Check for updates

The Role of Frailty Scores to Predict the Outcomes in Non Operative Treatment of Valgus Impacted Neck of Femur Fractures

Mohammed Ali[1,*], Chryssa Neo[2], Aysha Rajeev[2], Sharad Bhatnagar[1]

ABSTRACT

Objectives: The management of valgus-impacted neck of femur fracture is controversial between operative and conservative treatments. This study aimed to investigate the usefulness of the Clinical frailty Score for predicting the prognosis of patients who underwent non-operative treatment for the valgus-impacted neck of femur fracture (NOF).

Methods: A single-centred retrospective review of patients admitted with valgus impacted NOF. Data were collected from patients' records, including demographics, Clinical Frailty Score (CFS), Nottingham Hip Fracture Score (NHFS) and Abbreviated Mental Test Score (AMTS). Patients were followed up to 24 months postoperatively.

Results: Fifty-eight patients who were treated non-operatively with a mean follow-up of 2.6 years met our inclusion criteria. Twenty-nine patients failed the non-operative treatment and required replacement surgeries, while 29 had successful outcomes (50%). There were no differences between the two groups' mean age and gender distributions (P 0.527 and 0.139, respectively). The successful group had significantly higher CFS (P 0.013), worse AMTS and higher mortality risk based on the NHFS (P 0.006 and P < 0.001, respectively).

Conclusion: This study demonstrates that CFS, AMTS and NHFS can be used as predictors when considering non-operative treatment for the valgus-impacted neck of femur fracture. Patients who are frail, demented and high risk based on the NHFS have higher success rates with non-operative treatment.

AUTHOR AFFILIATIONS

[1] Department of Trauma and Orthopaedics, Royal Victoria Infirmary, Newcastle, United Kingdom
[2] Department of Trauma and Orthopaedics, Gateshead health Foundation NHS Trust, Gateshead, United Kingdom
* Corresponding author: Specialist Registrar, Royal Victoria Infirmary, Newcastle, United Kingdom; e-mail: mohammed.ali102@nhs.net

INTRODUCTION

The neck of femur (NOF) fracture is one of the most common and devastating injuries encountered by orthopaedic surgeons. The impacted Neck of Femur (NOF) fractures are defined as fractures with close apposition of fragments and various degrees of angulations, according to basic radiographs (1). Because the fracture is commonly impacted laterally and the femoral head trabeculae are tilted in the valgus position, most cases include the femoral head being in this position (1). Impacted fractures represent roughly 15–25% of total NOF fractures (2) and these include Garden 1 and 2 fractures (3, 4), which are classified to be naturally stable (5) according to Beimers et al. (6), who categorised NOF fractures as stable or unstable.

The best course of treatment for impacted NOF fractures is still up for debate, and the research in this field is generally lacking. While some surgeons advocate primary surgical stabilisation, others have found positive outcomes with conservative therapy (7–15). According to reports, the non-operative approach has a success rate of about 85%; however, no published data discusses non-operative treatment indications (10).

Recently, researchers and clinicians have focused on frailty, which is frequently defined as a multifaceted condition in elderly patients, and it has come to be recognised as a determinant in surgical and geriatric outcomes (16). Frailty or ill health may contribute to the explanation of why some elderly individuals recover less than anticipated (17). It is typically caused by a decreased physiological ability to react to stimuli like trauma or infection (18). It means that biological and chronological ages may vary significantly and might be regarded as a loss of physiologic resilience or reserve. Most physicians believe that being weak puts patients in danger, and numerous studies have shown that frailty increases the risk of repeated falls, trips to the emergency room, hospitalisation, higher mortality and institutionalisation in the general geriatric population (19).

