

Original Article

Proximal femoral fracture outcomes in inpatients and community patients: A comparative study

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Abstract

Objectives: 7% of proximal femoral fractures occur in patients admitted to hospital for unrelated medical and surgical presentations. This comparative study will assess morbidity and mortality in patients sustaining proximal femoral fractures both as inpatients and in the community. **Methods:** Retrospective review of patients admitted to a regional specialist hip unit with fracture of the proximal femur sustained both from the community and other inpatient settings. Patient demographics, risk factors and outcomes were recorded and analysed – with focus on 30-day and 1-year mortality. **Results:** 3445 patients were admitted over a 10-year period, 292 of which sustained proximal femoral fractures as an inpatient. 30-day and 1-year mortality was 23.7% and 47.9% respectively in the inpatient group, compared to 6.9% and 22.4% respectively in the community group. Mean time from presentation to operating room was 27.8 hours for the inpatient group, compared to 25.2 hours for the community group. **Conclusion:** Inpatients who sustain a proximal femoral fracture have significantly higher 30-day and 1-year mortality rates when compared to patients in the community sustaining the same injury. There is also a noted delay to theatre in this patient group.

Keywords: Inpatient Falls, Mortality, Proximal Femoral Fracture

Introduction

The incidence and prevalence of proximal femoral fractures has been increasing consistently worldwide over the past decade; with a continued rising trajectory to be expected¹. Proximal femoral fractures most commonly occur in elderly, frail patients with multiple co-morbidities^{2,3}. Therefore, this group of patients are at an increased risk of increasing levels of morbidity and mortality should a proximal femoral fracture be sustained^{4,5}.

Geriatric patients admitted to hospital have an increased preponderance to falls in the hospital environment; thus, being more susceptible to proximal femoral fractures⁶. Geriatric patients in hospital are at an eleven times increased risk of sustaining proximal femoral fractures when compared to their community counterpart⁶. The most important predisposing factors for falls, resulting in proximal femoral fracture, are advancing age, reduced mobility, deranged mental state (e.g. delirium and impaired cognition), polypharmacy and the need for one to one nursing care⁷.

Requirement of operative and rehabilitative intervention in the aforementioned frail and at risk group of patients is

likely to have a significant impact upon the individual⁷. The geriatric cohort of patients are associated with a noticeably high anaesthetic risk, increased rate of post-operative complications, increased length of stay before and after operative intervention and as a consequence exhibit a higher incidence of morbidity and mortality⁸. It is therefore essential to fully understand the morbidity and mortality specific to geriatric patients sustaining a proximal femoral fracture whilst already in hospital for an initially unrelated presentation.

The authors have no conflict of interest.

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Co-morbidities	Community patients (%)	Inpatients (%)	p-value
Cardiac disease	23	33	<0.0001
Copd	24	28	<0.0001
Chronic kidney disease	18	35	<0.0001
Malignancies	12	8	<0.001
Pre-existing anaemia	5.8	27	<0.0001
Oral anticoagulants	25	26	<0.001
Cns disorders (cva, parkinson's)	18	22	<0.0001
Diabetes	28	30	<0.0001

Table 1. Comparative data of pre-existing co-morbidities in community and inpatient cohorts.

Place of residence	Community patients	Inpatient	p-values
Own home	1390	25	<0.001
Sheltered home	1076	34	<0.001
Nursing home	458	168	<0.0001
Residential home	149	55	<0.0001
Others	80	10	<0.001
Total	3153	292	

Table 2. Pre-admission residential status in community and inpatient cohorts.

The aim of this retrospective study was to assess and compare the outcomes regarding morbidity and mortality at thirty days and one year following proximal femoral fractures sustained in two distinct cohorts of elderly patients; namely those sustaining fractures whilst already in hospital for a different presentation and those sustaining fractures in the community.

Methodology

A retrospective review of patient clinical notes and available radiographic data was undertaken at a regional specialist hip unit. Data was collected from January 2007 to December 2017. All data was obtained from the hospital trust neck of femur (NOF) fracture database, theatre notes and hospital clinical notes.

No ethical approval was required for this study. Permissions were sought and granted from the Gateshead Health Foundation NHS Trust Audit and Information Governance Department.

“Inpatient fractures of the proximal femur” were defined as femoral neck fractures occurring in patients admitted for medical or surgical treatment unrelated to falls or any type of soft tissue or bony injury whilst in hospital. The community patient group was defined as all patients sustaining proximal femoral fracture following a fall in the community and

subsequent resultant admission to hospital.

