CASE SERIES

The Outcome of Corrective Transverse Osteotomy in Paediatric Tibia Vara

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Abstract

Background: Tibia vara is a three-dimensional deformity of the proximal tibia, varus, internal tibial torsion and procurvatum. It is an uncommon deformity with the surgical management varied. This study describes the outcomes of tibia vara management using a corrective transverse osteotomy in one centre.

Materials and methods: A retrospective cohort study was conducted involving eight patients with tibia vara (ten tibias). Consent was obtained for treatment using an acute corrective osteotomy. Measurements of Drennan's angle, the tibiofemoral angle (TFA) and the procurvatum angle were measured preoperatively and postoperatively both just after surgery and at 1 year. A validated questionnaire—the Knee Outcome Survey of Activity Daily Living (KOS-ADL)—was utilised to assess clinical function and outcome. Also recorded were the intraoperative and postoperative complications, the radiological lower limb alignments, the union rate and the recurrence of deformity.

Results: There were eight patients involved in this study with a total of ten tibias (six with unilateral tibias and two with bilateral tibias). The mean age of the patients was 11.3 years old (ranging from 8 to 15 years old) with most males (five males and three females). The affected tibias were 6 right sided and 4 left sided. Measurements of Drennan's angle, the TFA and the procurvatum angle were used to determine lower limb alignment preoperatively, postoperatively (immediate post-surgery) and at 1-year follow-up. Functional parameters were measured using the KOS-ADL. A descriptive analysis between the preoperative and postoperative variables was done. The mean for Drennan's angle was 21.6 (±5.2) preoperatively, 3.6 (± 2.3) postoperatively and 4.9 (±2.8) at 1-year follow-up. The TFA was improved from 22.6 (±6.1) preoperatively to 3.5 (±2.8) postoperatively and 4.4 (±2.0) at 1-year follow-up. The procurvatum angle was improved preoperatively from 8.20 (±7.5) to 2.40 (±2.5) postoperatively and 2.20 (±2.5) at 1-year follow-up. At the latest follow-up, the ADLS mean score was 98.5 (±2.6) while the SAS mean score was 97.5 (±3.3). The mean length follow-up period was 2 years (ranging from 1 year to 3 years). None of the patients developed postoperative complications with all achieving union without deformity recurrence in the period of observation.

Conclusion: This study revealed that acute correction via a corrective transverse osteotomy of the tibia is a safe and effective method in treating tibia vara.

Keywords: Blount's disease, Corrective osteotomy, Tibia vara, Transverse osteotomy.

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Introduction

Tibia vara is an asymmetrical three-dimensional deformity of the proximal tibia.[1] It was first reported by Erlacher in 1922 and was further delineated by Blount in 1937.[2] Blount's report in 1937 described an abrupt varus angulation of proximal tibia in the frontal plane only, but it is now believed to involve varus, internal tibial torsion and procurvatum.[1] These changes potentially lead to limb length discrepancies, gait abnormalities and early osteoarthritis.[3]

Surgical management is dominant in the treatment of tibia vara deformities owing to the high impact of the consequences of such a deformity in the long term. The aim is to restore the alignment of the lower limb. Gradual correction with distraction osteogenesis is considered the preferred option,[4] but for rural communities, as in Sarawak, the geographical and logistic issues make compliance to such treatment and the subsequent mandatory follow-up difficult. Acute correction of the deformity is one option that overcomes these problems. The aim of this study is to describe the outcomes of tibia vara management using an acute corrective transverse osteotomy in a consecutive series of patients from one centre.

Materials and Methods

This is a retrospective case series on the outcomes of an acute corrective transverse osteotomy for tibia vara. This study was conducted in a tertiary referral centre, the General Hospital of Sarawak, Kuching, Malaysia, which is the centre of referral for the whole of the state of Sarawak.

The technique of an acute correction through a transverse osteotomy in the proximal tibia was introduced in 2018. Patients were identified through the following selection criteria:

1. Inclusion criteria
    a. A paediatric patient with a confirmed diagnosis of unilateral or bilateral tibia vara.

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   b. The patient underwent a corrective transverse osteotomy for the tibia vara.
   c. The patient has a follow-up record of at least 1 year after surgery.
2. Exclusion criteria
   a. A deformity of the tibia other than tibia vara.
   b. A patient older than 18 years at presentation.

