

Role of Gastrocnemius Release in Treatment of Equinus Deformity in Cerebral Palsy

KG Korsah, FRCS*

Salem Al-Zahrani, FRCS**

ABSTRACT

Equinus deformity is one of the common deformities seen in Cerebral Palsy. Various methods have been used to correct the deformity but failed to give good result.

Study done on 22 patients (total 40 limb) who had gastrocnemius release with or without an additional elongation of the achilles tendon. There were seventeen patients with spastic diplegia, 4 patients with infantile hemiplegia and one patient with spastic quadriplegia. Twelve patients were females.

Average age was 10 years and 7 months and the mean period of follow-up was 30 months. Elongation of achilles tendon was done for 2 patients with spastic paraplegia and 4 with infantile hemiplegia.

The result was 70% excellent, 20% good and 10% poor. Most of the excellent and good results were in younger age group.

The aim of this paper is to describe this method which gave satisfactory results in correction of the spastic equinus deformity.

Cerebral Palsy is a difficult problem requiring a multi-disciplinary approach to manage it. Equinus is one of the most common deformities seen in these children^{1,2,3,4,5}.

Various methods have been used to correct equinus deformity, including passive stretching by physiotherapists, splinting with ankle-foot-orthosis (AFO) of knee-ankle-foot-orthosis (KAFO), denervation of gastrocne-

mius and soleus muscles⁶ and open lengthening of the Achilles tendon or percutaneous tenotomy of Achilles tendon⁷. We have tried many of these methods in turn, and wish to describe gastrocnemius release with or without an additional elongation of the achilles tendon which gave satisfactory results in correction of the spastic equinus deformity.

It is fairly well established that the abnormality that produces the equinus deformity and the adductor spasm is the exaggerated stretch reflex⁵. Many of these patients have plantigrade feet at rest but the deformity gets more pronounced at the beginning of the movement or in the attempt to stand. Forcible dorsiflexion of the foot may provoke spasm or ankle clonus. Thus, it is quite clear that the equinus deformity is a dynamic posturing rather than a static contracture of the gastrocnemius alone and sometimes with soleus. This is especially true in the young patients before the fixed secondary changes in the soft tissues and bone had occurred. When the knee is flexed and the foot can be dorsiflexed fully, the equinus is due to spasm in the gastrocnemius alone (Positive Silverskiold test). So the gastrocnemius release alone will correct the deformity. If there is some limitation of dorsiflexion with the knee fully flexed, then both the gastrocnemius and the soleus are involved in the spasm⁸. To correct such deformity it is not enough to elongate the Achilles tendon alone, as was commonly believed, but the gastrocnemius release should be done at the same time.

METHODS

Between 1984 and 1989, we selected cerebral palsy patients with spastic diplegia, infantile hemiplegia and spastic quadriplegia for surgery. Patients with dyskinesia,

* Associate Professor
Orthopaedic Department
Medical College and
King Khalid University Hospital
Riyadh, Saudi Arabia

** Assistant Professor
Orthopaedic Department
Medical College and
King Khalid University
Hospital, Riyadh Saudi Arabia

ataxia or athetosis, and those with cognitive disability or mental retardation were excluded on account of their inability to learn how to walk. Many of the patients had been treated earlier at Riyadh Rehabilitation Centre with splints without success. The ages ranged from 5 years to 31 years, with an average age of 10 years and 7 months. Twenty two patients were included in the study; a total of 40 limbs were operated on. There were 12 females and 10 males. The mean period of follow-up was 30 months (December 1984 - December 1989), from 5 months to 60 months.

The Operation - Indication and Technique

The indication for gastrocnemius release was a positive Silfverskiold test. Patients who had persistent or residual equinus after full flexion of the knee were treated with both gastrocnemius release and elongation of the Achilles tendon.