Inclusion criteria were all patients aged sixty years or over with proximal femur fractures admitted from the community and inpatients admitted to medical or surgical wards who sustained a proximal femur fracture as a result of a fall on the ward or the surrounding environment. Exclusion criteria were all patients with pathological proximal femur fractures due to malignant secondary deposits, peri-prosthetic fractures and those patients who were treated non-operatively.

Recorded and analysed data included age, gender, laterality of injury, location where injury was sustained (type of ward), ASA grade, fracture pattern, details of the operation, Abbreviated Mental Score (AMT) score, pre-existing co-morbidities (Table 1) and residence prior to sustaining fracture (Table 2). The outcomes for each cohort were assessed and recorded. This included mortality at 30 days and 1-year, mean time from presentation to theatre, mean length of stay and the percentage of patients discharged to their own home. Specialist trauma care coordinators monitored patient rehabilitation and recorded the outcomes as aforementioned accordingly.

Statistical analysis was undertaken using SPSS version 23. Comparison between the inpatient and community group was undertaken using chi-squared test. Parametric analysis was undertaken for the community group using

		Community patients	Inpatients	p-value
Age (mean) (range 70-101)		79.6	87.1	<0.0001
Gender	Males	98	1058	<0.0001
	Females	194	2095	
Laterality	Right	150	1580	<0.05
	Left	142	1573	
Asa grade (mean)		3.75 SD = 0.5 ± 7.0	3.3 SD = 0.2 ± 6.4	<0.0001
Amt score (median)		7.4	7.3	<0.05

Table 3. Patient demographic data for community and inpatient cohorts.

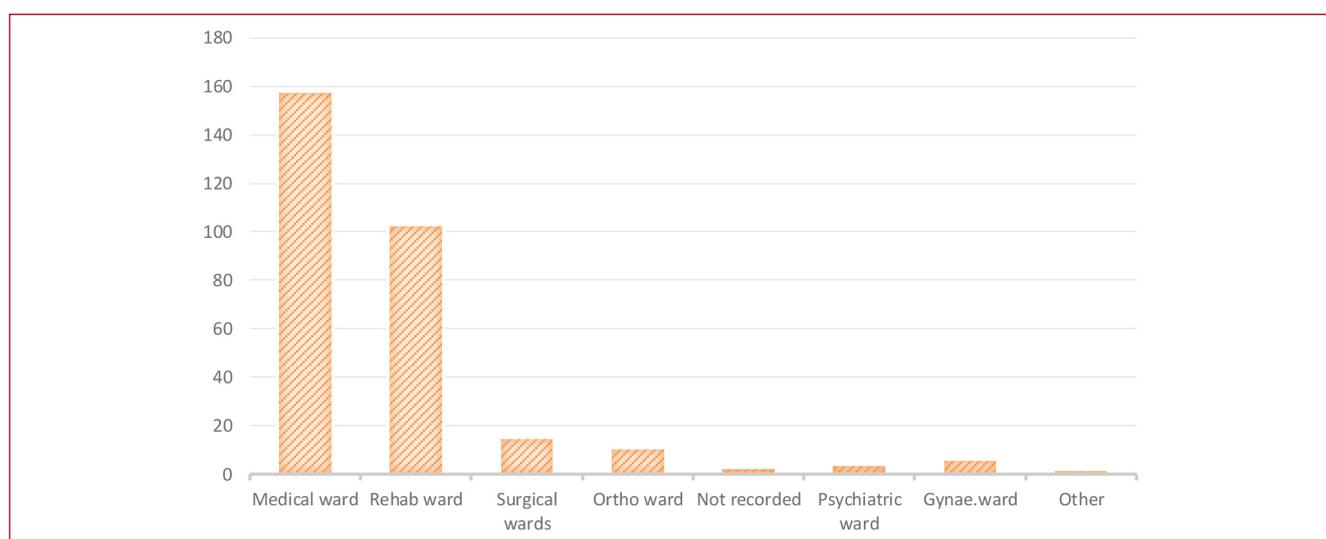


Figure 1. Prevalence of hospital location of fall amongst inpatient cohort.

student's t-test due to the large sample size. Non-parametric analysis was undertaken using Mann-Whitney U test for the inpatient group. A p-value of ≤ 0.0001 was interpreted to be of significance.

