

# Medial Longitudinal Arch Arthrodesis with a Plantarly Applied Plate for Midfoot Charcot Neuropathic Osteoarthropathy: A Retrospective Analysis



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## Abstract

We retrospectively reviewed 9 patients who underwent plantar plating of the medial column for reconstruction of Charcot neuroarthropathy of the midfoot with average follow-up of 25.2 ± 13.9 months. Meary's angle, calcaneal inclination, and Kite's angles were evaluated and clinical outcomes were assessed with the ACFAS rearfoot scale. The average correction of Meary's angle, calcaneal inclination angle, and Kite's angle were 35.1 ± 20.6 degrees ( $P = <.001$ ), 4.4 ± 9.3 degrees ( $P = .006$ ), and 4.0 ± 4.9 degrees ( $P = .01$ ) respectively. The average postoperative ACFAS score was 75.4 ± 19.3. Eight out of 9 (88.9%) feet went on to achieve fusion of the entire medial column at an average of 9.2 ± 0.7 weeks. At final follow-up, all patients were ambulating in diabetic shoes, no ulcers had recurred, and no patients required bracing for ambulation.

## Introduction

Neglected Charcot neuroarthropathy of the midfoot often leaves patients with deformities that lead to chronic ulcerations, leaving patients with significant ongoing morbidity. Definitively treating Charcot neuroarthropathy of the midfoot helps reduce overall morbidity and provide a more stable, usable limb for patients.

The purpose of this retrospective cohort study was to evaluate our mid-term results with plantar plating of the medial column for midfoot Charcot reconstruction. We

hypothesized that plantar plating would provide restoration of the radiographic measurements with good clinical outcomes allowing patients to ambulate without the need for bracing or other assistive devices.

## Methods

A retrospective review was performed of nine consecutive patients who underwent medial column arthrodesis with a plantarly applied plate for the correction of midfoot Charcot neuroarthropathy. All patients had initially failed conservative care including total contact casting and CROW boots were included.

Nine patients (9 feet) were recruited from the senior author's clinic (K.P.M.) between September 2006 and July 2010. The average age of the patients was 68.3 ± 10.6 (range 49 – 81) years. All surgeries were performed by the senior author (K.P.M.) on 6 (66.7%) females and 3 (33.3%) males. Patients were followed for 25.2 ± 13.9 months. Postoperative ACFAS Rearfoot scoring scales were used for postoperative evaluation.

Other outcome measures included digitally measured radiographic angles (Meary's, calcaneal inclination and Kite's angle) by a single reviewer (M.D.H.) and union rate. Paired student's t-tests were used to compare values with a normal distribution.

## Operative Technique

A Hoke tendoachilles lengthening was performed first in all cases. Next, the medial column was prepped and reduced into alignment by taking a wedge out of the joint in order to recreate the medial longitudinal arch. Remaining plantar prominences were planed when necessary. Bone marrow aspirate from the calcaneus and demineralized bone matrix was added to arthrodesis sites. A plate was then applied plantarly from the talar neck to the diaphysis of the 1<sup>st</sup> metatarsal. All patients were stabilized with the static circular ring external fixation for 6.9 ± 1.5 weeks. They began weightbearing in a walking boot when consolidation at the arthrodesis site was appreciated radiographically and transitioned back into diabetic shoes as tolerated (Figure 1-3).

Table 1. Comparison of preoperative and postoperative radiographic angles after medial column arthrodesis with a plantar plate for midfoot Charcot reconstruction (n = 9 feet in 9 patients)

Radiographic angle (degrees)	Preoperative (degrees) *	Postoperative (degrees) *	Difference	P value
Meary's angle	30.4 ± 18.5 (9 to 60)	-4.7 ± 5.3 (-10 to 3)	35.1 ± 20.6	<0.001
Calcaneal inclination angle	9.2 ± 7.6 (2 to 21)	13.7 ± 10.2 (-11 to 25)	4.4 ± 9.3	0.006
Kite's angle	17.0 ± 5.0 (9 to 21)	21.0 ± 4.4 (15 to 28)	4.0 ± 4.9	0.01

\* Results for the preoperative and postoperative measurements shown as mean ± standard deviation (minimum to maximum range).



