INCIDENCE OF FRACTURES, PARTICULARLY OF THE NECK OF THE FEMUR, IN PATIENTS IN MENTAL HOSPITALS

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In 1870 a correspondent of the *Lancet*, in commenting on the incidence of fractures in patients in mental institutions, suggested "that important pathological facts of the kind should be communicated to the profession in the medical journals". This was written after there had been some discussion of the possible causes of increased fragility of the skeleton in these patients. In this paper we have endeavoured to obey his injunction.

THE PATIENTS

A survey was made of all the fractures occurring in seven mental hospitals in the London area in the 1954-58 quinquennium. These hospitals were concerned with all forms of mental disease and almost all of the patients were adults. The types of treatment and the general pattern of management were much the same in all; the open hospital policy was followed and all patients were encouraged to be as mobile as possible.

METHOD

The population at risk was derived from the census of the hospitals on January 1, 1954, and adjusted for subsequent years by the annual admissions, discharges, and deaths. These populations were tabulated by 10-year age groups for each of the years under review (Table I). This shows that there was a slight general trend towards an ageing population but not of a degree sufficient to have more than a minimal influence on the pattern of fractures.

TABLE I
POPULATION DISTRIBUTION IN SEVEN MENTAL HOSPITALS 1954-58, BY AGE AND SEX

Year	Sex	Age Group (yrs)					Total
		45-54	55-64	65-74	75-84	85+	
1954	M	1,059	912	668	274	32	2,945
	F	1,361	1,517	1,480	822	149	5,329
1955	M	1,041	921	672	272	32	2,938
	F	1,336	1,482	1,516	872	166	5,372
1956	M	1,036	977	693	272	39	3,017
	F	1,311	1,507	1,541	905	184	5,448
1957	M	1,047	978	682	283	34	3,024
	F	1,294	1,522	1,512	876	180	5,384
1958	M	1,021	973	680	268	52	2,994
	F	1,276	1,488	1,525	931	199	5,419
Total Person-Years	M	5,204	4,761	3,395	1,369	189	14,918
	F	6,578	7,516	7,574	4,406	878	26,952

Table II (opposite) shows the anatomical distribution of the fractures reported in the 5 years 1954 to 1958. There was a total of 1,111 fractures with a fairly typical distribution. Of these, fractures of the upper end of the femur (neck and trochanter) were the most common, forming 22.7 per cent. of the total. These fractures were then studied in detail.

FRACTURES OF THE UPPER END OF THE FEMUR

The 253 fractures of the neck of the femur and of the trochanteric region occurred in 250 patients, 57 (23 per cent.) males and 193 (77 per cent.) females. This ratio confirms the general experience of a considerable predominance of women over men.

TABLE II

NUMBER OF FRACTURES IN PATIENTS OF SEVEN MENTAL HOSPITALS, 1954-58, BY SITES

Site	No. of Fractures
Skull	6
Nose	44
Mandible	9
Clavicle	49
Scapula	2
Upper third of humerus	84
Shaft of humerus	17
Elbow (Supracondylar and upper third of forearm)	27
Shafts of forearm bones	42
Collar	156
Hand	81
Ribs	74
Spine	38
Pelvis	32
Coccyx	1
Upper end of femur	253
Shaft of femur	8
Knee (Supracondylar and upper third of tibia)	26
Shaft of tibia	40
Pott's fracture	80
Foot	42
Total	1,111

There was no case of bilateral simultaneous fracture; but two patients suffered more than one fracture—one of them being unlucky enough to have sustained three separate fractures. This low incidence of refracture is in contrast with the finding of Cleveland, Bosworth, Thompson, Wilson, and Ishizuka (1959) that 16.4 per cent. of patients suffered a further hip fracture.

Table III shows the average annual incidence-rates for fracture of the femoral neck and trochanter in the seven mental hospitals, and for comparison includes the rates obtained for the general population of two cities, Dundee and Oxford (Knowelden, Buhr, and Dunbar, 1964), in the same period. Four male and two female patients have been excluded from this Table as they were under 45 years of age

TABLE III

INCIDENCE OF FRACTURE OF THE FEMORAL NECK AND TROCHANTER IN SEVEN MENTAL HOSPITALS AND IN TWO CITIES, 1954-58, BY SEX AND AGE GROUP

Age Group (yrs)	Population (person-years) of Mental Hospitals		No. of Fractures in Mental Hospitals		Average Annual Incidence Rate per 10,000			
					Mental Hospitals		Dundee and Oxford	
	M	F	M	F	M	F	M	F
45-54	5,204	6,578	5	5	9.6	7.6	1.3	1.0
55-64	4,761	7,516	12	24	25.2	31.9	3.9	3.0
65-74	3,395	7,574	15	51	44.2	67.3	7.8	15.9
75-84	1,369	4,406	19	87	138.8	197.5	30.2	63.3
Over 85	189	878	4	25	211.6	284.7	63.4	192.6

Six fractures in the large population under the age of 45 years are not included in this analysis.

and the appropriate population at risk, in decennial groups, was not available below this age.

