Original Research Article

Functional and radiological outcome of unstable Intertrochanteric femur fractures in elderly patients treated With Proximal femoral nail-A prospective study from Mumbai,Maharashtra

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Abstract

Background: Inter-trochanteric fractures are one the most common injury in the elderly population. They are mostly treated surgically. Treatment of unstable intertrochanteric fracture poses a surgical challenge especially in the elderly. The choice of implant for fixation of unstable intertrochanteric fracture is still debatable. Extra-medullary and Intra-medullary are the two main categories of implants available. Dynamic Hip Screw (DHS) is a widely used extra-medullary implant considered as the gold standard for fixation of intertrochanteric fractures. But Dynamic hip screw (DHS) is plagued with complications especially in unstable intertrochanteric fractures. Proximal femoral nail (PFN) is a relatively newer intra-medullary implant. This study aims is to study the functional and radiological outcome of unstable intertrochanteric femur fractures in elderly (>50 years) patients treatedwith the proximal femoralnail.**Methods:** This study out was conducted in the orthopaedics department, LokmanyaTilak Municipal Medical College and General Hospital, Sion, Mumbai, Maharashtra, India from August 2017 till July 2020. 33 patients above 50 years with unstable intertrochanteric fractures treated with proximal femoral nail were included. Patients were followed up at regular intervals to evaluate the functional and radiological outcome and complications if any.Functional outcome was measured using Harris hip score.**Results:** All patients achieved bony union at a mean duration of 20 weeks (range 16-24). No complication was seen in 23 patients. 3 patients developed screw back out, 3 patients developed varus mal-union and 4 patients had anterior thigh pain. None of the patients had any infection. The mean Harris hip score was 83 at one year postoperatively indicating a good functional outcome.**Conclusions**: Unstable intertrochanteric fractures in elderly patients treated with Proximal Femoral Nail (PFN) gives good functional and radiological outcome leading to a high rate of bony union with acceptable complications rate which can be minimised with a good surgical technique.

Keywords: Unstable Intertrochanteric fracture, Proximal Femoral Nail, Harris hip score, Singh's index, AO, elderly

Introduction

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Background

Inter-trochanteric fractures are fractures in the proximal part of the femur in the region between greater and lesser trochanter. These fractures are most commonly seen in the elderly population by low energy trauma like fall. These fractures can also occur in the younger population by high energy trauma like road traffic accidents. With an increase in the elderly population, the incidence of hip fractures is on

an increasing trend and about half of these will be inter-trochanteric femur fractures.

These fractures are three to four times more common in females than in males due to the increased prevalence of osteoporosis particularly in the post-menopausal age group. About 35-40 % of these fractures are unstable.

Since many of these fractures are associated with osteoporosis,[1,2] the current paradigm shift regarding hip fracture care related to three main strategies:

1. Prevention by aggressive screening and treatment of patients at high risk for fragility fracture;
2. Standardisation of hip fracture centres with aggressive early intervention and protocols to avoid complications;
3. Optimisation of the fracture reduction and new implant component fixation in osteoporotic bone with conceptual design changes in fixation stability and augmentation of the bone-implant interface.[3]

Despite great advances in traumatology, the management of intertrochanteric fractures is still a subject of debate. Operative management has become the treatment of choice for inter-trochanteric femur fractures. Osteosynthesis (internal fixation) with orthopaedic implants and arthroplasty in form of Bipolar hemiarthroplasty or Total hip arthroplasty (THA) are the two operative options available[4].The acetabulum retroversion is less in the Indian population compared to western counterparts; this along with cost-constrains make THA a less feasible option in Indian scenario[5].

Operative management with internal fixation is now considered the standard mode of treatment. As with any fracture, the ultimate aim remains to achieve anatomical reduction, ensure bony union, ensure early mobilization. There are two internal fixation options for fixation of inter-trochanteric femur fractures extra-medullary fixation and intramedullary fixation. Dynamic hip screw (DHS)[6]is the commonly used extra-medullary fixation device for fixation of inter-trochanteric femur fractures. Proximal femur nail (PFN), Proximal femur nail anti-rotation (PFN-A2), Gamma nail etc. are devices used for intramedullary fixation.

Dynamic hip screw (DHS) has been the gold standard for internal fixation of inter-trochanteric femur fractures. But Dynamic hip screw (DHS) is associated with a high failure rate in the fixation of unstable inter-trochanteric femur fractures. DHS has been associated with a high incidence of screw cut out, medial displacement of femur shaft, varus collapse and implant failure in fixation of unstable inter-trochanteric femur fractures.

