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Past fractures indicate increased risk of hip fracture

We compared the prevalence of previous fractures among 428 women and 147 men who had hip fractures with the fracture prevalence of the general population. An increased prevalence of previous fractures was found in patients with a hip fracture up to the age of 70 for women and 80 for men. Below these age limits, the probability of a later hip fracture increased with the number of previously sustained fractures.

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It seems probable that a progressively larger proportion of fractures occurring after a certain age do so because the skeleton is weakened by osteoporosis. A larger proportion of osteoporotic individuals could therefore be expected among patients with previous fractures after this age than in the population in general. Such individuals might thus be more likely to sustain hip fractures later in life.

We determined whether a history of previous fracture after the age of 40 is more common in patients treated for hip fracture than in the general population, and whether individuals with a history of multiple fractures after the age of 40 years are more at risk than those who have sustained fewer fractures.

Patients and methods

All fractures in Trondheim residents, and many in the surrounding area, are treated at our hospital. All fracture patients treated in 1983 and 1984, except those with fractures of the head and neck, were interviewed at the time of treatment with regard to their fracture histories.

Fracture incidence was based on the census figures for the city of Trondheim, and the fractures occurring in Trondheim residents during the period under study. No effort was made to collect information on Trondheim residents with fractures treated away from Trondheim as this number is known to be low.

The age- and sex-specific incidence of a fracture of any kind after the age of 40 was calculated, and the prevalence at any age of having sustained a fracture was estimated by calculating the area under the incidence curves.

The prevalence of having sustained a fracture after the age of 40 was determined from the fracture history for each age-group among our hip fracture patients. A ratio was calculated by dividing the prevalence in hip fracture patients by that in the general population.

To evaluate the significance of multiple previous fractures, we calculated the incidence and prevalence in the general population of sustaining the first, second, third, and fourth or more fractures after the age of 40. We let fractures of paired bones, such as radius and ulna or tibia and fibula or multiple fractures of one hand or foot, count as one fracture only. On the other hand, two fractures in different parts of the skeleton, such as a hip fracture and a Colles' fracture occurring at the same time, were counted as two – two first fractures were considered to have occurred. If such a patient had a later fracture, this was counted as the patient's third fracture.

The corresponding prevalence was then calculated for our hip fracture patients, and the ratio of prevalence in hip fracture patients to that in the general population determined.

Results

During the 24 months studied, 575 hip fractures were treated in patients over age 50 (Tables 1 and 2). The frequency of a history of previous fracture was more than twice as high in female patients with hip fracture than in the general population up to the age of approximately 65 years, whereas it was three times as high in male patients with hip fracture up to about age 75 years (Figure 1).

All age-groups up to 70 years in women and 80 years in men had a ratio > 1, which increased with the number of previous fractures, but decreased with age (Figure 2).

Table 1. Hip fracture patients. The number of previous fractures after the age of 40 years.

Age	Total	Number of previous fractures				
		0	1	2	3	4 +
Women						
50–	12	8	4	0	0	0
55–	12	6	3	0	3	0
60–	23	14	5	1	2	1
65–	33	21	8	3	0	1
70–	50	29	19	2	0	0
75–	71	38	26	3	3	1
80–	98	57	29	8	2	2
85–	91	56	19	12	4	0
90+	38	21	11	6	0	0
Total	428	250	124	35	14	5
Men						
50–	8	6	2	0	0	0
60–	32	21	11	0	0	0
70–	47	31	9	4	1	2
80+	60	47	9	1	3	0
Total	147	105	31	5	4	2

Table 2. Fracture patients resident in Trondheim. The number of patients sustaining their first, second, third, and fourth or more fracture after the age of 40 years.