Results

A total of 3445 patients sustained a proximal femoral fracture over the aforementioned 10-year period; 292 of which acquired proximal femoral fractures whilst an inpatient. The comparative patient demographic data is outlined in Table 3.

Mean age of the inpatient cohort was 79.6 years (Range 70-101 years) compared to 87.1 (Range 64-103) amongst the community cohort ($p < 0.0001$). There was an increased number of females affected than males in both patient cohorts ($p < 0.0001$). There were no significant differences

between the frequency of right and left hip fractures in both cohorts ($p < 0.05$). 158 (54%) patients with proximal femoral fractures were inpatients on a medical ward upon sustaining the injury, with 35% (103 people) on rehabilitation wards (Figure 1). The inpatient cohort included 181 (62%) intra-capsular fractures, 100 (35%) intertrochanteric fractures and 11 (3%) sub trochanteric fractures (Figure 2). 180 (62%) patients amongst the inpatient cohort had one or more significant co-morbidity.

The mean ASA grade was 3.75 (SD=0.5±7.0) in the inpatient cohort, compared to 3.1 (SD=0.2±6.4) in the community cohort ($p < 0.0001$). The median AMT score did not significantly differ between the two assessed cohorts ($p < 0.05$).

32% (94) of patients who sustained a proximal femoral fracture as an inpatient were discharged to their own homes, compared to 65.2% (2246) of patients who were admitted

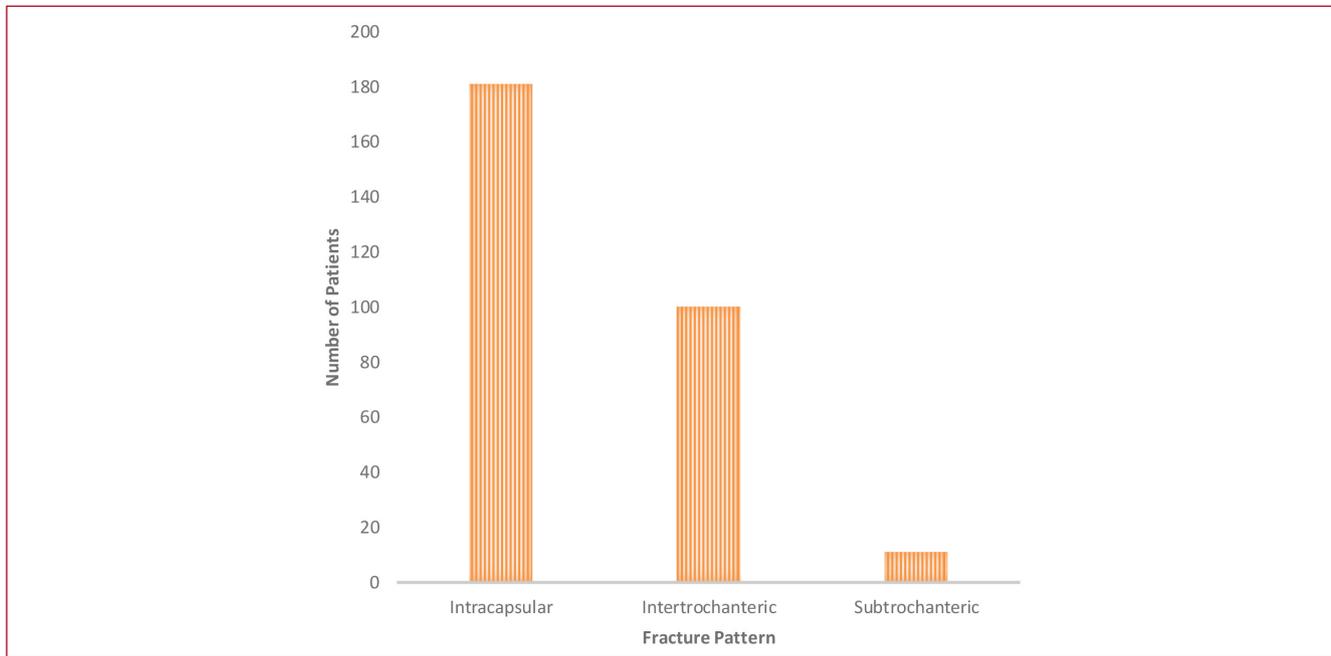


Figure 2. Graph displaying prevalence of fracture pattern amongst the inpatient cohort.

