

PAPERS

Prognostic factors for the elderly with proximal femoral fracture

T. B. YOUNG* AND A. C. C. GIBBS†

* *Accident and Orthopaedic Department, Victoria Infirmary, Glasgow* and † *Department of Community Medicine, University of Manchester*

SUMMARY

A prospective study of 125 elderly patients (over 65 years) with proximal femoral fracture was carried out to compare pre-fracture sociomedical factors with the local and general complications following surgical treatment, in predicting mortality and length of stay. A poor pre-fracture mental state was more important than associated physical illness in predicting mortality. Pre-fracture mobility state was the most useful early prognostic predictor of length of hospitalization. Post-operative general complications were the most significant in predicting mortality and length of hospitalization, and more important than failure of operative technique.

INTRODUCTION

It has been shown that mortality following hip fracture decreases gradually after the fracture and eventually becomes parallel with the mortality of the general population of similar age. This duration may vary from 2 months (Dahl, 1980) to 18 months (Jensen & Tondevold, 1979). Pre-injury factors which influence this mortality and hospitalization time have been identified as age, source of admission, social status, associated illness, mental state, and mobility (Baker *et al.*, 1978; Miller, 1978; Ceder *et al.*, 1981; Jensen, 1984). However, the relative significance of each has not been established. The outcome of any operation is influenced by post-operative complications but it is not known if these are more important than factors already present before injury.

The aim of this study was to establish the relative importance of the pre-fracture factors to each other and their importance relative to post-operative complications.

* *Present address and address for correspondence: Mr T. B. Young, Accident and Emergency Department, Lincoln County Hospital, Sewell Road, Lincoln*

METHODS

A total of 210 consecutive patients above 65 years with proximal femoral fractures admitted during 1981 to the Victoria Infirmary, Glasgow were assessed for the purpose of this study at the time of injury and followed up by the authors. Due to technical difficulties only 129 cases were finally included and these were considered suitable for the study as they were randomly distributed throughout the original list. A further four patients who were not operated on were excluded from the statistical analysis.

The following factors were identified at the time of presentation to the Accident and Emergency Department in patients over 65 years who had incurred a fracture of the hip.

Mental State

This was defined as:

fully alert—oriented in time and place on presentation and able to give a full account of the incident;

confused—oriented at presentation but did not know the details of the accident;

demented—disoriented at presentation and classed as such by independent specialist assessment.

Associated Illnesses

These were diagnosed from examination at presentation and previous medical records. Only illnesses requiring treatment or chronic disabling conditions were included.

Mobility (prior to fracture)

This was defined as:

fully mobile;

partial mobility—needing aid to walk;

immobile—totally bed- or chair-bound.

Age

Only patients aged 65 years and above were included.

Source of Admission

This was classified as follows:

Group I —patients who came from their own homes;

Group II—patients who came from institutions, e.g. elderly persons' homes, nursing homes, etc.

Medication

Patients on one or more regular medications for at least 3 months before the fracture were included in this group.

Following admission to the ward each patient was followed up and any post-operative complications noted.

The time of death or discharge was noted in each case and those who were discharged were followed up to a minimum of 8 months and a maximum of 20 months.

RESULTS

All patients included in this study were operated on within 48 hours (Table 1). There were 15 males and 110 females. The median age was 80 years and the range 66–95. The female to male ratio was 7·3:1. A total of 26 patients died in hospital, 11 of them within one month of the operation. The median in-hospital time for the survivors was 31 days and the range 3–161 (Table 2). By the time the final review was made seven more

Table 1 Type of fracture and operation performed

| Type of fracture | No. of patients |
|--|-----------------|
| Intracapsular | 59 |
| Trochanteric | 58 |
| Subtrochanteric | 2 |
| Trochanteric complicating subtrochanteric | 4 |
| Unknown | 2 |
| Total | 125 |

| Type of operation | No. of patients |
|-------------------------------|-----------------|
| Pugh's Nail Plate | 81 |
| Thompson's Arthroplasty | 14 |
| KY Nail | 16 |
| Enders (Condylcephalic) Nails | 5 |
| Total Hip Replacement | 7 |
| Jewett Nail Plate | 2 |
| Total | 125 |

Table 2 Hospital time

| | No. | % | Hospital stay median (days) | Range |
|--------------------------|-----|-------|--------------------------------|-------|
| Hospital Mortality Group | 26 | 20·8 | 43 | 6–300 |
| Survivors | 97 | 77·6 | 31 | 3–161 |
| Unknown discharge time | 2 | 1·6 | | |
| Total | 125 | 100·0 | | |

patients had died after discharge, their survival time ranging from 80 days to 8 months post-operatively.

