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# Pediatric Lower Limb Deformities



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Sanjeev Sabharwal  
Editor

# Pediatric Lower Limb Deformities

Principles and Techniques of Management

 Springer

*Editor*

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*To all children with limb deformities and their caregivers.*



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## Foreword

“There is only one child in the world and the Child’s name is All Children.” Thus did the poet Carl Sandburg succinctly describe the universal appeal of children and humankind’s concern for child welfare, health, and happiness. The most successful charitable organizations, such as Easter Seals (originally, the National Society for Crippled Children) and the March of Dimes (originally, the National Foundation for Infantile Paralysis), continue to focus fundraising and service projects on children with birth defects and developmental and acquired deformities and disorders.

Likewise, major service organizations and clubs, including the Shriners and the Scottish Rite Freemasons, point to their respective children’s hospitals with pride and a sense of accomplishment. All of these efforts, which occupy so much time and energy, are directed towards a single goal: helping clinicians and researchers cure or relieve those conditions that prevent a child from reaching his or her full potential. In this regard, there is no higher calling that a human being could possibly undertake than being a frontline soldier in the battle against childhood diseases, disorders, and deformities.

Up until the mid-twentieth century, surgery focused on correcting pediatric congenital, developmental, and acquired musculoskeletal defects and deformities had a limited capacity to obtain full restoration of function. Often times, amputation proved the most practical means of achieving maximal functional capacity for a child with certain limb deficiencies. Correction of angular long bone deformities, for example, involved wedge resection of osseous tissue that would certainly improve the angulation but left the youngster with the need for clunky shoes or braces (or both) to get around.

In 1951, Prof. G. A. Ilizarov discovered how to create new osseous tissue in a widening distraction gap. He worked in far-off Siberia, alone at first, away from the prying eyes of Soviet colleagues, giving him a chance to learn by trial and error the parameters of his evolving methodology. More than 30 years elapsed before surgeons in Western countries learned of Ilizarov’s discoveries. By then, techniques and instrumentation had been perfected, basic science research was completed, and a massive Medical Center had been constructed in Kurgan, USSR, all to provide care to children and adults with musculoskeletal conditions never before thought treatable.

As a result, the Methods of Ilizarov first appeared in Western medicine as a mature system of treatment, capable of achieving stunning results. In a sense, the situation resembled the appearance of Nike Athena in Greek mythology, who sprung as a fully grown adult from the head of Zeus, armor-clad and battle-ready.

In the 25 years since the introduction of Ilizarov’s therapeutic strategies into Western medicine, ingenious surgeons have found ways to combine Ilizarov’s distraction osteogenesis with well-established principles of deformity correction, growth rate prediction, and soft tissue releases to yield new and ever-evolving paradigms to deal most effectively with conditions that interfere with a child’s full participation in life’s activities.

Although these combined surgical techniques are reported piecemeal in journal articles and at open meetings, there has not been, until now, a textbook updating the current principles of pediatric deformity correction in a comprehensive way. The volume you are holding in your hands was specifically designed to overcome such a deficiency. Dr. Sabharwal has prevailed upon leading practitioners of these modern strategies to write chapters in their fields of interest

and clinical research. As a result, this book is a remarkable compendium of primary source material that will aid clinicians around the world in treating lower limb deformities of childhood.

My only regret is that visionary founders of the charitable organizations and service clubs who dedicated so much effort to establish children's hospitals and child-centered research and support enterprises are not alive today to see what has become of their dreams and hard work. They would be amazed, that's for sure!

Orange, CA, USA

Stuart A. Green, MD



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## Preface

In titling his 1741 book, Nicolas Andry coined the phrase *Orthopédie* from two Greek words: *orthos*, “straight, correct,” and *paiedeia*, “rearing of children.” While the field of orthopedics has branched further into a number of subspecialties affecting various body parts in the young and old, Andry’s original illustration of a straight stake tied to a crooked sapling has withstood the test of time. However, despite the ubiquitous presence of lower limb deformities in children globally (albeit with varied etiologies), a textbook devoted to the treatment of the “crooked child” is sorely missing from the current literature.

This unique text is primarily intended for orthopedic surgeons and trainees worldwide who have an interest in pediatric lower limb deformities. This book is not meant to be a “how to apply an external fixator to the tibia” type of manual, but rather a broad-based text highlighting both general principles and specific strategies for managing the entire spectrum of pediatric lower limb deformities, applying to circumstances of various etiology and resource availability. The authors of the 32 chapters are well-known leaders in the field of pediatric lower limb deformities, and I am truly indebted to every one of them and their coauthors for their excellent contributions. I invited these contributors not only on the basis of their expertise in the field but also in light of the diversity of their working environments and unique challenges that they face when treating children with limb deformities.

This book is divided into five parts, although each chapter can serve as a standalone guide for the clinician dealing with a specific patient. Part I highlights the general principles and techniques, including patient evaluation, decision making, and various surgical methods for deformity correction. Part II deals with related concepts, including management of soft tissue contractures, amputation, and working in resource-challenged environments. Part III includes lower limb deformities associated with specific metabolic, neuromuscular, and tumor-related conditions, as well as skeletal dysplasias. Part IV covers specific congenital and developmental disorders of the lower extremity. Finally, Part V explores various sequelae and complications associated with lower extremity deformities in the growing child. All authors were encouraged to incorporate relevant figures, tables, and highlight boxes to clearly deliver their message to you, the reader. While I did spend many hours editing and making suggestions to each of the corresponding authors, my role here was simply that of a facilitator.

When asked why I chose the field of pediatric orthopedics, I often respond by saying, “It just feels right to make a child’s crooked leg straight,” perhaps not too far off from what Nicholas Andry had in mind more than 250 years ago. While that may be too simplistic of an answer, I do hope that this book will resonate with you and help guide your encounters with these children and their caretakers.

Newark, NJ, USA

Sanjeev Sabharwal, MD, MPH



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I am grateful to my parents, grandparents, mentors, and students for helping me recognize the importance of integrity and hard work. Thanks to my dear wife, Ranjit, who for the past 30 years took care of essentially everything so that I could pursue an academic career in pediatric orthopedics. I deeply appreciate our three children, Samir, Simran, and Sabhyta, for keeping me honest and grounded.



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