



## Does the place of fall influence the time to specialist treatment in patients sustaining hip fractures ? A study of 4917 patients falling in four different settings

Sameer K. KHAN, Anil KHANNA, Moaz AL-SALAH, Martyn J. PARKER

*From Peterborough District Hospital, Peterborough, U.K.*

Delay to treatment is a multifactorial issue for patients sustaining hip fractures. The place of fall could possibly impact on the time to specialist care. We aimed to investigate the correlation between the place where a hip fracture occurs, and the time to initiation of specialist fracture-specific treatment. We retrospectively analysed data that had been collected on 4917 consecutive hip fracture admissions to our unit. The recorded places of fall were divided into four groups, including those falling 'outside home', 'at home', 'residential or nursing home', and 'hospital inpatients' respectively. A 24-hour scale was used to record times of fall and of initiation of treatment. The latter was the time of admission to Accident & Emergency for groups 1-3, and the time of referral to the Orthopaedic team for group 4. 23.5% patients fell outside their own home (group 1), and presented at only 2 hours post-injury. Patients in both group 2 (47.7%) and group 3 (23.6%) presented after 3 hours. Group 4 (4.9%) patients had to wait a median of 8 hours being referred to the Orthopaedic team. We found an interesting correlation between the place of injury and the delay in receiving treatment, in that those patients already receiving maximal healthcare attention, had to wait the longest to be referred to specialist care.

**Keywords:** proximal femoral fractures; time to initiation of treatment; institutionalised fallers; hospitalised fallers.

### INTRODUCTION

Hip fractures are one of the leading causes of morbidity in the elderly population. In elderly patients, the 1-year mortality rate for hip fracture ranges from 14% to 36% (19). Additionally, these injuries have been shown to be associated with poor functional outcomes (12,11). Surgical delay beyond 48 hours of admission has been found to increase the length of hospital stay and the incidence of post-operative complications (6,7,20,10). It may also

- 
- Sameer K. Khan, MRCS, Specialist Registrar in Trauma & Orthopaedics.  
*James Cook University Hospital, Middlesbrough, UK.*
  - Anil Khanna, MS (Orth), MRCS, Orthopaedic Research Fellow.  
*University Hospital of North Staffordshire, Stoke-on-Trent, UK.*
  - Moaz Al-Salahi, MRCS, Clinical Fellow.  
*Peterborough District Hospital, Peterborough, UK.*
  - Martyn J. Parker, MD, FRCS (Orth), Orthopaedic Research Fellow.  
*Peterborough District Hospital, Peterborough, UK.*
- Correspondence : Mr Sameer K. Khan, 103 Kildale House, Marton Road, Middlesbrough TS4 3TG, UK.  
E-mail : Sameer.khan@doctors.net.uk  
© 2011, Acta Orthopædica Belgica.
-

increase 30-day and 1-year mortality (17). Several factors may be implicated in causing these delays (5). Patient factors include poor general health, need for medical optimisation for anaesthesia, and correction of anaemia, dyselectrolytaemias, dehydration or coagulopathy etc. Administrative and logistic reasons could include restricted access to theatre, surgeon, or anaesthetist. This implies that an appreciable reduction in morbidity could be achieved if these individuals can have their definitive fracture treatment initiated rapidly.

We resolved to explore the very first step of fracture-specific care i.e. the initial referral to and review by the trauma team. We felt this would enable us to identify factors that possibly delayed the initiation of treatment, and also if these could be minimized or ameliorated, thereby optimising patient care.

#### PATIENTS AND METHODS

Between January 1999 and November 2006, 5246 patients with proximal femoral fractures were

admitted to our unit. After informed consent, information regarding each case was prospectively collected on a detailed proforma and entered into a hip fracture database. This collective data was then retrospectively analysed. This study was authorised by the local ethical committee and was performed in accordance with the Ethical standards of the 1964 Declaration of Helsinki as revised in 2000.

Patients of all ages were included. All causes of fall were included, i.e. mechanical fall, cerebrovascular event, myocardial ischaemia etc. Patients with a pathological fracture secondary to bone malignancy, Paget's disease, or a localised bone cyst were excluded from the study. One patient with incomplete data, and those patients with no history of a fall (169 cases) were excluded. This left 4917 patients for consideration.