The difference between the incidence of femoral fractures in the mental hospital patients compared with the general population of Dundee and Oxford is large. Between 45 and 65 years of age the mental hospital rates are about seven times as great. For older persons the difference is still considerable, particularly for men, in whom the mental hospital rate at 85 years and over is three times that in Dundee and Oxford. Both populations had a steep rise in risk with age, but the gradient was less steep in the mental hospitals. These contrasts are shown in the Figure.

FIGURE.—Incidence of fracture of the upper end of the femur (annual rate per 10,000) in Mental Hospital Population and Dundee and Oxford Survey, by sex and age.

The differences can be restated by applying the Dundee and Oxford incidence-rates to the hospital populations, giving the number of fractures that might have been anticipated (Table IV, overleaf). Instead of the 55 fractures in males and 192 in females actually observed, only 10.5 in males and 59.9 in females would have been expected; *i.e.* the mental hospital population suffered an excess of 44 fractures affecting men and 132 fractures affecting women.

TABLE IV

COMPARISON OF FRACTURE INCIDENCE IN MENTAL HOSPITALS AND IN THE GENERAL POPULATIONS OF DUNDEE AND OXFORD, BY AGE AND SEX

Age Group (yrs)	No. of Fractures Expected at Dundee and Oxford Rates		No. of Fractures Observed in Mental Hospital Population	
	M	F	M	F
45-54	0.7	0.7	5	5
55-64	1.8	2.3	12	24
65-74	2.6	12.1	15	51
75-84	4.1	27.9	19	87
85+	1.2	16.9	4	25
Total	10.5	59.9	55	192

ASSOCIATED FACTORS

TYPE OF MENTAL DISORDER.—For both sexes by far the commonest psychiatric diagnosis in the patients who suffered fractures was senile dementia (44 per cent. for males and 73 per cent. for females). The next commonest were schizophrenia (25 per cent. males and 13 per cent. females) and epileptic dementia (9 per cent. males and 5 per cent. females). There was only a handful of patients with each of the remaining psychiatric diagnoses. In the absence of data by age on the proportion of beds occupied by patients with the different diagnoses, it is impossible to determine the relative risks. The large number of patients with senile dementia is possibly of some significance, however, since, by applying Dundee and Oxford rates to the mental hospital population of 1954-58, only 28 per cent. of male and 61 per cent. of female fractures would be expected in patients aged 65 years and over, not all of whom would have had a diagnosis of senile dementia. It is possible also that patients with epileptic dementia form a small proportion of the total mental hospital population and that the risk of fracture for them is unduly high.

TYPE OF ACCIDENT.—The immediate causes of injury as reported in the notes are shown in Table V. No comparable study could be found, but Sheldon (1948) lists six common causes of falls producing fractures in the elderly:

- (1) General muscular weakness.
- (2) Arthritis of the lower limbs.
- (3) Minor pyramidal tract lesions.
- (4) Paralysis agitans.
- (5) Syncopal attacks.
- (6) "Premonitory falls".

Buhr and Cooke (1959) mention eleven other causes, including obstacles in the house (such as furniture, rugs, and pets), slippery floors, and impaired co-ordination.

It will be noted that most of the fractures were immediately due to external causes. Some were

TABLE V

DISTRIBUTION OF 253 FRACTURES OF THE UPPER END OF THE FEMUR BY METHOD OF INJURY

Cause of Injury	Sex		
	M	F	Both Sexes
Stumbled and fell in Ward ..	24	100	124
Fell out of Bed	10	28	38
Pushed by Another Patient ..	6	18	24
Fell from Chair	7	11	18
Fell from Lavatory Seat ..	2	11	13
Fell in Hospital Grounds ..	4	9	13
Fell during a Fit	0	5	5
Electro-convulsive Therapy ..	3	2	5
Syncope	1	2	3
Fell Downstairs	0	2	2
Pathological Fracture ..	0	1	1
Not Known	2	5	7
Total	59	194	253

connected with the particular environment, such as being pushed over by another patient (24 instances, 9.5 per cent.) and electro-convulsive therapy (five instances, 1.9 per cent.).