Biomechanically intramedullary devices are a better implant choice for the fixation of unstable inter-trochanteric fractures. Intra-medullary devices are load-bearing as compared to load sharing extra-medullary plates. Intra-medullary implants lie closer to the mechanical axis of the limb, decreasing lever arm distance. They are associated with less operative time and blood loss.

Proximal femur nail (PFN) was introduced by AO in 1997 as an intramedullary implant for the management of such fracture. PFN has been widely used for the fixation of unstable inter-trochanteric fractures since its introduction. But PFN is technically more demanding and is associated with its complications like z- effect, reverse z-effect, peri-implant fracture, varus collapse non-union, delayed union etc.

Aims and Objectives

The present study is aimed to evaluate functional and clinical outcomes of the proximal femoral nail (PFN) in the treatment of unstable inter-trochanteric femur fractures in elderly patients.

Methods

Study Design and Period

This is prospective observational, conducted in the Department of orthopaedics at LTMGH, SION Hospital, Mumbai, from August 2017 to July 2020 after getting approval from the ethics committee of theInstitution (IEC/496118). We considered 80% confidence level and power of test 80% for sample size calculation. The mean value of Harris hip score before treatment was 67.77 with variance/SD 33.18 and the mean value of HHS after treatment was 80.35 as per reference. The sample size was calculated based on the formula:

$N=\alpha 2(t\alpha=t\beta)^2/(\mu 0- \mu a)^2$

Here t is the T distribution score at α and β. Calculated sample size based on the above formula and considered Harris hip score is minimum 33. So a total of 33 patients were enrolled in the study.

Inclusion criteria

Patients included in the study were those who were medically or anaesthetically fit for surgery and were willing to give informed written consent following the inclusion criteria as follows:

1. Unstable intertrochanteric femur fractures, AO type 3A2 7onwards (medial wall comminution, reverse oblique fractures, inter-trochanteric fracture with sub- trochanteric extension, presence of greater trochanter fragment).
2. Age greater than 50 years

Exclusion Criteria

1. Pathological fractures
2. Compound fractures
3. Previously operated fracture or old hip fracture
4. Bilateral hip fractures.

The AO/OTA fracture classification was used to classify the fractures based on pre-operative X-rays[7].

On admission data from all patients were collected regarding age, sex, mechanism of injury, the interval between injury and surgery, co-morbid conditions (hypertension, diabetes, ischaemic heart diseases). Pre-anaesthetic fitness was obtained for all the patients. Patients were classified according to the American Society of Anesthesiologists (ASA) grade. They were classified into ASA grade 1 to 4, with 1 and 2 indicating good health and 3and 4 poor health status.

Surgical Technique

All patients were given one dose of intravenous 4th generation cephalosporin pre-operatively. Patients were operated under combined epidural and spinal anaesthesia (CSEA). All patients were operated on a fracture table in the supine position. Initially, closed reduction was attempted with traction and internal rotation on the fracture table with reduction monitoring under fluoroscopic control. If unsatisfactory then after painting and draping of the affected limb, the reduction was achieved by per-cutaneous steinmen pin placed in the fracture site and using it to joystick the fragments in place. In cases of intertrochanteric fracture with sub-trochanteric extension, a cerclage wire was used to hold the reduction provisionally passes using wire passer in a minimally invasive fashion. Reduction and Proximal Femoral Nail (PFN) fixation procedure was followed according to standard technique under fluoroscopic guidance. The Lag screw was placed at the infero-centric region of the femoral head and anti-rotation screw was placed parallel to the lag screw. After the fixation is over, lavage is given using hydrogen peroxide, povidine iodine and normal saline. Incision was closed in layers. A sterile dressing is applied over the wounds and compression bandage given

Post-operative Management

Post-operatively patients were advised bed rest with operated limb elevation for 24 hours after surgery. Intravenous antibiotics for the first 2 days followed by oral antibiotics for the next 5 days were given. An anteroposterior (AP) and lateral radiographs were taken on the second postoperative day to assess fracture reduction, the position of screws and tip-apex distance (TAD) according to the criterion laid down by Baumgärtner et al..Patients were encouraged to do static quadriceps exercises on day 2 after surgery. Active quadriceps exercises were started on day 4 of surgery.

