

Case 4: 19-Month-Old Girl with Anterolateral Bowing but No Fracture

Presenter: Mark T. Dahl, MD (MD)

Expert Panel: In-Ho Choi, MD, PhD (IC); Joachim Horn, MD, PhD (JH); Benjamin Joseph, MBBS, MS, MCh (BJ)

Moderator: Jennifer C. Laine, MD (JL)

Brief History: This patient is a 19-month-old girl referred with painless anterolateral tibial bowing (Figure 1). She has no history of trauma. No evidence of neurofibromatosis. Her parents were counseled of the natural history of potential fracture. An ankle foot orthosis (AFO) was prescribed.

The family followed up with serial radiographs and clinical exams. Full time brace compliance was reported (Figures 2 and 3).

Decision Point #1—Expert Panel

JL: Professor Choi, Dr. Joseph, and Dr. Horn, what are the key problems and concerns for this patient?

JH and BJ: Sclerotic bone and the narrowing of the tibial diaphysis (reduced cross sectional diameter) might cause the tibia to fracture in the near future. The large degree of angulation in this particular case increases the risk of fracture and leads to a non-physiological load of the ankle and subtalar joints. Varus deformity appears to be more than 30 degrees, which exceeds the ability of compensation in the subtalar joint. This might lead to overload of the lateral rays of the foot, causing pain and gait problems. Furthermore, the load on the ankle joint and compensation mechanisms, especially in the subtalar joint, might lead to secondary structural changes. Spontaneous correction of the existing antero-lateral bowing is unlikely. Some leg length discrepancy might develop gradually.

IC: Serial radiographs demonstrate that the tibial fibrocystic lesion has been healed over the past one year in the presence of persistent anterolateral bowing with



Figure 1. Anteroposterior (AP) and lateral radiographs of the tibia at 19 months of age.

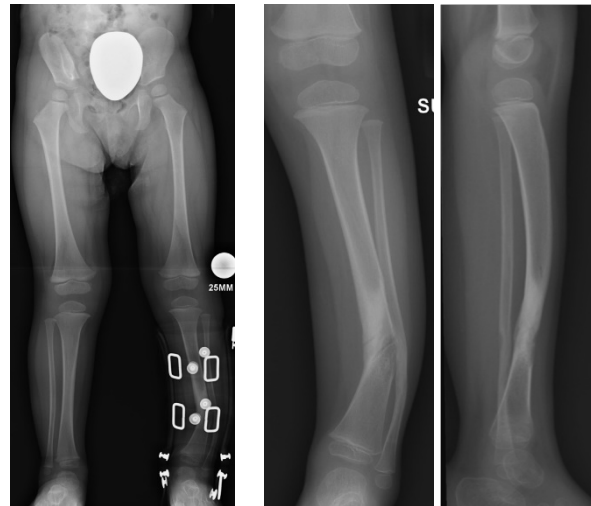


Figure 2 (left). AP radiograph of bilateral lower extremities in orthosis at 2 years and 4 months of age.

Figure 3 (middle and right). AP and lateral radiographs of the tibia at 2 years and 7 months of age.

obliterated medullary canal. Medial proximal tibial angle (MPTA) seems to be slightly increased, suggestive of mild proximal tibial valgus. There still remains the risk of fracture. Therefore, this concern needs to be resolved

as early as possible in a toddler with increasing physical activities.

JL: *If this were your patient, what would you recommend and why?*

BJ and IC: *Continue with bracing but extend bracing to above-knee clamshell orthosis (to try to prevent the tibia from fracturing). We would recommend placing a two-hole tension band plate in the lateral aspect of the distal tibia for guided growth control at this time point—this would provide the following advantages: (1) decreased tibial angulation with a resultant reduction of fracture risk, (2) improved bone quality and remodelling in accordance with correction of residual angulation, (3) improved ankle joint orientation and mobility—this will be helpful to build-up gastrosoleus muscle power, and (4) preserved leg length.*

JH: *The family should receive the following information: There is no consensus regarding the treatment of antero-lateral bowing with no fracture (Crawford type I and II) although surgery might be indicated when increased bowing is seen. Cases with mild deformity should be treated with an ankle foot orthosis until skeletal maturity and no surgery in the affected leg. However, in this particular case, we see a degree of deformity which with time might lead to secondary changes in the foot and ankle and which might cause pain and gait problems.*

