International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2025; 11(2): 103-108

www.orthopaper.com
Received: 09-02-2025
Accepted: 12-03-2025

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Functional analysis of Single Event Multilevel Surgery (SEMLS) for Cerebral Palsy (CP) children in Southern Andhra Pradesh

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DOI: https://www.doi.org/10.22271/ortho.2025.v11.i2b.3752

Abstract
Background: Orthopaedic Surgery (OS) in Cerebral Palsy (CP) children plays important role to improve function, correct and prevent deformities. It is one of the most frequent causes of motor disability of children due to brain lesion in developing foetus or infant. The incidence is 2 to 3 cases as in 1000 live births.
Aims and Objectives: The aim of surgical intervention is to address all the deformities simultaneously by simple, single stage surgical procedures. During the past 3 decades correction of all fixed musculoskeletal deformities by Single Event Multilevel Surgery (SEMLS) has been popularized and advocated in many paediatric orthopaedic surgical centres. SEMLS improves walking balance, early mobilization, reduces the need for repeated hospitalization.
Study design and methods: This prospective study started in September 2023. CP children from 5 to 8 years age are included. SEMLS procedures are performed for 40 children. 25 are female and 15 are male. The Gross Motor Function Classification System (GMFCS) [4] and International Classification of Functioning, Disability and Health Child (ICFDHC) [12] are followed for clinical evaluation, surgical planning and to evaluate the results.
Results: The functional improvement as per GMFCS noticed after 12-24 months (avg 18 months). There were 25 children (62.5%) excellent, 10 (25%) good results and 5(12.5%) children got poor results.
Conclusion: Single event multilevel soft tissue surgery in the lower limbs yields good results for locomotion. There is improved personal hygiene in cases of bilateral adductor spastic contractors.

Keywords: Cerebral palsy, OS-Orthopaedic Surgery, SEMLS-Single Event Multilevel Surgery, GMFCS-Gross Motor Function Classification System

Introduction
The cerebral palsy is a heterogeneous disorder of movement and posture, presenting from mild motor disturbance to severe total body involvement. The main consequence is the development of neuromuscular incoordination, dystonia, weakness and spasticity. Oro-facial motor in co-ordination may make speech and swallowing difficult and drooling is a frequent problem. The four subtypes of CP are 1. Spastic, 2. Athetoid or Dyskinetic, 3. Ataxic, 4. Mixed are recognised. About 75% are spastic and among these spastic cases 60% are Diplegic.
The secondary consequences of musculoskeletal system in a growing child are progressive, leading to gradual deterioration of mobility from childhood to the start of adolescent growth spurt. Therefore, improving and maintaining gross motor function and gait is the primary goal. It is cost effective and less burden on family members than staged procedures.

Methods
This prospective study started in September 2023, cerebral palsy children from 5 to 8 years age are included in this study. History and clinical evaluation are the primary tools in making the diagnosis of cerebral palsy. The rare disorders like Familial spastic paraparesis and congenital ataxia are excluded by history. There is no known genetic component. The MRI, CT scan and PET scan are not advised.
The inclusion criteria are i) Age of the child from 7 to 16 years, ii) Children with spastic paralysis.

The exclusion criteria are, i) Below 07 yrs and above 16 yrs, ii) Children with congenital anomalies, iii) Severe athetosis, chorea and quadriplegia with severe spasticity or atonia.

The static and dynamic deformities of all the joints are recorded. The static equinus, static hip flexion and adduction, medial and lateral hamstrings static deformities are recorded with total and mean values in degrees. The gross motor function classification system (GMFCS) [4] and International Classification of Functioning, Disability and Health Child (ICFDHC) [12] are followed for clinical evaluation and planned the appropriate surgical procedures and to evaluate the results.

SEMLS procedures are performed on 40 children. 25 are female and 15 are male children age group from 5yrs to 8yrs. Most of the children operated are spastic cerebral palsy includes cerebral diplegia and cerebral hemiplegia with difficulty in standing and walking even with aid of orthosis.