Follow- up

Patients were ambulated non-weight bearing with the aid of a walker. Full weight-bearing was allowed at three months after surgery depending on fracture consolidation as evident on the follow-up x-rays. Patients were followed up at 2 weeks, 1 month, 3 months, 6 months and 1 year after surgery. At each follow up an anteroposterior (AP) and lateral radiograph of the affected hip was obtained. Fractures were considered united if callus was seen in at least 3 cortices on anteroposterior and lateral radiographs. The Harris hip scoring system (HSS) were used as standards for evaluating the function of the limb. In HHS functional outcome is measured using pain, function, absence of deformity and range of motion of the operated limb. Total 100 points are there out of which pain comprise 0-44 points, function has 0-47 points, absence of deformity 0-4 points and range of motion 0-5 points. A score of less than 70 is considered poor, 70-80 fair, 80-90 good and 90-100 excellent.

Statistical Analysis

The collected data was tabulated and analyzed in accordance with the objectives of the study. Statistical analysis was done using Microsoft Excel 2013. Mean & percentage mean was calculated from the available data and various data subsets were compared to external comparison groups wherever necessary.

Results

Total 33 patients were enrolled in this study. All patients above 50 years were included in the study. In the present study, the mean age of the patients was 64.2±8.29 years (range 51-80 years). Out of 33 patients, 18(54.5%) were male and 15(45.5%) were female. The average duration of surgery was 67.58± 18.38 minutes. In the present study, the mean length of the incision was 8.58± 1.15 cm. Intraoperative blood loss was calculated by GROSS'S formula[8].In the present study, the mean blood loss was 68.18 ± 30.15 ml. In the present study, the mean duration of hospital stay 4.09±1.26 days. According to Singh's index[9], there was 1(3.0%) patient with grade 1 osteoporosis, 3(9.1%) patients with grade 2 osteoporosis, 12(36.4%) patients with grade 3 osteoporosis,11(33.3%) patients with grade 4 osteoporosis and 6(18.2%) with grade 5 osteoporosis.

The tip apex distance was calculated on standard anteroposterior (AP) and lateral radiograph as per Baumgartener's criterion[10] at 15 days, 3 months, 6 months and 1-year follow-up. The mean tip apex distance (TAD) was 16.55 ±4.56 at 15 days, 16.97±4.47 at months, 17.30±4.73 at 6 months and 17.70±5.28 at 1-year follow-up. The mean cervico-diaphyseal angle was 129.45˚±3.88 ˚ at 15 days, 12.64 ˚ ±4.74 ˚ at 3 months, 128.48 ˚ ±4.77 ˚ at 6 months and 128.48 ˚ ±4.77 ˚ at 1 year follow up. The lag screw position was calculated by Cleveland scoreand given in the table below (Table 1).

Table 1: Lag Screw Position

	15 days		3 Months		6 Months		12 Months	
Score	Frequency	%	Frequency	%	Frequency	%	Frequency	%
4	1	3.0	1	3.0	1	3.0	1	3.0
5	3	9.1	3	9.1	3	9.1	3	9.1
7	4	12.1	4	12.1	4	12.1	4	12.1
8	22	66.7	22	66.7	22	66.7	22	66.7
9	3	9.1	3	9.1	3	9.1	3	9.1
Total	33	100.0	33	100.0	33	100.0	33	100.0

The mean Harris Hip Score (HHS) was 43.73±6.463 at one month follow up, 49.12±5.936 at 3 months follow up, 71.33 ± 8.940 at 6 months follow up 75.33±9.636 at 9 months follow-up and 83.09±6.658 at 1 year follow up.

