



EVALUATION OF FUNCTIONAL OUTCOMES OF SINGLE EVENT MULTILEVEL SURGERY IN AMBULATORY SPASTIC DIPLEGIC CHILDREN WITH CEREBRAL PALSY.

Orthopaedics

Satishkumar.S	senior resident, Department of Orthopaedics, Government medical college, Nizambad , Telangana, India.
Laxmikanth S*	Assistant professor, Department of Orthopaedics, SVS Medical College And Hospital, Mahabubnagar , Telangana, India.*Corresponding Author
K.L.Jagadishvar Rao	professor and Head of the Department, Department of Orthopaedics, SVS Medical College And Hospital, Mahabubnagar, Telangana, India.

ABSTRACT

Cerebral palsy is described as a set of permanent disorders of development, movement and posture leading to limited activity levels, caused by non progressive disturbances in development of fetal and infant brain resulting in UMN lesion. The incidence accounts to 3 per 1000 live births and prevalence 2.4 per 1000 children and has a slight male preponderance. Which is characterized by spasticity weakness and impaired selective motor control with time, majority of children develop a spectrum of secondary problems, collectively referred to as "progressive musculo skeletal pathology". Single-event multi level surgery (SEMLS) can improve gait and functioning in children with Cerebral palsy in one session. The operative procedures comprise the correction of fixed contractures by muscle recessions and tendon lengthening, addressing muscle imbalance with tendon transfers, correction of bony deformities and joint stabilization procedures. The present study was to evaluate the results of SEMLS in the lower limbs of patients with spastic diplegic CP during follow-up appointments 12–24 months after surgery.

KEYWORDS

Single, Multilevel, Cerebral Palsy, Spastic, Diplegia

INTRODUCTION

Cerebral palsy (CP) is currently the most common cause of motor disorders in young people¹. Cerebral palsy (CP) is the result of a static encephalopathy or non-progressive lesion of the developing brain but the musculoskeletal deformities in growing children are often progressive. Musculoskeletal deformities may impair both gait and gross motor function².

The assessment and treatment of gait abnormalities in children with CP are challenging. Several complementary interventions range from physical and occupational therapy, neurosurgical and pharmacological interventions to reduce hypertonia and orthopedic interventions aiming to restore anatomical structures and musculoskeletal conditions are often used to develop the most optimal and energy efficient gait pattern in these children³.

Regarding surgical interventions recent years, the approach to surgery has changed from performing one or two procedures at a time to addressing all deformities simultaneously. Single event multilevel surgery (SEMLS) refers to the correction of all orthopaedic deformities in one session, which has the advantage of requiring one hospital admission and one period of rehabilitation. A further rationale for SEMLS is the prevention of secondary deformity which can occur when a single deformity is addressed⁴.

The aim of this study was to evaluate the results of SEMLS in the lower limbs of patients with spastic diplegic CP during follow-up appointments 12–24 months after surgery.

MATERIALS AND METHODS

The study was carried from 2014 to 2018 at SVS INSTITUTE OF MEDICAL COLLEGE HOSPITAL, MAHABUBNAGAR, TELANGANA, comprising of 20 children with spastic diplegic CP. The study included children age 5-15 with GMFCS II&III (figure 1). Children with upper limbs involvement, dystonia, mixed or dyskinetic CP, previous surgery for the same, requiring bony surgery GMFCS IV&V, are excluded.

All the operative procedure's will be performed under general anesthesia by single surgeon. Preoperative findings will be documented which include the anatomical structure involved and degree of deformity depending on these operative procedure will be planned. In the present study video recordings were used to assess patients' gait (ability to walk independently with or without walking aids). Recordings were made using two simultaneous cameras

positioned in orthogonal projections. Degree of deformity is also measured intraoperatively under anesthesia. The procedure done our hospital are a hip adductor tenotomy, Hamstring release and lengthening, TA lengthening, Obturator and Soleal neurectomy done in patients with severe deformity with ankle clonus

Our Post operative protocol includes mobilization of patient over leg plaster cast with cross bars (Petri cast) for 6 weeks from 2nd or 3rd postoperative day under the guidance of physiotherapist. Walking and Weight bearing with crutches started by using orthotics like KAFO or AFO started after 6 weeks and continued till 1 year.

