

INCIDENCE OF FRACTURES OF THE DISTAL RADIUS AND PROXIMAL FEMUR

Comparison of Patients in a Mental Hospital and the General Population

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A statistically significant increase in the incidence of fractures of the distal radius was found in the general population of southern Sweden during recent decades. As regards fractures of the proximal femur, an increase in the incidence of trochanteric fractures was observed only in women. In male patients at a mental hospital the fracture rate of the distal radius was the same as in the general population but the fracture rate of the proximal femur was about twelve times higher. In female patients at the same mental hospital the fracture rate of the distal radius was three times greater and that of proximal femur about seven times greater than that of the general population. This difference may not only be due to an increased skeletal fragility in patients in mental institutions but may also suggest poorer protective mechanisms against falls. Undiagnosed cardiovascular or neurological diseases, for example intermittent cardiac arrhythmia or transient cerebral ischaemic attacks, may cause falls. Early diagnosis and treatment of such diseases may reduce the number of fractures of the proximal femur.

Key words: dementia, senile; epidemiology; femoral neck fractures; fractures, occurrence; hip fractures; mental hospitals; radius fractures

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The number of fractures of the proximal femur has increased during recent decades owing to a growing elderly population in the industrialized countries. At the same time the incidence of these fractures in the elderly has been reported to have increased (Alffram 1964, Nilsson & Obrant 1978, Jensen 1980). Previous studies have also shown a higher incidence in institutionalized patients (Knowelden et al. 1964, Leitch et al. 1964, Engh et al. 1968).

The aim of this study was to discover if the incidence of fractures of the distal radius has also increased and to see if the pattern of fracture incidence of the distal radius and the proximal femur in a mental hospital was different from that in the general population.

PATIENTS AND METHODS

All recorded fractures of the distal radius (Ekenstam & Hansson 1974) and of the proximal femur from the primary area of the University Hospital of Lund in 1972 were reviewed, as well as records of patients with fractures from the local mental hospital (St. Lars) in Lund. Patients outside the primary area of Lund were also referred to this mental hospital and they were thus included. This material was compared with the findings in Malmö of fractures of the distal radius during the 5 years 1953–1957 (Alffram & Bauer 1962) and of hip fractures in Malmö during 1951–1960 (Alffram 1964). The patients at the mental hospital had different hospitalization times which were taken into account when calculating their time at risk.

The population of the primary area of the University Hospital of Lund is both urban and rural, in contrast to the purely urban one of Malmö. Otherwise the populations are similar and geographically neighbours.

The statistical methods used were tests based on Poisson distribution for the separate age groups and a modification of the Mantel-Haenszel test according to Miettinen (Mantel & Haenszel 1959, Miettinen 1974).

The following levels of significance were used:

- *** = $P < 0.001$ (highly significant)
 ** = $0.001 < P < 0.01$ (significant)
 * = $0.01 < P < 0.05$ (almost significant)
 N.S. = $P > 0.05$ (not significant)

RESULTS

A significant ($P < 0.001$) increase in the incidence of fractures of the distal radius for the total

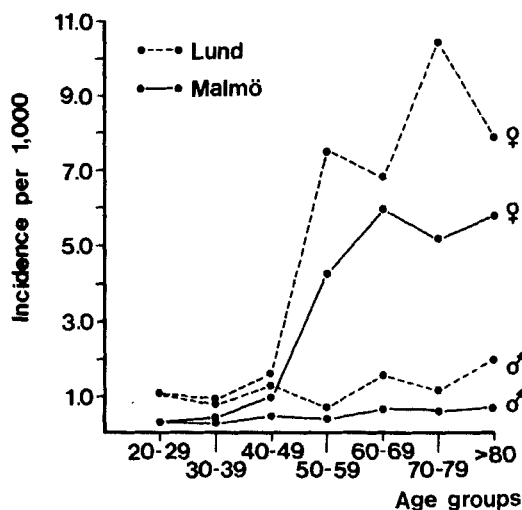


Figure 1. Incidence of fractures of the distal radius in males and females, according to age, in Malmö 1953–1957 and in Lund 1972.

