The ankle fracture as an index of future fracture risk

A 25–40 year follow-up of 1063 cases

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In 1992 a retrospective case control study was performed, based on all patients with ankle fractures (n 1063) treated at the Department of Orthopedics in Malmö, Sweden, between 1950–1951 and 1961–1965. As all radiographic examinations have been saved in Malmö, we were able to study all subsequent fractures that this group had sustained. 260 patients from 1961–1965 who were still living in Malmö today were also compared with an age- and gender-matched control group regarding the location and type of subsequent fractures.

The group with former ankle fractures continued to have a two-fold increased incidence of all sorts of fractures. The same result was found when looking at the upper and lower extremities separately. However, the risk of sustaining new fractures in the once-fractured extremity was not increased compared to the uninjured side.

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Nilsson (1966), Andersson and Nilsson (1979) and Obrant and Nilsson (1984) have found a decreased bone mineral content in the same limb after a tibial shaft fracture. 1 year after a fracture of the tibia diaphysis, there remains, on average, 75 percent of the bone mineral content in the proximal tibia (Andersson and Nilsson 1979). Even 30 years after a tibial shaft fracture, the bone mineral content is not restored in the femoral condyle (Karlsson et al. 1993b). This indicates that bone mineral loss after a tibial shaft fracture in adults is permanent. After an ankle fracture there is a bone mineral loss in the injured leg compared to the uninjured. There is some restoration of bone mass during the first year but hardly any regeneration during the second year after the trauma (Finsen et al. 1989). As the bone mineral loss after a fracture seems to be permanent this could lead to an increased incidence of fractures in the once-injured leg.

The purpose of this study was to see if post-traumatic osteopenia in the once fractured extremity is followed by an increased incidence of new fractures in this leg compared to the uninjured side. We also wanted to study the overall incidence of subsequent fractures in the previously fractured group compared to controls.

Patients and methods

All cases with ankle fractures in the city of Malmö in 1950–1951 and 1961–1965 were registered. After exclusion of patients with previous fractures in the legs and multifractures at the time of the injury, 1063 patients remained. 212 of these patients were less than 18 years old at the time of the ankle fracture. Referrals and reports at the Department of Diagnostic Radiology were scrutinized for all subsequent fractures and possible side-preponderance in all these individuals. 260 of the cases with fractures during 1961–1965 were still living in Malmö at the time of the follow-up in 1992. These were compared with double numbers of age- and gender-matched controls, randomly selected from the city files. The controls were living in Malmö in the early 60s as well as today.

Malmö had a population of 192,000 inhabitants in 1950 and 233,000 in 1982. In the city there is only 1 hospital where virtually all emergency cases are treated. All fractures in city residents, and those which occur outside the city, are recorded at the Department of Diagnostic Radiology in the same hospital. All radiographs have been saved, and from 1950, registered in the same way. From the referrals and reports, we could register and classify all fractures that the study group and the controls had sustained during the 25–40 years of follow-up. The total number of fractures was calculated and the side-localization compared to the previous ankle fracture side.

Statistical calculation was done by using the chi-square test and odds ratio test.

Table 1. Number of patients with new fractures after an ankle fracture. Some patients have had more than one fracture

		Total body		Upper extremity		Lower extremity	
	N	Ipsilateral	Contralateral	Ipsilateral	Contralateral	Ipsilateral	Contralateral
All patients	1063	124	104	82	72	72	58
Men	562	54	57	35	39	32	30
Women	501	70	47	47	33	40	28
Patients							
<18 years	212	18	11	10	7	8	6
>18 years	851	106	93	72	65	64	52

There were no significant differences between the ipsilateral and contralateral groups.

Table 2. Number of individuals with new fractures. Former patients with ankle fractures compared with controls without earlier fractures in the lower extremity. Some individuals have had several fractures

	N	Total body	Upper extremity	Lower extremity
All patients	260	106 ***	70 **	48 **
vs				
Controls	520	129	93	54
Patients <18 yr	57	18 *	13 ns	7 ns
vs				
Controls	114	19	15	6
Patients >18 yr	203	88 ***	57 *	41 **
vs				
Controls	406	110	78	48

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$

Table 3. Number of individuals with new fractures. Former patients with ankle fractures separated into sexes compared with controls without earlier fractures. Some individuals had had several fractures

	N	Total body	Upper extremity	Lower extremity
Women	134	62 **	42 ns	33 **
vs				
Controls	268	81	64	36
Men	126	44 ***	28 **	15 ns
vs				
Controls	252	48	29	18

