e-ISSN: 0975-5160, p-ISSN: 2820-2651

Available online on www.ijtpr.com

International Journal of Toxicological and Pharmacological Research 2024; 14(6); 181-187

Original Research Article

# Study the Functional Outcome in Intertrochanteric Fractures Managed by Positive, Neutral and Negative Reduction.

**Sagar Rampure[1], Praveen Kumar Chavan[2], Sandesh C Patil[3], Sushil Kasnale[4]**

[1]Senior Resident, Department of Orthopaedics, Shri Atal Bihari Vajpayee Medical College and Research Institute, Bengaluru

[2]Senior Resident, Gulbarga Institute of Medical Sciences Kalaburagi

[3]Assistant Professor, Department of Orthopaedics, Shri Atal Bihari Vajpayee Medical College and Research Institute, Bengaluru

[4]Junior Resident, Mahadevappa Rampure Medical College, Kalaburgi

**Received: 19-03-2024 / Revised: 22-04-2024 / Accepted: 30-05-2024**

**Corresponding Author: Dr. Sandesh C Patil**

**Conflict of interest: Nil**

**Abstract**

Intertrochanteric fractures are most frequently observed fractures of proximal femur. It involves upper end of femur, area between two trochanters with or without extending into the upper femoral shaft. With increased life expectancy, incidence of proximal femoral fractures is rapidly increasing. In geriatric population, inter-trochanteric fractures are caused by moderate to minimal fall while in younger population, it is caused by high velocity trauma. In 1990 26% of total hip fractures of world occurred in Asia. This is expected to rise upto 37% in 2025 and 45% in 2050. Femur being the chief weight bearing bone of the body is related to mobility. A hip fracture represents probably the most devastating consequence of osteoporosis and a mild trauma in terms of mortality, morbidity, disability, quality of life and hospital care and cost. Femoral fractures mandate end of patient's functional freedom, hence results in chronic bedridden state.

**Keywords:** Proximal Femoral Nail, Proximal Femoral Nail Antirotation, Dynamic Hip Screw.



## Introduction

Intertrochanteric fractures are most frequently observed fractures of proximal femur. It involves upper end of femur, area between two trochanters with or without extending into the upper femoral shaft. With increased life expectancy, incidence of proximal femoral fractures is rapidly increasing [1]. In geriatric population, inter-trochanteric fractures are caused by moderate to minimal fall while in younger population, it is caused by high velocity trauma. In 1990 26% of total hip fractures of world occurred in Asia. This is expected to rise upto 37% in 2025 and 45% in 2050 [2,3]. Femur being the chief weight bearing bone of the body is related to mobility. A hip fracture represents probably the most devastating consequence of osteoporosis and a mild trauma in terms of mortality, morbidity, disability, quality of life and hospital care and cost. Femoral fractures mandate end of patient's functional freedom, hence results in chronic bedridden state. These patients are more prone for urinary tract infection, respiratory tract infection, bed sores and joint stiffness. For the patient it is not only a difficult physiological trauma, but also a psychological trauma that threatens continued autonomy. The fear of sustaining a hip fracture with loss of independence is great among elderly people in the community, which was clearly demonstrated in the study by Salkeld et al [4] from 2000 where 80% of old women expressed the opinion they would rather die than suffer from a hip fracture with a bad outcome. Orthopaedic surgeons must consider above mentioned complications and financial burden caused by loss of working days and treatment cost. Hence, effective treatment strategies which can provide high rates of fracture union coupled with low complication rates are sought after. This concept has given rise to current approach of choosing operative management over conservative one. The goal of the treatment is to restore preoperative function and mobility in a short time. As an operative treatment for intertrochanteric hip fractures, extramedullary fixation and intramedullary fixation have been used. Kaufer described factors affecting the biomechanical strength of the repair. Bone quality and fracture pattern which are surgeon independent along with surgeon dependent parameters are Implant choice, effective fracture reduction and implant placement [5]. The reduction techniques used in femoral fracture reduction are classified into three groups according the grade of medial cortical support in fracture reduction (positive, neutral, and negative). Chang SM [6] has elaborately defined the