RESULTS

Total of 20 cases were studied out of these 12 were boys and 8 were girls, Min follow-up period was 1yr. Mean age was 8.5 years. (5 to 15 years).

All children with spastic diplegia without upper limb involvement were taken into consideration. They all had sitting ability. There prior GMFCS levels were: Level III – 12 cases, Level II– 8 cases. Equinovarus was seen in 7 feet, Equinus in 28 feet, B/L Hamstring contractures were present in 18 patients, B/L Adductor contractures were seen in 15 children. All children underwent multi level surgery in one set up. B/L Tendo achilles lengthening was done for 28 feet. B/L hamstring lengthening was done for 18 patients. Adductor tenotomy was required for 8 patients, with additional obturator neurectomy in 7 children. Percutaneous TA lengthening for 2 patients. B/L soleal neurectomy for 2 patients. Final assessment was made at mean period of 1 year after operation. At all levels, the static contractures in all the children were almost completely resolved except for a few degrees of static flexion at the knees in 4 patients (20%). Residual ankle contracture was present in 2 patients (10%). There was fair improvement in GMFCS levels. All children moved to walking levels 12 patients attained level I. (60%), 7 patients attained level II (40%), 1 patients attained level III (5%)(figure 2). There was substantial improvement in mean GMFM scores, preoperatively it was 71.4 (Figure 3) and post operatively after 1yr follow up was 78.2 (Range 52.3 - 96.1)(figure 4). 18 cases were within 97 percentile.

DISCUSSION

Lower extremity musculotendinous surgery is standard treatment for ambulatory children with deformities such as joint contractures and bony torsions resulting from cerebral palsy (CP). Ideally, these procedures are completed during 1 surgical setting to balance joint forces about the hip, knee, and ankle by lengthening shortened muscle-tendon units and realigning bony levers. The objectives of surgical

management in CP are to improve function, decrease discomfort, and prevent disabling structural changes. The assumption is that by improving gait, function in general will improve⁵.

In the present study 20 cases were studied out of these 12 were boys and 8 were girls. This observation is similar to the study Raj Kumar et al where 78.57% children male, almost 3.6times higher than female. Pratihba SD et al study in 1000 patients reported 67.5% male, Srivatsava VK et al study (65.1% male) Reddy B et al on 100 patients (66% male)⁶.

In the present study mean age was 8.5 years with age range of 5 to 15 years, this is in concordance with a study conducted by Akhmed Tomov et al average age was 11.3±1.7 years¹, Pam Thomason et al mean age 9.7years (range 7.7–12.2 years)².

The aim of present study was to investigate whether single-event multilevel surgery improved gait in patients with spastic diplegia, and whether improved function is durable. It is similar to study conducted by Norlin and Tkaczuk assessed 23 subjects at the 5-year follow up to determine the long-term success of single-event surgery⁷. However, their study only included video recordings as a means of assessment, whereas our results are based on GMFCS SCALE and GMFM 66 SCORE and minimum follow up period of 1yr.

In present study mean improvement in GMFM scores after minimum 1yr post operative assessment were 6.8. Mean GMFM score preoperatively was 71.4 (figure 3) and post operatively after 1yr follow up was 78.2. However, Gorton et al found no change in GMFM-66 scores in multicenter, prospective, controlled trial of children who had undergone orthopaedic surgery. They found significant deficits in muscle strength and that GMFM-66 scores had not returned to baseline at twelve months after multilevel surgery, despite a strengthening program and improvements in kinematic parameters⁵. In a study conducted by Thomason et al (2013) the improvement in the mean GMFM scores at 2 year follow-up period to prospective study, showed a change in mean GMFM-scores of only 0.2 at the one year post-operative assessment, a change of 4.9 at the two year post-operative assessment².