If the patient had tight adductor muscle, adductor tenotomy was done before he was turned prone over chest and pelvic supports. Gastrocnemius release was done through a midline incision in the upper third of the calf. The sural nerve and short saphenous vein were identified and protected. The gastrocnemius tendon is identified at its insertion into the soleus aponeurosis. The loose areolar tissue and any fascial attachments on the medial and lateral borders were freed by blunt dissection right up to the popliteal fossa. The gastrocnemius divided at its musculotendinous junctions and its bellies freed from their attachment to the soleus. They were left free to find their own new level of attachment. If full correction was not achieved we divided the fibrous raphe in the soleus muscle. The limbs were immobilised with the knee fully extended and the ankle fully dorsiflexed beyond the right-angle in and above knee plaster of Paris. If the patient had adductor tenotomy, a wooden cross bar was fixed at the level of the knee in abduction until the patient was ready to start walking in plaster. Most of the patients started walking after the third or fourth day when pain had subsided. We believe that early walking helped to determine the new level of attachment of gastrocnemius tendon to the soleus muscle. The patient was allowed to walk in the long leg plaster for four weeks. After the removal of plaster he was allowed to continue walking freely without splint and with use of a walking frame until he was able to walk unaided.

RESULTS

Twenty two patients with cerebral palsy were treated surgically in this review (Table 1). Seventeen were

Table 1
Type, Result and Additional Procedure

Type	No	Limb	Excel	Good	Poor	AT*	ETA†
Spastic Diplegia	17	34	24	6	4	30	4
Infantile Hemiplegia	4	4	4	-	-	-	4
Spastic Quadriplegia	1	2	-	2	-	2	-
Total	22	40	28	8	4	32	8
Percentage	70	20	10				

*AT - Adductor tenotomy

†ETA - Elongation of the Achillis tendon

diagnosed as spastic diplegia, four as infantile hemiplegia and one as spastic quadriplegia. Sixteen patients had tight adductor muscles. Three patients had already developed fixed knee contracture which required supplementary Eggers operation to enable them to walk.

The results were classified as follows:

1. **Excellent** - Patients who were able to walk independently, and were able to return to normal activities of daily living without support.
2. **Good** - These were able to resume their activities of daily living but required some assistance with splints and walking stick or crutches.
3. **Poor** - Patients who could not return to their activities of daily living in spite of walking aids. These were wheelchair dependent although they could move from chair to couch.

Adductor tenotomy was done in 16 patients. Only two patients of the spastic diplegia group and 4 patients of infantile hemiplegia required elongation of the Achilles Tendon (Table 1). This is because most of the patients were young and had not developed fixed deformities. Eggers operation was done for 3 patients aged 9,10,31 years respectively. The two patients aged 9 and 10 were wheel chair bound before the time of presentation and walked for the first time after the operation. The 31 year old patient was home bounded and seemed to be devoid of any motivation. She had a poor result. Seventy percent of the patients had excellent result, twenty percent had good result, and ten percent had poor result. Most of the excellent results in younger age group under 10 years of age was shown in table 2.

Table 2
Result related to age distribution

Age (Years)	Limb	Excel.		Good		Poor	
		No	%	No	%	No	%
1 - 10	29	25	86	4	14	-	-
11 - 20	5	3	60	2	40	-	-
21 - 30	4	-	-	2	50	2	50
31 - 40	2	-	-	-	-	2	100
Total	40	28		8		4	

DISCUSSION

A study of Equinus deformity in cerebral palsy clearly points out that the main aetiological factor is the primitive abnormal stretch reflex⁸. If any surgical operation in the management of the equinus deformity is to succeed, the operation should aim at weakening the ability of the muscle to be stretched sufficiently to invoke the stretch reflex. Since the slack is quickly taken during growth elongating the Achilles tendon alone is not enough⁹. This gives the impression that the role of the Achilles tendon is a secondary contracture and not part of the original disorder. It was not present in patients under the age of 5 years in our group of patients. Various methods have been tried to achieve weakening of stretch reflex such as altering the origin or insertion of the affected muscle.

