EDITOR'S CHOICE

The Effect of Osteoporosis on the Outcomes After Volar Locking Plate Fixation in Female Patients Older than 50 Years With Unstable Distal Radius Fractures

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Purpose The aim of this study was to investigate the effect of osteoporosis on radiological and clinical outcomes after volar locking plate (VLP) fixation in women older than 50 years with unstable distal radius fractures (DRFs).

Methods We retrospectively reviewed data of 79 women older than 50 years with DRFs treated by VLP fixation. We collected patients' baseline data, including age and bone mineral density. We also measured the cortical thickness of the distal radius on plain radiographs and computed tomography to assess local bone density. Radiological outcomes included late displacement at 1 year after surgery, which was defined as a change in radiological parameters (radial inclination, volar tilt, and ulnar variance). Clinical outcomes were assessed with the Disabilities of the Arm, Shoulder, and Hand (DASH) and modified Mayo wrist score at 1 year after surgery. We compared mean values between the nonosteoporotic (group 1, T score > -2.5) and the osteoporotic groups (group 2, T score ≤ -2.5). We conducted linear and logistic regression analysis to investigate factors associated with poor outcomes.

Results There were 49 patients in group 1 and 30 patients in group 2. Radiological outcomes were similar in both groups. The mean DASH score was 14.9 (SD, 16.4) for group 1 and 12.5 (SD, 13.5) for group 2, and the mean modified Mayo wrist score was 87.6 (SD, 8.8) for group 1 and 88.2 (SD, 11.4) for group 2. There were no significant differences in clinical outcomes between groups. Simple and multivariable linear regression analysis showed only older age was associated with the change in volar tilt. Osteoporosis and cortical thickness were not associated with poor clinical outcomes on simple logistic regression analysis.

Conclusions Osteoporosis and cortical thickness of the distal radius did not affect clinical outcomes after VLP fixation in women older than 50 years with unstable DRFs. *(J Hand Surg Am. 2018;■(■):■−■.*

Type of study/level of evidence Prognostic II.

Key words Osteoporosis, local bone density, distal radius fracture, volar locking plate, functional outcome.

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Osteoporotic fractures are common orthopedic and public health problems. These fractures often occur at the hip, vertebra, and distal radius. Distal radius fractures (DRFs) are the most common osteoporotic fractures in women older than 50 years of age, and they are one of the 10 most costly medical occurrences worldwide according to the World Health Organization.[1] Although nonsurgical treatment is still used in the majority of DRFs in older patients, there has been an increase in the use of internal fixation using volar locking plates (VLPs).[2,3] Despite recent increases in the utilization of VLP fixation in older patients with DRFs, the influence of osteoporosis on radiological and clinical outcomes has not been fully understood and there is conflicting evidence regarding its effects.[4–9]

This study investigated the effect of osteoporosis on radiographic and functional outcomes in women older than 50 years with unstable DRFs treated with VLPs. Our hypothesis was that women with osteoporosis treated with VLP fixation have worse radiographic and clinical outcomes than women without osteoporosis.

PATIENTS AND METHODS

We retrospectively reviewed data of women older than 50 years with unstable DRFs treated by VLP fixation between March 2014 and March 2016. The study was approved by our institutional review board. The indications for VLP fixation included 1 or more of the following: radial shortening greater than 5 mm in a wrist posteroanterior view, dorsal angulation greater than 20° on wrist lateral radiographs, metaphyseal comminution, and an articular stepoff greater than 2 mm.

A total of 156 patients (157 wrists) were treated with VLP fixation for DRFs. Of these 156 patients, 65 were excluded as follows: 47 men and 16 women who were younger than 50 years, 1 patient with open fracture, and 1 patient with bilateral DRFs. Thus, a total of 91 patients were enrolled in the study, all of whom were asked to return for follow-up at 1 year after surgery. Twelve patients did not return for follow-up, leaving 79 patients to be included in the study.

All patients were assessed by plain radiographs, including anteroposterior, lateral, and oblique views, and computed tomography (CT) before surgery. We recorded patients' demographic data, including age, whether the dominant limb was fractured, the presence of diabetes mellitus, and bone mineral density (BMD), which was evaluated at the lumbar spine and both proximal femurs by Dual Energy X-ray Absorptiometry (DEXA) (Hologic QDR4500, Bedford, MA) before surgery. The average time interval between injury and DEXA was 5.2 days. We also collected radiological data, including the fracture classification (AO Foundation and Orthopaedic Trauma Association [AO/OTA] classification), associated ulnar styloid fracture, and cortical thickness of the radius. Cortical thickness was measured to assess local bone density of the distal radius on plain radiographs, according to the measurement technique of Webber et al.[10] It was also measured on the axial radius image on CT (Fig. 1).

All patients with unstable DRFs were treated with VLPs (Depuy Synthes, Paoli, PA, or Medartis, Basel, Switzerland) performed by 2 fellowship-trained orthopedic surgeons (J.I.L. and K.C.P.). After surgery, the wrist was immobilized in a below-elbow orthosis. Active digital movement was allowed immediately after surgery. The sutures and orthosis were removed 2 weeks after surgery. Patients were instructed to perform active and passive range of motion exercises of the wrist at home for a minimum of 30 minutes a day and they were allowed to perform activities of daily living after removal of the orthosis.

Radiological outcomes were evaluated as changes between the initial postoperative and the final radiological parameters, including radial inclination, volar tilt, and ulnar variance 1 year after surgery. All measured radiographic parameters were calculated as the absolute displacement from the immediate postoperative values. All cortical thickness and radiological parameters were measured by 1 fellowship-trained hand surgeon (J.I.L.) and 2 orthopedic residents (I.H.J. and H.W.J.) using computer-aided measurement software included in the picture archiving and communication system (PiViewSTAR; INFINITT Health Care, Seoul, Korea). Interobserver reliability of radiological measurements was assessed with the interclass correlation coefficient (ICC). An ICC greater than 0.8 was considered acceptable reliability. Clinical outcomes, including the Disabilities of the Arm, Shoulder, and Hand (DASH) score and the modified Mayo wrist score, were evaluated at 1 year after surgery. The DASH questionnaire (range, 0−100, with 0 as the best result) was self-administered by the patients, and the modified Mayo wrist score (range, 0−100, with 100 as the best result) was completed by a fellowship-trained hand surgeon (J.I.L.).

All enrolled patients were categorized into 2 groups according to the lowest T score between the lumbar spine and the proximal femur, excluding Ward triangle. Group 1 included patients without osteoporosis (T score > -2.5), and group 2 included patients with osteoporosis (T score ≤ -2.5).