Those patients who underwent this procedure were identified, and all medical and radiographic records for period of January 2018 to December 2020 were traced. The patients' clinical notes and imaging records were reviewed. Radiological data were collected for the preoperative, postoperative and at least 1 year of follow-up stages. For each subject, the weight-bearing long leg views (or full length of both lower limbs views) and anteroposterior and lateral radiographs of the tibia and fibula were studied. Three radiographic criteria were used to assess the axis and alignment of the lower limb. All these measurements were measured twice by the principal investigator on a physical X-ray view box. Repeated measurements were made with the Radiant DICOM Viewer software to improve measurement accuracy. The measurements taken included the metaphyseal diaphyseal angle (Drennan's angle), the tibiofemoral angle (TFA) and the procurvatum angle.

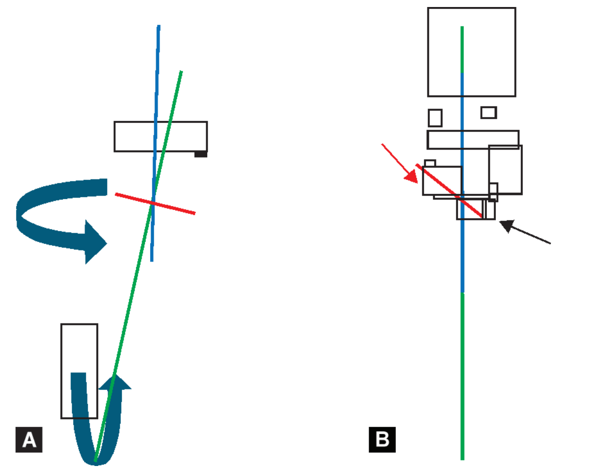
The clinical review was conducted through use of a validated questionnaire, the Knee Outcome Survey of Activity Daily Living (KOS-ADL). Knee Outcome Survey of Activity Daily Living is a self-reported measure to determine knee function and symptoms in individuals suffering from a variety of knee musculoskeletal disorders. It is applicable to subjects undergoing various orthopaedic procedures. It is composed of the Activities of Daily Living Scale (ADLS) and a Sports Activity Scale (SAS).

The ADLS is a 14-item scale that assesses knee symptoms that affect the ability to perform general daily activities (six items) and specific functional tasks (eight items). Each item is scored 0–5, with 5 indicating "no difficulty" and 0 representing "unable to perform". The highest possible score is 70. The scores of all items are summed, divided by 70 and then multiplied by 100 to give an overall ADLS percent score. Higher percentages reflect higher levels of functional ability. This scale would be appropriate for subjects who either do not participate in sports or recreational activities or for those who have not yet progressed in performing these activities.

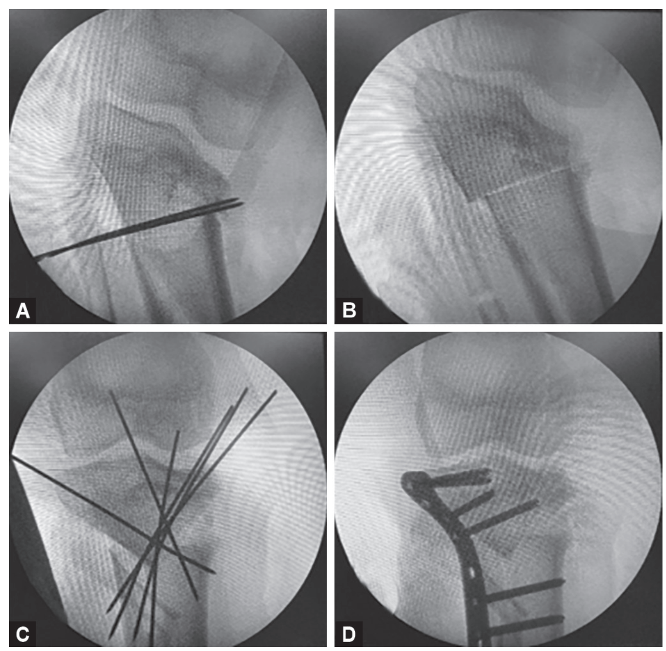
The SAS is an 11-item scale that assesses how symptoms affect their ability to perform sports and recreational activities (seven items) and how the knee condition affects the ability to perform specific sports-related skills such as straight running, jumping and landing, quick stopping and starting, cutting and pivoting (four items). The score is similar to the ADLS in that each item is scored 0–5. The highest possible score is 55, and the sum of scores is divided by 55 and multiplied by 100 to give an overall SAS percent score. Higher percentages reflect higher levels of sports and recreational functions. This scale was developed to evaluate higher levels of physical function in subjects with knee pathology.

