The Results of Lengthening in Congenital Posteromedial Angulation of Tibia

Thanase Ariyawatkul MD*, Kamolporn Kaewpornsawan MD*,
Chatupon Chotigavanichaya MD*, Perajit Eamsobhana MD*

** Department of Orthopedic Surgery, Faculty of Medicine Siriraj Hospital, Bangkok, Thailand*

Background: *Congenital posteromedial bowing of the tibia (PMBT) is a rare deformity with limb length discrepancy (LLD) with or without significant angular deformity. Some patients need only limb length equalization while many patients require additional angular correction. Limb length equalization may be achieved by either limb lengthening, epiphysiodesis or acute shortening of the long leg. Limb lengthening is the preferred treatment option in PMBT patients with significant angular deformity.*

Objective: *The presented study is to evaluate the results of lengthening with Ilizarov fixator in these patients.*

Material and Method: *PMBT patients treated with Ilizarov lengthening were retrospectively reviewed. Progression of angular deformity and LLD were assessed. Residual deformity after Ilizarov lengthening and complications were also evaluated.*

Results: *Limb lengthening with Ilizarov external fixator was performed in 4 PMBT patients. Mean age at surgery was 3.7 years. Expected LLD (using multiplier method) of tibia ranged from 5.1 to 9.9 cm. Younger patients had more angular deformity than older patients. One patient had pin tract infection requiring Ilizarov removal. Lengthening index varied from 1.2 to 2.1 month/centimeter. LLD after the lengthening was -1.4 to 0.4 cm. Mean progression of LLD was 1.8 mm/year.*

Conclusion: *Ilizarov lengthening for posteromedial angulation shown good result with average residual LLD 0.4 to 1.4 cm which is not clinically significant.*

Keywords: *Congenital posteromedial angulation of tibia, Congenital posteromedial bowing of tibia, Leg length discrepancy, Ilizarov*

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Congenital posteromedial bowing of the tibia (PMBT) is a rare, benign condition with associated talipes calcaneovalgus foot[1,2]. The angular deformity and limb length discrepancy (LLD) are mostly obvious since birth. The apex of angulation is in the posteromedial direction and usually in middle or distal part of the affected tibia. This condition is self-limited in nature because spontatenous correction of angular deformity can be expected. However, LLD with or without residual angular deformity are the main concerns of the patients and parents. Pappas[3] found that proportionate LLD between affected limb and normal limb remain stable after the age of 1 year and absolute LLD varied from 3.3 to 6.9 cm. Some reports demonstrated that LLD may increase with age.

Correspondence to:
Eamsobhana P, Department of Orthopedic Surgery, Faculty of Medicine, Siriraj Hospital, 2 Wanglang Road, Bangkok Noi, Bangkok 10700, Thailand.
Phone: +66-89-6743554
E-mail: peerajite@gmail.com

The treatment options include conservative treatment, epiphysiodesis, corrective osteotomy and limb lengthening. Conservative treatment may be indicated in patients with less than 2 centimeter LLD. Surgical treatment is mostly recommended in significant LLD and residual angular deformity. Corrective osteotomy and limb lengthening is beneficial for patients with significant LLD (especially in patients with more than or equal to 5 centimeter LLD) and residual angular deformity. Epiphysiodesis or acute shortening or long leg may be alternative option in less LLD without significant angular deformity. Our study is to evaluate the outcomes of Ilizarov lengthening.

Material and Method

All PMBT patients treated with Ilizarov lengthening in Siriraj Hospital were retrospectively reviewed. PMBT patients with incomplete medical records were excluded. Patients treated between October 2008 and October 2015 were included in the study. All patients were treated by pediatric orthopedic

surgeons. Lengthening was performed using Ilizarov fixator. Follow-up was scheduled 2-week interval regularly. Demographic data consisted of age at diagnosis, age at surgery, gender, affected limb, and associated conditions. Femoral length, tibial length, LLD, anteroposterior angulation and mediolateral angulation were assessed at preoperative, postoperative and last follow-up teleoroentgenogram. Complications and progression of LLD were evaluated.

Results

Four PMBT patients were included in the presented study. Demographic data and pre-operative radiographic parameters were summarized in Table 1. Left tibia was affected in three patients. Age at surgery ranged from 2.25 years to 5.33 years (mean age at surgery is 3.7 years). Expected LLD at maturity varied from 5.1 cm to 9.9 cm.

