EDITOR'S CHOICE

Treatment of Infected Forearm Nonunions With Large Complete Segmental Defects Using Bulk Allograft and Intramedullary Fixation

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CME Continuing Medical Education

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Disclosures for this Article

Editors

Jennifer Moriatis Wolf, MD, has no relevant conflicts of interest to disclose.

Authors

All authors of this journal-based CME activity have no relevant conflicts of interest to disclose. In the printed or PDF version of this article, author affiliations can be found at the bottom of the first page.

Planners

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Learning Objectives

Upon completion of this CME activity, the learner should achieve an understanding of:

- The options for treatment of infected forearm nonunions
- The benefits and details of the Masquelet technique
- The pros and cons of using bone transport to bridge large gaps after debriding infected forearm bone

Deadline: Each examination purchased in 2016 must be completed by January 31, 2017, to be eligible for CME. A certificate will be issued upon completion of the activity. Estimated time to complete each JHS CME activity is up to one hour.

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Purpose The purpose of this study is to report the results of a series of infected forearm nonunions treated from 1998 to 2012 using a staged reconstruction technique.

Methods At a median of 42 months follow-up, 7 patients who had an average segmental defect of 4.9 cm (range, 2.3−10.4 cm) were available for clinical and radiographic evaluation. Treatment consisted of serial debridement, implantation of an antibiotic cement spacer, and staged reconstruction using a bulk radius or ulna allograft with intramedullary fixation.

Results All 7 patients ultimately achieved solid bone union, although 4 patients (57%) required additional surgery, consisting of autologous bone grafting and plating, to achieve healing at 1 of the allograft-host junction sites. No patient had recurrence of infection, and all reported substantial improvement with increased function and decreased pain.

Conclusions Our approach ultimately resulted in a 100% union rate without recurrence of infection, although many patients may require additional surgery to attain healing at both allograft-junction sites. Using bulk allograft provides the ability to span a large defect while reconstituting the forearm anatomy. *(J Hand Surg Am. 2016;41(9):881−887.*

Type of study/level of evidence Therapeutic V.

Key words Nonunited fracture, radius, ulna, trauma, reconstruction.

Improved understanding of the biomechanics of forearm fixation and adherence to AO principles has decreased the rate of nonunion in the forearm to less than 5%.[1] Factors that increase risk for nonunion of a diaphyseal forearm fracture include open injury, comminution, complex soft tissue injuries, inadequate surgical fixation, and infection.[2−5] The forearm is vital in positioning the hand in space,[6] and treatment of fractures and nonunions must, therefore, restore length and alignment to maximize functional motion.[7]

Although infected forearm nonunions are rare, they can be particularly challenging owing to the presence of necrotic bone, segmental bone loss, sinus tract formation, fracture instability, and a poor soft tissue envelope.[4,5] Reconstructive options for large bony defects include intercalary nonvascular grafts, vascular grafts, Ilizarov bone transport, and the Masquelet (induced membrane) technique.[8−10] Structural corticocancellous grafting has been shown to be useful for small aseptic defects, but the technique is associated with morbidity such as donor site pain and weakening of the donor bone.[11,12] Vascularized fibula grafts are useful to treat larger defects, but the technique requires specialized microvascular expertise and other resources that limit widespread applicability.[13−15] Ilizarov distraction osteogenesis with bone transport, which allows for bone regeneration without further disruption of a noncompliant soft tissue envelope, is another option to treat infected forearm nonunions with a large defect.[16] However, the Ilizarov technique is particularly technically demanding in the forearm and requires substantial surgical experience, time, resources, and patient compliance.[15,17,18] The 2-stage Masquelet technique first includes debridement, soft tissue reconstruction, and implantation of a polymethylmethacrylate (PMMA) spacer to span the defect, which over time induces formation of a biomembrane surrounding the foreign body. In the second stage, 6 to 8 weeks later, the spacer is removed, but the membrane is retained and autogenous cancellous bone graft is packed into the resulting cavity. Eight to 10 months of external fixation is required to allow graft incorporation, healing, and remodeling.[8−10] The Masquelet technique requires multiple planned operations, often a very large volume of autogenous bone graft, and a lengthy course of treatment.

Few studies have focused on infected nonunion of the forearm, and much of the literature consists of small case series.[19−21] The largest series of infected forearm nonunions was 21 cases treated by bone transport reported by Liu and coauthors in 2013.[22] Prasarn and colleagues[4] reported good results for 15 patients with an average defect of 2.1 cm using corticocancellous graft and plate fixation, but the utility of this technique for infected forearm nonunions with larger defects remains unknown.

The purpose of the current investigation was to report the results of a series of infected forearm nonunions treated by a single surgeon (M.R.B.) using serial debridement, implantation of a PMMA-antibiotic spacer, and staged reconstruction using a bulk allograft and intramedullary (IM) fixation.