This questionnaire was designed for adult patients. In the absence of a similar validated questionnaire for paediatric age groups, it was decided this would be used as a viable surrogate in view of its simplicity and easy of understanding. The questionnaire was utilised with the interpretation and help from parents or caretakers of the patients.

Three radiographic criteria were used to assess the axis and alignment of the lower limb:



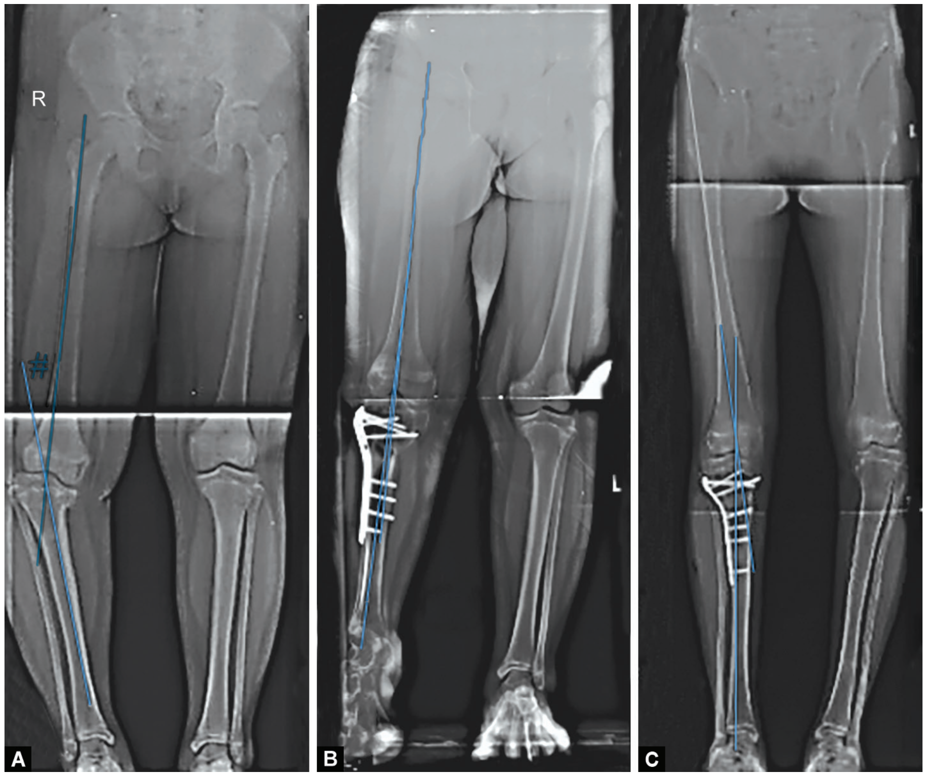
Figs 1A and B: Green line: anatomic axis of distal tibia. Blue line: anatomic axis of proximal tibia. The intersection of these lines was CORA. The tibial osteotomy was made perpendicular to anatomic axis of distal tibia at the level of CORA (red line). The distal tibia was manipulated into valgus, external rotation and recurvatum (blue arrow). The final position will result in an open wedge on the medial side (red arrow) and a closed wedge over the lateral side (black arrow)



Figs 2A to D: (A) The CORA is identified and marked with K-wires; (B) A transverse osteotomy is made at the proximal tibia and fibula; (C) Manipulation of the tibia is performed into valgus, external rotation and recurvatum and held temporarily with multiple K-wires; (D) Definitive fixation was done with proximal lateral tibia plating

(a) TFA.
(b) Metaphyseal diaphyseal angle (Drennan's angle).
(c) the procurvatum angle.

