Current Approaches in Cerebral Palsy, A Focus on Gait Problems

Editorial Comment

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In modern terms, cerebral palsy is defined as a childhood condition in which a motor deficit occurs due to a static, nonprogressive lesion of the brain. From a historical perspective, William John Little was the first to characterize spastic cerebral palsy in the 1830s [1]. He described it as a brain injury due to oxygen deprivation to the brain at birth. Sir William Osler was one of the first early researchers to study cerebral palsy and wrote the first book on the topic, *The Cerebral Palsies of Children* [2]. Cerebral palsy is a heterogeneous condition. The size and location of the brain lesion approximates both the severity and characterization of motor involvement. Gait problems are common in ambulatory patients with cerebral palsy. Ambulatory ability may vary from independent ambulation to the need for ambulatory aids such as a walker. In the latter case, ambulatory ability may also depend on good upper extremity function.

In this symposium, “Current Approaches in Cerebral Palsy, A Focus on Gait Problems,” pediatric orthopaedic surgeons from cerebral palsy centers in various countries have been invited to focus on current problems that affect ambulatory children with cerebral palsy. The initial article highlights current assessment and outcome measurement tools for the upper extremity. These tools are helpful in assessing upper extremity function in patients who may require upper limb function for the use of an ambulatory aid.

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Fig. 1 Kirk W. Dabney, MD, is shown.

Fig. 2 Freeman Miller, MD, is shown.

As clinicians, we recognize the alteration in muscle both physiologically and structurally between normal individuals and patients with cerebral palsy and between muscle agonist and antagonist in the patients with cerebral palsy. The second provocative article focuses on the basic science of the difference in the expression of myosin heavy chain fibers between wrist flexor and extensor muscles as one of these possible ultrastructural changes that occur in spastic muscle. Another structural difference frequently confronted by the orthopaedic surgeon is the muscle volume differences seen in cerebral palsy, especially the child with spastic hemiplegia. The next article compares the relationship between muscle volumes and concentric muscle work differences between involved and uninvolved sides in spastic hemiplegic cerebral palsy and their potential relationship to gait deviations.

Even within the ambulatory population, walking performance is quite heterogeneous, influencing both treatment methods and outcomes. To this end, it is important to characterize ambulatory ability across the cerebral palsy population according to different variables. A large cross-sectional study of a population of children with cerebral palsy characterizes walking performance at different distances and environments according to gross motor function, cerebral palsy subtype, and age.

A final group of articles focuses on outcomes after a variety of surgical procedures performed to treat common deformities in ambulatory children with cerebral palsy. Multilevel surgery is uncommon in the spastic hemiplegic population but more common in the Type 4 hemiplegic (hip, knee, and ankle involvement) population. The first article in this group focuses on multilevel surgery in this subgroup of children with spastic hemiplegia and describes the outcomes of surgery in treating hip dysplasia in these patients. A stiff knee gait pattern is common in patients with cerebral palsy with the diplegic pattern and interferes with swing phase clearance during gait. Indications for treatment include difficulty with gait due to toe drag, a

decrease and delay in swing phase peak knee flexion by kinematics, and out-of-phase rectus femoris activity during swing by dynamic EMG on gait analysis. The next two articles look at the outcomes of two different surgical treatments for stiff knee gait secondary to rectus femoris spasticity. Hamstring contracture causes both a shortened step length and instability during stance. The next case series explores the effect of selective voluntary motor control on hamstring lengthening. The gastrocnemius muscle is perhaps one of the most important muscles for walking, providing 60% of power during gait. Lever arm dysfunction causes a decrease in gastrocnemius push-off power, is common in the child with cerebral palsy, and can result from both torsional deformity of the tibia and planovalgus foot deformity. The final two articles look at outcomes after correctional surgery for external tibial torsion and a different approach to the correction of severe planovalgus foot deformity, respectively.

We believe the broad range of articles in this symposium will be both beneficial and stimulating for the orthopaedic surgeon who treats children with cerebral palsy. We have purposely solicited a range of topics from both basic science and clinical studies to provide guidance in treatment and stimulate questions for future research.

We would like to thank each group of authors who contributed to this symposium and the reviewers who both challenged the authors and provided the invaluable input that improved each article. We hope the readers will find this symposium both useful and provocative.

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