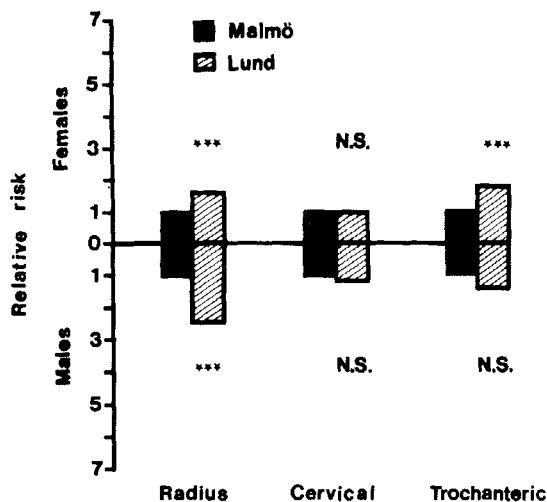


Figure 2. Relative risk of sustaining a fracture of the distal radius or of the proximal femur for males and females in Lund in 1972 (▨) compared to Malmö in 1953–1957 (radius) and in 1951–1960 (femur) (■). For significance levels, see Methods.

material was noted in the male and female populations of Lund compared with the previous figures from Malmö (Figure 1, Table 1). The relative risk had increased about two and a half times in males and about one and a half times in females (Figure 2, Table 1). In the female population of Lund, in the separate age groups 20–29 years ($P < 0.01$), 50–59 years ($P < 0.01$) and 70–79 years ($P < 0.001$), a significant increase in incidence was observed in comparison with the Malmö material. For the male population sig-

Table 1. Relative risk (RR) with 95 per cent confidence limits and its chi-square value (χ^2) with significance for various fracture types. Comparison of Lund (1972) with Malmö (1953–1957 for radius and 1951–1960 for cervical and trochanteric fractures), and the mental hospital (1972) with the general population of Lund (1972)

Fracture type	Sex	Lund – Malmö			Mental hospital – Lund		
		RR	limits	χ^2	RR	limits	χ^2
Radius	Male	2.5	1.9–3.4	43.9***	1.5	0.2–10.3	0.1 ^{NS}
	Female	1.6	1.4–1.9	51.2***	3.1	1.7–5.6	13.2***
Cervical	Male	1.1	0.7–1.7	0.1 ^{NS}	12.0	5.8–24.7	45.4***
	Female	1.0	0.8–1.2	0.0 ^{NS}	7.6	4.6–12.5	63.3***
Trochanteric	Male	1.4	0.9–2.2	2.4 ^{NS}	11.3	5.3–24.1	39.2***
	Female	1.8	1.4–2.2	20.2***	6.6	3.9–11.0	50.2***

For significance levels, see Methods.

Table 2. Populations of Lund and of the mental hospital in 1972

Age groups	Lund		Mental hospital*	
	M	F	M	F
20-29	15,415	16,308	468 (69.3)	236 (34.7)
30-39	13,532	12,818	419 (62.7)	184 (37.7)
40-49	9,788	9,471	416 (78.1)	192 (32.4)
50-59	8,787	8,982	409 (89.5)	227 (61.9)
60-69	7,981	8,675	247 (98.3)	237 (86.9)
70-79	4,930	6,375	167 (85.5)	240 (122.4)
≥80	1,999	3,159	151 (69.1)	174 (100.4)
Total	62,432	65,788	2,277 (552.5)	1,490 (489.8)

* The number in parentheses denotes total hospitalization time in years (time at risk).

Table 3. Number of fractures of the distal radius in Lund and at the mental hospital in 1972 grouped according to age and sex

Age groups	Lund		Mental hospital	
	Number of fractures Male	Female	Number of fractures Male	Female
20-29	17	18	—	—
30-39	11	12	—	1*
40-49	13	15	—	—
50-59	6	68	1*	—
60-69	13	59	—	3*
70-79	6	67	—	4*
≥80	4	25	—	2
Total	70	264	1	10

Comparison of mental hospital versus Lund. For significance levels, see Methods.

nificant differences were found in the separate age groups 20-29 years ($P < 0.05$) and 40-49 years ($P < 0.05$) (Figure 1, Tables 2 and 3).