The TFA is the angle between the anatomical axes of the femur and tibia (Fig. 1). Drennan's angle is the angle formed between a line connecting the most distal points of the medial and lateral proximal tibial metaphyseal beak and a line perpendicular to the anatomical axis of the tibia (Fig. 2). As the TFA and Drennan's angle



Figs 3A to C: Tibiofemoral angles. (A) Preoperative; (B) Postoperative; (C) 1-year follow-up

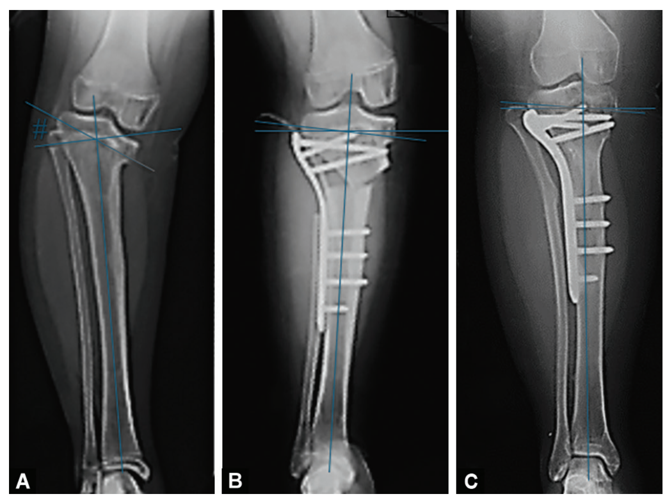
measure a coronal plane deformity, the sagittal plane deformity is measured by the procurvatum angle. The procurvatum angle is obtained from a measurement of posterior proximal tibial angle (PPTA) first. The PPTA is measured between a tangent to the tibial plateau and the modified mechanical axis of the tibia in the sagittal view (a line formed by joining the centre of the ankle joint to a point one-fifth anteroposterior along the tangent to the tibial plateau, (Fig. 3). The reference value for PPTA is 81 degrees. The procurvatum angle is obtained by 81 minus the measured PPTA. A positive value indicates radiographic procurvatum, while a negative value indicates recurvatum.

Statistical Analysis

All data were collected via a data collection form. These data were then transferred and organised in Microsoft Excel. Statistical analysis was performed using the Statistical Package for Social Science (SPSS) version 26. A descriptive analysis performed of the categorical variables such as age, gender and side of the limb affected was summarised into frequencies (number) and relative frequencies (percentage). Inferential analysis using mean and standard deviation (SD) was carried out on the radiological measurements at preoperative, (immediate) postoperative and 1-year stages, the lower limb radiological alignment (TFA, Drennan angle and procurvatum angle) and KOS-ADL scores. Based on inferential analysis, the comparisons were made and represented in another tables.

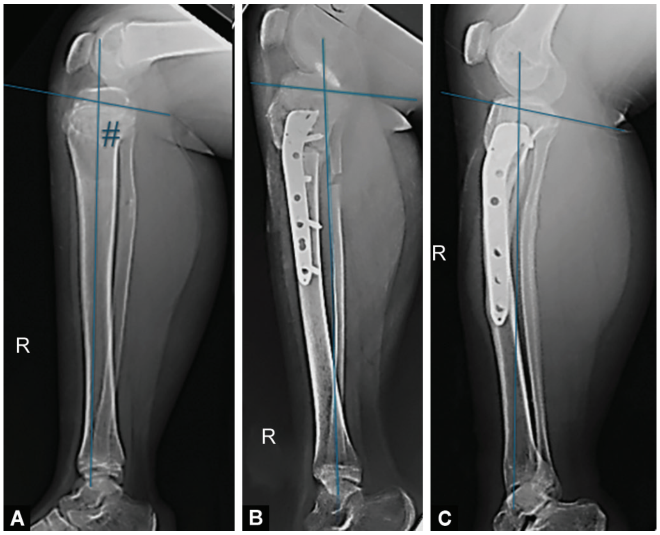
Surgical Technique

Clinical and radiological evaluations were obtained to determine the individual deformity characteristics. Initially, the centre of rotation angulation (CORA) was determined from the AP radiograph. This CORA is the intersection of the proximal and distal anatomic reference axes. The tibial osteotomy was made perpendicular to anatomical axis of distal tibia at the level of CORA (Fig. 4).