Using the *Chi*-square test with Yates' correction the factors identified at admission were compared with each other as prognostic indicators of mortality. The most significant of these was mental state ($p < 0.0005$), followed by associated illness ($0.005 > p > 0.001$), then mobility ($0.05 > p > 0.025$) and age ($p < 0.034$) (see Tables 3–5). (Age for the Mortality Group and Survivors was compared using a *t*-test for

Table 3 Mental state on admission

| | Total | | |
|----------------------|-------|----------|--|
| Fully alert | 81 | (70.43%) | |
| Dementia | 23 | | |
| Confused | 11 | | |
| Unknown mental state | 10 | | |
| Total | 125 | | |

| Relationship to survival | | | |
|--------------------------|--------------------------|-----------|-------|
| | Hospital Mortality Group | Survivors | Total |
| Alert | 8 | 73 | 81 |
| Less than alert | 14 | 20 | 34 |
| Unknown mental state | 4 | 6 | 10 |
| Total | 26 | 99 | 125 |

The difference in pre-fracture mental state between the Hospital Mortality Group and the Survivors was the most significant factor ($p < 0.0005$).

independent groups.) There was no significant statistical difference between patients who came from home and those who came from institutions. Patients not taking medication were compared with those on one or more drugs. The difference was not statistically significant (see Tables 6 and 7). A total of 30 patients were on diuretics and 79 patients were on medications which can produce dramatic orthostatic hypotension and syncopal falls. A total of 49 patients were taking a medication which is known to produce bone weakness and predispose to fracture (Table 7). Medications taken by patients in this study can promote falls or fracture; however, patients on medication were not generally ill or at a special risk.

Age (statistically just significant) is not a very helpful predictor of the outcome of this fracture.

Of those patients with post-operative general complications, 32.5% died eventually in hospital, compared with 2.19% of those not having general complications. This is a very striking difference, and is the most significant of all the variables considered relating to survival, including the pre-fracture factors (see Table 8).

Of those patients with one or more local complications, 53% died in hospital compared with 16% of those not having local complications. The difference was statistically

Table 4 Associated illness on admission

| | No. of Patients |
|--|-----------------|
| Significant respiratory disease | 16 |
| Gastrointestinal disease | 15 |
| CVA (5), Epilepsy (4), TIA (3), Parkinsonism (2) | 14 |
| Cardiac incompetence on admission | 10 |
| History of MI or Angina | 10 |
| Diabetes | 9 |
| Hypertension above 170/100 | 8 |
| Joint disease affecting mobility | 8 |
| Severe eye/ear disability (4+2) | 6 |
| Cancer | 6 |
| Total incontinence of urine | 5 |
| Total incontinence of faeces and urine | 5 |
| Renal failure (BU > 15 mml/l) | 2 |
| Urinary tract infection | 2 |
| Associated fractures | 3 |
| Anaemia | 2 |
| Varicose veins | 1 |
| Thyroid disease | 1 |
| Falls cause unknown | 1 |
| Previous lower limb amputation | 1 |

There were 13 patients with previous upper femoral fracture and four patients with previous major joint replacements; four patients had fractures prior to admission, with no residual functional disability. These conditions were therefore excluded.

Relationship to survival

| | Hospital Mortality | | |
|-------------|--------------------|-----------|-------|
| | Group | Survivors | Total |
| No illness | 3 | 50 | 53 |
| One or more | 23 | 49 | 72 |
| Total | 26 | 99 | 125 |

There is more associated illness in the Hospital Mortality Group.
This is statistically significant ($0.005 > p > 0.001$).

