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Research Article

Contralateral Second Hip Fracture during the Same Hospital Admission Dramatically Increases the Risk of Mortality

Daoud Makki[1], Michael Hughes[1]*, Joseph Alsousou[2], Philippa Thorpe[3], Ravindra Gudena[4] and Ronan Banim[5]

[1]*Specialist Registrar, Trauma and Orthopaedic Surgery, Mersey Deanery, Liverpool, UK*

[2]*Academic Clinical Fellow in Trauma and Orthopaedic Surgery, University of Liverpool, Liverpool, UK*

[3]*Consultant Orthopaedic Surgeon, Arrowe Park Hospital, Wirral, UK*

[4]*Consultant Orthopaedic Surgeon, Whiston Hospital, Whiston, UK*

[5]*Consultant Orthopaedic Surgeon, Countess of Chester Hospital, Chester, UK*

***Corresponding Author:** Michael Hughes, Specialist Registrar, Trauma and Orthopaedic Surgery, Mersey Deanery, Liverpool, UK.

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Abstract

Background: We analysed 5334 patients presenting with a hip fracture at 3 large District General Hospitals in North West England over a 6-year period. 33 patients who suffered a second hip fracture in the immediate post-operative period were identified. The aim of this study is to analyse this rare sub-group of patients to characterise the demographics and outcomes following their second hip fracture. We hypothesise that a second hip fracture during same admission increases the risk of mortality significantly.

Methods: This is a 1:2 matched-control cohort study. Prospectively collected data was retrospectively analysed using SPSS software and a significance level of 0.05.

Results: Within the case group, There was a significant difference between the patients who died and those who survived in age (90.9 vs 85.7, p 0.023), AMT score (3.05 vs 6.23, p 0.004), NHFS (20.55 vs 11.54, p 0.001) and time to second fracture (3.05 vs 6.23 days, p 0.004). Case days to death were significantly lower than that of control (9 vs 75 days, p 0.0001). For patients who survived, the median of days to discharge of cases was not statistically significant than control (p 0.378). The type of fracture affected the days to death in case group only (P 0.305) and did not affect discharge in both groups.

Conclusion: Second hip fracture in the immediate post-operative period is associated with significantly increased mortality. We suggest that all hip fracture patients who are post-operation have a robust fall prevention programme in place as part of their rehabilitation regime.

Keywords: *Trauma; Hip Fracture; Contralateral; Complications; Mortality; Falls*

Introduction

Fractures of the femoral neck are a very common presentation to orthopaedic services globally. The incidence of hip fractures is increasing, predominantly due to the ageing global population and better provision and access to healthcare. In the United Kingdom there were approximately 65000 new cases reported in the National Hip Fracture Database in 2015 [1]. Hip fracture 30-day mortality in the United Kingdom is approximately 7.1% [1]. The overwhelming majority of cases are elderly patients with fractures resulting from low energy trauma, e.g. fall from standing height. Risk factors for hip fracture include increasing age, frailty, female gender, frequent falls, dementia and osteopenia [2,3]. The incidence of second contralateral hip fractures is also increasing in line with the incidence of first fractures [4]. Sustaining a first hip fracture has been shown to be a significant risk factor for a second fracture [5,6]. Dementia,

stroke, blindness, syncope and solitary lifestyle have been shown to be risk factors for second hip fractures [7,8]. One study reported the incidence of second hip fracture to be 2.7% at 1 year and 7.8% at 8.5 years, however this is likely to have increased [9]. The risk of second fracture is highest in the first 12 months, then decreases towards the baseline risk for age [10,11]. The functional outcome following a second hip fracture outside of the early post-operative period has shown to be similar to the first fracture [12,13].

Various studies have examined simultaneous bilateral hip fractures, or contralateral hip fractures following a first fracture [14,15], however to our knowledge, there are no studies specifically investigating second hip fractures in the very early post-operative period.

Our study examines a rare sub-group of patients who have sustained a second hip fracture in the immediate post-operative period before they have been discharged.

