

Original Article

Melt-metaphyseal and diphyseal osteotomy for correction of infantile Blount's disease: a long-term follow-up study

Jie Liu¹, Lei Cao², Shi-Fang Guo¹, Wen Xue¹, Zhi-Xin Chen¹, Hui-Ping Tai¹, Zong-Ru He¹, Yao-Wen Qian¹

¹Department of Orthopaedics, The People's Hospital of Gansu Province, Lanzhou 730000, Gansu, China; ²Gansu Provincial Maternity and Child-Care Hospital, Lanzhou 730050, Gansu, China

Received October 14, 2014; Accepted January 17, 2015; Epub February 15, 2015; Published February 28, 2015

Abstract: Blount's disease is an uncommon disorder of postero-medial proximal tibial physis. Blount described infantile and adolescent types. This study aims to describe using femur, tibia and fibula osteotomies to treat infantile Blount's disease. From May 1992 to May 2005, 7 patients of Blount's disease (3 males, 4 females) were included, whose age was range from 17 to 62 months. Femorotibial angle (FTA) was $31 \pm 6^\circ$ (range from 27° to 41°). Metaphyseal-diaphyseal angle (MDA) was $16 \pm 4^\circ$ (range from 13° to 24°). The femoral vara angle was $10 \pm 4^\circ$ (range from 2° to 23°). According to Langenskiold's classification, 3 patients were in stage II, 7 patients in stage III, and 2 patients in stage IV. Five cases were affected bilateral and 2 unilaterally, treated by femur, tibia and fibula valgus osteotomies, and a hip spica cast were used for 6 weeks after operation. Results indicated that all patients were followed up 3 to 16 years. FTA, MDA and femur diaphysis were measured, FTA was $2 \pm 7^\circ$ valgus (from 4° vara to 13° valgus). MDA was $1 \pm 2^\circ$ valgus (range from 0° to 12°). Femoral diaphyseal angle was $1 \pm 3^\circ$ valgus (range from 3° vara to 7° valgus). Six patients could walk without any knee pain, except for 1 patient with bilateral disorder feels his left genu uncomfortable after long time stand or work. His MDA was 12° , and FAT was -4° . In conclusion, femur, tibia and fibula osteotomies are useful for correction of Blount's disease. Recurrence and complication are less than those reported for Blount's disease.

Keywords: Blount's disease, tibia vara, valgus osteotomy

Introduction

Blount's disease is an uncommon disorder of the postero-medial proximal tibial physis, which varus promimal tibia, tibia internal torsion, procurvatum and shortening. Blount described infantile and adolescent types [1, 2]. The precise pathogenesis of the condition remains obscure, but associations include an early walking age, obesity, familial tendency and Afro-Caribbean race. It is frequently bilateral [3]. This disease is more common in black people than in yellow people. The diagnosis of Blount's disease follows clinical assessment and radiographs of the knee, which show a progressive varus deformity and typically an increased metaphyseal-diaphyseal angle. The natural history of the conditions is adult knee pain, deformity and arthrosis.

Treatment of dependent on the age of the child, the stage of the disease and the amount of

angular and articular deformity present [2, 4]. Bracing may be used for early stage infantile disease. Surgical treatment options include hemi epiphysiodesis, osteotomy and bar excision. Monitoring of limb alignment and length is required until skeletal maturity. In this study, aims to treat Blount's disease using femur, tibia and fibula osteotomies.

Materials and methods

We reviewed 12 tibia vara in 7 patients treated with femur, tibia and fibula osteotomies. 3 males, 4 females, age from 17 to 62 months (average 31 months). The femorotibial angle (FTA) was $31 \pm 6^\circ$ (27° to 41°). Metaphyseal-diaphyseal angle (MDA) was $16 \pm 4^\circ$ (13° to 24°). The femoral vara angle was $10 \pm 4^\circ$ (2° to 23°). According to langenskiold's classification, 3 were stage II, 7 were stage III, and 2 were in stage IV (**Figure 1A, 1B**).