No significant difference in the incidence of radial fractures was noted in the total male population when Lund and the mental hospital were

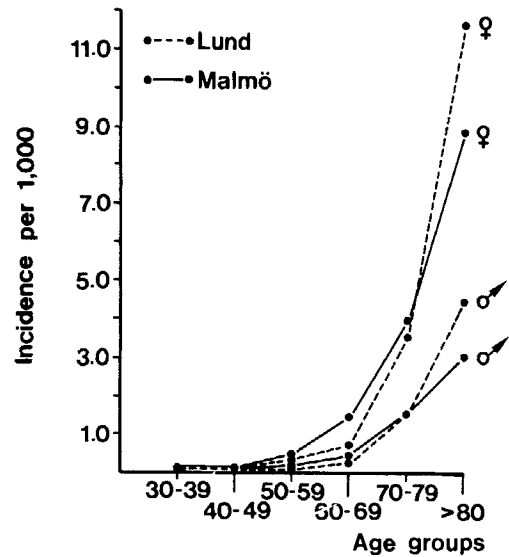


Figure 3. Incidence of cervical fractures in males and females, according to age, in Malmö 1951-1960 and in Lund 1972.

compared (Table 1). However, the incidence of radial fractures in females at the mental hospital was three times greater ($P < 0.001$).

In both the male and female populations of

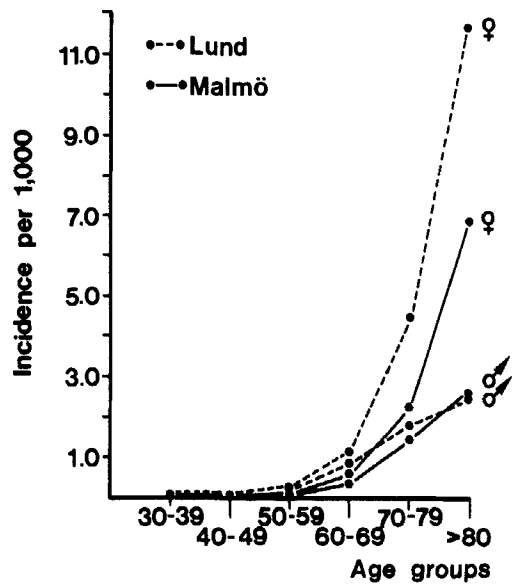


Figure 4. Incidence of trochanteric fractures in males and females, according to age, in Malmö 1951-1960 and in Lund 1972.

Table 4. Cervical and trochanteric fractures in the population of Lund and in the patients at the mental hospital in 1972 grouped according to age and sex

Age groups	Lund				Mental hospital			
	Cervical		Trochanteric		Cervical		Trochanteric	
	Male	Female	Male	Female	Male	Female	Male	Female
30-39	—	—	—	—	—	—	—	—
40-49	2	1	—	—	—	—	—	—
50-59	1	4	3	1	1**	—	—	—
60-69	2	7	7	10	—	2**	3***	4***
70-79	8	23	9	29	1	5***	1	4**
≥80	9	37	5	37	4***	6***	1	4*
Total	22	72	24	77	6	13	5	12

Comparison of mental hospital versus Lund. For significance levels, see Methods.

Lund a slight but not significant increase in the incidence of *cervical fractures* for the highest age groups was noted in comparison with the Malmö material (Figure 3, Tables 1 and 4). The same pattern was found for *trochanteric fractures* in males whereas a slight (1.8 times) but significant ($P < 0.001$) increase in the incidence of trochanteric fractures was found in the female population in Lund (Figure 4, Table 1). Thus, when all trends in the age groups were combined this significant increase in the incidence of trochanteric fractures was noted in females (Figure 2, Table 1); when considering the various age groups separately only females aged 70-79 years showed a significant increase ($P < 0.05$).

In both the male and female populations of the mental hospital a significant increase ($P < 0.001$)

in the incidence of cervical and trochanteric fractures was observed when compared to the population of Lund (Tables 1 and 4). The relative risk of cervical and trochanteric fractures was about seven times greater in females and about twelve times in males (Table 1, Figure 5). Significant differences between the mental hospital and Lund were found for most of the age groups above 60 years (Table 4). Despite the fact that the number of patients in the mental hospital was gradually reduced by over one-third from 1970 to 1980, the number of hip fractures per year has been fairly constant (Table 5).