Discharge destination	Community patients (%)	Inpatients (%)	p-value
Own home	2058 (65.2)	94 (32)	<0.0001
Rehabilitation unit	888 (28.2)	130 (44.5)	<0.0001
Sheltered accommodation	207 (6.6)	68 (23.5)	<0.0001
Total	3153	292	

Table 4. Discharge destination for community and inpatient cohorts following hospital episode.

Outcome criteria	Inpatients	Community patients	p-values
30-day mortality (%)	23.7	6.9	<0.0001
One-year mortality (%)	47.94	22.4	<0.0001
Average time taken to theatre(hours)	27.8 SD = 21.9 ± 33.7	25.2 SD = 19.6 ± 30.8	<0.0001
Mean length of stay in hospital(days)	17.4 SD = 13.1 ± 21.7	17.6 SD = 12.4 ± 22.8	<0.05

Table 5. Comparative outcome data for community and inpatient cohorts.

from the community ($p < 0.0001$). 44.5% (130 patients) of the inpatient cohort were referred to a rehabilitation ward compared to 28.2% (972 patients) of the community cohort ($p < 0.001$) (Table 4). The readmission rate for the community patient cohort was 4.3% (136) compared to 11.6% (34) for inpatient cohort.

The mean time to operative intervention was 27.8 hours ($SD = 19.6 \pm 30.8$) in the inpatient cohort, compared to 25.2 hours ($SD = 21.9 \pm 33.7$) in the community cohort ($p < 0.0001$). The mean length of stay in hospital after surgery was 17.4 days ($SD = 12.4 \pm 22.8$) in the inpatient cohort, compared to 17.6 days ($SD = 13.1 \pm 21.7$) in the

Discharge destination	One year mortality	
	Community Cohort (%)	Inpatient Cohort (%)
Own home	440 (19.6)	36 (38.3)
Rehabilitation unit	274 (28.4)	85 (65.4)
Sheltered accommodation	58 (26.6)	19 (27.9)
Total	772	140

Table 6. One-year mortality rates and discharge destinations amongst community and inpatient cohort.

community cohort ($p < 0.05$).

The 30-day mortality for patients who sustained a fractured neck of femur as an inpatient was 23.7% (75 patients) compared to 6.9% (238 patients) in the cohort from the community ($p < 0.0001$). The 1-year mortality was 47.94% (140 patients) in the inpatient cohort and 22.4% (772 patients) in the community cohort ($p < 0.0001$), as outlined in Table 5.

The one-year mortality rate for patients discharged directly to rehabilitation units was 28.4% (274 patients) for those in the community cohort and 65.4% (85 patients) for the inpatient cohort. In comparison, the one-year mortality for patients discharged directly to their original place of residence was 19.6% (440 patients) in the community cohort and 38.3% (36 patients) amongst the inpatient cohort. These findings are highlighted in Table 6.

Discussion

Inpatients sustaining proximal femoral fractures are predisposed to a number of factors affecting overall health; including frailty, polypharmacy, multiple co-morbidities and poor baseline function⁹. Thus, it is paramount that these factors are acknowledged in this patient group. The aforementioned factors suggest patients are at increased risk of falls whilst being managed as an inpatient, as well as increased complication risks intra-operatively and post operatively. This is particularly reflected in the increased mean ASA grade in the inpatient cohort when compared to the community cohort.

An absence of patient specific definitive guidelines for inpatients sustaining proximal femoral fractures could be a possible factor leading to the worse patient outcomes highlighted in this study. A lack of guidance has been shown to have the resultant effect of delayed time to surgery compared to patients sustaining the same injury in the community¹⁰. This was highlighted in the patient cohort in this study; where average time to theatre from presentation was 27.8 hours for inpatients and 25.2 hours for those patients admitted from the community; results also reproduced in the study conducted by Hamilton et al (27.8 and 26.6 hours respectively)¹¹.

Green et al concluded that 78% of inpatient proximal

femoral fractures occur on acute medical and rehabilitation wards¹². Mohamed et al displayed that 48% of inpatient falls occurred on medical wards and 38% of falls occurred on geriatric/elderly medicine rehabilitation wards¹³. These findings were consistent with the results of this study, which found that 54% of patients sustaining proximal femoral fractures as inpatients were located on medical wards, at the time of their injury and 35% were on rehabilitation wards.

One must note that patients admitted to acute medical, geriatric and rehabilitation wards are often frail and of poor overall health^{11,14}. These patients, as described above, are at increased risk of falls whilst an inpatient. This is outlined in the cohorts assessed as part of this study in Table 1; identifying that the rate of significant co-morbidities was consistently higher in the inpatient cohort in comparison to the community patient cohort. This risk is furthered by ongoing pressures on healthcare systems, with increased patient to nurse ratios, resulting in a lower level of supervision of this vulnerable patient group^{9,15,16}.