*$P < 0.05$, **$P < 0.01$, ***$P > 0.001$

Results

We found no preponderance of patients with new fractures of the once-injured side (n 1063). The same result was found for the upper and lower extremities investigated separately (Table 1). When looking at the risk of getting a second, third or fourth fracture after the initial injury, no difference was found between the sides. The same result was found in the upper and lower extremities separately. Regarding the total number of fractures, 267 were found in the same side and 223 in the opposite side, compared to the original ankle fracture. The corresponding values for the upper extremitites were 148 new fractures in the same side as the original ankle fracture and 126 in the opposite side. In the lower extremities there were 105 and 88 new fractures, respectively. When age at initial ankle fracture was taken into account, no side difference was found. No difference was found for fractures in the right or left side of the body.There was no difference for either men or women when comparing former fractured and unfractured sides as regards future fracture risk (Table 1).

The group with former ankle fractures still alive in Malmö had more fractures compared with controls. The same result was found when looking at patients with fractures in the upper and lower extremities separately (Table 2). The odds ratio to have a new fracture within the follow-up period was 2.1 for those with ankle fractures. Among children with ankle fractures and still living in Malmö, we also found a predominance of individuals with new fractures compared to controls (Table 2). The odds ratio for children having a new fracture was 2.3. No difference was found when looking at the upper or the lower extremity separately. Among those who were adults at the time of the injury and still living in Malmö, there was also a predominance of patients with fractures in the upper extremities, lower extremities and as a whole, compared to the controls (Table 2). The odds ratio of having a new fracture in the follow-up period was 2.3 in adults. Both in women and men, we found more subjects with new fractures in the former ankle fracture group compared to controls (Table 3). The odds ratio to sustain a new fracture was for women 2.0 and for men 2.3.

Discussion

Due to the unique health care system in Malmö, with 1 emergency hospital and with all the radiographic referrals and reports saved since the beginning of the century, we could follow a well-defined group of ankle fracture patients and register all fractures that this group had sustained during a follow-up period of up to 40 years. We found no increased risk of sustaining fractures in the same side as the previously fractured leg. This indicates that post-traumatic osteopenia is of minor clinical importance after an ankle fracture. The same result has earlier been found in a group of patients with tibia shaft fractures (Karlsson et al. 1993a). In this study we had early bone mineral data in 89 patients. No difference in the future fracture incidence was detected between those with more than average bone mass loss and those with less than average bone mass loss after the tibial shaft fracture. As this group of patients, however, was rather limited and a tendency for ipsilateral preponderance of new fractures was found, we thought it might be of interest to study a larger group of patients, i.e., patients with ankle fracture.

It is well known that a fracture in an extremity is followed by a marked decrease in bone mineral content in the fractured extremity (Nilsson 1966, Westlin 1974, Nilsson and Westlin 1977, Andersson and Nilsson 1979, Obrant and Nilsson 1984, Finsen et al. 1989, Karlsson et al. 1993b). Even 30 years after a tibial shaft fracture there is a remaining bone mineral loss in the femoral condyle (Karlsson et al. 1993b). Also after an ankle fracture, there is a loss of 9 percent in the injured extremity. During the second year there is hardly any bone mass restoration (Finsen et al. 1989). Whether this well-documented bone mineral loss is followed by an increased risk of sustaining future fractures in the same extremity is still under debate. Finsen et al. (1989) concluded that after femoral shaft fracture and supracondylar femoral fractures the bone mineral changes may offer an explanation of the following unequal distribution of secondary fractures. After other fractures, for example, cervical and trochanteric hip fractures, a new fracture is likely to appear in the contralateral side. This indicates that bone mineral loss could not explain all of the subsequently altered pattern of fracture incidence after previous fractures. Change in bone mineral content is only one of a number of possible causes of altered fracture predisposition after previous fractures. Decreased muscle strength, derangement of joint mobility or discoordination may be of more importance for the future fracture localization.

As with the findings after tibial shaft fractures (Karlsson et al. 1993a), we found, after ankle fractures, an increase in the total fracture incidence in both the lower and the upper extremities. Whether this group of patients is more prone to falling or having a life-style with a higher incidence of traumas, is unclear. There are no data about the bone mineral content in the total body in patients with previously sustained ankle fractures compared to controls. 30 years after a tibia shaft fracture there are no differences, however (Karlsson et al. 1993b). It is therefore unlikely that a bone mass difference could explain the differences in fracture incidence.

In conclusion, we have found that patients with ankle fractures continue to sustain an increased number of new fractures, but without any preponderance for the initially fractured side. Possible remaining differences in local bone mineral content should therefore be of minor clinical importance.

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