Therefore, I would recommend continuing treatment with a full-time brace (ankle foot orthosis) for another 1–2 years. If no spontaneous improvement of the deformity is seen, the patient develops symptoms, or the deformity is increasing (eventually accompanied by minor tibial stress fractures), I would recommend a corrective osteotomy and all steps according to the cross-union protocol (Paley) around age 4. However, I would not recommend locking of the male part of the Fassier-Duval (FD) nail in the distal tibial epiphysis since we have seen migration of this locking pin through the physis over the course of treatment. This resulted in growth disturbance of this physis with subsequent varus deformity and the need for secondary surgery.

Treatment for Case 4

Persistent sclerosis was noted at the apex of deformity and the parents were again counseled about fracture risk. Surgery was recommended, including an intraoperative stress assessment of the tibia under fluoroscopy, followed by guided growth of the distal tibia if the tibia was stable. Intraoperatively, the tibia was stable, and guided growth was performed. The patient was then followed clinically and radiographically at regular intervals (Figures 4-6).

Due to screw encroachment on the physis, implant revision was recommended (Figure 7), followed by continued regular clinical and radiographic follow-up (Figures 8 and 9).

With improved mechanical axis and the ankle joint now parallel to the floor, implant removal was recommended. The patient continued regular follow-up (Figures 10-13)

See Case 4 Outcome video

Presenter Commentary

JL: *Dr. Dahl, thank you for sharing this case of long-term follow-up for a patient treated with guided growth for fracture prevention. Do you have any technical pearls on using this method?*

MD: *This case demonstrates that the epiphyseal screw can quickly encroach upon the physis as the screws diverge with growth. It is important to follow patients closely for this. I have found that the epiphyseal screw migrates rapidly, especially if it is short. I try to use the longest screw possible in the epiphysis. I typically place the epiphyseal screw first with this technique and place the guide wire as close to subchondral bone (distally) as possible. I have found that by doing this, the implant lasts longer.*

*For this case in particular, I would also like to emphasize that during the initial trip to the operating room, the tibia was stressed under fluoroscopy to confirm that the lucency seen radiographically was not a fracture. I do **not** recommend using guided growth in the setting of a fracture for this condition.*

Figure 4. Three months after application of anterolateral guided growth plate.

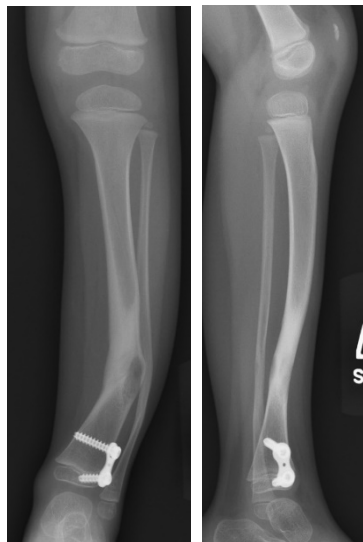


Figure 5 (left). Six months after anterolateral guided growth plate application. Screws are appropriately divergent. Epiphyseal screw approaching the physis. Cyst and angulation improving. **Figure 6 (middle and right).** Nine months after guided growth application. Distal screw encroaching on the physis.

Figure 7. Plate and screws exchanged in new location with longer epiphyseal screw.

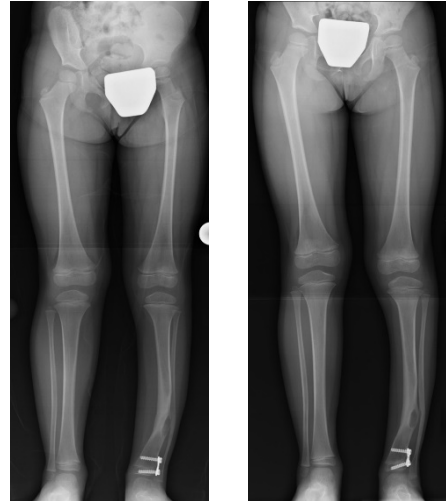
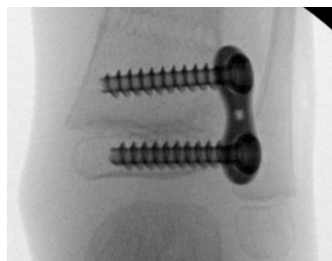


Figure 8 (left). Six months after plate and screw exchange. Cyst continues to move away from physis, diminish in size, and angulation continues to improve. **Figure 9 (right).** One year after plate exchange. Redirection of ankle joint is complete, cyst continues to resolve, and the marrow space is beginning to reform. The epiphyseal screw is noted again to approach physis encroachment.