Several clinical methods have been scientifically verified to determine a person's frailty. The Clinical Frailty Scale (CFS), which assesses particular areas like comorbidity, function, and cognition to provide a frailty score ranging from 1 (extremely fit) to 9 (terminally ill), is the frailty score that we utilise in our study (20). In general, all prediction issues cannot be resolved by the frailty models now offered by researchers. They do play a significant part in enhancing the quality of patient care by weighing the risks and advantages of various treatment alternatives. Patient recruitment for clinical trials is still an issue to improve outcome prediction. Due to a lack of patient participation, several trials have been prolonged or prematurely discontinued (21–23).

This retrospective cohort study sought to determine the utility of the CFS for predicting the prognosis of patients who underwent non-operative treatment for the valgus impacted neck of femur fracture at our tertiary referral centre, given the prevalence of frailty in patients who sustained proximal femur fractures. We predicted that higher clinical frailty ratings would be linked to higher non-operative therapy failure rates.

This study's primary goal was to assess how the non-operative treatment for impacted NOF fractures performed
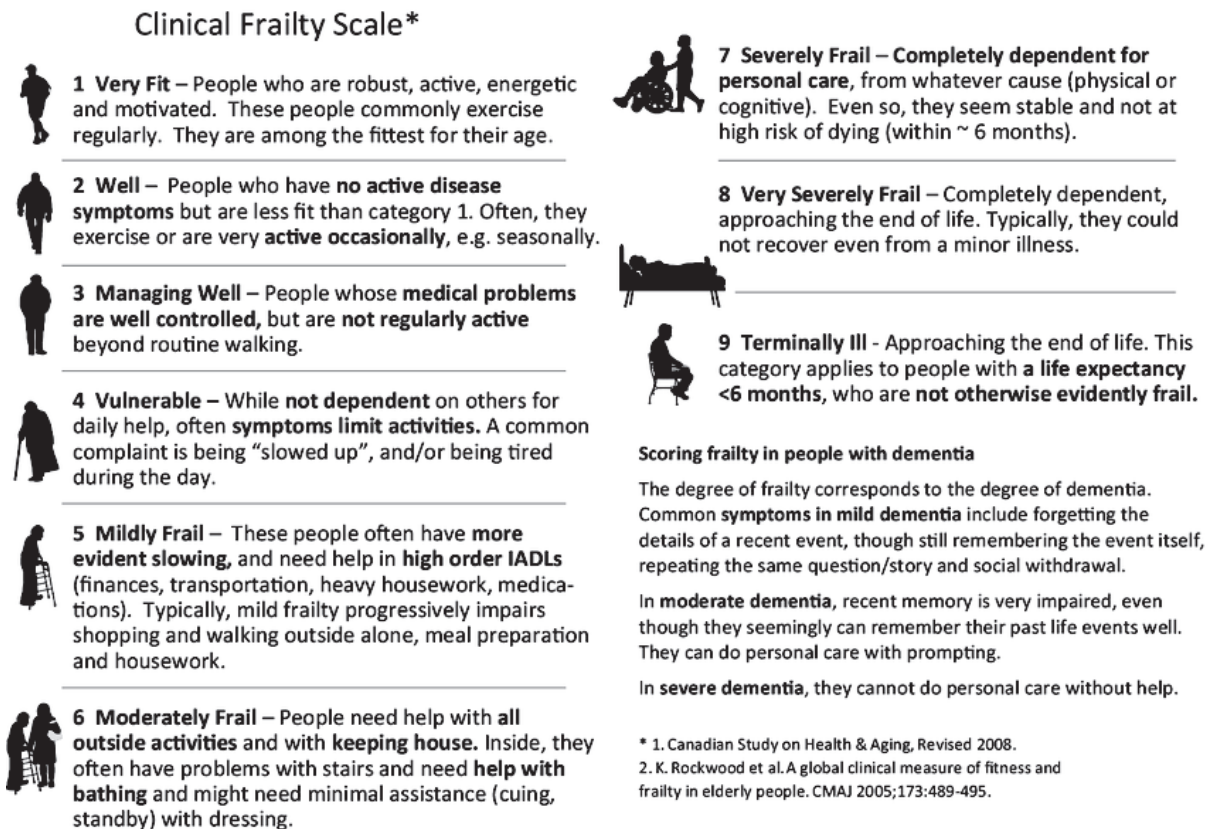

Clinical Frailty Scale*

1 Very Fit – People who are robust, active, energetic and motivated. These people commonly exercise regularly. They are among the fittest for their age.