Radiographic parameters in immediate post-treatment period (after Ilizarov removal) and complications were summarized in Table 2. One patient (ID 3) had pin tract infection in which require Ilizarov removal before bone consolidation and long leg cast was applied instead. Last follow-up data were summarized in Table 3. Mean progression of LLD was 1.8 mm/year and residual angulations were observed. ID 2 pre-operative, postoperative and last follow-up radiographs were displayed in Fig. 1.

Discussion

PMBT is a rare congenital disorder and benign nature is expected. Two of our patients had significant angular deformity at the age of 2 years whereas 2 older patients had less angular deformity. These findings may be compatible with the previous studies that spontaneous correction could be anticipated. Main problems are LLD and residual angular deformity. Conservative treatment was also advocated by some

Table 1. Individualized preoperative data

ID	Gender	Affected limb	Age at surgery	Valgus ang (degrees)	Posterior ang (degrees)	Tibia LLD (mm)	Expected LLD (mm)
1	Male	Left	5.33	8	13	-27.9	-50.8
2	Female	Left	2.25	29	22	-41.2	-98.5
3	Female	Right	2.75	22	25	-29.4	-60.6
4	Male	Left	4.50	7	0	-30.3	-57.9

Table 2. Individualized postoperative data

ID	Tibial lengthening (mm)	Months in EF	Lengthening index	LLD after EF removal (mm)	Complications
1	31	3.75	1.2	3.1	Transient peroneal n. palsy
2	42.6	6	1.4	4	None
3	22.9	5	2.1	-6.5	Pin tract infection
4	16.2	3	1.85	-14.1	None

Table 3. Last follow-up data

ID	Last F/U (months)	Age at last F/U (years)	LLD at last F/U (mm)	Progression of LLD (mm./year)	Valgus ang (degrees)	Posterior ang (degrees)
1	84	10	-6	1.3	14	0
2	105	11	-24	3.1	-6	12
3	24	5	-8	0.8	20	24
4	12	7	-16	1.9	21	-7

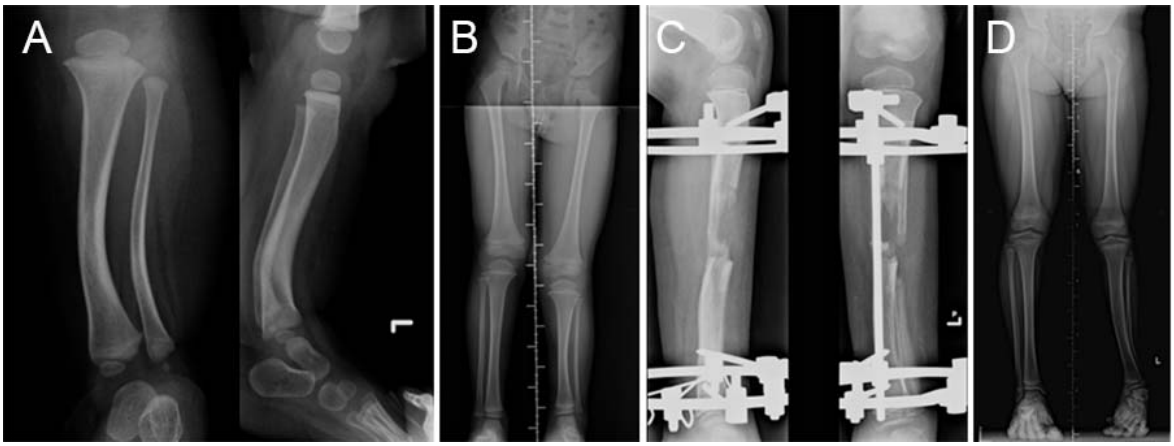

Fig. 1 (A) radiographs of patient at the age of 3 years showed posteromedial angulation, (B) remodeling of angulation was shown with LLD 2.5 cm at 4 years of age, (C) Ilizarov lengthening was performed, (D) final result at the age of 11 years.

authors such as Heyman and Herndon[4], Yadav and Thomas[5]. Non-operative approach consists of massage and stretching of the anterior soft tissues, casting in plantar-flexed position, shoe lift and bracing. Heyman et al[6] reported good long-term outcome of conservative treatment ten years afterward.

