Section: Orthopedics

Original Research Article

CLINICAL EVALUATION OF OPERATED INTERTROCHANTERIC FRACTURES OF FEMUR USING SHORT PROXIMAL NAIL ANTIROTATION (PFNA) AS FIXATION DEVICE

Pardeep Singh[1], Amit Thakur[2], Sandeep Verma[3], Omeshwar Singh Rai[1], Priyanka Thakur[4]

[1]Assistant Professor, Department of Orthopedics, MM Medical College & Hospital, Kumarhatti-Solan, India.
[2]Associate professor, Department of Orthopedics, All India Institute of Medical Sciences, Vijaypur (Jammu), India.
[3]Senior Resident, Department of Orthopedics, MM Medical College & Hospital, Kumarhatti-Solan, India.
[4]Senior Resident, Department of anesthesia, Government Medical College and Hospital, Jammu, India.

Received : 12/04/2023
Received in revised form : 25/05/2023
Accepted : 07/06/2023

Keywords:
Intertrochanteric fracture, PFNA.

Corresponding Author:
Dr. Pardeep Singh,
Email: thakurpardeep95@gmail.com

DOI: 10.47009/jamp.2023.5.3.341

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2023; 5 (3); 1703-1708

Abstract

Background: Treating intertrochanteric fracture adopting reduction and internal fixation has become the most accepted method of treatment. But there is no consensus on choice of implant depending upon a fracture pattern. we did a study to evaluate the results of short proximal femoral nail antirotation (PFNA) as a fixation device in intertrochanteric fractures of femur. **Materials and Methods:** Total 95 cases including both male and female subjects with intertrochanteric fractures were include in the study. All cases were treated with intramedullary fixation with PFNA. Out of the 95 cases 11 were lost to follow up and 2 patients died due to unrelated causes to surgery. Boyd-Griffin Classification is used in this study for classifying the fractures. Various parameters were studied and recorded which include average time of surgery, blood loss, need for blood transfusion, hospital stay, mobility and weight bearing status of the patient, any post-operative complications, fracture union. Harris Hip Score was used to evaluate the hip joint function. Patients were followed up for 9-12 months. **Result:** Mean age of the patients was 67 years with male more than females. Total 66% fractures occurred due to domestic fall and 15% due to road traffic accidents. Total 68% patients had stable and 32% had unstable fracture pattern. 29% patients had grade-Il and 27% has grade III Osteoporosis. Five patients needed blood transfusions, and the average amount of blood loss was 68 ml. The mean operative time was 50.60 minutes. 15% of the patients required limited open reduction. Total complications were 9% with, superficial wound infection 5%, helical blade back-out in 2%. The average hospital stay was 4.7 days. We had 32% excellent, 41% good 17% fair, 10% poor results according to Harris Hip Score. **Conclusion:** Higher surgical competence, a decent fracture table, excellent instruments, and good C-arm control are requirements for PFNA. Although there is a high learning curve, it is a safe and simple implant option for treating complicated intertrochanteric fractures with the right instruction and technique.

INTRODUCTION

Intertrochanteric fracture is one of the common fractures in senile patients. It usually occurs due to low energy trauma like trivial fall. Hip fractures are one of the leading causes of disability and death among elderly. The ageing of the population in most of the countries has led to an increase in the frequency of senile hip fractures.[1] Due to their larger pelvis and earlier onset of osteoporosis, women are three times more likely than males to sustain these sorts of fractures. Young people typically suffer high energy trauma as a result of intertrochanteric fractures. Early mobilization is the main objective in the care of a patient with an intertrochanteric fracture. Early patient mobilization lowers the risk of morbidity and death.[2] A variety of circumstances, including the fact that many of

ISSN (O): 2687-5365; ISSN (P): 2753-6556

these patients have severe osteoporosis and other medical conditions that raise the risk associated with surgery and anaesthesia, make managing intertrochanteric fractures difficult for orthopaedic surgeons. Therefore, selecting the best fixation technique and equipment is crucial for a successful result.

Prior to the development of effective fixing techniques, non-operative therapy for intertrochanteric fractures involved extended bed rest in traction and abduction until fracture healing occurred (typically 10–12 weeks), followed by a protracted ambulation training programme. This method was linked to significant complication rates in senior individuals; common issues included decubitus ulcers, joint contractures, pneumonia, and thromboembolic complications, leading to a high death rate. Additionally, because traction was unable to adequately offset the deforming muscle forces, fracture recovery was frequently accompanied by mal-union, particularly varus deformity and shortening.

