

# Treatment of ankle varus deformity due to physeal bar formation: A case report

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## ABSTRACT

Treatment of ankle deformities caused by the physeal bar after a fracture sequel is complicated. Each patient should be treated individually depending on of the severity of the deformity and bar location. We presented a case report of a successful treatment of an 11-year-old male patient with progressive varus deformity and bar formation due to trauma in the distal tibial physis. Tibia distal open wedge osteotomy, fibula closed wedge osteotomy, bar resection, and autogenic adipose tissue interposition were performed. The patient is at 4 year follow-up without any complication. We think that bar resection technique provides favorable results even in severe ankle deformity.

**Keywords:** Ankle fracture; physeal bar; physis fracture; varus deformity.

## INTRODUCTION

Ankle fractures account 5% of all fractures and 15–20% of all growth plate injuries in children and are the most common growth plate injury in the lower extremity. Injuries to the physis of the distal tibia are the second most common growth plate injuries following those of the distal radius.<sup>[1]</sup> The distal tibial physis contributes 40% to the longitudinal growth of the tibia, compared with 60% in proximal physis. Injury to the physal distal tibia can lead to growth arrest, angular deformities and leg length discrepancy due to bone bar formation. Despite various treatments methods have been shown to be effective, there is no standardized method currently for the treatment of a physeal bar in growing children. Treatment options include shoe elevations, bone bar excision, contralateral and ipsilateral epiphysiodesis, leg lengthening, corrective angular osteotomy, and Ilizarov corrective procedures.<sup>[2,3]</sup> We presented a case report which shows that bar resection is a worthwhile procedure in the treatment of ankle varus deformity and bar formation due to trauma in the distal tibial physis.

## CASE REPORT

A 6-year-old male patient admitted to at another hospital due to ankle fracture 9 years ago after a motorcycle accident. Conservative treatment was planned for the ankle fracture and a short leg cast was applied. The cast was removed after 45 days and full weight bearing was initiated. Thereafter, the patient was admitted to our center 4 years ago at age 11 because of the progressive deformity, pain, and limb leg discrepancy. On physical examination he had 3 cm shortness of the left extremity and prominent ankle varus deformity (Fig. 1). Ankle joint range of motion and neurological examination was evaluated as normal. Radiological evaluation through direct radiography and computed tomography (CT) revealed central bar formation in the tibial distal physis. 30 degrees of varus deformity were measured at the left ankle joint (Fig. 2). Distal tibia and fibula osteotomy levels were planned preoperatively on plain radiographs.

The patient was operated in a supine position under a tourniquet. Initially distal tibia medial open wedge osteotomy was

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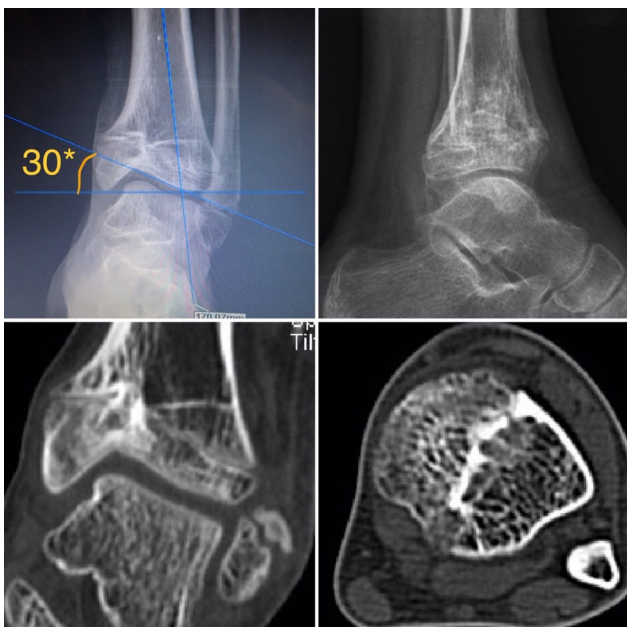
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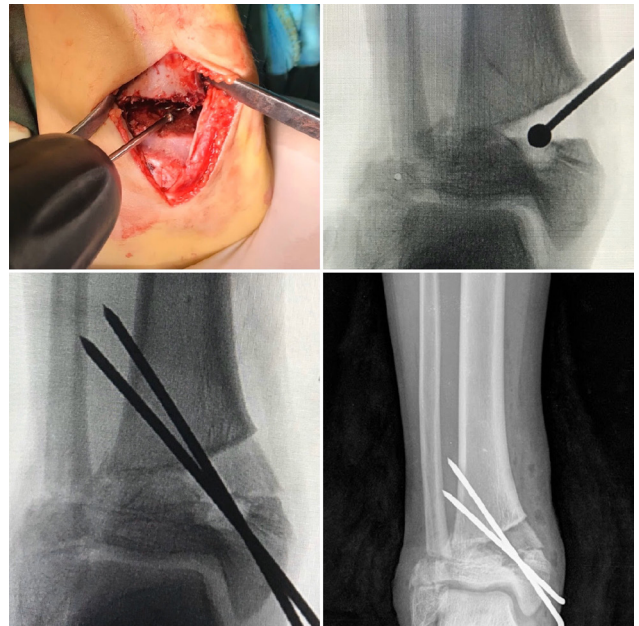




