Clinical/Basic Science Research Article

OTA ORTHOPAEDIC TRAUMA ASSOCIATION

OTA INTERNATIONAL THE OPEN ACCESS JOURNAL OF ORTHOPAEDIC TRAUMA

OPEN

Surgical management and weight-bearing recommendations for geriatric distal femur fractures

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Objective: To investigate current practices among orthopaedic trauma surgeons in treating geriatric distal femur fractures and evaluate current postoperative weight-bearing recommendations.

Methods: A 26-question survey was emailed to Major Extremity Trauma Research Consortium surgeon members to characterize current practice with different fixation methods for distal femur fractures and the surgeon-directed postoperative weight-bearing recommendations for each approach.

Results: Surveys were completed by 123 orthopaedic trauma surgeons with a response rate of 37% (123/332). Retrograde intramedullary nailing (IMN) was commonly performed by 88% of surgeons, and lateral locked plate was commonly performed by 74% of surgeons. Retrograde IMN with a lateral plate was commonly performed by 51% of surgeons. Dual femoral plating was commonly performed by 18% of surgeons and sometimes performed by 39% of surgeons. Surgeons were significantly more likely to allow immediate postoperative weight-bearing for retrograde IMN ($P < 0.001$), retrograde IMN with lateral plate ($P < 0.001$), and dual plate ($P < 0.001$) as compared with locked lateral plate. Most surgeons (79%) would be interested in participating in a randomized controlled trial (RCT) investigating single implant versus dual implant for distal femur fractures and believe that a trial incorporating immediate weight-bearing is important.

Conclusion: A variety of implants are commonly used to treat geriatric distal femur fractures. Patients with distal femur fracture commonly have weight-bearing restrictions in the immediate postoperative period. A large proportion of orthopaedic trauma surgeons have clinical equipoise for an RCT to investigate the impact of surgical construct and weight-bearing on geriatric distal femur fracture patient recovery.

Keywords: distal femoral fracture, dual plate, plate, nail, dual implant, plate/nail

1. Introduction

Distal femur fractures in elderly patients continue to increase with the aging patient population.[1] While less common than geriatric hip fractures, patients with distal femur fracture present similar treatment challenges because of poor bone mineral density and patient comorbidities. Care for patients with distal femur fracture emphasizes early mobilization to avoid the complications of recumbency including pneumonia, pressure sores, and venous thromboembolism. Patients with geriatric fracture often have difficulty mobilizing with restricted weight-bearing because these patients often have poor strength, inadequate balance, and insufficient coordination that are required to participate in protected weight-bearing. Consequently, restricted weight-bearing may be a contributing factor to the high rates of morbidity and mortality reported for patients with geriatric distal femur fracture.[2,3]

Distal femur fractures have traditionally been operatively fixed with a single implant, either a lateral locked plate or a retrograde intramedullary nail (IMN). While recent studies suggest that early weight-bearing can be tolerated with low failure rates, many surgeons continue to institute weight-bearing restrictions for osteopenic patients treated with single implant fixation.[4] This can make it challenging for distal femur fractures to adequately mobilize and avoid physiologic issues associated with recumbency and inactivity. In addition, non-union rates for operatively treated distal femur fractures are as high as 20% in large series, leading to additional surgery.[5,6] More recently, surgeons may situationally supplement fixation with additional plates and/or nails to address concerns regarding early weight-bearing and the high rates of complications after single implant fixation.[7–10]

J. M. Haller is a paid consultant for Stryker, Globus, Orthogrid, Osteocentric, and NewClip Technics. T. F. Higgins is a consultant and collects royalties for Depuy-Synthes and owns stock in Imagen, Osteocentric, and NT nPhase. R. V. O'Toole is a paid consultant for Stryker, collects royalties from Lincotek, and owns stock in Imagen. L. S. Marchand and L. Reider have no disclosures. No funding was received for this manuscript.

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Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.jorthotrauma.com).

