

REVIEW ARTICLE

The Surgical Treatment and Outcome of Blount Disease in a Tertiary Hospital: A 10-years Review

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ABSTRACT: *Blount disease is an uncommon condition in Malaysia. The prevalence has not been documented and to the best of our knowledge, there are no local studies published on this condition.*

This is a retrospective study carried out in the Department of Orthopedics and Traumatology, Hospital University Kebangsaan Malaysia. Fifteen patients participated in this study, 12 of them had bilateral knee involvement. All patients had an oblique osteotomy of the proximal tibia without an elevating osteotomy of the medial tibial plateau. The objective of this study was to examine the clinical outcome for the surgical treatment of Blount disease in our institution from 1997 to 2008 by measurements of metaphyseal –diaphyseal angles (MDA) and tibio-femoral angles (TFA) preoperative, postoperative and during follow up.

The study showed statistically significant reduction in the mean metaphyseal – diaphyseal angles (MDA) and mean tibio-femoral angle (TFA) angles respectively post operatively compared to pre-operatively ($p < 0.001$). Recurrence of the deformity was noted in 10 knees. All of them underwent further surgery. The mean postoperative follow up is 4.9 years. Half of the cases were Langenskiold stage III. One patient developed gas gangrene post operatively (3.8%) and another patient had wound dehiscence (3.8%).

Conclusion: An oblique osteotomy of the proximal tibia without an elevating osteotomy for the improves the clinical and radiological outcome for our patients. However, one patient developed gas gangrene – an extremely rare complication following a clean surgical procedure.

Key words: tibia vara, oblique osteotomy.

INTRODUCTION

Blount disease is a developmental condition characterized by a disordered endochondral ossification of the medial part of the proximal tibial physis resulting in multi planar deformities of the lower limb. A three-dimensional deformity of the tibia with varus, procurvatum and internal rotation develops, along with possible limb shortening in unilateral cases [1]. This entity can lead to a progressive deformity with gait deviations, limb-length discrepancy, and premature arthritis of the knee.

Blount disease can occur in growing children of any age and is classified into 2 groups: early onset and late onset. Early onset (in children <3 years) is termed the infantile type (Figures 1A, 2A, 2 B). The late-onset group includes the juvenile form (in children aged 4-10 years) and the adolescent form (in those aged 11 years and older) of the disease. Physiologic tibia varum is generally accepted to be common in children who are less than three years old. However, the prevalence of Blount disease has been reported less than one per cent at this age [2]. And because of the risk of progressive and permanent

physeal damage, it is important to diagnose Blount disease in the early stages so that appropriate treatment can be rendered.

Treatment depends on the age of the child and the severity of the various deformities. However, progressive deformity usually requires osteotomy. Operative treatment is not recommended for children younger than 2 years because the deformity may be an exaggerated physiologic genu varum. Many different types of osteotomies have been described in the literature, including opening and closing wedge, spike, dome, and oblique osteotomies. In infantile form, the guided growth technique using the 8-plate is now recommended [3].

The absolute indications for surgery are depression of the tibial plateau, impending closure of the medial physis of the upper tibia (stage IV), and ligamentous laxity of the knee [4].

The present study was to determine the associated factors related to Blount disease, to identify the postoperative complications and to assess the relationship between the body mass index, recurrence of the deformity and the clinical outcome.

MATERIALS AND METHODS

Study design and duration: This is a retrospective study carried out in the Department of Orthopaedics and Traumatology, Hospital Universiti Kebangsaan Malaysia from 1997 to 2008. The patients' records and radiographs were reviewed retrospectively. Measurements of metaphyseal – diaphyseal angles (MDA) and tibio-femoral angles (TFA) pre operatively, post operatively and during follow up were used for evaluation of radiological outcome. The postoperative angles are used as outcome parameters for evaluation of genu varus and medial tibial plateau depression. They were grouped as follows: MDA between 9° to 11° as well corrected, between 12° to 19° as acceptable correction and above 20° as poor correction. For TFA : 0° to 5° valgus was considered good anatomical axis alignment, 0° to 5° various considered under correction of anatomical axis and 6° and more of varus was considered poor anatomical axis alignment.

An oblique osteotomy of proximal tibia and an additional proximal lateral tibialepiphyodesis, were done when indicated according to the age of the patient and the severity of the deformity.

The operations were done by two paediatric orthopaedic surgeons. The indication of surgery was depression of the medial tibial plateau with progression of the disease, lateral thrust, metaphyseal – diaphyseal angle (MDA) more than 11° and tibio-femoral angle (TFA) more than 7° varus .We did not perform elevation of the depressed medial tibial plateau .All patients had regular follow up with serial radiographs.