Our study aims to evaluate the risk of mortality in this group of patients who have sustained a second hip fracture in the immediate post-operative period before they have been discharged from hospital in comparison to a matched control group. Also, to identify comorbidities that affects the risk of mortality in this group comparing to the matched-control group. We hypothesise that a second hip fracture during same admission increases the risk of mortality significantly.

To our knowledge there has not been any published evidence in the literature specifically looking at the patient cohort in our study.

Methods

A prospective multi-centre review was carried out using electronic and paper case notes at three large District General Hospitals in North West England between 2008 and 2013. The collection was compatible with the national Hip Fracture Database and managed in accordance with Caldecott principles. Inclusion criteria were; age over 18yrs, admitted with confirmed single femoral neck fracture, surgical management of the fracture, second femoral neck fracture before discharge, surgical management of the second fracture, access to case notes and follow up to discharge or death. Patients that were managed non-operatively were excluded. We defined the study period as the time from admission to discharge or death. Using methods described previously [16,17], each case was matched with two controls taken from the same prospectively collected dataset. The controls were matched based on six factors known to influence outcome after neck of femur fracture [18]. These were the same gender, age within five years, same fracture type (intra- or extra-capsular), Nottingham Hip Fracture Score (within 1 bracket), an identical operation and comorbidities. All patients were studied during their acute admission until discharge.

Basic patient demographics, time to first surgery, Abbreviated Mental Test (AMT) score, Nottingham Hip Fracture Score (NHFS), admission haemoglobin (Hb), home and mobility circumstances, time to second operation, types of procedure, outcome and discharge destination were collected. Information regarding mortality was obtained one year after the last patients was included in the study. This allowed us to calculate the probability of mortality. Censored data have been accommodated in our statistical analysis using Kaplan-Meier survival analysis.

Data were analysed using SPSS statistics software, version 24.0 using Shapiro Wilks to assess normality, Mann-Whitney test with continuous data and direct logistic regression to identify risk factors for mortality. Survival and mortality probability was estimated using Kaplan Meier test and Cox regression analysis. A p value of less than 0.05 was considered significant.

Literature searches were carried out using the Medline database accessed via OVID and PubMed. Keywords included neck, femur, femoral, second, contralateral, complication. Truncated terms were applied to maximise results. Additional manual searches were carried out using references from identified articles. No studies were found from the literature with similar inclusion criteria. All studies identified from the literature searches were analysed using a standard appraisal tool.

Results

We identified 5334 hip fracture admissions between 2008 and 2013. From these admissions we identified 33 patients (11M, 22F) who met the case group inclusion criteria. The ages ranged from 73-100 years (mean 88.9). The cohort crude mortality rate was 60.6% (n = 20). We identified a further 66 patients from the general cohort which were matched as closely as possible by age (+/- 5yrs), sex, NHFS (+/- 1 bracket), co-morbidity and procedure demographics. These patients were then analysed to provide a matched 2:1 comparison population. There was no statistically significant difference in these data between our matched control group and study group (Table 1).

	Cases	Matched Controls	p-value
Mean age at fracture (years)	88.9	88.0	0.55
Female (%)	66.7	66.7	1.00
Mean NHFS	16.8	15.0	0.26
AMTS	4.3	4.9	0.38
Type of fracture (%)			
Intracapsular	45.4	60.6	0.15
Extracapsular	42.4	36.4	0.56
Subtrochanteric	12.2	3.0	0.11
Operation type (%)			
DHS	45.4	31.8	0.30
Hemiarthroplasty	42.4	56.0	0.48
THA	0	1.5	0.48
IM Nail	12.2	10.7	0.82
HB	11.1	10.4	0.47
Time to second fracture (days)	7.8	n/a	n/a

Table 1*: Case and Matched Control group comparison data.*

The majority of patients had 2 or more co-morbidities, the most common being hypertension, atrial fibrillation, osteoarthritis, dementia and cardio- or cerebro-vascular disease.

Seven patients (21.2%) were admitted from their own home, with the remainder being admitted from Residential (51.5%) or Nursing homes (27.2%). Unsurprisingly, those patients admitted from their own home were more likely to survive to discharge. Six patients (18.2%) were independently mobile with no mobility aids on admission, with the majority of the cohort using a walking stick or frame.