When compared to the literature, mean age of the population in this study (79.6 years) was noted to be lower than that of aforementioned literature^{11,13}. However, the percentage of our study population that acquired a proximal femoral fracture as an inpatient was 8.5%, significantly higher than the described literature (4% and 6% respectively). This is likely to be due to the particularly large number of patients included in this study in comparison to the aforementioned literature^{11,13}.

The study displayed that 62.5% of patients admitted from the community upon sustaining a proximal femoral fracture were discharged to their original place of residence. This is seen to be higher in comparison to patients sustaining proximal femoral fractures as inpatients – 32%. This may be attributed to the fact that those amongst the inpatient cohort had an increased number of co-morbidities, and thus patients are likely to have increased post-operative requirements in comparison to the community cohort.

Similarly, 44.5% of the inpatient cohort were transferred to a rehabilitation unit post-operatively; in comparison to 28.5% amongst the community cohort. This identifies that those sustaining proximal femoral fractures as inpatients are likely to have increased rehabilitative demands in comparison to those sustaining the injury in the community. This could

potentially be reflected by the fact that a higher proportion of those of the inpatient cohort were originally from a nursing home environment in comparison to the community cohort – 57.5% and 14.5% respectively. An increased proportion of patients originating from nursing home residence will inevitably lead to increased post-operative care and rehabilitation³.

The one-year mortality rate for the inpatient cohort of this study was 47.94%; significantly higher in comparison to the community cohort – 22.4%. The higher one-year mortality rate amongst the inpatient cohort was consistent for patients that were discharged to either their original place of residence or to rehabilitation units. The contributory factors to the aforementioned increased one-year mortality rate are multifactorial – these include an increased number of pre-existing co-morbidities, polypharmacy, increased rate of cognitive impairment and requirement of one-to-one nursing once discharged¹¹.

A number of publications compare 30-day and 1-year mortality rates between patients sustaining proximal femoral fractures as inpatients and in the community. Hamilton et al and Mohamed et al both displayed a higher 30-day and 1-year mortality rate for patients sustaining proximal femoral fractures as inpatients when compared to those in the community^{11,13}, consistent with findings in this study. However, only 47 and 70 patients were included in the mentioned studies. The authors concluded that communication and collaboration between surgeon, anaesthetist and patient regarding decisions on prosthesis and anaesthesia would be an appropriate initial measure to reduce intra-operative and post-operative morbidity and mortality specific to this patient group.

Johal et al's study of 327 patients also displayed higher 30-day and 1-year mortality rates in patients sustaining proximal fracture fractures as an inpatient compared to their community counterparts⁵. Conclusions were drawn that patients sustaining proximal fractures whilst admitted to the hospital setting, were frailer, had a higher level of cognitive impairment and were at increased risk of morbidity and mortality. The study also described that inpatients on geriatric wards with a focus of those with mental health conditions, most often dementia, are the most at-risk group. The mentioned findings further confirm the outlined findings of this study, and thus further highlight the importance of falls prevention assessments for all inpatients and implementation of measures as appropriate.

Green et al assessed outcomes of 40 patients sustaining proximal femoral fractures as inpatients and in the community¹⁶; also displaying 30-day and 1-year mortality rates to be significantly higher in the inpatient group, when compared to the community group. The study also displayed those patients sustaining proximal femoral fractures as inpatients had longer time to surgery when compared to the community group. The authors make suggestions that at-risk inpatients should be under 24 hour supervision to

minimize the risk of injury, as well as a formal management protocol for patients sustaining proximal femoral fractures to minimize time to surgery and improve overall patient outcomes.

The strength and novelty with this study in comparison to the available literature is displayed assessing the outcomes in the two distinct cohorts in a particularly large patient group (3445 patients). The 30-day and 1-year mortality was seen to be higher in the inpatient cohort which is comparable to the results of previous studies^{5,11,13,16}, even though the number of patients included in this study is significantly greater.

With the noted increased risk, as well as poorer overall outcomes in patients sustaining proximal femoral fractures as inpatients, it is important to focus on factors of prevention. The aforementioned studies highlight the value of education for staff and patients, as well as improved supervision measures to those most at risk, as possible effective measures^{16,17}. In addition, Santesso et al have also proposed the use of hip protectors for vulnerable patients most at risk¹⁷ – displaying such intervention reduced the rate of proximal femoral fractures without hindering overall mobility.