OTAI (2024) e296

Received: 22 April 2023 / Accepted: 14 October 2023
Published online 14 December 2023

http://dx.doi.org/10.1097/OI9.0000000000000296

There are now several widely accepted treatment methods for patients with distal femur fracture; however, little is known about how often the different approaches are used in current practice or about surgeon weight-bearing recommendations. Furthermore, there are currently no clinical trials comparing the effectiveness of these approaches and the implications for immediate weight-bearing, which may be an advantage of dual implant fixation. Therefore, the purpose of this study was to investigate current practices among orthopaedic trauma surgeons in treating geriatric distal femur fractures and to help evaluate the feasibility of a clinical trial investigating fixation and/or postoperative weight-bearing.

2. Methods

A 26-question survey was created to assess surgeon practice demographics, identify surgeon experience with different fixation methods for distal femur fractures, and evaluate surgeon-directed postoperative weight-bearing regimens for each fixation construct. The survey was piloted for length, clarity, and relevance by 3 orthopaedic trauma surgeons (J.H., L.M., T.H.). The survey was distributed by email to surgeon members of the Major Extremity Trauma Research Consortium (METRC). The survey was available for a 4-week period. All survey data were collected and stored using the Redcap online database. The study was deemed exempt from Institutional Review Board and Animal Use Committee Review.

The survey queried surgeons on the use of distal femur fracture treatment methods including locked lateral plating, retrograde intramedullary nailing, retrograde intramedullary nailing with locked lateral plate, dual distal femoral plating, and distal femoral replacement (DFR) (Appendix 1, http://links.lww.com/OTAI/A89). For each treatment method, surgeons reported on their treatment frequency (never/rarely[1x/year]/commonly) and whether they allow patients to be weight-bearing as tolerated (WBAT) immediately after surgery. Surgeons were also asked about their typical weight-bearing restrictions for each treatment method and if they would be willing to randomize a patient with distal femur fracture treated with each respective treatment construct to early versus delayed weight-bearing. Finally, surgeons were asked if they would be willing to participate in a randomized clinical trial evaluating single versus dual implant fixation, immediate versus delayed weight-bearing, and a factorial design randomized controlled trial (RCT) evaluating both single versus dual implant fixation and immediate versus delayed weight-bearing for patients with distal femur fracture.

2.1. Statistical analysis

Descriptive statistics were performed to assess the variability in operative treatment, weight-bearing recommendations, interest in patient randomization, and interest in clinical trial participation. The Fisher exact test was performed to compare postoperative weight-bearing recommendations (Stata 12.1, StataCorp, College Station, TX). $P < 0.05$ is considered statistically significant.

3. Results

A total of 123 respondents participated in the survey study with a response rate of 37% (123/332). Nearly all respondents (121/123, 98%) were orthopaedic trauma fellowship–trained. Most respondents had greater than 5 years of clinical practice (114/123, 93%), and surgeons with greater than 20 years of experience were the most represented surgeon grouping (32%) (Table 1).

For single implants, a lateral locked plate was commonly performed by 74% of surgeons (Table 2). Of those performing the operation, only 21% allow patients to be WBAT immediately after surgery (Fig. 1). Most commonly, surgeons allow patients with distal femur fracture with a lateral locked plate to be WBAT between 6 and 10 weeks (72/123, 62%). Most surgeons (85/123, 74%) would be willing to randomize patients treated with a lateral locked plate to immediate versus delayed weight-bearing. Retrograde IMN was commonly performed by 88% of surgeons (Table 2). Of those who perform the operation, 64% allow patients to be WBAT immediately after surgery (Fig. 1). Most surgeons (98/123, 80%) would be willing to randomize patients treated with a retrograde IMN to immediate versus delayed weight-bearing. Surgeons were significantly more likely to allow retrograde IMN patients to immediately weight-bear as compared with locked lateral plate ($P < 0.001$).

