



Comparison of Complications for Internal and External Fixation for Charcot Reconstruction: A Systematic Review



Paul Dayton, DPM, MS, FACFAS¹, Mindi Feilmeier, DPM, FACFAS², Mitchell Thompson, BA³, Paul Whitehouse, BS³, Rachel A. Reimer, PhD⁴

¹ Physician, UnityPoint Clinic Foot and Ankle, Fort Dodge, IA; Assistant Professor, Des Moines University College of Podiatric Medicine and Surgery, Des Moines, IA

² Assistant Professor, Des Moines University College of Podiatric Medicine and Surgery, Des Moines, IA

³ Podiatric Medical Student, Des Moines University, Des Moines, IA

⁴ Chairperson and Program Director, Master of Public Health Program, and Associate Professor, Des Moines University College of Health Sciences, Des Moines, IA

ARTICLE INFO

Level of Clinical Evidence: 4

Keywords:

amputation
deformity
diabetes
limb salvage
neuropathy
surgery

ABSTRACT

The surgical reconstruction of Charcot deformity can be a challenge for foot and ankle surgeons. Consensus is lacking among surgeons regarding the best method of surgical fixation to be used in reconstruction, and clear strong evidence is also lacking in published studies. We undertook a systematic review of electronic databases and other relevant sources in an attempt to better understand the complications and outcomes associated with internal and external fixation for Charcot foot and ankle reconstruction. A total of 23 level 4 studies with 616 procedures were identified. Of these, 12 studies with 275 procedures used internal fixation, and 11 studies with 341 procedures used external fixation. The odds of a successful outcome with internal fixation was 6.86. The odds of a successful outcome with external fixation was 13.20 (odds ratio 0.52, 95% confidence interval 0.30 to 0.90). The odds of success for internal fixation was 0.52 times as likely as the odds of success with external fixation. Because the odds ratio did not include 1, this difference was statistically significant at the $p < .05$ level. An identified trend was that external fixation was used more often in cases deemed to be difficult by the surgeon preoperatively. These findings could prove helpful to foot and ankle surgeons when making decisions regarding fixation for Charcot reconstruction.

© 2015 by the American College of Foot and Ankle Surgeons. All rights reserved.

Charcot foot deformity is a challenging condition most commonly seen in diabetic patients with lower extremity sensory neuropathy. Difficulty results from both the loss of stability and bone and joint destruction (1). Surgeons must consider the onset and severity of the deformity, with the goals of restoring stability and plantigrade positioning of the foot for normal ambulation (2). Surgical stabilization is often necessary when severe deformity has developed or when conservative measures have failed.

The options for stabilization of Charcot foot and ankle deformity after correction include internal fixation and external fixation. Controversy exists in the foot and ankle surgery community regarding which of these techniques is most efficacious and most appropriate. Although the scientific evidence is sparse and opinions vary among physicians regarding the choice of internal versus

external fixation, our clinical experience has revealed some general trends. First, internal fixation techniques have the advantage of patient and surgeon acceptance, because they use fixation techniques we are comfortable with in everyday practice for a variety of conditions. Furthermore, internal techniques are preferred by some because they are perceived as being more straightforward and might not require multiple or staged procedures. However, some surgeons prefer external techniques because they provide a wider range of stability and adjustability and can provide a platform for soft tissue preservation through minimally invasive surgical techniques. External fixation can also provide a platform for progressive correction in complicated and severe deformities, which is not possible with internal techniques. Some surgeons combine these techniques to capitalize on the strengths of both.

To better understand the outcomes for each technique we undertook a systematic review of the published data regarding internal and external fixation for Charcot reconstruction. It is useful to understand these outcomes from both techniques to provide the safest and most efficacious methods for reconstruction in our patients.

Financial Disclosure: None reported.

Conflict of Interest: None reported.

Address correspondence to: Paul Dayton, DPM, MS, FACFAS, UnityPoint Clinic Foot and Ankle, Des Moines University College of Podiatric Medicine and Surgery, 804 Kenyon Road, Suite 310, Fort Dodge, IA 50501.