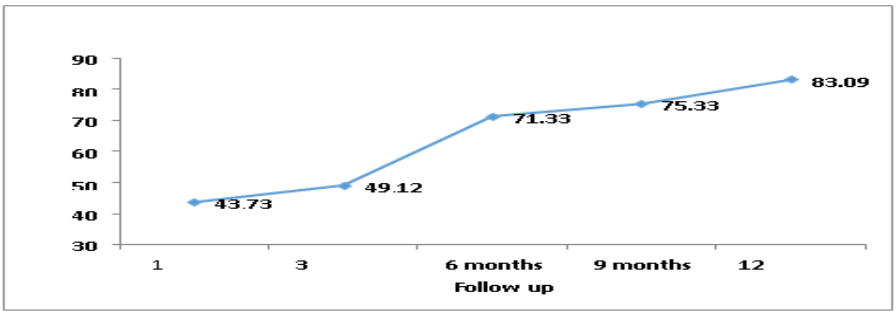

Fig 1: Mean Harris Hip Score

Patients were started on partial weight-bearing according to fracture stability and patient's compliance. Out of 33 patients, 30(90.9%) were started on partial weight-bearing at the end of 1 month following surgery. The remaining 3(9.1%) patients started weight bearing at the end of 3 months following surgery. Full weight-bearing was started considering radiological signs of union with signs of callus formation in at least 3 cortices, fixation stability and no signs of implant failure. 12(36.4%) patients were started on full weight-bearing at the end of 4 months following surgery,5(15.2%) patients started full weight-bearing at 5 months,7(21.2%) at 6 months, 6(18.2%) at 8 months and 3(9.1%) patients started full weight-bearing at the end of 12 months following surgery.In the present study 26(72%) patients had no complications. 3(9.09%) patients had screw back out. Varusmalunion was seen in 3 (9.09%) patients. 4(11%) patients had anterior thigh pain. None of the patients had any infection.

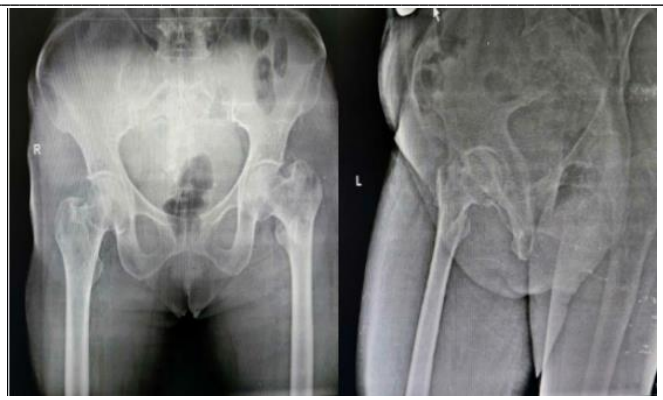

Fig 2: Showing pre-operative X- rays

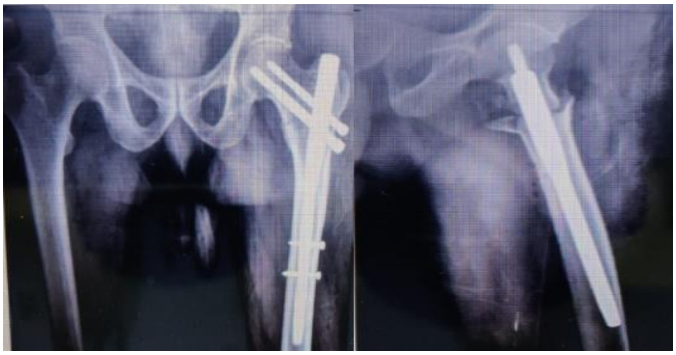

Fig 3: Showing post-operative X- rays

Discussion

Inter-trochanteric fractures are a common injury in the elderly population. With the ageing population there incidence are also increasing. The goal of treating these fractures are functional rehabilitation of the patient and early mobilisation to reduce complications associated with prolonged recumbency. The treatment of choice for these fractures is operative. Osteosynthesis (internal fixation) with orthopaedic implants and arthroplasty in form of Bipolar hemiarthroplasty or Total hip arthroplasty (THA) are the two operative options available[4]. Operative management with internal fixation is the established modality of treatment. There are two internal fixation options for fixation of inter-trochanteric femur fractures extra-medullary fixation and intramedullary fixation. Dynamic hip screw (DHS)[6]is the commonly used extra-medullary fixation device for fixation of inter-trochanteric femur fractures. Proximal femur nail (PFN), Proximal femur nail anti-rotation (PFN-A2), Gamma nail etc. are devices used for intramedullary fixation.