Our study has provided a foundation for future research field that would see development in fracture prevention in inpatients overall.

Conclusion

The findings of this study have further reinforced the need to focus on the vulnerable patient group that sustains proximal femoral fractures as inpatients. The results display that 30-day and 1-year mortality rates are significantly higher in patients sustaining proximal femoral fractures as inpatients compared to those in the community. In addition, the inpatient group was shown to have a delay to surgery compared to the community group.

The authors of this study recommend a focus of fracture prevention in the most at risk group of inpatients to avoid the incidence of inpatient proximal femoral fractures. Suggested measures include one-to-one supervision and hip protectors for the most vulnerable patient groups – patients on geriatric wards with cognitive impairment. In addition, there is scope for an agreed upon protocol of management for inpatients sustaining proximal femoral fractures with aim of patients receiving efficient surgical, anaesthetic and orthogeriatric review – reducing overall time to surgery, and subsequent intra-operative and post-operative complications.

References

1. Royal College of Physicians. Falls and Fragility Fracture Audit Programme. National Hip Fracture Database (NHFD) Annual Report. London: Royal College of Physicians, 2019.
2. Lisk R, Yeong K. Reducing mortality from hip fractures: a systematic quality improvement programme. *BMJ Qual Improv Rep* 2014;3(1).
3. Rapp K, Becker C, Lamb SE, Icks A, Klenk J. Hip fractures in institutionalized elderly people: incidence rates and excess mortality. *J Bone Miner Res* 2008; 23(11): 1825-31.

4. Pulcins I, Wan E. In-hospital hip fractures in Canada: using information to improve patient safety. *Healthc Q* 2004; 7(4):25-7.
5. Johal KS, Boulton C, Moran CG. Hip fractures after falls in hospital: a retrospective observational cohort study. *Injury* 2009; 40(2):201-4.
6. Hitcho EB, Krauss MJ, Birge S, Claiborne Dunagan W, Fischer I, Johnson S, Nast PA, Costantinou E, Fraser VJ. Characteristics and circumstances of falls in a hospital setting: a prospective analysis. *J Gen Intern Med* 2004; 19(7):732-9.
7. Amador LF, Loera JA. Preventing postoperative falls in the older adult. *J Am Coll Surg* 2007; 204(3):447-53
8. Nicolai B, Foss, Henrik Palm, Henrik Kehlet. In-hospital hip fractures: prevalence, risk factors and outcome. *Age and Ageing* 2005; 34(6): 642-5.
9. Murray G.R, Cameron I.D, Cumming R.G. The Consequences of Falls in Acute and Subacute Hospitals in Australia That Cause Proximal Femoral Fractures. *Journal of the American Geriatrics Society* 2007; 55(4):577-82.
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(7):692-7.
11. Hamilton PD, Whelan A, Isaacs D, Mestha P, Armitage A, Skyrme A. Increased mortality among patients sustaining hip fractures requiring surgery in a district general hospital. *Hip International* 2007; 17(3):160-3.
12. Green CM, Zeiton M, Foulkes K, Barrie J. Acute fracture neck of femur among inpatients: severe injuries which need to be taken seriously. *Journal of Patient Safety* 2018; 14(4):202-5.
13. Mohamed M, Patel D, Zhao S, Ballal MS, Scott S. Increased Mortality Amongst Patients Sustaining Neck of Femur Fractures as In-Patients in a Trauma Centre. *The Open Orthopaedics Journal* 2015; 9:412-7.
14. Wiklund R, Toots A, Conradsson M, Olofsson B, Holmberg H, Rosendahl E, Gustafson Y, Littbrand H. Risk factors for hip fracture in very old people: a population-based study. *Osteoporosis International* 2016; 27(3):923-31.
15. Jones S, Blake S, Hamblin R, Petagna C, Shuker C, Merry AF. Reducing harm from falls. *New Zealand Medical Journal* 2016; 129(1446):89-103.
16. Green CM, Zeiton M, Foulkes K, Barrie J. The inpatient fracture neck of femur: an important subgroup of patients. *Injury* 2014; 45(12):1946-9.
17. Santesso N, Carrasco-Labra A, Brignardello-Petersen R. Hip protectors for preventing hip fractures in older people. *Cochrane Database Syst Rev* 2014; (3):CD001255.