The patients were grouped according to where they fell (Fig. 1). Group 1 included patients who fell outside their own home. The second group comprised individuals that fell within their own homes (own house or bungalow, rented accommodation or warden controlled accommodation). Patients in the third group fell inside residential or nursing home accommodation, while those in the fourth group fell whilst being inpatients in hospital for other reasons.

### Distribution of patients

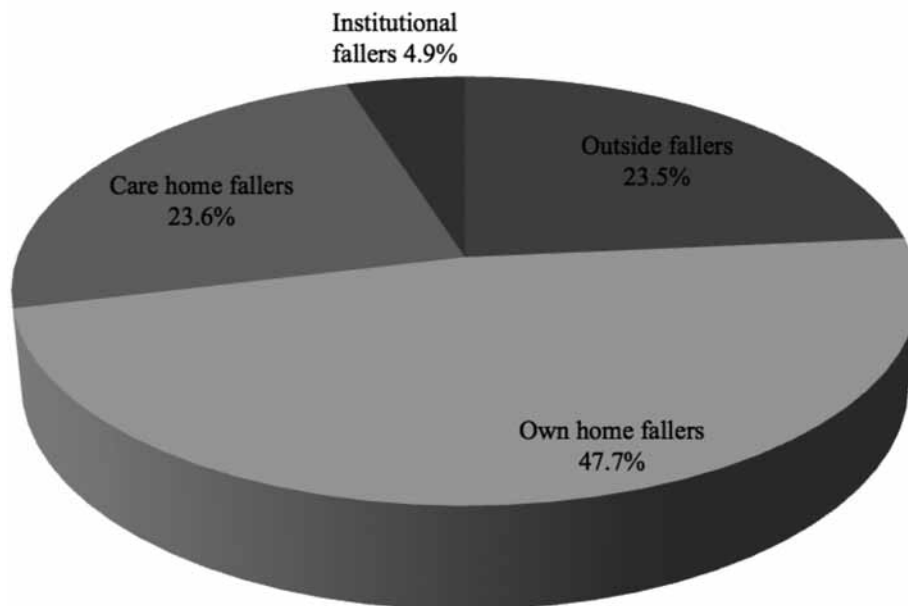


Fig. 1. — Pie chart showing percentage distribution of patients across the four groups

The ‘time of fall’ was defined as the earliest time the patient fell, was seen to fall, or was found fallen on the ground. This was ascertained from the patients themselves (if they could recall it), or from neighbours, carers, paramedical/medical/nursing staff, as applicable. This time was recorded on a 24-hour scale.

The ‘time of initiation of treatment’ was defined as the time of presentation to the Accident and Emergency department for patients falling outside the hospital (Groups 1-3). This was recorded from the computer-generated front sheet of their casualty notes, to maintain uniformity and accuracy. For hospital inpatients suffering falls, it was the time of referral to the oncall Orthopaedic team, which gets entered manually by the oncall clinician on their handover sheets, as per departmental policy. The time was subdivided into hourly intervals for first 24 hours and then into groups of 2-3 days, 4-5 days, 6-7 days and > 7 days groups. Using this information, the time interval between ‘fall’ and ‘initiation of treatment’ was calculated for each group.

**RESULTS**

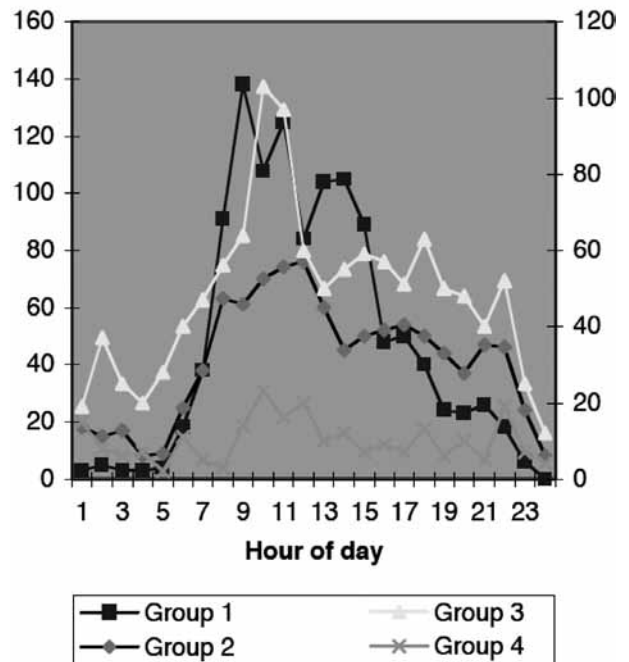
**Group 1**

1157 (23.5% of all) patients fell outside, away from their own home. These falls were more likely to occur between the hours of 08:00 and 15:00 with 65.9% (762/1157) of falls occurring in this time period, and 91.7% (1062/1157) falling between 08:00 and 22:00. Falls between the hours of 22:00 and 08:00 were 8.3% (95/1157). The median time of arrival was 2 hours ; 70.4% (814/1157) of patients were seen within three hours from injury (Fig. 2 & 3).