The primary procedures performed were hemiarthroplasty (n = 15, 45.5%), dynamic hip screw (n = 14, 42.4%) and cephalo-medullary nail (n = 4, 12.1%). The secondary procedures performed were hemiarthroplasty (n = 16, 48.5%), dynamic hip screw (n = 12, 36.4%), cephalo-medullary nail (n = 4, 12.1%) and total hip replacement (n = 1, 3.0%). The primary and secondary procedures were identical in 20 patients (60.6%). There was no significant difference in admission Hb (g/dL) between those who died and those who survived (mean 11.125 vs 11.123, p = 0.956, Mann-Whitney).

We identified several significant differences between those patients who died and those that survived in the case group. There was a statistically significant difference in mean age (years) (90.9 vs 85.7, p = 0.023, students t-test), AMT score (mean 3.05 vs 6.23, p = 0.004, Mann-Whitney U), NHFS (% mortality at 30 days) (mean 20.55 vs 11.54, p = 0.001, Mann-Whitney U) and time (days) to second fracture (mean 3.05, vs 6.23, p = 0.004, Mann-Whitney U).

We also identified a statistically significant difference in death rates between those who patients who sustained their second fracture at the weekend versus those that fractured on a weekday (p = 0.001, Chi-squared). We calculated the absolute risk of death from a weekend fracture at 0.89 vs 0.27, (Relative Risk Reduction 0.7). Most patients received their surgical treatment within 36 hours from the diagnosis of the second hip fracture and both those that survived and those that died were comparable: 11 out of 19 patients who sustained the second fracture on weekends and 8 out of 14 patients who sustained the second fracture on weekdays received their surgical intervention within 36 hours of diagnosis. This difference was not statistically significant (Fisher's exact test, p = 0.99). The risk of death associated with having an AMT score of 0-5 was 0.77 vs 0.27 for those with a score of 6-10 in the case group which differed in the control group (AMT 0-5, 0.16 vs AMT 6-10, 0.15).

Compared to our matched control population, there was again no significant difference in Hb (p = 0.465, Mann-Whitney U), however we found statistically significant differences in days to death or discharge (p = 0.001).

Kaplan-Meier survival curves were plotted for days to death in both groups (Figure 1). The majority of cases died before discharge (60.6%, 20 out of 33 cases), while the majority of controls survived till discharge (15.15%, 10 out of 66). Cases days to death (median 9 days) were significantly lower than that of control (median 75 days, p 0.0001). For patients who survived, the median of days to discharge from hospital of cases (21 days) was not statistically significant than control (16 days) with p value of 0.378 (Figure 2).