Figs 4A to C: Drennan's angle. (A) Preoperative; (B) Postoperative; (C) 1-year follow-up

The patient is placed in the supine position. The anterolateral approach of the proximal tibia is used until distal to the tubercle and a subperiosteal exposure is obtained. A temporary K-wire is inserted at the CORA perpendicular to the tibial shaft as a guide for the tibial cut (Fig. 5A). This is facilitated by image intensifier (II) guidance. A second skin incision is made over the lateral part of the proximal leg to reach the fibula. This is within 1–2 cm distal to the planned tibial osteotomy. The fibula was cut using multiple drill holes, followed by an osteotome. The fibula osteotomy was performed not at the level of the proximal fibula, as it may risk



Figs 5A to C: Posterior proximal tibial angle (PPTA). (A) Preoperative; (B) Postoperative; (C) 1-year follow-up

injury to the common peroneal nerve. This lateral surgical wound was lavaged and closed in layers.

The next step is the transverse osteotomy at the proximal tibia, and this is done using an oscillating saw. The saw direction and cut are adjacent and parallel to the temporary K-wire (Fig. 5B). Once both osteotomies are completed, the distal tibia should be mobile enough to be manipulated. The distal tibia is manipulated into valgus, external rotation and recurvatum. This will correct tibia varus, internal rotation and procurvatum. The correction of the tibia vara would be a closing wedge over the lateral side and an opening wedge over the medial side of the tibia. Although there is a gap over the medial side, no bone graft is needed. Once the deformity has been corrected and the bone alignment or anatomical axis restored between proximal and distal tibia (confirmed under image intensifier), the position is held temporarily with K-wires prior to definitive fixation with a plate (Fig. 5C). In some cases where the size of the tibia is too small for a plate, K-wires would be used as the definitive fixation. The surgical wound is lavaged and closed in layers. No fascial closure to avoid the risk of compartment syndrome.

Results

There were 23 patients identified with tibia vara. Following data screening and review, only 20 subjects had their clinic cards and radiographs available. Further selection was made based on the inclusion and the exclusion criteria leaving 12 eligible subjects. Out of the 12 subjects, 8 subjects were able to participate in the study, whereas the others had either defaulted, were non-contactable or had declined to participate in the study. With the eight patients, six had unilateral tibia vara, whereas two had bilateral tibia vara. Therefore, a total of 10 limbs were included in the study consisting of 6 right tibias and 4 left tibias (Fig. 6). Demographic data listed the following variables: age, radiological parameters preoperative, postoperative and after 1-year follow-up. The KOS-ADL (ADLS and SAS) scores were taken after 1-year follow-up, and postoperative complications were noted from the clinical data.

There were five males and three females in this study. The mean age was 11.25 ± 2.5 years old (ranging from 8 to 15 years old). The duration of follow-up ranged from 2 to 4 years. No intraoperative and postoperative complications were recorded; specifically, there was no record of compartment syndrome, infection and neurovascular injury (Table 1).

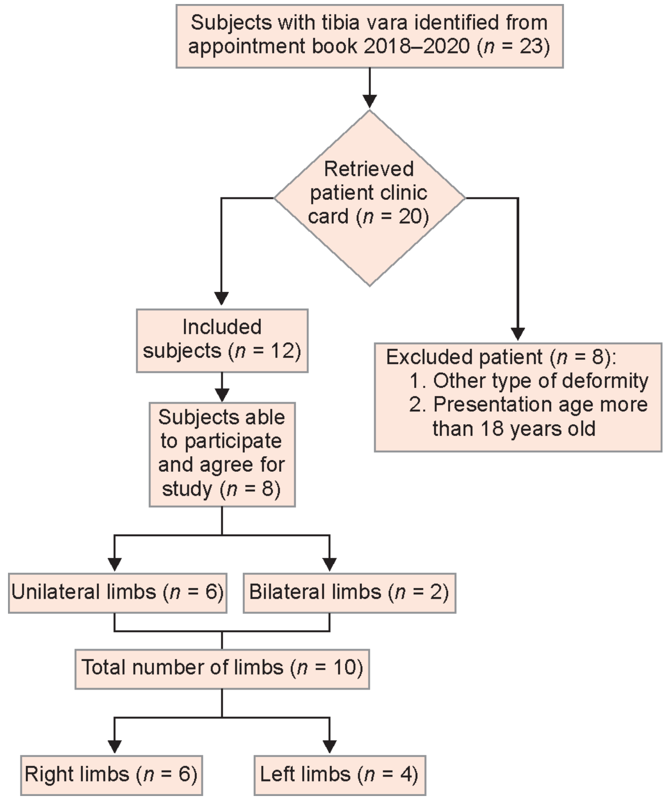


Fig. 6: Flowchart of the study

The preoperative Drennan's angles ranged from 15 to 30 degrees, with a mean of 21.6 ± 5.2 degrees. The preoperative TFAs ranged from 13 to 32 degrees, with a mean of 22.6 ± 6.1 degrees. The preoperative procurvatum angles ranged from 1 to 23 degrees, with a mean of 8.2 ± 7.5 degrees (Table 2).

