SIMULTANEOUS MULTIPLE OPERATIONS FOR THE LOWER EXTREMITY CONTRACTURES OF SPASTIC CEREBRAL PALSIED PATIENTS

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SUMMARY

Introduction: Spasticity around the hip, knee and ankle in cerebral palsy patients interferes with ambulation, sitting and hygiene. Surgical release of the spastic muscles is frequently needed.

Materials and Methods: Eight patients, three girls and five boys, ages ranging from 7 to 17, had simultaneous multiple operations for their lower extremity contractures. Two patients were quadriplegics and 6 were diplegics. The mean number of operations performed at a single session were 6.6 (range 4 to 10). The mean operation time was 105 minutes (range 35 to 180 minutes) and the mean hospital stay was 3.4 days (range 2 to 6 days).

Results: There were no serious complications during and after the operations. Rehabilitation was started by hysiotherapists soon after surgery. All the diplegics attended sessions of hippotherapy, therapy by horse riding. At latest follow-up at a mean of 24 months all the patients had increase at their level of activities.

Conclusion: Simultaneous correction of the lower extremity deformities of the cerebral palsied patients decreases costs and simplifies postoperative rehabilitation without increasing the risks for the patients.

Key Words: *Cerebral Palsy, Spasticity, Children.*

ÖZET

SPASTİK SEREBRAL PARALİZİDE ALT EKSTREMİTE KONTRAKTÜRLERİNE TEK SEANSTA BİRDEN FAZLA SEVİYEDE CERRAHİ GİRİŞİM

Serebral Paralizi hastalarında kalça, diz ve ayak bileğini ilgilendiren alt ekstremite kontraktürleri oturma, ambulasyon ve hijyen kurallarına uyum gibi çok önemli fonksiyonları olumsuz etkilemektedir. Spastik adalelerin cerrahi olarak gevşetilmesi ile bu sorunlar hafifletilebilir.

Bu çalışmada yaşları 7-17 arasında değişen 3 kız ve 5 erkekden oluşan 8 hastadaki alt ekstremite kontraktürlerine yönelik tek seansta birden fazla seviyede uygulanan cerrahi girişimler tartışılmıştır. İki hasta kuadriplejik iken diğer 6 hasta ise diplejik idi, ve tek seansta ortalama 6.6 (4-10) ayrı cerrahi girişime uğramışlardı. Ortalama ameliyat süresi 105 dakika (35-180 dakika), ve hastanede kalış süresi 3.4 (2-6 gün) gündür. Gerek cerrahi sırasında ve gerekse ameliyat sonrasında önemli ciddi bir komplikasyona rastlanmamıştır. Cerrahiyi takiben kısa bir süre sonra rehabilitasyona başlanmıştır. Diplejik hastalar özellikle ata binme tedavisi, hippotrerapi programına alınmışlardır. Ortalama 24 aylık takip sonucunda hastalarda fonksiyonel olarak aktivite seviyelerinde artış gözlenmiştir. Tek seansta birden fazla seviyede uygulanan cerrahi girişimlerin hastalar için komplikasyon riskini arttırmadan, ekonomik boyutu azalttığı ve ameliyat sonu rehabilitasyonu en azından bir seansa indirerek basitleştirdiği söylenebilir.

Anahtar Kelimeler: *Serebral Paralizi, Spastisite, Çocuklar, Cerrahi Uygulamalar.*

INTRODUCTION

Cerebral palsy is a static encephalopathy resulting in varying degrees of delay in milestones of development. The classification systems of the disease are according to the anatomical and pathophysiological involvement. Spasticity is the most common type of pathology encountered other types being as mixed spastic-athetoid, dyskinetic forms like athetosis, ataxia and rigidity[1-3].

The aim of spasticity treatment is to reduce contractural deformity, improve patient function and relieve pain. Simultaneous correction of deformities of the spastic cerebral palsy at many joints has been

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recommended by Reimers, Bleck and Rang et al. and has been supported by other authors[4-7]. This aggressive approach causes less morbidity, decreases total hospital stay and home care and simplifies postoperative rehabilitation to a single stage.

The purpose of this study is to review the results of simultaneous correction of the lower extremity deformities of quadriplegic and diplegic spastic children. Also, an unusual rehabilitation protocol is presented.

PATIENTS AND METHODS

Patients having at least four surgeries at different parts of their lower extremities at a single session were included into the study. There were 8 patients, 3 girls and 5 boys, with ages ranging from 7 to 17 years.

All the patients had spastic type cerebral palsy, 7 due to prematurity and one had Pelizeus Merzbacher disease (Table I). Two of the patients were quadriplegic and 6 were diplegic. Three of the patients were non-ambulatory before surgery; two of them quadriplegic, one diplegic. Two other diplegics were using walkers for ambulation.

Preoperative functional status of the patients was recorded. Each of the deformities of the hip, knee, ankle and foot were assessed, and a preoperative plan was made to address them at a single session whenever possible.