E-mail address: daytonp@me.com (P. Dayton).

Materials and Methods

We undertook a systematic review of electronic databases, including PubMed (available at <http://www.ncbi.nlm.nih.gov/pubmed>), OvidSP (available at <http://ovidsp.ovid.com/>), Google Scholar (available at <http://scholar.google.com>), and the websites for the Journal of Foot and Ankle Surgery (available at <http://www.jfas.org/>) and Foot and Ankle International (available at <http://www.aofas.org>). An inclusive search using “internal fixation,” “internal reconstruction,” “external fixation,” and “external reconstruction,” with the Boolean operators “AND” and “OR” to include “Charcot” and “diabetic deformity,” was performed. A manual bibliographic search of the chosen reports was also completed to identify any additional pertinent references. The inclusion criteria were as follows: reports published in English or translated into English in peer-reviewed medical journals between 1960 and 2014, human clinical studies with patients >18 years old, a study population of ≥10 procedures per fixation method, defined outcomes and data with complication rates reported, a mean follow-up period of ≥12 months, and a specific description of the fixation methods used.

The initial abstract review was completed by all of us (P.D., M.F., M.T., P.W.), with agreement by all required for final inclusion. The lead author (P.D.) acted as the moderator. The selected studies were reviewed in detail by 2 senior authors (P.D., M.F.), and final inclusion according to the criteria was agreed on. After review of the included reports, the following data were extracted: number of procedures in each report; mean patient age, number of male and female patients, anatomic site (foot or ankle, or both), fixation type, number of successful procedures (union, stable nonunion, successful return to ambulation), number of unsuccessful procedures (recurrence, infection causing abandonment of reconstructive procedure, unsuccessful revision, amputation), and amputation rate reported as a separate outcome measure. The reports were graded using the American College of Foot and Ankle Surgeons levels of clinical evidence guidelines as referenced in the Journal of Foot and Ankle Surgery Guide for Authors. Those reports determined to be a level 1, 2, 3, or 4 were included. Level 5 clinical evidence reports were excluded.

We did not undertake a rigorous meta-analysis in the present systematic review because the reported methods and results were, we believe, too heterogeneous. Although it has been established that a meta-analysis can be performed on observational studies (3), such as those selected for use in our review, the differences in study design, inconsistencies in data collection, and the lack of reported variance data (e.g., standard deviation) in the selected reports made the use of Cochran's Q test or the I^2 statistic inappropriate, because the published reports were unsuitable for meta-analysis (3).

The proportion of successful outcomes for each study was calculated by dividing the number of successful outcomes by the total number of procedures. The proportion of successful outcomes was then used to calculate the probability of success for each group (internal versus external fixation). Using the formula odds = $P/(1 - P)$, the odds of success for each group was calculated (Table 1). The odds of a successful outcome with internal fixation was 6.86. The odds of a successful outcome with external fixation was 13.20. The odds of success for internal fixation was 0.52 as likely as the odds of success with external fixation (odds ratio 0.52, 95% confidence interval 0.30 to 0.90).

Results

A total of 65 reports were recovered using our systematic search terms as defined in the “Materials and Methods” section. After the initial abstract review, 27 studies were eliminated, leaving 38 for the full review, of which 23 fit our selection criteria. All 23 studies had a level of evidence of 4 as determined using the Journal of Foot and Ankle Surgery Guide for Authors. A total of 616 procedures were reported in these studies, with 275 specific to Charcot deformity correction using internal fixation (12 studies) and 341 attempting correction with external fixation (11 studies).

The 12 studies using internal fixation as a method for Charcot deformity correction are summarized in Table 2. A total of 275 procedures in 274 patients (124 females and 150 males) included a mean follow-up period of 33.7 months and an average patient age of 57.8 years. Of the 275 procedures, 240 (87.3%) achieved successful salvage, and 35 (12.7%) were reported as unsuccessful. Amputation was performed 18 times in these studies, for an amputation rate of 6.5%. The

procedures involving the ankle joint totaled 175 and led to successful salvage in 147 (84%), with amputation performed 15 times (8.6%). When surgery was performed in the foot only, successful outcomes were obtained in 93 of 100 cases (93%), with 3 amputations (3%) required.