**Group 2**

2344 (47.7% of all) patients fell inside, at their own home ; 88.8% of these falls (2081/2344) occurred between the hours of 08:00 to 22:00, with the most common time being in the morning between the hours of 08 :00 and 13 :00. They took a median time of 2 hours to arrive ; 57.6% (1351/2344) of patients were first seen within three hours from the time of injury (Fig. 2 & 3).

**Time of fall on a 24 hour scale**



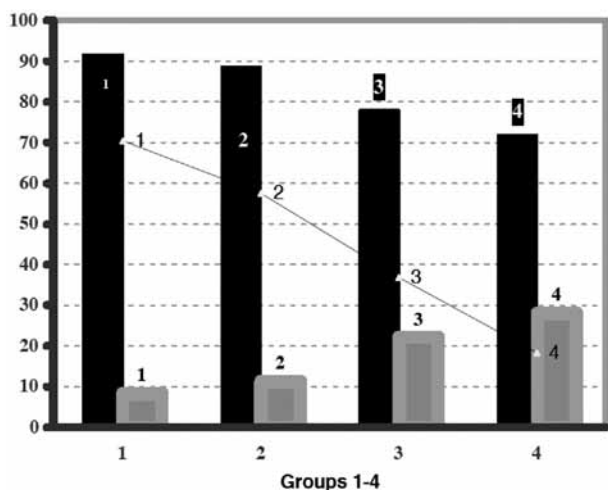
**Fig. 2.** — Time of fall for all four groups on a 24 hour scale. X-axis : Hour of day Y-axis : Number of patients.

**Group 3**

1173 (23.6% of all) patients fell inside in residential home/nursing home. There was a broader spread of falls over the 24-hour period : 78% (915/1173) of falls occurred between the hours of 08:00 to 22:00, while 22% (258/1173) of falls occurred between the hours of 22:00 and 08:00. Median time to admission was 3 hours ; 36.8% (432/1173) of patients were first seen within three hours of the injury (Fig. 2 & 3).

**Group 4**

243 (4.9% of all) patients fell whilst they were hospital inpatients. These individuals exhibited no



**Fig. 3.** — Percentage of patients falling by time for all groups. Black bars : Percentage of patients falling between 08:00 and 22:00. Light two-tone bars : Percentage of patients falling between 22:00 and 08:00. Black line : Percentage of patients seen within 3 hours of fall (groups 1-3) or referral (group 4).

particular pattern in their referral to the orthopaedic team, as there was a more even spread of the falls over the 24 hour period : 72% (175/243) of falls occurred between the hours of 08:00 to 22:00. The median time for diagnosis of this injury was surprisingly high at 8 hours. Only 18.3% (45/243) of patients were first seen within three hours from the time of injury (Fig. 2 & 3).

## DISCUSSION

Admission time has been shown to predict outcome after hip fracture (3,6). However, its relation to place of fall has not been addressed in clinical studies to date. We believe this study is first of its kind to relate the two. We acknowledge that the study is limited by the absence of a statistical analysis. Patients with proximal femoral fractures span a spectrum of physiological fitness, as indicated by the four groups in this study. It is difficult to quantify the effect of delayed presentation and referral, without adjusting for confounding factors. These include both patient factors (co-morbidities, ASA grade, mental status etc) and logistical factors

(access to help, mode of transport, and patient load in the Emergency department, among others). However, given the large database of patients (n = 4917), we believe the results of this study are still pertinent.

Group 1 patients tended to be the fittest and most mobile of all groups. This is reflected by their cause of injury, eg. slipping off a bicycle or scooter, as well as by their place of fall, eg. grocery shop, activity centre or after tripping on the street. They also tend to present the earliest. One of the explanations may be that other individuals who witnessed the fall alerted the emergency services and also these individuals had a fall mainly during the working hours when lot of individuals are present around them.