OSTEOPOROSIS.—With regard to the internal causes mentioned by Buhr and Cooke, this survey was unsatisfactory. The prime question was whether there was evidence of severe osteoporosis causing undue fragility of the patients' bones. The only material available for assessment was radiographic. But the radiographs had been taken solely for the diagnosis of fractures and for observing their progress; portable x-ray machines were often used and exposures were commonly limited to the region of the hip. The radiographic criteria of osteoporosis mentioned by Cooke (1955) require films of high quality; even then (Lachmann and Whelan, 1936) the method is crude, because between 30 and 60 per cent. of mineral must be lost before osteoporosis can be recognized with certainty. All the available radiographs were examined, but without any fruitful result.

TIME SPENT IN HOSPITAL BEFORE A FRACTURE OCCURRED.—Table VI (opposite) shows that many of the fractures occurred in patients who had spent a comparatively short time in hospital, but no clear conclusion can be drawn from this without full knowledge of the pattern of length of stay. The great labour involved in obtaining this information is more than is warranted by its possible value in this survey, but this factor should be taken into account in any future investigation. In 1955 (Ministry of Health, 1957) almost one-quarter of the patients

TABLE VI
DURATION OF STAY IN HOSPITAL AT TIME OF FRACTURE
OF UPPER END OF FEMUR, BY SEX

Duration of Stay	M	F
3 mths	7	24
3-5 mths	4	20
6-8 mths	7	12
9-11 mths	3	4
1-4 yrs	10	65
5-9 yrs	3	20
10-19 yrs	9	24
20+ yrs	16	25
Total	59	194

in mental hospitals in England and Wales were discharged within 1 month and over half within 3 months, and these proportions had increased to one-third and nearly three-quarters respectively by 1959 (General Register Office, 1962). Thus the mental hospital population is predominantly short-stay, and this alone might account for the high proportion of fractures in the early months and years. It would not be inconceivable or indeed surprising if, with all the data before us, it turned out that a shorter stay in a mental hospital did not, in fact, carry a higher risk of fracture. A suggestion made to us that these early fractures are connected with patients' restlessness shortly after admission is at present unsubstantiated.

DISCUSSION

The observation made nearly 100 years ago that there was an increased risk of fracture in mental hospitals is supported by this survey, but that this is due to increased fragility of the bones is not established. The general distribution of fractures is much the same as was found in the Dundee-Oxford series.

In reviewing the fractures of the neck of the femur, it was noticed that in spite of the preponderance of elderly patients no fracture through a metastatic malignant deposit was observed. The one "pathological fracture" noted in Table V occurred in a bedridden patient with such advanced osteoporosis that the break occurred while she was in bed.

Of the causes of injury the commonest was stumbling and falling in the ward. Many of these patients were infirm and for that reason alone they may have found it difficult to adjust themselves to an unfamiliar environment.

The problems posed by furniture and equipment have occupied the attention of several of the administrators who co-operated in the survey, and they did not believe that they had been completely solved. Changes in the arrangement of furniture and an extensive trial of non-slip floor polish and non-skid mats and rugs had not materially reduced the incidence of injuries.

A point mentioned by one of the physicians was that of sedation, especially at night. Many of the wards were understaffed and it appeared that an infirm patient rendered more than usually shaky by an evening hypnotic might go unattended to the lavatory and fall on the way there. This sedation may also have contributed to fractures due to falling out of bed and falling off the lavatory seat.

The role of osteoporosis requires investigation. The impression was that the incidence was unusually high in the younger age groups, but there was no firm evidence to support this. Immobility and dietetic deficiency did not appear to be significant. Patients were encouraged to remain up and about and the diets were said to be adequate.

This investigation was originally proposed by Mr G. C. Robin when he was a registrar at the Royal National Orthopaedic Hospital (he is now working at the Hadassah University Hospital, Jerusalem) and by his brother Dr A. A. Robin, Consultant Psychiatrist, Runwell Hospital, Wickford. G. C. Robin started the work, but handed it over to one of us (IHL) when he went to Israel. The inquiry could not have been carried out without the enthusiastic support of the medical superintendents and other members of the staffs of the seven mental hospitals. We are greatly indebted to:

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