DISCUSSION

This investigation confirms earlier reports of an increase in the incidence of hip fractures (Nilsson & Obrant 1978, Jensen 1980), only as regards trochanteric fractures in females. In the present material from Lund there was a significant increase in the incidence of fractures of the distal radius in both sexes, and the relative risk of radial fracture in the female population of the mental hospital was three times greater than that of Lund (Figures 2 and 5). The rise in incidence of radial fractures starts in middle-aged females, whereas a corresponding rise in the incidence of hip fractures occurs in the aged. The increased incidence of radial fractures might be an expression of a

Table 5. Number of fractures of the proximal femur every year from 1970-1980 in patients at the mental hospital

1970	27
1971	28
1972	36
1973	33
1974	29
1975	23
1976	23
1977	18
1978	24
1979	21
1980	20

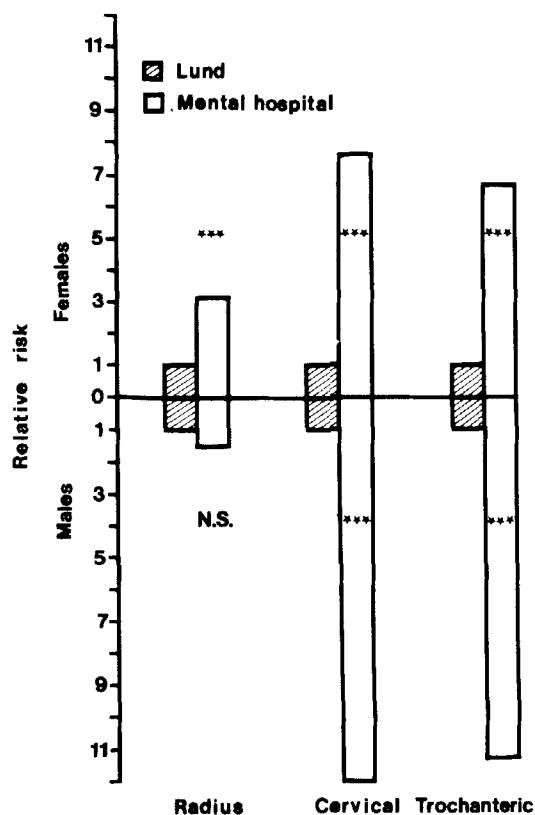


Figure 5. Relative risk of sustaining a fracture of the distal radius or of the proximal femur for males and females in 1972 in the mental hospital (□) compared to Lund (▨).

general increase in bone fragility and might therefore in the years following be manifested as an increase in hip fractures (Bauer 1960, Alffram 1964, Gay 1974, Gallagher et al. 1980).

Fractures of the distal radius and of the hip are both considered to be related to increased skeletal fragility associated with ageing, and this is especially valid for women. However, in contrast to fracture of the distal radius, hip fracture is related to disease as well (Alffram 1964, Ceder et al. 1981). No increased risk of a fracture of the distal radius was found in the male patients at the mental hospital when compared to the general population of Lund. However, the risk of hip fracture was eleven to twelve times higher. This risk of sustaining a hip fracture is reduced to five times in males and four times in females if the number of patients in the mental hospital alone is

considered (Table 2). The total hospitalization time, however, is the actual time at risk. Lidgren & Wallöe (1977) stated that the fracture risk in institutionalized patients with epilepsy was about six times higher than in the general population and was specifically related to osteomalacia associated with anti-epileptic drugs. The most common diagnosis of the patients in the mental hospital in the present study was senile dementia and they were generally not on anti-epileptic drugs. It is supposed that all institutionalized patients run a greater risk of sustaining a fracture than the general population, and that a hip fracture is an expression of general fragility.

The incidence of fracture of the distal radius was about the same in the general population of Lund as in the male patients at the mental hospital. This could be interpreted as the risk of a fall being the same in both populations, but the higher incidence of hip fractures in relation to radial fractures among the mental hospital patients might be an expression of poorer protective mechanisms against falls, as well as of disease. Other factors such as different dietary status may also influence fracture rates (Matković et al. 1979). In addition institutionalized patients may be more prone to stress fractures of the proximal femur (Devas 1975). Probably hip fracture patients fall more often than other people (Livesley & Atkinson 1974, British Medical Journal 1978, Nilsson & Abdon 1980). This may be due to cardiac or neurological disease (Abdon & Nilsson 1980, Ceder et al. 1981). Contrary to a common belief in society that institutionalization is a good safeguard against falls and fractures, the risk is high. Institutionalized patients often have several concurrent diseases as well as dementia or apathy with accompanying inactivity. However, in several cases treatable conditions such as intermittent cardiac arrhythmia, transient cerebral ischaemic attacks or other neurological diseases may go unnoticed or undiagnosed (Abdon 1975, Wright & Fenwick 1978, Abdon & Nilsson 1980, Ceder et al. 1981). Perhaps diagnosis and treatment of such diseases may reduce the number of fractures in institutionalized patients (Ceder 1980).

The results of this study indicate that increased efforts, in cooperation with the staffs of geriatric

and mental hospitals, are required in order to prevent and treat fractures and other orthopaedic injuries in institutionalized patients.

