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Early Weightbearing After Arthrodesis of the First Metatarsal-Medial Cuneiform Joint: A Systematic Review of the Incidence of Nonunion

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ABSTRACT

Arthrodesis of the first metatarsal-medial cuneiform articulation is a reliable and effective surgery for correction of hallux abducto valgus deformity. However, one potential relative contraindication to the procedure is the extended period of non-weightbearing immobilization that is typically associated with the postoperative course. The objective of this investigation was to perform a systematic review of the incidence of nonunion after early weightbearing in patients who underwent arthrodesis of the first metatarsal-medial cuneiform articulation for correction of a hallux abducto valgus deformity. We performed a review of electronic databases with the inclusion criteria of retrospective case series, retrospective clinical cohort analyses, and prospective clinical trials with 15 or more participants; a mean follow-up period ≥12 months; a postoperative early weightbearing protocol (defined as ≤2 weeks); a clear description of the fixation construct; and a reported incidence rate of nonunion. Eight studies met our inclusion criteria, with a total of 443 arthrodeses analyzed. Of these, 16 (3.61%) were described as developing a nonunion. This would likely be considered an acceptable rate of nonunion when considering this procedure and might indicate that the Lapidus procedure does not always require an extended period of postoperative non-weightbearing immobilization.

Arthrodesis of the first metatarsal-medial cuneiform articulation (i.e., the Lapidus procedure) is a reliable and effective surgery for correction of hallux abducto valgus deformity (1). However, one potential relative contraindication to the procedure is the extended period of non-weightbearing immobilization that is typically associated with the postoperative course. Because consolidation of the arthrodesis site is required for successful outcome, a 6- to 8-week period of non-weightbearing cast immobilization is often prescribed (2–4). Not all patients are able to tolerate this recommendation, in addition to the potential complications associated with prolonged immobilization, such as muscular atrophy and thrombotic events (5,6). Secondary to these considerations, several authors have recently proposed early or immediate weightbearing with the procedure (7–16). Their studies have typically been Level 4 retrospective case series with varying fixation constructs and numbers of patients.

The objective of this investigation was to perform a systematic review of the incidence of nonunion after early weightbearing in patients who underwent arthrodesis of the first metatarsal-medial cuneiform articulation for correction of a hallux abducto valgus deformity.

Materials and Methods

We performed a systematic review of the medical literature using PubMed and Ovid through Medline (available at http://www.ncbi.nlm.nih.gov/pubmed and http://ovidsp.ovid.com/autologin.cgi), Embase (available at https://www.embase.com/login), and the Cochrane Database of Systematic Reviews (available at http://www.cochranelibrary.com/cochrane-database-of-systematic-reviews). Additionally, we performed a manual search of the references of any article we identified as meeting our inclusion criteria. The search was performed in July 2016 with no restriction on publication date with the word query: ("arthrodesis" OR "fusion") AND ("first metatarsal-cuneiform" OR "first metatarsal-medial cuneiform" OR "Lapidus" OR "tarsometatarsal" OR "tarsal-metatarsal" OR "hallux valgus" OR "hallux abducto valgus" OR "HAV"). The abstracts returned from these searches were initially individually reviewed by a single author (A.J.M.) for potential relevance. Each potentially relevant report was then reviewed by all study authors (A.C., J.C.V., and A.J.M.) for our specific inclusion/exclusion criteria. Complete agreement was required for final inclusion.

Inclusion criteria consisted of retrospective case series, retrospective clinical cohort analyses, and prospective clinical trials with 15 or more participants; a follow-up period of ≥12 months; a defined postoperative early weightbearing protocol (defined as ≤2 weeks); a clear description of the fixation construct; and a reported incidence rate of nonunion. Only full-text reports were considered, and studies not published in the English language were excluded.

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Results

The searches for potentially relevant articles yielded 47 unique studies. We then obtained and reviewed each of these for our specific inclusion/exclusion criteria, which resulted in the final inclusion of 8 (17.02%) published reports (17–24). Six (75.0%) of the included studies were retrospective cohort analyses (17,19–22,24) (Table), 1 (12.5%) was a prospective comparative cohort analysis (23), and 1 (12.5%) was a prospective randomized clinical trial (18). In total, these 8 studies included analysis of 443 arthrodeses; of these, 16 (3.61%; 16/443) were described as developing a nonunion.

Four (50.0%) of these studies (n = 254 [57.34%] arthrodeses) involved fixation with at least 2 compression screws (17-19,22); 3 (37.5%) of these studies (n = 164 [37.02%] arthrodeses) involved fixation with some form of plate construct with or without a compression screw (20,21,23); and 1 (12.5%) study (n = 25 [5.64%] arthrodeses) involved use of an external fixator device with or without an internal compression screw (24). Four (50.0%) studies (n = 143 [32.38%] arthrodeses) allowed immediate weightbearing in a wedged surgical shoe, short cast boot, or cast (17,19,21,23), whereas the remaining studies (n = 300 [67.72%] arthrodeses) allowed for weightbearing within 2 weeks with a cast or cast boot (18,20,22,24).

