

## Surgical Treatment for Clubfoot at Maharat Nakhonratchasima Hospital : Clinical Results

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**Abstract :** 72 Congenital clubfoot patients were treated by McKay complete subtalar release, between Jan 1992 and Dec 1999. The average age at operation was 5.8 months (range 2-48 months). 35 patients (56 feet) were evaluated for clinical and X ray results at 3 years after the operation using the N. J. Rumyantsev rating : excellent or good results were achieved in 44 feet, fair in 2 feet, and poor in 10 feet. The mean rating was 101.9 points. The feet with excellent or good results were idiopathic clubfoot, with variable degree in severity and rigidity, had more than grade 0 peroneus muscle function before the operation, and at least grade 4 at 3 years after the operation. 8 of the 10 feet with poor results were teratologic clubfoot with more severity and rigidity and grade 0 peroneus muscle power before the operation and at 3 years later. The average AP talocalcaneal angle, talofirstmetatarsal angle, lateral talocalcaneal angle and calcaneal pitch were 24.3, 2.1, 30.6 and 13.8 degrees respectively. 9 feet (16.07%) required a second operation for recurrent deformity. McKay complete subtalar release was concluded to be an effective procedure to correct clubfoot deformity.

### Introduction

Various methods of surgical treatment have been used to correct multiplanar deformity of clubfoot that does not respond to initial conservative treatment, or which relapses. The aims of the present study were to evaluate the clinical results after McKay complete subtalar release done by the same surgeon and to investigate any correlation among the preoperative function, the post-operative exercise program, and the final result.

### Materials and Methods

72 patients with clubfoot were surgically treated between January 1992 and December 1999. Their average age at operation was 5.8 months (range 2-48 months). Cases with less than 3 years follow-up were excluded. 35 patients (56 feet) were investigated with a mean follow-up time of 5.2 years (range 3-9.5 years). The indication for surgery followed the McKay criteria<sup>1)</sup>.

Preoperative management involved gentle correction and serial plasters, non-forcible manipulation to prevent rocker bottom and

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**Key words :** clubfoot, complete subtalar release, peroneus muscles

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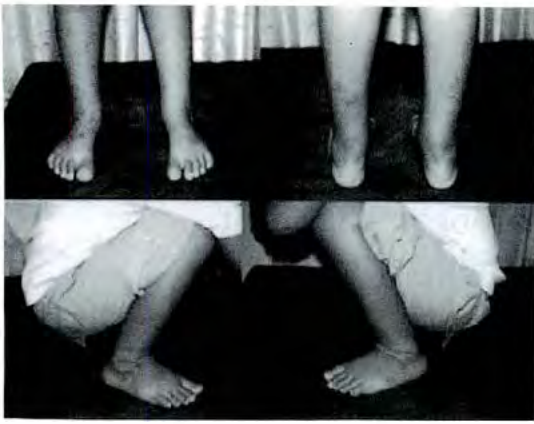


Fig. 1. Group II bilateral clubfeet with excellent final result

bean shaped foot. The operative technique was McKay complete subtalar release via a Cincinnati incision. The postoperative program was different from that of McKay. After skin closure, the deformity still could be slightly seen due to the tight suture. An AP short leg slab was applied without foot manipulating for one week, and this was changed to a short leg cast at the next visit. The short leg cast was revised every week. Before new casting, the foot was gently progressively manipulated, and the peroneus muscles were stimulated by finger touching along the lateral side of the foot and calf. K wires were removed at the 4th week and followed by cast changing every week. At the 8th week, the cast was removed, and an exercise program was started especially for peroneus muscle function. Straight last shoes were used for 1 year while sleeping and walking, and the muscles exercise program was continued everyday.

Because the child's age at operation was too young to find any significant difference between grade 0 and grade 1 power, the preoperative peroneus muscle strength was classified into 2 groups. Group I (21 feet) had no evertor function when stimulated. Group II (35 feet) had more than grade 1 peroneus muscle power, the inversion deformity could slight-



Fig. 2. Group I bilateral clubfeet with poor final result

ly correct itself, and the prominence of the peroneus tendon could be seen on the lateral side below the ankle joint while the muscle was in contraction. At the final follow up, the peroneus muscle power was tested and classified from grade 0 to 5.

