IS ANATOMICAL REDUCTION OF FRACTURES OF THE FOURTH AND FIFTH METACARPALS USEFUL ?

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Most fractures of the fourth and fifth metacarpals are treated conservatively. How necessary it is to pursue anatomical reduction of these fractures has not been determined. In order to evaluate whether anatomical reduction will result in a better outcome, two groups of one hundred patients each, were compared. One group had been treated with near-anatomical reduction. Only partial reduction had been accomplished in a control group with similar fractures. The residual radiographic angulation of the subcapital fracture at the four-week follow-up was measured in both groups, but no significant difference could be demonstrated. In shaft fractures, however, the anatomical reduction group showed significantly less residual angulation. Only reduction of shaft fractures is worthwhile in order to achieve a better anatomical outcome.

Keywords : metacarpal ; fracture ; hand ; reduction.
Mots-clés : fracture ; main ; métacarpe ; réduction.

INTRODUCTION

Fractures of the fourth and fifth metacarpals are usually treated conservatively. There is, however, no consensus about the necessity to reduce these fractures, nor about the degree to which this should be accomplished (2, 7, 8, 9, 10, 12, 13). Reduction is often lost at follow-up. The author is not aware of any report evaluating the influence of the degree of initial reduction in relation to the residual angulation in these fractures. Previous studies have only described the results of a single therapy, without evaluating the actual influence of reduction on it (10, 11, 16). In the present study, the residual radiographic fracture angulations in two groups of patients with similar fractures were compared. In the first group, near-anatomical reduction had been achieved initially, versus partial reduction only in the second one.

PATIENTS AND METHODS

Some 200 patients were selected from the files of the casualty department of the Maasland Hospital Sittard. All had undergone conservative treatment for primary fractures of the fourth and fifth metacarpals, between November 1990 and May 1995. Manual dominance, fracture type and localisation, and the degree of communition were noted. In 100 cases, near-anatomical reduction had been achieved by means of one or more reduction procedures, performed under local anaesthesia (group A).

Reduction was defined as near-anatomical if a residual angulation of less than 5° had been achieved. The group was divided into subgroups of 10° increments in initial angulation in the subcapital region, and 5° increments in the shaft. A control group of 100 patients, with the same number of comparable fractures was compiled from the remaining files (group B). In this group only partial reduction had been achieved with a single reduction procedure. The decision whether or not to pursue initial anatomical reduction was solely dependent on the conviction of the specialist on duty. Reduction was defined as partial, if the residual angulation exceeded 5°. The fractures were assumed to be comparable in the two groups, when the location of the fracture and the degree of communition were similar, and when the fracture angulation belonged to the same subgroup. Radiographs were taken in standard

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PA, pronated oblique, and straight lateral views (3, 15). To improve reproducibility a positioning device (No. 583400 ; Infab Corporation, Camarillo, California) was used during pronated oblique positioning (5). All patients were treated with an antebrachial cast with the wrist in 45° extension, the MCP joints in 90° flexion and the IP-joints in 0°-10° flexion, for a period of four weeks. None of the patients was receiving physiotherapy. Control radiographs were taken after reduction, and at four-week follow-up, by which time permanent angulation has been reached (8). All radiographs were arbitrarily numbered to prevent observer bias. The fracture angulation was measured on all initial radiographs, on those taken after reduction and at follow-up to detect any loss of reduction. The actual angle of immobilisation of the MCP joint in the plaster was checked to be within 85°-95°, in order to prevent bias in outcome due to a different degree of immobilisation. All measurements were performed three-fold at six-week intervals using the standardised subcapital-axis-angle method (6). The mean value was used.

Statistical analysis was performed by means of the non-parametrical Kruskal-Wallis test. For statistical significance $p < 0.05$ was used.

RESULTS

The distribution of age, manual dominance and number of non-dominant fractured hands did not differ significantly between the two groups. Table I shows the distribution of the fractures. In the shaft fractures the mean angulation was 15.5° in the fourth, and 15.7° in the fifth metacarpal. In the subcapital area the mean angles were 30.2° and 38.9°, respectively.

Table II shows the angulation after the initial reduction and at follow-up for both groups. Reduction was partially lost in all but one case : a patient in group B.

In the shaft fractures, a better reduction resulted in a lower degree of angulation at follow-up in all subgroups. However, in the subcapital region no difference in residual angulation could be demonstrated between the anatomical- and partial reduction groups. Manual dominance was of no influence.

DISCUSSION

In this study the residual angulation in subcapital fractures was independent of the degree of initial reduction achieved, but in shaft fractures a significantly better reduction was maintained if an anatomical reduction could be accomplished initially. This was true in both the fourth and fifth metacarpals.

Fracture reduction was partially lost in all but one case (group B) despite adequate immobilisation. Many authors endorse this opinion (1, 4, 9, 10, 11, 16). As a result of the mechanism of injury and the forces across the metacarpo-phalangeal joint produced by the intrinsic muscles, angulation occurs in the radio-palmar direction in the subcapital fractures, and in the palmar direction in shaft fractures. Due to the palmar communition and predominantly cancellous bone in the subcapital region, no rigid support preventing re-dislocation after reduction is available in the subcapital

Table I. — The number of fractures in each subgroup

SHAFT :	No	1-5°	6-10°	11-15°	16-20°	21-25°	26-30°	31-35°
MC4 :	14	1	4	3	2	2	1	1
MC5 :	23	1	4	9	3	3	2	1
SUBCAPITAL :		1-10°	11-20°	21-30°	31-40°	41-50°	51-60°	61-70°
MC4 :	6	0	1	2	2	1	0	0
MC5 :	57	2	3	7	17	20	7	1

The angulation in each subgroup corresponds to the maximum angulation measured on either the PA, oblique pronated, or straight lateral radiograph. The fracture distribution in groups A and B is identical.

