Correction of Right Tibial Varum and CavoVarus Deformity Secondary to Traumatic Incident Luis Marin, DPM FACFAS¹ Joseph Watson, DPM ² Rishad Ahmed, DPM ³ Sara Rose, DPM ⁴

Statement of Purpose and Review

Cases of tibial varum and cavovarus deformity secondary to a traumatic incident have been described infrequently in the literature. In our research we could not find a publication of this specific surgical correction for a case of post traumatic tibial varum and cavovarus, however surgical correction of either cavovarus or tibial varum have been often been addressed. This patient had a history of a traumatic event years ago in which a truck ran over both extremities.

Our patient presented with ankle varus and anterior pes cavus with apex of deformity in midtarsal joint (Fig 1 & 2). Due to the severity of the injury, patient remained with chronic deformity and pain. Patient had a similar procedure done to left lower extremity and at this point in time due to chronic pain, deformity and decreased activities of daily living, operative intervention was deemed necessary. This case study presents our approach for a Tibial and Cole osteotomy to realign the tibia and produce a congruous ankle joint and rectus foot, thus creating a function limb.

The Cole osteotomy is used in the surgical management of a cavovarus foot in which a laterally based midfoot wedge osteotomy with the apex is at the naviculocuneiform joint is used to allow for a more plantigrade foot. The procedure was popularized by Cole in 1940 (1) although originally described by Saunders in 1935 (2). Over time it has proven very effective in the correction of a sagittal plane, pes cavus in which the apex of the deformity is located in the midfoot (1-3) These osteotomies have been used in neuromuscular disease, residual clubfoot, and idiopathic cavus, (3) and less of often in a post traumatic deformity.

Tibial wedge osteotomies can correct the varus component of the deformity in either an acute or gradual manner and can also address limb length discrepancies (5-7). External fixation is chosen over internal fixation alone to allow for early weight bearing and allow for correction of rotational and limb length malalignment. It also may used for gradual correction via distraction osteogenesis (5,6).

Young et. al. reported successful outcomes in a valgus producing tibial osteotomies in increasing functionality and decreasing pain in 21 limbs however warn about importance of preoperative discussion with patient and emphasis on compliance (5). Acute correction with an external fixator was chosen with a closing wedge in order to address the limb length discrepancy as well as the frontal plane deformities.



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Case Study - Surgical Procedure



Fig 1: AP view of the right ankle preoperatively.

