



# Outcome Following Surgery for Proximal Femur Fractures in Centenarians

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## Abstract:

### Purpose

The Heart of England Foundation Trust has a catchment area of 1.5 million and admits more than one thousand patients with a proximal femur fracture annually. In an aging population, many of these are centenarians. In England and Wales in 2012, there were 12320 centenarians. Given the poor outcomes reported in this patient group further study is important. We report one of the largest known series assessing outcomes and examining the implications for resource allocation.

### Methods

Thirty-two centenarians with a proximal femur fracture who were admitted between January 2000 and April 2012 were compared with a group of 33 patients aged between 60-95 years. Patient outcomes were measured in terms of mortality, mobility, and post operative residential status.

### Results

The average age amongst centenarians was 101.71 years, with a female preponderance in both groups. Three quarters of younger patients lived at home compared with 40.6% aged  $\geq 100$  years. As expected, younger patients had better pre-morbid mobility, with 42.42% walking independently compared with 9.37% of centenarians. The distribution of fracture types was similar in both groups.

Centenarians' stay was 10.1 days greater than younger patients, whilst in-hospital mortality was 18.8% compared with 34.4% (younger vs centenarians). Thirty day mortality was almost double in centenarians whilst 120 day mortality, at 62.5% compared with 21.2% in the younger patients was statistically significant.

Upon discharge, two thirds of younger patients returned home, compared with only 15.6% of centenarians. Of the younger patients, 42.4% regained pre-fracture mobility compared with 15.6% of centenarians. None of the younger patients were unable to walk post-operatively compared with more than 33% of centenarians.

### Conclusions

Our findings support previous studies which show that centenarians have poor outcomes with a 120 day mortality exceeding 50%. Such patients require prolonged hospitalisation and social care support. It emphasises the requirement for preventative resource allocation to an aging population.

**Keywords:** Proximal Femur, Neck of femur, Fractures, Centenarians, Outcomes

## INTRODUCTION

In 2002 the average life expectancy was 81 years for females and 76 years for males; individuals over 85 years is the fastest growing age group in the UK. There are currently more than 13350 persons in the UK who are more than 100 years [1]. Increasingly these patients require surgery. In 2007 a total hip replacement was carried out in a centenarian at Heart of England Foundation Trust (Mr Brian Banerjee, Personal Communication). Heart of England Foundation Trust (HEFT) has a catchment area of 1.5 million and admits more than one thousand patients with a proximal femur fracture annually [2]. It is not uncommon to see centenarians who require surgery for a proximal femur fracture.

The earliest known report of a proximal femur fracture in a centenarian was by Fabian in the German literature [3]. Forster and Calthorpe in 2000 reported that the mortality at 30 days, 6 months and 1 year was 31%, 50% and 56% respectively in a series of 13 centenarians [4]. The mortality was higher than the in-hospital mortality ( $p < 0.001$ ) and the 1 year mortality ( $p = 0.002$ ) for proximal femur fractures at all ages. In 2004 Oliver and Burke reported on 18 centenarians with hip fractures who had an in hospital, 1 and 4 month mortality of 11.1%, 33.3% and 50% respectively [5]. In the centenarians the 4 month mortality was significantly higher than a hip fracture cohort in the 75 to 83 age range ( $p = 0.007$ ). Twenty two percent of the centenarians regained prefracture walking ability and 28% were able to continue living independently post fracture. Kent et al in 2009 presented 13 proximal femur fractures 10 of whom had surgery, the in-patient mortality was 50% and the 1 year mortality was 41.6% [6]. Verma et al in 2009 reported on the largest series so far with 26 centenarians who had proximal femur fractures [7]. The in-patient and 30 day mortalities were 17.3 and 30.4% respectively compared with 2 and 14% in the non-centenarians.

Oliver and Burke and Verma et al showed that the duration of hospitalisation after a proximal femur fracture in centenarians was longer than in non-centenarians [5, 7]. The duration of hospitalisation accounts for 84% of the cost of treatment of a proximal femur fracture [8]. This has implications for the National Health Service as there will be a greater demand on its resources with the changing demographics.

