Single-Event Multilevel Surgery: Contender or Pretender
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Single-event multilevel surgery (SEMLS) refers to the surgical management of children and adult patients with cerebral palsy and spastic diplegia to address muscle imbalance, contractures, and musculoskeletal deformities secondary to untreated or inadequately treated spasticity.1–3 Spasticity is a movement disorder in which there is injury to upper motor neurons comprising the pyramidal tract. The upstream inhibitory influence of the central nervous system is interrupted, causing the local reflex arc in the spinal cord to become disinhibited and leading to continuous muscle contraction. The spasticity is characterized by a velocity-dependent increase in muscle tone with hyperreflexia.

Surgical management consists of concurrent orthopedic procedures targeting the musculoskeletal system at ≥2 levels (eg, feet, ankles, knees, and hips). Procedures include tendon lengthening to correct contractures, tendon transfers for muscle imbalance, rotational osteotomies for torsional deformities, and stabilization of the hip and foot. The advantages of SEMLS include a single hospital admission, decreased need for repeated anesthetics, a single stay in inpatient rehabilitation, and the prevention of secondary deformities from delay in sequential treatment of spasticity, contractures, and bone deformities.3 SEMLS is far more commonly performed in children than in adults, for whom the evidence for its efficacy is less robust.4

Controversy of this treatment approach stems from the adoption of SEMLS as a standard of care in children without a randomized controlled trial demonstrating its safety (ie, risk/benefit ratio) and efficacy compared with other primary treatments for spasticity, such as botulinum toxin, intrathecal baclofen therapy (ie, baclofen pump), and selective dorsal rhizotomy. In fact, selective dorsal rhizotomy (Fig 1), a modulation of tone instead of an complete obliteration of muscle tone, has become a mainstay of treatment for some types of spasticity in the lower extremities, where relief of spasticity is sufficient to develop functional recovery.5

Points of contention common to studies analyzing outcomes for SEMLS are standardized indications and patient selection, optimal time for intervention, and long-term follow-up and durability of gait function at skeletal maturity. These points have not been established for SEMLS in studies with high-level evidence.

In this month’s issue of Pediatrics, Amirmudin et al6 provide a well-written and methodologically sound systematic review and meta-analysis of the SEMLS literature. One important limitation is that none of the data come from trials. Still, the authors found restrained enthusiasm for SEMLS after synthesizing the literature: improvement in body structure and function, such as gait, but no change in overall activity for children after

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Opinions expressed in these commentaries are those of the authors and not necessarily those of the American Academy of Pediatrics or its Committees.

DOI: https://doi.org/10.1542/peds.2019-0102
Accepted for publication Jan 25, 2019
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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).
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FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: No external funding.

POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest to disclose.

COMPANION PAPER: A companion to this article can be found online at www.pediatrics.org/cgi/doi/10.1542/peds.2018-3390.

SEMLS. The authors do highlight the weaknesses of the present literature studying SEMLS, as described above, and make a call for the planning and design of additional randomized controlled trials analyzing the effects of SEMLS to address the shortcomings of today’s literature.

The place and role of SEMLS in the overall surgical strategy and algorithm for treating select children with cerebral palsy has yet to be formally defined. That is, should SEMLS be considered a treatment of last resort after failure of primary treatment of spasticity (intrathecal baclofen therapy or selective dorsal rhizotomy), or should SEMLS include simultaneous neuromodulation and correction of soft tissue and bone deformities (multilevel, multiorgan-system surgery under the same anesthetic session)? While these questions are being addressed, these complex, fragile patients should continue to be evaluated and treated in a coordinated multidisciplinary program that can help their families decide on which therapeutic approach is best for their children.

**ABBREVIATION**

SEMLS: single-event multilevel surgery

**REFERENCES**


**FIGURE 1**

In selective dorsal rhizotomy, the dorsal afferent (sensory) rootlets are identified and separated (red vessel loops) from the ventral efferent (motor) rootlets through knowledge of anatomy and confirmation with intraoperative neurophysiological stimulation. The dorsal rootlets are divided into its individual fascicles. Electrical activity is recorded with a bipolar stimulator, and only the most electrically abnormal fascicles are sectioned. The surgical goal is not to completely abolish the local reflex arc, which results in a flaccid paralysis. Comparatively, muscle-tone modulation should be the intention of selective dorsal rhizotomy; that is, the preservation of some muscle tone is essential in borderline ambulators because these patients depend on a degree of spasticity for locomotion.
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Pediatrics 2019;143;
DOI: 10.1542/peds.2019-0102 originally published online March 27, 2019;

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