# Mortality and morbidity after hip fractures

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**Abstract**

***Objective*—To study the mortality and morbidity associated with proximal femoral fractures with reference to fracture type (intracapsular and extracapsular).**

***Design*—Consecutive prospective study with 12 month follow ups.**

***Setting*—Two British trauma receiving centres.**

***Patients*—1000 consecutive acute proximal femoral fractures (fractured necks of femur) in 972 patients.**

***Results*—Significantly higher mortality at one year was seen in patients with extracapsular fractures (188/490; 38%) than in those with intracapsular fractures (147/510; 29%; $p<0{\cdot}01$). Greater morbidity was experienced during the study period by patients with extracapsular fractures, who were less mobile and less independent at the time of their injury.**

***Conclusions*—The rise in average age of presentation with proximal femoral fracture is associated with a persistently high mortality (33%) and morbidity, greater in patients with an extracapsular fracture. Comparison with other studies, principally from outside Britain, is difficult, but despite advancing standards of care the mortality and morbidity of femoral neck fractures remains high, placing an ever increasing burden on the health service.**

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## Introduction

The incidence of proximal femoral fractures continues to rise and is approaching epidemic proportions, according to a report by the Royal College of Physicians in 1989[1]; such "femoral neck fractures" were estimated in 1987 to cost the NHS £165 million a year.[2] Past mortality figures and morbidity measures have been circumspect and subject to much speculation, backed up with little substantiated evidence.[3-5] We prospectively studied 1000 consecutive cases admitted to two centres with proximal femoral fractures to determine the level of mortality and morbidity, in relation to the type of fracture, with a one year follow up period after injury.

### Assessing morbidity after fractured hip

*Mobility score*—the mobility score is a point scoring system, previously published,[3-5] for three basic functions:

- Can the patient do their own shopping?
- Is the patient able to get out of the house?
- Is the patient able to get about the house?

Each function is scored out of four points:

| | |
|---|---|
| Able to do independently | Score 3 points |
| On their own, but using an aid | Score 2 points |
| Only with someone's assistance | Score 1 point |
| Not able (bed, chair, or housebound) | Score 0 points |

*Walking aids*—Patients were questioned as to whether they could mobilise independently, with the use of sticks or a walking frame, or whether they considered themselves to be immobile.

*Residential status*—The residential status of patients before and after their fracture was considered in three categories: those living in their own home, those living in a residential or nursing home and those hospitalised (for 28 days or more).

*Pain*—Patients were assessed for the pain experienced and analgesia required at the end of the one year period:

| | | |
|---|---|---|
| Score 1 point | No pain | No analgesia |
| Score 2 points | Occasional and slight pain | No analgesia |
| Score 3 points | Pain on initiation of exercise | Occasional mild analgesia |
| Score 4 points | Pain with exercise, not at rest | Frequent mild analgesia |
| Score 5 points | Constant yet bearable pain | Occasional strong analgesia |
| Score 6 points | Constant severe pain | Frequent strong analgesia |

## Patients and methods

One thousand consecutive admissions for proximal femoral fractures in 972 patients were prospectively studied. The patients were admitted in equal proportions to the Birmingham Accident Hospital and the Peterborough District Hospital between 1989 and 1992.

To determine morbidity, patients were assessed at the time of emergency admission. At regular intervals up to one year after their injury all surviving patients were reviewed in dedicated hip fracture clinics; those unable to attend the clinic were contacted by letter or telephone. Follow up was performed by one study member and all information was recorded on a computerised data base. For those patients who died, progress was monitored until the time of death.

Mortality is relatively easy to assess—only three patients could not be contacted or located, and inquiry to the Office of Population Censuses and Surveys—confirmed that they had not died. Morbidity, however, is less easy to quantify, and to measure morbidity, we studied four factors: mobility score; dependency on walking aids; residential status; and degree of residual pain (box). These factors were recorded for all patients immediately before their fracture and during the subsequent year. Statistical analysis was by the log rank test for the variable mortality and the Mann-Whitney U test for pain and mobility. A p value $>0{\cdot}05$ was considered not significant.

## Results

In 1000 cases of proximal femoral fractures there were 490 extracapsular fractures and 510 intracapsular fractures. Mean age at fracture was slightly higher in patients with extracapsular fractures (80 years) than in patients with intracapsular fractures (78 years). In both groups about 81% of patients were women. Intracapsular fractures included subcapital and transcervical fractures; extracapsular fractures included basal, trochanteric, pertrochanteric, and subtrochanteric fractures (within 5 cm of the lesser trochanter).