A study was designed to assess the outcome following proximal femur fractures in centenarians in relation to mortality, walking ability and residential status and to examine the implication for resource allocation in treatment of this sector of the population. We report the largest known series of proximal femur fractures in centenarians.

## PATIENTS AND METHODS

Permission for this retrospective study was obtained from the audit department. Patients who were 100 years or more on admission with a proximal femur fracture and had a complete set of casenotes were included in the study. The casenotes were reviewed to collect data on the patients' residential status and walking ability at the time of the fracture. The type of fracture, American Society of Anaesthesiologist (ASA) grade, method of surgical treatment, 30 day and 120 day mortality, date of death and discharge destination were also recorded. Radiographs were reviewed to ascertain the type of proximal femur fracture. The discharge destination was contacted by telephone to ascertain the latest functional status of surviving patients. Data was recorded on the Standardised Audit of Hip Fractures in Europe forms and entered on an Excel spreadsheet.

Complete casenotes were available for 32 patients who were 100 or more years at the time of admission with a proximal femur fracture, they were compared with a randomly selected control group of 33 younger patients with a mean age of 82.06 years (range 60 to 95 years) who had a proximal femur fracture. The data was analysed on an excel spreadsheet. The chi squared test was used to compare the 30 day and 120 mortality in the two groups.

**RESULTS**

The mean age of the younger ‘normal’ hip fracture patients was 82.06 years (range 60 – 95 years) compared to a mean age of 101.71(range 100-105 years) in the centenarians. Females were more common than males in both groups with a male to female ratio of 9:24 in the 60 – 95 year olds and 4:28 in the centenarians. In the younger patients 25 (75.8%) lived in their own home and 6 lived in either a residential or nursing home prior to the fracture. Thirteen (40.6%) of the centenarians lived in their own home and 18 lived in either a nursing or residential home prior to the fracture (Table 1). Fourteen (42.42%) of the younger patients compared to 3 (9.37%) of the centenarians walked without walking aids prior to the fracture.

**Table1. Pre-fracture residence**

Pre-fracture residence	60 – 95 year olds	Centenarians
Own home	25	13
Sheltered accommodation/wardencontrolled flat	2	1
Residential Home	4	5
Nursing Home	2	13

There were 14 intracapsular fractures, 18 intertrochanteric fractures and 1 subtrochanteric fracture in the 60 - 95 years patients and 14 intracapsular, 16 intertrochanteric and 2 subtrochanteric fractures in the centenarians. In the 60 -95 years patients Austin Moore’s hemiarthroplasty was performed in 10, dynamic hip screw in 17, Cemented Thompson’s hemiarthroplasty in 1, cannulated screw fixation in 2, dynamic condylar screw fixation in 1, total hip replacement in 1 and nonoperative management in one. Among the centenarians 12 had Austin Moore hemiarthroplasty, 16 had dynamic hip screw fixation, 1 had insertion of a gamma nail, 1 had insertion of a dynamic condylar screw and 1 was treated non-operatively.

The mean length of stay was 18.7 days (range 1 – 93days) in the 60 – 95 year old patients and 28.8 days (range 2 – 81 days) in the centenarians. Among the younger cohort of patients 22 (66.7%) returned to their own home after the fracture whereas only 5 (15.6%) of the centenarians returned to their own home after the fracture. Five (15.2%) of the 60- 95 year old patients required institutional care post-fracture compared with 15 (46.9%) in the centenarians (Table 2). Nine (27.2 %) of the 60-95 year old patients were able to mobilise without walking aids after the fracture; only 1 (3.1%) centenarian mobilised without walking aids after the fracture. Twelve (37%) of the centenarians were unable to walk post operatively. Fourteen (42.4 %) of the younger patients regained their pre-fracture mobility compared with 5 (15.6 %) of the centenarians (Table 3).