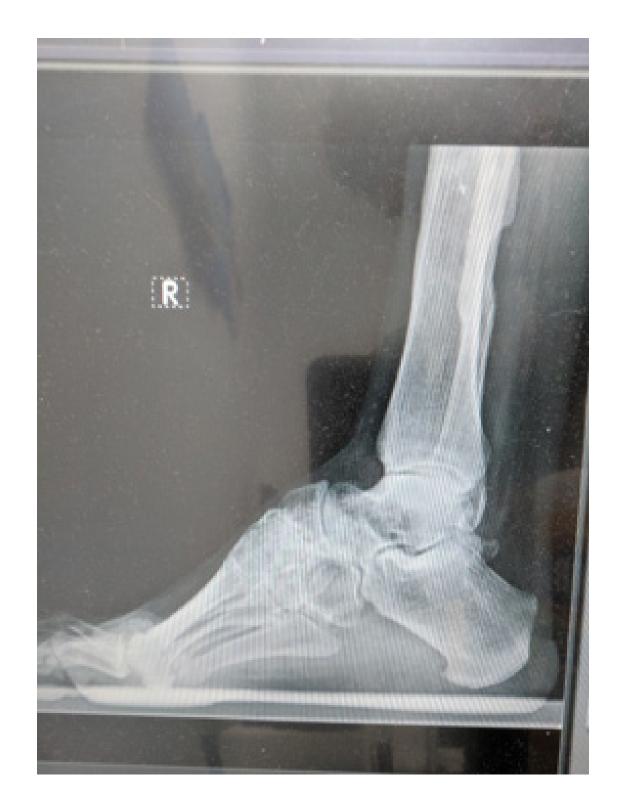


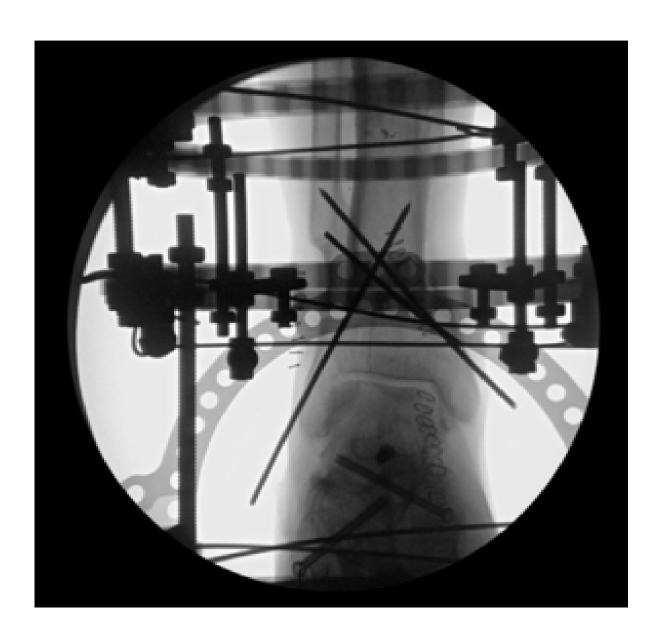
Fig 2: Lateral view of the right ankle preoperatively.

This case presents a 63-year-old male with tibial varum and cavovarus deformity of the right lower extremity secondary to a traumatic injury. The patient sustained an injury when he was younger in which a truck ran over both of his lower extremities. Patient was treated with cast immobilization for several months. After the completion of his treatment patient was noted to have cavus foot deformity bilaterally. Patient has no past medical history of neuromuscular disorder. Patient has full sensation and motor function intact bilaterally. Patient had been living with the chronic deformity and pain for many years and elected for surgical intervention due to his decreased activities of daily living and quality of life.

The patient previously had undergone a similar procedure for the left lower extremity. Patient also had displayed a limb length discrepancy. The patient underwent Cole mid-foot dorsiflexory wedge osteotomy; Right tibia osteotomy with frontal plane correction; and application of external fixator. The patient also underwent arthroplasty and Weil osteotomy of the fifth digit and metatarsal.

The bilateral lower extremities were prepared to allow the left lower extremity to act as a template for the tibial osteotomy and for the tibial length. One incision was made over the dorsal medial aspect extending from the talonavicular joint to the junction of the first and second tarsometatarsal joints. Care was taken to retract the tibialis anterior as well as the extensor hallucis longus tendon. A secondary lateral incision was then made, bisecting the peroneal brevis and the extensor digitorum brevis muscle belly. The extensor digitorum brevis was reflected superiorly in a subperiosteal dissection ensued gaining access to the calcaneocuboid joint as well as the lateral tarsometatarsal joints.

At this point in time, a connection was made subperiosteally and a malleable retractor was placed within the wound. The K-wires were then used to create a template for the Cole wedge osteotomy with the apex of the osteotomy plantarly. The osteotomy was then fixated with 4.5 screws placed medial distal to proximal lateral, followed by a screw distal lateral to proximal medial; and a final screw in a dorsal to plantar fashion angled slightly posteriorly from the dorsal aspect of the remaining navicular.



At this point in time, the cavus deformity was reduced adequately. Attention was then directed to the lateral aspect of the lower extremity where external rotation forces were visualized. In order to osteotomize the tibia, initially an osteotomy of the fibula was needed. Utilizing an oscillating saw, a 1-cm wedge was removed from the fibula. Attention was then directed over to the anterior aspect of the tibia where a 1-cm wedge was measured out a drill was used to create linear fenestrations at the proximal and distal cuts. An osteotome was then used to penetrate the posterior cortex with care being taken not to protrude through the intermuscular septum in order to not violate the posterior neurovascular bundle. The limb was then shortened and the frontal plane rotation was corrected and fixated with steinman pins placed in a medial proximal to lateral distal as well as proximal lateral to medial distal fashion to hold the osteotomy site. External fixation device was then applied to the right lower extremity for static stability. A forefoot wire was placed distal to the Cole sagittal plane osteotomy and archwire technique bringing the wires posteriorly and tensioning to add compression to the midfoot osteotomy. This procedure eliminated varum deformity in the frontal plane and reproduced a congruous and rectus foot and ankle.



Fig 3: AP view of the right ankle postoperatively.



Fig 4: Lateral view of the right ankle postoperatively.

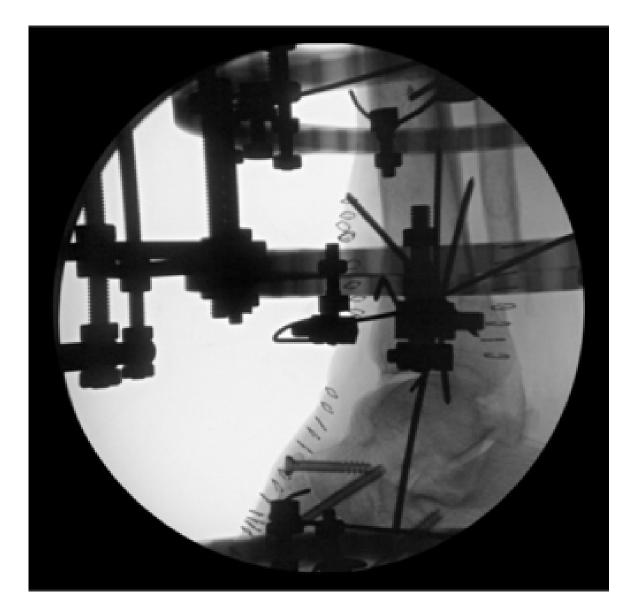


Fig 5: Medial Oblique view of the ankle postoperatively.