Proximal Femur Nail (PFN) provides controlled compression at the fracture site. In unstable proximal femoral fractures, control of axial telescoping and rotational stability is essential. Intramedullary implants inserted in a less-invasive manner are better tolerated by the elderly. The main advantages of the Proximal Femoral Nail over its precursor-gamma nail, are that two proximal screws are smaller in diameter. The two proximal screws provide better rotational control of the proximal fracture fragment. Complications of proximal femoral nailing include lateral protrusion of screws, Z effect or reverse Z effect, fracture of the lateral wall of the trochanter, intra-operative femoral shaft fractures and anterior thigh pain.In the present study, the total sample size was 33 which included patients above 50 years out of which 12 were from 51-60 years, 14 were from 61-70 years and 7 from 71-80 years of age group with the mean of 64.2±8.29 years. In the study conducted by Dr.Ravishankar et al,[11] the mean age group of patients was 64 years which is similar to our study group.Out of 33 patients, 18(54.5 %) were male and 15(45.5 %) were female indicating a male preponderance. A similar male preponderance (62.2 %) was seen with the study done by Dr.Ravishankar et al[11] in 2016.In the present study, the mean duration of surgery was 67.58±18.38 minutes. The study conducted by Bartonicek j shows the mean duration of surgery as 70 minutes. Also, studies conducted by Pan et al (59.16 min), Saudan et al (64 min), Shen et al (62.06 min) shows similar results[12,13].In the present study, the mean length of the incision is 8.58±1.15 cm. The mean length of incision in studies conducted by Pan et al 2004 was 14.20 cm and in the study conducted by Zao et aL in 2009 was 9.60 cm which is comparatively more than this study.In the present study, the mean blood loss is 68.18 ± 30.15 ml. However, in studies conducted by Pajarinen et al in 2005, the mean blood loss was 320 ml. Similar studies conducted by Pan et al 2004 (273.33 ml), Shen et all 2007(123.73 ml), Zao et al 2009 (179 ml) indicate more blood loss than this study[13].In the present study, the mean duration of hospital stay was 4.09±1.26 days. However, in the study conducted by Anmol Sharma et al., the mean duration of hospital stay was 9.29 days, which is comparatively more than this study[14].In the present study, tip apex distance (TAD) as calculated by Baumgartner's criteria was 17.70± 5.28 at the end of one year. In the study conducted by Jeffrey A. et al, the mean TAD was 20 mm ± 9 mm with an 8.5% cut-out rate (n = 7 patients)[15].The mean TAD of the patients who developed cut out was 38 mm and and 18 mm for those who did not develop cut-out (p = 0.012). TAD greater than 25 mm,varus reduction and improper reduction is associated with fixation failures. There was no screw cut out in the present study group.Cervico-diaphyseal angle i.e. neck-shaft angle was calculated from the standard anteroposterior (AP) radiograph in all 33 patients. The mean cervico-diaphyseal angle was 129.45± 3.88 at 15 days after surgery and 128.88± 4.77 at one year following surgery. Thus the loss of neck-shaft was very minimal indicating good fixation and

bony union.In the present study, functional outcome was calculated using Harris Hip Score (HHS). Mean HHS after 1 month was 43.73 (SD 6.463), 3 months 49.12 (SD 5.936), 6 months 71.33 (SD 8.940), 12 months 83.09 (SD 6.658).Thus an increase in hip function is seen over 1 year period indicating a good functional outcome. In the study conducted by R.N. Singh et al[15], a similar increasing functional outcome was observed. The HHS in their study was at 33 (SD 0.4) at one month, 58 (SD 5.6) at 3 months, 88 (SD 2.5) at 6 months and 93 (SD 2.7) at 1year follow, which is comparatively better than our present study group but was statistically not significant.In the present study, Singh's osteoporotic index was calculated from radiography of the normal side hip and used to assess the level of osteoporosis and bone quality. 48.48% of the patients had Singh's index less than or equal to 3 compared to 38% reported in a study conducted by Dr Sharma A et al[14]We also evaluated the effect of osteoporosis on the functional outcome of the patients but could not achieve any statistically significant correlation indicating that PFN fixation with good surgical technique even in the osteoporotic patient can give good functional outcome. The average time of union was in our study was 20 weeks with a range of 16 to 24 weeks. However, the present study showed that patient with increasing age and with Singh's osteoporotic index less than 3 are more prone to complications like implant failure, delayed union and varus collapse.In the present study, lag screw position was identified by radiographic x rays taken in anteroposterior (AP) and lateral views by Cleveland index and the score didn't change significantly till one year follow up. Patient with a Cleveland index of more than 4 have less chance of complications like screw backout, z-effect or reverse z- effect. This is because of the presence of strong calcar in the inferior and medial quadrant giving rise to stronghold and purchase for the screw.In the present study, postoperative complications included mechanical failure in 3 patients (9.09 %) with screw backout, 3 patients (9.09 %) with varusmalunion, 4 patients (12.12 %) with anterior thigh pain. Some patient had more than one complications. 26 patients (72 %) did not have any complications. The study conducted by Anirudh Sharma et al[13] shows screws back out in 28.4 % of patients (115). The study conducted by Dr Gadegone et al[16] faced post-operative complications like 4(4%) superficial wound infection, 1 (1%) AVN, 1(1%) non-union, 5(5%) mechanical failure, 6(6%) varusmalunion, 7(7%) lateral thigh discomfort and 10(10%) shortening of affected lower limb (24) but the study was limited to short PFN, our study includes both short and normal PFN. Thus our study has less or comparable complication rates with other studies using PFN.