For dual implants, a retrograde IMN with a lateral plate to treat geriatric distal femur fractures was the commonly performed by 51% of surgeons (Table 2). Of those who perform the operation, 80% of surgeons allow patients to be WBAT immediately after surgery (Fig. 1). Eighty-four surgeons (84/123, 79%) would be willing to randomize patients treated with a retrograde IMN with a lateral plate to immediate versus delayed weight-bearing. Dual femoral plating was commonly performed by 18% of surgeons and rarely performed by 39% of surgeons (Table 2). Of those who perform the operation, 64% allow patients to be WBAT immediately after surgery (Fig. 1). 80% of surgeons would be willing to randomize patients treated with dual plates to immediate versus delayed weight-bearing. When compared with locked lateral plating, surgeons were significantly more likely to allow immediate postoperative weight-bearing for retrograde IMN with lateral plate ($P < 0.001$) and dual plate patients ($P < 0.001$).

Only 4% of surveyed surgeons routinely perform DFR, and 18% rarely perform DFR. 79% of surgeons would be interested in participating in an RCT investigating single implant versus dual implant for distal femur fractures. 72% percent of surgeons would be interested in participating in an RCT investigating immediate versus delayed weight-bearing, regardless of implant. For a factorial 2×2 RCT randomizing patients single versus dual implant and immediate versus delayed weight-bearing, 67% of surgeons would be interested in participating.

4. Discussion

Geriatric distal femur fracture treatment has become an increasingly controversial topic. With mortality and complication rates similar to hip fractures, distal femur fractures can be challenging fractures to treat but have not been the focus of high-quality clinical trials as compared with their counterpart the geriatric hip fracture. The goal of the current study was to

TABLE 1

Respondent Characteristics

	n (%)
Number of years in practice	
<5	9 (7.3)
5–10	36 (29.3)
11–15	24 (19.5)
16–20	14 (11.4)
>20	40 (32.5)
Fellowship training	121 (98.4)

TABLE 2

Surgeon Responses for Treatment of Geriatric Distal Femur Fractures

	Commonly	Rarely	Never
Locked lateral plate	90 (74%)	26 (21%)	6 (5%)
Retrograde IMN	108 (88%)	14 (11%)	1 (1%)
Retrograde IMN + lateral plate	62 (51%)	45 (37%)	15 (12%)
Dual plate	22 (18%)	48 (39%)	52 (42%)

evaluate current practices in treating distal femur fractures, assess current postoperative weight-bearing recommendations, and query surgeon interest in participating in a prospective, randomized clinical trial to compare currently used treatment plans. The study was able to include mostly trauma fellowship–trained surgeons practicing at busy level-1 and level-2 trauma centers across the United States.

Traditional fixation methods including a retrograde IMN and lateral locked plate continue to be the most commonly used implants for distal femur fractures. Dual implant constructs including retrograde IMN with an additional lateral plate and dual plating are less familiar but are still used by over 60% of surgeons in the survey. Given that respondents were trauma fellowship–trained and practicing at high-volume centers, the percentage of surgeons who perform dual implant surgeries is likely less frequent among private practice orthopaedic surgeons who treat geriatric distal femur fractures. This may represent a new arena for surgeon education to review possible indications and technical tricks for dual implant implementation in distal femur fractures if future work demonstrates superiority of dual implant constructs.

Based on the hip fracture literature, postoperative weight-bearing is a critical component to minimizing mortality and perioperative complications after a geriatric fracture. Early weight-bearing after geriatric hip fracture has been demonstrated to correlate with reduced mortality, pneumonia, delirium, and hospital stay.[11–13] Similar to hip fracture, older adults with distal femur fractures tend to have multiple comorbidities and poor bone quality. However, several small series of patients with distal femur fracture have demonstrated similar reoperation rates for restricted and full weight-bearing patients.[4,14] However, geriatric nonhip fractures continue to have higher rates of restricted weight-bearing than geriatric hip fractures.[15] The findings of this study further highlight the hesitancy to allow distal femur fractures to immediately weight-bear after surgical fixation. Only 21% of surgeons currently allow patients with distal femur fracture treated with a locked lateral plate to immediately weight-bear as tolerated. Surgeons treating distal femur fractures with one of the other treatment constructs were more likely to allow immediate weight-bearing (64%–80%). With early mobilization and ambulation as one of the treatment goals for geriatric distal femur fractures, surgeons should either question current weight-bearing guidelines or reconsider an isolated locked lateral plate as a reasonable treatment strategy. Based on current surgeon-directed weight-bearing guidelines, dual implant constructs may present an opportunity to allow earlier full weight-bearing after surgical fixation.

