

randomization. Other outcomes assessed were the Disabilities of the Arm, Shoulder, and Hand (DASH) score, the EuroQol-5D (EQ-5D) visual analog scale and utility index, and wrist range of motion (ROM), in addition to radiographic evaluation of the wrist at 3 and 12 months.

Baseline characteristics—age, sex, fracture severity, general health status, and activity status—were similar between the 2 groups. Thirty-seven patients (41%) assigned to cast immobilization had subsequent surgery due to significant loss of reduction in the cast. After 1 year, in the intention-to-treat population, surgery showed a marginal nonsignificant advantage when compared to cast treatment (SF-36 Physical Component Summary mean difference, 3.3 in favor of surgery; 95% CI, -0.2 to 6.8). The mean difference in DASH scores (5.0 in favor of surgery; 95% CI, 1.0 to 11.0), EQ-5D visual analog scale scores (3.0 in favor of surgery; 95% CI, -1.9 to 7.9), and EQ-5D utility index (0.0 in favor of surgery; 95% CI, -0.06 to 0.06) were also not significantly different between the treatment groups.

In both treatment groups, patients returned to their preinjury activity statuses without significant differences between them. Although the group that underwent surgery had a faster improvement in wrist ROM at 3 months ( $P < .05$ ), there was no significant difference in wrist ROM in all planes between groups at the 1-year follow-up. Although anatomic restoration of the distal radius in palmar tilt, ulnar variance, and radial height was significantly superior in the group that received surgery (each  $P < .05$ ), these improvements did not translate into better function, said Prof Bartl.

The outcomes were similar when the analysis was conducted according to the actual treatment received. Patients in the group with secondary conversion to surgical management achieved equivalent scores when compared to those with primary surgery. Patients with a higher fracture comminution grade (AO/OTA C3) in the cast group had a 2-fold increased risk for conversion to secondary surgical management vs patients with AO/OTA type C1/C2 fractures. Both procedures are safe, as the researchers did not observe cases of infection in the surgical group or relevant cast pressure marks. There was only 1 case of complex regional pain syndrome overall.

Prof Bartl concluded that closed reduction and cast immobilization remain a valid first-line treatment option for elderly patients with displaced intra-articular distal radial fractures. If cast treatment fails, conversion to secondary surgery within 3 weeks does not compromise final outcome results. Patients with high fracture comminution grades and those in high-demand populations may benefit from primary surgical management.

## Augmentation Plating Superior to Nail Exchange for Femoral Shaft Nonunion After Nail Fixation

Written by Wayne Kuznar

The optimal treatment for femoral shaft nonunion after intramedullary nail fixation is controversial and is a challenge for orthopaedic surgeons. Bosong Zhang, MD, Jishuitan Hospital, Beijing, China, described a retrospective study comparing nail exchange with augmentation plating to treat femoral shaft nonunion after nail fixation.

The nonunion rate for femur shaft fracture after nailing is as high as 12.5% [Pihlajamäki HK et al. *J Orthop Trauma*. 2002]. Strategies for the treatment of femur shaft nonunion are bone grafting, exchange nailing, nail removal plus plating and bone grafting, leaving the nail in situ plus external fixation, and nail retention plus augmentation plating and bone grafting. In the literature, the union rate for exchange nailing ranges from 72% to 100% [Brinker MR, O'Connor DP. *J Bone Joint Surg Am*. 2007], compared with almost 100% for augmentation plating and bone grafting [Park J et al. *J Orthop Trauma*. 2010; Choi YS et al. *Int Orthop*. 2005].

The results of augmentation plating were compared with exchange nailing for femoral shaft nonunion after nailing in 104 cases. From March 2003 to June 2011, exchange nailing without autogenous bone grafting was performed in 21 patients, and augmentation plating with nail retention and autogenous bone grafting was performed in 83.

Exchange nailing was performed by nail removal, followed by use of a reamer to enlarge the femoral canal and insertion of a larger-diameter nail to enhance fixation stability. Prof Zhang noted that rotational instability is one reason for nonunion of femoral shaft fracture after interlocking nailing [Park J et al. *J Orthop Trauma*. 2010; Zhao G et al. *Chinese J Surg*. 2009; Ueng SW et al. *J Trauma*. 1997]. Augmentation plating combined with leaving the nail in situ in this instance can resolve the rotational instability and allow fracture healing [Choi YS et al. *Int Orthop*. 2005; Wu CC et al. *Int Orthop*. 2002]. The augmentation plate procedure in this study used a nonrotating plate and insertion of 3 screws on each side of the fracture. Screws were placed bicortically; the locking screw was placed monocortically. Simultaneous bone grafting was performed in patients who received an augmentation plate.