**Table2. Discharge destination following neck of femur surgery.**

Discharge destinationpost-fracture	60 – 95 year olds	Centenarians
Own home	22	4
Warden controlled flat	-	1
Residential Home	2	-
Nursing Home	2	13
Community hospital	1	3
Died in hospital	6	11

**Table 3.** Post-fracture mobility.

Post-fracture mobility	60 – 95 year olds	Centenarians
Full weight bearing	9	1
1 stick	1	0
Frame	17	7
unable to walk	0	12
died in hospital	5	11
no data	1	1

The in hospital mortality for the younger patients was 18.8 % compared with 34.4 % for the centenarians. One month post fracture 6 (18.2%) of the 60 -95 year old patients had died compared to 10 (31.2%) in the centenarians. The 120 day mortality increased to 21.2% in the 60 – 95 year old patients and 62.5% in the centenarians. Using the Fisher’s Exact test version of the Chi-squared test the difference in survival at 30 days (82% vs 69% survival) is not significant,  $p=0.32$  whereas it was highly significant at 120 days (76% vs 38%)  $p = 0.002$ .

**DISCUSSION**

Rehabilitation was more difficult in the centenarians. Compared with the younger cohort the centenarians showed greater impairment in mobility postoperatively; only one (3.1%) walked independently and 12 (37%) were unable to walk. Five (15.6 %) of the centenarians returned to their pre-fracture walking grade compared with 14 (42.4 %) of the younger group of patients. This is comparable with the findings of Oliver [5] in which 22.2 % of centenarians regained their pre-fracture walking grade. One third of the centenarians in the present series were unable to walk post-operatively while in Oliver’s study 44 % were either bedridden or confined to a wheelchair.

The compromised rehabilitation and limited physiological reserves contributed to the prolonged length of stay noted in the centenarians. The mean length of stay was 10 days longer in the centenarians compared with the younger patients. The prolonged length of stay indicates that the cost of care to the NHS following a proximal femur fracture is greater in the centenarians. The length of stay in the present series is longer than is other comparable series, this maybe a reflection on the lack of beds for rehabilitation in the community as the NHS closes its community hospitals. The mean length of stay in the younger patients was 18.7 days (range 1- 93 days). In the centenarians the mean was 28.8 days (range 2-81 days).

There is considerable variability in the duration of hospitalisation after neck of femur fractures. Forster [4] showed that the length of stay in hospital in centenarians was 13.5 days (range 2 – 26 days). Oliver [5] reported a 10.1 day mean length of stay in centenarians and 9.7 in his younger cohort. At Nottingham University Hospital the length of stay was 23 days (range 6 – 73 days) in fracture neck of femur patients with a mean age of 83.5 years (range 62 – 96 years) [8]. The prolonged hospitalisation in the present series is a reflection of the lack of rehabilitation beds in the Trust rather than any difference in the standard of care or functional outcome in the present series of centenarians. According to calculations by Lawrence et al, the mean hospital cost of treating a hip fracture is £12163.00 (mean stay 23 days); ward stay accounted for 84% of this cost [8]. Prolonged stay in hospital after neck of femur fracture coupled with an ever increasing geriatric population significantly increases the cost of care to the NHS.

Only four centenarians (12.5%) returned to the own home post-operatively compared with 22 (66.6 %) of the younger group. This is reflected in the greater need for institutional care in the centenarians, thirteen of whom (40.6 %) needed care in a nursing home. Forster reported that none of their centenarians returned to their own

home after a neck of femur fracture, 38 % were referred for rehab and 3 (23 %) were admitted to a nursing or residential home [4]. Oliver showed that 28.6% of centenarians were able to continue living independently compared with 69.2 % of the younger “normal” cohort after sustaining a neck of femur fracture [5]. Seventy seven percent of the centenarians in that series were in residential care at four months compared with 29.4 % of the younger neck of femur fracture patients. In centenarians, after a neck of femur fracture the cost of care to Social Services is greater than that in younger neck of femur fracture patients.

In this study centenarians showed a higher mortality than the younger patients both at 30 and 120 days with the latter being statistically significant. Oliver reported a 33 % thirty day mortality and a 50 % four month mortality following neck of femur fractures in centenarians compared with 0 % and 5.6 % in the younger “normal” group [5]. As in the present study the four month mortality in centenarians was significantly higher than that in younger proximal femur fracture patients  $p = 0.007$ .