Limitations

Limitations of the study include small sample size and relatively short follow up limited to one year only. Further research with large sample size and longer follow up is needed to know long term outcomes.

Conclusion

Unstable intertrochanteric fractures in elderly patients treated with Proximal Femoral Nail (PFN) gives good functional and radiological outcome leading to a high rate of bony union with an acceptable path. Complications can be minimised using good intra-operative fracture reduction, implant positioning and surgical technique with minimum soft tissue damage.

References

1. Mallya S, Kamath SU, Madegowda A, Krishnamurthy SL, Jain MK, Holla R. Comparison of radiological and functional outcome of unstable intertrochanteric femur fractures treated using PFN and PFNA-2 in patients with osteoporosis. Eur JOrthopSurgTraumatol. 2019;29(5):1035-1042.
2. Mulay Sanjay, Kumar Pushpak& Singh Abhishek. Functional outcome of treatment of fractures of distal radius with volar locking plate & crossed k wires. International Journal of Orthopaedics Sciences. 2017; 3:778-782.
3. Evans EM. The treatment of trochanteric fractures of the femur. J Bone Joint SurgBr. 1949;31B(2):190–203.
4. Mulay, Sanjay&Singh, Abhishek&Saji, Mahammadakram. Study of treatment of fracture neck of femur with Bipolar / Austine Moore's Prosthesis. International Journal of Orthopaedics Sciences. 2017; 3:377-382.
5. Deepak Tambe,Arvind Goregaonkar,BinotiSheth, Rahul Supe. Radiographic signs of retroversion of acetabulum in adult Indian population, retrospective observational study. Int J OrthopSci. 2018; 4(1):80-83.
6. Mulay, Sanjay &Thadeshwar, Dr Rabari, Yash&Dhaytadak Dinesh & Kumar, Pushpak. Comparitive study of fixation done in intertrochanteric fractures by PFN &DHS.International Journal of Orthopaedics Sciences. 2017; 3:146-152.
7. Schipper IB, Steyerberg EW, Castelein RM et al. Reliability of the AO/ASIF classification for pertrochanteric femoral fractures.ActaOrthop Scand. 2001; 72(1):36–41
8. Singh M, Nagrath AR, Maini PS. Changes in trabecular pattern of the upper end of the femur as an index of osteoporosis. J Bone Joint Surg (Am). 1970;52A:457–467.
9. Baumgaertner MR, Curtin SL, Lindskog DM, Keggi JM. The value of the tip-apex distance in predicting failure of fixation of peritrochanteric fractures of the hip. The Journal of bone and joint surgery American. 1995; 77(7):1058-64
10. Ravishankar J, Dr.Puneeth, Dr.Jaipalsinh R Mahida. A prospective study to evaluate the radiological and functional outcome of unstable intertrochanteric fractures treated with proximal femoral nail. Int J Orthop Sci. 2016;2(4):302-306.
11. Bartonícek J, Dousa P, Kostál R, Svatos F, Skála J. Duration of surgery in osteosynthesis of fractures of the trochanter. Acta Chir OrthopTraumatol Cech. 2001;68(5):294-9.
12. Zhang K, Zhang S, Yang J, Dong W, Wang S, Cheng Y, Al-Qwbani M, Wang Q, Yu B. Proximal femoral nail vs. dynamic hip screw in treatment of intertrochanteric fractures: a meta-analysis. Med SciMonit. 2014;20:1628-33.
13. Sharma A, Sethi A, Sharma S. Treatment of stable intertrochanteric fractures of the femur with proximal femoral nail versus dynamic hip screw: a comparative study. Rev Bras Ortop. 2017;53(4):477-481.
14. Geller JA, Saifi C, Morrison TA, Macaulay W. Tip-apex distance of intramedullary devices as a predictor of cut-out failure in the treatment of peritrochanteric elderly hip fractures. IntOrthop. 2010;34(5):719-22.
15. Kumar R, Singh RN, Singh BN. Comparative prospective study of proximal femoral nail and dynamic hip screw in treatment of intertrochanteric fracture femur. J Clin Orthop Trauma. 2012; 3(1):28-36.
16. Gadegone WM, Salphale YS. Short proximal femoral nail fixation for trochanteric fractures.Journal of orthopaedic surgery. 2010; 18(1):39-44

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