The patients admitted to the two hospitals were of similar characteristics: average age 79 years; 19% (94/500) of patients admitted to Peterborough District Hospital were male, compared with 18% (91/500) at Birmingham Accident Hospital; the average mobility scores before the accident (5·3) were identical for both hospitals; and 75% (374) of patients at Peterborough District Hospital were admitted from their own home, compared to 71% (357) at Birmingham Accident Hospital.

Table I lists the methods of treatment. A minority of patients were treated conservatively: four patients with intracapsular fractures and 24 with extracapsular fractures were medically unfit for surgery. Conservative treatment was chosen as a preference for seven patients

TABLE I—*Treatment for proximal femoral fractures*

| Method | No of patients |
|---|---|
| Intracapsular fractures (n=510): | |
| Non-operative | 11 |
| Dynamic hip screw | 3 |
| Total hip replacement | 9 |
| Lag screws | 81 |
| Garden screws | 116 |
| Hemiarthroplasty | 290 |
| Extracapsular fractures (n=490): | |
| Non-operative | 42 |
| AO blade plate | 2 |
| Intramedullary nail | 15 |
| Nail plate | 35 |
| Dynamic hip screw | 396 |

with undisplaced intracapsular fractures and 18 with undisplaced extracapsular fractures. The method of conservative treatment for intracapsular fractures consisted of a period of bed rest to allow the pain to settle, followed by early mobilisation (partial or non-weight bearing). Patients with extracapsular fractures were treated with on average five weeks' skin traction followed by gentle mobilisation, non-weight bearing.

The remaining patients were treated surgically. Most intracapsular fractures within the Garden grades I and II[6] were treated with internal fixation, and the more displaced fractures underwent hemiarthroplasty (Thompson or Austin Moore prosthesis). With a few exceptions, the extracapsular fractures were internally fixed with the AO/ASIF (Arbeitsgemeinschaft fur Osteosynthesefragen/Association for the Study of Internal Fixation) dynamic hip screw. Those patients given an intramedullary nailing device had sustained subtrochanteric fractures, all within 5 cm of the lesser trochanter.

MORTALITY

Mortality at one year was related to age and fracture type. Mortality was lowest in patients under 60 (3%; 2/56) and rose steadily to 51% (66/129) among the nonagenerians (fig 1). Mortality at six months and one year was significantly lower in patients with intracapsular fractures than those with extracapsular fractures (table II). Fifteen per cent of patients (152/1000) died during the study period without being discharged from hospital.

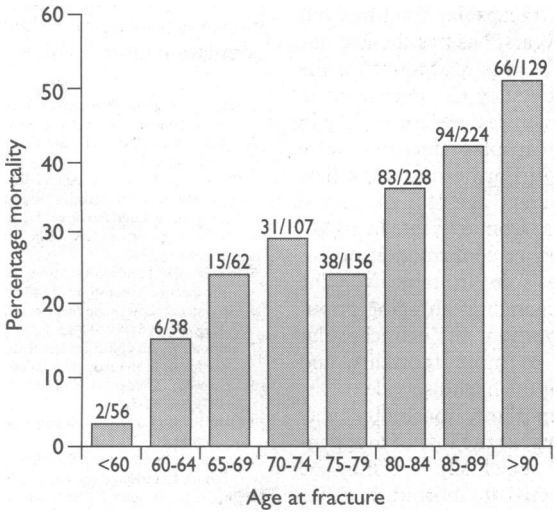


FIG 1—*Mortality one year after proximal femoral fracture in relation to age*

TABLE II—*Mortality at six months and one year after proximal femoral fracture. Value are numbers (percentages) of patients unless indicated otherwise*

| | Mortality at 6 months | | Mortality at 12 months | |
|---|---|---|---|---|
| All patients (n=1000) | | 284 (28) | | 335 (33) |
| Intracapsular fractures (n=510) | 122 (24) | | 147 (29) | |
| Extracapsular fractures (n=490) | 162 (33) | | 188 (38) | |
| Difference | | 40 (9) | | 41 (9) |
| 95% Confidence interval (%) | | 3·6 to 14·7 | | 3·7 to 15·4 |
| p Value for comparison | | <0·025 | | <0·01 |

