Upper Tibial Coronal Plane- Oblique Osteotomy for Deformity Correction in Blount's Disease

Tarek A. Aly, M.D., Mahmoud El-Rosasy, M.D., Mohamed S. Saied, M.D.

ABSTRACT

INTRODUCTION: Correction of tibia vara deformity entails correction of varus and internal rotation deformities. In small children, the use of internal fixation is not desirable to avoid physeal violation; also, external fixator may not be applicable. Then, the osteotomy should be inherently stable, corrects all elements of deformity and allows post-operative adjustments of position.

BACKGROUND: Oblique osteotomy has been described to perform varus derotation of the proximal femur and to correct varus internal rotation of the tibia in Blount's disease.

MATERIALS AND METHODS: The present study included 16 children. In ten patients the deformity was bilateral and it was unilateral in the other six patients, with a total of 26 tibiae. The youngest child was three years old and the oldest was 12 years old. The procedure included coronal plane oblique osteotomy starting distal to the tibial tubercle and runs up to the posterior tibial metaphysis just distal to the epiphyseal plate. A single fixation screw was used for limited internal fixation in the sagittal plane to allow post-operative position correction by cast wedging.

RESULTS: All osteotomies healed within 12 weeks. The deformities were corrected with ten degrees of over-correction of varus deformity. In two patients post-operative weakness of extensor hallucis longus occurred which resolved within one week.

CONCLUSION: Upper tibial oblique osteotomy in the coronal plane has the advantages of correction of all deformity elements with minimal internal fixation, at the same time allows post-operative adjustments which are desirable in small children.

KEYWORDS: Blount's disease, oblique, tibia, osteotomy

INTRODUCTION

In 1937, Blount reported on a series of thirteen patients who had tibia vara. He stated that it is a developmental disorder of growth that affects the medial aspect of the proximal tibial physis. The disease occurs in two forms. Infantile form, become manifested between fourteen and thirty-six months old. The adolescent form occurs between six and thirteen years old.

Upper tibial osteotomy for correction of deformity associated with Blount's disease should accomplish several specific goals. Ideally, osteotomy should fully correct varus and internal rotation deformities, correct deformity as close to the knee joint as possible, avoid damage to the proximal tibial growth plate, maintain tibial length, unite rapidly, allow for postoperative adjustment of position, use minimum internal fixation, be as safe as possible, and be cosmetically acceptable.

An oblique osteotomy of the proximal tibia that meets these goals has been devised. The osteotomy runs obliquely from a point distal to the tibial tubercle up to the posterior tibial metaphysis, just distal to the epiphyseal plate.

The purpose of this study was evaluation of the results of this technique and its merits over the other osteotomy techniques.

PATIENTS & METHODS:

Sixteen patients (twenty-six involved extremities) who had tibia vara had been seen. All patients were followed up for a mean of 26 months (range from 14 to 37 months). The average age of our patients is 6.4 years (range from three to twelve years). They were nine males and seven females. The evaluation consisted of review of the chart, recording of a detailed history, physical examination, and review of anteroposterior radiographs of both lower extremities that has been made while the patient standing.

Concept of the osteotomy

Correction of a pure rotational deformity requires an osteotomy in the transverse
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plane. If pure varus-valgus correction is desired, the osteotomy must be in frontal (coronal) plane. Flexion-extension correction requires a sagittal plane osteotomy. Because most clinical deformities of Blount's disease varus and internal rotation must be corrected, the osteotomy should have transverse and frontal plane components. An oblique osteotomy directed from antero-distal to postero-proximal splits the difference between the transverse and frontal planes (Figure 1). Osteotomy cuts that are more vertical corrects greater varus deformity than internal rotation deformity; cuts that are more transverse do the opposite. Rotation with its two faces in contact corrects varus and internal rotation. The average patient with Blount's disease has approximately equal varus and internal rotation deformities. So, 45° upwards osteotomy has been appropriate for complete clinical correction. The graph in figure 2 provides a quick estimate of the osteotomy angle when differing degrees of external rotation and valgus is required.

Operative technique

Under tourniquet, a transverse incision at the lower pole of the tibial tubercle is done (Figure 3A). The periosteum is incised in Y-shaped fasion, and dissected subperiosteally (Figure 3B). Malleable retractors are placed behind the tibia. A K-wire is passed at 45° angle 1 cm beneath the tibial tubercle, and advanced under C-arm control until it just passes into the posterior cortex distal to the epiphysial plate (Figure 3C). The osteotomy cut is done immediately below the K-wire using saw and osteotome (Figure 3D).