Many rating systems have been used to determine the results from clubfoot surgery<sup>1)2)5)7)</sup>. The N. J. Rumyantsev Rating System (Table 1) was chosen for this study because it has a wide range with fine detail, with a plus and minus range (from 140 to 150) to assess static foot appearance, dynamic function and radiographic ankle range of motion. The radiographic examination was done at the final follow up using a standard view of Simon<sup>8)</sup> to measure the range of ankle motion and the AP talocalcaneal, talo-firstmetatarsal angle, lateral talocalcaneal angle, and the calcaneal pitch.

### Results

There were 35 patients in this study, 21 (60%) were boys and 14 (40%) were girls. Of the 56 clubfeet, 26 (46.4%) were right, and 30 (53.6%) were left. Twenty-one patients (60%) had bilateral clubfeet. None of the feet had any wound problem. No calcaneal foot and no over correction was presented. One foot had mild pain on heavy activity.

**Table 1.** N. J. Rumyantsev Rating System for Clubfoot Surgery

Criterion	Level	Points
Gait abnormality	Absent	10
	Only while running	0
Shoe type	Constant	10
	Regular	10
	Regular+Orthopedic	5
Pain	Orthopedic only	0
	Never	10
	With heavy activity	5
Ankle dorsiflexion (passive motion)	With routine activity	0
	15-25 over 90	20
	5-14 over 90	10
	0-4 over 90	0
Position of heel when standing	<90	20
	0-5 valgus	10
	6-10 valgus	5
	11-20 valgus	-5
	>20 valgus	25
Appearance of forefoot	0-5 varus	5
	>5 varus	25
	Neutral	10
	<5 ADD/ABD	5
Ankle motion by radiograph	5-15 ADD/ABD	0
	>15 ADD/ABD	10
	>30	30
	31-40	20
	21-30	10
Calf atrophy	11-20	0
	<11	20
	Absent	5
Cavus/planus	Mild	3
	Severe	0
	Absent	10
Foot knee realignment @	Present	0
	Rocker bottom or dorsal navicular subluxation	10
	External rotation 0-15	10
Flexion of great toe	Neutral	0
	Internal rotation or external rotation >15	10
Strength of triceps surae	Present	5
	Absent	0
	Weight supported on toes, one foot only	10
Functional abilities	Weight supported on toes, both feet	5
	Weight not supported on toes	0
	Can heel and toe walk	10
	Can heel- or toe-walk	5
	Cannot heel or toe walk	0

ADD, adduction; ABD, abduction.

@General foot position in relation to the knee joint and lower limb as a whole was assessed according to presence or absence of toe in gait. Foot progression angle, and thigh foot angle were also evaluated.

**Table 2.** Correlation between Preoperative Peroneus Muscle Function and Final Average Score Points

Group	No. of feet	Average score	SD
I	21	49.48	53.3
II	35	126.86	11.2

Significant difference at  $p < 0.001$  (Wilcoxon's rank sum test)

**Table 3.** Correlation between Last Follow up Peroneus Muscle Power and Final Average Score Points in 21 Group I Feet

Peroneus muscle power at last follow up	No. of feet	Average score	SD
Grade <4	9	21.66	33.2
Grade 4 or 5	12	70.33	57

Significant difference at  $p = 0.04$  (Wilcoxon's rank sum test)

**Table 4.** Comparison to Mean Angles of 52 Normal Thai Feet

Mean of Angles	Normal Thai feet	Final results
AP talocalcaneal angle	27.7	24.3
Talo-first metatarsal angle	0.3	2.1
Lateral Talocalcaneal angle	38.5	30.6
Calcaneal pitch	17.5	13.8

The mean rating score at the final follow-up was 101.9 points (range -36 to 148; SDA 6.1). Excellent results (111-150 points) were achieved in 36 feet, good results (71-110 points) in 8 feet, fair results (31-70 points) in 2 feet, and poor results (<30 points) in 10 feet. 32 of the 36 feet with excellent results were in Group II. The other 4 feet with excellent results and 5 feet with good results were in Group I in which the peroneus muscle power could be trained to become better than grade 4 at the final follow-up. 8 of 10 feet with poor results were teratologic clubfoot such as arthrogryposis, myelomeningocele or, spinal dysrhapism. All of these were in Group I with no peroneus muscle power at final follow-up. Table 2 shows the correlation between the preoperative peroneus muscle strength and the final result. The

mean rating score of Group I was 49.48 and in Group II was 126.86 points. With contraction of the peroneus muscles preoperatively, the final results were significantly better ( $p < 0.001$ ). The postoperative peroneus muscle strength increased progressively after the exercise program in all of those feet in Group II and became more than grade 4 muscle power at the final follow-up. As shown in Table 3, 12 feet in Group I with trainable peroneus muscles to better than grade 4, had a mean score of 70.33 points, significantly better ( $p = 0.04$ ) than the 9 untrainable feet. Imbalance in the muscles gave poor final results which required a second operation for recurrent deformities. Tibialis anterior tendon transfer to the third cuneiform was done in 4 feet, three feet required a repeated McKay complete subtalar release combined with tibialis anterior tendon transfer, and talectomy was done in another 2 feet with arthrogryposis.

