The Plano Valgus Foot in Cerebral Palsy

History/Symptoms
- Clinical exam features
- Gait parameters
- Radiographic features
- Surgical technique
- Evidence

I. PATHOANATOMY - CLINICAL FEATURES: This is primarily a stance phase problem
   a. EQUINUS CONTRACTURE at the ankle because of a gastro-soleus contracture.
   b. Initial contact: mid foot or forefoot
   c. Collapse of the medial arch:
      i. Talus is in equinus, talo-navicular joint is subluxed
      ii. Os Calcis is in Valgus and has a decreased pitch
      iii. Secondary changes in Midfoot and forefoot: dorsal peri-talar subluxation
      iv. External Tibial Torsion and Hallux Valgus
   d. Prominence of the navicular tuberosity -Skin Callosities and pain
   e. Brace Intolerance

II. ASSESSMENT
   a. GMFCS AND FMS
   b. Topography: unilateral, bilateral involvement
   c. Tone Disorder: Spastic, Dystonic, Mixed
   d. Gait parameters:
      i. Temporospatial: Stance phase prolonged
      ii. Ankle and foot kinematics:
         1. Absence of the first Rocker
         2. Curtailed Second Rocker
         3. Early heel rise
         4. Transfer of GRF onto forefoot
         5. Poor third Rocker
      iii. Kinetic changes: Ankle dorsiflexor moment, reduced ankle power
      iv. Proximal level changes: flexed knee gait, incompetent PF-KE couple

III. RADIOGRAPHY
   a. Weightbearing views only
   b. Antero-posterior and lateral views of the foot
   c. AP views of the Ankle
   d. CT for tibial torsion- if indicated

IV. Management options:
   a. Tone management
   b. Orthoses
   c. Contracture management
   d. Skeletal stabilisation

V. Surgical treatment
   a. Stabilisation of the hindfoot with extra-articular techniques
   b. Restoration of the talo-navicular alignment: restore the weight bearing competence of the medial column.
i. Extra-articular hindfoot arthrodesis
ii. Lateral column lengthening: os calcis, calc-cuboid lengthening fusion
iii. Medial column surgery: talo-navicular fusion, naviculo-cuneiform fusion, medial cuneiform osteotomy

References:


Clinical decision making for the management of foot deformities in children with cerebral palsy is based on the collection and integration of data from 5 sources: the clinical history, physical examination, plain radiographs, observational gait analysis, and quantitative gait analysis (which includes kinematic/kinetic analyses, dynamic electromyography, and dynamic pedobarography). The 3 most common foot segmental malalignments in children with CP are equinus, equino-planovalgus, and equinocavovarus. The 2 most common associated deformities are ankle valgus and hallux valgus. Foot and ankle deformities caused by dynamic overactivity and imbalance of muscles are best treated with pharmacologic or neurosurgical interventions designed to manage muscle tone and spasticity, or muscle tendon unit transfers. Deformities caused by fixed or myostatic soft tissue imbalance without fixed skeletal malalignment are best treated with muscle tendon unit lengthening surgery. Deformities characterized by structural skeletal malalignment associated with fixed or myostatic soft tissue imbalance are best treated with a combination of soft tissue and skeletal surgeries.


BACKGROUND: In children with cerebral palsy, planovalgus deformity of the foot is common. The aim of this study was to evaluate the outcome of calcaneal
lengthening for the treatment of planovalgus foot deformity in children with cerebral palsy. MATERIALS AND METHODS: We reviewed 19 children (28 feet) treated between 1996 and 2004 in our institution. There were 14 ambulating (19 feet) and 5 nonambulating children (9 feet). The average age of the children at time of surgery was 8.6 years. Followup averaged 4.3 years. RESULTS: We found satisfactory results in 75% of the feet clinically and in 79% radiologically according to Mosca’s criteria. We saw no overcorrection but a relapse of the deformity in seven cases. There were six unsatisfactory radiological results, two (out of 19) in the ambulating and four (out of nine) in the nonambulating group. Ambulating children had a significantly better clinical and radiological outcome than nonambulating children (p = 0.042). A significant correlation was found between Ankle-hindfoot Score and clinical result according to Mosca’s criteria (p = 0.001). CONCLUSION: In ambulatory children with cerebral palsy calcaneal lengthening is an effective procedure for the correction of mild to moderate planovalgus foot deformities. In nonambulatory children with severe plano-valgus deformities of the foot, calcaneal lengthening cannot be recommended because of the high relapse rate in these patients.