TABLE III—*Mobility scores (0-9) of survivors. Values are means (SD) unless indicated otherwise*

| Score | All patients (n=716) | Intracapsular fractures (n=388) | Extracapsular fractures (n=328) | Difference (95% confidence interval) | p Value* |
|---|---|---|---|---|---|
| Before fracture | 6·0 (2·6) | 6·2 (2·8) | 5·7 (2·5) | 0·5 (0·09 to 0·91) | 0·006 |
| One year after fracture | 4·4 (2·2) | 4·6 (2·7) | 4·2 (1·8) | 0·4 (0·05 to 0·75) | <0·001 |
| Reduction in mobility | 1·6 (1·5) | 1·6 (1·5) | 1·5 (1·4) | 0·1 (−0·12 to 0·32) | NS |

*Comparison of intracapsular and extracapsular fractures by Mann-Whitney U test.

TABLE IV—*Use of walking aids before and one year after fractured hip. Figures are numbers (percentages) of patients*

| Walking before fracture | Aids used one year later: No aids | Sticks | Zimmer frame | Immobile |
|---|---|---|---|---|
| Unaided (n=362) | 144 (40) | 122 (34) | 85 (23) | 11 (3) |
| With sticks (n=188) | 2 (1) | 83 (44) | 95 (51) | 8 (4) |
| With Zimmer frame (n=81) | 0 | 1 (1) | 61 (76) | 19 (23) |

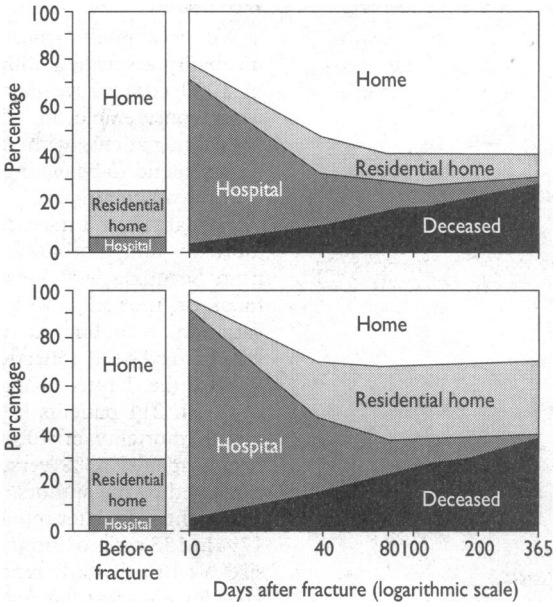


FIG 2—*Residence of patients with intracapsular fractures (top) and extracapsular fractures (bottom)*

MORBIDITY

*Mobility*—Patients with extracapsular fractures were less mobile than those with intracapsular fractures at the time of their injury. One year later, the extracapsular group continued to be less mobile but during the study period the loss of mobility was marginally greater in patients with intracapsular fractures (table III). Before their injury 28% of patients (284) were housebound; 46% (305/665) were housebound after treatment. Similarly, 54% of patients (537) were able to do their shopping before their fracture, but only 33% (221) were able to go shopping one year later.

*Walking aids*—Both groups of patients showed a greater dependence on walking aids after one year (table IV). Of patients walking unaided before their fracture, 40% (144/362) returned to that state; 34% (122/362) required sticks and 23% (85/362) a walking frame. Of those already using sticks before their fracture, 44% (83/188) returned to walking with sticks and 51% (95/188) required the use of a walking frame. Seventy six per cent (61/81) of patients walking with a walking frame before their fracture still needed the device at one year. Only 1% (3/269) of those using either sticks or a walking frame improved on their previous mobility during the follow up period.

*Residential status*—The residential status required by patients with the two types of fracture varied greatly (fig 2). A greater proportion of patients with intracapsular fractures were living in their own home before injury (76% (387/510) *v* 70% (344/490)), and a year later a greater proportion of patients with intracapsular fractures had returned to living in their own home (58% (298/510) *v* 28% (137/490)). A total of 18% (93/510) of patients with intracapsular fractures were in residential accommodation at the time of injury, compared with 25% (121/490) of those with extracapsular fractures. After one year only 10% of patients with intracapsular fractures (50) required residential care, compared with 30% (149) of those with extracapsular fractures.

*Pain*—The pain experienced by the two groups varied slightly. The patients with intracapsular fractures reported a mean (SD) residual pain score of 2·1 (1·2) at one year compared with a score of 1·9 (1·0) in patients with extracapsular fractures (95% confidence interval of difference 0·03 to 0·37; p=0·02, Mann-Whitney U test).

