

# Management of Aseptic Tibial and Femoral Diaphyseal Nonunions Without Bony Defects



Mark R. Brinker, MD<sup>a,b</sup>, Daniel P. O'Connor, PhD<sup>c,\*</sup>

## KEYWORDS

• Fractures, Ununited • Exchange nailing • Augmentative plating • Revision surgery • Bone graft

## KEY POINTS

- The presence of in situ hardware is a primary determinant of nonunion treatment.
- Aseptic diaphyseal nonunion of the tibia or femur without segmental defect and with an in situ nail are best managed with augmentative plating or exchange nailing.
- Aseptic diaphyseal nonunion of the tibia or femur without segmental defect and with in situ plate and screw fixation are best managed with revision plate and screw fixation and bone graft.
- Various bone graft methods, including intramedullary reaming, autogenous iliac crest bone marrow, and reamer-aspirator-irrigator technique, facilitate healing.
- Biologic implants (eg, recombinant human bone morphogenetic protein, platelet gel) and nonoperative treatments (ultrasound, electrical shock wave therapy) are associated with relatively high healing rates in most reports.

## INTRODUCTION

This article describes an evidence-based approach to the treatment of aseptic tibial and femoral diaphyseal nonunions without segmental defects. The evidence for current best practices was obtained by searching the English-language literature for articles published from January 2005 through January 2015. The authors systematically searched Medical Literature Analysis and Retrieval System Online (MEDLINE) using the key terms: “fractures, ununited” or “nonunion” or “nonunions”, “tibia” or “tibial” or “femur” or “femoral”, and “treatment”. The search was

limited to adults (age  $\geq 18$  years). The results were 860 potential articles. We then reviewed the abstracts of all of these articles to identify the relevant papers.

We excluded articles reporting treatment of only infected nonunions or segmental defects. We excluded case reports, review articles, and technique papers that did not report results of treatment. We excluded papers reporting treatment of failed arthroplasty, failed arthrodesis, tumor resection, nonunions involving the articular surface, metaphyseal or epiphyseal nonunions, nonunions following periprosthetic fracture, and nonunions

Funding Sources: None (Dr M.R. Brinker); Research funding from CDC (U18DP003350), NIH (2R44GM095005), US Department of Education (H133G120192), Joe W. King Orthopedic Institute (Dr D.P. O'Connor).

Conflict of Interest: None (Dr M.R. Brinker); Consultant for Nimbic, Inc (Dr D.P. O'Connor).

<sup>a</sup> Fondren Orthopedic Group LLP, Texas Orthopedic Hospital, 7401 South Main Street, Houston, TX 77030, USA;

<sup>b</sup> Department of Orthopaedic Surgery, The University of Texas Medical School at Houston, 6431 Fannin Street, Houston, TX 77030, USA; <sup>c</sup> Department of Health and Human Performance, University of Houston, 3855 Holman GAR104, Houston, TX 77204-6015, USA

\* Corresponding author.

E-mail address: [dpocunno@central.uh.edu](mailto:dpocunno@central.uh.edu)

Orthop Clin N Am 47 (2016) 67–75

<http://dx.doi.org/10.1016/j.ocl.2015.08.009>

0030-5898/16/\$ – see front matter © 2016 Elsevier Inc. All rights reserved.

following pathologic fractures. Finally, we excluded articles that had insufficient detail or contained large variation in the reported nonunion types or treatments. This process left 41 articles (25 femur, 22 tibia, 6 both) that we retrieved and reviewed in full.

## FEMUR

### ***Augmentative Plating***

Eight articles described the use of augmentative plating, the use of plate and screw fixation in addition to an in situ intramedullary nail, with autogenous bone grafting for aseptic femoral diaphyseal nonunions (Table 1).<sup>1-8</sup> All 147 cases reported in these 8 papers healed (100% union rate) with average times to union ranging from 4.3 to 7.5 months.