Figure 1. Representative preoperative radiographs of a patient with Eichenholtz Stage 3 midfoot Charcot neuropathic osteoarthropathy. The navicular and cuneiforms have consolidated to become one continuous bone. Note the chronic stress fracture at the second metatarsal from the first ray insufficiency due to the talonavicular joint subluxation.



Figure 3. Patient in Figure 1, 9 weeks status post midfoot Charcot reconstruction with plantar plate showing arthrodesis across the metatarsocuneiform, naviculocuneiform, and talonavicular joints.

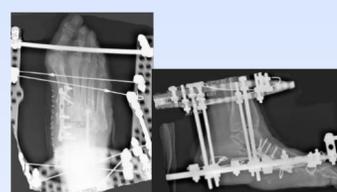


Figure 5. Postoperative radiographs of the patient in Figure 4, showing excellent realignment of the medial longitudinal arch with the plantar plate. Also note the lateral column beaming.



Figure 2. Initial postoperative radiographs of the patient in Figure 1 showing plantar plate placement for the medial column arthrodesis as well as static circular frame placement.



Figure 4. Preoperative radiographs of a patient who required both medial column arthrodesis with a plantar plate as well as lateral column beaming after appropriate wedges were removed from the joints to recreate the medial longitudinal arch.



Figure 6. Radiographs showing the radiolucency and nonunion of the talonavicular joint 9 months after the initial reconstruction.



Figure 7. Radiographs of the patient in Figure 6, after subsequent nonunion repair and application of the dorsomedial column plate to prevent any compression of the dorsal talonavicular arthrodesis site.

## Results

Two (22.2%) patients had concomitant lateral column beaming due to a plantarly subluxed cuboid (Figure 4-5). Eight of 9 (88.9%) feet went on to fusion of the entire medial column at an average of 9.2 ± 0.7 weeks. One patient had an asymptomatic nonunion of the TN (Figure 6). She ultimately underwent a revision arthrodesis that achieved fusion by 9 weeks post-op (Figure 7).

The average correction of Meary's angle, calcaneal inclination angle, and Kite's angle was 35.1 ± 20.6 degrees ( $P = <.001$ ), 4.4 ± 9.3 degrees ( $P = .006$ ), and 4.0 ± 4.9 degrees respectively ( $P = .01$ ) (Table 1). Two patients (22.2%) developed superficial pin tract infections that necessitated pin removal. One patient (11.1%) had 2 broken screws and 1 patient (11.1%) broke a pin on the external fixator.

The average post-op ACFAS score was 75.4 ± 19.3. All of the respondents patients were able to ambulate in diabetic shoes without need for assistive devices. No patients had a recurrence of the plantar ulceration or midfoot instability.

## Discussion

In 1998, plantar plating was first introduced for fixation of the medial column due to the fact that the plate was placed on the tension side of the midfoot (1). The plantar plate showed

both less initial displacement and the ability to maintain significantly higher loads compared with screw fixation.

Reported fusion rates for midfoot Charcot reconstruction using axially placed screws range from 73% to 83% (2-3). Our rate of 88.9% arthrodesis compares favorably to the literature. Our results are promising for the surgical repair of midfoot Charcot neuroarthropathy with a medial column arthrodesis utilizing a plantarly applied plate. No patient had a recurrence of plantar ulceration or midfoot instability at final follow up (25.2 ± 13.9 months). All patients were able to ambulate with diabetic extra depth shoe gear and without other assistive devices and had a stable, plantigrade foot.

## Conclusion

In conclusion, our study supports the use of plantar plating of the medial longitudinal arch for reconstruction of midfoot Charcot neuropathic osteoarthropathy. It has reliable mid-term results and has led to a stable, plantigrade, ulcer-free foot that does not require a brace for ambulation.

## References

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