positive, negative and neutral cortical support. The positive cortex support is when medial cortex of the head–neck fragment displaced and located a little bit supero-medially to the medial cortex of the shaft. If the neck cortex is located laterally to the shaft, it is negative reduction, and if the two cortices have anatomical reduction with smooth contact, it is in neutral position. While neutral reduction as anatomic reduction and it is difficult to achieve. Osteoporotic bone resorption causes varus deformity in patients operated with neutral reduction. Varus angulation of the proximal fragment causes functional limb lengthening upon application of body weight. There is significant risk of the device cutting out of the femoral head due to higher placement of implant in femoral head. While many orthopaedic surgeons believe that a slight valgus position (created by positive medial cortical support) allows for impaction, it means more stable fracture reduction and implies better neck-to-shaft angle and neck length result. They started weight-bearing much earlier than the negative reduction group, with good functional results and less hip and thigh pain. However, there have been few relevant biomechanical support studies. Chang SM[6] used this positive support theory to treat intertrochanteric fractures successfully. The essence of the theory is that the fracture can obtain secondary stability without anatomical reduction, providing a relatively stable biomechanical environment for fracture healing. The AO/ASIF classification emphasizes the lateral wall and weakened medial wall[7]. In the past, it was the medial wall that was considered to play an important role in the stability of intertrochanteric fractures. Therefore, there remains a controversy concerning the importance of the medial wall or the lateral wall. In order to be able to improve treatment methods and to assess the impact of the injury/disease upon the patients' overall function, there is a need for validated outcome measures. In studies on the treatment of injuries and diseases of the hip, the outcome is frequently reported using basic measures such as range of motion, fracture healing and the need for revision surgery. Choice of fixation device also impacts the outcome. Unstable fractures account for large number of inter-trochanteric fractures. When internally fixed, the osseous fragments of these unstable fractures are not able to share the weight-bearing loads, and therefore the loads are predominantly borne by the internal fixation device. Proximal femoral nail and dynamic hip screw are most commonly devices for fixation. Currently available literature is inefficient to throw light on which device works better with which fixation technique. In view of above mentioned literature current study is undertaken to evaluate the impact of positive, negative and negative reduction on functional outcome of intertrochanteric fracture.

## Material and Methods

This observational study was hospital based, and was from Department of Orthopaedics, Shri Atal Bihari Vajpayee Medical College and Research institute, Bengaluru. Patients operated by Proximal femoral nailing will be evaluated for positive, negative and neutral reduction.

### Inclusion Criteria:

1. All patients with intertrochanteric fracture who had undergone surgery with proximal femoral nailing.

### Exclusion Criteria:

1. Patients with pathological intertrochanteric fractures.
2. Open fractures.
3. Peri-prosthetic fractures.
4. Patient admitted for revision surgery
5. Reverse oblique fractures and fractures with subtrochanteric extension.

## Results

The analysis of patient data, intra-operative data and post-operative outcome are as follows:

**Table 1: Distribution based on Gender**

| Gender | No. of patients (n) | Percentage (%) |
|---|---|---|
| Male | 28 | 46.7 |
| Female | 32 | 53.3 |
| **Total** | **60** | **100** |

28 (46.7%) male patients and 32 (53.3%) female patients suffered from intertrochanteric fractures. Male to female ratio was 0.87:1. In our study, females had slight increased propensity towards fractures than males.

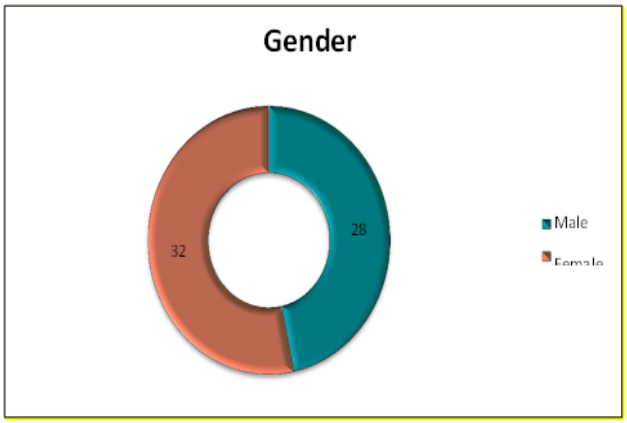



**Table 2: Distribution based on age groups of patients studied**

| Age groups (Years) | No. of patients (n) | Percentage (%) |
|---|---|---|
| 30-40 | 1 | 1.7 |
| 41-50 | 2 | 3.3 |
| 51-60 | 21 | 35 |
| 61-70 | 29 | 48.3 |
| >70 | 7 | 11.7 |
| **Total** | **60** | **100** |