With ongoing controversy regarding optimal surgical treatment and current hesitancy to permit immediate full weight-bearing, orthopaedic surgeons are interested in further investigation into geriatric distal femur fracture care. This information also suggests a need for high-quality data in this regard. Most of the orthopaedic surgeons responding to this survey would be willing to randomize various treatment constructs to either immediate versus delayed weight-bearing. Nearly 80% of surgeon respondents would be interested in participating in a prospective clinical trial randomizing patients with geriatric distal femur fracture to either a single (lateral locked plate or retrograde IMN) implant or a dual (retrograde IMN with locked plate or dual plate) implant.

This study has several limitations. Although the response rate was relatively low (37%), this rate was similar to other published orthopaedic trauma survey studies.[16,17] This low response rate could introduce sampling bias that may not accurately represent the opinions of the orthopaedic community. Furthermore, the survey was completed by only orthopaedic trauma fellowship–trained surgeons and may be skewed toward higher complexity fractures or higher risk patients. In addition, many of the factors that influence implant choice and weight-bearing status including bone quality and fracture comminution were not available to survey respondents and may have affected their weight-bearing restrictions. Finally, the willingness to participate in an RCT may be influenced by many details of the trial, and actual willingness might be very different from the willingness to participate in a vague RCT without any detail of the trial.

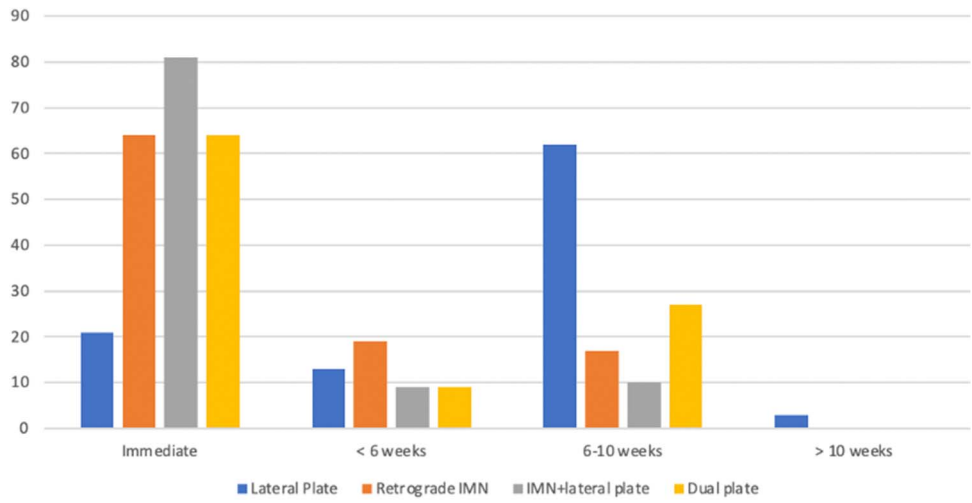

Figure 1. Surgeon-directed weight-bearing restrictions based on fixation construct.

This study has several strengths as well. We report the first study on current treatment and postoperative weight-bearing practices for geriatric distal femur fractures. Our study includes surgeons with varying experience levels practicing at both academic and private practice institutions. Our survey response rate was similar to prior orthopaedic trauma survey studies.[16,17] In addition, the orthopaedic surgeons who responded to the survey have practices established in over 60 medical systems across every region of the United States to account for patient and surgeon diversity.

