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Hip fracture incidence in Stockholm 1972–1981

We studied the incidence of cervical and trochanteric hip fractures in Stockholm, Sweden from 1972 through 1981. The material, selected from a computerized medical information register, consisted of 11 812 cervical fractures and 8094 trochanteric fractures. The incidence did not change in the age group 50–74 years. In males 75 years of age and older, the incidence of both fracture types caused by moderate trauma increased annually by 5–6 per cent. In females 75 years and older, the incidence of trochanteric fractures caused by moderate trauma increased annually by 6 per cent, whereas the incidence of cervical fractures increased only marginally.

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During recent decades there have been conflicting reports on the incidence of hip fractures. Scandinavian and British studies have reported an increase (Alffram 1964, Horsman 1976, Falch & Ilebekk 1978, Baker 1980, Jensen 1980, Lewis 1981, Zetterberg & Andersson 1982, Frandsen & Kruse 1983, Elabdien et al. 1984, Johnell et al. 1984). Two studies, one from the United States and one from Sweden, reported no increase (Melton et al. 1982, Wallöe et al. 1983). The magnitude of the reported increase of hip fracture incidence in the studies from Oslo, Norway, and Gothenburg, Sweden, is impressive and has important medical and socio-economic implications.

We studied the incidence of femoral neck and trochanteric fractures for possible changes in Stockholm County, Sweden, from 1972 through 1981. We also looked for possible changes specific for sex, age, type of fracture, and also for type of trauma causing the fracture.

Patients and methods

Since 1971, all hospital discharges in Stockholm County have been reported to a computerized medical information register (Peterson 1975), the Inpatient Care Register (ICR). Each registration contains name, sex, date of birth, place of residence, date of admission and discharge, hospital department, diagnostic code, operation code, and anesthesia. The external cause (E-code) of the fracture is also coded according to the Nordic version of the ICD. For fractures a five-digit code is used, subdividing cases into fracture, compound fracture, and sequelae from fracture (Socialstyrelsen 1968).

We selected for our study all hospital discharges with a diagnosis of (cervical) fracture of the femoral neck or the trochanteric region of the femur (code numbers 820.00, 820.10, 820.01, 820.11) from 1972 through 1981. To avoid multiple registrations caused by transfers between hospitals and departments, only the first admission, for fracture, in hospitals with emergency care was considered. Thus, fractures of the same type occurring more than once in the same individual during the study period were not included. Bilateral cases were considered as separate fractures only in cases of a cervical and a contralateral trochanteric fracture. This results in an underestimation of the incidence rate of 1.8 per cent for the whole period under study, calculated from the original medical files of a randomly selected sample of 218 hip-fracture patients. The validity of the data in the register was estimated by an examination of the randomly selected cases. The diagnostic code was correctly recorded in 95.4 per cent and the E-code in 98 per cent. In 9 of the 10 misclassified cases, a trochanteric fracture was given the code number for a cervical fracture and in one case *vice versa*. Thus, all misclassified cases were proximal femoral fractures, but the subclassification was incorrect.

To estimate a reporting rate error in the ICR-data from 1972 to 1981, we analyzed 885 hip fracture cases reported to the ICR. The cases were identified in the files in the Radiology Department and in the operation files at Huddinge Hospital from 1972 to 1981. Eight hundred and sixty-eight fractures (98 per cent) were recorded in the ICR. Seventeen unre-

Table 1. Number of cervical (C) and trochanteric (T) fracture cases each year of study

	Male		Female		
	C	T	C	T	Total
1972	226	184	753	398	1561
1973	262	187	792	461	1702
1974	279	215	881	543	1918
1975	270	224	873	551	1918
1976	309	256	926	600	2091
1977	303	240	931	598	2072
1978	306	248	905	619	2078
1979	295	258	908	625	2086
1980	330	234	947	654	2165
1981	349	260	967	739	2315
Total	2929	2306	8883	5788	19906

ported cases were fairly evenly distributed over the period. To some extent it is possible for the ICR to estimate the proportion of hospital discharges that are never reported. The overall proportion in the first years under study was 2–3 per cent, and 1 per cent during the last years. Our 2 per cent frequency of unreported hip fractures accords closely with the ICR data. Whether Huddinge Hospital is representative for Stockholm county in this respect is not known.

Our sampling method seems therefore to result in a slight underestimation of the true incidence, somewhat more pronounced in the first years under study.

The increased reporting rate of approximately 1–2 per cent during the whole period could theoretically lead to a falsely increasing incidente rate. The effect on the time trend of the missed refracture cases, however, works in the opposite direction. The low values of both missed refracture cases and unreported cases seem to warrant the conclusion that the ICR data are of satisfactory quality for the purpose of the investigation.

The risk population was the inhabitants of Stockholm County. From the population register, the mean population was calculated for each year in the study period. Only individuals aged 50 years or more were included. The material was stratified by sex, 5-year age groups, and year of admission (Tables 1 and 2). To study time trends in the incidence rates, differences in age distribution were accounted for by means of a multiplicative model, which is standardized for age and compares each year to the first year under study (Alfredsson & Ahlbom 1983). In addition, an exponential regression model was used to estimate the average annual change of the incidence rates based on the same multiplicative model.