2 Well – People who have **no active disease symptoms** but are less fit than category 1. Often, they exercise or are very **active occasionally**, e.g. seasonally.

3 Managing Well – People whose **medical problems are well controlled,** but are **not regularly active** beyond routine walking.

4 Vulnerable – While **not dependent** on others for daily help, often **symptoms limit activities.** A common complaint is being "slowed up", and/or being tired during the day.

5 Mildly Frail – These people often have **more evident slowing,** and need help in **high order IADLs** (finances, transportation, heavy housework, medications). Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation and housework.

6 Moderately Frail – People need help with **all outside activities** and with **keeping house.** Inside, they often have problems with stairs and need **help with bathing** and might need minimal assistance (cuing, standby) with dressing.

7 Severely Frail – Completely dependent for personal care, from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within ~ 6 months).

8 Very Severely Frail – Completely dependent, approaching the end of life. Typically, they could not recover even from a minor illness.

9 Terminally Ill - Approaching the end of life. This category applies to people with **a life expectancy <6 months,** who are **not otherwise evidently frail.**

Scoring frailty in people with dementia

The degree of frailty corresponds to the degree of dementia. Common **symptoms in mild dementia** include forgetting the details of a recent event, though still remembering the event itself, repeating the same question/story and social withdrawal.

In **moderate dementia**, recent memory is very impaired, even though they seemingly can remember their past life events well. They can do personal care with prompting.

In **severe dementia**, they cannot do personal care without help.

* 1. Canadian Study on Health & Aging, Revised 2008.
2. K. Rockwood et al. A global clinical measure of fitness and frailty in elderly people. CMAJ 2005;173:489-495.

Fig. 1 Table shows the clinical frailty scores.

in connection to frailty score. Evaluation of the impact of age, gender, AMTS, and NHFS on the success of non-operative treatment was the secondary goal.

METHODS

This is a retrospective analysis of prospectively collected data hence ethical approval was not required. The study was carried out in a tertiary centre in the United Kingdom. Patients were initially identified using the Hip Fracture Database between 2016 and 2020. Data were collected from patients' notes, clinical letters and radiological images. We included adult patients with traumatic valgus impacted NOF fractures who were diagnosed based on x-rays or CT scans and treated non-operatively at the first instance. Garden 1 and 2 NOF fractures are regarded as impacted fractures that were considered inherently stable. We followed up patients up to a minimum of nine months post injury. The United States Food and Drug Administration (USFDA) defines a non-union as a fracture at least nine months old and has not shown any signs of healing for three consecutive months. Patients who had no documented follow-up to confirm the success or failure of their treatment were excluded. We collected patients' demographic data, AMTS, NHFS and frailty scores. The orthogeriatric team in our department has adopted the Clinical Frailty Scale (CFS) as a rapid bedside frailty screening tool. Based on this scale, patients are classified as very mild, mild, moderate, severe, very severe frailty and terminally ill (Figure 1).

The Abbreviated Mental Test Score (AMTS), which assesses the patient's memory (24), and the Nottingham Hip Fracture Score (NHFS), which estimates the mortality rate (25), were also reported. According to the AMTS, patients who scored more than six were classified as coherent and six or less were classified as demented. NHFS was used to estimate mortality rates and based on this; patients were classified as low (NHFS ≤ 4) or high risk (NHFS > 4). The Nottingham Hip Fracture Score (NHFS) is a scoring system that predicts 30-day mortality for patients after hip fracture.7 It is made up of seven indices. Pendent predictors of 30-day postoperative mortality that have been incorporated into a risk score: age (66–85 and ≥86 years); sex (male); number of co-morbidities (≥2), admission mini-mental test score (≤6 out of 10), admission haemoglobin concentration (≤10 g dl21), living in an institution; and the presence of malignant disease.