## Discussion

We accurately measured the mortality and morbidity associated with proximal femoral fractures in 1000 consecutive cases. Mortality and morbidity were considerable in all patients but significantly higher in patients with extracapsular fractures—such patients tend to be older and have greater morbidity at the time of their injury.

The largest and most comprehensive studies on the mortality and morbidity of hip fractures have come from Scandinavia.[7-9] Most previous studies (table V) focus on mortality, with rates showing considerable variation. Scandinavian mortality figures are lower, which may be a reflection of differing populations. Within the United Kingdom, a study from Newcastle on 211 patients in two hospitals reported a six month mortality of 40%; the variation between the two hospitals, 53% versus 28%, could not be fully explained by the authors.[10] A further study in the same area eight years later reported a six month mortality of 17% in 158 cases of intracapsular fractures.[11] The other sizeable British study reported a one year mortality of 26% for intracapsular fractures.[12] There is evidence to suggest the proportion of extracapsular fractures has gradually increased over the years,[13] as has the average age of the patients, which may in part account for the variable mortality figures. Sir Astley Cooper stated in 1824 that intertrochanteric fractures present mainly in the under 50s, while intracapsular fractures were predominant in "the elderly."[14] Furthermore, the past five decades have seen the average age of presentation of hip fracture patients increase from 67 years in 1944[15] to 79 years in this study. Further confirmation of this progressive age rise can be seen in table V. The pattern of disease is clearly changing; an aging population with a greater proportion of extracapsular fractures is bound to lead to more mortality and morbidity and greater costs for the health service.

Although mortality is important, morbidity may carry more serious implications, as the loss of independence and requirement for social support may be treatable—yet few papers focus on morbidity. After treatment, 80% of our surviving patients were discharged to their own home, and 55% maintained this residential status after one year; the remainder had died or had moved to accommodation offering enhanced support. This compares with a study in 1983 that showed 50% of patients failed to return to their own home from hospital.[16] It is difficult to determine to what extent the loss of independence following a hip fracture is related to the injury, although all patients had a loss of mobility. Many of the patients who moved into a residential home had already considered such housing, and the fracture served as a catalyst. Although intracapsular fractures were more painful, chronic pain did not seem to be an important factor after a proximal femoral fracture.

This paper identifies the considerable morbidity and mortality attached to proximal femoral fractures, together with the potential social implications, and highlights the need to reduce the incidence of femoral neck fractures. Recently the use of hormone replacement therapy has been emphasised, but efforts to prevent the falls that generally precipitate such fractures may be more beneficial for the current elderly population most at risk.[17-19]

TABLE V—*Mortality for all types of hip fractures*

| Study | Year | Country | No of patients | Average age | Mortality (%) 6 Months | Mortality (%) 1 Year |
|---|---|---|---|---|---|---|
| Fitts *et al*[20] | 1959 | USA | 109 | 71 | 24 | NA |
| Alffram[5] | 1964 | Sweden | 1114 | 72 | 19 | NA |
| Baker *et al*[21] | 1978 | England | 50 | NA | 44 | NA |
| Evans *et al*[8] | 1979 | England | 211 | NA | 40 | NA |
| Jensen *et al*[6] | 1979 | Denmark | 1592 | 77 | 21 | 27 |
| Ceder *et al*[22] | 1980 | Sweden | 103 | 75 | 10 | NA |
| Dahl[7] | 1980 | Norway | 675 | 74 | 21 | NA |
| Kenzora *et al*[23] | 1984 | USA | 406 | 74 | NA | 14 |
| Kreutzfeldt *et al*[24] | 1984 | Denmark | 117 | 79 | NA | 26 |
| White *et al*[25] | 1987 | Canada | 272 | 75 | NA | 22 |
| Dolk[26] | 1989 | Sweden | 282 | NA | NA | 28 |
| Present study | 1993 | England | 1000 | 79 | 28 | 33 |

NA=Not available.

### Clinical implications

- The average age of presentation with a proximal femoral fracture has continued to rise
- The proportion of extracapsular fractures has increased
- Over half of patients retain their former residential status one year after their fracture
- Mortality and morbidity are higher in patients with extracapsular fractures
- As the population ages, proximal femoral fractures will place an increasing burden on the health service


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