Out of 60 patients studied, majority belonged to age group 61 to 70 years old (29 cases, 48.4%); followed by 21 cases (35%) from age group 51 to 60 years old. One patient (1.7%) was seen in age groups 30 to 40 year old. Two patients (3.3%) were found in age group 41 to 50 years old. Seven patients (11.7%) more than 70 years old.

Youngest patient enrolled was 35 years old male while oldest one was 82 years old female. Mean age was found to be 62.9 ± 7.5 years.

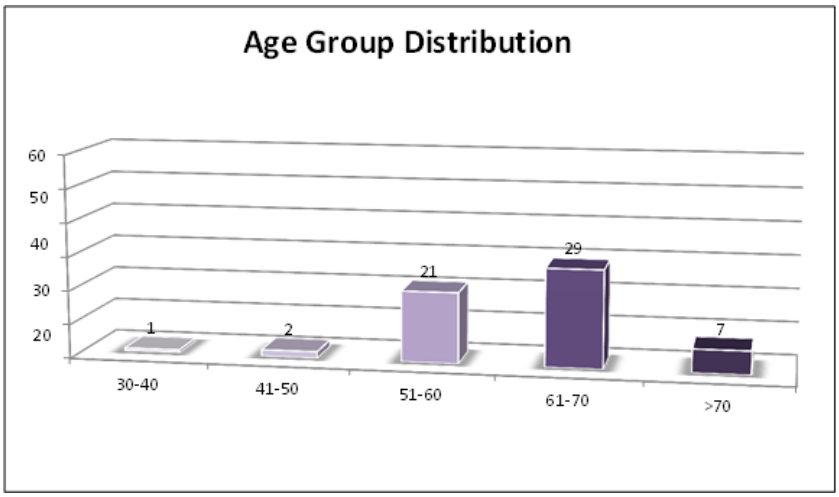



**Table 3: Distribution of side affected:**

| Side affected | No. of patients (n) | Percentage (%) |
|---|---|---|
| Left | 27 | 45 |
| Right | 33 | 55 |
| **Total** | **60** | **100** |

It was seen that most commonly right side of the patient was affected more than that of left side. Out of 60 patients, 33 patients (55%) had fracture on right side while 27 patients (45%) had fracture on left side.

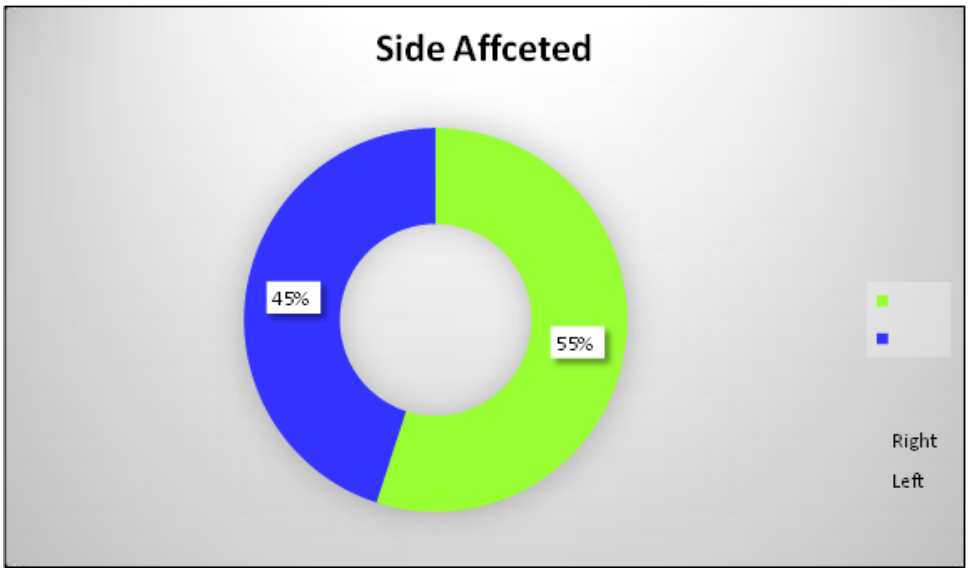



**Table 4: Distribution of mode of injury**

| Mode of injury | No. of patients (n) | Percentage (%) |
|---|---|---|
| Fall | 57 | 95 |
| RTA | 3 | 5 |
| **Total** | **60** | **100** |

