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Hip Dislocation in Cerebral Palsy treated with Soft-Tissue Release

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Abstract：The success of soft-tissue release around the hip in cerebral palsy is closely related to the degree of subluxation at the time of surgery. Here we report the outcomes from soft-tissue release in 25 cases of hip dislocation involving 21 patients with cerebral palsy, between 1989 and 2009. Their mean age at operation was 7.2 years (range from 3.2 to 13.8 years), and the mean duration of follow-up was 69 months (range from 5 to 156 months). Follow-up examinations included anteroposterior radiographs to calculate the hip migration index (MI). A hip is defined as being dislocated if the MI is 80% or more. Postoperatively re-dislocation occurred in 12 hips (48%), and 2 (17%) of these had received reoperation before the re-dislocation. The mean interval between initial surgery and re-dislocation or reoperation was 37.3 months (range from 0 to 139 months). These findings suggest that soft-tissue release was not adequate for managing hip dislocation in cerebral palsy.

Introduction

In children with cerebral palsy, the hip has no dislocation at birth, but subluxation and dislocation then develop due to spasticity and contracture in the muscles around the hip. The greatest risk to dislocation occurs during middle childhood ages (range from 4 to 12 years)[2]. It has been suggested that an untreated dislocation would likely become painful in the natural course. Therefore a wide variety of treatments are used in the management of hip subluxation and dislocation, ranging from bracing and botulinium injection to soft-tissue release and bone surgery. Soft-tissue release aims to balance the muscle forces across the hip joint and improve the location of the femoral head in the acetabulum. The success of soft-tissue release is closely related to the degree of subluxation at the time of surgery[1]. Generally bone surgery is necessary to treat dislocation of the hip because of bone deformities such as increased anteversion in the femur, coxa valga, and an increased acetabular angle. We have used soft-tissue release as a treatment for 'scissors' posture, subluxation, and for dislocation of the hip. Here we report the outcomes after soft-tissue release for hip dislocation in patients with cerebral palsy.

Subjects and Methods

A retrospective review identified 25 hips (involving 21 patients) that had undergone soft-tissue release for hip dislocation, between 1989 and 2009. The mean age of the patients at

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Table 1. Clinical profiles

Patient No Sex	Site	Age (yr)	Type	Time to re-operation or re-dislocation (mo)	Duration follow-up (mo)	GMFCS* (before operation)	GMFCS* (final follow-up)
1M	R	5	Spastic	—	36	4	3
2M	L	3	Spastic	—	26	4	4
3M	L	5	Spastic	—	23	3	3
4M	R	5	Spastic	—	30	5	5
5M	R	5	Spastic	43	96	5	5
6M	R	8	Spastic	3	12	5	5
	L			1			
7F	L	4	Spastic	—	89	4	4
8M	L	11	Spastic	—	16	5	5
9M	L	4	Spastic	—	98	3	4
10M	R	12	Flaccid	4	16	5	5
11M	R	10	Spastic	0	40	4	4
	L			0			
12M	R	4	Spastic	—	142	4	4
13M	L	5	Spastic	75	100	5	5
14F	R	5	Spastic	100	112	5	5
15F	L	10	Athetotic	—	47	2	5
16F	R	7	Spastic	13	94	4	4
17F	R	5	Spastic	139	156	5	5
18M	R	13	Spastic	0	5	4	4
19M	L	9	Spastic	4	70	5	5
20F	R	5	Spastic	—	120	5	5
	L			—			
21M	R	6	Spastic	70	156	4	4
	L			70			

*Gross Motor Function Classification System for cerebral palsy (GMFCS)

surgery was 7.2 years (range from 3.2 to 13.8 years). In the group treated at < 6 years old, there were 13 hips (involving 12 patients), and in the group treated at ≥6 years old, there were 12 hips (involving 9 patients). The mean duration of follow-up was 69 months (range from 5 to 156 months). Follow-up included measuring the migration index (MI) on anteroposterior radiographs. The MI is calculated by dividing the width of the uncovered femoral head by the total width of the femoral head[2]. This measurement is made by drawing Hilgenreiner's line horizontally, then Perkins' line vertically, and then expressing the amount of the femoral head lateral to Perkins' line as a percentage of the total width of the femoral head multiplied by 100[3]. A hip was defined as being dislocated if the MI was ≥ 80%[7]. The clinical profile of each patient is summarized in Table 1.

In soft-tissue release, the adductor longus tendon is lengthened near its origin, and the gracilis is transected from its origin. The proximal hamstrings (semimembranosus, semitendinosus and biceps tendon) are fractionally length-

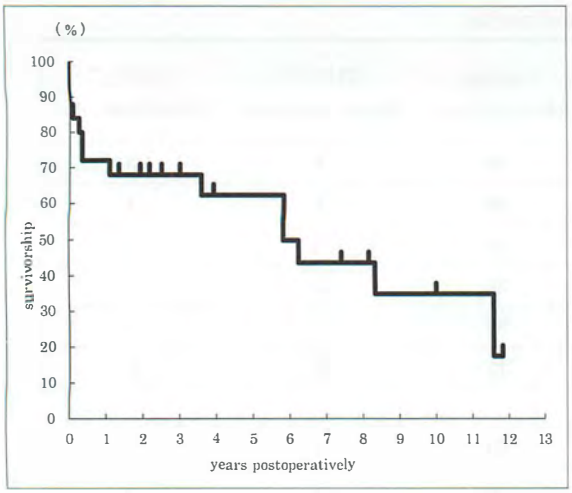

Fig. 1. Kaplan-Meier curve for maintenance of hip correction using re-dislocation or re-operation as the endpoint.

