

## SEMLS in Young Children with Cerebral Palsy - need of Orthopedic Surgery Reviewed

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By definition cerebral palsy is an umbrella term for group of disorders that affect movement, muscle tone, posture and coordination, caused by hypoxic injury to be developing brain [1]. Though it is a non-progressive neurological condition the effect of the condition varies according to the area of the brain affected and changing motor impairment syndromes based on development of brain [2]. It is the leading cause of motor and postural deformities in children. The primary motor disorders in children with CP are muscle tone abnormalities which lead to impairments in posture, movement, decreased strength, loss of selective motor control, balance and coordination. The secondary musculoskeletal problems are muscle contractures and bony deformities like scoliosis, pelvic obliquity, windswept hip deformity, hip subluxation/dislocation, excessive femoral anteversion, tibial torsion and ankle equinus which develop progressively in response to the primary deficits and causes further motor dysfunction and the need for orthopaedic surgery [3,4].

Though there are some options available rather than surgery for orthopedic complications in cerebral palsy like botulinum toxins or long-term orthosis which gives short term results. The hypertonic muscle in cerebral palsy children affects growing bone results in rotational deformities. Eventually correcting only muscular level of the dysfunction will result in recurrence of deformity. Because it fails to correct lever arm dysfunction (LAD). The concept of lever arm dysfunction is proposed by Dr. James cage [9]. levers are rigid structures that pivoted at fixed fulcrum when force is applied. In human body bones are levers and joints acts

as fulcrum and muscles are the forces that moves the lever over fulcrum. Due to hypertonia muscles pulls growing bones in wrong directions causes some rotational deformities which contributes to further functional weakness of muscles due to decreased power generation and abnormal direction of pull of muscles The types of Lever Arm Dysfunctions with examples are increased femoral anteversion caused by lack of standing erect in first few years of life, increased femoral anteversion is associated with internal rotation of hip joint which then compromise the length of hip abductors and causes coxa valga. And internal hip rotation affects loading of knee and foot causes external tibial torsion and equino calgus foot deformity in ambulant children with spastic diplegia. This compromised alignment around knee and foot worsens preexisting weakness of plantar flexors. These dysfunctions are obvious around age of 4 years in most cases of spastic diplegia and quadriplegia and then progressively worsens with growth leading to further malalignment of bone as well as unwanted gait compensations in ambulant children with CP. Lever arm dysfunction cannot be resolved without bony Orthopedic Surgery. It is important to understand that muscles cannot be effectively strengthened by physical therapy until co-existing lever arm is corrected. Early recurrence of contractures is common if LAD is not corrected simultaneously along with surgery of the musculotendinous unit. Lengthening muscles by surgery or BT injections will provide only short term results because bone itself is in torsional deformity [7]. In children with cerebral palsy all three components of lever arm is affected. To address all components of Lever arm multi-level surgery is required.

Single Event Multi Level Surgery (SEMLS) is the orthopedic surgery introduced by Norlin and Tkaczuk, in 1985 for lower limb deformities in Cerebral Palsy [5]. As name indicates it is a surgery performed in more than 2 level of kinetic chain at same time under single anesthesia. Procedures include tendon lengthening to correct contractures, tendon transfers for muscle imbalance, rotational osteotomies for torsional deformities of long bones. Advantages of this procedure includes minimized hospital stay, avoiding second surgeries and early rehabilitation [6].

Though these surgery address only the orthopedic complications of cerebral palsy, it contributes a lot in motor development in CP children when performed in particular age. SEMLARASS - Single Event Multilevel Lever Arm Restoration and Anti Spastic Surgery developed by Dr. Deepak Sharan is an minimally invasive type of orthopedic surgery for children who are between ages 4-6 years, seeks to correct spasticity, athetosis, contractures, bony deformities, and rebalance abnormal muscle forces producing gait deviations or other functional problems [8]. Where he proposes selectional muscle release to retain antigravity functions based on a Japanese orthopedic surgical procedure called OSSCS- orthopedic selective spasticity control surgery. In this method mono articular or stability muscles are preserved and multi articular muscles are considered for surgical lengthened along with bony lever correction [7]. Valgus Derotational osteotomy is performed at hip level to correct hip dysplasia, femoral anteversion, hip internal rotation and coxa valga. Sometimes it can be combined with pelvic osteotomy or acetabular remodeling [10]. Proximal Tibial derotational osteotomies can be performed to correct external tibial torsion (pigeon toe) at knee level [11].

If performed in younger children with CP orthopedic surgeries can contribute to motor development and significant difference in GMFCS level also [7].

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