Pathogenesis of Idiopathic Scoliosis

Masafumi Machida • Stuart L. Weinstein
Jean Dubousset
Editors

Pathogenesis of Idiopathic Scoliosis

Springer

Editors
Masafumi Machida
Department of Spine and Spinal Cord Surgery
Yokohama Brain and Spine Center
Yokohama, Kanagawa, Japan

Stuart L. Weinstein
University of Iowa
Iowa, USA

Jean Dubousset
Academie Nationale de Medecine
Paris, France

ISBN 978-4-431-56539-0 ISBN 978-4-431-56541-3 (eBook)
https://doi.org/10.1007/978-4-431-56541-3

Library of Congress Control Number: 2017964308

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer Japan KK
The registered company address is: Shiroyama Trust Tower, 4-3-1 Toranomon, Minato-ku, Tokyo 105-6005, Japan

Foreword

I first met Dr Masafumi Machida in 1989, when he came to France with a Cotrel Fellowship program, for a training on CD instrumentation.

Years later, in 2000, one of his research projects on etiopathogenesis of idiopathic scoliosis was selected by the members of the scientific Board of the Fondation Cotrel. Ever since then, I have witnessed his dedication to attending the annual meetings in Paris, sharing his progresses with all the researchers.

As the founder of the Fondation Cotrel for spinal research—Institut de France and as a friend, it is now my pleasure to write a few words for this book dedicated to the pathogenesis of idiopathic scoliosis.

I am pleased to see such a book being published.

I have known most of the authors—if not all of them—for many years. I know of their dedication to fundamental basic science and research as well as clinical work on this topic.

Despite the obvious major improvements of the last four decades for the surgical treatment of scoliosis, the scientific explanation of its occurrence will be a great step forward.

I am sure the readers of this book will find the historic aspect as well as a real update of this problem of high interest.

This book brings up the most recent results as well as some openings for future works, leading one day, hopefully, to the prevention of such disorder.

These works put the stress on the importance of the most early detection possible and the risk of progression, in order to start the proper treatment and get the best result possible. The purpose is to avoid the surgery: even though the techniques have improved, they still ankylose, at more or less extent, the spinal organ.

I want to thank Professor Machida and the authors who have participated into this book for sharing their scientific knowledge, hopes and aims oriented toward a better and comprehensive understanding of the initiation of the disease.

This will, no doubt, benefit to the patients and their families.

Docteur Yves Cotrel

Preface

Idiopathic scoliosis comprises a three-dimensional deformity of the spine with lateral curvature combined with vertebral rotation that develops in the absence of congenital spinal anomaly or neurologic musculoskeletal disorders. First described by Hippocrates, the entity became known as “idiopathic scoliosis”, the term probably introduced in the middle of nineteenth century by Bauer, used by Nathan in 1909 and defined by Whitman in 1922.

A number of genetic, biochemical, skeletal and neuromuscular abnormalities have emerged as contributing elements in the pathogenesis of idiopathic scoliosis in humans and experimentally induced scoliosis in animals. These multiple factors, however, may constitute its epiphenomena rather than etiologic causes. More recent studies using magnetic resonance imaging have aimed to investigate the potential contribution of the central nervous system. Developments in diffusion tensor imaging allows the assessment of white matter microstructure such as synchronization of axonal myelination and pruning. Advances in human genome mapping and genetic methodology has made it possible to screen the entire genome of an individual with genetic markers evenly spaced along the chromosomes. Using this technique, called positional cloning or linkage analysis, recent genome-wide association study yielded candidate genes that implicate neuromuscular disease origins. Next-generation genomic technologies may enable the creation of idiopathic scoliosis mutations in the animal model.

A couple of text books dealing with this subject matter are already available: “Pathogenesis of Idiopathic Scoliosis” by Scoliosis Research Society in 1983 and “The Aetiology of Idiopathic Scoliosis” by Gordon Robin in 1990. Since their publication, a large number of articles appeared relative to pathogenesis of idiopathic scoliosis. We have incorporated these new data in preparing the current volume. I have asked my mentors, Dr. Jean Dubousset, to describe the definition of idiopathic scoliosis and Dr. Stuart Weinstein, to summarize its natural history based on his own Iowa experience. Both also served as editors of the remaining chapters, which introduce new concepts and current topics in each area of pathogenies of idiopathic scoliosis.

A majority of investigators now regard idiopathic scoliosis as a multifactorial disease with genetic predisposing factors. In most current studies, observed abnormalities may represent secondary features of the disease, making it difficult to distinguish the primary cause of the disease. We hope future studies will identify various factors directly involved in the causation of this disorder. Only then, we will be able to elaborate on its effective treatment and undertake plans for its eventual eradication.

Yokohama, Japan Masafumi Machida

Contents