Strayer attempted gastrocnemius release but found high percentage of recurrences because he reattached the separated gastrocnemius at a higher level^{9,10}. Sharrard performed a similar operation without reattaching the gastrocnemius but left it to find its own new attachment. He considered that elongation of the Achilles tendon gave the same effect¹. Craig and Van Vuran were not satisfied with the results of the lengthening procedures of the tendo-Achilles, and decided that if the Silfverskiöld test were positive, combined tendo-Achilles lengthening and strayer-type procedure should be performed¹¹. We agree with Craig and Van Vuran, except that we prefer Sharrard's modification of Strayer's operation with division of the fibrous raphe of the soleus muscle if needed to achieve full correction.

Most of the excellent results were found in the younger age group. We are encouraged to continue offering this procedures to other patients starting at an early age. To achieve a good result we advice mobilization of patient at fourth day of operation.

CONCLUSION

From our series we have arrived at certain conclusions that we would like to recommend to surgeons in this field.

1. Silfverskiöld test is a useful test to use to select suitable patients for the operation. If correction of the equinus is full on maximum flexion of the knee, gastrocnemius recession alone is adequate. If correction of the ankle is not full, then both gastrocnemius recession and elongation of the Achilles tendon is the operation of choice.
2. During the gastrocnemius recession the loose fascial and areolar tissues on the medial and lateral borders of the muscle bellies must be free. This allows the muscle to contract fully, especially during the early phase of walking training.
3. The fibrous raphe in the soleus may need to be divide to allow full dorsiflexion of the ankle.
4. After surgery the limb must be immobilised in above knee plaster of Paris with the knee in full extension and the ankle dorsiflexed beyond the right angle.
5. Patient who had adductor tenotomy had a crossbar with the legs in wide abduction until the patients were ready to walk in about the 4th or 5th post operative day.
6. Our patients were made to start walking with a Zimmer frame on the 4th or 5th post operative day under the supervision of a Physiotherapist. We believe this invokes reflexes which stimulates the gastrocnemius to contract maximally.
7. Plasters are removed after 4 weeks, and walking continued under the instruction of a Physiotherapist until the patients are weaned off all appliances and walking aids.

REFERENCES

1. Sharrard WJW, Bernstein S. Equinus deformity in Cerebral Palsy. *J Bone Joint Surg* 1972;54B:272-6.
2. McCarrol HR, Swartzmann JR. Spastic Paralysis and Allied Disorders. *J Bone Joint Surg* 1943;25:745.

3. Pollock GA. Lengthening of the Gastrocnemius Tendon in Cases of Spastic Deformity. *J Bone Joint Surg* 1953;35B:148.
4. Pollock GA. Surgical Treatment of Cerebral Palsy. *J Bone Joint Surg* 1962;44B:68.
5. Silver CM, Simon SD. Gastrocnemius Recession (Silfverskiöld Operation) for Spastic Equinus Deformity in Cerebral Palsy. *J Bone Joint Surg* 1959;41A:1021.
6. Stoffel A. The Treatment of Spastic Contracture. *Am J Ortho Surg* 1913;10:611.
7. Delpech JM. Tenotomie du Tendo. Paris: Chirurgie Clinique de Montpelier, 1823.
8. Silfverskiöld N. Reduction of the Uncrossed Two joints Muscles of the leg to one joint Muscles in Spastic Conditions. *Acta Scandinavia* 1924;56:315.
9. Strayer LM Jr. Recession of Gastrocnemius. *Am J Orthop Surg* 1950;32:671.
10. Strayer LM Jr. Gastrocnemius Recession. *J Bone Joint Surg* 1958;40A:1019.
11. Craig JJ, Van Vuren S. The importance of Gastrocnemius recession in the correction of equinus deformity in cerebral palsy. *J Bone Joint Surg*. 1976;58b:84.