Surgical treatment of unstable fractures of the distal clavicle

A comparative study of Kirschner wire and clavicular hook plate fixation

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ABSTRACT – During 1988-1999 39 unstable fractures of the distal clavicle (Neer 2) were operated on in Oulu University Hospital. Kirschner wire (K-wire) fixation was used in 22 cases and a clavicular hook plate in 17. Shoulder symptoms and function were assessed using self-administered questionnaires devised by L'Insalata et al. (1997), and Constant scoring. Mean follow-up was 6.2 years in the K-wire fixation group and 2.0 years in the clavicular hook plate one. The mean L'Insalata scores were 91 in both groups (92% and 93% of the contralateral side) and the mean Constant scores 84 (95%) and 90 (96%) for K-wire fixation and the clavicular hook plate, respectively. Complications commonly occurred with K-wires, which migrated in 12 cases, resulting in loss of reduction in 7 and infection in 3, and 2 cases of non-union. In the clavicular hook plate group, there was 1 complication, a fracture of the clavicle, and 2 cases of non-union. We conclude that shoulder symptoms were reduced and function restored to an adequate level by both methods, but complications were unacceptably frequent when K-wires were used. The clavicular hook plate was better in this respect and it is therefore recommended.

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Unstable fracture of the distal clavicle (Neer 2) is usually accepted as an indication for surgical treatment (Neer 1968, 1984, Neviaser 1987, Edwards et al. 1992). Several methods have been proposed (Neer 1968, 1984, Schmittinger and Sikorski 1983, Goldberg et al. 1997, Eskola et al. 1987, Ballmer and Gerber 1991, Webber and Haines 2000), the commonest probably being trans- or extra-articular K-wire fixation (Neer 1968, Eskola et al. 1987), but this carries a considerable risk of complications, especially migration of the pin and loss of reduction (Kona et al. 1990). Plate fixation is insecure, because the distal fragment is usually small and the metaphyseal bone soft. Therefore, a hooked plate with an extension under the acromion has been developed to give more stable fixation (Schmittinger and Sikorski 1983). Only a few reports, mainly in German, of the results of hook plate fixation are available (Schmittinger and Sikorski 1983, Hackenbruch et al. 1994, Eberle et al. 1992, Mizue et al. 2000). We compared retrospectively K-wire fixation and clavicular hook plate fixation in the treatment of unstable fractures of the distal clavicle.

Patients and methods

In Oulu University Hospital during 1988–1997 unstable fractures of the distal clavicle were stabilized with extra- or transarticular K-wire fixation. After 1997, the method was abandoned and we started to use clavicular hook plates. Case records and radiographs were reviewed retrospectively and complications and reoperations recorded.

Shoulder symptoms were assessed using self-administered questionnaires, devised by L'Insalata et al. (1997), returned by post. Patients who were willing to come to a follow-up visit at the outpatient clinic were reviewed by an independent physiotherapist. Shoulder function was evaluated with the Constant-Murley scoring system (Con-

stant and Murley 1987). Plain radiographs of clavicles were used to assess union.

K-wire fixation

There were 22 patients (16 male) with a mean age of 35 (17–68) years. The fixation was extra-articular in 4 cases (Figure 1) and transarticular through the acromioclavicular (AC) joint in 18 (Figure 2). 2 wires were usually used. An additional cerclage wire tension band was used in 16 cases because the surgeon judged that additional fixation was necessary. The arm was supported with a sling, usually for 3–4 weeks, and after that gentle mobilization was started. In cases of transarticular fixation, a full range of motion was allowed only after the K-wires had been removed (mean 2 (1–5) months).

The mean follow-up was 6 (3–12) years. 1 patient died and 2 patients were lost to follow-up. 19 patients completed L'Insalata scoring and 13 were reviewed at follow-up and underwent Constant scoring and radiological assessment.

Clavicular hook plate fixation

There were 17 patients (16 male) with a mean age of 43 (18–71) years. The patients were operated on using the methodproposed by the plate manufacturer (Clavicular hook plate, Stratec Medical, Oberdorf, Switzerland). After the fracture was reduced, a tunnel was made in the subacromial space behind the AC joint. The plate (Figure 3) was fixed using dynamic compression, if possible. Mobilization was allowed from the first postoperative day. Full range of motion was usually achieved after 3–4 weeks. Heavy manual work was not allowed until the plate was removed (mean 5 (3–13) months). Mean follow-up was 2 (1–2) years. All patients completed both types of scoring and radiographs were taken at follow-up.

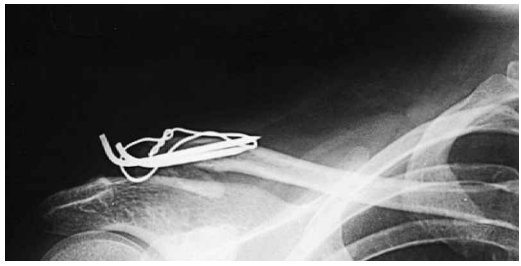

Figure 1. Extra-articular K-wire fixation with tension band.

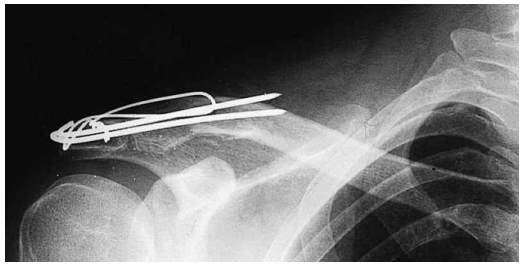

Figure 2. Transarticular K-wire fixation with tension band.