Postoperative radiological parameters were measured just after surgery and again at 1-year follow-up. The postoperative Drennan's angles ranged from 0 to 9 degrees, with a mean value of 3.6 ± 2.3 degrees. Drennan's angles measured with at least 1-year follow-up ranged from 1 to 11 degrees, with a mean value of 4.9 ± 2.8 degrees. The postoperative TFAs ranged from –1 to 9 degrees, with a mean of 3.5 ± 2.8 degrees. The TFAs with at least 1-year follow-up ranged from 0 to 7 degrees, with a mean value of 4.4 ± 2.0 degrees. The postoperative procurvatum angles after surgery ranged from 0 to 9 degrees, with a mean value of 2.4 ± 2.5 degrees. These procurvatum angles with at least 1-year follow-up ranged from 0 to 9 degrees, with a mean value of 2.2 ± 2.5 degrees (Table 3).

All patients achieved union between 3 and 7 months, with a mean of 3.8 ± 1.2 months. The KOS-ADL scores have components of ADLS and SAS that was measured during follow-up. The ADLS ranged from 94 to 100% with a mean of 98.5 ± 2.6%. The SAS ranged from 92 to 100%, with a mean of 97.5 ± 3.3% (Table 4).

The preoperative radiological measurements were compared with postoperative: the mean difference between preoperative and postoperative Drennan's angles was 18.0 degrees; the mean difference between preoperative and postoperative TFAs was

Table 1: Data collected from the subjects

No	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Gender	Female	Male	Male	Female	Female	Female	Male	Male	Male	Male
Limb	Left	Right	Right	Left	Right	Right	Left	Right	Left	Right
Age	14	10	15	13	13	9	11	11	8	10
Fixation method	Plate	K-wire	Plate	Plate	Plate	Plate	Plate	Plate	K-wire	K-wire
Drennan angle pre/post	21/4	26/ 3	15/3	26/3	26/3	19/4	30/2	17/0	21/9	15/5
Drennan angle after 1 year	5	3	6	3	3	5	7	1	11	5
TFA pre	19	32	26	32	24	13	23	20	19	18
TFA post	5	5	7	5	2	2	0	–1	3	7
TFA after 1 year	6	5	7	5	3	5	3	0	5	5
Procurvatum angle pre	3	2	13	2	23	9	17	1	9	3
Procurvatum angle post	1	2	3	2	2	2	0	2	9	1
Procurvatum angle after 1 year	1	1	3	1	2	2	0	2	9	1
Union rate (months)	4	3	3	3	3	7	4	4	3	4
ADLS	100	100	100	100	100	100	94	94	100	97
SAS	95	100	100	100	100	100	94	94	100	92
Postoperative complication	No	No	No	No	No	No	No	No	No	No

Table 2: Preoperative radiological parameters

Angles analysed	*Minimum*	*Maximum*	*Mean*	*Std. deviation*
Drennan angle preoperative	15	30	21.6	5.2
Tibiofemoral angle preoperative	13	32	22.6	6.1
Procurvatum angle preoperative	1	23	8.2	7.5

Table 3: Radiological parameters postoperative and at 1-year postoperative

Angles analysed	*Minimum*	*Maximum*	*Mean*	*Std. deviation*
Drennan angle postoperative	0	9	3.6	2.3
Drennan angle postoperative 1 year	1	11	4.9	2.8
Tibiofemoral angle postoperative	–1	7	3.5	2.8
Tibiofemoral angle postoperative 1 year	0	7	4.4	2.0
Procurvatum angle postoperative	0	9	2.4	2.5
Procurvatum angle postoperative 1 year	0	9	2.2	2.5

Table 4: Descriptive analysis of union rate and knee scoring (ADLS and SAS)

Angles analysed	*Minimum*	*Maximum*	*Mean*	*Std. deviation*
Union rate (months)	3	7	3.8	1.2
Knee Outcome Survey Activity of Daily Living Scale/ADLS (%)	94	100	98.5	2.6
Knee Outcome Survey Sport Activity Scale/ SAS (%)	92	100	97.50	3.3