A second small incision over the midfibula and excision of 1-2 cm segment of the fibula is done.

A hole is predrill in the anteroposterior direction across the osteotomy cut, lateral to the tibial tubercle (Figure 3E). The osteotomy is rotated along its face by external rotation and valgus rotation, and secured the osteotomy with a single 3.5 screw overdreilled anteriorly (Figure 3F). The screw is not overtightened. Subcutaneous fasciectomy is performed between the two incisions. The tourniquet released and after haemostasis the wound is closed over suction drain and the limb is fixed in above knee cast. The single screw is loose enough to allow the position of the osteotomy to be adjusted by cast wedging if necessary. The cast is changed after 4 weeks and is worn till union is evident radiographically. Clinical case is presented in figure 4.

RESULTS:

The goal of osteotomy (correction of the deformity) was achieved in all patients. Union occurred uneventfully in each case. There were no deep infection. Only two patients developed a partial weakness of the extensor hallucis longus which resolved completely within a week. There was no clinical evidence of deep compartment syndrome. No patient evidenced change from the position accepted at the end of operation until final union.

Radiologically, the angle formed by the femoral shaft and and tibial shaft were corrected from 34° of varus to 4° of valgus. The average angle formed by the femoral condyle and tibial shaft was corrected from 67° to 89°.

DISCUSSION:

The age of onset of idiopathic tibia vara ranges widely and has been the basis for separation of patients into groups labeled as infantile, juvenile, adolescent. Marked internal tibial torsion in association with varus deformity is always present (9,10). Osteotomy to correct the varus of the tibia is inadequate to obtain and maintain satisfactory correction of the deformity about the knee joint and sometimes several osteotomies may be required during the growing years of a child with Blount's disease leading to grotesque deformity of the upper tibia. The best way to obtain correction is with simple procedure carried out as high in the tibia as possible to promote rapid union, quick remodeling, and minimal proximal shaft deformity.

The oblique osteotomy has many advantages. It avoids damage to the apophysis of the tibial tubercle while allowing a very proximal cut. It corrects accurately both varus and internal rotation deformities. Its broad flat metaphyseal surface in the tibia heals quickly. Limited internal fixation with a single screw is adequate to control position.
Fig. (1): Rotation about the face of the cut will produce both valgus and external rotation correction.

Fig. (2): Graph to calculate angle of oblique osteotomy.

Fig. (3): Operative technique.
(a) Transverse skin incision.
(b) Y-shaped periosteal incision.
(c) K-wire inserted in the proximal tibia.
(d) Saw and osteotome marked with pin to avoid over-penetration.
(e) Oblique osteotomy and predrilled hole for the screw.
(f) Osteotomy rotated and held with single screw.

Fig. (4): Case presentation.
(a) Pre-operative and immediate postoperative radiograph showing correction of varus deformity in Blount’s disease.
(b) Radiograph 2 months postoperative.
(c) Pre-operative clinical presentation and postoperative clinical outcome.
Tibial osteotomy has always a high risk of complications\(^{(11)}\), including loss of motion of the knee, deep wound infection, non-union, malalignment, and compartment syndromes. In this work only two patients (7.6%) were complicated with transient extensor hallucis longus weakness following the oblique osteotomy resolved completely within one week. Steel and colleagues\(^{(12)}\), documented this complication in 29% of their patients with valgus tibial osteotomy and suggested experimentally that the etiology of ischemia was due to compression of the anterior tibial artery as it emerges through the interosseous membrane. Medial or lateral translation of the osteotomy faces also allow change in the interosseous membrane configuration without affecting the angle of correction. Staheli\(^{(13)}\) outlined three potential causes for neurovascular compromise following tibial osteotomy: traction on the peroneal nerve, anterior compartment syndrome, and anterior tibial artery damage or occlusion. So, prophylactic decompression at the time of the operation by fibular excisional osteotomy, subcutaneous fasciotomy, and suction drainage can add to the safety of the operation. However, the surgeon and the family must be aware of the potential for serious neurovascular problems in the postoperative period, and severe pain must be investigated rapidly. Use of transverse incision is effective and cosmetic, it can be easily extended medially if necessary to perform additional procedures as physeal bar resection or epiphyseal osteotomy.

REFERENCES: