Fourth and Fifth Metatarsal to Cuboid Arthrodesis
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Statement of Purpose
This study was undertaken to evaluate the effectiveness of 4th and 5th metatarsal to cuboid arthrodesis. Radiographic, union, lateral column angles, pain level, patient satisfaction, and complication rate were described with a minimum of forty-month follow-up from the time of surgery.

Methods and Procedures
A retrospective case review was performed of all patients who underwent arthrodesis of the fourth and fifth metatarsal to the cuboid for complex patients over the period of August 2000 to December 2011. All surgeries were performed by the senior author (RD). Arthrodesis was accomplished via titanium plate and screw fixation for 33 of 37 patients.External fixation was used to supplement the arthrodesis site in remaining 4 of 37 patients. Fifteen of the patients treated with plate and screw fixation were also treated with external fixation as part of their overall reconstructive fixation construct. Four patients in this series underwent isolated fixation of the 4th and 5th metatarsal cuboid joints. The remaining patients underwent fusion of the other tarsometatarsal joints during the same procedure.

Radiographic analysis was performed of preoperative and postoperative radiographs. Postoperative radiographs were taken at the final office visit for each patient with mean follow-up of thirty-four (34) months (SD 38). Radiographic union was confirmed with osseous bridging across the arthrodesis site with no hardware failure. Lateral calcaneal to 5th metatarsal angle was measured using the bisector of the anterior process of the calcaneus and the bisector of the fifth metatarsal longitudinally. AP calcaneal to 5th metatarsal angle was measured using the lateral cortex of the calcaneus and the lateral cortex of the 5th metatarsal. All patients were contacted by mail to fill out a brief survey in March 2012. The survey included questions regarding the time of surgery. Each patient was contacted by phone and 4 patients preferred to give their responses over the phone. Demographics, patient history, and any complications directly related to the surgery. Twenty-eight (28) total responses were obtained of the survey performed thirty-three (33) in the cuboid cohort and fifteen (15) in the 5th metatarsal cohort.

All statistics were performed using Microsoft Excel 2010. Inferential statistics were performed comparing preoperative and postoperative radiographic measures and pain VAS scores using a paired, two-tailed Student’s t test. Radiographic analysis was performed of all patients. Thirty-seven patients eventually went on to osseous union, and 5 patients achieved arthrodesis after union revision was performed. AP and lateral calcaneal to 5th metatarsal angles were measured preoperatively and postoperatively. There was a statistically significant decrease in the AP angle as well as the lateral angle for both cohorts of patients. For the Charcot group the average AP angle decreased from 15.06 (SD 12.70) to 9.26 (SD 3.98) p = 0.05. The lateral angle increased from 15.66 (SD 10.00) to 17.39 (SD 9.86) p = 0.04.

LITERATURE REVIEW
Joint arthrodesis is a well described, consistent, and effective way to decrease foot deformity and pain from degenerative joint disease. Indications for medical and central tarsometatarsal joint arthrodesis include deformity secondary to Charcot neuropathy induced "roll-over deformity" and pain associated with degenerative joint disease.

Descriptions and outcomes of fourth and fifth metatarsal arthrodesis to the cuboid are sparse in the current literature. Park in 2002 described an isolated arthrodesis for post-traumatic Charcot deformity and for pain relief from lateral column deformity correction and for pain relief from lateral column instability. The fourth nonunion occurred in a patient from the Charcot cohort. The remaining patients overall achieved pain relief, general satisfaction and a willingness to recommend the procedure to another with similar indications or have the contralateral procedure performed. The non-union rate in this series of cases of 10.8% is comparable that previously described by Raiken et al. indicating loss of motion will change the overall biomechanics of foot function in stance and gait. One of the primary goals of this study was to determine the postoperative patient satisfaction and impact on daily life that results from this procedure. High satisfaction was found in both the Charcot and osseous cohorts. These patients related overall decrease in pain, general satisfaction and a willingness to recommend the procedure to another with similar indications or have the contralateral procedure performed.

DISCUSSION
Ossuary in 1989 examined the motion of the mid-foot and determined that the majority of motion of this joint complex occurs through the lateral column. Arthrodesis of these joints and the resulting loss of motion will change the overall biomechanics of foot function in stance and gait. One of the primary goals of this study was to determine the postoperative patient satisfaction and impact on daily life that results from this procedure. High satisfaction was found in both the Charcot and osseous cohorts. These patients related overall decrease in pain, general satisfaction and a willingness to recommend the procedure to another with similar indications or have the contralateral procedure performed.

Joint arthrodesis provides reduction of pain with a low complication rate and high patient satisfaction. Arthrodesis of these joints should be considered for the patient with Charcot deformity of the lateral midfoot or pain from arthritis.

Patient Satisfaction was also surveyed with three additional survey questions:
- Was your ability to walk and perform daily activities important to your life?
- Did you have surgery performed on the other foot if you developed similar pain or deformity?

limitations of this study include the limited sample size in this group. Future studies should be undertaken with a larger sample size and diversity of surgeons to provide additional generalizability of the data. Prospective comparison of arthroplasty of the lateral midfoot to arthrodesis of these joints would also be beneficial. A validated foot function outcome measure was not utilized in this study; future studies should include the use of such a tool both preoperatively and postoperatively. Specifically, future studies may compare arthrodesis of the fourth and fifth metatarsal without other tarsometatarsal fusion procedures.

This case series provides compelling data that 4th and 5th metatarsal to cuboid arthrodesis provides reduction of pain with a low complication rate and high patient satisfaction. Arthrodesis of these joints should be considered for the patient with Charcot deformity of the lateral midfoot or pain from arthritis.

References