All the surgeries were performed under general anaesthesia by a team composed of the two authors (UŞ and SA) and two assistants. When possible two teams worked simultaneously on each of the lower extremities. Tourniquets were not used, because they were found to be cumbersome when a hip surgery was performed on the same extremity.

All the hip surgeries were done patients lying supine. For hip flexion contracture a Campbell type iliac crest resection combined with iliopsoas and rectus femoris tenotomy was performed[8]. Adductor muscles were released by open technique without an obturator neurectomy.

For release of knee flexion contracture patients were turned to the prone position. Semitendinosis was lengthened by Z-plasty, semimembranosus and biceps femoris tendons were recessed at multiple levels.

Table I
A Summary of The Surgeries Performed and Preoperative and Postoperative Functional Status of the Cases

Case	Sex	Age at Surgery	Diagnosis	Operations Performed	Functional Status	
					Preoperative	Two Years Follow-up
1	M	8	Diplegia	Bilateral adductor myotomy, Bilateral iliopsoas tenotomy, Bilateral excision of the excessive portion of the iliac crest, Bilateral hamstring lengthening, Bilateral subtalar extraarticular arthrodesis	Difficulty in sitting, Poor perineal hygiene, Difficult mobilization using a walker	Comfortable sitting, Better perineal hygiene, Mobilizatilon in a long leg brace without assistance
2	F	16	Quadriplegia and mental retardation	Bilateral adductor myotomy, Bilateral iliopsoas tenotomy, Bilateral excision of the excessive portion of the iliac crest, Bilateral hamstring lengthening, Bilateral Achilles tendon lengthening	Nonambulator, Dificulty in sitting, Poor perineal hygiene	Comfortable sitting, Better perineal hygiene
3	M	17	Quadriplegia and mental retardation	Bilateral adductor tenotomy, Bilateral hamstring release, Bilateral iliopsoas tenotomy	Nonambulator, Difficulty in sitting, Poor perineal hygiene	Comfortable sitting, Better perineal hygiene
4	F	8	Diplegia	Bilateral adductor myotomy, Bilateral hamstring release, Bilateral Achilles tendon lengthening	Difficulty in walking and wearing shoes	Better walking without assistance and better shoe fitting
5	F	10	Diplegia	Bilateral adductor tenotomy, Bilateral subtalar extraarticular arthrodesis	Difficulty in wearing shoes, Skin breakdown at the medial borders of the feet	Better shoe fitting, Increase at the speed of walking
6	M	11	Diplegia	Bilateral adductor tenotomy, Open reduction, Salter's innominate osteotomy and varus derotation osteotomy of the righ hip, Right psoas tenotomy, Bilateral hamstring release, Bilateral Achilles tendon lengthening	Nonfunctional ambulator with support, Pain at the right hip	Functional walking with long leg brace and crutches
7	M	7	Diplegia	Bilateral adductor myotomy, Bilateral Achilles tendon lengthening	Difficulty in walking and wearing shoes	Better shoe fitting and walking
8	M	13	Diplegia	Bilateral adductor tenotomy, Bilateral hamstring release, Transfer of FCU to extensor tendons	Poor shoe fitting, Poor perineal hygiene, Scisoring gait	Better shoe fitting and perineal hygiene, Better walking

Achilles tendons were lengthened by open Z-plasty or by closed tenotomy per preference of the operating surgeon.

For subtalar arthrodesis Grice Green technique was used, but instead of harvesting a graft from the tibia, bone resected from the ilium during hip contracture release was used when available[9].

Long-leg bivalved casts with the knee in extension and ankle in neutral position were used postoperatively. Gentle passive movements of the joints were started within the first week of the operation. After discharge from the hospital the parents under the supervision of physiotherapists performed home physiotherapy. The patients with a potential were started ambulation therapy after removal of the casts. Additionally, hippotherapy, therapy by horse riding, was started two to four months postoperatively. Each hippotherapy session continued for about 45 minutes, twice a week, under the supervision of a physiotherapist and a horse rider.

RESULTS

The mean number of lower extremity surgeries performed at a single session were 6,6 (range 4 to 10). Surgeries performed on each of the cases are summarized at the Table I. Only one patient had an upper extremity tendon transfer during lower extremity contracture release.

The mean operative time was 105 minutes (range 35 to 180 minutes). The mean blood loss was 195 cc (range 100 c to 600 cc). Two of the patients (case 2 and 6) necessitated blood transfusions, 450 and 750 cc respectively, postoperatively. The mean hospital stay was 3.4 days (range 2 to 6 days). None of the patients necessitated intensive care unit postoperatively.

No complications occurred during surgery. Postoperatively, haematoma collected at the left adductor release site of one patient (case no. 1), but wound healing was eventless after drainage. Another patient (case 6) had superficial necrosis of the distal part of the right Smith Petersen incision and the wound healed after debridment and secondary closure. All the wound of the rest of the patients healed without a problem.

The mean follow-up of the patients was 25.8 months (range 14 to 40 months). Four patients had release of their hip flexion contractures. The mean preoperative hip flexion contracture was 30 degrees on the right and 28.3 degrees on the left side and postoperative measurements were 6.25 and 5 degrees for right and left sides respectively (Table II).