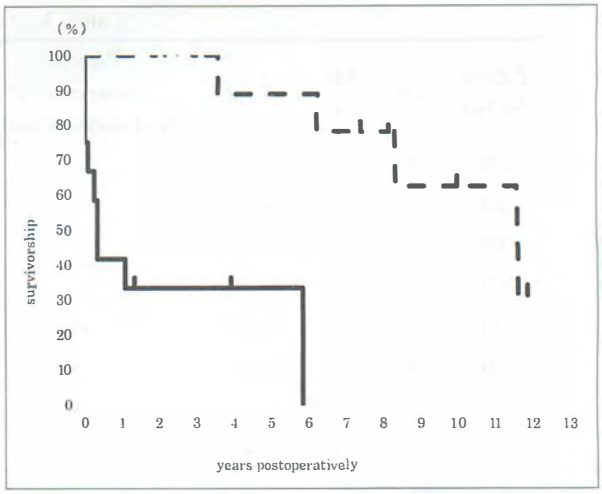

Fig. 2. Kaplan-Meier curve for maintenance of hip correction using re-dislocation or re-operation as the endpoint.
(<6 years ····· , ≥6 years —)

ened near the ischium. The rectus femoris is z-lengthened near its origin. The iliopsoas tendon is released near the lesser trochanter. Release of the ilio-femoral and pecto-femoral ligaments or capsulotomy is added if the hip cannot extend beyond −20°. The distal hamstrings are fractionally lengthened. We did the soft-tissue release at the contralateral side using the same method, whether there was dislocation or not. We then applied two long-leg casts connected with an abduction bar for 3 weeks, and two long-leg braces for the next 6 months. Anteroposterior radiographs of the hip were taken every 6 months. The Kaplan-Meier method was used to estimate probabilities of maintaining the hip correction. We defined the endpoint as re-dislocation or re-operation. For statistical analysis, the Wilcoxon test was used to assess any differences in the endpoint between the group treated at<6 years old and the group treated at≥6 years old at surgery. A p-value at less than 0.05 was accepted as significant. We used the Gross Motor Function Classification System for cerebral palsy (GMFCS) to evaluate patients before surgery and at final follow-up.

Results

The mean preoperative MI was 89.9% (range from 80.0 to 100.0%), and the mean postoperation MI was 52.0% (range from 11.1 to 100.0%). Re-dislocation occurred in 48.0% (12/25) of hips, and 8.0% (2/25) of hips underwent re-operation before re-dislocation. The average interval from surgery to re-dislocation or re-operation was 37.3 months (range from 0 to 139 months). The overall cumulative probabilities of maintaining the hip correction using re-dislocation or re-operation as the endpoint were 63.3% at 5 years and 34.9% at 10 years (Fig. 1). The cumulative probabilities were 88.9% at 5 years and 62.2% at 10 years in the group treated at<6 years old (Fig. 2), and 33.3% at 5 years and 0% at 6 years in the group treated at≥6 years old (Fig. 2). On statistical analysis, there was a significant difference in the endpoint between those at<6 years old and those at≥6 years old at surgery ($p<0.05$). At surgery, 85.7% (18/21) of patients were classified as Level 4 or 5 on GMFCS. Only one patient showed improvement at the final follow-up. The others were the same or worse at the final follow-up (Table 1).

Disccusion and Conclusion

We concluded that re-operation was not successful, because repeat soft-tissue release was less effective than the primary procedure. Presedo *et al* concluded that a repeat-soft tissue release may be indicated in those minimal acetabular dysplasia[5] at ≥8 years of age and with an MI≤40%. The overall rate of maintaining hip correction was 34.9% at 10 years. Therefore soft-tissue release was not adequate for managing hip dislocation in cerebral palsy. The optimum age for soft-tissue release around the hip is reported to be at<6 years[4]. Accordingly we divided our patients into two groups at<6 years old and at≥6 years old at surgery. Cornell *et al* concluded that a preoperative MI<40% showed satisfactory results, whereas all hips with a value of>60% had an unsatisfactory result[1]. The rate of maintaining hip correction was 62.2% at 10 years in patients treated at<6 years old, so nearly 40% of patients will need further hip surgery. We conclude that soft-tissue release at this age should be done before dislocation. The rate of maintaining hip correction was 0% at 6 years postoperatively in patients treated at≥6 years old. Therefore bone surgery for those at≥6 years old should be done within 6 years after soft-tissue release. The risk to hip displacement is directly related to gross motor function as graded using the GMFCS. Dislocation has been found at Level 4 in 12%, and at Level 5 in 26%[6]. In our patients with hip dislocation, 85.7% were classified as being at Level 4 or 5 on GMFCS. Almost all patients were the same or worse at final follow-up. Based on these results, soft-tissue release in cerebral palsy would not improve the level of GMFCS in these patients.

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要　旨

脳性麻痺股関節脱臼に対する軟部組織解離術の治療成績

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脳性麻痺患者の股関節は生下時には脱臼は無いが，痙性のために徐々に亜脱臼や脱臼を生じる．股関節周囲の軟部組織解離術の成績は，手術時の股関節亜脱臼の程度に左右されるといわれている．今回我々は脳性麻痺股関節脱臼に対する軟部組織解離術の成績を調査したので報告する．1989～2009年までに，脳性麻痺股関節脱臼21人25股関節に軟部組織解離術を行った．手術時平均年齢は7.2歳(3.2～13.8歳)，平均観察期間69か月(5～156か月)であった．股関節正面X線像にてmigration index(MI)を評価した．MI≧80%を脱臼と定義した．48.0%(12/25)に再脱臼を生じた．8.0%(2/25)は再脱臼する前に再手術を行っていた．手術から再脱臼や再手術までの期間は平均37.3か月(0～139か月)であった．脳性麻痺股関節脱臼に対する軟部組織解離術の効果は満足できるものでは無かった．