During emergency surgery, centenarians may experience a marked fall in blood pressure independent of the type of anaesthetic used but overall they tolerate surgery well [9]. In 2004 Shabat in Israel carried out a retrospective analysis of 23 patients who were older than 100 years when they had a proximal femur fracture, to determine if operative treatment is justified [10]. The 4 patients treated non-operatively died within 2 months whereas those treated operatively survived for 0 to 78 (mean 13.8) months. Post-operatively only 4 retained their ability to walk, most had impairment in their activities of daily living. Without doubt nursing care was easier. Recently Tarity et al in the United States reviewed the mortality among centenarians with a proximal femur fracture to determine if operative treatment is safe and appropriate [11]. They concluded that the mortality is acceptable and that age alone should not preclude these patients from operative treatment.

In assessing outcome following a proximal femur fracture one may assess the outcome of the fracture or the patient. Patient outcome was chosen because of the morbidity and mortality associated with this fracture as well as the cost both financial and social. Mortality, walking ability and residential status are useful measures of outcome in these patients.

This study presents one of the largest detailed series of proximal femur fractures in centenarians. In a “letter to the editor” Rodríguez-Molinero [12] reported on data from the Spanish National Surveillance System for Hospital Data which covers 95% of hospitals in Spain. In 2005 one hundred and sixty two patients with a mean age of 101.2 (100-107) years were hospitalised with a neck of femur fracture. Neck of femur fractures exceeded congestive cardiac failure and pneumonia as causes of admission in centenarians. The global incidence of hip fractures in centenarians in Spain in 2005 was 3.8% with a 17.3% in hospital and 19 % one year mortality. This mortality is lower than that in the present study. In a similar study Mazzola et al [13] analysed the Lombardy Healthcare Utilization Database in Italy and noted 7830 centenarians who had 286 hospitalisations for neck of femur fractures between 2004 and 2011. Mortality during follow-up was significantly higher than in age and gender matched patients who did not have neck of femur fractures (77.3% vs. 60.6%,  $p < 0.001$ ). The two reports above provide some insight into the scale of the problem in managing femoral neck fractures in centenarians on a national level. They also cite the growing population of centenarians.

The patients in the current study were drawn from the catchment area of a district general hospital. The results are believed to be representative of other district general hospitals in the United Kingdom and comparable with that in other developed countries although there is some variability in the results from different countries. Martin Garcia [14] reviewed 21 neck of femur fractures in Spain in 2003, mean survival was 17.7 (0.5 – 17.7) months, they had a 19% one year mortality. Their results were consistent with those of Rodríguez-Molinero [12]. Patil [15] reported a remarkably low mortality of only 8.3 % in centenarians treated for fracture neck of femur. In his series 46.2 % of centenarians were discharged home with relatives or hired help. Perhaps that is due to the cost of healthcare in the United States or it may be a reflection on the level of family support available

to their elderly patients. The results reported by Rodríguez-Molinero [12], Martín García [13] and Patil [15] are in sharp contrast to those of Mazzola [16] from Italy who in a small series of 10 patients reported a 20 %, 70% and 80% mortality at 1, 3 and 12 months following surgery for neck of femur fractures.

One of the limitations of this study is that data was collected retrospectively. As in other retrospective studies data collection may be incomplete; there was no data on the post fracture mobility of one centenarian and one younger patient. Both groups were equally affected hence it does not invalidate the results. This is an observational study. The cohort was small and the patients were seen over several years. Subgroup analysis as to which is the best treatment for individual types of femoral neck fractures in centenarians is therefore difficult.

## **CONCLUSION**

This is one of the largest and most comprehensive reviews of the outcome of proximal femur fractures in centenarians. As the population ages more centenarians require surgery for fracture neck of femur. Our findings support those of Forster and Oliver in that centenarians do poorly after proximal femur fractures with a more than 50 % mortality 4 months after the fracture [4, 5]. These patients require prolonged hospitalisation, they are less likely to return to their own home and more likely to require institutional care. It emphasises the need to mitigate the effects of osteoporosis and highlights the need for the NHS and Social Services to allocate resources to care for older patients who are living longer. These results are equally applicable to other developed countries.

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