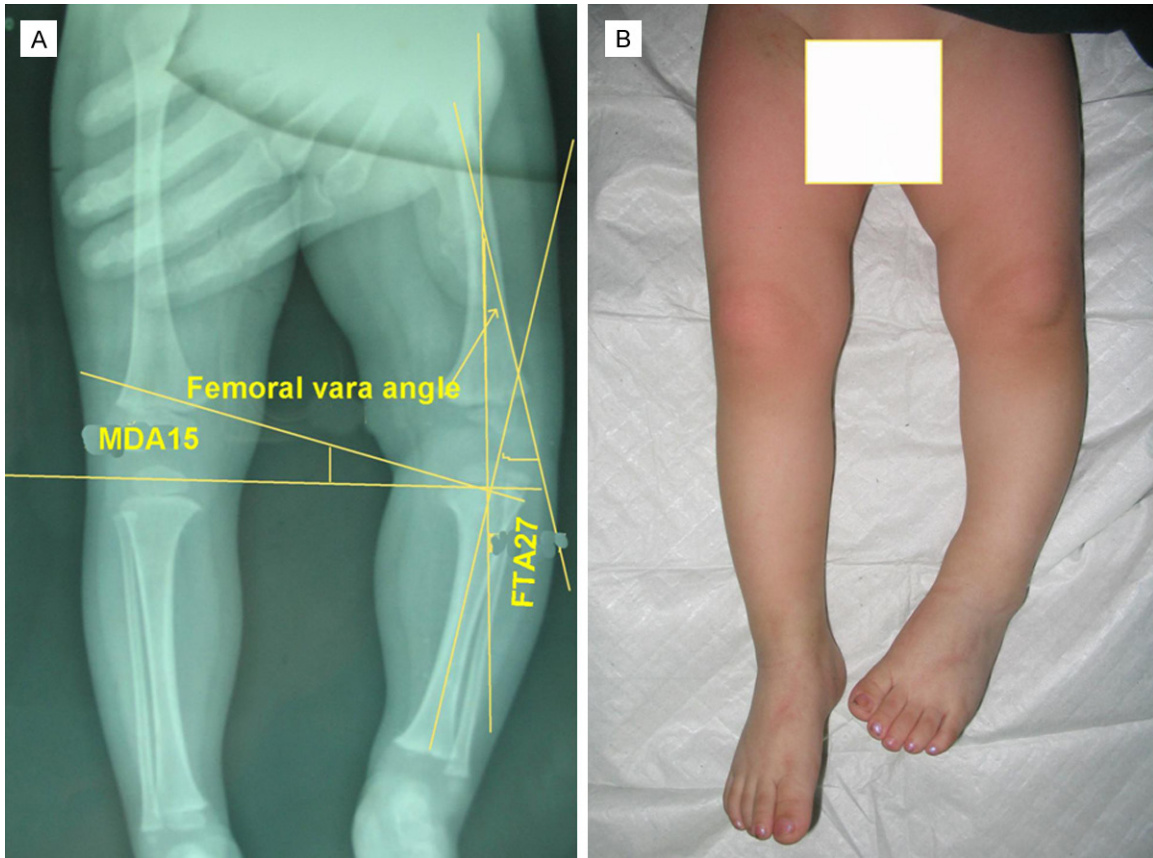


Figure 1. X-ray image and symptom of infantile Blount's disease. A. X-ray shows that tibia vara, MDA was 15, FTA is 20. Femur was 14° valgus. B. The symptom showed that the left limb was short, the tibia was inter torsion and varus.

We place the patient supine on operating table, preparing the leg from the toes to the ilium. It will allow more accurate evaluation of the tibial torsion and FTA. Begin the procedure with the femur osteotomy. Expose the middle third of the femur through a lateral approach incise the fascia lata. Use an oscillating saw to complete the osteotomy and then fix the femur with screw and plate with mild valgus overcorrection. Then we expose the proximal third of the fibula through the interval between the lateral and posterior compartment. Remove a 1-2 cm segment of the fibula. It allows the distal portion of the fibula to slide past the proximal fragment as the leg is brought from a varus to a valgus position. For the tibial osteotomy, made a short straight incision 3 to 5 cm distal to the tibia tubercle staying lateral to the anterior spine of the tibia. A arch-shaped osteotomy is made just distal to the tibial tubercle. The tibia is fixed by crossed K-wires with mild valgus overcorrection (**Figure 2A, 2B**). A hip spica cast was used for 8

weeks. No weight-bearing is allowed for the first 4 weeks after surgery. The cast was changed at 4 weeks, and if the healing is satisfactory on roentgenograms, the K-wires was removed and weight-bearing begun. When the FTA was less than 0°, it was considered that the deformity was resolved.

Results

All patients were followed up 3 to 16 years (average 9 years). In May 2008, those patients' FTA was $2 \pm 7^\circ$ valgus (4° varus to 13° valgus). MDA was $1 \pm 2^\circ$ (0 to 12°). Femoral diaphyseal angle was $1 \pm 3^\circ$ valgus (3° varus to 7° valgus) (**Figure 3**). Six patients could walk without any knee pain, except 1 patient with bilateral disorder felt his left genu uncomfortable after long time stand or work. This patient's left low limb's MDA was 12°, FTA was 4° varus, femoral diaphyseal angle was 5°, 4 years after his first operation. And after his second proximal tibial osteotomy, the result is satisfactory.

