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## To assess the improvement of cerebral palsy patients with single event multilevel surgery

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### Abstract

Spastic or contractural deformities at multiple joints of cerebral palsy patients, is the major reason for their poor quality of life. There is no cure to cerebral palsy, but various forms of therapy can help patients with this disorder to function more effectively. One such multidisciplinary intervention is “single event multi level Surgery”. Our aim was to assess the improvement of cerebral palsy patients with single event multilevel surgery. It was a hospital based descriptive study with 143 patients over a period of 36 months. All patients with spastic type cerebral palsy having adequate standing balance without any significant prior surgeries were included. Different soft tissue or bony Procedures were done at hip, knee and ankle at single sitting according to Deformities. Postoperative improvement was assessed with Gross motor function Classification system and gait. Postoperatively 40 patients had improvement in one level of GMFCS score, 60 had two level, 21 had three level and 13 had four Level improvement, but 5 remained constant. Of the 51 who were unable to walk, 40 became household ambulators and 7 became community ambulators and of The 64 house hold ambulators, 63 became community ambulators. Overall, we appreciated a significant improvement in gait and functional ability of patients with single event multilevel surgery. Gait parameters improved much faster and to a greater degree than did functional parameters showing their nonlinear Relation. Post-surgical physiotherapy is vital in maintaining and improving the Function.

**Keywords:** Cerebral palsy, single event multilevel surgery, spasticity and GMFC

### 1. Introduction

Cerebral palsy is a disorder of movement and posture that appears during infancy and early childhood due to non-progressive damage to the brain before during or shortly after birth<sup>1</sup>. Although primary brain pathology is non progressive, musculoskeletal pathology is progressive<sup>1</sup>. Incidence of cerebral palsy has increased during the past two decades, due to the increased survival of preterm and low birth weight babies. More than the financial aspect, it is the future and self-dependency of the child which bothers the families of the affected children. Children with cerebral palsy whom are non-ambulant or poorly ambulant are having a poor quality of life. Spastic or contractural deformities at multiple joints are the major reasons for the discomfort and pain. Spasticity<sup>[1]</sup> can be managed medically with drugs like baclofen, diazepam, physiotherapy and orthotic devices, invasive procedures like botulinum toxin injection or intrathecal baclofen, surgically by myofascial release or neurosurgical procedures like dorsal rhizotomy. If we are not intervening at the right time the natural progression of gait in cerebral palsy may progress to crouch gait<sup>[2]</sup> which is very difficult to treat. The treatment of cerebral palsy includes a multidisciplinary team approach including physiatrist, occupational and speech therapist, social workers, orthopedicians and paediatrician as well as neurologist<sup>1</sup>. There is no cure for cerebral palsy, but various forms of therapy can help patients with this disorder to function and live more effectively. One such orthopaedic surgical intervention is “single event multi-level surgery”<sup>[3]</sup> which includes multiple joint soft tissue releases & bone osteotomy procedures in a single sitting after detailed physical examination and observational gait analysis. The role of surgery in cerebral palsy is to correct the deformity whether static or dynamic, balance muscle power and to stabilize uncontrollable joints<sup>1</sup>. It is not possible to assess and treat hip knee or ankle as an isolated entity hence various disabling deformities are corrected in a single sitting thereby decreasing

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hospitalization, immobilization, rehabilitation time and number of anaesthesia exposure.

### 1.1 Aim

Our aim was to assess the improvement of cerebral palsy patients with single event multilevel surgery.

### 2. Patients and Methods

This is a hospital based descriptive study done with 143 patients over a period of 36 months. Preoperative assessment included detailed history, gait and deformity assessment and Investigations like X-ray. All patients with spastic type cerebral palsy having adequate standing balance without any significant prior surgeries were included.