Discussion

The objective of this systematic review was to evaluate the incidence of nonunion in patients who underwent arthrodesis of the first metatarsal-medial cuneiform articulation with implementation of an early weightbearing protocol. We observed an incidence of nonunion of 3.61% (16/443) and conclude that this is an acceptable incidence of nonunion when considering this procedure. This indicates that arthrodesis of the first metatarsal-medial cuneiform articulation likely does not always require an extended period of postoperative non-weightbearing immobilization.

As with any scientific investigation, critical readers are encouraged to review and assess the study design and specific results to reach their own independent conclusions. However, the preceding represents our conclusions based on the data. We also recognize the fact that all investigations have limitations, and this one had several to consider that are inherent to systematic reviews. First, we did not use every available electronic database for our search—only those that we find most useful in our clinical practices. Additionally, this type of search process, particularly the initial abstract screening for potentially relevant articles, is prone to human error and subjectivity. Because of this, it is possible that there are other investigations that meet our inclusion criteria that were not included in this report.

Second, we excluded articles based on our inclusion/exclusion criteria, which could be considered limited or restrictive. Another group of authors undertaking a similar investigation with another group of less strict inclusion/exclusion criteria would likely report a different incidence of nonunion. For example, we chose to define early weightbearing as ≤14 days, whereas other studies have defined early weightbearing as several weeks (11,13,15). However, our inclusion/exclusion criteria could also be considered too lenient. For example, we did not include any restrictions with respect to fixation constructs. Our investigation also did not include any reporting of functional outcome measures and instead relied solely on incidence of nonunion.

Moreover, our aim was to simply describe the observed incidence of nonunion in patients who underwent arthrodesis of the first metatarsal-phalangeal joint, and we did not undertake tests of heterogeneity to determine if the data were suitable for pooling. As such, we did not undertake a quantitative meta-analysis of the published reports that met our inclusion criteria.

Finally, this type of investigation is reliant on the details and descriptions provided by other authors. It is most conservative to exclude reports or results that do not provide appropriate detail. Most relevant to this investigation is the varying and sometimes vague definitions used by authors for the diagnosis of nonunion. This is also a study of complications. Therefore it is reliant on authors accurately and truthfully reporting their complications. Additionally, it is possible that accurate reporting of surgical complications is underreported in the medical literature if authors choose to focus primarily on successful surgical outcomes.

In conclusion, we observed an incidence of nonunion after arthrodesis of the first metatarsal-medial cuneiform articulation with an early weightbearing protocol of 3.16%. We expect that this investigation will add to the body of knowledge with respect to arthrodesis of the first metatarsal-cuneiform articulation, lead to further investigations on the topic, provide foot and ankle surgeons with an objective measure of the perioperative risk associated with the procedure, and enable foot and ankle surgeons to more effectively communicate these risks to their patients during the education and consent process (Table).

Table
Summary of included articles and results

Authors, Year	Study Design	Number of Arthrodeses	Fixation Construct	Postoperative Weightbearing Protocol	Reported Incidence of Nonunion
Sangeorzan et al, 1989 (17)		N = 40 (9.03%)	Two crossing screws	Immediate toe-touch weightbearing in a cast	4/40 (10.0%)
Faber et al, 2004 (18)		N = 51 (11.51%)	Two screws	Full weightbearing in a cast at 14 postoperative days	5/51 (9.80%)
Kazzaz et al, 2009 (19)		N = 27 (6.09%)	Two crossing screws	Immediate weightbearing in wedged surgical shoe	0/27 (0.0%)
Cottom et al, 2013 (20)		N = 88 (19.86%)	Compression screw with a plate	Full weightbearing in a cast boot at 7-10 postoperative days	2/88 (2.27%)
Klos et al, 2013 (21)		N = 59 (13.32%)	Compression screw with a plate	Immediate weightbearing in a cast boot	1/59 (1.69%)
King et al, 2015 (22)		N = 136 (30.70%)	Two crossing screws	Mean partial weightbearing in a cast boot initiated at 12.2 postoperative days	3/136 (2.21%)
Gutteck et al, 2015 (23)		N = 17 (3.84%)	Anatomic plate	Immediate weightbearing in a cast boot	0/17 (0.0%)
Paulick et al, 2015		N = 25 (5.64%)	Mini-rail external fixation with or without a compression screw	Full weightbearing in a cast boot at 14 postoperative days	1/25 (4.0%)
Total		N = 443			16/443 (3.61%)

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