Foreword to the First Edition

There are many kinds of textbooks written today but nearly all of them are more technical and less interesting than they should be, and few of them are written to provide a clear and understandable approach to the problem under discussion.

A good textbook should grip the reader in much the same way as a well-crafted adventure story and should appeal to many levels of expertise. One should feel the urge to continue reading beyond the initial area of interest, even though one’s comprehension is being stretched to the limit and the new thoughts are sometimes difficult to integrate.

Since my first experience with the operative repair of a lumbar myelomeningocele some 45 years ago, I have had an intense interest in the complex ramifications of developmental anomalies of the central nervous system. Here, at last, in Professor Yamada’s book are the answers to some of these intriguing puzzles.

The chapters on embryology and physiology are brilliant in their clarification of the abnormalities of structure and function, while those on radiology and clinical studies are current not only procedurally but also in theory. I hope that the chapter entitled “Tethered Cord Syndrome in Adults” will demonstrate to “adult” neurosurgeons, urologists, and orthopedists that the “tethered cord” is not confined to the arena of interest of the pediatric subsections of their specialties!

This is not just a book for neurosurgeons and neurologists. It will be a source of information for senior medical students, residents, internists, and other health care providers.

All chapters are eminently readable, stand alone, and avoid the use of technical jargon. This is unusual and most welcome in these days of information flood.

I recommend most strongly Tethered Cord Syndrome to all those who have an interest in or even a passing involvement with the patient with problems of the central nervous system and, in particular, spinal cord dysfunction.

I enjoyed every chapter.

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Ontario, Canada
1996
Foreword to the Second Edition

One might wonder just when the word tether made its way into the medical lexicon and what the implications of this label were. Some would be familiar with its application to animals and a tether limiting their ability to roam within the radius allowed. By contrast, radius fixation is moot when the term is applied to the consequences of multiple forms of intrinsic intradural spinal column developmental pathology. The feature of this form of tethering inhibits “the ascent of the intrathecal nervous tissue within the vertebral canal during growth.”¹ Several years passed following this alert before there began an effort to explain the disturbed anatomy of the tethered spinal cord. In 1981, the senior author of this text became the leading academic of this disorder, a devotion that remains with him to this day.²

The various applications of “tether” were incorporated first into the multiple and intriguing patterns of “closed” spinal dysraphism (e.g., diastematomyelia, lipomyelomeningocele, the benign dermoid and epidermoid tumors, and the whimsically labeled “fatty filum”). Children’s neurosurgeons also began regretting their earlier repairs of open neural tube defects in newborn infants. As time passed, many noted that the intradural landscape was cluttered with adhesions that were “anchoring the cord” and that such could only have resulted from operative technique. These architectural features became apparent to clinicians coincident with the emergence of magnetic resonance imaging technology.

The second edition of this book brings forth source information with respect to folic acid supplementation and the reduction of neural tube defects, modern imaging features of the dysraphic spine, the accomplishments of intrauterine myelomeningocele repair, and appropriately for the continuum through to adulthood the features of the tethered cord as well as urological management that even in its mildest forms is a given in every aging patient. This book is directed at those with career paths identical to its authors but also to those in the fields of rehabilitation medicine and physio- and occupational therapy, as well as to front-line pediatricians and others who take care of an aging population.

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Preface

In the first edition (1996), the editor expressed his gratitude for the acceptance of “tethered cord syndrome (TCS)” as a standard of medical practice. This acceptance followed many decades of skepticism that viewed the expression tethered cord as limited to visual impressions without scientific background or merit. Today’s practice of neurosurgery and the associated research that will lead to even better neurosurgical practice in the future is indebted to the many clinicians and scientists who defined tethered cord syndrome (TCS) as a clinical syndrome and brought understanding to the pathophysiology, diagnosis, and treatment of this syndrome. The excellent contributions of the many clinicians and investigators in that edition and in this updated second edition underscore the importance for health care professionals to know the signs and symptoms of TCS and of treatment options and prognoses.

The first edition, published by AANS (1996), emphasized that accurate diagnosis and proper treatment of TCS requires understanding TCS pathophysiology and its links with TCS symptomatology. Responses were such that the book was sold out within a few years. This second edition was prompted by such acceptance of the first edition and also by the facts that (1) many patients with disabling TCS symptomatology are still unaware of such a syndrome, (2) the range of knowledge about TCS among medical professionals continues to be variable, and (3) there are still multiple interpretations of TCS among neurosurgeons and related specialists.

Goals of this edition were to weave its 21 chapters among themes in a manner that provides new information and answers to questions that have developed since the first edition. The first of these themes is the essential background necessary for understanding TCS, its diagnosis and treatment. Chapter 2 (embryology) explains with beautiful illustrations the complexities of central nervous system growth and the clinical problems found in spinal cord patients when there are deviations from normal spinal development. Chapter 3 (pathophysiology) reviews basic understandings of TCS and distinguishes this syndrome from that which occurs in patients with similar symptomatology when there is visual cord tethering.

The second theme is TCS diagnosis, which is complex given that TCS requires a functional diagnosis in a manner similar to epilepsy. This is because TCS is not strictly anatomical, which would allow it to be regarded in the same manner as spinal cord tumors.

Within this broad topic, Chapter 4 describes key techniques for neurologically examining TCS patients, whereas Chapters 5 and 6 summarize imaging procedures that are essential to demonstrate anomalies in the spinal canal and to assist in accurately diagnosing this syndrome. These chapters emphasize the importance of carefully evaluating the locus of anomalies by magnetic resonance imaging (MRI) or ultrasonography when categorizing TCS in the manner described in Chapter 1. Chapters 7 and 8 center on the urological aspects of TCS, which may
include incontinence with or without motor and sensory dysfunction. These chapters report that a goal of TCS treatment should be early correction of urinary dysfunction and prevention of irreversible incontinence. Chapter 10 discusses neurological lesions of cervical TCS that can be localized either cephalic or caudal to the tethering site, whereas Chapter 9 relates TCS to pediatric patients, revisiting the original "tethered spinal cord" by Hoffman et al and updating new development.

Adult TCS was expanded to include late teenage patients whose follow-up is often lost in the gap between pediatric and adult neurosurgeons. Chapter 15 summarizes findings in TCS patients without neural spinal dysraphism. These patients are often referred to neurosurgeons because they suffer disabling back and leg pain for many months or years without definite diagnosis. The diagnosis in this age group requires physicians’ familiarity with the specific symptomatology and imaging features, and an understanding of the pathophysiology of TCS. In contrast, Chapter 16 describes occult TCS, which includes patients with lipomyelomeningoceles and those with cord elongation and filum thickening. Also within this theme is Chapter 11, which considers surgical treatment of a variety of lipomyelomeningoceles. Related as well are Chapter 12, which describes epidermoid or dermoid to be related to TCS, and Chapters 17 and 18, which review diagnostic-related findings in the caudal end of the spinal cord, the diameter of the terminal filum. These two chapters support the inelastic nature of the filum to be the mechanical cause of TCS as a functional disorder.

The third theme relates to TCS treatment, including surgery for myelomeningoceles and lipomyelomeningoceles (c.f. Chapters 11, 13, and 16). Chapter 13 describes in utero surgical attempts to prevent progressive and permanent neurological deficit that might develop during gestation. Chapter 14 details results of folic acid administration in pregnant women for prevention of myelomeningoceles. Chapters 19 and 20 detail progress in neurophysiological testing (preoperative and postoperative somatosensory or motor evoked potential recording) for enhancing TCS diagnosis, and intraoperative recording of lumbosacral cord or sacral nerve root stimulation to protect the nerve elements.

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