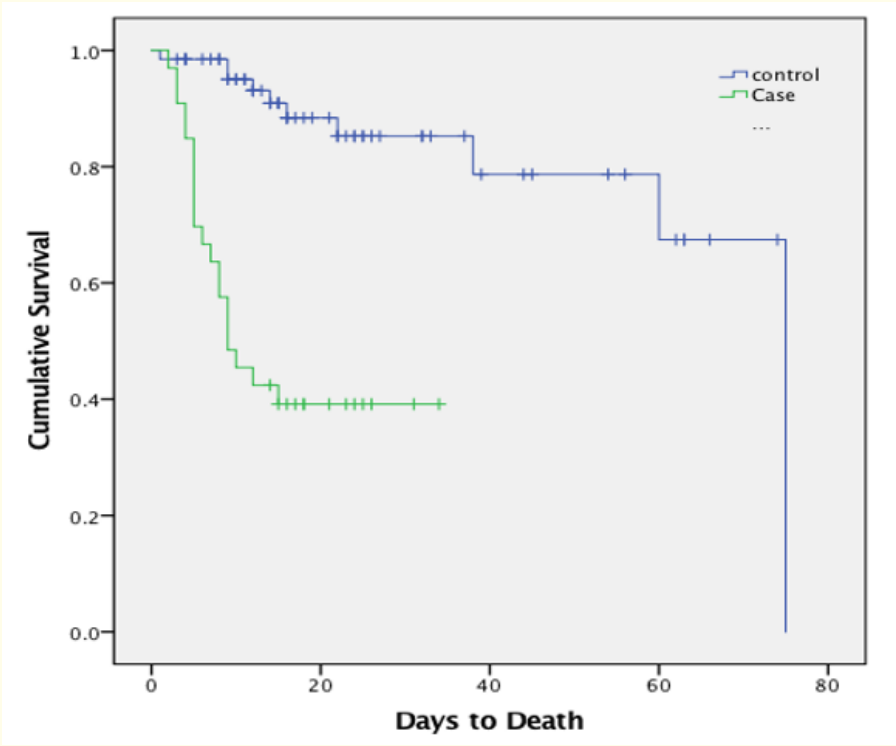

Figure 1: *Kaplan-Meier survival analysis showing case and matched control days to death.*

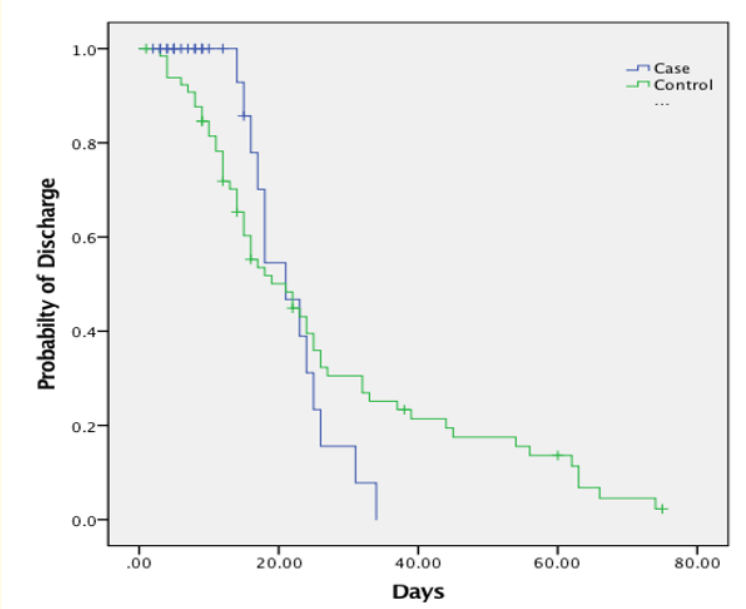

Figure 2: *Kaplan-Meier survival curve showing case and matched control days to discharge.*

Interestingly the type of fracture had an effect on the days to death in the cases group (p 0.038) with extracapsular fractures having better survival than intracapsular fractures. This effect was not significant in the control group (P 0.305) (Figure 3). There was no significant effect of the type of fracture on the days to discharge from hospital in both cases and control groups (p 0.616 and 0.337 respectively).

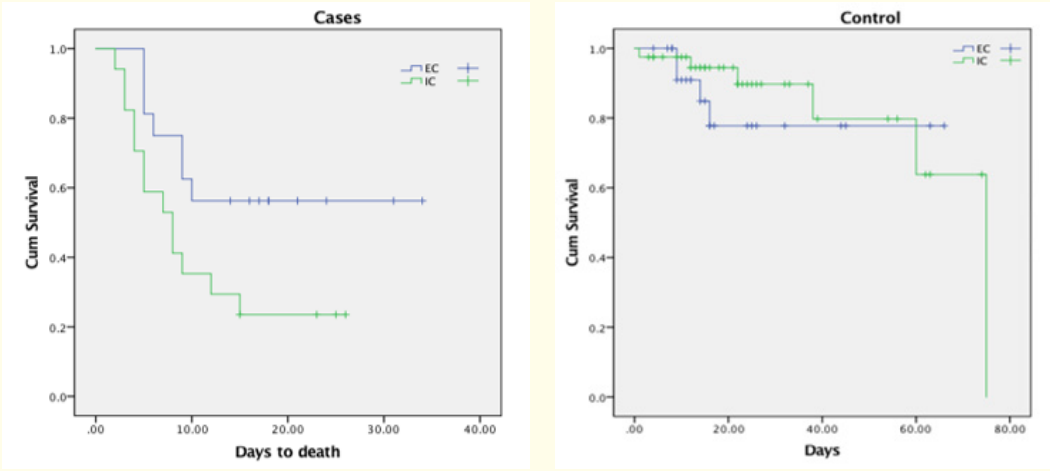

Figure 3: *Survival curves of intracapsular (IC) and extracapsular (EC) fractures in cases (left graph) and controls (right graphs).*

Discussion

We identified several interesting areas for discussion from our results. We identified a clear difference in survival between those patients who suffered a single fracture versus those that suffered a second fracture. This is not surprising given the second physiological insult to this frail patient group. What was surprising was that the mortality rate was so high.