Patients who had fracture displacement, developed non-union or avascular necrosis were considered as failed treatment. While those who healed radiologically and progressed with mobility were considered as successful. We compared those who failed the non-operative treatment with the successful ones to see if any variable affected their outcome. Between-group comparisons of categorical variables were analysed using the Chi-square test for independence. The level of statistical significance was set at a p-value of <0.05. Statistical analysis was performed using SPSS for Windows version 27.0 (IBM Corp., Armonk, New York) and GraphPad Prism 9 software version 9.4.1

RESULTS

We reviewed all patients admitted between 2016 and 2020 with valgus impacted neck of femur fractures and treated non-operatively at first instance. 92 patients were treated non operatively of whom 29 passed away within the first nine months post injury. We excluded those 29 patients, and 5 patients had no documented follow-up. Fifty-eight patients met our inclusion criteria. Twenty-nine of them had successful outcomes following non-operative treatment and equally twenty-nine failed and required an operative intervention such as a total hip replacement or a hemiarthroplasty. The mean age of the successful group was 81.75 years (SD 9.1) including 10 males and 19 females. The failed group had 5 males and 24 females and the mean age was 80.17 years (SD 9.5). there were no statistically significant differences between the two groups' demographics (Table 1). In the successful group, the mean Frailty score was 5.17 (SD 1.57) which is statistically higher than the failed group (Table 2). In addition, the AMTS and the NHFS scores were significantly worse in the successful group (Table 2). According to the CFS we classified patients as frail if they score 6 or more (moderate frailty to terminally ill patients). The number of frail patients was significantly higher in the successful group (P 0.024) (Table 3). According to the AMTS we classified those patients as coherent if they scored 7 or more and demented if scored less than 7. There were significantly more demented patients in the successful group (0.008). The NHFS which estimates patients' mortality risk, was used to subgroup patients to high and low mortality risk. Those patients in the successful group had significantly higher mortality risk than the failed ones (Table 3).

Tab. 1 Compares gender and age between the two groups.

Groups	Male	Female	Age > 85	85 or less
Successful	19	10	9	20
Failed	24	5	9	20
Chi-Square	0.230		1.000	

Tab. 2 Compares the means of the tested variables.

Groups	Age	Gender	Frailty	AMTS	NHFS
Successful	81.75	10 Male	5.17	5.68	5.62
	SD 9.09	19 Female	SD 1.57	SD 3.11	SD 1.18
Failed	80.17	5 Male	4.17	7.86	4.31
	SD 9.5	24 Female	SD 1.31	SD 2.51	SD 1.53
P value	0.527	0.139	0.013	0.006	<0.001

Tab. 3 Compares surgical risk, mental state and frailty between the two groups.

	Surgical risk		Mental state		Frailty	
Groups	low risk	high risk	demented	coherent	non frail	frail
Successful	7	22	21	8	15	14
Failed	15	14	10	19	24	5
Chi-Square	0.057		0.008		0.024	

The successful group had more frail patients compared to the failed group on the other hand those who failed we remarkably less frail (P 0.024). Furthermore, the failed group contained more coherent patients with lower mortality risk (Figure 2).
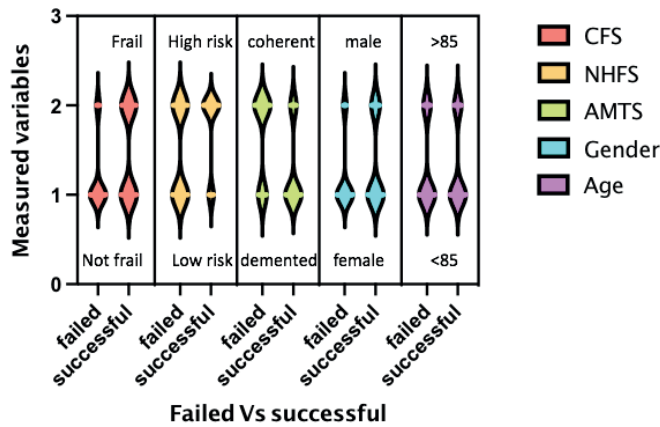

Fig. 2 Plot shows patients' distribution in the measured variables.