Some authors recommended osteotomy at the young age. Buxton[7] performed osteotomy and casting of tibia and fibula in patient with posterior angulation of the tibia and fibula at 5 months. This patient had straight leg at 5 years of age. Napiontek and Shadi[8] reported multilevel osteotomy in 4 children with mean age of 3.7 years. LLD could progress as patients' age increased[9]. Correction of angular deformity and lengthening of the affected limb were advocated by many authors. Kaufman et al[10] reviewed 11 PMBT patients who were successfully treated with lengthening using either monolateral external fixator or Ilizarov circular fixator and these authors suggested lengthening as a good option rather than epiphysiodesis for the treatment of LLD in these patients. Johari et al[11] also recommended to delay surgery until patients were near skeletal maturity and to perform one-stage lengthening and residual angular deformity. All patients in the presented study had expected LLD of 5 cm or more which required treatment. Gradual lengthening is one of the treatment options in these patients. Shoe lift was used in these patients prior to surgery. These patients cannot tolerate after using it for some time, thus they chose lengthening. Angular deformity after lengthening was found and this situation may need further treatment at near maturity.

The presented study shown that LLD can progress in PMD average 1.8 mm per year. From these data, informing patients and parents is very important as this might result in second lengthening. Lengthening at nearly skeletal maturity also suggest in patients who calculate for final LLD of not more than 5 cm (15% of mature tibial length) as complications for lengthening from 10 to 15% of lengthening, is less.

Conclusion

Ilizarov lengthening for posteromedial angulation has shown good results with average residual LLD 0.4 to 1.4 cm. which is not clinically significant.

What is already known on this topic?

LLD with or without residual angular deformity are the main concerns of the patients and parents with posteromedial angulation problem. Proportionate LLD between affected limb and normal limb remain stable after the age of 1 year and absolute LLD varied from 3.3 to 6.9 cm. Some reports demonstrated that LLD may increase with age.

What this study adds?

The presented study showed that LLD can progress in PMD average 1.8 mm per year. From these data, informing patients and parents is very important as this might result in second lengthening. Lengthening at nearly skeletal maturity also suggests in patients who calculate for final LLD of not more than 5 cm. (15% of mature tibial length) as complications for lengthening from 10 to 15% of lengthening, is less.

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Potential conflicts of interest

None.

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การรักษาภาวะหน้าแข้งโก่งด้านในและด้านหลังแต่กำเนิดด้วยการใช้อิลิซาลอฟ

ธเนศ อริยวัตรกุล, กมลพร แก้วพรสวรรค์, จตุพร โชติกวณิชย์, พีระจิตร เอี่ยมโสภณา

ภูมิหลัง: ภาวะหน้าแข้งโก่งด้านในและด้านหลังแต่กำเนิดเป็นภาวะที่พบน้อย ผู้ป่วยมักมีปัญหาขาสั้นยาวไม่เท่ากันและกระดูกหน้าแข้งผิดรูป ผู้ป่วยบางรายอาจมีปัญหาน้อยและรักษาได้ด้วยการเสริมรองเท้า ทว่าขาสั้นยาวไม่เท่ากันและหน้าแข้งที่โก่งอาจส่งผลต่อการใช้ชีวิตประจำวันมาก ส่งผลให้การผ่าตัดมีความจำเป็นในผู้ป่วยบางราย

วัตถุประสงค์: การศึกษานี้ทำขึ้นเพื่อศึกษาผลการรักษาในการยืดขาด้วยอิลิซาลอฟในผู้ป่วยภาวะหน้าแข้งโก่งด้านในและด้านหลังแต่กำเนิด

วัสดุและวิธีการ: ทำการศึกษาย้อนหลังในผู้ป่วยภาวะหน้าแข้งโก่งด้านในและด้านหลังแต่กำเนิด โดยศึกษาจากเอกซเรย์ วัดมุมความโก่งและวัดขาสั้นยาวไม่เท่ากันหลังการรักษา

ผลการรักษา: ผู้ป่วยภาวะหน้าแข้งโก่งด้านในและด้านหลังแต่กำเนิดจำนวน 4 ราย อายุเฉลี่ยที่ได้รับการผ่าตัด 3.7 ปี พยากรณ์ขาสั้นยาวไม่เท่ากันเมื่อสิ้นสุดการเจริญเติบโตด้วยวิธี multiplier ได้ระยะตั้งแต่ 5.1-9.9 เซนติเมตร ระยะขาสั้นยาวไม่เท่ากันหลังการรักษา -1.4 ถึง 0.4 เซนติเมตร

สรุป: การรักษาภาวะหน้าแข้งโก่งด้านในและด้านหลังแต่กำเนิดด้วยอิลิซารอฟได้ผลเป็นที่น่าพอใจ มีระยะขาสั้นยาวไม่เท่ากันหลังการรักษาอยู่ระหว่าง -1.4 ถึง 0.4 เซนติเมตร ซึ่งไม่ส่งผลทางคลินิกต่อผู้ป่วยอาทิเช่น การเดินเขย่ง ปวดเข่า ปวดหลัง ปวดสะโพก