Age	Total	Number of patients				Population at risk (thousands)
		Rank of fracture				
		1st	2nd	3rd	4th+	
Women						
40–	31	30	0	1	0	3.8
45–	36	33	3	0	0	3.1
50–	87	70	14	3	0	3.2
55–	102	70	27	4	1	3.8
60–	140	84	43	6	7	3.9
65–	146	71	57	10	8	3.4
70–	141	78	45	13	5	2.8
75–	136	79	39	10	8	2.3
80–	141	82	38	13	8	1.5
85–	92	45	28	12	7	0.8
90+	36	21	11	4	0	0.3
Total	1088	663	305	76	44	29
Men						
40–	74	68	5	1	0	6.8
50–	84	56	24	4	0	6.6
60–	101	66	25	8	2	6.3
70–	74	50	14	9	1	3.2
80+	67	45	16	4	2	1.0
Total	400	285	84	26	5	24

Discussion

The incidence of certain fracture types has increased (Alffram 1964, Baker 1980, Jensen 1980, Lewis 1981, Zetterberg & Andersson 1982, Frandsen & Kruse 1983, Swanson & Murdoch 1983, Elabdien et al. 1984, Johnell et al. 1984, Bengnér & Johnell 1985, Finsen & Benum 1986a), and it may be assumed that the incidence of fractures in general may have increased to some extent, so that our estimate of the prevalence of previous fractures in the general population is somewhat high.

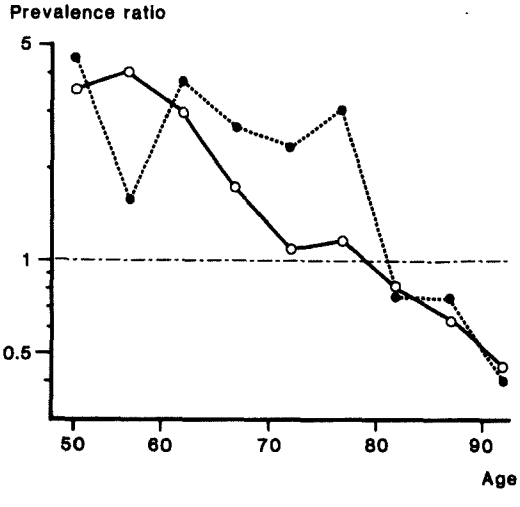

Figure 1. Prevalence of previous fracture after the age of 40 years. Ratio of hip fracture patients/general population. Women ——, Men ·····.

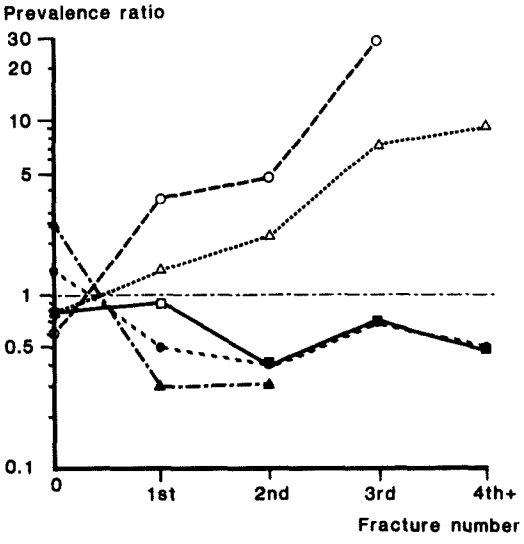

Figure 2. Ratio of prevalence of previous fractures in women after the age of 40 years. Hip fracture patients/general population.
Age 50 – – –, 60 ·····, 70 ——, 80 - - - -, 90 —·—·

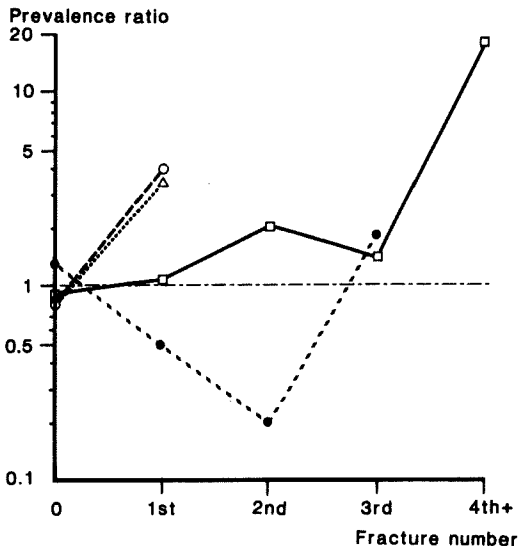

Figure 3. Ratio of prevalence of previous fracture in men after the age of 40 years. Hip fracture patients/general population. Age 50 ----, 60 ·····, 70 ——, 80 - - - -

