SIR—Hip fracture is the commonest reason for admission to acute orthopaedic wards, with 86,000 fractures each year in the UK [1]. Awareness of this and of the risk of resulting death, disability and dependency make it a much feared injury among older people [2].

The frailty of the people who typically suffer from this injury contributes to the high resulting mortality, with figures varying between 5 and 24% at 3 months and between 24 and 29% at 1 year [3].

Most UK studies have focused on 30-day, 120-day and 1-year mortality, and only a few have reported longer-term outcomes. We set out to profile mortality in a 5-year follow-up study of a cohort of >1,000 patients admitted with hip fracture. Long-term dependency and institutional care placement explain much of the economic cost of this injury [4, 5]. Using the same cohort, we examined survival for those people who needed care home placement as a consequence of increased dependency following a hip fracture.

Outcome following hip fracture: post-discharge residence and long term mortality

This was a prospective study of 1,050 people—all those presenting to the Cardiff Trauma Unit with hip fracture over a 2-year period (1 January 2003–31 December 2004).

Using the Cardiff Hip Fracture Database, we routinely collect baseline demographic details of all admissions, along with: date admitted, age, sex, date of birth (for calculating age at fracture), the latest available General Practice record, details of the fracture, admission diagnosis, any previous fracture, previous hip surgery, date and nature of admission, whether in hospital before admission, date of hip fracture, date of entry to the Cardi...
with admission clinical assessment data, information regarding their progress through surgical and rehabilitative care, details of their discharge abilities and destination, and postal and telephone follow-up data at 4 months. This is the same methodology now used across the UK by the National Hip Fracture Database [6].

In addition, for the purpose of this study, in January 2009 we repeated the usual follow-up process: to determine which patients were still alive and to define their residential status at a mean of 5 years after their original presentation. We specifically looked to see whether patients were living in residential homes (which in the UK provide carers to help with meals and personal care) or nursing homes (which offer the additional support of qualified nurses).

The Cardiff Trauma Unit accepts some admissions from the nearby town of Caerphilly, from other areas of South Wales normally served by adjacent Trusts and occasional temporary residents. In this study, we excluded these individuals (as identified by their residential post code) since we could only be confident of follow-up data for people from our own catchment area. Patients from the other areas may have visited their local hospitals for post-discharge care, and thus follow-up data regarding outcome and mortality might have been incomplete.

**Results**

Exclusion of these patients from outside Cardiff and the adjacent Vale of Glamorgan meant that we followed up a total of 916 subjects. Reference to Trust IT systems, local general practitioner mortality audit data and finally a postal questionnaire to patients left only 48 patients (5.2%) in whom we were unable to ascertain survival and residence at follow-up.

We present data on the total of 869 patients (94.8%) for whom follow-up was possible. Patients’ ages ranged from 31 to 103, with a mean of 81.3 and a median of 83 years. Three quarters (74.1%) were female.

By the end of the study period, 577 patients (66.4%) had died and 292 (33.6%) were alive.

Twenty-two percent of people were admitted from care homes and 23% were discharged to such institutional care. The similarity of these two figures conceals considerable flux. Increased dependency after hip fracture meant that while two-thirds of admissions were from residential homes, two-thirds of eventual discharges were to nursing homes.

Survival probability was analysed using the Kaplan–Meier method. The median survival time was 2.83 years [95% confidence interval (CI) 2.47–3.2].

We had recruited patients over a 2-year period but completed the follow-up process at a single time point an average of 5 years later. Thus, the Kaplan–Meier curve for all 869 patients (Figure 1) includes survival status for all cases for 4 years after fracture, but ‘censored’ data on a progressively decreasing proportion between 4 and 6 years.

Cox regression analysis was used to analyse the difference in risk of mortality by age, gender, admission physical status, American Society of Anaesthesiologists (ASA) grade, and pre-fracture residence:

- Every 10-year increase in age increased risk of death by 41% [hazard ratio (HR) 1.41; 95% CI 1.28–1.56].
- Male gender increased risk of death by 68% (HR 1.68; 95% CI 1.38–2.04).
- A one-point increase in ASA grade increased risk of death by 51% (HR 1.51; 95% CI 1.33–1.71).
- The risk of death was reduced by 40% (HR 0.60; 95% CI 0.46–0.79) for patients admitted from their own home.

![Figure 1. Left panel: survival curve for all patients admitted following a hip fracture. Right panel: survival for patients admitted from their own home and discharged to different settings.](image-url)
A total of 139 patients (16%) died in hospital, many of them being frailer older individuals who had originally been living in institutional care. Moreover, 599 (69%) of patients were admitted from their own home, and 448 (74.8%) of these patients returned there on discharge.

Patients admitted from home who were able to return there had a median survival of 5.25 years (63 months) while those who needed new placement in institutional care had a median survival of only 1.33 years (16 months), a difference that was statistically significant on log-rank test (Table 1).

Post-discharge mortality was lower in patients who returned home compared with those needing new placement in a nursing home (HR 0.35; 95% CI 0.22–0.55). Mortality was slightly, non-significantly lower in institutional homes compared with nursing homes.