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REFERENCES

- Abdon, N. J. (1977) Unrecognized intermittent bradycardias in patients treated for senile dementia. In: *Cardiac pacing*. (Ed. Watanabe, Y.), pp. 93–97. Excerpta Medica (International Congress Series no. 395), Amsterdam and Oxford.
- Abdon, N. J. & Nilsson, B. E. (1980) Episodic cardiac arrhythmia and femoral neck fracture. *Acta Med. Scand.* **208**, 73–76.
- Alffram, P.-A. (1964) An epidemiologic study of cervical and trochanteric fractures of the femur in an urban population. *Acta Orthop. Scand.*, Suppl. 65.
- Alffram, P.-A. & Bauer, G. C. H. (1962) Epidemiology of fractures of the forearm. *J. Bone Joint Surg.* **44-A**, 105–114.
- Bauer, G. C. H. (1960) Epidemiology of fracture in aged patients. *Clin. Orthop.* **17**, 219–225.
- British Medical Journal. Editorial (1978) Falls and femoral fractures. *Br. Med. J.* **2**, 522.
- Ceder, L. (1980) *Hip fracture in the elderly. Prognosis and rehabilitation*. Thesis, University of Lund, Sweden.
- Ceder, L., Elmqvist, D. & Svensson, S.-E. (1981) Cardiovascular and neurological function in elderly patients sustaining a fracture of the neck of the femur. *J. Bone Joint Surg.* **63-B**, 560–566.
- Devas, M. B. (1975) *Stress fractures*. Churchill Livingstone, Edinburgh, London and New York.
- Ekenstam, J. & Hansson, L. I. (1974) Faktorer som påverkar besöksfrekvensen i öppen vård i ortopedisk kirurgi. (Factors influencing out-patient attendance in orthopaedic surgery. Summary in English). *Läkartidningen* **71**, 4491–4497.
- Engh, G., Bollet, J. A., Hardin, G. & Parson, W. (1968) Incidence of hip fractures in mental institutions. *J. Bone Joint Surg.* **50-A**, 557–562.
- Gallagher, J. C., Melton, L. J. & Riggs, B. L. (1980) Examination of prevalence rates of possible risk factors in a population with a fracture of the proximal femur. *Clin. Orthop.* **153**, 158–165.
- Gay, J. D. L. (1974) Radial fracture as an indicator of osteoporosis: a 10-year follow-up study. *Can. Med. Assoc. J.* **111**, 156–157.
- Jensen, J. S. (1980) Incidence of hip fractures. *Acta Orthop. Scand.* **51**, 511–513.
- Knowelden, J., Buhr, A. J. & Dunbar, O. (1964) Incidence of fractures in persons over 35 years of age. *Br. J. Prev. Soc. Med.* **18**, 130–141.
- Leitch, I. H., Knowelden, J. & Seddon, H. J. (1964) Incidence of fractures, particularly of the neck of the femur, in patients in mental hospitals. *Br. J. Prev. Soc. Med.* **18**, 142–145.
- Lidgren, L. & Wallöe, A. (1977) Incidence of fractures in epileptics. *Acta Orthop. Scand.* **48**, 356–361.
- Livesley, B. & Atkinson, L. (1974) Repeated falls in the elderly. *Mod. Geriatrics* **4**, 458–467.
- Mantel, N. & Haenszel, W. (1959) Statistical aspects of the analysis of data from retrospective studies of disease. *J. Natl. Cancer Inst.* **32**, 719–748.
- Matković, V., Kostial, K., Šimonović, I., Buzina, R., Broderec, A. & Nordin, B. E. C. (1979) Bone status and fracture rates in two regions of Yugoslavia. *Am. J. Clin. Nutr.* **32**, 540–549.
- Miettinen, O. S. (1974) Simple interval estimation of risk ratio. *Am. J. Epidemiol.* **100**, 515–516.
- Nilsson, B. E. & Abdon, N. J. (1980) Episodic cardiac arrhythmia and accident rate. *Acta Med. Scand.* **208**, 69–71.
- Nilsson, B. E. & Obrant, K. J. (1978) Secular tendencies of the incidence of fracture of the upper end of the femur. *Acta Orthop. Scand.* **49**, 389–391.
- Wright, W. B. & Fenwick, G. M. (1978) The fractured femur: why call in the geriatrician? *Injury* **9**, 282–283.

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