Table 5: Mean value of radiological parameters preoperative and postoperative

Angles analysed	*Preoperative (Mean ± SD)*	*Postoperative (Mean ± SD)*	*Mean difference*
Drennan angle	21.6 ± 5.2	3.6 ± 2.3	18.0
Tibiofemoral angle (TFA)	22.6 ± 6.1	3.5 ± 2.8	19.1
Procurvatum angle	8.2 ± 7.5	2.4 ± 2.5	5.8

Table 6: Comparison of radiological parameters between immediately postoperative and at 1 year of follow-up

Angles analysed	*Postoperative (mean ± SD)*	*Postoperative 1 year (mean ± SD)*	*Mean difference*
Drennan angle	3.60 ± 2.319	4.90 ± 2.767	1.30
Tibiofemoral angle (TFA)	3.50 ± 2.759	4.40 ± 1.955	0.90
Procurvatum angle	2.40 ± 2.459	2.20 ± 2.530	0.20

19.1 degrees; the mean difference between preoperative and postoperative procurvatum angles was 5.8 degrees (Table 5).

At a minimum follow-up of 1 year, the mean difference between immediate postoperative Drennan's angles and those at 1 year was 1.3 degrees. For the TFAs, this was 0.9 degrees, whereas for the procurvatum angles, it was 0.2 degrees (Table 6).

Discussion

Tibia vara often is a multiplanar deformity of the knee. Treatment depends on the severity of the deformity and the age of presentation. In the context of surgical correction, strategies are those of acute correction or gradual correction. Gradual correction by distraction osteogenesis is often considered a superior technique to address multiplanar deformity and limb length discrepancy.[4] This technique requires a high degree of patient compliance and has the potential for different and difficult complications that prompt for additional surgical interventions, such as premature consolidation of the bone.[5] In acute correction, there are concerns about potential complications of nerve palsy, residual malalignment, limb-length inequality, compartment syndrome, failure of fixation and a recurrence of deformity.[6,7] Nevertheless, there are numerous acute correction techniques reported with good outcomes. The technique described here involves a single transverse osteotomy at the proximal tibia, which allows acute correction of all components of the deformity presenting as tibia vara, including sagittal, coronal and rotational alignment. This technique does not require bone grafting and is easier to perform.

Blount described two types of tibia vara: the infantile type when the child begins to walk and the adolescent type that develops between the age of 6 and 13 years old.[2] Later, two other types were included; late-onset tibia vara and tibia vara caused by focal fibrocartilaginous dysplasia.[2] Thompson and Carter later divided tibia vara according to the age group at clinical onset; infantile 1–3 years old, juvenile 4–10 years old and adolescent at 11 years old or older.[8] These categories divide the pathology according to age at onset but do not explain the aetiology.

Tibia vara has a high association with child obesity, early walking and amongst the African American population.[9] A few articles describe a hereditary association with tibia vara.[10] Two articles indicate Blount's disease is more common in patients of African race independent of their country of birth and upbringing.[8,11] The estimated prevalence in the US is <1%.[9]

Infantile tibia vara is diagnosed at the age of 1–3 years old.[8] At this age group, it is important to differentiate between physiological and pathological bowing. The causes of pathological bowing are Blount's disease, rickets, focal fibrocartilaginous defect, skeletal dysplasia or due to trauma or infection.[2] Salenius and Vankka developed a graph to help clinicians differentiate pathological and physiological bowing according to the tibiofemoral angle at the age of presentation.[12] Radiographic findings in Blount's disease described by Langenskiöld and Riska are the presence of progressive bowing of proximal tibia associated with a medial metaphyseal lucency, sclerosis, fragmentation and delayed ossification of the medial epiphyseal ossific nucleus, a wedge-shaped epiphysis and prominent, beak-like recurving medial metaphysis.[13]

The aetiology of idiopathic Blount's disease is multifactorial and multiple hypotheses have been proposed with no definite consensus made. It is thought that childhood obesity increases mechanical pressure on the growth plate and disrupts the normal growth of the tibia.[9] Another hypothesis postulates this increase in mechanical pressure on the growth plate occurs in children who are early walkers.[9] Retarded growth on the medial side (compression) combines with accelerated growth on the lateral side (tension) contributes to the varus deformity in these groups of children.