Due to these factors, internal fixation and reduction have evolved to be the accepted therapy for intertrochanteric fractures. But there is no consensus on choice of implant depending upon a fracture pattern.[3] Therefore, we did a study to evaluate the results of short proximal femoral nail antirotation (PFNA) as a fixation device in intertrochanteric fractures of femur. We used Boyd-Griffin Classification in this study for classifying the fractures.[4] Boyd and Griffin (1949) divided trochanteric femur fractures into four categories. Their categorization is helpful for determining prognosis and planning treatments. Harris Hip Score was used to evaluate the hip joint function.[5]

MATERIALS AND METHODS

Study Design: Patients with intertrochanteric fractures treated with short Proximal femoral nail antirotation (PFNA) as fixation device were selected for the study. Patients with type I-IV Intertrochanteric femoral fractures based on Boyd-Griffin Classification, and closed fractures presenting within 72 hrs to the hospital were included in the study. Patients with subtrochanteric fractures., femoral shaft fractures, isolated or combined with intra-capsular femoral neck fractures and metastatic or pathological fracture were excluded from the study. Various parameters were studied and recorded which include average time of surgery, blood loss, need for blood transfusion, hospital stay, mobility and weight bearing status of the patient, any post-operative complications, fracture union. The clinical and radiological outcome of the patients were studied.

Implant (Proximal Femoral Nail Antirotation): The AO/ASIF created the PFNA system in 2004. The single large-surface area blade of implant serves as its primary design feature. The cancellous bone is compressed by the blade insertion. These features give the implant the best possible anchoring and stability when it is placed in osteoporotic bone.[6-8] The nail is 170, 200, or 240 mm long. The nail proximal portion has a 16.5 mm diameter, while its distal portion comes in 10-, 11-, or 12-mm sizes. Sizes for helical blades range from 80 to 120 mm. Both the proximal and distal portions have a 6° angle. The nail tip is precisely designed to lessen tension and increase concentration. Static or dynamic proximal locking are both possible.

Operative Technique: Under spinal/general anaesthesia, the procedure was performed. In every case, a fracture table and an image intensifier were utilised. After proximal reaming of the medullary canal, the short PFNA was placed. In order for the blade to be positioned through the aiming arm in the lower half of the neck in the AP view and in the centre of the neck in the lateral view, a guide wire was inserted into the femoral neck. With the aid of a hammer, the blade, which was attached to a unique inserter, was inserted over the guide wire. The blade would be secured when the introduction was finished to prevent spinning. Either dynamically or statically, the PFNA can be far locked. Uninjured limb Depending upon the level of fracture displacement traction force is adjusted and fracture is reduced while manipulating the limb in internal or external rotation under the C-arm. The greater trochanter should be the site of the guide pin insertion, which should be done at the virtual intersection of the neck centre line and the femoral shaft 60-lateral line. In 60 of valgus, a 2.8mm guide wire is placed into the femoral shaft and over the fracture site. The C-arm checks its location. And an awl is used to enlarge the entrance. With the reamer included in the kit, the proximal femur is reamed. The nail is secured to the jig, and alignment is verified. The femur is then punctured with the nail. The C-arm is used to measure the depth of the hole for the helical blade. The insertion of helical blade lateral cortex is reamed using lateral cortex reamer followed by reaming over the guide wire for helical blade to appropriate length after measuring size of the helical blade using the measuring gauze. The jig is used to insert one static or dynamic 4.9mm interlocking bolt into the nail distal end from which one hole is static and the other is dynamic. The incision was stitched up without the use of a drain after the final nail location was verified in the C-arm in both views. Before surgery, the patient received one dose of IV wide spectrum cephalosporin; thereafter, BID doses continued until 48 hours, depending on the patient's and the wound's health. After the fixation was finished, the wound was thoroughly washed with regular saline. Layers were used to seal the wound. Compression bandage was utilised after sterile dressing.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

RESULTS

The study involved 82 patients above 40 years of age. The age distribution was from 40 to 85 years. The average age was 67 years. The largest group of patients being from 51-60 years. Males have a relatively higher percentage of intertrochanteric fractures as compared to females (M: F 1.2:1). Most common causes of injury are trivial fall/slip (66%), fall from height (height > 6 feet) (15%), RTA (15%), violence (5%). Most of the patients who had trivial fall were older in age and had osteoporosis. Fracture pattern are divided into various types according to Boyd and Griffin classification. Type II (53%) was most common followed by type III (20%) and type I (15%) [Table 1].