BACKGROUND: The rigid planovalgus foot has historically been difficult to correct and maintain in a corrected position with triple arthrodesis (TA). The lateral column lengthening (LCL) is a procedure that corrects the position of the planovalgus foot. Combining the TA with LCL at the calcaneocuboid joint may improve ultimate position after fusion for patients with rigid planovalgus foot deformities. METHODS: A retrospective review of all patients who underwent TA with LCL through the calcaneocuboid joint for rigid planovalgus foot deformity was performed. Preoperative and postoperative radiographs were compared for foot alignment by measuring the talo-first metatarsal angle in the anterior-posterior and lateral planes, calcaneal pitch, talo-horizontal angle, metatarsal stacking angle, and medial/lateral column ratio. Clinical outcomes were evaluated for correlation with preoperative and postoperative deformity and surgical indications. RESULTS: Twenty-nine surgeries were identified with solid fusions occurring in 27 patients by 12 weeks postoperatively. Two patients with cerebral palsy had persistent hindfoot valgus. At an average follow-up of 32 months after surgical intervention, correction of the talo-first metatarsal angle in the AP and lateral planes, calcaneal pitch, and talo-horizontal angles were statistically significant. There were 25 good clinical results with minimal or no pain with activity (86.2%) and 4 poor or fair results with moderate or severe pain (13.8%). There were 26 radiographic successes (89.7%) and 3 radiographic failures (10.3%). Cerebral palsy was associated with a higher rate of radiographic failures (P=0.01). There were 15 total complications in 11 feet (37.9%). These included 4 related to hardware, 3 involving neurological symptoms, 2 related to soft tissues, development of a symptomatic bony prominence in 2 patients, 1 forefoot deformity, 2 nonunions, and 1 case of Achilles tendonitis. CONCLUSION: Good correction can be obtained and maintained with LCL and TA for rigid planovalgus foot deformity. The procedure is associated with good short-term
clinical and radiographic outcomes and improves the position of the foot with diminished risk of recurrent or continued deformity as compared with historical controls. LEVEL OF EVIDENCE: Level IV (case series).


OBJECTIVES: We evaluated the results of the Grice subtalar extra-articular arthrodesis for pes planovalgus deformity in patients with cerebral palsy and its effectiveness in providing hindfoot alignment. METHODS: Grice subtalar extra-articular arthrodesis was performed for pes planovalgus deformity in 14 feet of nine patients (5 males, 4 females; mean age 10.3 years; range 6 to 12 years) with cerebral palsy. Six patients were diplegic, two patients were paraplegic, and one patient was hemiplegic. Four patients had unilateral, five patients had bilateral involvement. A fibular graft taken from the distal third of the fibula above the syndesmosis was used in all the patients without any fixation material. The patients were assessed with the AOFAS (American Orthopaedic Foot and Ankle Society) hindfoot scoring system pre- and postoperatively. The mean follow-up was 30 months (range 6 to 81 months). RESULTS: Compared with the preoperative values, the mean AOFAS hindfoot score increased from 53 (range 41 to 81) to 68.4 (range 51 to 96), the mean talocalcaneal angle decreased from 52.6 degrees to 30.4 degrees, and from 55.8 degrees to 35.9 degrees in frontal and sagittal planes, respectively (p<0.05). The mean ankle valgus angle measured on anteroposterior radiographs remained unchanged (mean 5 degrees). Of five patients who underwent bilateral surgery, three (21.4%) developed donor-site fibular nonunion on one side. One (7.1%) of these patients also had graft nonunion and displacement. Treatment was rated as satisfactory by the parents of seven patients (77.8%; p<0.05). CONCLUSION: Despite donor-site morbidity, the Grice subtalar extra-articular arthrodesis is an effective procedure for the correction of hindfoot alignment in patients with pes planovalgus deformity secondary to cerebral palsy.


