Management of Blount's Disease by External Fixators

Essay

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ABSTRACT

Blount's disease is one of the pathological idiopathic causes of genu varum. Include the infantile and late-onset (adolescent) types. Pathological changes are localized to the posteromedial part of the proximal tibia due to the increased stresses on this part. Patients are obese with varus and internal torsion of the tibia. In infantile tibia vara operative treatment before the age of 4 years, with mild to moderate deformity with a single corrective osteotomy is the treatment of choice. In late-onset type or neglected infantile type treatment by external fixators is becoming more popular for gradual precise correction. The currently used fixators are Ilizarov, TSF and T-Garches external fixator for distraction osteogenesis, and Modified Wagner fixator-distractor for epiphyseal distraction.

Key words: Blount's disease, genu varum, tibia vara, osteotomy, epiphyseal distraction, Ilizarov and external fixators.

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INTRODUCTION

Tibia vara or Blount’s disease is a condition characterized by proximal varus angulation of the tibia associated with medial metaphyseal depression, internal torsion of the tibia, genu procurvatum, growth retardation, and a propensity toward additional progression(4, 19). The deformity is thought to be as a result of the increased stresses on the medial aspect of the proximal tibia and distal femoral physes(18). According to Blount's first clinical description; this condition may affect the patients either in early childhood (infantile type) or adolescence (late-onset tibia vara)(23).

The physical manifestations of Blount disease include the internal tibial torsion, genu varum, evidence of certain radiographic changes, limb length disparity, gait changes and ligamentous instability of the knee(68). Bowing may be unilateral or bilateral(47).

Definitive diagnosis of Blount disease is based on the progressive clinical bowing which occurrs in the presence of characteristic radiographic changes about the proximal and medial tibial physis, as initially described by Langenskiöld(20).

The principle of management in Blount's disease is alteration of abnormal compressive forces so that the normal growth will resume and the genu varum will be corrected(43). Treatment should begin in an early stage by restoring the

shape of the epiphysis, the anatomical axis of the knee, and completing the merging of all growth cartilage while projecting the leg's length discrepancy(52).

Different methods have been reported for the treatment of Blount's disease depending on factors such as the patient's age, the magnitude of the deformity, the severity of physeal and epiphyseal changes, and the presence or absence of secondary valgus deformity of the distal part of the femur(23).

The classical modality of managing infantile Tibia vara is a proximal tibial osteotomy with different forms of internal & external fixation, bony bar resection and epiphysiodesis. Many authors have described different forms of osteotomies for simultaneous correction of the varus and internal torsion(47).

External fixation of the tibia can be used in the treatment of tibia vara especially in the correction of severe deformities. The dynamic axial monolateral fixator can easily achieve an acute correction with relative patient acceptance. Circular external fixation is the preferred approach for gradual correction of the proximal tibia(83).

This essay will discuss preoperative evaluation and different methods of treatment of Blount's disease. The review stresses on the role of external fixators in the treatment of late-onset type and severe deformities of infantile type.

Aim of the work

The aim of the work is to review the literature on Blount‘s disease (tibia vara), reporting the different available treatment modalities. The review stresses on the role of external fixators in the treatment of severe deformities.

TEATMENT MODALITIES

The goal of treatment in Blount's disease is to obtain a well-aligned lower extremity with normal joint orientation and equal leg lengths that are maintained beyond skeletal maturity(81).

Infantile tibia vara

The natural history of untreated infantile Blount's disease is not well documented, but spontaneous resolution of the varus deformity is rare However, Ingvarsson et al stated that only one-third of all untreated patients with infantile Blount's disease will have a straight leg without arthritis at the age of 40 years(46).

Once the diagnosis of tibia vara is certain, treatment is recommended since patients that treateted in early stages of the disease have a better prognosis(50). Current management of established infantile tibia vara aims at unloading of the proximal, medial tibial physis(22).

Methods of treatment include:

1. Bracing.
2. Osteotomy of the tibia and fibula.
3. Osteotomy and epiphysiodesis of the lateral condyle and the proximal end of fibula.
4. Osteotomy and resection of bony bar.
5. Osteotomy, elevation of medial tibial condyle and epiphyseodesis(50).

◙ Bracing:

Controversy has arisen in the treatment of tibia vara and the roles of orthotic versus operative therapy have been argued. Although some authors have advocated the more aggressive role of tibial osteotomy, others have advocated the use of splinting to correct the deformity(59).

The principle of orthotic management in infantile tibia vara is alteration of abnormal compressive forces so that normal growth will resume and the genu varum will be corrected. Brace treatment should be considered in all patients less than 2½years of age with early Blount's disease changes (Langenskiöld stages I, II) and in patients older than 2 years who have persistent bowing and risk factors for Blount's disease(43).

Recent studies have demonstrated that brace treatment can correct both the varus deformity and the pathologic proximal-medial tibial growth disturbance(77, 78, 101). The best results were obtained with unilateral deformity. Bilateral deformity, obesity, female gender and a poor social situation are poor prognostic signs for successful bracing(59, 83).

FIGURE (4-1)

The knee-ankle-foot orthosis used for patients with infantile tibia vara. The single medial upright has no knee joint. The lateral cuff pulls the knee into valgus angulation. The brace can be easily adjusted as the genu varum corrects(43).

◙ Surgical treatment:

The indications for the surgical treatment of Blount's disease are progressive, painful or disabling deformity(11, 12, 57). The goals of surgery are to relieve pain, when present and to correct limb alignment with a horizontal knee joint for weight-bearing(17).