The 11 studies reporting on the results of external fixation in Charcot foot reconstruction are summarized in Table 3. A total of 341 procedures were performed among 319 patients (139 females and 180 males), with a mean follow-up period of 26.9 months and an average patient age of 55.1 years. Of the 341 total procedures, 317 (92.9%) resulted in successful salvage and 24 (7.04%) in unfavorable outcomes. The amputation rate for external fixation was 3.5% (12 amputations). Of the external fixation procedures used to treat both the foot and ankle, 203 (94.9%) resulted in successful salvage, 5 (2.3%) in amputation, and 11 (5.1%) in unsuccessful salvage. External fixation with just foot involvement yielded 84 (90.3%) with successful salvage, 5 (5.4%) with amputation, and 9 (9.7%) with unsuccessful salvage. Finally, when only considering the ankle with external fixation, 30 (88.2%) resulted in successful salvage, 2 (5.9%) in amputation, and 4 (11.7%) in unsuccessful salvage.

Discussion

The decision to use external or internal fixation in reconstruction of Charcot deformity is based on many factors. In many cases, surgeon comfort, experience, and traditions are at the forefront of the decision. A thorough understanding of the risks and benefits of each technique provides the surgeon with important information to determine the best option for fixation in each individual case. Clearly, in the case of Charcot, which involves complex and varied deformity and high-risk patients, a detailed understanding of the options will help guide the decisions that will lead to the best possible patient outcomes.

Our systematic review has helped to clarify the available evidence regarding the choice of reconstruction procedure, and our results highlight several trends in the usage of each fixation technique. Internal fixation tended to be the method chosen when the deformity did not include complicated wounds or osteomyelitis. In the internal fixation population, screws were the preferred hardware of choice for surgeons correcting foot deformities (5 of 6 studies). In contrast, those correcting ankle deformities were more likely to use intramedullary nails (6 of 7 studies). Amputation also occurred at a greater prevalence (8.6%) in the patients undergoing only ankle procedures compared with those undergoing operation in the foot only (3.0%). The treating physician must also consider the necessary extended time in non-weightbearing status for patients undergoing correction using internal fixation alone.

A retrospective study of 22 patients undergoing reconstruction with midfoot arthrodesis using axially placed intramedullary screws was performed by Sammarco et al (4) in 2009. Their data showed a stable foot in 21 of 22 cases, with complete union in 16 and nonunion in 5. One patient showed no radiographic progress and eventually developed a collapsed longitudinal arch due to hardware failure. The investigators also reported on complications involving hardware, which led to screw removal (8 of 22), breakage (7 of 22), and replacement (1 of 22) (4).

Dalla et al (5) in 2007 completed a retrospective review of 18 patients with Charcot neuroarthropathy. In these patients, pantalar arthrodesis using an intramedullary retrograde transcaneal nail was performed. Of the 18 cases, 14 resulted in stable union; the remaining 4 patients achieved a fibrous union. Limb salvage was accomplished in all 18 patients, along with satisfactory plantigrade positioning of the foot. Three patients were noted to have developed ulcers at the site of the proximal screws in the tibia; however, this did not compromise nail fixation.

Placement of a plantar plate for reconstruction of Charcot foot was performed on 24 patients (25 feet) by Garchar et al (6) in 2013. The

Table 1
Odds ratio calculations for internal versus external fixation

Fixation Type	Success (n)	Failure (n)	Total (n)
Internal	240	35	275
External	317	24	341

Odds ratio: $(240/35)/(317/24) = 0.52$; 95% confidence interval = odds ratio $\pm 1.96 \times$ standard error log normal(odds ratio) = 0.3 to 0.90.

Download English Version:

<https://daneshyari.com/en/article/2722389>

Download Persian Version:

<https://daneshyari.com/article/2722389>

[Daneshyari.com](https://daneshyari.com)