SCIENTIFIC ARTICLE

The Effect of Bisphosphonates on the Clinical and Radiographic Outcomes of Distal Radius Fractures in Women

Kristin E. Shoji, MD,* Brandon E. Earp, MD,† Tamara D. Rozental, MD‡

Purpose To compare clinical and radiographic outcomes of distal radius fractures (DRF) treated with nonsurgical management in female postmenopausal patients receiving bisphosphonate (BP) therapy at the time of injury with those not receiving BP therapy.

Methods We prospectively enrolled 33 female postmenopausal patients with 35 DRF between December 2010 and January 2014 at 2 Level I tertiary care centers. Eleven patients with 12 DRF were currently receiving BP at the time of injury (BP group) and were compared with 22 controls with 23 DRF (CONT group) who were not receiving BP at the time of injury. All were postmenopausal women with fragility fractures managed nonsurgically. Primary outcomes were radiographic healing measured by the Radius Union Scoring System (RUSS) score and clinical and functional outcomes. Radiographs, range of motion, pinch and grip strength, Patient-Rated Wrist Evaluation scores, and Disability of the Arm, Shoulder, and Hand scores were determined at 6, 9, and 12 weeks and 1 year from time of injury and compared between groups.

Results The BP and CONT groups were similar in terms of age, comorbidities, and fracture severity. Both groups had progressively improving RUSS scores from the time of injury throughout subsequent evaluation, and all patients achieved radiographic union. Fracture healing was similar in both groups at 6, 9, and 12 weeks after injury. The RUSS scores were slightly better in the CONT group at 1 year. There were no differences in wrist range of motion, pinch, grip, Patient-Rated Wrist Evaluation, or Disability of the Arm, Shoulder, and Hand scores at any time point after injury.

Conclusions Patients receiving BP at the time of DRF had clinical outcomes similar to those not receiving antiresorptive treatment. Although there was a small difference in RUSS scores at 1 year after injury, this was not clinically relevant and all fractures united in a similar time frame with no healing complications. These results suggest that BP may be continued throughout nonsurgical management of DRF without detrimental effects on healing or function. *(J Hand Surg Am. 2017;■(■):■−■. Copyright © 2017 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Prognostic II.

Key words Bisphosphonate, distal radius, fracture, osteoporosis, union.

*From the *Harvard Combined Orthopaedic Residency Program; the †Department of Orthopaedic Surgery, Brigham and Women's Hospital; and the ‡Department of Orthopaedic Surgery, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, MA.*

Received for publication March 18, 2017; accepted in revised form September 6, 2017.

No benefits in any form have been received or will be received related directly or indirectly to the subject of this article.

Corresponding author: Tamara D. Rozental, MD, Department of Orthopaedic Surgery, Beth Israel Deaconess Medical Center, 330 Brookline Avenue, Stoneman 10, Boston, MA 02215; e-mail: trozenta@bidmc.harvard.edu.

0363-5023/17/■ ■-0001$36.00/0
https://doi.org/10.1016/j.jhsa.2017.09.006

Osteoporosis affects more than 54 million adults in the United States older than age 50 years.[1] The incidence of osteoporosis-related or fragility fractures is rising with an aging population; studies suggest that approximately 1 in 2 women and up to 1 in 4 men aged 50 years and older will sustain a fragility fracture.[2] Fractures of the distal radius are the most frequent upper-extremity fracture in women aged greater than 50 years and present at an earlier age than fractures of the hip or vertebra.[3,4] Because approximately 30% of women and 22% of men with a fragility fracture experience a second fracture within the next 5 years,[5] fractures of the distal radius present a unique opportunity for preventative strategies. Pharmacological treatment for osteoporosis has been shown to improve bone mineral density and may decrease the incidence of future fractures by up to 50%.[6,7] Bisphosphonates (BP) are the most commonly prescribed antiresorptive medications for patients with osteoporosis.[7–11] Because BP act to suppress both bone resorption and formation, it has been suggested that they may interfere with the normal process of fracture healing.[12,13] Animal studies have varying results, but overall they have demonstrated that although the early stages of fracture healing (including formation of granulation tissue, cartilaginous, and bony callus) are relatively unaffected by BP, the remodeling of the bony callus may be delayed.[14–22] The purpose of this study was to compare clinical and radiographic outcomes of distal radius fractures (DRF) treated with nonsurgical management in female postmenopausal patients receiving BP therapy at the time of injury with those not receiving BP therapy. We hypothesized that patients with DRF who were receiving BP at the time of injury would exhibit clinical and radiographic outcomes similar to patients with DRF who were not receiving BP treatment.