The survival curve (Figure 1) illustrates the survival pattern between these groups. The increased post-discharge mortality among patients needing new care home placement was most evident in the first months after fracture. Half of patients placed in nursing homes survived <9 months, with equivalent figures of 18 months for those in residential care and 54 months for those who returned home.

## Discussion

Mortality following hip fracture has been well documented in numerous previous studies [3, 7–12]. Mortality patterns described in such studies include a 4% increase in mortality for every year of age and a 41% increase among men [7]; observations that were confirmed in our work where mortality increased by 41% for every 10 years of age and by 68% in men.

Our figure for 30-day mortality is broadly comparable with other UK studies. Work from Northern Ireland found mortality to be 6.9% at 30 days and 22.3% at 1 year [9], with the equivalent figures from our own work slightly higher at 8.4 and 33.6%, respectively.

We could only identify one previous longer-term UK study. The abstract of this unpublished follow-up of patients admitted between April 1999 and May 2004 suggested 81.7% mortality at 5 years [10]; rather higher than the figure of two-thirds seen in our study.

The huge economic impact of osteoporosis [4] reflects increases in hip fracture patients’ need for social and medical care. Such estimates have been based on models that only include data on early costs of home care and of long-term institutional care placement.

Our study can be used to refine such approaches. We did not examine the cost of health, social services and informal care provided to people who returned to their own home, or the costs incurred by people who move from a residential to a nursing home following hip fracture, but our figures can be used to examine the lifetime cost of new institutional care placement for people who were previously living at home.

- We have showed that mean survival was higher for those needing residential home placement (30.4 months) than for those needing nursing home care (19.6 months).
- Fees vary considerably between care homes, but for 2007–08 the estimated weekly cost of providing care was £502 for a residential home and £712 for a nursing home [13].

Combining these figures, we are able to estimate the average lifetime cost of providing care following a new care home placement (Table 1). This proved to be similar in both settings: £61,323 for residential care and £66,377 for nursing care.

Our unit deals with 500 people with hip fracture each year, and 70% of them are admitted from their own home. If 10% of them move to a care home on discharge, this would mean a total of 55 people needing new care home placement each year.

We have shown each such placement to carry an estimated lifetime cost of around £64,000, which implies an annual total of over £2.2 million for the lifetime cost of new care home placements from our unit.

Such estimates might prove useful when trying to convince commissioners to invest in the orthogeriatric care and multidisciplinary rehabilitation that have been shown to be effective in preventing poor outcome after hip fracture [14].

## Key points

- Only a third of people will still be alive 5 years after hip fracture.
Research letters

- Mean survival after placement in a residential home is 30 months, and for a nursing home is 20 months.
- The lifetime cost of each such institutional care placement averages over £60,000.

Conflicts of interest

None declared.

ANTONY JOHANSEN*, MAIZURA MANSOR, SUE BECK, HEATHER MAHONEY, SUZANNE THOMAS
Cardiff Trauma Unit, University Hospital of Wales, Cardiff CF14 4XW, UK
Tel: (+44) 29 2074 4687; Fax: (+44) 29 2074 5131
Email: antony.johansen@wales.nhs.uk

*To whom correspondence should be addressed

References


doi:10.1093/ageing/afq074
Published electronically 28 June 2010

Muscle strength is associated with adipose tissue gene expression of inflammatory adipokines in postmenopausal women

SIR—Ageing is associated with declines in physical function that lead to physical disability and loss of independence [1, 2]. Traditionally, loss of muscle mass has been thought of as the most important factor leading to loss of physical function and onset of disability. However, the number of older persons with excess fat mass is increasing [3], and a growing body of evidence shows obesity is an independent risk factor for ageing-related disability. Cross-sectional data show a higher prevalence of frailty, low function and disability, with higher body mass index (BMI) and fat mass, even in older persons with a normal amount of lean mass [4–7]. Longitudinal data also support a greater decline in physical function in more obese older adults [7, 8]. Since most mechanistic studies focus primarily on skeletal muscle, little is known regarding the mechanisms by which excess adipose tissue contributes to loss of physical ability in older adults.

The relationship between excess fat and loss of function in older adults is, in part, mediated by biomechanical factors [9, 10]. However, increasing knowledge about the role of adipose tissue as an endocrine organ suggests there may also be biochemical effects of adipose tissue itself on properties of skeletal muscle that lead to loss of function, i.e. the association of excess adipose tissue with physical function decline may also be due to the secretion of inflammatory proteins by adipose tissue [11]. This premise is supported by evidence that muscle strength is lower in obese persons and in conditions characterised by chronic inflammation such as diabetes and metabolic syndrome [4, 12]. Our overall hypothesis is that adipose tissue contributes to ageing-related loss of physical function, in part, via its capacity to produce and secrete inflammatory mediators that subsequently affect skeletal muscle function. This study begins to test this hypothesis by determining whether adipose tissue gene expression of specific inflammatory adipokines, interleukin-6 (IL-6) and tumour necrosis factor-α (TNFα), is associated with clinical measures of muscle strength in overweight or obese, postmenopausal women.

Methods

Data are from women who volunteered for a randomised clinical trial as detailed elsewhere [13]. Briefly, women were (i) abdominally obese (BMI: 25–40 kg/m² and waist circum-