The aim of this study was to report the experience with the use of a modified Grice-Green technique, which was performed using a partial subperiosteal fibular bone graft because of valgus unstable foot in children with cerebral palsy. Fifteen feet of 11 patients were evaluated on the basis of the appearance of the feet, clinical symptoms, and radiographic measurements. After an average follow-up duration of 24 (9-39) months, all feet showed satisfactory clinical and radiological results. Solid fusion and sustained correction took place in all feet. The gap at the donor site was bridged with new bone in all cases. No donor-site morbidity was detected. This modification of the Grice-Green technique can be used effectively in the correction of planovalgus foot in cerebral palsy.

Pes planovalgus deformity is common in children with cerebral palsy. In planovalgus foot, the talus subluxates medially, the calcaneus is in valgus, and the forefoot is in supination and external rotation related to the midfoot. In young children, mild planovalgus feet can be managed with orthotics. Surgery is indicated if the deformity is not reducible or if the patient cannot tolerate orthotics during functional activities. The surgery can be calcaneal lengthening or subtalar fusion to restore a stable plantigrade foot and achieve hindfoot correction. Medial column fusion is important to reconstruct the medial arch in severe planovalgus feet.


BACKGROUND: We studied the use of cortico-cancellous circular allograft combined with cannulated screw fixation for the correction of dorsolateral peritalar subluxation in a series of children with bilateral spastic cerebral palsy undergoing single event multilevel surgery. METHODS: Forty-six children who underwent bilateral subtalar fusion between January 1999 and December 2004 were retrospectively reviewed. Gait laboratory records, Gross Motor Function Classification System (GMFCS) levels, Functional Mobility Scale (FMS) scores, and radiographs were reviewed. The surgical technique used an Ollier type incision with a precut cortico-cancellous allograft press-fit into the prepared sinus tarsi. One or two 7.3 mm fully threaded cancellous screws were used to fix the subtalar joint. Radiographic analysis included preoperative and postoperative standing lateral radiographs measuring the lateral talocalcaneal angle, lateral talo-first metatarsal angle, and navicular cuboid overlap. Fusion rate was assessed with radiographs >12 months after surgery. RESULTS: The mean patient age was 12.9 years (range, 7.8 to 18.4 y) with an average follow-up of 55 months. Statistically significant improvement postoperatively was found for all 3 radiographic indices: lateral talocalcaneal angle, mean improvement 20 degrees (95% CI, 17.5-22.1; P<0.001); lateral talo-first metatarsal angle, mean improvement 21 degrees (95% CI, 19.2-23.4; P<0.001); and navicular cuboid overlap, mean improvement 29% (95% CI, 25.7%-32.6%; P<0.001). FMS improved across all patients, with Gross Motor Function Classification System III children experiencing a 70% improvement across all 3 FMS distances (5, 50, and 500 m). All 3 radiographic measures improved significantly (P<0.001). Fusion was achieved in 45 patients and there were no wound complications. CONCLUSIONS: With this study, we demonstrate significant improvement in radiographic segmental alignment and overall function outcome with this modified subtalar fusion technique. We conclude that this technique is an effective complement for children with dorsolateral peritalar subluxation undergoing single event multilevel surgery. LEVEL OF EVIDENCE: Level IV.


PURPOSE: The purpose of this report is to review our experience with talonavicular joint arthrodesis for the treatment of severe valgus foot deformities in older children and adolescents with cerebral palsy (CP). METHODS: The clinical, radiographic, and gait parameters results after talonavicular joint arthrodesis were retrospectively
reviewed in 32 patients (59 feet) with valgus deformities of the foot. The surgery was performed as part of multiple simultaneous surgeries for the treatment of gait disorders. The mean age of the patients was 13.9 years (range 9-20 years) and the mean follow-up was 40 months (range 18.3-66.7 months). RESULTS: The clinical and radiographic measurements improved significantly (P = 0.000). There were no significant changes in gait parameters. Symptoms were relieved in most patients with symptomatic preoperative feet. The most frequent complication was pseudoarthrosis, which occurred in seven feet. We found a high rate of satisfaction of patients (or parents) and most of them recommended the procedure to other patients with the same condition. CONCLUSION: Talonavicular joint arthrodesis is a reliable technique that provides both functionally and cosmetically good results with a low rate of complications in the treatment of severe pes planus valgus in older children and adolescents with CP. Careful examination should rule out concomitant ankle valgus deformities. A stable fixation of the arthrodesis is recommended.