DISCUSSION

This paper discusses utilising the CFS, AMTS and NHFS in predicting the outcomes of non-operative treatment of the valgus impacted neck of femur fractures. Patients who were frail, demented and with high surgical mortality risk had satisfactory outcomes following non-operative treatment. On the other hand, treatment failure was more noticed in those who are not frail, coherent and have low surgical risk. To our knowledge, this is the first study in the literature to discuss using CFS, AMTS and NHFS as predictors.

Frail patients who suffer hip fractures can be challenging to manage, necessitating a multidisciplinary approach to patient care. These patients frequently have many medical comorbidities and represent a substantial health burden, which is expected to rise as the population ages and becomes more comorbid (18). Frailty as an independent risk factor for mortality, morbidity, extended length of stay, and readmission rate is not a novel finding; however, with the application of the CFS, all members of the multidisciplinary team, including the surgeon, may now easily apply frailty to hip fractures (26).

In addition, the CFS is a helpful tool for determining the best course of action (i.e. relatively quicker operations with shorter anaesthetic time or hemiarthroplasty over total hip arthroplasty in frail patients). Its usage in the orthopaedics and orthogeriatric treatment models is supported by its simplicity of application and prognostic advice. The CFS reduces age-related bias in surgical management decision-making by identifying independent, non-frail older patients.

The published literature shows controversy on how to treat Impacted Femoral Neck Fractures, and the most effective way to treat an impacted fracture is still up for dispute. While primary surgery is advised by some researchers, such as internal fixation and arthroplasty, others report positive outcomes from conservative measures

(1–15). Raaymakers et al. (27) successfully treated 170 affected femoral neck fractures with early mobilisation and weight-bearing in their prospective trial. At one year, mortality overall was 16%. One hundred forty-three fractures (86%) in the 167 patients were monitored until fracture healing or secondary instability. Only individuals over 70 and younger patients with a limited life expectancy experienced instability. Age (above 70 years) and poor general health (determined by stepwise logistic regression analysis) were risk factors. Although the findings of this study support the non-operative treatment, their identified risk factors are in contrast to ours. The recent advances in bedside care and community nursing have hugely impacted the outcomes of managing the elderly population with limited mobility, including those with lower limb fractures. Measures like chest physiotherapy, venous thrombo-embolism prophylactic treatment and bedsores management have generally improved the management outcomes (28–30). These can be considered contributing factors that might explain why our successful cohort differs.

Conservative treatment proponents point out that because most patients would heal without internal fixation when adequately supervised, the risks associated with the operation are not justified in preventing displacement in a tiny fraction of cases (12). Others support using hip arthroplasty to treat elderly patients with non-displaced or impacted NOF fractures to promote early mobility, recovery and lower mortality (13–15, 31). Hemiarthroplasty is thus advised for patients above the age of 75. However, many elderly individuals are not candidates for surgery due to a combination of high-risk comorbidities, and some patients may even decline the procedure. The postoperative death rate is significant in people over 65 having neck of femur surgery (32).

A systematic review by Xu et al. (33) included 29 studies comprising 5071 individuals with undisplaced femoral neck fractures. One thousand one hundred twenty patients were treated nonoperatively, while 3951 were treated surgically. In the former and latter groups, the union rates were, respectively, 68.8% (642/933) and 92.6% (635/686) (p 0.001). Avascular necrosis occurred at an incidence of 10.3% (39/380) in the group receiving conservative care against 7.7% (159/2074) in the group receiving surgical care (p = 0.09). The authors concluded that surgery had a greater union rate and a propensity toward less avascular necrosis.