The calculation of the prevalence of previous fracture in the hip fracture patients, on the other hand, relies on the patients' memory; in many cases this was incomplete, as some patients were mentally debilitated. In addition, it is difficult for 90-year-old patients, even if lucid, to remember the fractures they have sustained during 50 years. In both cases the confounding factors would be contrary to our finding that there is a preponderance of previous fractures among women treated for hip fractures at least until the age of 70 years, and that the same is true of men up to the age of 80 years. Below these ages, therefore, a history of previous fracture after 40 years of age is an indication of increased risk of later hip fracture.

It is not surprising that few of the younger patients previously had multiple fractures after the age of 40 years – time alone would preclude this. Nevertheless, there was a tendency for an increasing number of previous fractures to better the separation between the hip fracture patients and the general population. In the oldest patients the bias caused by failing memory will no doubt increase. In addition, it must be borne in mind that the proportion of hip fractures among all fractures incurred increases dramatically with age – in patients over the age of 80 more than half of all fractures are hip fractures – and that fracture of a hip greatly reduces the risk of subsequent fracture of the same hip (Finsen & Benum 1986b). As the fracture-prone patients grow older, the chance increases that they already have sustained hip fractures and therefore have a reduced risk of hip fracture in spite of multiple previous fractures.

We conclude that at least men under the age of 80 years and women under 70 who have a history of previous fractures after the age of 40 are more liable to sustain hip fractures than the general population, and that this risk increases with each fracture unless the fracture is of the hip.

References

Alffram, P. A. (1964) An epidemiological study of cervical and trochanteric fractures of the femur in an urban population. *Acta Orthop. Scand.* Suppl. 65.

Baker, M. R. (1980) An investigation into secular trends in the incidence of femoral neck fracture using Hospital Activity Analysis. *Public Health* **94**, 368–374.

Bengnér, U. & Johnell, O. (1985) Increasing incidence of forearm fractures. A comparison of epidemiological patterns 25 years apart. *Acta Orthop. Scand.* **56**, 158–160.

Elabdien, B. S. Z., Olerud, S., Karlström, G. & Smedby, B. (1984) Rising incidence of hip fractures in Uppsala, 1965–1980. *Acta Orthop. Scand.* **55**, 284–289.

Finsen, V. & Benum, P. (1986a) Changing incidence of hip fractures in rural and urban areas of central Norway. *Clin. Orthop.* In press.

Finsen, V. & Benum, P. (1986b) The second hip fracture. *Acta Orthop. Scand.* In press.

Frandsen, P. A. & Kruse, T. (1983) Hip fractures in the county of Funen, Denmark. *Acta Orthop. Scand.* **54**, 681–686.

Jensen, J. S. (1980) Incidence of hip fractures. *Acta Orthop. Scand.* **51**, 511–513.

Johnell, O., Nilsson, B., Obrant, K. & Sernbo, I. (1984) Age and sex patterns of hip fracture – changes in 30 years. *Acta Orthop. Scand.* **55**, 290–292.

Lewis, A. F. (1981) Fracture of neck of femur: Changing incidence. *Br. Med. J.* **283**, 1217–1220.

Swanson, A. J. G. & Murdoch, G. (1983) Fractured neck of femur. Pattern of incidence and implications. *Acta Orthop. Scand.* **54**, 348–355.

Zetterberg, C. & Andersson, G. B. J. (1982) Fractures of the proximal end of the femur in Göteborg, Sweden, 1940–1979. *Acta Orthop. Scand.* **53**, 419–426.