Blood loss was counted intra-operatively by no. of 30*30 sponges used during the surgery. One sponge equal to 61ml blood loss approximately. The average blood loss was 1 sponge so 61ml (50-100ml). 5 patients (12%) required intra-operative blood transfusion as their pre-operative hemoglobin was low. Osteoporosis was graded using Singh's index. Most of the patient fell in grade II (29%) and III (27%). Fracture was reduced anatomically by closed means (85%). If it was not achieved then it was achieved by limited open reduction (15%) during surgery. Near anatomical reduction was achieved in 42 patients (84%).

Four patients had a superficial wound infection. One of the patients was a female patient suffering from Type II Diabetes Mellitus. The infections of both the patients subsided with prolonged antibiotics and wound wash. One patient had lag screw back out at 13 weeks. The patient was followed up for another 8 weeks till radiological union occurred but the screw was not removed as the patient does not have any clinical symptoms [Table 2 and Figure 1].

Table 1: Mean age, cause of injury and type of fracture.

Variable	Subdomain	Mean or N (%)
Mean age		67 years
Causes of injury	Fall from height	12 (15%)
	Trivial fall/slip	54 (66%)
	RTA	12 (15%)
	Assault	4 (5%)
Type of fracture	Type I	12 (15%)
	Type II	44 (53%)
	Type III	16 (20%)
	Type IV	10 (12%)

Table 2: Complications in postoperative patients.

Complication	Number of patients
Superficial infection	4
Lateral sliding of the blade(>10mm)	2
Lateral thigh pain	2

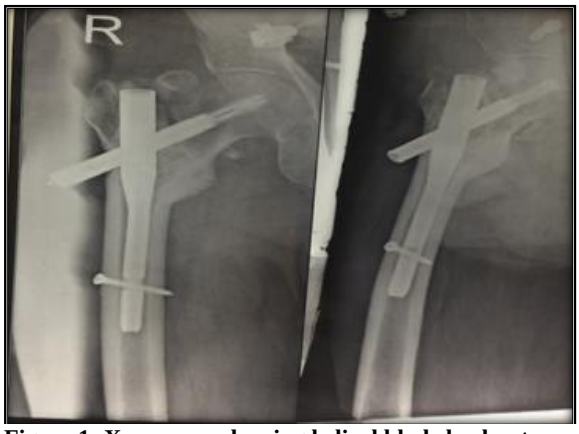

Figure 1: X-ray scan showing helical blade backout.

The average operating time was 50.60 mins (40min-60min) after anesthesia. The average hospital stay was 4.6 days (7-14 days) from the date of admission. It varied in patients due to factors like availability of operation theatre and comorbid conditions of the patients. All the patients after union of fracture or after 16 weeks were grouped and the anatomical and functional results were evaluated according to Harris Hip Score. We had 32% excellent, 41% good 17% fair, 10% poor results. X-ray was performed after 3 and 6 months of follow up in postoperative cases [Figure 2 and 3].

