A Suggested Beaming Construct to Reduce Forefoot Abduction in Charcot Neuroarthropathy of the Midfoot

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INTRODUCTION

- In this case series, we examine the use of a novel beaming construct to reduce abduction deformity in Charcot neuroarthropathy (CN) of the midfoot. We hypothesize that beaming only the 2nd ray to the talus will provide reproducible stable fixation and reduction of pertinent radiographic parameters maintained at long term follow-up.

LITERATURE REVIEW

- The deformity and neuropathy caused by CN predisposes the limb to instability and ulceration. Patients with diabetic CN with wounds have been found to have a 12 times higher risk of major amputation (1).
- Multiple radiographic parameters and their influence on wound formation have been studied, including AP and lateral talar-1st met (Meary's angle), cuboid height, and calcaneal inclination angle (2, 3, 4).
- The use of beaming in midfoot Charcot reconstruction has been shown to improve clinical and radiographic parameters, although complications such as infection and non-union have been reported (5, 6).
- The literature is lacking regarding techniques for reconstructing abduction deformity in midfoot CN. We provide a novel technique that avoids overcorrection while addressing important radiographic parameters and provides long term stability.

METHODS

- 3 patients with consolidated Charcot neuroarthropathy of the tarsometatarsal joint resulting in midfoot abduction were included in this case series **(Figure 1)**.
- All patients had type 2 diabetes mellitus complicated by peripheral neuropathy. 1 patient had a medial midfoot wound with contiguous osteomyelitis, 2 patients were without ulceration.
- Radiographic measures were taken pre-operatively and at final follow-up post-operatively.
- Outcomes evaluated include change in radiographic measures, hardware failure, as well as ulceration and ambulatory status at minimum 1 year follow-up.

SURGICAL TECHNIQUE

- Infection is addressed prior to reconstruction of deformity.
- Achilles tendon lengthening or tenectomy is performed percutaneously.
- An incision is made vertically over the medial prominence of the midfoot. Steinman pins are inserted perpendicular to the long axis of the 1st metatarsal and talus to guide osteotomy with sagittal saw. A medially based wedge is removed from the midfoot at the estimated apex of deformity, with translation performed as necessary **(Figure 2A).**
- Appropriate placement of guide pins is confirmed with fluoroscopy. Drills can be left in place to maintain reduction **(Figure 2B).**
- Utilizing cannulated 7.0mm cortical screws, the 1st ray is beamed from the 1st metatarsophalangeal joint to the navicular tuberosity. The 2nd ray is beamed past the talonavicular joint. The calcaneocuboid joint (CCJ) is fused **(Figure 3)**.
- The subtalar joint (STJ) is prepared through a lateral approach and fused with 1 6.5mm partially threaded screw **(Figure 3)**.
- An external fixator with extra-articular pin to stabilize the ankle joint may be applied as necessary to augment fixation and allow for weight-bearing.

RESULTS

- 1 patient osteomyelitis was treated with a 2-stage approach utilizing antibiotic-loaded calcium sulfate cement prior to reconstruction and primary closure of wound. 2 patients were treated with supplemental external fixation for 3 months to augment fixation and allow for weightbearing.
- At final follow-up (average 1 year 3 months) thus far:
  - None had surgical site infection
  - None experienced hardware breakage or loosening
  - None developed ipsilateral ulceration
  - None developed ipsilateral ankle Charcot neuroarthropathy
  - None underwent major amputation
- At final follow-up (average 1 year 3 months) thus far:
  - AP Meary's improved +16 degrees
  - Lateral Meary's improved +15 degrees
  - AP calc-5th met angle improved +8 degrees
  - Calcaneal inclination angle improved +4.3 degrees
  - Cuboid height remained negative in all patients

CASE STUDY

FIGURE 1

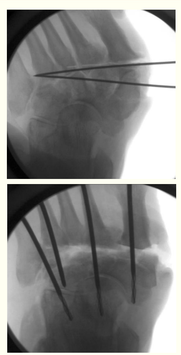

FIGURE 2

FIGURE 3

DISCUSSION

- The literature has shown the benefit of beaming the 1st ray to the talus in midfoot CN (5, 6, 7).
- In our 3 patient case series, the method of realigning the foot with only a 2nd ray beam to the talus along with 1st ray beam to the navicular, CC joint fusion, and STJ fusion showed positive clinical results, including no reulceration, development of ankle CN, or hardware failure.
- Pertinent radiographic parameters showed improvement with this construct that were maintained at minimum 1 year follow-up.
- Furthermore, the construct provided benefit in the setting of staged reconstruction for osteomyelitis, as well as when augmented with external fixation **(Figure 4)**.

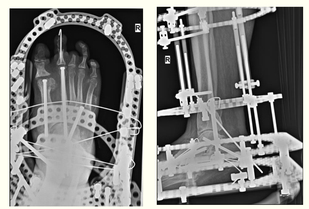

FIGURE 4

- Our case series exemplifies a novel construct that addresses abduction deformity in midfoot CN. Despite the small sample size, the results indicate that this method could achieve adequate correction while minimizing risk of overcorrection. A larger prospective study should be undertaken to verify these findings with long-term follow-up.

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