Procedures planned and performed in our institute so for are

- Strayer's gastrocnemius release for equinus deformity-15 cases.
- Selective adductor longus release for unilateral adductor contracture-8 cases.
- Bilateral adductor longus and brevis release for bilateral adductor contracture with scissors gait-12 cases.
- Hip adductor and knee flexor muscle spasticity children are treated by fractional lengthening of medial hamstrings-8 Cases.

The children post-operatively followed by structured, intensive, institutional, surgeon directed, multidisciplinary rehabilitation protocol.

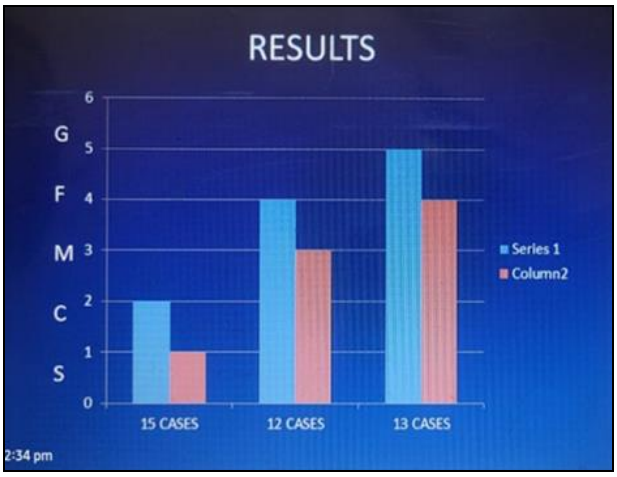

Fig 1: Results

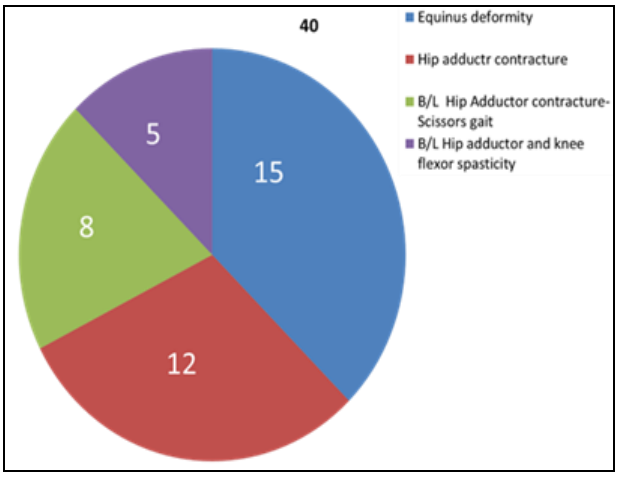

Fig 2: Pie chart illustrating the distribution of musculoskeletal deformities among a sample of 40 individuals. The deformities are categorized into four types

Case 1

Pre-operative picture

HIP surveillance

Intra-operative



Post-operative Sitting practice Sitting without support

Case 2



Pre-operative HIP surveillance Post-operative



Sitting practice Sitting without support Intra-operative

Case 3

Pre-operative Post-operative Post-operative

Case 4

Pre-operative Pre-operative Pre-operative

Case 4 and Case 5

Pre-operative Pre-operative Post-operative

Results

Our aim of achieving satisfactory results is children must stand upright and can ambulate with or without assistive orthotic devises after deformity correction surgery. There is improved personal hygiene in cases of bilateral adductor spastic contractures. The follow-up results are evaluated according to GMFCS 5 level classification[4]. The functional improvement noticed after 12-24 months (avg 18 months), There were 25 children (62.5%) excellent, 10 (25%) good results and 5(12.5%) children got poor results.