Table II
Pre and Postoperative Knee and Hip Flexion Contractures of the Patients

	Popliteal Angle				Hip Flexion Contracture			
	Preop		Two Years Postop		Preop		Two Years Postop	
Case	R	L	R	L	R	L	R	L
1	70	65	20	15	30	25	10	5
2	80	80	25	25	40	40	5	10
3	45	50	15	20	15	20	0	0
4	25	25	10	10	–	–	–	–
5	–	–	–	–	–	–	–	–
6	75	50	25	10	35	–	10	–
7	–	–	–	–	–	–	–	–
8	20	20	5	5	–	–	–	–

Six patients had release of knee flexion contractures. The mean preoperative popliteal angles were 52.5 and 48.3 degrees for the right and left sides respectively. These measurements decreased to 16.6 and 14.1 degrees for the right and left sides respectively (Table II).

During rehabilitation, a non-displaced femoral neck fracture occurred in a patient and healed without an intervention. Another patient had a supracondylar femoral fracture, which was treated by open reduction and plate fixation and healed without a problem. Both of these patients were non-ambulatory quadriplegics and had osteoporotic bones. Preoperative and postoperative two years follow-up functional levels of the patients are listed at the Table I.

DISCUSSION

Treatment options for spasticity in cerebral palsied patients includes physiotherapy, use of neuropharmacological agents, orthotics and surgical procedures[10-12]. Often a combination of the above procedures is needed for an individual patient. Surgical management of spasticity can be performed at different levels as the brain, medulla spinalis, peripheral nerves and contracted or spastic muscles. Stereotactic brain surgery and non-specific cerebellar stimulation need further technical refinements to be used widespread. Selective posterior rhizotomy is popular with variable but encouraging results. Although, the contracted or spastic muscle is only the end-organ, the release, lengthening or transfer of such a muscle are the most common surgical procedures performed[13].

It is imperative that the treating surgeon has a thorough knowledge of the complex effect of each deformity on other joints. In the lower extremity flexion contracture of the hip, knee and the ankle

are closely interrelated and a surgical intervention targeting only one of these joints is likely to fail with recurrence of the deformity. After such a procedure efforts of rehabilitation are also useless since some of restraints for sitting and walking are still active. Also staged surgery and following rehabilitation for these deformities are painful, expensive, boring and time wasting for the patient and the parents. These are the reasons why many authors are now advocating simultaneous correction and aggressive rehabilitation of the deformities in cerebral palsy[7,14].

One may be concerned about the morbidity of such an extensive procedure on a patient already considered risk for surgery. All of our patients tolerated the procedures very well without a single peroperative complication. Mean operation times were reasonable and rate of blood transfusions was low. The mean hospital stay was not also lengthened considerably compared to other types of minor surgeries performed for cerebral palsy.

Technically, simultaneous surgery is not problematic. A double team approach shortens the operation time and we have not encountered any problems during turning the patient from supine to prone position. An advantage of our technique is the usage of excessive iliac crest bone as a graft for subtalar arthrodesis where needed. This prevents the donor site morbidity compared to obtaining the graft from the tibia[9]. The iliac crest bone is of comparable strength and can incorporate more easily than the cortical tibial bone.

All our patients had aggressive postoperative rehabilitation program starting from the day after surgery. This was complicated by two fractures, which healed uneventfully. One must be cautious during the passive mobilization of the joints of a non-ambulatory patient who has extremely osteoporotic bones. Otherwise all of the patients improved considerably compared to their preoperative status.

Hippotherapy uses the horse as an aid in therapy on the principle of conveying to the patient the three-dimensional swinging motion of the horse's back[15]. Tauffkirschen mentions the possibility of neurodevelopmental treatment by hippotherapy[16]. In our group, excluding the mentally retarded quadriplegics, this kind of physiotherapy improved the posture tonus, reduced the spasticity and inhibited the pathological movement patterns. This therapeautic pleasure also motivated the children to a satisfactory cooperation (Figures 1 and 2).

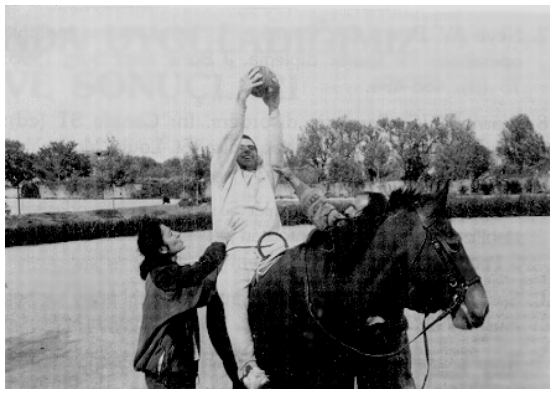

Fig. 1

Fig. 2

In conclusion, if the advantages of simultaneous multiple surgeries can be coordinated with an intensive physiotherapy program by an experienced team, reasonably successful results can be obtained for the treatment of the lower extremity contracures of the cerebral palsied patients.

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