Moderate trauma was defined as a fall at the same level. Traffic accidents and a fall from one level to another were considered as severe trauma. Since the E-code was not reported in 7 per cent of the cases and the unreported E-codes were unevenly distributed over the study period (0–19 per cent yearly), the time-trend analysis was made with corrected values.

Results

The pooled relative risk of cervical fractures in women under and over 75 years of age decreased yearly during the period of study by 1.1 and 0.6 per cent, respectively (Figure 1). In both age intervals, the 90 per cent confidence limits (−2, 1) included the possibility of no

Table 2. Total number of cases and incidence rates per 10000 person years in cervical (C) and trochanteric (T) fracture cases in 5 year age groups

Age	Male				Female			
	C		T		C		T	
	Cases	Incidence	Cases	Incidence	Cases	Incidence	Cases	Incidence
50–	128	2.9	154	3.4	175	3.7	72	1.5
55–	206	4.7	202	4.6	361	7.4	139	2.9
60–	315	8.2	271	7.1	492	11	253	5.6
65–	351	11	336	11	817	20	388	9.5
70–	455	20	369	16	1292	39	635	19
75–	548	40	353	26	1763	72	1092	45
80–	447	63	315	44	1925	127	1384	92
85–	308	107	201	70	1390	188	1167	158
90–	171	204	105	125	668	251	658	248
Total	2929	14.3	2306	11.2	8883	33.7	5788	22.0

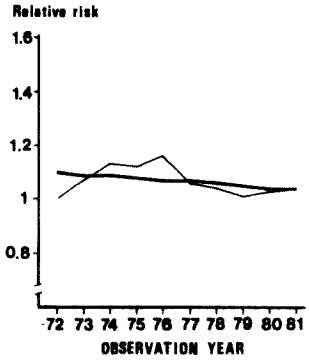

Figure 1.

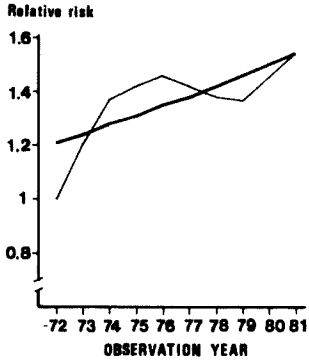

Figure 2.

Figure 1. Annual relative risk (—) for cervical fractures in females 75 years of age and older. Regression line (—) decreased annually by 0.6 per cent (90 per cent confidence limits: −2 per cent, ±0 per cent). Regression line equation: $Y = 1.10 \times 0.994^{T}$. T denotes year of observation (0, 1, 2, ... 9).

Figure 2. Annual relative risk for trochanteric fractures in females 75 years and older. Regression line increased annually by 2.7 per cent (90 per cent confidence limits: 2 per cent, 4 per cent). Regression line equation: $Y = 1.21 \times 1.027^{T}$. Same symbols as in Figure 1.

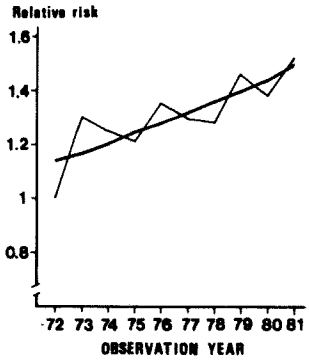

Figure 3.

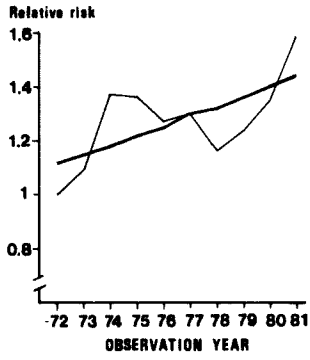

Figure 4.

Figure 3. Annual relative risk for cervical fractures in males 75 years and older. Regression line increased annually by 3.0 per cent (90 per cent confidence limits: 2 per cent, 4 per cent). Regression line equation: $Y = 1.14 \times 1.030^{T}$. Same symbols as in Figure 1.

Figure 4. Annual relative risk for trochanteric fractures in males 75 years and older. Regression line increased annually by 2.8 per cent (90 per cent confidence limits: 1 per cent, 5 per cent). Regression line equation: $Y = 1.12 \times 1.028^{T}$. Same symbols as in Figure 1.

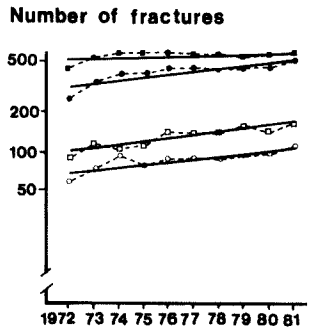

Figure 5.