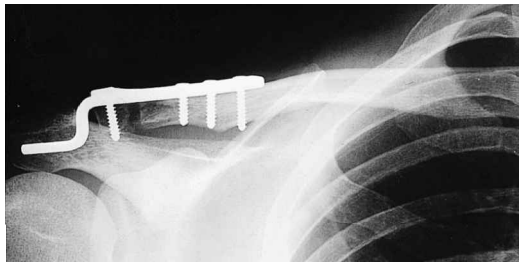

Figure 3. Clavicular hook plate.

Results

K-wire fixation

The mean L'Insalata score was 91 (47–100) (93% of the control side) and the mean Constant score 84 (68–95) (95% of the control side). The subjective result was assessed as good in 10 cases, fair in 8 and poor in 1 case. Unsightly scarring was the commonest complaint. 13 patients had complications. In 12 cases, wires migrated, resulting in loss of reduction in 7 cases (4 partial and 3 total). The 3 patients with a total loss of reduction underwent reoperation using a plate in 1 case and new K-wires with a tension wire band in 2. The fractures united uneventfully and the functional result was good. In 3 cases, migration of the wire caused an infection removal of wires and debridement of the wound were necessary. 1 patient developed a postoperative infection, not related to wire migration. At follow-up, 2 cases of non-union occurred, but both had few symptoms and no other procedures were needed.

Clavicular hook plate fixation

The mean L'Insalata score was 91 (79–100) (92% of the control side) and the mean Constant score

90 (84–95) (96% of the control side). The patients assessed the result as good in 13 cases and fair in 4; only 1 patient suffered complications. This patient had a clavicular fracture at the medial end of the plate as a result of a new injury. This was managed without surgery and the fracture healed uneventfully. The functional result was satisfactory. There were 2 cases of non-union. In 1 case, this was probably related to premature plate removal after 3 months and in 1 case, the reason was unclear. The latter patient underwent reoperation using a new plate with a bone graft and the fracture healed rapidly. The functional result was good. The other case of non-union was left untreated because the patient only occasionally had a little pain in his shoulder. There were no cases of postoperative infection.

Discussion

In our material the functional results were similar using both methods, but complications were commoner in the K-wire fixation group. The subjective result was better in the clavicular hook plate group than in the K-wire group. Our results are in line with those of previous investigators who have reported a high complication rate using K-wire fixation (Kona et al. 1990). However, unlike other studies, despite the frequent loss of reduction and other complications, the subjective and functional results were good. The clavicular hook plate provided reliable fixation and significantly fewer complications than K-wire fixation.

The results with K-wire fixation are disputed. Neer (1968) and Eskola et al. (1987) had good subjective results using K-wire fixation, with few complications, but Kona et al. (1990) reported several complications, poor functional results and they did not recommend it. According to Poigenfurst et al. (1991), the findings were similar with coracoclavicular screw fixation and K-wire fixation, despite frequent wire migration. Various authors have reported serious complications related to K-wire fixation of the AC joint, because of wire migration to vital organs (Lyons and Rockwood 1990, Leppilahti and Jalovaara 1999).

There are only a few reports, mainly in German, on clavicular hook plates. Schmittinger and Sikorski (1983), Hackenbruch et al. (1994) and Mizue et al. (2000) reported good results in a small number of patients, with few complications. Eberle et al. (1992) compared coracoclavicular screw fixation with clavicular hook plate fixation and found similar functional results in both groups. However, earlier mobilization was possible when clavicular hook plates were used. Our results accord with this view. The clavicular hook plate is well tolerated by patients and it can be removed after union. We found no evidence that the plate damages the acromion or rotator cuff, although it is inserted into the subacromial space.

Kiefer et al. (1986) compared the mechanical strengths of various types of fixation of the AC joint and found that transarticular K-wires with a tension band were much more stable than a clavicular hook plate (Balser plate), which had no rotational stiffness. During mobilization of the shoulder, rotation of the clavicle causes migration of wires. When a clavicular hook plate is used, the AC joint can rotate normally and undisturbed bone-to-bone healing occurs at the fracture site. Coracoclavicular screw fixation is also a mechanically good method (Kiefer et al. 1986), but it is difficult to perform, especially if inexperienced, but good results have been reported (Ballmer and Gerber 1991, Yamaguchi et al. 1998).

Our study has several limitations. It was retrospective and not randomized. The groups were not similar, as regards mean age and length of follow-up, and only 13/22 patients in the K-wire group could be reviewed at the follow-up visit. Despite this, we think that our data clearly show that both of these methods give good subjective and functional results, but the risk of complications with K-wire fixation is unacceptably high. Since distal clavicle fractures are rare, several multicenters should carry out a prospective randomized study.

Although surgical treatment is generally accepted as the treatment of choice in unstable distal clavicular fractures, its natural course if left untreated is not well known. Surgery is usually recommended on the basis of retrospective analysis of a small number of fractures, suggesting that failure to oparate will lead to non-union in up to 30% of cases (Neer 1963, Edwards et al. 1992). Nordqvist et al. (1993) reviewed 110 fractures of the distal clavicle, of which 23 were unstable Neer 2-type frac-

tures treated without surgery. Non-union occurred in 5 of the cases, but the result was regarded as good in 3 and fair in 2. They concluded that surgical treatment is not necessary. In our series, we had 4 cases of non-union, of which 3 were asymptomatic and only one needed reoperation. It remains uncertain whether unstable fractures of the distal clavicle need to be operated upon in the first place. To date, no prospective randomized studies have compared surgical and non-surgical treatment of this fracture.

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