MC4 : fractures in the fourth metacarpal ; MC5 : fractures in the fifth metacarpal.

Table II. — The mean angulation after initial reduction and at follow-up

SHAFT :		1-5°	6-10°	11-15°	16-20°	21-25°	26-30°	31-35°
MC4 :		A B	A B	A B	A B	A B	A B	A B
mean	I-angle	3.0/4.0	7.5/7.5	12.3/12.3	18.5/18.0	21.5/21.5	27.0/28.0	34.0/33.0
mean	PR-angle	0.0/3.0	2.0/4.8	2.3/ 5.7	2.5/ 9.0	1.5/10.5	5.0/13.0	3.0/18.0
mean	FU4-angle	0.0/6.0	3.0/6.3	4.0/ 8.7	6.0/13.0	5.5/15.5	7.0/20.0	10.0/26.0
MC5 :		A B	A B	A B	A B	A B	A B	A B
mean	I-angle	3.0/4.0	7.3/7.5	12.1/12.3	17.0/17.0	23.7/23.0	27.5/28.5	33.0/34.0
mean	PR-angle	2.0/2.0	2.5/4.5	2.8/ 7.2	1.0/11.7	2.0/15.7	3.0/15.5	4.0/18.0
mean	FU4-angle	3.0/4.0	3.5/6.0	4.3/ 9.7	6.3/15.3	7.7/19.0	6.5/19.5	10.0/26.0
SUBCAPITAL :		1-10°	11-20°	21-30°	31-40°	41-50°	51-60°	61-70°
MC4 :		A B	A B	A B	A B	A B	A B	A B
mean	I-angle	—	14.0/15.0	26.0/26.0	35.0/35.0	43.0/44.0	—	—
mean	PR-angle	—	3.0/ 9.0	1.0/16.5	3.0/16.0	3.0/16.0	—	—
mean	FU4-angle	—	12.0/12.0	18.0/18.5	18.5/18.0	24.0/24.0	—	—
MC5 :		A B	A B	A B	A B	A B	A B	A B
mean	I-angle	7.0/8.0	15.0/15.3	24.3/24.6	35.7/35.6	44.0/44.5	55.6/55.7	—
mean	PR-angle	1.5/4.0	3.0/10.0	3.3/15.0	2.8/16.7	2.1/19.3	2.6/22.1	—
mean	FU4-angle	5.5/6.0	11.3/11.3	18.6/19.0	24.7/24.5	30.0/30.6	38.4/38.1	—

In each subgroup of initial angulation, the reduction achieved is partially lost again. In the shaft fractures only, can a smaller angulation at follow-up be achieved by means of a better reduction.
mean I-angle : angle before reduction ; mean PR-angle : angle after initial reduction ; mean FU4-angle : residual angle at four-week follow-up.

fractures. In shaft fractures, however, there is hardly ever communition, and the thick cortex will limit re-dislocation after initial reduction.

Functional measurements of the hands at follow-up were not included, because numerous studies have proven that the amount of residual angulation bears no relationship to residual symptoms or functional disability if rotational deformities are corrected (1, 2, 4, 7, 8, 10, 13, 16).

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SAMENVATTING

M. BRAAKMAN. Is anatomische repositie van fracturen van het vierde of vijfde os metacarpale zinvol ?

Fracturen van het vierde en vijfde os metacarpale worden meestal conservatief behandeld. Omdat het onbekend is of anatomische repositie zinvol is, werden twee groepen van 100 patiënten vergeleken. In één groep werd anatomisch gereponeerd, en in de andere groep met vergelijkbare fracturen, werd slechts gedeeltelijke repositie verkregen. De radiologische restangulatie werd na 4 weken gemeten. Bij subcapitale fracturen kon geen verschil worden aangetoond. Bij schacht fracturen leidde betere repositie tot minder restangulatie. Alleen bij schachtfracturen is repositie zinvol.

RÉSUMÉ

M. BRAAKMAN. Une réduction anatomique est-elle utile pour les fractures du 4ème et du 5ème métacarpiens ?

La plupart des fractures du 4ème et du 5ème métacarpiens sont traitées de façon conservatrice. L'intérêt d'une réduction anatomique initiale de ces fractures n'a pas été démontré. Nous avons cherché à évaluer l'intérêt d'une réduction anatomique initiale en comparant deux groupes de 100 patients chacun présentant des fractures comparables. Dans le premier groupe, une rédution pratiquement anatomique avait été obtenue au départ ; dans l'autre groupe, la réduction initiale était imparfaite. L'angulation résiduelle a été mesurée dans les deux groupes sur des radiographies prises au contrôle à 4 semaines ; aucune différence significative n'a pu être démontrée en ce qui concerne les fractures sous-capitales des métacarpiens. Dans les fractures diaphysaires au contraire, l'angulation résiduelle était moindre dans le groupe où la réduction avait été anatomique. Une réduction initiale n'a d'intérêt que dans le cas des fractures diaphysaires.