Group 2 patients comprise the majority of hip fracture patients. This is consistent with previously published literature (1,2). Their presentation to hospital may be delayed due to personal or logistic reasons, eg. calling the general practitioner to visit at home, or being unable to get off the floor to call an ambulance. Neighbours or next of kin might be the first to find them on the floor, and this might not happen till next morning. Additionally, there might be delays in the ambulance arriving to fetch them, or delays on the road.

Group 3 patients are ‘institutionalised fallers’. Fall to admission time in this group declines as the time goes by until delayed presentation is seen (> 2-3 days group). This second rise is seen mainly in patients with multiple co morbidities who are otherwise less mobile before fall and are thus less likely to be closely monitored. This concurs with previous studies of community dwellers compared to institutionalised patients suffering hip fractures (4).

Group 4 patients are ‘hospitalised fallers’. These pose particular problems of their own. We acknowledge the methodological exception given to this group in our study. The primary measure ‘time of presentation to Accident & Emergency’ could not be used in them. So the ‘time to referral to the oncall orthopaedic team’ was used as a substitute. This can be less accurate than the computer-generated measure used for groups 1-3, making the comparison less than true. However using the time of orthopaedic assessment for all groups could incur

accrual of errors and inaccuracies in the whole data set.

For group 4 the reasons for delay in referral are likely multifactorial. These hospitalised patients already had medical or surgical co-morbidities and had poor mobility to begin with (13). They fell while being an inpatient on medical, geriatric or psychiatric wards. Common causes include fall off a chair or a bed when asleep or agitated, falls due to postural hypotension or psychoactive medication, or a fall while attempting ambulation without enough assistance or supervision (8,14,16). It is possible that they were not paid much attention immediately after their fall, as far as their mobility is concerned, since they were considered by their caring teams to be in the right place anyway.

With the 'Hospital at night' scheme being implemented, there are fewer junior doctors to cover the wards, and they may be cross-covering additional specialties, and hence more patients than during the daytime. It might therefore take longer for an initial assessment before a referral is made to the orthopaedic team. There may possibly be an element of complacency to wait till the morning to do so. Additionally, when an in-patient falls, it is usual to arrange radiographs to confirm the fracture, before referral to the orthopaedic team. Obtaining these in the middle of the night can be time-consuming, as there are fewer portering staff to take patients down to the radiography suite, and pelvis radiographs are not routinely done on the ward.

We did not undertake an analysis of whether sex, age or mental status made a difference to our findings. There was however no preponderance for type of fracture i.e. intracapsular or extracapsular in any of the four groups. We realise that the time from injury to surgery in these patients is a sum total of sequential events. The initial referral or presentation is followed by radiological diagnosis, admission to a surgical ward, optimisation for surgery, and listing on an operating list, etc. Even in patients who present early, surgical repair might be delayed for any of these later-mentioned factors. As such, delayed presentation and referral is only one cause of surgical delay. However we intuitively suggest that early referral and presentation, especially in institutionalised and hospitalised patients, could

lessen this surgical delay, and hence reduce morbidity further in these patients.

Figure 3 displays a trend of worsening mobility and delay to specialist treatment. This brings to light the fact that a very high index of suspicion of hip fracture is required in all elderly patients sustaining a fall especially when their previous mobility is limited, and specially when they are already institutionalised or hospitalised. It also demonstrates that increased awareness of the causation and clinical features of hip fractures needs to be disseminated among a larger audience. In an institutional setting, this includes nursing and residential home staff, home managers, senior activity organisers and general practitioners. Previous studies have looked at strategies and interventions targeting these groups, with evidence suggesting reduced incidence of injuries (9,18). In hospitals, medical, geriatric and psychiatry teams need to be targeted via means like multidisciplinary meetings and educational sessions etc. The onus of initiating this increased awareness however lies with the Trauma or Orthopaedic department, as the case may be. Reporting systems for falls in institutions and hospitals need to be re-inforced and strengthened (5). We also feel that more studies need to be carried out looking at similar parameters and factors delaying the presentation and diagnosis of hip fractures, so that an attempt can be made to decrease the morbidity in this already frail elderly population.

## CONCLUSIONS

We conclude that the place where the injury occurred, correlates with delays in receiving treatment. Those who sustained hip fractures after falling in hospitals or institutional care were more likely to be delayed in receiving the surgical care. This needs to be fed back to the care-providers at these institutions, to expedite referral and fracture-specific treatment.