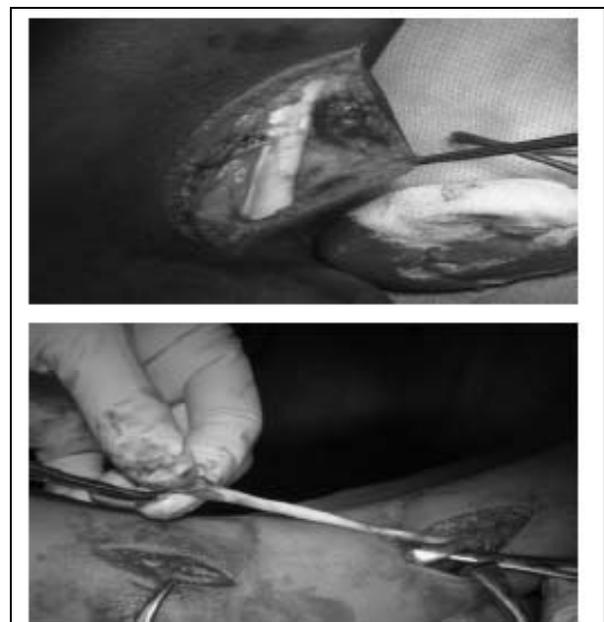
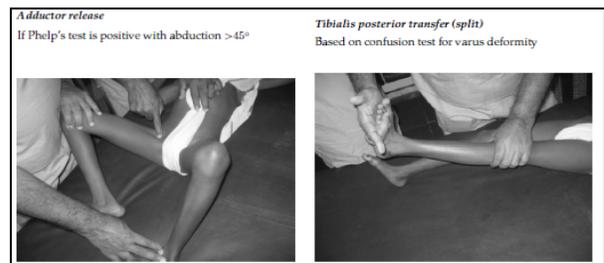
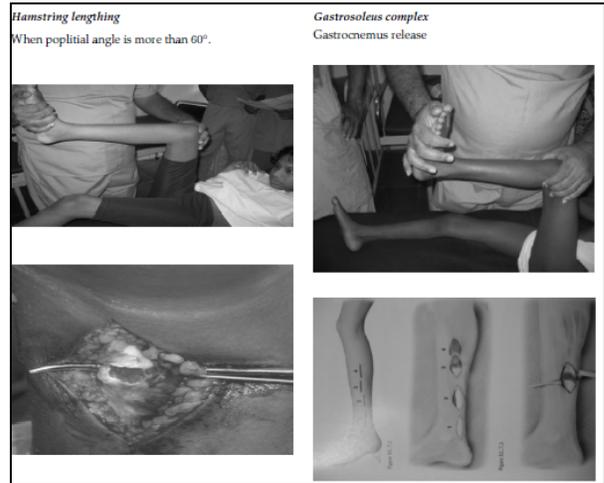
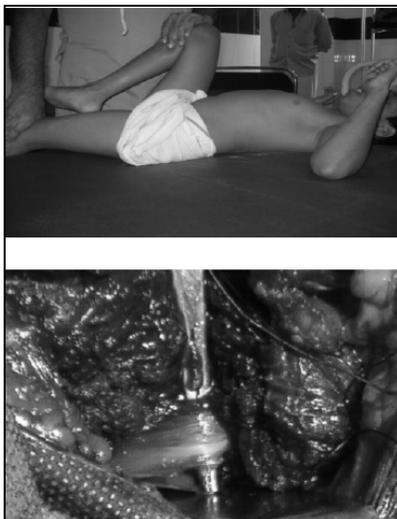
Bed bound patients, those without adequate trunk balance, those with any prior surgical attempts and those not willing to participate in study are excluded. Assessment of deformities were done by physical examination, observational gait analysis and X-rays in selected cases.

Physical examination includes assessing the tone of different muscle groups by modified Ashworth scoring system<sup>4-6</sup>. Thomas test and Staheli maneuvers for hip flexion contracture, Obers test for iliotibial band contracture, Prone Duncan Ely's test for rectus femoris contracture, Phelps and modified Phelps test to differentiate between hip adductor muscle spasm from hamstring spasm, Popliteal angle for hamstring tightness, Confusion test for assessing tibialis anterior, Silverskiold test to assess contribution of gastrocnemius & soleus to equinus deformity, Craigies Rider's method for femoral anteversion, Thigh foot angle and bimalleolar axis for tibial torsion and Extension block (Coleman) test to determine fore foot & hind foot relationship as well as flexibility of hind foot in foot deformities 1, 7 were all done. Observational gait analysis includes taking a video of the gait of the patient from the anterior, lateral and posterior aspects for about 5-10 min. This is analysed for the speed, pattern of gait, need for assistive devices, and deformities at different levels. Radiological assessment includes mainly pelvis with both hip in "Hip at risk children"<sup>1</sup> (i.e., when hip abduction less than 30 degree) or flexion adduction deformity of hip leading to hip subluxation or dislocation<sup>1</sup>.

