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Bone mineral loss after Colles' fracture

Plaster cast and external fixation equivalent

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The bone mineral content of the radius and ulna was analyzed in 31 postmenopausal women with displaced Colles' fractures. Sixteen fractures were treated with a below-the-elbow plaster cast and 15 with primary external fixation. The bone mineral content of the forearm bones was measured with a photon absorptiometer 9 (6–24) months later. There was a mean 15 percent mineral decrease in the radius, but no difference between the two treatment groups. The decrease did not correlate with the age of the patient, nor was there any correlation with grip strength or range of wrist motion. The more severe fractures, according to the Frykman classification, had a more pronounced mineral loss than the simpler fractures.

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A possible disadvantage of treating unstable Colles' fractures with external fixation is that the operative trauma of pin insertion may cause increased osteoporosis (Vaughan et al. 1985, Kongsholm et al. 1987, Jenkins et al. 1987, Kaukonen et al. 1989). The rather great rigidity of the external fixator may also induce increased osteoporosis.

We have measured the mineral content of the forearm bones in patients with displaced Colles' fractures treated either with a plaster cast or with external fixation.

Patients and methods

Our study included 31 otherwise healthy women, mean age 66 (53–82) years, with a displaced Colles' fracture. None of the patients had had a previous forearm fracture or had undergone hormonal therapy. The dominant side was affected in 14 cases. A radiographic examination with anteroposterior and lateral projections according to Friberg and Lundström (1976) was performed initially, after reduction, 11 days, and 4 and 8 weeks posttrauma.

The distribution of the fractures according to the classifications of Lidström (1959), Older (1965), and Frykman (1967) is presented in Table 1. One fracture was impossible to classify. Sixteen patients were treated with reduction and plaster-cast immobilization and 15 patients with primary external fixation. All the patients were immobilized for 4 weeks. There were no differences in age, type of fracture, or dominant side between the treatment groups. A clinical examination including subjective, objective, and radiographic evaluation was performed after 10–12 days, 4, 8, 12 weeks, and finally after 6 months. Grip strength was measured with a balloon vigorimeter. The mineral content of the forearm bones was measured with a modified computerized photon absorptiometer (ND 1100A Bone Density Scanner, Christiansen and Rødbro 1977) after 37 (23–96) weeks.

There was no difference in the follow-up time between the groups. The distal radius and ulna were scanned at 8-mm intervals; and from these data, a region of interest was chosen for the statistical evaluation in the bones proximal to the callus formation. The uninjured forearm was scanned at the corresponding level as a control, and the relative bone mineral content was calculated (BMC percentage).

The Mann-Whitney *U*-test (unpaired observations) was used to calculate the statistical differences between the groups, and chi-2 analyses were used for the ordinal data. Pearson's product-moment correlation was used for the analyses of the covariance. The statistical analyses were performed on a Macintosh® SE computer using the statistical package StatView SE + Graphics™. Differences were considered significant at $P < 0.05$.

Table 1. Classification of 30 Colles' fractures according to Lidström (1959), Older (1965), and Frykman (1967)

	Lidström					Older		Frykman							
	2A	2B	2C	2D	2E	3	4	1	2	3	4	5	6	7	8
Plaster cast	0	2	5	8	0	6	9	0	4	0	1	1	1	3	5
External Fixation	0	2	8	3	2	7	8	1	1	0	1	1	4	1	6

Table 2. Bone mineral content in the radius and ulna proximal to the fracture given as a percentage of the values of the contralateral arm. Mean (range)

	Plaster-cast treatment (n 16)		External fixation (n 15)	
	Radius	Ulna	Radius	Ulna
Mineral content	87 (68–99)	93 (76–123)	83 (61–102)	93 (77–120)

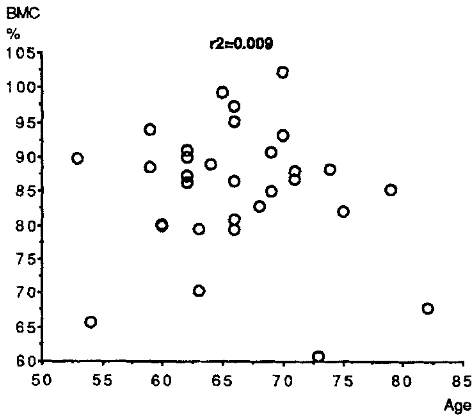

Figure 1. Correlation between age of the patients and BMC in the radius as a percentage of the values of the contralateral arm.

