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TREATMENT OF COLLES' FRACTURE

A Prospective Comparison of Three Different Positions of Immobilization

OLA WAHLSTRÖM

Department of Orthopaedic Surgery, Regionsjukhuset, Linköping, Sweden

The usual treatment of Colles' fracture, i.e. fracture of the distal radius with dorsal angulation of the distal fragment, is closed reduction and immobilization in a plaster cast. The position of the forearm in the cast varies, according to the reports of various authors. Forty-two extra-articular fractures of the distal radius have been randomly divided into three groups. All were reduced, and the forearms were then immobilized in three different positions of rotation according to the grouping. The study indicates that the position of the forearm during immobilization is of importance as regards redislocation. After application of a plaster cast with the forearm in pronation there seems to be less likelihood of redislocation occurring than when the forearm is immobilized in supination ($P < 0.05$).

Key words: Colles' fracture; fracture reduction; immobilization, treatment

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The routine treatment for distal fracture of the radius with dorsal angulation – Colles' fracture – is closed reduction and immobilization in a plaster cast. A variety of techniques have been recommended for the reduction (Böhler 1953, Charnley 1963 and others) but usually it has been accomplished by traction and manipulation.

The reduction of the fracture is usually easy, but there is a tendency for redislocation to occur.

The extent of the plaster, its shape and the position of the hand in the plaster are three factors which vary in the reports in the literature (Lidström 1959). In a prospective, comparative study Poole (1973) used several methods of treatment and found that plaster cast of the forearm is as good as or even better than high plaster cast, the latter also immobilizing the elbow. Böhler (1953) recommends a dorsal plaster cast from the MCP-joints to the proximal part of the forearm. According to Böhler the forearm should be fixed somewhere midway between pronation and supination. Sarmiento (1965, 1975) recommended immobilization of the forearm in supination, which is said to prevent the redislocation which often occurs. Sarmiento stated that the brachioradial muscle was responsible for redislocation and from this point of view the pronation position could be considered especially unsuitable.

Other authors have reported good results using a modified method of Böhler (Blichert-Toft & Jensen 1971). In this method the forearm is placed in pronation and then immobilized.

Thus several opinions exist as to how best to immobilize the wrist after Colles' fracture. There seems to be no comparative study in which the importance of the different positions of the forearm, during immobilization in a plaster cast, has been investigated.

In this report the importance of three different positions of the forearm during immobilization after Colles' fracture has been studied.

Change of position during immobilization was evaluated roentgenologically.

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PATIENTS AND METHODS

In a prospective study three different positions of immobilization were compared. The study was performed between November 1977 and March 1979 at the Department of Orthopaedic Surgery, Regional Hospital, Linköping, Sweden. In order to obtain as homogenous a material as possible only women over 40 years with a closed extra-articular dislocated fracture of the radius (group II a+c according to Lidström 1959) were included. All fractures were reduced.

The patients were randomly divided into three different groups and were accordingly allotted to immobilization in pronation, supination or the midway position. They were all treated by the routine method to be described. The only difference was the position of immobilization.

The material consisted of 42 patients; 14 were included in the pronation group; 12 in the midway group and 16 in the supination group. The age of the patients was similar in the three groups, mean 65 years. The patients have been roengenographically examined immediately after reduction, 10 days after and finally 4–5 weeks after reduction. At the roentgenographic investigation, any change of position was estimated and especially the angle between the articular surface of the radius and the longitudinal axis on the lateral projection.

METHOD OF TREATMENT

Anaesthesia with local infiltration in the fracture haematoma with 1 per cent Xylocain or Carbocain was used. After a few minutes' traction the fracture was reduced. Tideström's apparatus (Figure 1) for traction and reduction was routinely used, as this enabled an exact adjustment of the degree of pronation or supination. The forearm was held in pronation during the manipulation. After fixation a dorsal plaster, at least 15 cm wide, was applied. The wrist was fixed in a slightly volar and ulnar flexion. The dorsal plaster slab also supported the radius and the ulna on the volar side. The wrist and the forearm were immobilized in a wide dorsal plaster in pronation, the midway position or in the supinated position, depending on which treatment group the patient belonged to. The plaster was applied from the MCP-joint to the elbow. It allowed movement in the MCP-joints and the elbow, but prevented movement in the wrist and considerably reduced pronation and supination movements in the forearm.

