Management of Crouch in Cerebral Palsy Diplegia

Dr. Kunjabasi Wangjam, MBBS, MS (Orth), DNB (PMR), Assoc Prof and Head
Dr. Ak. Joy Singh, MBBS, MD (PMR), DNB (PMR), Assistant Professor
Dr. L. Nilachandra Singh, MBBS, Registrar
Department of Physical Medicine and Rehabilitation,
Regional Institute of Medical Sciences, Imphal, Manipur

Abstract

Crouch gait or posture is one of the most resistant conditions to treat in cerebral palsy with spastic diplegia. Twenty nine such patients (19 males, 10 females); aged between 3 to 16 years (mean 8.9 years) were treated at the Department of Physical Medicine & Rehabilitation, Regional Institute of Medical Sciences, Imphal from January 1992 to December 2003 by partial transfer of distal hamstrings to correct crouch gait. Semitendinosus and biceps femoris tendons were transferred to lower femoral condyles by fixing to tendinous origins of corresponding gastrocnenii. Semi-membranosus tendon was not transferred; but lengthened and it was left to serve as knee flexor. Results were assessed at 6 weeks, 3 months, 12 months after operation based on reduction of popliteal angle, increase of hip extensor power, improvement in balance and gait. Accordingly, 6 cases were graded as excellent; 16 as good; 2 as fair and there was no patient in poor grade. Genu-recurvatum occurred in 2 cases. Patients were followed up for a period ranging from 1 to 10 years (mean 5.5 years). This method of partial transfer of distal hamstrings is effective in relieving crouch gait in spastic diplegic cerebral palsy.

Key Words: Cerebral palsy, Crouch gait, Spastic, Diplegia, Hamstrings transfer, Hamstrings lengthening

Introduction

Crouch gait/ posture is one of the most resistant conditions to treat in cerebral palsy with spastic diplegia. Conservative treatments like stretching of spastic knee flexors, strengthening of knee and hip extensors, fitting of orthosis fail to address this problem in majority of cases. Most popular method of treatment of crouch gait is lengthening of hamstrings which reduces knee flexion – the most important component of crouch complex directly. Injection of botulinum toxin in hamstrings to weaken it is also another method of treatment. More rational approach in treating crouch gait is to transfer distal hamstrings to distal femur in which the deforming force is utilized for improving hip extension. The earliest reported operation of this type is Egger’s operation1. In this operation, the problem of pelvic tilt is solved by improving hip extension. However, genu-recurvatum is the common complication after this procedure. Evans2, Ray and Ehrlich3 reported modifications to Egger’s technique to avoid this complication. In this study we transfer semi-tendinosus and biceps femoris to femoral condyles to function as hip extensor and retain semi-membranosus as knee flexor to prevent genu-recurvatum. Semi-membranosus is appropriately lengthened to correct knee flexion deformity.

Objective

The objective of this was to test the effectiveness of our method of partial transfer of distal hamstrings combined with appropriate lengthening of remaining hamstrings in correcting crouch gait in CP diplegic; and of minimizing the usual complications like pelvic tilt, genu-recurvatum associated with transfer of hamstrings reported earlier.

Materials and Methods

Twenty nine CP diplegic patients (19 M, 10 F); aged between 3 to 16 years (mean 8.9 years) who attended Department of Physical Medicine and Rehabilitation from Jan 1992 to Dec 2003 were included in this study. Out of 29, 13 children were delivered at hospital; rest 16 children at home. Fourteen cases were born premature; remaining 15 were full term. There was one case of instrumental delivery.

Inclusion criteria for this study were:

- Cerebral palsy with spastic diplegia.
- Popliteal angle more than 40°
- Presence of kneel standing balance.
Patients with the following conditions like ilio-psoas spasticity, mental retardation, hearing impairment, visual impairment were excluded from this study. Cases which were previously operated by neurectomy, tendon transfer etc. were also excluded, except in two cases. Presence of calf spasticity and ankle clonus was not considered as contraindication.