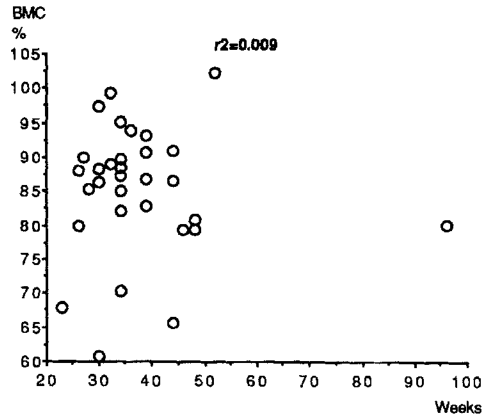

Figure 2. Correlation between time of injury (weeks) and BMC in the radius as a percentage of the values of the contralateral arm.

Results

No differences in bone mineral content were found neither in the radius nor in the ulna between the treatment groups (Table 2). Further, there was no correlation between the age of the patients and the decrease in bone mineral content in the radius (Figure 1), nor was there any correlation between the bone mineral content in the radius and ulna and the time lapse between the injury and the analysis (Figure 2). The loss in bone mineral content did not correlate with grip strength or range of motion at any time during the rehabilitation of the entire patient material. The average decrease in bone mineral content of the less severe Frykman (1967) fractures, Types 1–7, was 11 percent (Figure 3). For the most severe fractures, Type 8, the loss was 21 percent (P = 0. 012).

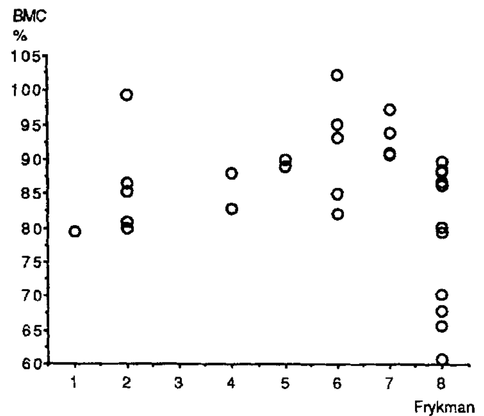

Figure 3. Correlation between Frykman's class (1967) and BMC in the radius as a percentage of the values of the contralateral arm.

Discussion

The amount of bone mineral loss found was in agreement with previous studies, e.g., Westlin (1974) who found a decrease of 18 percent after a Colles' fracture. The bone mineral loss following a fracture can be due to both the posttraumatic effect (Nilsson and Westlin 1975) and the stress shielding due to the fixation (Terjesen and Benum 1983). There was no difference between the two treatment groups, indicating that the bone loss is mainly posttraumatic. Further support for this is that the bone mineral loss was less in the nonfractured ulna, which at least in the plaster-cast group was immobilized in the same way as the radius. That the mode of treatment did not affect the decrease in bone mineral content accords with the findings of Ahl et al. (1988), who reported that the calcaneal bone density in patients operated on for ankle fractures was the same after weight bearing as after nonweight bearing for 7 weeks, and Andersson and Nilsson (1979), who found no difference in bone mineral content between weight bearing and nonweight-bearing treatment of tibial fractures. The severity of the initial trauma is of significance as regards the amount of posttraumatic bone loss, because Frykman (1967) Type-8 fractures were associated with more bone loss than the less severe fractures.

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