

Spine Essentials Handbook

A Bulleted Review of Anatomy,
Evaluation, Imaging, Tests, and Procedures

Kern Singh



 Thieme

Spine Essentials Handbook

**A Bulleted Review of Anatomy, Evaluation, Imaging, Tests,
and Procedures**

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165 illustrations

Thieme
New York • Stuttgart • Delhi • Rio de Janeiro

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Illustrations drawn by Andrea Hines and Alyssa Minatel

Library of Congress Cataloging-in-Publication Data

Names: Singh, Kern, editor.
Title: Spine essentials handbook : a bulleted review of anatomy, evaluation, imaging, tests, and procedures / Kern Singh, MD.
Description: First edition. | New York : Thieme, [2019] | Includes bibliographical references. |
Identifiers: LCCN 2018041349 (print) | LCCN 2018047944 (ebook) | ISBN 9781626235106 (e-book) | ISBN 9781626235076 (print) | ISBN 9781626235106 (ebook)
Subjects: LCSH: Spine—Surgery—Handbooks, manuals, etc.
Classification: LCC RD768 (ebook) | LCC RD768 .S6744 2019 (print) | DDC 617.5/6059—dc23
LC record available at <https://lccn.loc.gov/2018041349>

© 2019 Thieme Medical Publishers, Inc.

Thieme Publishers New York
333 Seventh Avenue, New York, NY 10001 USA
+1 800 782 3488, customerservice@thieme.com

Thieme Publishers Stuttgart
Rüdigerstrasse 14, 70469 Stuttgart, Germany
+49 [0]711 8931 421, customerservice@thieme.de

Thieme Publishers Delhi
A-12, Second Floor, Sector-2, Noida-201301
Uttar Pradesh, India
+91 120 45 566 00, customerservice@thieme.in

Thieme Publishers Rio de Janeiro, Thieme Publicações Ltda.
Edifício Rodolpho de Paoli, 25ª andar
Av. Nilo Peçanha, 50 – Sala 2508,
Rio de Janeiro 20020-906 Brasil
+55 21 3172-2297 / +55 21 3172-1896
www.thiemerevinter.com.br

Cover design: Thieme Publishing Group
Typesetting by DiTech Process Solutions

Printed in The United States of America
by King Printing Company, Inc.

5 4 3 2 1

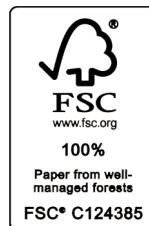
ISBN 978-1-62623-507-6

Also available as an e-book:
eISBN 978-1-62623-510-6

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I dedicate this book to my father. As I now progress into parenthood, I realize the sacrifices you made for me. Never ending patience, bountiful amounts of time, and a dedication to giving me every opportunity to succeed.

- *K. Singh*

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Preface

The *Spine Essentials Handbook* was produced as a portable resource that is easily accessible to all medical professionals. The detailed information, ranging from basic neuroanatomy to spinal pathology to surgical intervention, allows the reader to fully grasp the complexity of the spine. This holistic compilation helps the audience become comfortable with the intricacy of the spine before entering a clinic or the operating room. The clear depiction of complex spinal anatomy overlaid with real-time intraoperative pictures facilitates an understanding of the nuances associated with spine surgery. As any surgery demands efficiency, the accompanying text provides an in-depth coverage of technique as well as pearls to help execute the operation expeditiously. Lastly, the handbook outlines possible complications associated with spine surgery with suggestions for prevention.

The text offers up-to-date knowledge in the quickly advancing field of spinal anatomy, pathology, and surgery. With comprehensive images, cross-sectional illustrations, and emphasis on potential difficulties, this handbook allows for improved expertise on surgical procedures and postoperative care. Clinical questions included at the end of this e-book are provided to help test and solidify your knowledge and comprehension about the complexities of spine and spinal surgery.

This handbook will be of value to not only surgeons and surgical trainees, but also for the other surgical staff involved in the medical care of spine surgery patients. We are optimistic that the *Spine Essentials Handbook* will grant readers a better understanding of the delicacies of spine surgery.

Kern Singh, MD

Acknowledgements

We would like to thank all of those who assisted in the creation of this book. In particular, we would like to acknowledge

Brittany Haws and Benjamin Khechen for their efforts in seeing this book to completion.

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1 Neuroanatomy and Physiology

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1.1 Neuron Anatomy

- Basic components (**Table 1.1, Fig. 1.1**).
- Synaptic junction and signal transmission:
 - Mechanism of basic chemical synapses (**Fig. 1.3**).
 - Action potential (depolarization) reaches terminal branch of the presynaptic neuron.
 - N-type Ca^{2+} channels open, Ca^{2+} influx.
 - *Associated pathologies*: Lambert–Eaton myasthenic syndrome.
 - Ca^{2+} facilitates vesicle docking, neurotransmitter released into synaptic cleft.
 - *Associated pathologies*: botulism, tetanus (lockjaw).
 - Neurotransmitter binds neurotransmitter receptor (postsynaptic neuron).
 - *Associated pathologies*: myasthenia gravis.
 - Depending on its function, the neurotransmitter receptor creates either an excitatory postsynaptic potential (EPSP) or an inhibitory postsynaptic potential (IPSP).

Table 1.1 Basic anatomy of the neuron

Component	Function
Dendrites	Receive signals from other neurons for transfer toward the cell body
Cell body (soma)	Contains cell nucleus. Site of protein and ATP production
Axon hillock	Portion of cell body that connects to axon. Final site of action potential summation (trigger zone)
Axon	Carries action potential from cell body to terminal branches
Myelin sheath	Fatty insulating layer around axon that facilitates action potential through saltatory conduction. <ul style="list-style-type: none"> • Oligodendrocytes myelinate neurons of the central nervous system (CNS). A single oligodendrocyte myelinates multiple neurons (Fig. 1.2a). • Schwann's cells myelinate neurons of the peripheral nervous system (PNS). Multiple Schwann's cells myelinate a single neuron (Fig. 1.2b).
Nodes of Ranvier	Occasional interruptions in the myelin sheath that expose the axonal membrane. Contain a high density of voltage-gated Na^+ and K^+ channels and Na^+/K^+ ATPases, which act to regenerate the action potential.
Terminal branches (boutons) of axon	Branched terminal portion of an axon. Site of neurotransmitter release into the synaptic cleft. Often referred to as the presynaptic terminal.