

Department of Orthopedic Surgery, Malmö General Hospital (University of Lund)
Malmö, Sweden.

LONG-TERM OBSERVATIONS ON THE LOSS OF BONE MINERAL FOLLOWING COLLES' FRACTURE

Bo E. NILSSON & NILS E. WESTLIN

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In a longitudinal study of the changes in bone mineral content in the forearm after fracture of the distal end of the radius (Colles' fracture) Westlin (1974) could demonstrate an average loss in the shafts of the fractured forearm of 18 per cent. This change occurred during the first 4 months after the injury. During the first year after the injury there was no tendency towards restoration of the lost mineral.

There is no data available on long-term observations of the bone mineral content after forearm fractures. In order to find out if the loss of bone mineral after the fracture is permanent and irreversible it was decided to carry out a cross-sectional retrospective study in women with Colles' fracture.

MATERIALS AND METHODS

Included in the study were 74 women, age $61.8 \pm 9.5^*$, who had sustained a fracture of the distal end of the radius—Colles' fracture. The time which had elapsed after the injury ranged from 1 month to about 12 years. Only women in whom the fracture was the result of a trauma equal to or less than falling from the standing position were included. None of the women had a history of other fractures or of disease in the upper extremities. Also, in other respects these women were rated as healthy.

The bone mineral content in the forearms was measured using the method of gamma absorptiometry (Nilsson & Westlin 1972, Westlin 1974). Rectilinear scans were made across both bones of the forearm 6 cm and 1 cm from the distal dorsal edge of the ulna (Figure 1). The bone mineral content was calculated and expressed in mg of bone mineral/cm² of the radius plus the ulna in the pathway of the beam. In addition, in some cases the thickness of the combined cortices of

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* Average \pm SD.

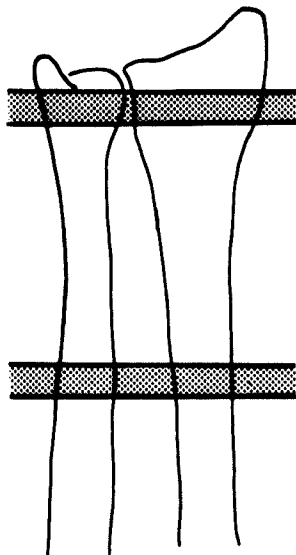


Figure 1. Measuring sites.

the radius and the ulna was calculated from the total widths and the widths of the marrow cavities of the two bones obtained from graphical tracings of the rectilinear scans of the proximal measuring sites (Westlin 1974).

The difference between the values obtained for the fractured and the uninjured side was calculated for both measuring sites and referred to as the *residual difference*. Because of the skewed distribution of the variable of time after fracture the logarithm was used in order to adjust the data to least square statistics.

RESULTS

The parameter of post-traumatic osteoporosis, the residual difference, included a large scatter (Figure 2). The bone mineral content of the fractured arm as compared to the uninjured decreased during the first 4 months and then appeared to reach a minimum. Also, it has previously been demonstrated that the post-traumatic loss increases during the first 4 months after fracture (Westlin 1974). Therefore, values obtained before 4 months were excluded leaving 50 cases observed from 4 months onwards for further calculations.

There was a highly significant difference between the fractured and the uninjured forearms (Table 1). In the fractured arms the bone mineral content was reduced by about 9 per cent as compared to the uninjured arms, measured on the proximal site. On the distal site, the site

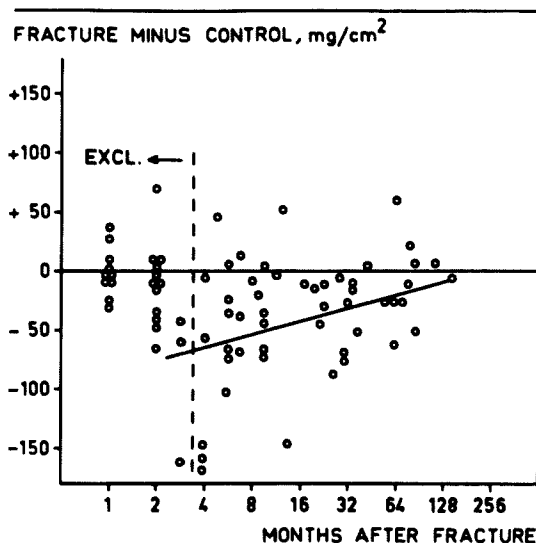


Figure 2. The residual difference, values for fracture minus those for uninjured forearm, in relation to time after the injury.

Table 1. Bone mineral content of the forearms of women with Colles' fracture (mg/cm², average \pm SD).

		Fracture	Uninjured	P*
Proximal	n = 50	414 \pm 65	453 \pm 84	P < 0.001
Distal	n = 48	274 \pm 63	226 \pm 76	P < 0.001

* T-test of pairs.

of the fracture, the mineral content was about 20 per cent greater in the fractured arm.