ISSN (O): 2687-5365; ISSN (P): 2753-6556

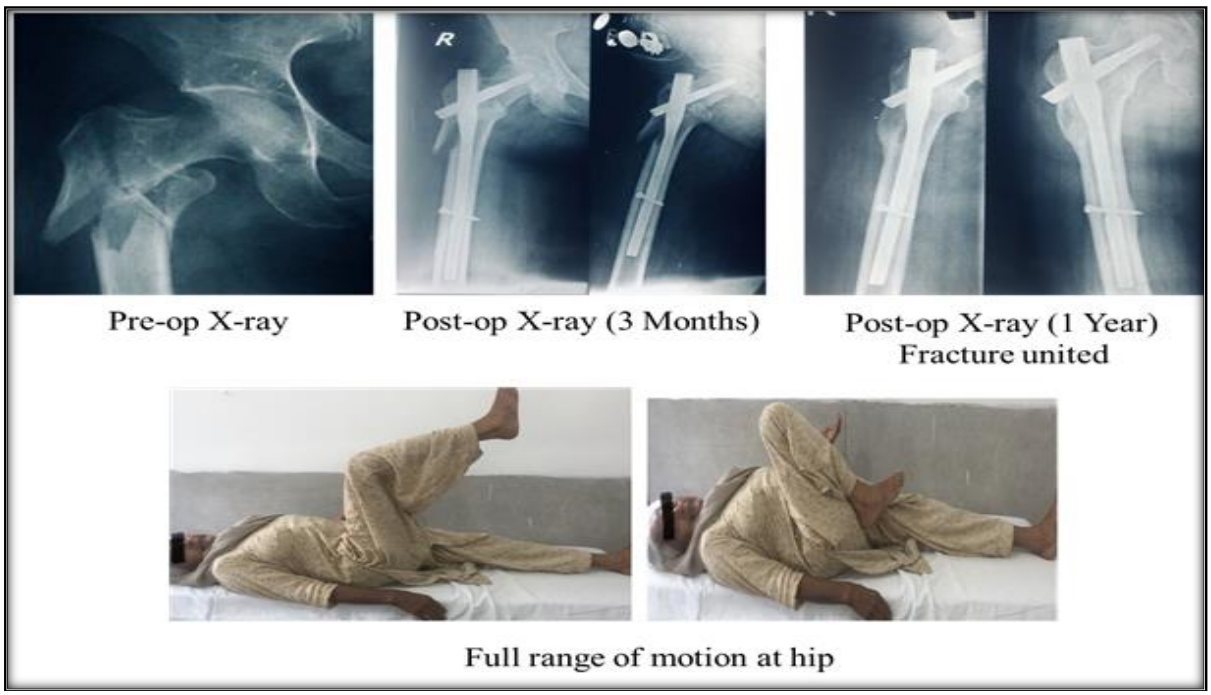

Figure 2: case details-pre- and post-op Xray showing fixation with PFNA, Range of motion at hip joint post operative at 1 year.

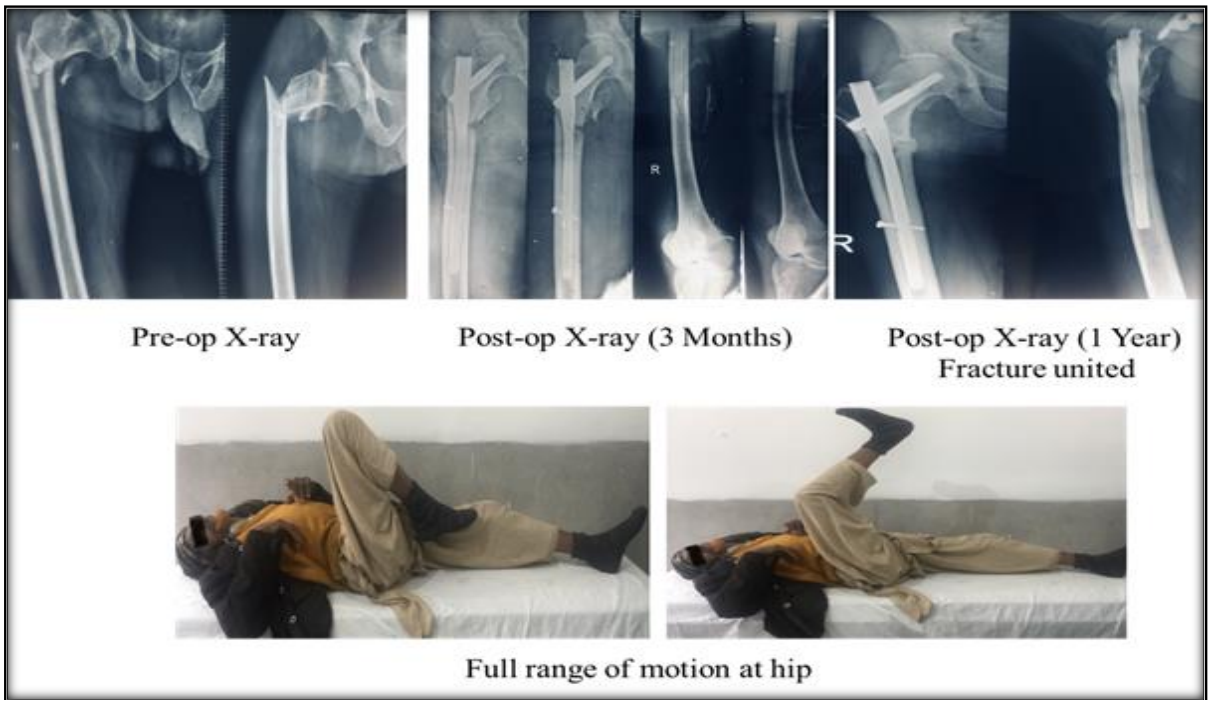

Figure 3: Case details-pre and post-op Xray showing fixation with PFNA, Range of motion at hip joint post-operative at 1 year.