- **GMFCS Level 1:** Child can walk indoors and outdoors and climb stairs without use of hands/orthosis for support. They can run and jump but have decreased speed, balance and coordination
- **GMFCS Level 2:** Children can walk indoors and outdoors, climb stairs using a railing. They experience difficulty with uneven surfaces, inclines or while in crowds and can minimally run or jump.
- **GMFCS Level 3:** Children walk with assistive mobility devices indoors and outdoors on level surfaces. They may be able to climb stairs using railing and propel a manual wheelchair but they need assistance for long distance or uneven surfaces.
- **GMFCS Level 4:** Children have walking ability severely limited even with assistive devices. They use wheelchair most of the time and may propel their own power wheelchair and can participate in standing transfers.
- **GMFCS Level 5:** Children having severe restriction of voluntary movement and they are unable to maintain normal head and neck position against gravity. They experience impairment in all areas of motor function and cannot sit or stand independently even with adaptive equipment. They cannot independently walk though maybe to use powered mobility devices.

Complications including superficial skin infection and recurrence of deformity are examined.

Discussion

The historical understanding of Cerebral palsy dates back to early descriptions by Hippocrates in his book corpus Hyppocraticum. The term cerebral palsy was coined in 18th century and treating physicians could not make out the exact cause till 19th century. William John Little first described in detail regarding spastic cerebral palsy as “Littles’ disease” in 1861. He emphasised the role of birth injuries in causing this condition. Sir William Osler published The Cerebral palsy of children in 19th century. During 20th century there were advancements in understanding the aetiology and management of cerebral palsy. Though birth asphyxia was widely believed to be the primary cause of cerebral palsy, the current understanding recognises it as a complex condition with various subtypes, causes and comorbidities requiring a multidisciplinary approach to the management.

The diagnosis of cerebral palsy in early childhood poses a major problem. Careful assessment of milestones of development, repeated reviews and clinical examination are paramount importance. In high resourceful countries, this condition is diagnosed early during 12-14 months and in lower resource countries the diagnosis is established only in 5th year onwards. The incidence is 2-3 diagnosed CP cases per 1000 live births suggestive of careful assessment and clear-cut protocols to follow in early diagnosis. There is no cure for this illness but early treatment interventions can help to improve function, limit the disability. In USA, each year 5,500-13,100 children are diagnosed to be suffering from CP. 2019 survey 1 million adults are living with cerebral palsy and their number will be keep growing. The exact statistics in our country is lacking because of various reasons. There are many spastic children are brought to Govt. hospitals for disability certificates and pensions. They are motivated for treatment and to improve the activities of daily living.

Most of orthopaedic surgeons are busy with trauma cases and we have to spend some time for this noble cause. All the parents of CP children are properly counselled, to bring the children for clinical evaluation and treatment.

We hypothesised that the frequency of surgical procedures per child did not increase with higher GMFCS level after` level I. The goal of surgery in ambulatory child is to improve gait and in non-ambulatory child is greater comfort in positioning, improved basic care, correction of severe foot deformities, prevent hip dislocations and halt the progression of scoliosis. The benefits of surgery are judged against the increased risk of major complications like nerve palsies and neuropathic pain [6].

Conclusions

SEMLS results in clinically and statistically significant improvement in gait and function. The deformity correction is evident immediately after surgery and increases the confidence, faith of the parents and reduces the burden of the care. They will be more compliant for further follow up. The functional improvement as per GMFCS noticed after 12-24 month (AVG 18 months). The continuing improvement in the functional outcome is only possible in the presence of meticulous pre-operative assessment, preparation, expert peri operative management and long term follow up.