Osteotomy of the proximal part of the tibia is indicated for the child who is first seen for treatment after the age of three years, for the child thirty to thirty-six months old who is a poor candidate for brace therapy and for the three-year-old child who has persistent genu varum despite brace therapy. Multiple techniques have been described for the performance of this procedure in children(16, 76, 88). All involve placement of the osteotomy distal to the tibial tubercle to prevent damage to the tibial apophysis and subsequent genu recurvatum. Concomitant osteotomy of the fibula is necessary to permit adequate correction of the genu varum and internal tibial torsion(43).

◘ The goal of osteotomy:

The osteotomy should restore normal alignment of mechanical axis, restore the parallel orientation of the knee and ankle, regain effective length, and address the deformity in three planes. In addition, the osteotomy should avoid injury to the physis and joint, and be of stable configuration to allow early knee motion and weight bearing(65). Such an osteotomy should be performed early, perhaps before the age of four years, to achieve lasting correction proximal tibial deformity is such that the valgus correction often must be accompanied by external tibial-fibular rotation (to counteract internal tibial torsion) and flexion (to counteract slight hyperextension)(84). The closer the osteotomy is to the physis, the better the alignment correction. Room must be left for fixation devices,

and the physis itself should not be entered(87).Osteotomy of the proximal part of the tibia may need limited internal fixation. A concomitant anterior compartment fasciotomy should be done(43).

Positioning of the osteotomy in excessive valgus is primarily used in a three or four-year-old child who has increased risk factors for recurrence; that is, obesity, female gender, and an increased medial physeal slope. This position minimizes compression across the disorganized physis and provides time for normal growth to resume. The degree of overcorrection is determined according to the surgeon's judgment, but it is generally 5 to 10 degrees more valgus angulation than is normal for the child's age. Overcorrection should not be done in a child without risk factors, because in such cases a persistent or even increasing valgus deformity can occur(43).

- **Types of osteotomies:**

Many types of osteotomies have been described in the literature, including opening wedge(82), closing wedge(55), spike(24), oblique(58, 65, 76), elevation of the medial plateau(44,84,88,98), complex(44, 46), and with or without a physeal procedure, such as epiphyseodesis or bridge resection(9). Fixation devices such as casting, K-wires, pins(13,33,57), plates and screws(62), and external fixation (18,35, 74) have been reported. Buckley et al (13) have reported that the type of osteotomy does not influence the outcome or the incidence of complications(17).

- **Complications of high tibial osteotomy:**

The risk of neurovascular complications following a proximal tibial osteotomy is greater in children than in adults. Many proximal tibial valgus osteotomies have been immobilized in a fully extended or semiextended position in a long leg cast after surgery. This position of

relative extension of the knee might contribute to the frequency of neurovascular problems seen after proximal tibial osteotomies(58). The drawbacks to internal fixation may be minor (for example, a slightly increased risk of infection because of the retained foreign body) or major (the increased risk of fracture after removal of the implant and most importantly, the need for a second operation for removal of the implant)(24).

- **Samples of high tibial osteotomy:**

Chevron osteotomy

Greene described an opening-closing chevron osteotomy in patients who have infantile tibia vara .This osteotomy is a modification of the dome osteotomy and has the advantage of providing greater stability and minimum change in leg lengths. The theoretical disadvantage is that a slightly longer period of cast immobilization (approximately two weeks) is needed for incorporation of the wedge segment. This, however, does not cause a problem in children and the additional period of reduced stress on the medial aspect of the physis may be advantageous(43).

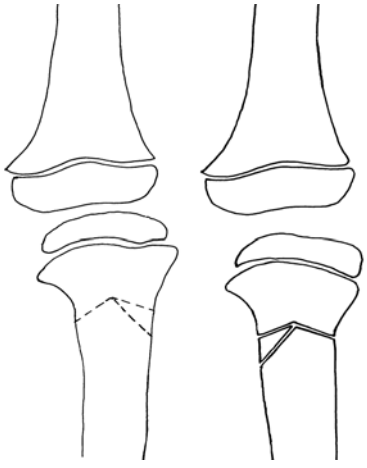
A  B 

FIGURE (4-2). A) Outline of the cuts for an opening-closing chevron osteotomy. At the completion of the osteotomy, the lateral wedge is inserted medially. **B)** Preoperative radiograph and intraoperative anteroposterior radiograph of the tibia after completion of the opening-closing chevron osteotomy(43).

W/M osteotomy

Hayek et al have used a surgical approach, the serrated W/M osteotomy of the proximal tibia, to correct infantile tibia vara. The W/M serrated osteotomy enables correction of infantile tibia vara to be made without the need for internal fixation. It allows correction of all aspects of the deformity while preserving length, restoring joint alignment and preventing recurrence(46).

A  B  C 

FIGURE (4-3). A) Photograph showing a model of the proximal tibia with the planning of drill holes and the serrated W/M osteotomy. **B)** The serrations are disengaged while the distal tibia is derotated and then re-engaged in the corrected position. **C)** An immediate postoperative anteroposterior (AP) radiograph showing the position of the tibia after the re-engagement of the serrations(46).

Elevation of depressed medial tibial plateau:

Many children are not evaluated and treated until they have the advanced changes characteristic of the disease (premature closure of the medial part of the proximal tibial physis with resultant substantial depression of the medial aspect of the tibial articular surface of the tibia). In such patients, an osteotomy to correct the varus of the tibia is