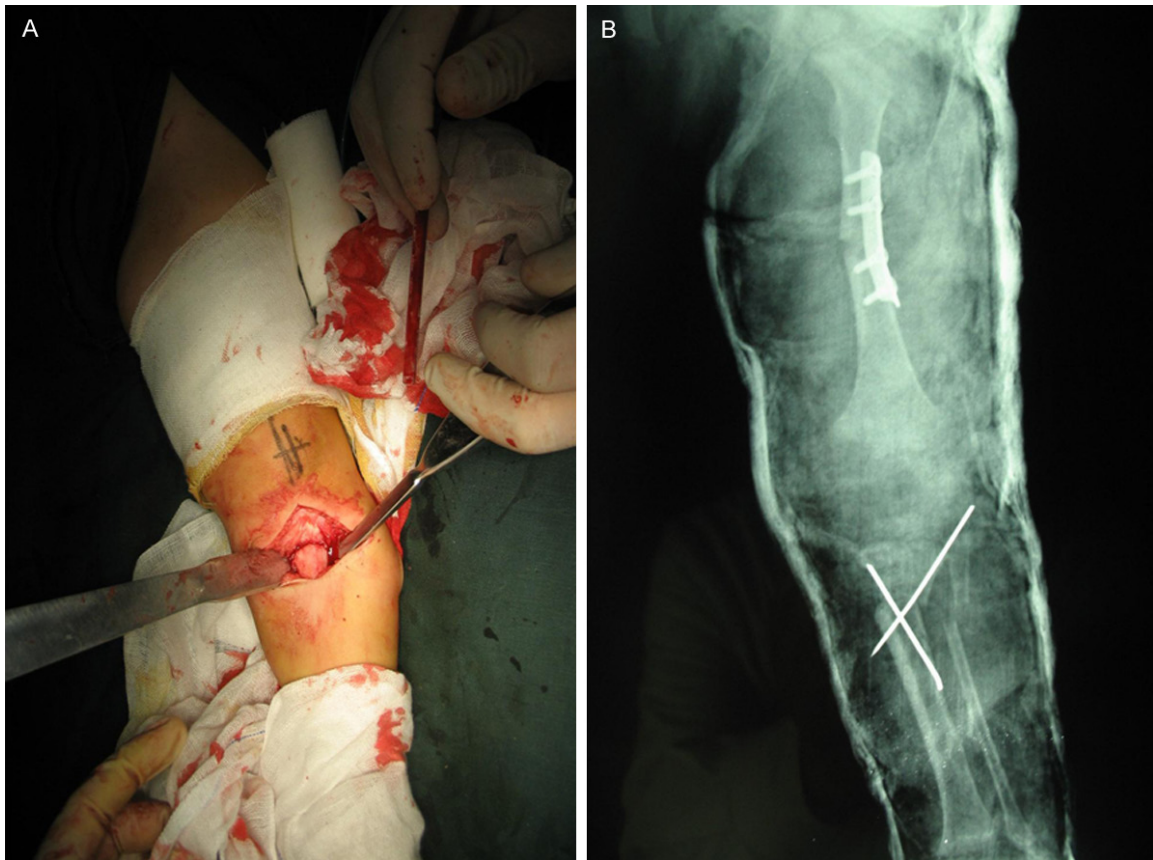


Figure 2. The tibia is fixed by crossed K-wires with mild valgus overcorrection. A. Arch-shaped osteotomy just distal to the tibial tubercle. B. Femur, tibia and fibula valgus osteotomies, then fixed with screw plate and K-wires.

Discussion

Tibia vara (Blount's disease) is a kind of rear disease. It was Blount's article in 1937 that prompted recognition of this disorder. Currently, tibia vara is considered an acquired disease of the proximal tibial metaphysis. The exact causes unknown, but trauma, infection, obesity, hereditary and early weight-bearing walk are the most causative factors.