MATERIALS AND METHODS

This was a prospective study; postmenopausal women who had fragility fractures of the DRF were eligible for inclusion. The study was conducted in an outpatient setting at 2 Level I tertiary care hospitals between December 2010 and January 2014. A fragility fracture was defined as a fracture sustained in a fall from standing height or less. Patients aged 50 years or less and those with fractures resulting from polytrauma or high-energy mechanisms and open fractures were excluded, as were patients treated with parathyroid hormone or medications that inhibit osteoclast activity such as denosumab, and those who were unable to provide informed consent. To conduct the best possible assessment of fracture healing without hardware to obscure fracture lines, only nonsurgical fractures were included. We screened 81 consecutive patients with DRF that were managed nonsurgically, 17 of whom had received BP at the time of injury and 64 of whom had not. Of those, all 17 patients who had received BP and 50 who had not (CONT) agreed to participate in the study. Five patients receiving BP and 27 CONT patients subsequently withdrew from the study. Thus, 12 in the BP group and 23 in the CONT group completed the study and form the basis of this report. One patient in each group sustained bilateral DRF. Patients were initially placed in an orthosis and transitioned to a short-arm cast for 6 weeks after injury. According to dual-energy x-ray absorptiometry, 9 of 11 (81.8%) patients in the BP group had a diagnosis of osteoporosis and 2 (18.1%) were osteopenic, whereas 4 of 22 (18.2%) in the CONT group had osteoporosis and 11 (50%) were osteopenic, which was consistent with the reported literature of bone mineral density of postmenopausal women who sustained DRF.[23,24] In the BP group, 8 of 11 patients (72.7%) reported taking alendronate, one patient each reported taking ibandronate and risedronate, and one was not recorded. We elicited and compared detailed demographic information including age at the time of injury, side involved, and comorbidities that could affect fracture healing, including diabetes, smoking, and steroid use (Table 1). Initial radiographs were reviewed and classified according to the AO/Orthopaedic Trauma Association fracture classification.[25] Anteroposterior and lateral radiographs were performed at 6, 9, and 12 weeks and 1 year from the date of injury and reviewed to determine the time to radiographic union, as graded by the Radius Union Scoring System (RUSS) score.[26] The RUSS score, as described by Patel et al,[26] was calculated by grading the union of each of the 4 cortices of the distal radius on anteroposterior and lateral radiograph by a 3-point scale (0 = a fracture line visible with no callus; 1 = callus formation but fracture line present; 2 = cortical bridging without clear fracture line) (Table 2). Radiographic union was defined as a RUSS score of 6 or greater[26] (Figs. 1, 2). Recorded clinical outcomes included wrist range of motion (ROM) (flexion, extension, pronation, and supination), pinch and grip strength (as a percentage of the unaffected side, not corrected for hand dominance), Disability of the Arm, Shoulder, and Hand (DASH) scores,[27] and Patient-Rated Wrist Evaluation (PRWE).[28] All radiographic and clinical outcomes were measured at set intervals of 6, 9, and 12 weeks and 1 year after injury and compared between BP and CONT groups (Table 3). A trained study coordinator performed all clinical measurements and administered the DASH