**Figure 1.** 11-year-old patient with varus deformity and shortness of the left ankle before surgery.



**Figure 2.** The appearance of bone bar in direct radiography and computed tomography in the preoperative period. The bar is located centrally and has an anteroposterior extension. Ankle varus measured 30 degrees.



**Figure 3.** Post-operative X-ray revealing fixation of the osteotomy after bony bar excision with burr.

performed first at the supramalleolar level. The lateral tibial cortex was not violated. Thereafter, fibular osteotomy was performed at the fibular angulation first and second fibular osteotomy carried out 2 cm proximally. After that 2 cm of fibular bone block was resected which provided sufficient distal tibia realignment. Physal bar resection was carried out with a bone burr at the osteotomy site and autogenic adipose tissue interposition was performed to fill the formed physal space in the distal tibia (Fig. 3). The removed fibula segment was interposed in to the medial osteotomy site in order to provide adequate deformity correction and enhance the stability of the osteotomy under fluoroscopic examination. Thereafter, osteotomy was fixed with 2 kirschner wires and a short leg cast was applied (Fig. 3). Post-operative radiological evaluations at follow-ups revealed that anatomical axis of the patient's ankle was obtained and the discrepancy was decreased to about 0.5 cm. At the 6<sup>th</sup> week follow-up, the Kirschner wires were removed as an outpatient procedure and weight bearing was initiated as tolerated (Fig. 4). Final clinical and radiological follow-up at 4 years revealed that bar resection resulted in continued symmetrical growth of the distal tibial physis with a painless ankle and a discrepancy of 1.1 cm (Fig. 5).

## DISCUSSION

Treatment of ankle deformities caused secondarily by the physal bar after a fracture sequel is complicated. Current literature reveals that surgical treatment including physal bar excision is a demanding procedure. The location, width of the bar, patient's age type of the interposition material, degree of angulation, and time of occurrence are the important issues of particular concern.<sup>[3-7]</sup> However, since many factors are effective in prognosis, no standard evaluation and treat-





**Figure 4.** Anteroposterior and lateral radiographics of the patient at 6<sup>th</sup> week follow-up.



**Figure 5.** Orthoroentgenogram of the patient at 4 years follow revealing 1.1 cm limb discrepancy.

ment are specified. Each patient is treated with a separate treatment procedure according to the surgeon's experience.

Williamson et al.<sup>[3]</sup> reported that bar excision leads to favorable outcome in growing children with adequate remaining growth potential. The average age at physeal bar resection was 12 years and 7 months in their case series. The authors suggested bar excision for skeletal immature children who continue to grow and stated that at least 2 years or 2 cm of growth should remain for successful surgical outcome. In our case, the patient age was 11 at operation and currently he is

15 years old and has only 1 cm limb discrepancy. There is no malalignment and joint degeneration.