One of the aims of our study was to identify commonalities in our patient group to allow us to identify risk factors for second fracture and subsequently help prevent them.

We identified that the most common cause of fracture was a fall from bed (n = 17, 51.5%), followed by a fall whilst walking (n = 7, 21.2%). We would therefore advocate that post-operative hip fracture patients should have full falls prevention measures in place. We would suggest that pressure alarms, cot sides and close supervision should be the minimum requirements. This could be achieved by nursing all post-operative hip fracture patients in designated bays to allow constant supervision. 3 patients (9.1%) had unwitnessed falls.

We identified an AMT score of < 6 to be a predictor of higher mortality. Increased mortality in hip fracture with dementia has been well described [2]. We would suggest that patients with dementia or post-operative delirium should be monitored closely to prevent falls.

We identified on sub-group analysis that those patients who suffered a second fracture at the weekend were more likely to die than those who had their second fracture mid-week. The principle cause of fracture in both groups was a fall from bed. We could not attribute this increase in mortality from weekend falls to staffing issues because nursing and on-call medical staffing levels are constant throughout the week, nor to any reduction in trauma list capacity as there is an all-day trauma list at the weekend at the three centres. Furthermore, there was no difference in the time from the diagnosis of the second fracture to surgical management between those who fell on weekends and those who fell on weekdays (the majority had treatment within 36 hours). We don't think that there is any link to staffing levels because most patients did not get their operation on the day they fell. This means for example people falling at the end of the week would be operated on at the weekend and vice versa. Our results suggest that patients may be more likely to fall at the weekend, but we cannot explain why these patients have a higher mortality rate. This difference may be due to a sample size effect of sub-group analysis within a small group.

Extra-capsular fractures showed a greater difference in survival rates between the control and study groups than intra-capsular (Figure 3), this may be due to greater heterogeneity in procedure in the extra-capsular group (DHS vs long or short cephalo-medullary nail). We did not carry out further analysis to examine any difference between cephalo-medullary nail versus DHS fixation.

This study has limitations. Firstly; We did not collect data about re-admission rates in our population. This could have been interesting given the high reported rate of re-admission in hip fracture patients [19,20]. Secondly, we did not follow the discharge location and whether having a second fracture affected this. Thirdly, a larger number of patients in this rare subgroup of hip fracture patients will allow the analysis of risk factors for the second fracture. This may be used to inform preventative measures.

Conclusion

We would like to emphasise the important take home messages from our study:

- Firstly; patients who suffer a hip fracture are at increased risk of a contra-lateral fracture.
- Secondly; this risk is much higher in patients with dementia or acute delirium.
- Thirdly; patients who suffer a contra-lateral fracture in the very early post-operative period have a dramatically higher mortality rate than those who don't.
- Fourthly; patients with higher NHFS and lower AMT scores have a higher mortality rate.

In conclusion, we present data from a multicentre prospective case control series, investigating a very rare sub-group of the hip fracture population. The fact that patients in our study cohort had a higher mortality rate than our control group is not surprising. Intuitively, one would expect a second significant injury to have a greater effect on the patient, what we were surprised by was the magnitude of the increase in mortality. There has been no published work examining the cohort of patients in our study. We identified a mortality rate of 60% in our study population. We identified previously described risk factors for second hip fracture, however we also described the mechanism of injury and distribution of aetiologies in this population.