## REFERENCES

1. **Abolhassani F, Moayyeri A, Naghavi M *et al.*** Incidence and characteristics of falls leading to hip fracture in Iranian population. *Bone*.2006 ; 39 : 408-413.

2. **Aharonoff GB, Dennis MG, Elshinawy A, Zuckerman JD, Koval KJ.** Circumstances of falls causing hip fractures in the elderly. *Clin Orthop Relat Res* 1998 ; 348 : 10-14.
3. **Clague JE, Craddock E, Andrew G, Horan MA, Pendleton N.** Predictors of outcome following hip fracture. Admission time predicts length of stay and in-hospital mortality. *Injury* 2002 ; 33 : 1-6.
4. **Formiga F, Lopez-Soto A, Duaso E et al.** Differences in the characteristics of elderly patients suffering from hip fracture due to falls according to place of residence. *J Am Med Dir Assoc* 2007 ; 8 : 533-537.
5. **Healey F, Scobie S, Oliver D et al.** Falls in English and Welsh hospitals : a national observational study based on retrospective analysis of 12 months of patient safety incident reports. *Qual Saf Health Care* 2008 ; 17 : 424-430.
6. **Hefley WF, Nelson CL, Puskarich-May CL.** Effect of delayed admission to the hospital on the preoperative prevalence of deep-vein thrombosis associated with fractures about the hip. *J Bone Joint Surg* 1996 ; 78-A : 581-583.
7. **Hoenig H, Rubinstein LV, Sloane R, Horner R, Kahn K.** What is the role of timing in the surgical and rehabilitative care of community-dwelling older persons with acute hip fracture ? *Arch Intern Med.* 1997 ; 157 : 513-520.
8. **Johal KS, Boulton C, Moran CG.** Hip fractures after falls in hospital : a retrospective observational cohort study. *Injury* 2009 ; 40 : 201-204.
9. **Johnson T, Binney S.** Reducing the incidence of falls and hip fractures in care homes. *Nurs Times.* 2003 ; 99) : 38-40.
10. **Khan SK, Kalra S, Khanna A, Thiruvengada MM, Parker MJ.** Timing of surgery for hip fractures : A systematic review of 52 published studies involving 291,413 patients. *Injury* 2009 ; 40 : 692-697.
11. **Magaziner J, Hawkes W, Hebel JR et al.** Recovery from hip fracture in eight areas of function. *J Gerontol A Biol Sci Med Sci* 2000 ; 55 : 498-507.
12. **Magaziner J, Simonsick E, Kashner M, Hebel J, Kenzora J.** Predictors of functional recovery one year following hospital discharge for hip fracture : a prospective study. *J Gerontol* 1990 ; 45 : 101-107.
13. **Nadkarni JB, Iyengar KP, Dussa C, Watwe S, Vishwanath K.** Orthopaedic injuries following falls by hospital in-patients. *Gerontology* 2005 ; 51 : 329-333.
14. **Oliver D, Killick S, Even T, Willmott M.** Do falls and falls-injuries in hospital indicate negligent care – and how big is the risk ? A retrospective analysis of the NHS Litigation Authority Database of clinical negligence claims, resulting from falls in hospitals in England 1995 to 2006. *Qual Saf Health Care* 2008 ; 17 : 431-436.
15. **Orosz GM, Hannan EL, Magaziner J et al.** Hip fracture in the older patient : reasons for delay in hospitalization and timing of surgical repair. *J Am Geriatr Soc.* 2002 ; 50 : 1336-1340.
16. **Schwendimann R, Bühler H, De Geest S, Milisen K.** Characteristics of hospital inpatient falls across clinical departments. *Gerontology* 2008 ; 54 : 342-348.
17. **Shiga T, Wajima Z, Ohe Y.** Is operative delay associated with increased mortality of hip fracture patients ? Systematic review, meta-analysis, and meta-regression. *Can J Anaesth* 2008 ; 55 : 146-154
18. **Tinetti ME, Baker DI, King M et al.** Effect of dissemination of evidence in reducing injuries from falls. *N Engl J Med* 2008 ; 359 : 252-261.
19. **Zuckerman JD.** Hip fractures. *N Engl J Med* 1996 ; 334 : 1519-1525.
20. **Zuckerman JD, Skovron ML, Koval KJ, Aharonoff G, Frankel VH.** Postoperative complications and mortality associated with operative delay in older patients who have a fracture of the hip. *J Bone Joint Surg* 1995 ; 77-A : 1551-1556.