Conflict of Interest

Not available

Financial Support

Not available

References

1. Khalequzzaman AKM, Aslam M, Salam SI. The functional outcome of single stage multi-level surgery of spastic cerebral palsy. SAS J Surg. 2022 Jun 8;6(6):425-429.
2. Dobson F, Graham HK, Baker R, Morris ME. Multilevel orthopaedic surgery in group IV spastic hemiplegia. J Bone Joint Surg Br. 2005;87:548-555. PII: 87-B/4/548. DOI: 10.1302/0301-620X.87B4.15525
3. Dreher T, Vegvari D, Wolf SI, GeisBusch A, Gantz S, Wenz W, *et al*. Development of knee function after hamstring lengthening as a part of multilevel surgery in children with spastic diplegia: A long-term outcome study. J Bone Joint Surg. 2012;94:121-130. DOI: 10.2106/JBJS.
4. Palisano R, Rosenbaum P, Walter S, Russell D, Wood E, Galuppi B. GMFCS. Dev Med Child Neurol. 1997;39:214-223.
5. Harvey A, Graham HK, Morris ME, Baker R, Wolfe R. The functional mobility scale: Ability to detect change following single event multilevel surgery. Dev Med Child Neurol. 2007;49:603-607.
6. Rehbein I, Teske V, Pagano I, *et al*. Analysis of orthopaedics surgical procedures in children with cerebral palsy. World J Orthop. 2020 Apr 18;11(4):222-231.
7. Fong MM, Gibson N, Williams SA, Jensen L. Clinical functional outcome measures for children with cerebral palsy after gait corrective orthopaedic surgery: A scoping review. Dev Med Child Neurol. 2023;65:1573-1586.
8. Maathuis KG, van der Schans CP, van Iperen A, Rietman HS, Geertzen JH. Gait in children with cerebral palsy: observer reliability of physician rating scale and Edinburgh visual gait analysis interval testing scale. J Pediatr Orthop. 2005;25:268-272.
9. McGinley JL, Dobson F, Ganeshalingam R, Shore BJ, Rutz E, Graham HK. Single-event multilevel surgery for children with cerebral palsy: A systematic review. Dev Med Child Neurol. 2012;54:117-128.
10. Narayanan UG. Management of children with ambulatory cerebral palsy: An evidence-based review. Dev Med Child Neurol. 2012;54 Suppl 2:S172-S181. DOI: 10.1111/j.1469-8749.2012.01241.x
11. Rutz E, Tirosh O, Thomason P, Barg A, Graham HK. Stability of the gross motor function classification system after single-event multilevel surgery in children with cerebral palsy. Dev Med Child Neurol. 2012;54:1109-1113.
12. Sharan D. Orthopaedic surgery in cerebral palsy: instructional course lecture. Indian J Orthop. 2017;51:240-255.
13. Sharan D. Effect of an intensive and sequenced rehabilitation protocol on the functional outcome after single event multilevel surgery in cerebral palsy. Presented at: 66th Annual Meeting of the American Academy for Cerebral Palsy and Developmental Medicine; 2012 Sep 12-15; Toronto, Canada.
14. Saraph V, Zwick EB, Zwick G, Wender SC, Wender SG, Linhart W. Multilevel surgery in spastic diplegia: Evaluation by physical examination and gait analysis in 25 children. J Pediatr Orthop. 2002;22:150-157.
15. Thomason P, Baker R, Dodd K, Taylor N, Selber P, Wolfe R, *et al*. Single-event multilevel surgery in children with spastic diplegia: A pilot randomized controlled trial. J Bone Joint Surg Am. 2011;93:451-460.
16. Thomason P, Selber P, Graham HK. Single event multilevel surgery in children with bilateral spastic cerebral palsy: A 5-year prospective cohort study. Gait Posture. 2013;37:23-28.
17. Thompson P, Beath T, Bell J, Jacobson G, Phair T, Salbach NM, *et al*. Test-retest reliability of the 10-metre fast walk test and 6-minute walk test in ambulatory school-aged children with cerebral palsy. Dev Med Child Neurol. 2008;50:370.
18. Williams EN, Carroll SG, Reddi Hough DS, Phillips BA, Galea MP. Investigation of the timed ‘up & go’ test in children. Dev. Med Child Neurol. 2005;47:518.

How to Cite This Article

Raveendra RVB. Functional analysis of Single Event Multilevel Surgery (SEMLS) for Cerebral Palsy (CP) children in Southern Andhra Pradesh. International Journal of Orthopaedics Sciences. 2025;11(2):103-108.