We recommend that all post-operative hip fracture patients who have dementia or post-operative delirium are monitored closely to prevent falls. Patients who do suffer a second hip fracture in the immediate post-operative period are at a surprisingly high risk of mortality. We suggest that these patients should be managed extremely carefully with full multi-disciplinary and Ortho-Geriatrician team input. We recommend that in the immediate post-operative period these patients should be nursed in a dedicated closely monitored area. We recommend careful rationalisation of medications to avoid worsening delirium. We recommend the use of pressure sensors, cot sides, one-to-one supervision, hip pads and non-slip footwear where appropriate.

Conflict of Interest

The authors received no financial or other support for this study and have no conflicts of interest to declare.

Bibliography

1. Falls and Fragility Fracture Audit Programme. National Hip Fracture Database 2015 Report (2016).
2. Fukushima T., *et al*. "Bilateral Hip Fractures". *Journal of Orthopaedic Science* 11.5 (2006): 435-434.
3. Shabat S., *et al*. "The Second Hip Fracture-An Analysis of 84 Elderly Patients". *Journal of Orthopaedic Trauma* 17.9 (2003): 613-617.
4. Burgers P., *et al*. "Cumulative incidence and treatment of non-simultaneous bilateral femoral neck fractures in a cohort of one thousand two hundred and fifty patients". *International Orthopaedics (SICOT)* 38.11 (2014): 2335-2342.
5. Schroder H., *et al*. "Occurrance and Incidence of the Second Hip Fracture". *Current Orthopaedics and Related Research* 289 (1993): 166-169.
6. Kok L., *et al*. "A retrospective analysis of bilateral fractures over sixteen years: localisation and variation in treatment of second hip fractures". *International Orthopaedics* 35.10 (2011): 1545-1551.
7. Saxena P and Shankar J. "Contralateral hip fractures - can predisposing factors be determined?" *Injury* 31.6 (2000): 421-424.
8. Kim SM., *et al*. "Prediction of survival, second fracture, and functional recovery following the first hip fracture surgery in elderly patients". *Bone* 50.6 (2012): 1343-1350.
9. Lawrence T., *et al*. "Age-specific incidence of first and second fractures of the hip". *Journal of Bone and Joint Surgery-British Volume* 92.2 (2010): 258-261.
10. Nymark T., *et al*. "Short time-frame from first to second hip fracture in the Funen County Hip Fracture Study". *Osteoporosis International* 17.9 (2006): 1353-1357.
11. Angthong C., *et al*. "Major risk factors for the second contralateral hip fracture in the elderly". *Acta Orthopaedica et Traumatologica Turcica* 43.3 (2009): 193-198.

12. Di Monaco M., *et al*. "Functional Recovery and Length of Stay After Recurrent Hip Fracture". *American Journal of Physical Medicine and Rehabilitation* 81.2 (2002): 86-89.

13. Sawalha S and Parker M. "Characteristics and outcome in patients sustaining a second contralateral fracture of the hip". *Journal of Bone and Joint Surgery-British Volume* 94.1 (2012): 102-106.

14. Gaumetou E., *et al*. "Non-simultaneous bilateral hip fracture: Epidemiologic study of 241 hip fractures". *Orthopaedics and Traumatology: Surgery and Research* 97.1 (2011): 22-27.

15. Weatherall M. "Contralateral fracture of the proximal femur". *Journal of Bone and Joint Surgery-British Volume* 81.1 (1999): 77-79.

16. Pollard TC., *et al*. "Deep wound infection after proximal femoral fracture: consequences and costs". *Journal of Hospital Infection* 63.2 (2006): 133-139.

17. Thakar C., *et al*. "The cost and consequences of proximal femoral fractures which require further surgery". *Journal of Bone and Joint Surgery-British Volume* 92.12 (2010): 1669-1677.

18. Ions GK and Stevens J. "Prediction of survival in patients with femoral neck fractures". *Journal of Bone and Joint Surgery-British Volume* 69.3 (1987): 384-387.

19. Hahnel J., *et al*. "Re-admissions following hip fracture surgery". *Annals of the Royal College of Surgeons of England* 91.7 (2009): 591-595.

20. Ip D and Ip F. "Elderly patients with two episodes of fragility hip fractures form a special subgroup". *Journal of Orthopaedic Surgery* 14.3 (2006): 245-248.

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