The abnormality is characterized by varus and internal torsion of the tibia and genu recurvatum. The disease according to age at onset was distinguished two types, including infantile and adolescent. All of our patients belong to infantile tibia vara. The differentiating physiological bowing from infantile tibia vara in its early stages is very difficult. According to Levine and Drennan's [5] report, 29 of 30 limbs with an MDA are more than 11° will develop Blount's disease, all of our patient's MDA was 13 to 24° , more than 11° . Zionts and Shean [6] reported that treatment with braces for early infantile

tibia vara, which showed no improvement by two years of age. And Shinohara et al. [7] also believed that the effects of brace treatment remain unclear. Langenskiold et al. [8] reported spontaneous resolution in only two of 71 patients. Ferriter et al. [9] reported a recurrent rate of 76% in children undergoing osteotomy at 5 years of age or older, compared with a 31% recurrence rate in those in whom osteotomy was done at a younger age. Hay et al. [10] recommended tibial osteotomy before the age of four years. 6 of our patient's osteotomy was done before 4 years old, 1 patient was 62 months old. And this older patient's left leg was recurrent, and needed second osteotomy of his left tibia. All of our patients had femoral varus before operation. It was a subsequent compensatory deformity of the tibia vara. Low extremity's alignment is an essential problem in the osteotomy surgeries of the Blount's disease. Not only tibia vara needs valgus osteotomy, but femur needs osteotomy too. Patient with tibia vara has abnormal alignment of the low extremity.



Figure 3. The X-ray showed that FTA was 10° valgus, MDA was 4° valgus, femur diaphysis was 8° valgus 10 years post-operation.

ty. The medial proximal part of the tibial metaphysis endures great, unbalanced compression. The power is an important factor effects the normal growth of the tibial metaphysis. Since the Blount's diseases does not occur in nonambulatory patients [11, 12], after femur, tibia and fibula valgus osteotomies with mild overcorrection. The compression to the medial side of the proximal tibial metaphysis is reduced. Before the weight-bearing, with the help of the cast, there is a reaction between the medial part of the knee joint. This power can stimulate the growth of the medial side of the proximal tibial metaphysis. An arch-shaped osteotomy simultaneously corrects angulation and rotation and maintains maximum bony contact for rapid healing.

The procedure is performed through 3 small, cosmetically acceptable incisions, minimizing soft tissue dissection. Results of the procedure are good, and the recurrence is less than those reported by other types of osteotomies of proximal tibial for Blount's disease.

Disclosure of conflict of interest

None.

Address correspondence to: Dr. Shi-Fang Guo, Department of Orthopaedics, The People's Hospital of Gansu Province, Lanzhou 730000, Gansu, China. Tel: +86-0931-8281772; Fax: +86-0931-8281772; E-mail: shifangguo@yeah.net

References

- [1] Niu JJ, Shen MJ, Meng B, Yang Y, Yang HL. Percutaneous kyphoplasty for the treatment of osteoporotic thoracolumbar fractures with neurological deficit: radicular pain can mimic disc herniation. *Int J Clin Exp Med* 2014; 7: 2360-2364.
- [2] Nunn T, Rollinson P, Scott B. Blount's disease. *Orthop Traum* 2011; 25: 454-461.
- [3] Henderson RC. Tibia vara: a complication of adolescent obesity. *J Pediatr* 1992; 121: 482-86.
- [4] Shi Y, Wang XH, Zhang HH, Zhang HQ, Tu JZ, Wei K, Li J, Liu XL. Quantitative analysis of real-time tissue elastography for evaluation of liver fibrosis. *Int J Clin Exp Med* 2014; 7: 1014-1021.
- [5] Levine AM, Drennan JC. Physiological bowing and tibia vara: the metaphyseal-diaphyseal angle in the measurement for bowleg deformities. *J Bone Joint Surg* 1982; 64: 1158-1163.
- [6] Zionts LE, Shean CJ. Brace treatment of early infantile tibia vara. *J Pediatr Orthop* 1998; 18: 102-109.
- [7] Shinohara Y, Kamegaya M, Kuniyoshi K. Natural history of infantile tibia vara. *J Bone Joint Surg Br* 2002; 84: 263-268.
- [8] Langenskiold A, Riska EB. Tibia vara (osteochondrosis deformans tibiae): a survey of seventy-one cases. *J Bone Joint Surg* 1964; 46: 1405-1420.
- [9] Ferriter P, Shapiro F. Infantile tibia vara: factors affecting outcome following proximal tibial osteotomy. *J Pediatr Orthop* 1987; 7: 1-7.
- [10] Hayek S, Segev E, Ezra E. Serrated W/M osteotomy: results using a new technique for the correction of infantile tibia vara. *J Bone Joint Surg* 2000; 82: 1026-1029.
- [11] Canale ST. *Campbell's Operative Orthopaedics*. 9th edition. 2001. pp. 891.
- [12] Oporto VGH, Fuentes R, Borie E, Del Sol M, Orsi IA, Engelke W. Radiographical and clinical evaluation of critical size defects in rabbit calvaria filled with allograft and autograft: a pilot study. *Int J Clin Exp Med* 2014; 7: 1669-1675.