There were no significant differences between the 2 groups in age, sex, volume of postoperative drainage, and length of hospital stay. For patients who underwent augmentation plating and bone grafting, operation time was significantly shorter, and volume of both



intraoperative blood loss and autogenous blood reinfused was significantly less. In addition, this group had a significantly lower cost of hospitalization and a significantly shorter time to radiographic union than patients who underwent exchange nailing. The union rate with augmentation plating was 100%.

Prof Zhang enumerated key differences between exchange nailing and augmentation plating via an antirotating plate. Augmentation plating is indicated for treatment of fracture nonunion anywhere along the length of the femur, whereas exchange nailing is indicated for the proximal two-thirds of the femur. Exchange nailing is contraindicated with bone loss and when no larger nail is available, and it requires use of a C-arm for intraoperative imaging. Use of augmentation plating requires bone grafting, but as shown in this study, augmentation plating has a shorter fracture union time and is associated with less operative blood loss. In addition, the cost tends to be lower with augmentation plating.

Prof Zhang concluded that for femoral shaft nonunion, use of an antirotating plate, leaving the nail in situ, with autogenous bone grafting may be a better option than exchange nailing.

## K-Wires Are an Efficacious and Cost-Effective Option for Stabilization of Dorsally Displaced Fractures of the Distal Radius

Written by Phil Vinall

Andrew C. Gray, MD, Warwick Clinical Trials Unit, University of Warwick, Coventry, United Kingdom, presented the results of a recent study showing no difference between the use of Kirschner wires (K-wires) and volar locking plates for fracture repair in patients with dorsally displaced fractures of the distal radius. K-wire fixation was less expensive, and surgery took less time [Costa ML et al. *BMJ*. 2014].

Surgical stabilization options for displaced and dorsally angulated distal radial fractures include the use of external fixation, dorsal or volar plates, and K-wires. Despite several Cochrane reviews over the last 10 years, the evidence for optimal treatment is inconclusive. The Distal Radius Acute Fracture Fixation Trial [ISRCTN31379280] was a multicenter randomized controlled trial to compare K-wire fixation with locking-plate fixation. Consenting adult patients with a dorsally displaced distal radial fracture were eligible to participate provided the injury was <2 weeks old and the surgeon believed that the patient would benefit from fracture

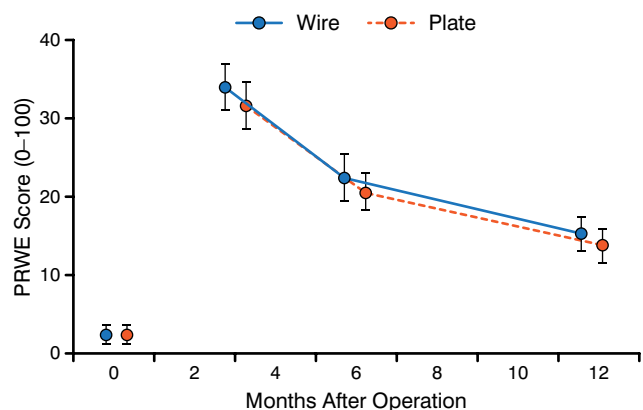
fixation. Patients with fractures extending > 3 cm from the radiocarpal joint and those with an open fracture with a Gustillo grade > 1 were excluded, as were those in whom the fracture or joint surface could not be reduced by closed or indirect means. The primary outcome measure was improvement in the Patient-Rated Wrist Evaluation (PRWE) in the 12 months after surgery. Secondary outcomes included Disabilities of the Arm, Shoulder, and Hand scores, radiographic changes, complications, and health economics (EuroQol-5D, resource use).

The study comprised 461 adult patients with a dorsally displaced distal radial fracture who were randomized to either K-wire fixation (n=230) or locking-plate fixation (n=231). The baseline characteristics of the 2 groups were well balanced for age, sex, preinjury function, and intra-articular extension. The majority of injuries were A2, A3, C1, and C2 fractures. More than 90% of patients completed follow-up. Both groups of patients recovered wrist function by 12 months.

PRWE scores did not differ between the 2 groups at 12 months when assessed for the overall population (95% CI, -4.5 to 1.8; *P* = .40; Figure 1) or according to age > 50 years or fracture (intra- vs extra-articular extension). Outcomes on the secondary measures were also similar. There was no difference in the number or type of complications between the groups, and there were negligible differences in quality-adjusted life-year gains.

Five patients in the K-wire group and 2 in the plate group required revision surgery due to loss of fracture reduction. Nine patients in the plate group required removal of symptomatic metalwork (4 for screw penetration of the joint). A buried K-wire was surgically removed in 1 patient.

Figure 1. Patient-Rated Wrist Evaluation Scores Over Time



PRWE, Patient-Rated Wrist Evaluation.

Adapted from *BMJ*, Percutaneous fixation with Kirschner wires vs volar locking plate fixation in adults with dorsally displaced fracture of distal radius: randomized controlled trial. Costa ML et al. 2014;349:g4807 © 2014 with permission from BMJ Publishing Group Ltd.