Table 5 Mobility prior to admission

| | Hospital Mortality | | |
|------------|--------------------|-----------|-------|
| | Group | Survivors | Total |
| Full | 11 | 63 | 74 |
| 1 stick | 5 | 11 | 16 |
| 2 sticks | 0 | 2 | 2 |
| Frame | 6 | 8 | 14 |
| Wheelchair | 1 | 0 | 1 |
| Not known | 3 | 15 | 18 |
| Total | 26 | 99 | 125 |

Relationship to survival

| | Hospital Mortality Group | Survivors | Total |
|-----------|-----------------------------|-----------|-------|
| Full | 11 | 63 | 74 |
| With aid | 12 | 21 | 33 |
| Not known | 3 | 15 | 18 |
| Total | 26 | 99 | 125 |

The survivors had better pre-injury mobility than the mortality group ($0.05 > p > 0.025$).

Table 6 Source of admission

| Patient's origin | Hospital Mortality Total | Group | Discharged |
|-----------------------|--------------------------------|-------|------------|
| Home | 94 | 17 | 74 |
| Elderly persons' home | 6 | 3 | 1 |
| Nursing home | 6 | 4 | 2 |
| Mental hospital | 14 | 1 | 14 |
| Other hospital | 5 | 1 | 6 |
| Not known | | | 2 |
| Total | 125 | 26 | 99 |

Table 7 Regular medication prior to admission

| Type of drug | No. of patients on drug |
|--------------------------------|-------------------------|
| Diuretics*† | 30 |
| Tranquilizers* | 16 |
| Anticonvulsants*† | 10 |
| Vasodilators* | 8 |
| Thyroxine†‡ | 7 |
| Digoxine | 7 |
| Antiparkinsonian* | 6 |
| Antidepressant* | 5 |
| Analgesics | 4 |
| Antibiotics | 4 |
| Antihypertensive* | 4 |
| Bronchodilators | 4 |
| Cimetidine | 4 |
| Iron | 4 |
| Folic acid and B ₁₂ | 3 |
| Oral hypoglycaemic | 3 |
| Antacid | 2 |
| Steroids† | 2 |
| Anticoagulant | 1 |

* May produce dramatic orthostatic hypotension and syncopal falls (Botez & Hausser, 1982; Hall, 1979).

† Can produce arrhythmias and muscle cramps.

‡ Can reduce bone density and predispose to fracture (Muckle, 1977).

Table 8 Post-operative general complications

| | No. of patients |
|--|-----------------|
| Post-operative anaemia requiring transfusion (Hb < 10) | 19 |
| Urinary tract infection† | 19 |
| Total confusion | 17 |
| Pneumonia (6 pulmonary embolism*) | 13 |
| Episodes of confusion | 12 |
| Bed sores | 9 |
| Renal failure (BU > 15) | 8 |
| Cardiac failure and MI | 7 |
| Incontinence | 7 |
| Gastrointestinal disease | 7 |
| Retention of urine | 2 |
| Cerebrovascular accident | 2 |
| Ketosis in a diabetic | 1 |
| Other surgery: | |
| Carcinoma colon | 1 |
| Perforated duodenal ulcer | 1 |
| Prostatectomy | 1 |
| Diverticular peritonitis | 1 |

*Clinical and x-ray diagnosis

†Needed treatment

Relationship to survival

| | Hospital Mortality | | |
|--------------------------------|--------------------|-----------|-------|
| | Group | Survivors | Total |
| Patients with no complications | 1 | 47 | 48 |
| Patients with one or more | 25 | 52 | 77 |
| Total | 26 | 99 | 125 |

Post-operative general complications in the Hospital Mortality Group were the most significant factor ($p = 0.0002$).

significant but less important than the general complications or pre-fracture mental state (see Table 9).

The actual cause of death, where available, is given in Table 10.

Length of hospitalization

The data were analysed using a stepwise linear regression programme. The variable that is the best predictor of length of stay is post-operative general complications, which is significant— $p < 0.001$, $t = 3.4$ with 96 degrees of freedom.