Majority of fractures were caused due to domestic falling. 95% of all fractures (57 cases) were due to fall while road traffic accidents contributed to 5% (3 cases) of all fractures.

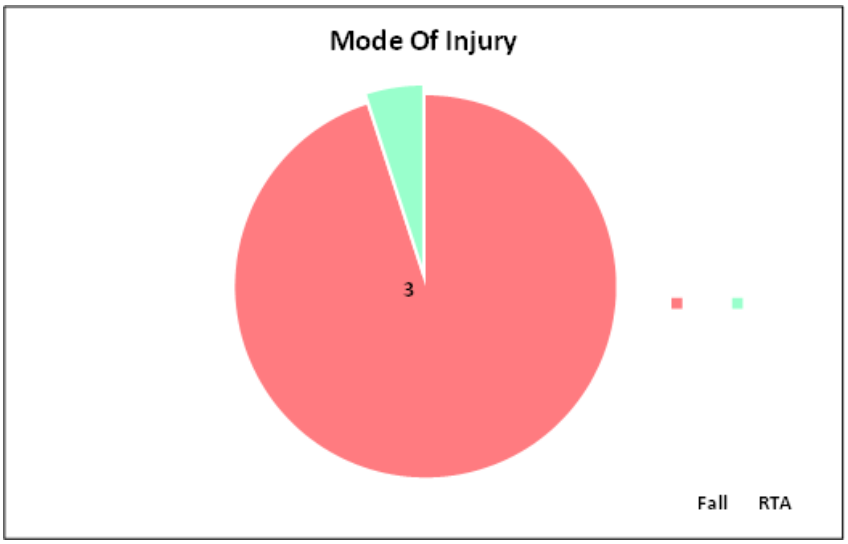



**Table 5: Distribution of type of reduction**

| Type of reduction | No. of patients (n) | Percentage (%) |
|---|---|---|
| Positive | 20 | 33.33 |
| Neutral | 20 | 33.33 |
| Negative | 20 | 33.33 |
| **Total** | **60** | **100** |

Out of 113 operated cases we have taken 20 cases each (33.33%) of positive, neutral and negative reduction for study purpose.

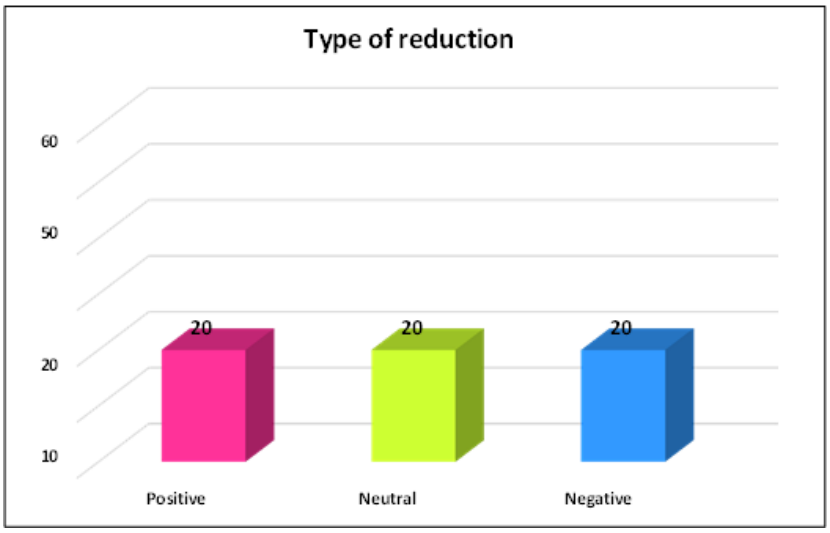



**Table 6: Distribution of intra-operative complications**

| Complications | No. of patients (n) | Percentage (%) |
|---|---|---|
| Fracture displacement by nail insertion | 2 | 1.2 |
| Failure to get anatomical reduction | 2 | 1.2 |
| Varus angulation | 2 | 1.2 |
| **Total** | **6** | **3.6** |

Fracture displacement by nail insertion, failure to get anatomical reduction and varus angulation was noted intra-operatively in two patients (1.2%) each. Out of 60 patients operated, six faced difficulty while operating.

