

Randomized Comparison of Volar Locking Plates and Intramedullary Nails for Unstable Distal Radius Fractures

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Purpose To compare minimally invasive intramedullary nails (IMN) and volar locking plates (VLP) for the treatment of unstable distal radius fractures by evaluating postoperative subjective, radiographic, and functional outcomes. The hypothesis was that IMN patients would have less pain and required less pain medication in the early postoperative period and returned to work earlier than VLP patients.

Methods Sixty patients with closed, displaced, unstable, extra-articular, metaphyseal fractures of the distal radius were randomized to receive a VLP or an IMN for internal fixation. Functional outcomes (Quick Disabilities of the Arm, Shoulder, and Hand, Michigan Hand Questionnaire), radiographic measurements (ulnar variance, radial height, inclination, and volar tilt), and range of motion were assessed until final follow-up at 2 years after surgery. Narcotic pain medication use was documented for 5 weeks following surgery.

Results There were 2 groups of 30 patients with IMN (mean age, 55 ± 14 y) or VLP (mean age, 55 ± 16 y) with similar demographics and comorbidities. Patients with IMN regained extension earlier but had similar range of motion to patients with VLP at final follow-up. There was similar improvement in Michigan Hand Questionnaire, Quick Disabilities of the Arm, Shoulder, and Hand, and strength between groups. Five weeks after surgery, fewer IMN patients required narcotic pain medication (13%) than VLP patients (33%). Radiographic outcomes were similar at final follow-up. There were 3 failures with IMN versus 1 failure with VLP. All 10 employed patients with IMN returned to previous work compared with 10 of the 12 employed patients with VLP. Time to return to work was similar for both groups.

Conclusions In a cohort of similar patients, IMN and VLP provided comparable improvement in functional and radiographic outcomes. Patients with IMN required less narcotic pain medication after surgery than VLP patients. (*J Hand Surg Am.* 2015;40(6):1095–1101. Copyright © 2015 by the American Society for Surgery of the Hand. All rights reserved.)

Type of study/level of evidence Therapeutic II.

Key words Forearm, open reduction internal fixation.

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VOLAR LOCKING PLATES (VLP) with low implant profiles are currently the most popular treatment options for dorsally comminuted distal radius fractures.^{1–6} However, secondary loss of reduction, hardware failure, and tendon adhesion or rupture may occur.⁷ Intramedullary nailing was introduced to minimize soft tissue disruption while promoting stable internal fixation.^{8–10}

Intramedullary nails (IMN) provided stable fixation and good functional outcomes in 29 patients older than

50 years of age at 1 year follow-up after extra-articular or simple intra-articular distal radius fracture treatment.⁹ Prospective studies comparing VLP and IMN for extra-articular fractures found no differences in clinical or radiographic outcomes at 1 year¹¹ or 2 year¹² follow-up. However, IMN fixation was associated with earlier improvement in wrist motion, and improved Disabilities of the Arm, Shoulder, and Hand and Mayo wrist scores 6 weeks after surgery¹³ with similar outcomes of VLP and IMN at 1 and 2 year follow-up.^{12,13} Differences in patient-related factors between IMN and VLP in the early postoperative period were not assessed.

The purpose of this study was to compare functional and radiographic outcomes between VLP and IMN in the treatment of closed, displaced, unstable, extra-articular, metaphyseal fractures of the distal radius with a focus on the early postoperative period. The study hypothesis was that patients who received an IMN would have less postoperative pain requiring medication and would return to work earlier than those patients with VLP, while having similar outcomes 2 years after surgery.

MATERIALS AND METHODS

A prospective, randomized trial, approved by our institutional review board, was conducted to evaluate the outcome of surgical treatment for distal radius fractures with a VLP (Synthes, West Chester, PA) or IMN (MICRONAIL, Wright Medical, Arlington, TN) at a tertiary academic medical center provided by 2 fellowship-trained hand surgeons. Study enrollment was limited to skeletally mature patients between 18 and 80 years of age who sustained closed, displaced, unstable, metaphyseal, extra-articular fractures of the distal radius (AO type A) requiring surgical fixation. The included patients agreed to participate in the study by providing informed consent. Exclusion criteria were multiple injuries including concomitant scaphoid fractures, bilateral upper extremity fractures, comminuted intra-articular distal radius fractures, previous injuries on the affected side, inflammatory arthritis, open fractures, and physical or mental impairment.

Typically, patients were seen in the emergency department where they underwent closed manipulation as needed. Patients were placed in an orthosis and seen in the clinic within 3 days. Randomization was performed following review of the radiographs and study enrollment.

Surgical procedure

Axillary block anesthesia was planned for in all patients. However, patients for whom regional anesthesia

was contraindicated received general anesthesia. Surgeries were performed as outpatient procedures, unless patient presentation and comorbidities required hospital admission.

Intramedullary nail: Preliminary reduction of the distal radius fracture was performed under fluoroscopic guidance as described previously, using a combination of longitudinal traction and pronation and palmarly directed force.^{8,14} A 1.6-mm (0.062-in) K-wire was inserted percutaneously from dorsal to palmar along the ulnar column to provisionally stabilize the fracture reduction during the surgical procedure. A 2-cm longitudinal incision was then made between the first and the second dorsal compartments. Superficial branches of the radial nerve were identified and protected. Another 1.6-mm K-wire was inserted obliquely into the radial styloid approximately 3 to 4 mm proximal to the articular surface. A cannulated drill was then used to open the cortex. The distal radius was prepared with an opening awl and broaches. The IMN was then inserted into the radius after broaching and sizing the nail according to anatomical parameters. Interlocking screws were inserted using the guides attached to the implant insertion device using an accessory 2-cm longitudinal dorsal incision. Limited incisions at the radial and ulnar columns were performed to achieve acceptable reduction of the fracture (fluoroscopic evidence of radial length within 1 mm and palmar tilt within 5° of the contralateral uninjured side).

Volar locking plate: The distal radius was exposed using a modified Henry approach. Longitudinal traction was applied to the wrist to achieve proper reduction and was held with temporary percutaneous pin fixation. Fracture fragments were reduced and stabilized using a 2.4-mm precontoured VLP or a combination of VLP. If necessary, an arthrotomy was performed to verify the reduction of fracture fragments by visual inspection. The VLP was contoured to fit the patient's anatomy. Fluoroscopic guidance was used during the procedure to verify the position of the VLP and locking screws. The same radiographic criteria for a stable reduction were used as described for IMN. Myoperiosteal tissue from the pronator quadratus was used for plate coverage when possible.

Postoperative course

Patients in both groups wore a removable wrist orthosis for comfort after surgery. Therapy started 2 weeks after surgery. Patients returned to the clinic for evaluations at 2, 6, and 12 weeks, 6 months, and 1 and 2 years after surgery. Patient recovery and function

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