### 2.1 Soft Tissue Procedures

#### 2.1.1 Psoas release

Based on Thomas test/Staheli test if  $>45^\circ$  hip flexion contracture.



### Bony Procedures

**Derotational femoral osteotomy**  
For excessive femoral anteversion by Craigi' method

**Supracondylar extension osteotomy**  
For static knee contracture.

**Mosca (calcaneal lengthening) or Evans lateral column lengthening**  
For less severe calcaneo valgus deformity in young children.

**Subtalar arthrodesis (grice green)**  
In passively correctable ossified tarsal bone with more severe valgus, in older.



**Shelf procedure**  
Has a salvage procedure in hip subluxation and dislocation.



**patellar tendon plication**  
For patella alta

**Procedures Done**

- T A lengthening : 26
- Gastrocnemius resection : 96
- Hamstrings lengthening : 121
- Adductor release : 57
- Derotation of femur : 9
- MOSCA : 9
- Hip reduction : 3
- T P Transfer : 12
- Rectus Transfer : 1
- Supracondylar osteotomy : 11
- Lateral Column lengthening : 9
- Obturator Neurectomy : 4

- Grice Green : 3
- Psoas release : 7
- Patellar tendon Plication : 11

Postoperative improvement was assessed with Gross motor function classification system<sup>1</sup> and gait. Intense postoperative rehabilitation, after 2 weeks of immobilization was done with help of physiotherapist. Different soft tissue or bony procedures were done at hip, knee and ankle at single sitting according to deformities.

### 3. Results

Follow up of 28 patients were lost for several reasons. Out of the available 115 patients 73 were males and 42 were females. Age distribution was 11 patients were below 4 yrs age, 67 patients between 5–9 yrs, 23 patients between 10–15 yrs & 14 patients above 15 yrs. 62 patients belonged to the poor socio-economic group. Ninety three (81%) patients were having spastic diplegia, twelve (10.4%) had spastic hemiplegia, five (4.3%) quadriplegic & five (4.3%) triplegic. Coming to gait pattern, fiftyone (44%) patients were non ambulant to start with, fourteen (12%) had true equines, twentyfour (21%) had jumping gait, nine (8%) had crouch gait, fourteen (12%) had scissoring gait & three (3%) had intoeing gait. Table 1 shows postoperative improvement in Gross Motor Function Scoring

System (GMFCS) comparing with preop status. Of the 51 who unable to walk, 40 became household ambulators and 7 community ambulators still 4 unable to walk. Of the 64 household ambulators 63 became community ambulators but 1 remained same. By applying the SPSS soft-ware in data interpretation for functional outcome according to GMFCS, using non parametric test, p value comes out to be 0.000 that means <math>p < 0.001</math>, that is there is significant improvement in ambulant status of patients after undergoing single event multilevel surgical procedure with rehabilitation.

### 4. Discussion

In our study we found that, there is no need for sophisticated gait analysis system for treatment plan as far as outcome is concerned, particularly in settings like India. Most of the children were of normal intelligence and none below mild mental retardation, hence we could train them in rehabilitation. Surprisingly none of our patients had scoliosis. Those who had a good trunk balance by four to five years are benefited from this procedure. We could able to do maximum of eight procedures in single setting in around six patients. Tendo achilles lengthening is required in very few selected cases, keeping in mind the change in deformity seen with development from equinus to calcaneus in spastic diplegic patients. Overall we appreciated a significant improvement in gait and functional ability of patients with single event multilevel surgery supporting numerous studies elsewhere in world. Gait parameters improved much faster and to a much greater degree than did functional parameters after surgery. This finding supports the principle that, although there is a relationship between gait and function, that relationship is not linear.

### 5. Conclusions

Our study shows that patients with cerebral palsy of spastic type, who are untreated, present late and cannot walk can be helped by single event multilevel surgery. Even children over 7–8 years of age can be helped, but it is important that they should have attained independent sitting by the age of four to five years. Post-surgical rehabilitation with physiotherapy is vital in maintaining and improving the function.

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