This study was approved by the ethic and clinical research committee of our institution.

STATISTICAL ANALYSIS

Data was entered and analyzed using the Statistical Package for the Social Science (SPSS) version 12. All continuous variables were expressed as mean and standard deviation for normal distribution data. However, if the data was not normally distributed or skewness of the data was seen, median and inter - quartile ranges were used as well as non-parametric test - Mann Whitney test and Wilcoxon Signed Ranks test in addition to repeated measurement analysis which was used to determine the difference in measurements in different time points. Statistical significance was set at p value of less than 0.05 ($p < 0.05$).

RESULTS

A total of 15 patients were included in this study, 12 of them had bilateral knee and three had unilateral knee involvement. The mean post-operative follow up was 4.9 years. The mean age at presentation was 6.4 years. They underwent surgical correction for their deformities at a mean age 7.4 years, where the youngest age was 2 years and the oldest was 13 years. Out of 15 patients 12 (80%) were males and 3 (20%) were females. Six subjects were Malays (40%), 5 Indians (33.3%) and 4 Chinese (26.7%). The mean body mass index (BMI) was 32.05 m²/kg which was categorized as obese (30 and above) according to the WHO classification.

The left knee was the mostly affected knee i.e 14 out of 26 knees (53.8%). Half of the cases were Langenskiold stage III (50%).

Bow legs were seen in all patients, knee pain was present in 8 knees (30.8%) and limping gait with lateral trust was seen in 12 knees (46.2%). Repeated measurements were done to find out if there was an overall reduction of MDA and it was found that there was statistically significant reduction in the mean metaphyseal -diaphyseal angles (MDA) post operatively at 13.8° and at the last follow up was 13.2° compared to pre-operative angle of 22.7° [$p < 0.001$].

There was statistically significant reduction in the median metaphyseal – diaphyseal angles (MDA) post operatively compared to pre-operatively at 12° vs. 20.5° ($p < 0.001$). However, there was no statistically significant further reduction in the median metaphyseal – diaphyseal angles (MDA) during the last follow up compared to post-operative ($p = 0.159$). Furthermore, there was statistically

significant reduction in the mean tibio-femoral angles (TFA) post operatively at 5 ° and at last follow up at 5.1° compared to pre-operatively at 24.5° ($p < 0.001$).

There was also a statistically significant reduction in the median tibio-femoral angles (TFA) post operatively compared to pre-operatively ($p < 0.001$). However, there was no statistically significant further reduction in the median TFA at last follow up compared to post operatively ($p = 0.638$).

The recurrence of the deformity was noted in 10 knees. They underwent further operations to correct the deformity. The result of this study show no statistically significant relation between multiple operations and BMI with ($p = 0.923$), as well as there was no statistically significant relation between the median age (in years) at the time of operation and those who had recurrent deformity after the first operation ($p = 0.05$).

There were three complications: one patient had superficial wound dehiscence which was treated with regular dressings. The most serious complication was in a patient who developed gas gangrene within 24 hours post operatively requiring multiple debridements and antibiotics which resulted in an equinus contracture of the ankle. The other patient had foot drop which recovered fully.

DISCUSSION

Osteotomy is an established treatment for Blount disease (tibia vara) especially for Langenskiold stages IV to VI. A variety of techniques have been advocated, including closing wedge, opening wedge, dome, serrated, and inclined osteotomies. Furthermore, different fixation methods have been reported, including cast immobilization, smooth pins and wires, interfragmentary screws, plates and screws, and external fixators.

The mean BMI was 32.5 kg/m² that was categorized as obese according to the Asia Pacific guideline for the management of obesity and compared with other studies that show similar relationship between body weight and tibia vara [5, 6].

The surgical technique performed was a proximal tibia oblique osteotomy. The osteotomy was done just below the tibial tuberosity and fixed with 2 cross K-wires and immobilized with full length Plaster of Paris. A proximal lateral tibialepiphyodesis was performed when indicated in 13 knees of older children without an elevating osteotomy of the medial tibial plateau (figures 1B-2C, D). There is controversy regarding the need to elevate the medial tibial plateau in Langenskiold stages IV to VI [7]. Van Huyssteen et al [8] reviewed 34 knees in 24 children after a double-elevating osteotomy for late-presenting infantile Blount disease. The mean age of his patients' was 9.1 years. All knees were in Langenskiold stages IV to VI. Although he used the angle of depression of the medial tibial plateau as a reference measurement for his technique, he obtained good results where the deformities were corrected in one operation.