In the present study has showed significant improvements in gait after 1yr follow up after surgery. Whereas, Gupta & Raja (2012) documented post SEMLS there is a larger improvement in gait from the pre-operative assessment to the six month follow-up period, with small improvements continuing to the one year follow-up⁸.

In the present study 60% patients were in GMFCS level III and 7 patients were in the age group of 10 to 15 and had significant improvement following surgery. It has been documented by Harvey et al, 2012 that there is greater change post SEMLS in children who have a higher GMFCS level⁹.

In the present study also there is significant improvement in GMFCS level after surgery 65% patients were under GMFCS level I post surgery. Similarly, Thomason, et al., 2013; Rutz, et al., 2013 stated research shows improvements in gait parameters at all joints except at the pelvis, but only with regards to pelvic tilt, at short-term follow-up of one year. There was no significant deterioration in these parameters at mid to long term follow-up^{2,7}. Hadders- Algra, 2014 Due to the plasticity of the infant brain, it has been proposed that early intervention is key to optimising function in 51 children with Cp¹⁰.

In the present study also all children were late diagnosed and had limited resources for physiotherapy as all children are from rural population. Khan, (2007) documented that late diagnosis and limited physiotherapy is typically seen in children with CP in developing countries¹¹. In contrast to present study Rutz, et al., 2012 documented studies in developed countries where GMFCS levels has been found to remain constant post SEMLS¹².

Therefore it is possible that there will be a greater change in function post SEMLS in children in developing countries who have previously had limited access to health care facilities. Ongoing postoperative physiotherapy must be emphasized preoperatively to all care-givers involved in potential SEMLS.

The present study concludes that of the 20 patients operated 18 (97 percentile) were able to walk without assistance and 2 with assisted

devices. Results were satisfactory pertaining to GMFCS levels.

Patients with CP and spastic diplegia who are untreated, present late, and cannot walk can be helped by single-event multilevel surgery. Good rehabilitation, post operative physiotherapy is essential for satisfactory results to be obtained.

Figure 1: GMFCS LEVEL PREOPERATIVELY. Level 3:60% of patients level 2:40% of patients.

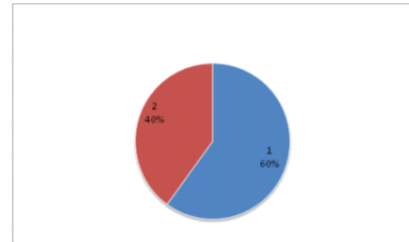


Figure 2: GMFCS LEVEL POSTOPERATIVELY AFTER minimum 1yr follow-up. Level-1: 60%, Level-2 :35%, Level-3 :5%

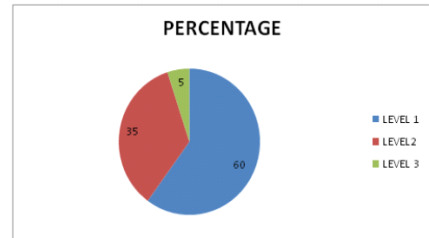


Figure 3

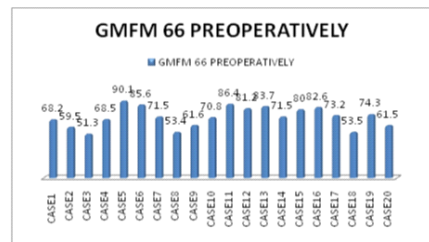
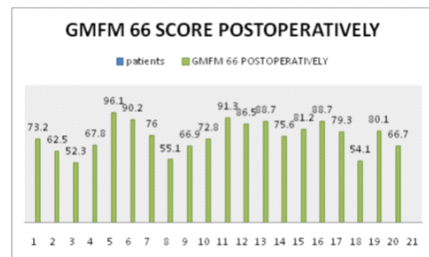


Figure 4



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