5. Conclusion

In summary, there are a variety of commonly used fixation constructs to treat geriatric distal femur fractures. Despite having similar patient demographics as hip fractures, patients with distal femur fracture commonly have weight-bearing restrictions in the immediate postoperative period. Dual implant constructs tend to have fewer weight-bearing restrictions than a lateral locked plate and could provide an avenue for earlier unrestricted weight-bearing. Orthopaedic surgeons have clinical equipoise and interest in performing a randomized clinical trial to further investigate the impact of surgical construct and weight-bearing on improving care for patients with geriatric distal femur fracture.

REFERENCES

1. Elsoe R, Ceccotti AA, Larsen P. Population-based epidemiology and incidence of distal femur fractures. *Int Orthop*. 2018;42:191–196.
2. Myers P, Laboe P, Johnson KJ, et al. Patient mortality in geriatric distal femur fractures. *J Orthop Trauma*. 2018;32:111–115.
3. Streubel PN, Ricci WM, Wong A, et al. Mortality after distal femur fractures in elderly patients. *Clin Orthop Relat Res*. 2011;469:1188–1196.
4. Lieder CM, Gaski GE, Virkus WW, et al. Is immediate weight-bearing safe after single implant fixation of elderly distal femur fractures? *J Orthop Trauma*. 2021;35:49–55.
5. Karam J, Campbell P, David M, et al. Comparison of outcomes and analysis of risk factors for non-union in locked plating of closed periprosthetic and non-periprosthetic distal femoral fractures in a retrospective cohort study. *J Orthop Surg Res*. 2019;14:150.
6. Hart GP, Kneisl JS, Springer BD, et al. Open reduction vs distal femoral replacement arthroplasty for comminuted distal femur fractures in the patients 70 Years and older. *J Arthroplasty*. 2017;32:202–206.
7. Liporace FA, Yoon RS. An adjunct to percutaneous plate insertion to obtain optimal sagittal plane alignment in the treatment of pilon fractures. *J Foot Ankle Surg*. 2012;51:275–277.
8. Yoon RS, Gage MJ, Donegan DJ, et al. Intramedullary nailing and adjunct permanent plate fixation in complex tibia fractures. *J Orthop Trauma*. 2015;29:e277–e279.
9. Liporace FA, Yoon RS. Nail Plate combination technique for native and periprosthetic distal femur fractures. *J Orthop Trauma*. 2019;33:e64–e68.
10. DeKeyser GJ, Hakim AJ, O'Neill DC, et al. Biomechanical and anatomical considerations for dual plating of distal femur fractures: a systematic literature review. *Archives Orthop Trauma Surg*. 2021;142:2597–2609.
11. Kamel HK, Iqbal MA, Mogallapu R, et al. Time to ambulation after hip fracture surgery: relation to hospitalization outcomes. *J Gerontol A Biol Sci Med Sci*. 2003;58:M1042–M1045.
12. Heiden JJ, Goodin SR, Mormino MA, et al. Early ambulation after hip fracture surgery is associated with decreased 30-day mortality. *J Am Acad Orthop Surg*. 2021;29:e238–e242.
13. Gannon NP, Kampa J, Westberg JR, et al. Does inpatient mobilization predict 1-year mortality after femoral neck fracture treated with hemiarthroplasty? *J Orthop Trauma*. 2022;36:98–103.
14. Paulsson M, Ekholm C, Jonsson E, et al. Immediate full weight-bearing versus partial weight-bearing after plate fixation of distal femur fractures in elderly patients. A randomized controlled trial. *Geriatric Orthop Surg Rehab*. 2021;12:21514593211055889.
15. Richardson C, Bretherton CP, Raza M, et al. The Fragility Fracture Postoperative Mobilisation multicentre audit: the reality of weightbearing practices following operations for lower limb fragility fractures. *Bone Joint J*. 2022;104-B:972–979.
16. Slobogean GP, Sprague SA, Scott T, et al. Management of young femoral neck fractures: is there a consensus? *Injury*. 2015;46:435–440.
17. Cunningham BP, Higgins TF, Vallier HA, et al. Standardizing screw head orthopaedic trauma implants. Is there an interest? An OTA member survey. *J Orthop Trauma*. 2022;36:e393–e398.