Table 9 Post-operative local complications

| | No. of patients |
|--|-----------------|
| Infection and other wound problems | 12 |
| Displacement of fixation | 8 |
| Penetration of femoral head | 3 |
| Dislocation of prosthesis, reduced by manipulation | 3 |
| Re-operation | 3 |
| Gross leg oedema (deep vein thrombosis)* | 3 |
| Painful stiff knee | 2 |
| Flexion leg contracture | 1 |
| Missed fracture | 1 |
| Fractured femur | 1 |
| Ischaemic foot | 1 |

*clinically diagnosed

Relationship to survival

| | Hospital Mortality Group | Survivors | Total |
|--------------------------------|--------------------------|-----------|-------|
| Patients without complications | 17 | 91 | 108 |
| Patients with one or two | 9 | 8 | 17 |
| Total | 26 | 99 | 125 |

Post-operative local complications were significantly predominant in the Hospital Mortality Group ($0.005 > p > 0.001$).

Table 10 Cause of death in hospital mortality

| | |
|---------------------------------|---|
| Pulmonary embolism* | 7 |
| Bronchopneumonia† | 5 |
| Renal failure | 2 |
| Myocardial infarction | 2 |
| CVA and renal failure | 1 |
| Diabetic ketosis | 1 |
| Heart failure and renal failure | 2 |
| Septicaemia | 1 |
| Urinary tract infection | 2 |
| Carcinomatosis | 2 |
| Heart failure | 1 |

* Suspected clinically, but not proven—two deaths were early post-operative perforated diverticulitis and prostatectomy

† One early post-operative perforated duodenal ulcer

Having included this variable, none of the other variables, when included, are statistically significant at the 0.05 probability level. Length of stay is a positively skewed variable. When the log of the length of stay was used, post-operative general complications is still the best variable for predicting length of hospitalization— $p=0.001$, $t=3.30$ with 96 degrees of freedom. Considering only those variables that were known before the fracture, then mobility is significant— $p=0.046$, $t=2.03$ with 96 degrees of freedom. No other variable (including age) when added is significant at the 0.05 probability level.

DISCUSSION

It appears that an accurate assessment of mental state in the accident and emergency department at the time of admission can predict survival after operation for a fracture of the hip. The elderly may be confused by the accident, or by pain, and disoriented due to the sudden change in their environment. In these cases enquiries from relatives, care assistants, etc. will reveal the true pre-fracture mental state. Why is the mental state so important with respect to mortality? Is it due to lack of motivation for mobility or poor nutritional state from inadequate communication? This is at present being investigated in a large prospective study.

Medication plays an important part in the treatment of the elderly. Studies have indicated that there is a relationship between medication and the patient's tendency to fall (Duthie, 1981; Sobel & McCart, 1983) and between medication and the incidence of fracture (Muckle, 1977; Muckle & Miscony, 1979). Uncertainties have been expressed by Sobel & McCart (1983) as to whether the medication is a causal factor in the fall, or simply an indicator of poor health which would predispose to falls. In our study, although more patients among those who died were on medication as compared to survivors, this did not reach statistical significance, indicating that being on medication is of no prognostic importance. It is true that drugs brought in with the patient may point to a particular illness, but these may, on the other hand, be misleading. It is not uncommon for the elderly person, who has been put on a drug for a specific illness, to continue it for prolonged periods afterwards, when it is not needed, and this is not always the patient's fault.

In this study, the source of admission was found to be an unreliable criterion for assessment. This is not the same finding as that of Miller (1978) and Evans *et al.* (1979), who stated that patients from institutions are at special risk. This may be because the criteria for institutionalization differ not only from country to country, but between areas of the same nation, and with individual family structures.

In this study, pre-fracture mobility was found to be a useful early predictor of the likely length of hospitalization.

Post-operative general complications were a more significant indicator of unsuccessful outcome to operation than failure of operative technique. It is suggested that most general complications after operation are preventable, viz. post-operative confusion, urinary tract infection, pneumonia, deep venous thrombosis and pulmonary embolism, bed sores and renal failure. As for most operations, post-operative

complications are the major contributor to mortality and it is therefore important that measures are taken to avoid them if patients have already been shown to be at risk in the accident and emergency department. Not surprisingly, regardless of factors already present on admission, the length of stay in hospital was more likely to be affected by post-operative complications. It is recommended that medical staff in the accident and emergency department determine accurately the mental state and mobility of patients before their fracture. When these factors are unfavourable it is important that every step is taken to avoid post-operative complications.

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