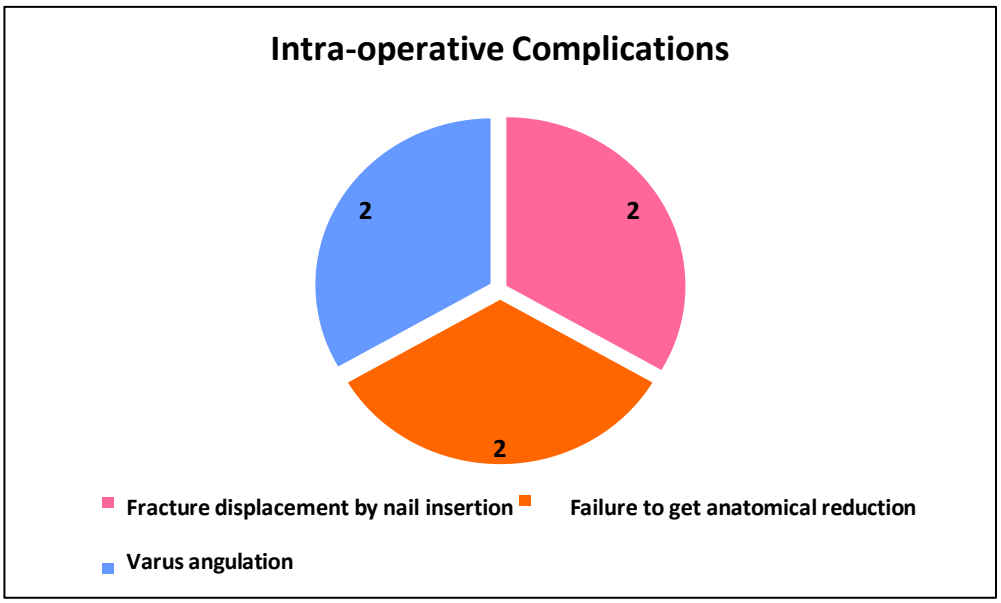
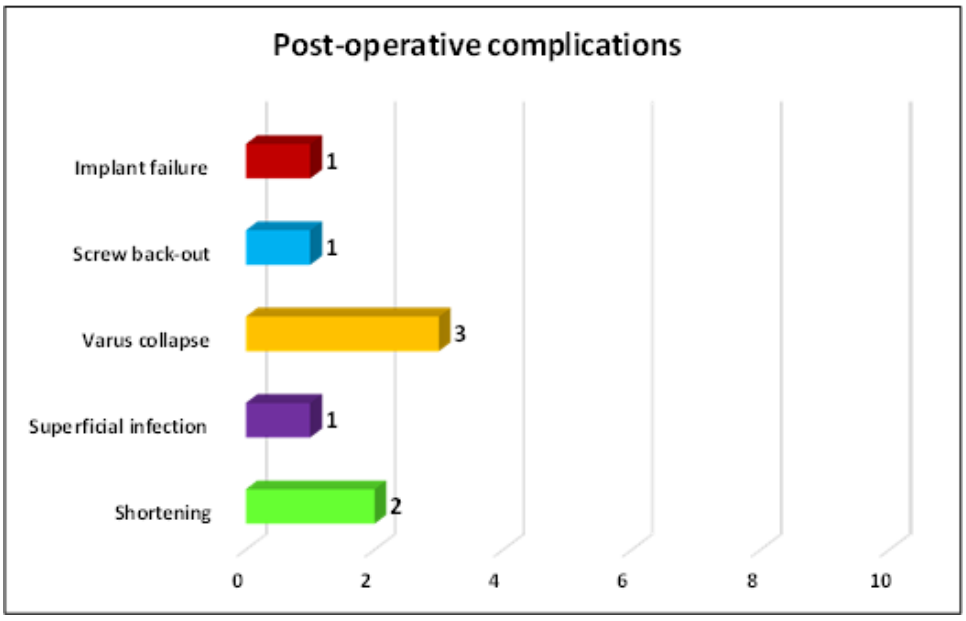