Figure 5. Age-standardized annual number of hip fractures caused by moderate trauma in individuals 75 years and older.
Females, ■ cervical, ● trochanteric.
Regression line increased annually by 1.5 per cent (95 per cent confidence limits: −0.3 per cent. 3.4 per cent) in cervical fractures and by 5.6 per cent (confidence limits: 2.8 per cent, 8.5 per cent) in trochanteric fractures.
Males, □ cervical, ○ trochanteric.
Regression line increased annually by 6 per cent (95 per cent confidence limits: 3.5 per cent, 8.5 per cent) in cervical fractures and by 5.2 per cent (95 per cent confidence limits: 2.6 per cent, 7.8 per cent) in trochanteric fractures.

change. The pooled relative risk of trochanteric fractures in women 75 years of age and older increased yearly by 2.7 per cent (Figure 2), whereas no change was observed in younger women. In men, the pooled relative risk of cervical and trochanteric fracture before 75 years of age increased yearly by 0.8 and 1.3 per cent, respectively. However, the 90 per cent confidence limits included the possibility of an unaltered relative risk. The relative risk of cervical and trochanteric fracture in males over 75 years of age increased annually by 3.0 and 2.8 per cent, respectively (Figures 3, 4).

The external cause of 83 per cent of the cases 75 years of age and older was a fall at the same level. Falls from one level to another (E880.9-884.9) accounted for 7.7 per cent and traffic accidents (E819.0-846.9) for only 0.9 per cent of the fractures over 75 years.

Moderate trauma. The incidence of trochanteric fractures caused by moderate trauma in patients over 75 years increased annually in males by 5.2 per cent and in females by 5.6 per cent (Figures 5, 6). Similarly, the incidence of cervical fractures caused by moderate trauma in males increased annually by 6 per cent (Figure 5) but only marginally in females (Figure 6).

Severe trauma. No significant changes in the incidence of hip fracture caused by severe trauma were observed in either sex.

Discussion

In women under the age of 75 years, the incidence of hip fractures observed in our study was similar to that found by Alffram (1964) in Malmö, Sweden, in the 1950's. In age groups over 75 years, however, we found the incidence to be 36–41 per cent higher. In men of all age groups our values were considerably higher than those found by Alffram; the difference was most pronounced in the age group 50–64 years of age, with a 133 per cent higher incidence. Alffram found an increasing incidence of hip fractures during the period 1949 to 1961, mainly due to an increased incidence of trochanteric fractures. Although geographical differences in hip fracture incidence cannot be ruled out, there seems to have been a continuous increase in the incidence of trochanteric fracture in women over 75 years of age in Sweden during the last 25 years. The incidence of cervical hip fractures in women over 75 years of age found in our study is likewise higher than that observed in Malmö in the 1950's by Alffram (1964). Our results indicate, however, that the incidence of cervical fractures in women is not increasing at present in Stockholm.

In men, the incidence of both types of hip fracture was considerably higher in all age groups than those reported by Alffram (1964), and it was increasing in the oldest men. An extrapolation of the incidence rates of hip fracture in men older than 75 years of age found by Alffram (1964) by a yearly 3 per cent increase would result in incidente rates similar to those observed in our study. However, geographic variations of hip fracture incidence must also be considered possible. A possible explanation of a geographic difference in fracture incidence between Malmö and Stockholm could be the higher alcohol consumption in the Stockholm region (Sales statistics 1981). Also a lower exposure to sunlight in the more northern city of Stockholm compared with Malmö may be a factor.

In contrast to our findings, an increase of cervical fractures in women aged 70–89 years was observed in Gothenburg between 1965 and 1979 (Zetterberg & Andersson 1982). In trochanteric fractures our findings and those of the Gothenburg study are comparable with one exception: in Gothenburg an increase was also observed in men aged 50 to 69 years.

In a comparison of the incidence of hip fractures in the city of Stockholm in 1963 with the incidence in a mixed urban-suburban area in Stockholm County in the 1970's, Nilsson (1984) reported an increasing incidence in all age groups. In contrast to our results, the increase was most pronounced in the age group 40–64 years of age.

Differences in methodology and possible geographic variations may explain the diverging results. In spite of an unaltered long-term incidence and approximately 900 cases annually of femoral neck fractures in females in our study, we observed annual variations of incidence rates up to 29 per cent. The large variation clearly indicates the difficulties of drawing conclusions from incidence rates derived from a limited number of years of observation.

There are two possible causes for the increasing incidence of fractures resulting from moderate trauma: either falls are becoming more frequent or the quality of the bone is deteriorating. The unaltered incidence of fracture caused by severe traumata implies that the elderly have not become physically more active but rather supports the theory of an increasing prevalence of bone fragility. The observed difference in the time trends of cervical and trochanteric fractures in women indicates differences in the etiology of these two fracture types. Disuse osteoporosis might affect the trochanteric region more than the cervical region. Reduced physical activity prior to the fracture and muscular disturbance in the affected leg

have been reported to be more commonly associated with trochanteric fracture (Dretakis & Christodolu 1983). In studies of iliac crest biopsies, the trabecular bone volumes has been reported to be lower in patients with trochanteric fracture than in patients with cervical fracture (Gallagher 1976, Lips et al. 1982).

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