In 2005, Choi and Kim<sup>1</sup> reported a 100% union rate for 15 aseptic femoral nonunions treated with augmentative plating using an AO plate. In 2009, Birjandinejad and colleagues<sup>2</sup> reported a 100% union rate for 25 aseptic femoral nonunions treated with augmentative plating using a lateral 4.5 mm broad dynamic compression plate (DCP) for midshaft nonunions with bone graft from the ipsilateral iliac crest for cases with less than 50% cortical contact (dynamic condylar screws or blade plates were used for proximal or distal nonunions but these were not reported separately from the overall series). The following year, Chen and colleagues<sup>3</sup> reported a 100% union rate and good-to-excellent functional outcomes for 50 aseptic femoral shaft nonunions treated with augmentative plating using a broad 4.5 mm DCP. Also in 2010, Park and colleagues<sup>4</sup> reported a 100% union rate for 11 aseptic femoral shaft nonunions treated with augmentative plating using compression plates.

Gao and colleagues<sup>5</sup> reported a 100% union rate for 13 aseptic nonisthmic femoral nonunions treated with augmentative plating using locking plates. Hakeos and colleagues<sup>6</sup> reported a 100% union rate for 7 nonunions treated with an augmentative plating technique that included removing the interlocking screws at 1 end of the in situ nail, applying compression intraoperatively via the plate or an articulated tensioning device, and then replacing the interlocking screws before DCP fixation. One subject had a postoperative infected hematoma and 1 had a residual leg length discrepancy. Said and colleagues<sup>7</sup> reported a 100% union rate for 14 aseptic femoral nonunion treated with augmentative plating with a 4.5 mm broad DCP. In 2012, Lin and colleagues<sup>8</sup> reported a 100% union rate for 22 femoral shaft nonunions treated with augmentative plating using a 4.5 mm broad DCP.

### ***Blade Plate Fixation***

In 2006, de Vries and colleagues<sup>9</sup> reviewed a consecutive series of 33 aseptic subtrochanteric femoral nonunions that had a variety of prior failed methods of internal and external fixation. The subjects were treated with hardware removal, blade plate, and autologous bone graft (13 cases), or demineralized bone matrix (DBM; 10 cases). Five infected nonunions were included but were not reported separately from the overall series. Union was achieved in 32 of the 33 nonunions (97%).

### ***Intramedullary Nail Fixation***

We identified 3 articles reporting the use of intramedullary nailing to treat a total of 70 aseptic femoral shaft nonunions, with an overall union rate of 83% in 4 to 8 months.

In 2007, Niedzwiedzki and colleagues<sup>10</sup> reported on 22 cases of aseptic femoral shaft nonunions treated with locked intramedullary nail fixation using nails 11 to 16 mm in diameter and 0.5 mm over-reaming. Although all cases had undergone 3 to 8 prior surgeries, these surgeries were not described except that 13 had failed at least 1 prior nailing. In addition, several cases were treated with either exchange nailing or with augmentative plating with intramedullary nailing; these cases were not reported separately. The union rate was only 59%. In 2009, Wu<sup>11</sup> reported a union rate of 89% for 18 aseptic, atrophic supracondylar femoral nonunions with in situ plate and screw fixation treated with hardware removal, debridement, a 12 mm diameter retrograde nail with 1 mm over-reaming, dynamic locking, and autogenous bone graft. In 2009, Megas and colleagues<sup>12</sup> reported a 97% union rate for 30 aseptic femoral shaft nonunions (25 atrophic) with an in situ plate treated with hardware removal, debridement, bone grafting in atrophic cases, and ante-grade reamed intramedullary nailing with 1.5 mm of over-reaming. The nails were dynamically locked in 22 atrophic cases and statically locked in the 5 hypertrophic cases and in the 3 atrophic cases with 1 to 2 cm of shortening, for which the defect was filled with autogenous iliac crest bone graft at the time of intramedullary nailing.

### ***Exchange Nailing***

We located 8 publications reporting results of exchange nailing for a total of 266 aseptic femoral shaft nonunions, with an overall union rate of 89% with time to union ranging from 4 to 8 months.

In 2007, Wu<sup>13</sup> reported a 92% union rate in 74 aseptic nonunions of the femoral diaphysis treated with exchange nailing including over-reaming by at

Download English Version:

<https://daneshyari.com/en/article/4082753>

Download Persian Version:

<https://daneshyari.com/article/4082753>

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