Fig 6: AP ankle 1 year follow up Fig 7: MO foot 1 year



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Fig 8: Lateral foot 1 year follow up

Results and Discussion

Correction of tibial varum and cavovarus foot was noted immediately. The patient has returned to regular activity with minimal pain. After a period of being non-nambulatory with an external fixator, the patient was transitioned to being full weight bearing with the external fixator and later into a CAM walker. There has not been a recurrence in deformity or overcorrection at 12 months postoperatively.

This specific deformity, tibial varum combined with cavovarus secondary to trauma, has a minimal amount of literature describing surgical reconstruction. Cavovarus secondary to neuromuscular and other disorders have been well described and surgical correction include rearfoot arthrodesis, calcaneal sliding osteotomies, metatarsal osteotomies as well as midfoot osteotomies. Most commonly these involve the use of internal fixation which involve extended periods of non weight bearing. External fixation has been widely used in correction of tibial varum. The combination of internal and external fixation procedures allowed for early weight bearing as well as a stable fixation with a large correction in this combined deformity in comparison with a cast, brace, or fracture walker (9).

We opted for a midfoot osteotomy for realignment of the foot due to the deformity being non progressive and concentrated on the lesser tarsus. Also, the osteotomy preserves midtarsal and subtalar joints, which would undergo further deformation in a patient with dynamic or progressive cavus foot (10).

Ankle varus or valgus is know to accelerate arthritis. Distal tibial deformity correction alone can contribute satisfactory results in an arthritic ankle. Therefore a correction of ankle varus can prevent progression of arthritis and present a more congruous ankle (Fig 3).

This case study details our tibial and Cole osteotomy for the treatment of tibial varum and cavovarus foot. Our surgical principles and techniques for this case are presented. The goal of our procedure was to realign the tibia in the frontal plane, create a rectus foot, decrease pain and improve function of the foot and ankle.

References

- 1. Cole W. The treatment of clawfoot. J Bone Joint Surg 22A:895, 1940
- 2. Saunders JT. Etiology and treatment of clawfoot. Arch Surg 30:2, 1935
- 3. Tullis B, Mendicino R, Catanzariti A, Henne T, The cole midfoot osteotomy: a retrospective review of 11 procedures in 8 patients, In The Journal of Foot and Ankle Surgery, Volume 43, Issue 3, 2004, Pages 160-165, ISSN 1067-2516, https://doi.org/10.1053/j.jfas.2004.03.009.
- 4. Lee W, Ahn J, Cho J, Park C. Realignment Surgery for Severe Talar Tilt Secondary to Paralytic Cavovarus. Foot & Ankle International [serial online]. November 2013;34(11):1552-1559. Available from: SPORTDiscus, Ipswich, MA. Accessed December 14, 2017.
- 5. Gilbody J, Thomas G, Ho K (2009) Acute versus gradual correction of idiopathic tibia vara in children: a systematic review. J Pediatr Orthop 29(2):110–114
- 6. Bachhal V, Sankhala SS, Jindal N, Dhillon MS (2011) High tibial osteotomy with a dynamic axial fixator: precision in achieving alignment. J Bone Jt Surg Br 93(7):897–903
- 7. Park Y, Song S, Kwon H, Refai M, Park K, Song H. Gradual correction of idiopathic genu varum deformity using the Ilizarov technique. Knee Surgery, Sports Traumatology, Arthroscopy: Official Journal Of The ESSKA [serial online]. July 2013;21(7):1523-1529. Available from: MEDLINE, Ipswich, MA. Accessed December 14, 2017.
- 8. Aminian, A; Sangeorzan, BJ: The anatomy of cavus foot deformity. Foot and ankle Clin. 13(2): 191-8, 2008. http://dx.2008.01.004 Coughlin mann. Pes cavus chapter. 9. Anderson R, Saltzman C, Coughlin M. Mann's Surgery Of The Foot And Ankle : Expert Consult - Online [e-book]. Philadelphia, PA: Mosby; 2014. 10. Downey MS. Cole Osteotomy. The Podiatry institute . 1993;37:204-208.