Figure 1. The Tideström apparatus for reduction of fractures of the forearm and hand has been used routinely at the Department of Orthopaedic Surgery, Regional Hospital, Linköping since 1976. The surgeon with both his hands free can manipulate the fracture while the patient's hand and forearm are fixed in the apparatus where traction and rotation are adjustable.

RESULTS

The results are given in degrees of dorsal angulation, i.e. the angle between the articular surface of the radius and the normal projection of the longitudinal axis of the radius. Redislocation $\Delta°$ is defined as a change of position occurring after reduction. The sign $\geq 10°$ indicates the number of patients where redislocation is greater than or equal to $10°$.

Five fractures have been re-reduced, one from the pronation group, one from the midway group and three from the supination group. The redislo-

Table 1. The increase in dorsal angulation in the three groups, i.e. the difference between the dorsal angulation immediately after reduction and that in the final position or the position existing at the time of re-reduction

	Pronation $n=14$	Middle way $n=12$	Supination $n=16$	Total $n=42$
Redislocation $\triangle°$ degrees of increased dorsal angulation ±s.d.	4.5±5.2	9.6±6.9	10.7±8.6	8.3±7.3
Patients with redislocations ≥10° number	2	6	8	16

Table 2. The dorsal angulation immediately after reduction and in the final position

	Pronation $n=14$	Middle way $n=12$	Supination $n=16$	Total $n=42$
Degrees of dorsal angulation after reduction ±s.d.	1.7±4.4	0.4±1.4	1.6±3.0	1.3±3.3
Degrees of dorsal angulation, final position ±s.d.	5.1±5.2	10.6±8.1	9.9±6.8	8.5±7.2
Age of the patients	64	67	64	65

cation was measured as the difference between the dorsal angulation immediately after reduction and that in the final position or the position existing at the time of re-reduction.

The increase in dorsal angulation was lower in the pronation group than in the other groups. (Table 1).

Table 2 shows the dorsal angulation immediately after reduction and at the final X-ray when the fracture was clinically healed. The final position is better in the pronation group than in the other groups. The position immediately after reduction is similar in all groups. The figures in Table 2 include the final position of the fractures that have been re-reduced.

The occurrence of redislocation in the pronation group is significantly ($P < 0.05$) lower than that in the supination group (Student's two-tailed t-test). However, the t-value is close to the limit and if applying, for instance, a rank sum test, the difference is not quite significant.

DISCUSSION

Sarmiento has drawn attention to the importance of the muscles as a deforming force in Colles' fracture. He states that the brachioradial muscle is the muscle which causes the typical redislocation in distal fracture of the radius. He has been able to show, with the aid of EMG studies, that the brachioradial muscle functions best when the forearm is in pronation. When the forearm is in supination its activity is reduced. He consequently recommends this position as being the best for avoiding redislocation of the fracture.

If, instead, the pronator quadratus muscle is studied, it can be seen that this could also cause the typical redislocation. The muscle is attached to the volar aspect of the proximal part of the radius and during contraction the proximal radius is displaced, with consequent dorsal angulation and radial displacement of the distal fragment. The typical displacement could then take place here as well. The pronator quadratus muscle contracts mainly when the forearm is in supination which makes this position especially unsuitable.

Our knowledge of how redislocation occurs in fractures of the radius is not sufficient to decide on a theoretical basis which position of fixation is the best.

Fixation in full pronation is most likely to give a more stable fixation of the peripheral fragment, and at the same time the proximal radius is prevented from further rotation. Both these factors contribute to the prevention of redislocation in the dorsal direction, whereas fixation in supination appears to allow such redislocation of the proximal radius. The results of this investigation give some support to the opinion that fixation in pronation counteracts redislocation better than other positions.

CONCLUSION

A prospective comparative study of three alternative positions of immobilization after extra-articular Colles' fracture is presented. The study indicates that the position of the forearm during immobilization is of importance for the degree of redislocation. The application of a plaster cast with the forearm in pronation seems better able to counteract redislocation than when the forearm is in supination.

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Correspondence to: Ola Wahlström, M.D., Department of Orthopaedic Surgery, Regionsjukhuset, S-581 85 Linköping, Sweden