In our study elevation of the medial tibial plateau was not done as intraoperative arthrograms did not show any depression of the medial tibial plateau. Ten knees underwent further surgical operations to achieve anatomical alignment. The most likely reason for the recurrence of deformity was failure of the lateral hemiepiphyodesis of the proximal tibia in Langenskiold stages IV to VI.

There was no statistically significant relationship between multiple operations and BMI, $P = 0.923$. We found all cases that underwent multiple surgery were Langenskiold stage III or above as well as late onset Blount disease. Schoenecker et al [9] followed up 27 patients (44 tibiae) with early-onset Blount disease treated with a valgus tibial osteotomy and noted a satisfactory outcome in 19 (83%) of 23 tibiae in which the osteotomy had been performed before the age of five years compared with eight (38%) of 21 tibiae treated in older children.

In contrast several authors have reported recurrence rates of >50% following valgus osteotomies in children with early-onset Blount disease, with better outcomes occurring when operative realignment had been done prior to the age of 4 years. Loder and Johnston et al [10] noted the prevalence of poor results and recurrent deformities following tibial osteotomy for the treatment of early-onset Blount disease increased with increases in the Langenskiold stage, an older age at the time of the osteotomy, and a lack of postoperative valgus overcorrection.

Doyle et al [11], in a series of 26 tibiae that had undergone a valgus osteotomy, found recurrences in four of 11 children who had had operative realignment before the age of 4 years compared with 9 of 15

children who had had operative realignment when they were older. There was no difference in recurrence rates based on the magnitude of the preoperative varus deformity. Knees in which the changes were less than Langenskiold stage III at the time of the osteotomy had a better outcome.

The femoral deformity was too small to warrant osteotomy in any of our patients. The mean pre-operative mechanical varus of 24.5° was corrected to a mean 5.0° of mechanical valgus in 14 knees. In 12 knees, there was an under correction of 3° to 27° of mechanical varus. The change in intercondylar distance (ICD) was from a pre operative mean of 12.2 cm to a post operative mean of 7.4 cm.

Hemiepiphysiodesis and hemiepiphyseal stapling are attractive alternatives to osteotomy in the growing child to allow "guided growth" to correct the angular deformity. Hemiepiphysiodesis, however, has the disadvantage of being permanent, as it irreversibly stops growth capacity, and thus requires accurate estimation of remaining growth, which is difficult [12, 13]. Physeal stapling has proven success [14], but problems with staples have included implant failure, extrusion and physeal damage resulting in permanent closure of the growth plate with the risk of producing a physeal bar. Recently, the tension band plate construct ("8-plate") has been promoted for temporary hemiepiphysiodesis leading to correction of the deformity [15, 16].

Wiemann et al [17] conducted a retrospective study on hemiepiphysiodesis for angular knee deformities comparing staples and eight-plates. Sixty-three hemiepiphysiodesis procedures were performed on 38 patients in the study. They concluded that the eight-plate is as effective as staple hemi-epiphysiodesis for guided correction of angular deformity with respect to rate of correction and complications. Higher complication rates were observed in patients with pathologic physes (Blount disease, skeletal dysplasias)

CONCLUSIONS:

Proximal tibia oblique osteotomy without elevation of the medial tibial plateau achieved satisfactory correction of tibia vara. However, repeat surgery may be required for Langenskiold stages IV to VI if lateral hemiepiphysiodesis of the proximal tibia is unsuccessful. One patient developed gas gangrene – an extremely rare complication following a clean surgical procedure

FIGURES:



(Fig1 A)

(Fig1 B)

(Fig1 C)

Figure 1: (A) Showing clinical photographs of a 2-year old boy with bilateral Blount disease, (B) 6 months post operation (C) 6 years post operation.



(Fig2 A)

(Fig2 B)

(Fig2 C)

Figure 2: (A, B) standing anteroposterior radiograph of the same 2-year old boy with bilateral Blount disease. (B,C) anteroposterior and lateral radiographs immediate post oblique osteotomy in a cast.



(Fig3 A)

(Fig3 B)

(Fig3 C)

Figure 3: (A) Standing anteroposterior radiograph 6 months post operation.(B,C) Standing anteroposterior radiograph 6 years post operation.



(Fig4 A)



(Fig4 B)



(Fig4 C)

Figure 4: (A) Showing clinical photographs of an 8-year old boy with bilateral Blount disease, (B) 1year post operation (C) 3 years post operation.