DISCUSSION

The successful management of intertrochanteric fractures depends on a variety of variables, including age, general health, the length of time from the fracture before therapy, the effectiveness of that treatment, any coexisting medical conditions, and the fixation stability. To decrease patient morbidity and mortality, it is currently accepted practise to internally treat all intertrochanteric fractures. The best way to treat the intertrochanteric fracture and the optimum implant are still up for dispute, since each technique has pros and cons of its own.

The average age in our study was 67 years, which was equivalent to both Indian and western writers who had conducted similar research. In contrast to female participants, men outnumbered them in our study. 66 percent of injuries in our research were caused by domestic falls. Age had a role in this as well since older patients were more prone to get

ISSN (O): 2687-5365; ISSN (P): 2753-6556

fractures from domestic falls. In our study, 32% of the fractures were unstable, whereas 68% were stable. The Singh's index was used to assess osteoporosis.[9] The elder patient and post-menopausal females had more osteoporosis. In our study, grade II osteoporosis affects 29% of participants, while grade III affects 27%.

The average intraoperative blood loss was very minimal. The average was 61ml and it was more in patients who required limited open reduction. It is comparable with that of study done by Tang Xin et al done in 2010.[10] Only five (10%) of our patients required intra or post-operative transfusion. But many of them had a very low preoperative hemoglobin.

From incision to closure, the average operating duration was 50.60 minutes. Compared to previous research, the typical length of operation was 68 min, 67 min and 20 min.[11-13] We started off with a longer operating time, which significantly decreased as the trial progressed. This represents the PFNA nailing learning curve. 4.6 days were spent in the hospital on average. More patients with co-morbid disorders exhibited it.

Total complications in our study were 9%. complications were mostly superficial wound infection in 4 patients it was superficial which was treated with repeated wound wash and dressing in ward along with antibiotics, some required debridement but none required revision and wound healed well. Lag screw back out in 2 patients. Although none of the patients required revision surgery. Complaint of lateral thigh pain occurred in 2 patients. There was no fracture of the femoral shaft at the tip of the nail. The average Harris Hip Score was 84.95. With good to excellent results in 73% of patients. The results are comparable with study of Li et al done in 2014.[14]

Competent surgical technique, appropriate equipment, and good C-arm visualisation were all necessary for the success of proximal femoral nail antirotation. We discovered benefits such as simpler reduction with traction, less help needed, little patient manipulation, lessening of patient trauma, and improved C-arm use with greater sight. The patient position on the fracture table is crucial; the upper body is abducted 10-15° for easier access to the greater trochanter. The C-position arm should allow for appropriate AP and lateral view of the proximal femur.

For simple handling and successful surgery, the patient anatomical reduction and safe fixation on the operating table are essential. If traction and manipulation failed to reduce the size of the fragment, nail reduction was used. In this procedure, a nail was inserted into the proximal fragment, and the nail rotational motions and compression were used to try to reduce the size of the fragment. If still reduction proved a challenge, restricted open reduction at the fracture site was used to solve the problem. Six individuals in our research needed a minor open reduction.

The greater trochanter tip or lateral portion served as the nail entrance site. The medial entrance site of the nail, which has a 60-degree valgus angle, increases the distraction of the fracture. Distal locking was done with the interlocking bolt in static mode. Nail cap was not used in any of the cases to decrease the cost of already costly implant. In our study one of the important factors was the cost of the implant as PFNA is costlier than both PFN and DHS, but at the end it did not cause much of the difference as less operative time thus reducing the cost, no or less transfusion of blood, post operative antibiotics were used less reducing the cost of the drugs, short hospital stays, early return to daily activities and minimal implant related complications.