Figure 10. Four years after initiation of guided growth. Ankle still parallel to floor, cyst resolving further.

JL: Is there an ideal age for intervening with guided growth for this condition? Are there patients who are too young or too old?

MD: Because these patients are at high risk of fracture, waiting can be a gamble. I recommend intervening early. In our subsequent experience, we have performed guided growth in a patient as young as 8 months of age. In young patients—especially those 18 months and younger—it can be useful to use an ankle arthrogram to appreciate the epiphyseal anatomy and confirm that the implant is extraarticular. For young patients, it may be necessary to use solid 2.7 mm screws. With respect to older patients, I continue to recommend this if there is growth remaining.

JL: Any comments on the proximal tibial valgus in these patients?

MD: I start with distal tibial guided growth and counsel patients and families that I will address the proximal tibial valgus at a later date, if needed. To date, I have only had one patient with residual proximal tibial valgus that required treatment.

JL: With this distal tibial guided growth technique, if there is a fibular pseudarthrosis, when do you address it?

MD: While there may be some improvement in fibular dysplasia with this technique for some patients, the fibular pathology often persists. I typically address the fibula once guided growth of the tibia is complete and the tibiotalar alignment is normal.

JL: With this distal tibial guided growth technique, if there is a fibular pseudarthrosis, when do you address it?

MD: While there may be some improvement in fibular dysplasia with this technique for some patients, the fibular pathology often persists. I typically address the fibula once guided growth of the tibia is complete and the tibiotalar alignment is normal.

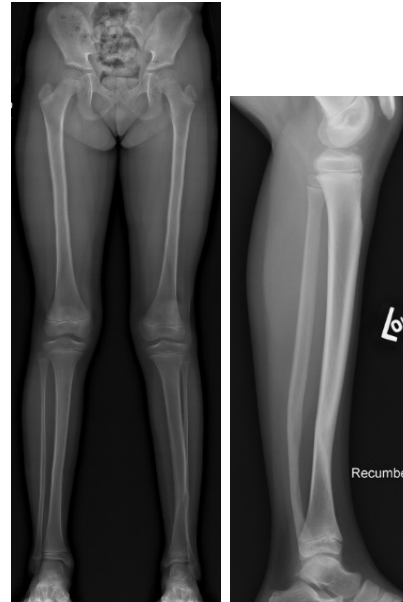


Figure 11. Nine years after initiation of treatment. Recanalization and corticalization progressing. At this point, AFO was discontinued.

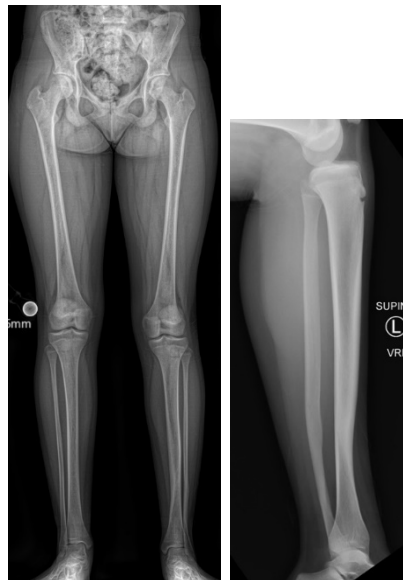


Figure 12. Ten years after initiation of guided growth. The patient is asymptomatic, nearing maturity, and avoids contact sports at surgeon's request. The cyst has resolved, marrow space and bone dimensions continue to approach normal with relative diaphyseal narrowing still present.



Figure 13. Clinical photos of the patient at the same clinic visit. She just turned 13 years old.