(Fig4 A)



(Fig4 A)

Figure 5: (A) Showing clinical photographs of 13year old boy with bilateral Blount disease, (B) 3year post operation

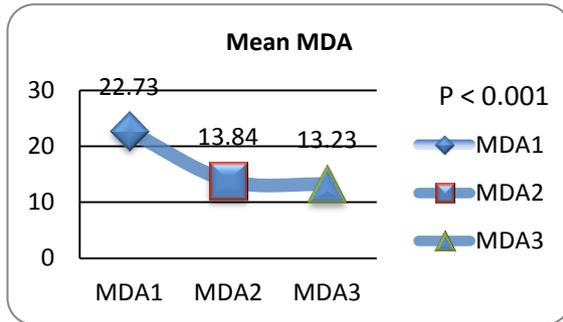


Figure 6: The graph showed a reduction MDA over the study period

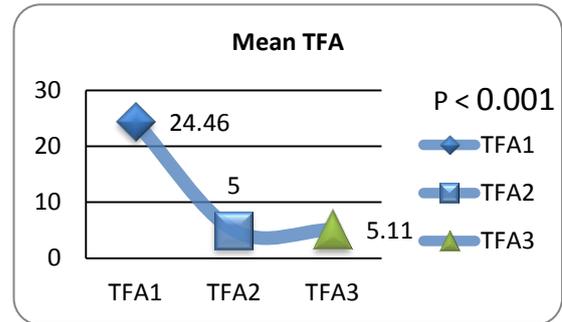


Figure 7: The graph showed a reduction in TFA over the study period

REFERENCES

- Hofmann A, Jones RE, Herring JA. Blount disease after skeletal maturity. *J Bone Joint Surg* 1982; 64 (7):1004. Sanjeev Sabharwal, MD, Current Concepts Review of Blount Disease *J Bone Joint Surg Am.* 2009; 91:1758-76.
- Stevens PM. Guided growth for angular correction: a preliminary series using a tension band plate. *J Pediatr Orthop.* 2007; 27:253-9.
- Tachdjian MO, ed. The foot and leg: tibia vara. In: *Pediatric Orthopedics Philadelphia* 1990; 4:2835-50.
- Gushue DL, Houck J, Lerner AL. Effects of childhood obesity on three dimensional knee joint biomechanics during walking. *J Pediatr Orthop.* 2005; 25:763-8.
- Sabharwal S, Lee J Jr, Zhao C. Multiplanar deformity analysis of untreated Blount disease. *J Pediatr Orthop.* 2007; 27:260-5.
- Gregosiewicz A, Wosko I, Kandzierski G, et al. Double-elevating osteotomy of tibiae in the treatment of severe cases of Blount disease. *J Pediatr Orthop.* 1989; 9:178-81.
- A. L. van Huyssteen, C. J. Hastings, M. Olesak, E. B. Hoffman. Double-elevating osteotomy for late presenting infantile Blount's disease, *J Bone Joint Surg [Br]* 2005;87- B: 710-15.
- Schoenecker P L, Meade W C, Pierron R L, Sheridan J J, Capelli A M. Blount disease: a retrospective review and recommendations for treatment. *J Pediatr Orthop* 1985; 5 (2): 181-6.
- Loder RT, Johnston CE 2nd. Infantile tibia vara. *J Pediatr Orthop.* 1987; 7:639-46.
- Doyle BS, Volk AG, Smith CF. Infantile Blount disease: long-term follow-up of surgically treated patients at skeletal maturity. *J Pediatr Orthop.* 1996; 16:469-76.
- Blair VP 3rd, Walker SJ, Sheridan JJ, Schoenecker PL. Epiphysiodesis: a problem of timing. *J Pediatr Orthop.* 1982; 2:281-4.
- Little DG, Nigo L, Aiona MD. Deficiencies of current methods for the timing of epiphysiodesis. *J Pediatr Orthop.* 1996; 16:173-9.
- Soo -Sung Park .Eric Gordon. Luhmann et al. Outcome of Hemiepiphyseal Stapling for Late-Onset Tibia Vara. *J Bone Joint Surgery.* 2005; 87:2259-2266.
- Vladimir Goldman and Daniel W. Green. Advances in growth plate modulation for lower extremity malalignment. *Current Opinion in Pediatrics.* 2010; 22:47-53
- Aykut U, Yazici M, Kandemir U, et al. The effect of temporary hemiepiphyseal stapling on the growth plate. *J Pediatr Orthop.* 2001; 25:336 -341.
- Wiemann JM 4th, Tryon C, Szalay EA. Physeal stapling versus 8-plate hemiepiphyseal stapling for guided correction of angular deformity about the knee. *J Pediatr Orthop.* 2009; 29:481-485