**Table 7: Distribution of post-operative complications**

| Complications | No. of patients (n) | Percentage (%) |
|---|---|---|
| Shortening | 2 | 1.2 |
| Superficial infection | 1 | 0.6 |
| Varus collapse | 3 | 1.8 |
| Screw back-out | 1 | 0.6 |
| Implant failure | 1 | 0.6 |
| **Total** | **8** | **4.8** |

Out of 60 patients operated for intertrochanteric fractures post-operative complications were noticed in eight patients. Limb shortening was seen in two patients (1.2%). In three patients (1.8%) varus collapse was noticed. In one patient each (0.6%) superficial infection, screw back-out and implant failure was seen.




**Discussion**

Intertrochanteric fractures are the most common fractures especially among elderly patients, which have serious medical, socioeconomic implications[8] and often lead to a substantial decline in function and independence[9]. Early surgical intervention is the optimal strategy that can enable early mobilization [10] and provide relief to patients[11]. Intramedullary fixation has been applied in more cases in recent years due to its theoretical advantages and biomechanical superiority over extramedullary fixation, especially in the unstable fracture patterns[12]. However, complication rates of up to 20.5% have been reported using the intramedullary nail technique[13]. Among all the complications, the two most common ones are excessive sliding of the cephalic screw[13] and cutout of lag screw[14]. Kaufer et al[15] reported five major factors associated with these complications: bone quality, fragment patterns, implant type, placement of implant, and quality of reduction. Haidukewych et al[16] also pointed out that the first two factors cannot be controlled, but the morbidity associated with the fractures could be minimized by selecting the appropriate implants, inserting them in the ideal positions, as well as performing the validated reduction. Therefore, the stability of fractures depends on the quality of fracture reduction after internal fixation. Commonly used devices for treating intertrochanteric fractures include extramedullary fixation such as dynamic hip screw (DHS) and intramedullary fixation such as Gamma nail (GN) for last decades. Proximal femoral nail (PFN) is an intramedullary device designed with a helical blade or screw, and is hypothesised to provide better angular and rotational stability and reduce the implant-related complications. Anatomical reduction remains gold standard for any fracture pattern. For intertrochanteric fractures, it is difficult to achieve true anatomical reduction due to various reasons The intertrochanteric area is the metaphyseal transition area, and the thickness and hardness of the two ends of the fracture are different;

- The existence of the cervical shaft angle, anteversion angle and torsion causes the eccentric conduction of gravity, which makes the femoral intertrochanteric fractures have congenital instability;
- At present, there is no good reduction and fixation method for the separated and displaced lesser trochanter bone blocks, and most of them are not fixed in clinical practice;
- The osteoporosis due to old age leads to poor control of bone by implants and it is difficult to obtain purchase in bone.

Hence, the concept of positive, neutral and negative reduction came in light.

The positive cortex support is when medial cortex of the head–neck fragment displaced and located supero-medially to the medial cortex of the shaft. If the neck cortex is located laterally to the shaft, it is negative reduction, and if the two cortices have anatomical reduction with smooth contact, it is in neutral position. In this study, we evaluated functional and radiological outcome of positive, neutral and negative reduction techniques in cases of Intertrochanteric fractures fixed with PFN. In our study, females had slight increased propensity towards fractures than males. 28 (46.7%) male patients and 32 (53.3%) female patients suffered from intertrochanteric fractures. Male to female ratio was 0.87:1. Out of 60 patients studied, majority belonged to age group 61 to 70 years old (29 cases, 48.4%); followed by 21 cases (35%) from age group 51 to 60 years old. Mean age was found to be 62.9 ± 7.5 years.