To our knowledge, no study has considered frailty a predictor of non-operative treatment of valgus impacted neck of femur fracture. Our study has demonstrated the potential prognostic value of the CFS grading tool as a risk stratification index before surgical management of impacted valgus neck of femur fractures. This study has found a significant relationship between the degree of frailty (as defined by the CFS) and the success of non-operative treatment. Furthermore, our study highlighted that patients with dementia and high mortality based on the NHFS are more likely to do well with non-operative treatment. Although there is an association between frailty and dementia but not all demented patients are frail, and not all frail patients have dementia. Based on this study,

predicting poor outcomes after conservative treatment helps inform the treatment decision and communication with patients and their carers.

The limitation of this study includes its retrospective nature, although the data were collected prospectively. Add to that the small number of patients and being a single-centred study.

CONCLUSION

Our study demonstrates that CFS, AMTS and NHFS better predict failure of non-operative treatment of valgus impacted neck of femur fracture. Patients who are frail, demented and have high mortality based on the NHFS have higher success rates with non-operative treatment. Functional treatment of frail patients with impacted femoral neck fractures seems, therefore, to be justified. Further research in this area is required.

REFERENCES

1. Rogmark C, Flensburg L, Fredin H. Undisplaced femoral neck fractures – no problems? A consecutive study of 224 patients treated with internal fixation. Injury 2009; 40(3): 274–6.
2. Colles A. Facture of the neck of the femur. Dublin Hosp Rep 1818; 2: 234–55.
3. Thomsen NO, Jensen CM, et al. Observer variation in the radiographic classification of fractures of the neck of the femur using Garden's system. Int Orthop 1996; 20(5): 326–9.
4. Lasanianos N, Kanakaris N, Giannoudis PV. An occult acetabular fracture preceding a femoral neck fracture. Orthopedics 2009; 32(8).
5. Melvin JS, Mataszewski P, Scolaro J, Baldwin K, Mehta S. The role of computed tomography in the diagnosis and management of femoral neck fractures in the geriatric patient. Orthopedics 2011; 34(2): 87.
6. Beimers L, Kreder HJ, Berry GK, et al. Subcapital hip fractures: the Garden classification should be replaced, not collapsed. Can J Surg 2002; 45(6): 411–4.
7. Taha ME, Audige L, Siegel G, Renner N. Factors predicting secondary displacement after non-operative treatment of undisplaced femoral neck fractures. Arch Orthop Trauma Surg 2015; 135(2): 243–9.
8. Ma S, Wang K, Tong Z, Zhang M, Wang W. Outcome of non-operative management in Garden I femoral neck fractures. Injury 2006; 37(10):974–8.
9. Buord JM, Flecher X, Parratte S, et al. Garden I femoral neck fractures in patients 65 years old and older: is conservative functional treatment a viable option? Orthop Traumatol 2010; 96(3): 228–34.
10. Phillips JE, Christie J. Undisplaced fracture of the neck of the femur: results of treatment of 100 patients treated by single Watson-Jones nail fixation. Injury 1988; 19(2): 93–6.
11. Chen WC, Yu SW, Tseng IC, et al. Treatment of undisplaced femoral neck fractures in the elderly. J Trauma Inj Infect Crit Care 2005; 58(5): 1035–9.
12. Bentley G. Treatment of Non-displaced fractures of the femoral-neck. Clin Orthop Relat Res 1980; 152: 93–101.
