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].

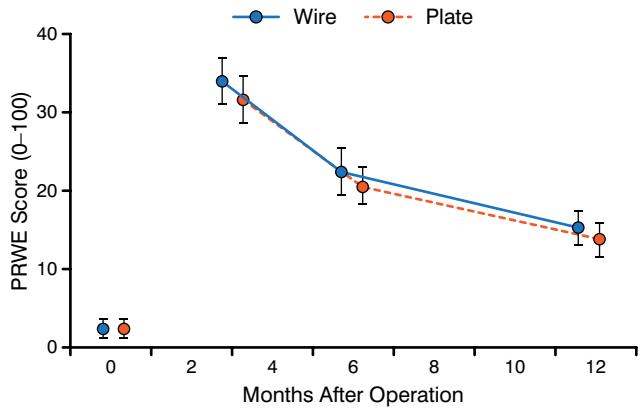
Surgical stabilization options for displaced and dorsally angulated distal radial fractures include the use of external fixation, dorsal or volar plates, and K-wires. Despite several Cochrane reviews over the last 10 years, the evidence for optimal treatment is inconclusive. The Distal Radius Acute Fracture 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.

The health economics results indicated that K-wires are less expensive and require significantly less operating time (median difference, 31 minutes; 95% CI, 28 to 35 minutes; $P < .001$). Therefore, Prof Gray recommended the use of K-wires vs volar locking plates for patients who are able to undergo a closed procedure to repair a dorsally displaced fracture of the distal radius.

POP Trial: Similar Functional Results in Each Treatment Method for Midshaft Clavicle Fractures

Written by Brian Hoyle

Frans-Jasper G. Wijdicks, MD, PhD, Diakonessenhuis, Utrecht, The Netherlands, reported the results of the randomized controlled Surgical Treatment of Midshaft Clavicular Fractures With Dislocation trial [POP; NTR2438], which compared the short- and mid-term outcomes of plate fixation and intramedullary (IM) nailing. Midshaft fractures were the focus because 80% of all clavicle fractures occur in the midshaft region, and half of the fractures involve dislocation.

The trial was conducted in 4 medical centers in The Netherlands, and involved 120 patients aged 18 to 65 years. There were no significant differences in baseline characteristics between groups (Table 1).

The patients were randomized to treatment with plate fixation (n = 58) or IM nailing (n = 62). The intention-to-treat analysis with a 1-year follow-up assessed shoulder function postoperatively, using the Disabilities of the Arm, Shoulder, and Hand (DASH) and Constant–Murley scores. The primary end point was the 6-month DASH score.

The DASH and Constant–Murley scores did not differ significantly at 6 months (3.0 and 99.2 for the plate group, and 5.6 and 95.5 for the IM group, respectively) and 1 year. However, measurement of the area under the curve for the DASH score between 6 weeks and 6 months was significantly different and favored plate fixation ($P = .02$).

Open reduction of fracture occurred in all 58 cases in the plate fixation group and in 46 of 62 cases (75%) in the IM nailing group. Conversion from one technique to the other occurred in 6 cases in the IM nailing group due to technical difficulties and 1 case in the plate fixation group due to a communication error. One case of nonunion occurred in the plate fixation group and 2 IM implants failed. No cases of malunion occurred. No neurovascular complications were evident. One plate fixation implant broke.

Major complication rates were low. However, minor complications were numerous and mainly related to irritation caused by the implants that necessitated implant removal, which involved 12 of 58 cases (21%) in the plate fixation group and 33 of 62 (53%) cases in the IM nailing group (Table 2).

Table 1. Baseline Characteristics

Baseline	Plate Fixation (n = 58)	Intramedullary Fixation (n = 62)
Age, y	38.3	39.1
Men, %	92	97
Body mass index, kg/m^2	24.7	23.7
Trauma mechanism, %		
Traffic accident	48	40
Sports	31	47
Fall from height	21	13

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Table 2. Complications

Complication	Treatment	Plate Fixation	Intramedullary Fixation
Implant breakage	Revision surgery	1 (2)	0
Implant failure	Revision surgery	0	2 (3)
Nonunion	Revision surgery	1 (2)	0
Malunion	Revision surgery	0	0
Refracture after removal	Revision surgery	2 (3)	0
Irritation	Removal of implant	12 (21)	33 (53)

Data are presented as no. (%).

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By 12 months, implant-related irritation was present in only 3% and 6% of patients in the plate fixation and IM nailing groups, respectively. To deal with implant irritation, the researchers recommend removal of the titanium elastic nail, generally under local anesthesia. Future research will focus on reducing irritation and the need for conversion.

Postoperative shoulder function at 6 months and 1 year were similar; patients treated using the plate fixation implant recovered faster than patients in the IM nailing group up to 6 months postoperatively, but ultimately both groups recovered to a similar degree. Although major complications were few, implant-related complications were frequent, mainly involving irritation, and were typically treated by removal of the implant.