Because PFNA nails have greater axial telescoping and rotational stability, we discovered that they are more beneficial in unstable and reverse oblique designs. Because they can resist higher static and many times higher cyclical stress than dynamic hip screws, they have proven to be biomechanically stronger. As a result, the fracture heals without the need for major medial support repair. The implant compensates for the function of the medial column.

CONCLUSION

According to the study, there are several benefits of using PFNA to treat intertrochanteric fractures in older individuals. It can be used to any proximal femoral fracture configurations. Since it is a closed procedure, the fracture hematoma is preserved while also producing early healing and early union. In all stages of osteoporosis, it may be applied with an equal degree of success. The technique is rapid, requires a little incision, and results in far less blood loss. Even when used for non-anatomical reduction, it produces good outcomes. Helical blade placement is important. It has to be fully impacted before locking the lag screw to obtain maximum compression and avoid any screw back-out complication. A greater level of surgical competence, a decent fracture table, competent instruments, and adequate C-arm control are necessary for nailing with PFNA. It requires a lot of learning. We may thus draw the conclusion that, with the right instruction and technique, the PFNA is a simple and safe implant option for the treatment of difficult intertrochanteric fractures.

REFERENCES

1. Xu Y, Geng D, Mao H, Zhu X, Yang H. A comparison of the proximal femoral nail antirotation device and dynamic hip screw in the treatment of unstable pertrochanteric fracture. J Int Med Res. 2010;38(4):1266-75.
2. Handoll HH, Parker MJ, Cochrane Bone J, Group MT. Conservative versus operative treatment for hip fractures in adults. Cochrane Database Syst Rev. 1996;2010(1).
3. Jones HW, Johnston P, Parker M. Are short femoral nails superior to the sliding hip screw? A meta-analysis of 24 studies involving 3,279 fractures. Int Orthop. 2006;30:69-78.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

4. Boyd HB, Griffin LL. Classification and treatment of trochanteric fractures. Arch Surg. 1949;58(6):853-66.
5. Banaszkiewicz PA. Traumatic arthritis of the hip after dislocation and acetabular fractures: treatment by mold arthroplasty: an end-result study using a new method of result evaluation. Classic papers in orthopaedics: Springer; 2013. p. 13-7.
6. Zeng C, Wang Y, Wei J, Gao S, Zhang F, Sun Z, et al. Treatment of trochanteric fractures with proximal femoral nail antirotation or dynamic hip screw systems: a meta-analysis. J Int Med Res. 2012;40(3):839-51.
7. Catalogue M. Original Instruments and Implants of the Association for the Study of Internal Fixation–AO/ASIF. SYNTHES (USA).1690:19301-1222.
8. Praveen M, Sri K, Muthukrishnan R. The AO/ASIF proximal nail antirotation (PFNA): a new design for the treatment of unstable proximal femoral fracture. Injury. 2009;4(40):428-32.
9. Ghattas PJ. Objective measures for estimating intraoperative blood loss. Wellmont Orthopedic Residency Program University of Texas Health Science Center. 2015.
10. Tang X, Liu L, Yang T-f, Tu C-q, Wang G-l, Fang Y, et al. Preliminary effect of proximal femoral nail antirotation on emergency treatment of senile patients with intertrochanteric fracture. Chinese Journal of Traumatology. 2010;13(04):212-6.
11. Banan H, Al-Sabti A, Jimulia T, Hart A. The treatment of unstable, extracapsular hip fractures with the AO/ASIF proximal femoral nail (PFN)—our first 60 cases. Injury. 2002;33(5):401-5.
12. Simmermacher R, Bosch A, Van der Werken C. The AO/ASIF-proximal femoral nail (PFN): a new device for the treatment of unstable proximal femoral fractures. Injury. 1999;30(5):327-32.
13. Takigami I, Matsumoto K, Ohara A, Yamanaka K, Naganawa T, Ohashi M, et al. Treatment of trochanteric fractures with the PFNA (proximal femoral nail antirotation) nail system. Bull NYU Hosp Jt Dis. 2008;66(4):276-9.
14. Li M, Wu L, Liu Y, Wang C. Clinical evaluation of the Asian proximal femur intramedullary nail antirotation system (PFNA-II) for treatment of intertrochanteric fractures. J Orthop Surg Res. 2014;9(1):1-8.

ISSN (O): 2687-5365; ISSN (P): 2753-6556