**Method**

Surgery was performed in prone position under GA. Fifty-eight limbs of 29 patients were operated. Both the limbs of the same patient were operated simultaneously by two teams under tourniquet. The hamstrings tendon insertions and tendinous origins of gastrocnemi were exposed through a horizontal incision at popliteal crease. Tendons of semi-membranosus and biceps femoris were divided near the insertions and secured with stay sutures. Short head of biceps was resected from the tendon. Tendon of semi-membranosus was lengthened by z-plasty or fractionally lengthened according to the degree of tightness. Superficial halves of tendinous origins of gastrocnemi were sliced off and reflected proximally (Fig.1). Tendons of semi-membranosus and biceps femoris were fixed to the reflected origins of gastrocnemi (Fig.2). Wound was closed in layers and long leg plaster cast was applied.

TA tightness or / and calf spasticity were released in the same sitting by lengthening or selective tibial neurectomy in 5 cases in addition to the above procedure to prevent genu recurvatum and stiff knee gait.

**Post-operative care**

At 3 weeks, cast and sutures were removed. Active hip extension, knee flexion and ankle dorsiflexion exercises were done with manual assistance in few weeks after removal of cast. Retraining of transferred tendons by faradic stimulation was also started during this period. Standing and weight bearing were started after 4 to 6 weeks after surgery. When standing balance was achieved, patients were allowed to walk inside parallel bar.

**Results**

Patients were assessed at 6 weeks; 3 months; 6 months; 1 year after surgery. Minimum follow-up period was 1 year and maximum 10 years (Mean 5.6 years). Of 29 patients, 5 were lost to follow-up; hence, only 24 patients were assessed as per following criteria:

- Decrease in popliteal angle: Pre and post operative values were recorded. Average values of right and left were plotted for each patients in chronological order of timing of operation as in Diagram 1a. Grading was done according to the degrees of reduction of post-operative measure compared to pre-operative value of this angle; poor – less than 15°; fair - more than 15°, less than 30°; good – more than 30° and less than 40°; excellent – more than 40° or normal post – operative Population.

- Increase in hip extensor strength: Hip extension was tested while the patient was in prone position. Power was graded in MRC scale 1 to 5. Difference between pre-operative and post-operative measures were plotted as in Diagram 1b. Grading of result was done as: poor – no improvement in grade; fair – 1 grade improvement; good – 2 grade improvement; excellent – 3 grade improvement.

**Post-operative care**

At 3 weeks, cast and sutures were removed. Active hip extension, knee flexion and ankle dorsiflexion exercises were done with manual assistance in few weeks after removal of cast. Retraining of transferred tendons by faradic stimulation was also started during this period. Standing and weight bearing were started after 4 to 6 weeks after surgery. When standing balance was achieved, patients were allowed to walk inside parallel bar.

**Discussion**

Crouch gait is the most resistant condition to treat in the diplegic spastic cerebral palsy. Crouch complex consists of flexion at hip and knee; planter flexion at ankle. Weakening of hamstrings to reduce knee flexion which is the most important component of crouch is the commonest technique used to treat this condition. Partial distal lengthening of medial or lateral
hamstrings;4,5,6 total distal lengthening,7,8,9,10,11,13,14,15,16 and proximal hamstrings lengthening17,18 by fractional lengthening or z-plasty are reported recently. Partial lengthening usually leads to re-appearance flexion attitude. Whereas, total release is associated with incidence of pelvic tilt6,7,10 and genu-recurvatum7. Pelvic tilt is due to weakness of extensor of hip, even if there is no spasticity or contracture of ilio-psoas. Hoffinger and Abou Ghaida19(1993) had shown that Hamstrings function as important hip extensor in CP diplegics as shown by dynamic electromyography of hamstrings. Other method of weakening of the hamstrings is by injection of Botulinum toxin in the hamstrings.20 This effect of toxin is shown by dynamic electromyography of hamstrings. Other complications reported by other workers,12 like knee flexor weakness,11 genu-recurvatum,3,4,7 lack of knee extension,9,10,12 we encounter hamstrings weakness in 9 cases; 2 cases of genu-recurvatum; none of the last. However, all the nine cases of hamstrings weakness achieved 3/5 power at six months after operation.

**Conclusion**

Partial transfer of distal hamstrings using semi-tendinosus and biceps femoris to femoral condyles through tendinous origins of gastrocnemius, combined with appropriate lengthening of semi-membranosus is effective in relieving crouch gait in cerebral palsy with spastic diplegia. Operation is technically same as any type of distal hamstrings lengthening. Serious complications of both hamstrings lengthening and transfer are avoided in this technique.

**References**

2. Eugene E. Bleck: Orthopaedic management of Cerebral palsy, 1979; 6: 182


