebral) occur in a predictable and reproducible fashion that is solely dependent on the mechanism of injury. As such, each type of injury produces indelible signs that I have termed "fingerprints." By following this logical approach and by applying the principles outlined in the text, the reader will gain confidence in his or her diagnostic skills and ability to diagnose even the most subtle injury.

Richard H. Daffner, MD

Acknowledgments

No book of this scope could be produced without the technical assistance of many individuals. I am extremely grateful to Maggie Cauley for her efforts in manuscript preparation, editing, and collation. I am indebted to Donna Spillane, of the Creative Services Department of Allegheny General Hospital, for production of the original illustrations. I thank Randy McKenzie, medical illustrator, for the new drawings as well as Scott Williams for the superb original artwork. Many thanks to Peter Brondar, of the Computer Laboratory at Carnegie Mellon University, for rescuing electronic images from the previous editions and restoring them so they could be used. I also acknowledge the artwork of Debbie Whitman and Maurice Williams, as well as the photography of Gary Stark and Douglas Whitman for the illustrations that were reused from the first and second editions of *Imaging of Vertebral Trauma*. For their assistance in clinical correlation of the case material in the book, I wish to thank Aurelio Rodreguez, MD, Head of the Trauma Center of Allegheny General Hospital, and his colleagues. Finally I thank my dear wife, Alva, for her encouragement, support, and patience, as well as her editorial skills in proofreading and editing the manuscript.