## Conclusion

Positive cortical support alignment is a non-anatomical reduction technique. The core idea is to avoid varus angulation and to maintain valgus reduction of fracture. The main purpose is to rebuild the mechanical stability of its own bone and share the body mass load of the endophytes, to ensure the maintenance and stability of postoperative internal fixation. This provides a solution for operative difficulty to achieve anatomical reduction. Our study provides comprehensive data on all three reduction techniques i.e. PMCS, NP and NMCS with respect to fixation by PFN in Indian population. Our study showed a decade earlier onset of disease in Indian population. It also showed better HHS in neutral reduction group compared to other groups at 3 months follow up. PMCS group showed lesser degree loss of femoral neck shaft angle and femoral neck length.

## References


1. Kumar R, Singh R, Singh B. Comparative prospective study of proximal femoral nail and dynamic hip screw in treatment of intertrochanteric fracture femur. Journal of clinical orthopaedics and trauma. 2012;3(1):28-36.
2. Gullberg B, Johnell O, Kanis J. World-wide projections for hip fracture. Osteoporosis international. 1997;7(5):407-13.
3. Melton Lr, Kearns AE, Atkinson EJ, Bolander ME, Achenbach SJ, Huddleston JM, et al. Secular trends in hip fracture incidence and recurrence. Osteoporosis international. 2009;20 (5):687-94.
4. Salkeld G, Ameratunga SN, Cameron I, Cumming R, Easter S, Seymour J, et al. Quality of life related to fear of falling and hip fracture in older women: a time trade off study Commentary: older people's perspectives on life after hip fractures. Bmj. 2000;320(7231):341-6.
5. Kaufer H. Mechanics of the treatment of hip injuries. Clinical Orthopaedics and Related Research (1976-2007). 1980; 146:53-61.
6. Chang S-M, Zhang Y-Q, Ma Z, Li Q, Dargel J, Eysel P. Fracture reduction with positive medial cortical support: a key element in stability reconstruction for the unstable pertrochanteric hip fractures. Archives of Orthopaedic and Trauma Surgery. 2015;135(6):811-8.
7. Gotfried Y. Integrity of the lateral femoral wall in intertrochanteric hip fractures: an important predictor of a reoperation. JBJS. 2007;89(11) :2552-3
8. Lizaur-Utrilla A, Gonzalez-Navarro B, Vizcaya-Moreno MF, Muñoz FAM, Gonzalez-Parreño S, Lopez-Prats FA. Reasons for delaying surgery following hip fractures and its impact on one year mortality. International orthopaedics. 2019;43(2):441-8.
9. Stone AV, Jinnah A, Wells BJ, Atkinson H, Miller AN, Futrell WM, et al. Nutritional markers may identify patients with greater risk of readmission after geriatric hip fractures. International orthopaedics. 2018;42(2):231-8.
10. Weller I, Wai E, Jaglal S, Kreder H. The effect of hospital type and surgical delay on mortality after surgery for hip fracture. The Journal of bone and joint surgery British volume. 2005; 87(3):361-6.
11. Wong SHJ, Fang XC, Yee KHD, Wong TM, Pun CTT, Lau TW, et al. Hip fracture time-to-surgery and mortality revisited: mitigating comorbidity confounding by effect of holidays on surgical timing. International orthopaedics. 2018;42(8):1789-94.
12. Anglen JO, Weinstein JN, Committee ABoOSR. Nail or plate fixation of intertrochanteric hip fractures: changing pattern of practice: a review of the American Board of Orthopaedic Surgery Database. JBJS. 2008; 90(4):700-7.
13. Liu W, Zhou D, Liu F, Weaver MJ, Vrahas MS. Mechanical complications of intertrochanteric hip fractures treated with trochanteric femoral nails. Journal of Trauma and Acute Care Surgery. 2013;75(2):304-10.
14. Lobo-Escolar A, Joven E, Iglesias D, Herrera A. Predictive factors for cutting- out in femoral intramedullary nailing. Injury. 2010;41(12): 13 12-6.
15. Kaufer H. Mechanics of the treatment of hip injuries. Clinical orthopaedics and related research. 1980(146):53-61.
16. Haidukewych GJ. Intertrochanteric fractures: ten tips to improve results. JBJS. 2009;91(3): 712-9.