Nutrient factors have also been investigated including vitamin D, zinc and alkaline phosphatase. One cohort study of 12 children with Blount's disease show an association of low level vitamin D with Blount's disease.[10] Giwa et al. did not find significant differences in calcium, inorganic phosphate or copper concentration, but there were decreases in serum zinc level and serum alkaline phosphatase level.[10]

Early treatment of pathological tibia vara is either conservative or operative. Generally, conservative treatment is favourable in patients in the Langenskiöld I or II groups and who are younger than 3 years old. There are many types of braces, but the most commonly used is the knee ankle foot orthosis (KAFO) with a knee valgus force applied through the concept of three-point pressure.[14–16] Conservative treatment through using daytime ankle-free, valgus-producing straps with a hinge or no hinge above knee brace.[16] Despite these options, operative treatment remains the main treatment strategy in most patients with tibia vara.

The aim of management is to correct the anatomical alignment of the lower limb. An early onset of presentation and less severe deformities are suitable for lateral hemiepiphyseal arrest (growth modulation) due to the good growth potential of younger age. In contrast, late presentations with complex deformity would have limited potential for growth modulation, thereby needing a surgical corrective osteotomy.[4]

The two main surgical techniques are gradual correction and acute correction. Gradual correction uses the principles of distraction osteogenesis. This technique requires high compliance from patients and can have problems with premature consolidation and pin-track infections. Acute corrective osteotomies overcome these issues.[15] In acute correction, fixation in the corrected position can be either by K-wire, plate fixation or external fixator.[9,14,17] Potential complications are nerve palsy, loss of alignment, limb length inequality, compartment syndrome, fixation failure and recurrence of deformity.[9] Furthermore, there is little opportunity to alter the amount of deformity correction postoperatively if the alignment is suboptimal without resorting to revision surgery.[9] With a good preoperative planning and surgical technique, acute corrective osteotomy can provide immediate alignment correction without need for additional corrective surgery.

The surgical technique of acute correction of deformity has been shown to have good outcomes.[4] Currently, gradual correction remains more popular for those with late-onset or severe Blount's disease, but there is little evidence to suggest the superiority of one method above the other.[17]

Our technique of acute correction involves a complete transverse osteotomy of the proximal tibia and proximal fibula, then manipulation of the tibia into valgus, recurvatum and external rotation, with appropriate checks for alignment intra-operatively. The osteotomy should be able to correct the deformity, and as it is performed primarily in cancellous bone near the site of deformity and, if fixation applied creates sufficient stability, early motion and weight bearing can be allowed.[18,19] Our technique has shown success in correcting all components of the deformity—axial, coronal and sagittal deformity—and thus is in accordance with other reported techniques.[3,7,14,15,19] A systemic review of osteotomy methods in Blount's disease by Phedy and Siregar showed no compartment syndrome was observed in these methods though some surgeons may perform a prophylactic fasciotomy of the leg.[1] A multicentre systemic review of both acute and gradual correction by Mohamed O. A study by Hegazy et al., which involved 328 osteotomies, showed no cases of non-union, three cases of deep infection and 11 cases of peroneal nerve palsy.[9] Ten of these were from the acute correction group, one was transient and none was permanently disabling. In our study, none of our subjects had any postoperative complications such as compartment syndrome, neurovascular injury, infection or nonunion.

There are limitations to this case series. This is a retrospective study with a small number of subjects and a short follow-up period. One concern is the risk of recurrence. There are numerous factors leading to recurrence after surgery for tibia vara; surgery after 4 years of age, obesity, Langenskiöld stages III to V and overcorrection of less than 15 degrees.[20,21] As all of our subjects were over 4 years old, and no subject had been overcorrected by more than 15 degrees, the risk of recurrence is a major concern. Longer data collection and follow-up are necessary to evaluate this risk. Late complications, such as degenerative changes and the impact of ligamentous laxity, are not assessed fully. Furthermore, there is a limitation in comparing the status of postoperative clinical improvement as the preoperative functional data were not documented adequately.

Conclusion

The optimum choice of osteotomy for the treatment of pathological tibia vara would depend on the patient's specific needs and surgeon's preferences. An acute correction through a transverse tibial osteotomy is an easy surgical technique with minimal hardware requirements. This case series documents the technique and supports it with positive radiological and clinical outcomes.

Ethical Approval

The study was approved by the National Ethical Committee.

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