The location of the physeal bar is another important factor to be considered for favorable surgical outcome. The location and area of the bar should be evaluated through plain radiography, CT and magnetic resonance imaging for appropriate preoperative planning. Central and peripheral or combinations of the two have been reported regarding the bar location and there is a general opinion that the excision of the centrally located bars yield better clinical results.<sup>[4]</sup> Besides, when the physeal bridge affects 50% and more of the physeal area adverse effect on longitudinal growth increase.<sup>[8]</sup> The smaller the dimension of the bar, the better the likely outcome because less resection is needed. In our case, the bar is located centrally and has an anteroposterior extension. The bar was excised with a bone burr after planning through tomography preoperatively.

Physeal bars occur after considerable time has passed from the physeal injury. Usually, bar formation occurs after bone healing is completed. However, the shorter the time between bar formation and excision, the better surgical outcome.<sup>[9]</sup> On the other hand, Langenskiöld and Österman reported successful results for bar excision performed 7 years later from the fracture.<sup>[10]</sup> Despite 4 years have passed since the injury. The result was quite successful in the presented case. The talotibial anatomical axis has returned to normal and complete remodelization was observed in the fibular bone. In our opinion, surgical treatment can be applied without even the prolonged time interval between bar formation and surgery. We think that good surgical planning and sufficient growth potential is more crucial for the favorable outcome.

Recurrent bar formation is one of the most common causes of failed surgery. Many different methods have been described in the relevant literature to prevent the development of this complication.<sup>[11]</sup> Hematoma formation should be observed after physeal bar excision. To prevent physeal bridge reformation, interposition material should be used to fill the cavity left by the physeal bar excision.<sup>[4,12]</sup> The cavity formed after bar excision is filled with autogenic fat, cranioplast, silastic, methyl methacrylate, and various cartilage tissues. Of these, autogenic fat tissue is the most frequently used and easily accessible. We also used the autogenic fat tissue obtained at cruris after bleeding control in our case. In our opinion; these patients should be followed up until the skeletal growth is completed.

Puno et al.<sup>[13]</sup> reported that tibial angular deformities over 4 degrees can cause degeneration in the ankle joint. Williamson and Staheli<sup>[3]</sup> suggested corrective osteotomy with physeal bar resection for any deformity over 10 degrees. We performed tibial distal medial open wedge corrective osteotomy because our case had varus in the distal tibia about 30°. Since fibula overgrowth has also observed, we have provided tibiotalar neutral arrangement by adding osteotomy.

In conclusion bar excision to restore ankle after distal physal bar formation is a useful and appropriate procedure. It provides restoration of growth arrest and correction of the deformity at the same time preventing the necessity of multiple surgical limb length equalizing procedures.

**Informed Consent:** Written informed consent was obtained from the patient's family for the publication of the case report and the accompanying images.

**Peer-review:** Internally peer-reviewed.

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## OLGU SUNUMU - ÖZ

### Fizyel bar oluşumuna bağlı ayak bileği varus deformitesinin tedavisi: Olgu sunumu

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Kırık sekeli sonrası oluşan fizyel barın neden olduğu ayak bileği deformitelerinin tedavisi karmaşıktır. Her hasta, deformite ve bar konumunun şiddetine göre ayrı ayrı tedavi edilmelidir. Biz distal tibial epifizde geçirilmiş travmaya bağlı meydana gelen varus deformitesi ve bar oluşumu olan 11 yaşındaki erkek hastanın bar rezeksiyon tekniği ile başarılı tedavisini sunduk. Tibia distal açık kama osteotomi, fibula kapalı kama osteotomi, bar rezeksiyonu ve otojenik yağ dokusu interpozisyonu uyguladığımız hasta herhangi bir komplikasyon olmaksızın dördüncü yılını doldurdu. Bar rezeksiyon tekniğinin ciddi ayak bileği deformitesinde bile olumlu sonuçlar verdiğini düşünüyoruz.

**Anahtar sözcükler:** Ayak bileği kırığı; distal tibial fizyel bar; fizis kırığı; varus deformitesi.

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