13. Manninger J, Kazar G, Salacz T, Varga A. Conservative or surgical treatment of undisplaced (impacted) femoral neck fractures? Unfallchirurgie 1990; 16(3): 116–21.
14. Cserhati P, Kazar G, Manninger J, Fekete K, Frenyo S. Non-operative or operative treatment for undisplaced femoral neck fractures: a comparative study of 122 non-operative and 125 operatively treated cases. Injury 1996; 27(8): 583–8.
15. Helbig L, Werner M, Schneider S, Simank HG. Garden I femoral neck fractures: conservative vs operative therapy. Orthopade 2005; 34(10): 1040–5.
16. Makary MA, Segev DL, Pronovost PJ, et al. Frailty as a predictor of surgical outcomes in older patients. J Am Coll Surg 2010; 210(6): 901–8.
17. Collard RM, Boter H, Schoevers RA, Oude Voshaar RC. Prevalence of frailty in community-dwelling older persons: a systematic review. J Am Geriatr Soc 2012; 60(8): 1487–92.
18. Abellan van Kan G, Rolland Y, Houles M, et al. The assessment of frailty in older adults. Clin Geriatr Med 2010; 26: 275–286.
19. Bergman H, Ferrucci L, Guralnik J, et al. Frailty: an emerging research and clinical paradigmVissues and controversies. J Gerontol A Biol Sci Med Sci 2007; 62: 731–737.
20. Cheung A, Haas B, Ringer TJ, et al. Canadian study of health and aging clinical frailty scale: does it predict adverse outcomes among geriatric trauma patients? J Am Coll Surg 2017; 225(5): 658–65.
21. Foy R. How evidence based are recruitment strategies to randomized controlled trials in primary care? Experience from seven studies. Fam Pract 2003; 20(1): 83–92.
22. Mcdonald AM, Knight RC, Campbell MK, et al. What influences recruitment to randomised controlled trials? A review of trials funded by two UK funding agencies. Trials 2006; 7(1): 9.
23. Treweek S, Mitchell E, Pitkethly M, et al. Strategies to improve recruitment to randomised controlled trials. Cochrane Database Syst Rev 2010; (1): MR000013.
24. Hodkinson HM. Evaluation of a mental test score for assessment of mental impairment in the elderly. Age Ageing 1972; 1(4): 233–8.
25. Maxwell MJ, Moran CG, Moppett IK. Development and validation of a preoperative scoring system to predict 30 day mortality in patients undergoing hip fracture surgery. Br J Anaesth 2008; 101(4): 511–7.
26. Narula S, Lawless A, D'Alessandro P, et al. Clinical Frailty Scale is a good predictor of mortality after proximal femur fracture: A cohort study of 30-day and one-year mortality. Bone Jt Open 2020; 1(8): 443–9.
27. Raaymakers EL. The non-operative treatment of impacted femoral neck fractures. Injury 2002; 33 Suppl 3: C8–C14.
28. Kane RL, Shamliyan T, Mueller C, Duval S, Wilt TJ. Nurse staffing and quality of patient care. Evid Rep Technol Assess (Full Rep) 2007; (151): 1–115.
29. Twigg DE, Whitehead L, Doleman G, El-Zaemey S. The impact of nurse staffing methodologies on nurse and patient outcomes: A systematic review. J Adv Nurs 2021; 77(12): 4599–611.
30. Kwong LM. Hip fracture and venous thromboembolism in the elderly. J Surg Orthop Adv 2004; 13(3): 139–48.
31. Ossendorf C, Scheyerer MJ, Wanner GA, Simmen HP, Werner CM. Treatment of femoral neck fractures in elderly patients over 60 years of age – which is the ideal modality of primary joint replacement?. Patient Saf Surg 2010; 4(1): 16.
32. Moon A, Gray A, Deehan D. Neck of Femur Fractures in Patient's Aged More Than 85 Years – Are They a Unique Subset?. Geriatr Orthop Surg Rehabil 2011; 2(4): 123–7.
33. Xu DF, Bi FG, Ma CY, Wen ZF, Cai XZ. A systematic review of undisplaced femoral neck fracture treatments for patients over 65 years of age, with a focus on union rates and avascular necrosis. J Orthop Surg Res 2017; 12(1): 28.