From the data of bone mineral content of the radius and the ulna on the proximal measuring site, presented in Figure 2, it can be seen that post-traumatic osteoporosis expressed as the residual difference between the fractured and the uninjured forearms is still obvious in the group years after the injury. There is, however, a tendency towards a decreasing residual difference which is significant ($r_{50} = 0.37$, $0.01 > P > 0.001$).

The variable of residual difference in cases observed 4 months and later after the fracture was also correlated to the age of the patient at the time of the fracture. This relationship was not a rectilinear

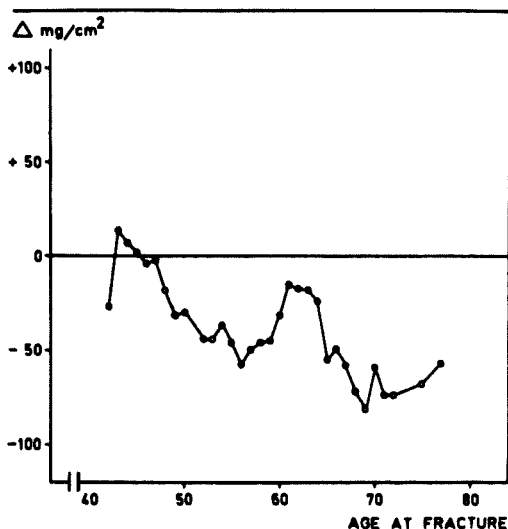


Figure 3. The residual difference, values for fracture minus those for uninjured forearm, in relation to the age at the time of the fracture ("running average").

one (Figure 3). It appears from these data that the peri- and early postmenopausal women are more vulnerable and lose more bone mineral after Colles' fracture. Also, there is a tendency towards a greater than average loss also in the oldest age groups. Interaction between age at the time of the measurement, age at fracture and time elapsed after fracture could not be demonstrated to be significant but it cannot be decided with certainty whether the apparent absence of post-traumatic osteoporosis before the age of 50 is due to restoration of lost mineral or to the fact that these women lost less in the first place.

The combined cortical thickness was measured in both forearms in 15 cases 2 years or more after the fracture. The thickness was 0.3 mm greater in the fractured arm without any significant or suggestive difference between the sides.

DISCUSSION

The major error in the data of the present study is introduced when the bone mineral content of the fractured forearm is related to that of the uninjured side. It has previously been demonstrated that there is a considerable although non-systematic left-right variation of bone mineral content in the forearms (Nilsson & Westlin 1974).

In a longitudinal study Westlin (1974) failed to demonstrate any restoration of the bone mineral content within the first year following Colles' fracture. In other studies of post-traumatic or other local osteoporosis covering many years after injury or onset of disease there has been little evidence of restoration of lost bone in adults (Nilsson 1966, Lundberg & Nilsson 1968, Nilsson & Westlin 1969). The findings of the present study seem to indicate that Colles' fracture in women unlike injuries or conditions with local osteoporosis previously studied is associated with a restoration of the lost mineral. However, it should be kept in mind that the parameter of post-traumatic osteoporosis in this study, the residual difference, is a result of changes in the fractured as well as in the uninjured limb. We are unable to differentiate between these changes; the decrease of residual difference may be due to a more rapid change with time in the uninjured than in the injured forearm after fracture. This limitation is inherent in a cross-sectional study. However, in a previous study it has been demonstrated that in the forearm loss of bone mineral is a constant finding after fracture (Westlin 1974). Therefore, the finding in certain age groups of this study of very little or no residual difference supports the hypothesis that a true restoration of bone mineral to the injured forearm may have taken place.

The finding of a greater loss of bone mineral in women in the perimenopausal and early postmenopausal age groups is in agreement with the findings of Nilsson (1966).

Westlin (1974) demonstrated that the loss of bone mineral in the shafts of the forearm following Colles' fracture was not associated with thinning of the cortices of the bones. In this study it is demonstrated that also later, two years or more after the fracture, the residual difference between the fractured and the uninjured sides cannot be explained by cortical thinning but is due rather to cortical porosity.

S U M M A R Y

Seventy-four women were studied at various points in time between 1 month and 12 years after a fracture of the distal end of the radius—Colles' fracture. In 50 cases the maximum loss of bone after fracture was considered to have taken place in that more than 4 months had elapsed since the accident. The bone mineral content was measured in both forearms with gamma absorptiometry. It was demonstrated that the degree of post-traumatic osteoporosis, calculated as the difference

between the values obtained for the injured and the uninjured arms, decreased with time. The difference between the arms was greater in peri- and early postmenopausal and in very old women suggesting that these groups had lost more bone and/or been less able to restore lost mineral with time.

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Correspondence to:

Bo Nilsson, M.D.
Dept. of Orthop. Surg.
MAS
Malmö
Sweden