The average ankle range of motion on X ray was 35.1 degrees (range 10-55 degrees, SD 12.4). The mean AP talocalcaneal angle, talo-firstmetatarsal angle, lateral talocalcaneal angle, and calcaneal pitch was 24.1, 2.1, 30.6, and 13.8 degrees, respectively. Table 4 shows the comparison to the mean angles of 52 normal Thai feet. 10 feet (17.8%) had flattening in the talar dome, 2 feet had avascular necrosis in the navicular, and one had mild dorsal subluxation in the navicular.

### Discussion

The McKay concept for surgical treatment of clubfoot is complete subtalar release to realign the bones to a normal horizontal subtalar rotation position, maintain the correction and prevent foot stiffness<sup>3</sup>. After correction of the

static deformities, the dynamic muscle balance has an important role to the final results. To maintain the correction and to prevent further recurrence in deformities after complete subtalar release in some feet, McKay transferred the flexor hallucis longus tendon to the peroneus tendon for augmentation in the evertor function. It is difficult to decide the indication for this procedure. Our study showed that the preoperative peroneus muscle function may be one factor that could indicate the need for evertor augmentation. Porter<sup>6</sup> reported that after correction of clubfoot deformity, an iatrogenic imbalance in the muscles was produced. Therefore, the three invertor tendons were lengthened to remove the deforming force and so prevent the evertors and pronators from loosening. A long time may be required to rebalance the loose peroneus muscles, and Porter advised to include reefing the peroneus longus tendon in the deformity correction operation to maintain a good appearance and better function. Huang et al.<sup>11</sup> reported that the muscle imbalance was due to some etiological factor. Their aim in surgery was to correct the deformities in the equinus, inversion and adduction and to achieve a dynamic muscle balance to maintain the correction. They performed a combination of deformity correction with a rebalancing procedure such as tibialis anterior transfer. Our study showed that with preoperative peroneus muscles function, 3 years was enough for rebalance training to at least grade 4 and lead to excellent or good results. Reefing of the peroneus tendon or transfer of the flexor hallucis longus to augment the peroneus tendon or tibialis anterior transfer were not necessary in this group. A rebalancing procedure may be useful in some Group I patients with untrainable

ble peroneus muscles. Postoperative peroneus muscle exercise is important even in cases with no preoperatively peroneus muscle function. If the muscles can be trained to at least grade 4, then significantly better clinical results can be expected. Reinnervation may be a reason that preoperative non-function muscles in some feet can later begin to function. With the small numbers in this study, further study is required.

In 1989, Magone reported 17 Idiopathic clubfeet treated using McKay complete subtalar release. The mean rating achieved according to Magone's scoring system was 78.8 points, including 5 cases(29.4%) with talar dome flattening, one case with avascular necrosis in the navicular, 5 cases(29.4%) with dorsal subluxation in the navicular involving more than one third of the talar head but not associated with cavus feet, and 5 cases(29.4%) with avascular necrosis in the calcaneus. In the present study of 56 congenital clubfeet, the mean rating achieved according to Magone's system was 83.1 points, and included 10 feet(17.8%) with talar dome flattening, 2 with avascular necrosis in the navicular, and one with dorsal subluxation in the navicular.

In 1983, McKay reported 55 feet treated by his technique. 45 feet had excellent or good results, 2 had fair, and 8 had poor results. The fair and poor results were due to technical errors, under- or over-correction in the subtalar rotation and lateral displacement in the calcaneus. In the present study, the two cases with fair and one case with poor results were due to K-wires loosening in the second week after the operation which caused under-correction in the subtalar rotation. The remaining 9 cases with poor results were in cases with weak peroneus muscles with gradually recur-

rent deformities. All feet were improved by the second operation.

### Conclusion

The McKay complete subtalar release can be used as the treatment of first choice for congenital clubfoot. Idiopathic clubfoot with good peroneus muscle function had better clinical and radiographic results than teratologic or weak peroneus muscle clubfoot.

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