International Journal of Medical Research Professionals
P-ISSN: 2454-6356; E-ISSN: 2454-6364
DOI: 10.21276/ijmrp

Original Research Article.

Assessment of Outcome and Complications of Proximal Femoral Nail in The Management of Intertrochanteric Fractures

Atul Pandey[1], GBS Kohli[2*]

[1]MBBS, D-Ortho, DNB (Orthopaedics), Senior Resident,
Department of Orthopaedics, North DMC Medical College and Hindurao Hospital, Delhi, India.
[2*]MBBS, DNB (Orthopaedics), MNAMS, CMO (NFSG),
Department of Orthopaedics, North DMC Medical College and Hindurao Hospital, Delhi, India.

ABSTRACT

Introduction: Years ago, intertrochantric fractures often used to be a terminal event in the life of feeble and fragile patients. The basic problem was not of union, but of complications arising due to immobilisation in bed till fracture heals. Inspite of improvement and modifications in conservative line of treatment, the ideal anatomical and functional result could not be achieved; prolonged immobilisation in bed was another important threat to life of elderly patients. So here is an effort to study the results of surgical management of intertrochanteric fractures with proximal femoral nails (P.F.N).

Materials and Methods: The present study was conducted in department of orthopaedics, among 30 adult cases of intertrochanteric fractures. Proximal Femoral Nail (P.F.N) Implant System with a standard length P.F.N. of 240 mm with distal diameter of 10-12mm and the neck –shaft angle of 1350 and with 60 medio lateral angulation was used. The final position of the nail was checked in the C-arm in both views, AP and Lateral and the wound was closed in layer. All patients were followed up, at every visit; patient was evaluated clinically and radiologically regarding hip and knee function, fracture union, implant failure, infection, etc.

Results: The delayed complications in our study includes hip joint stiffness in 3 (10%) cases, knee joint stiffness in 1(3%) case, varus angulation in 1(3%) case, Z- effect in 1(3%) case and shortening >1cm in 1(3%) cases. At the end of our follow up, results were evaluated by KYLE'S criteria and were excellent in 50% (15 patients), good in 26% (8 patients), fair in 16% (5 patients) and poor in 6% (2 patients).

Conclusion: Proximal femoral nail (P.F.N.) can be considered the most judicious, effective and rational method of treating intertrochanteric femoral fractures specially the unstable and reverse oblique type of intertrochanteric femoral fractures. But it is technically demanding so require higher surgical skill and expertise, proper fracture table, good instrumentation and image intensifier control. It has a steep learning curve. Thus, we can conclude that Proximal Femoral Nail (P.F.N.) fixation after proper training and technique is an effective and safe implant option for treatment of intertrochanteric fractures specially in unstable and reverse oblique type of intertrochanteric fractures.

Keywords: Intertrochanteric Fractures; Orthopaedics; Proximal Femoral Nail.

***Correspondence to:**

Dr. GBS Kohli, MBBS, DNB (Orthopaedics), MNAMS,
CMO (NFSG), Department of Orthopaedics, North DMC Medical College and Hindurao Hospital, Delhi, India.

Article History:

Received: 25-07-2018, **Revised:** 21-08-2018, **Accepted:** 28-09-2018

Access this article online	
Website: www.ijmrp.com	Quick Response code
DOI: 10.21276/ijmrp.2018.4.5.040	

INTRODUCTION

Years ago, intertrochantric fractures often used to be a terminal event in the life of feeble and fragile patients, who used to die from cardiac, pulmonary and renal complications which were aggravated by recumbence and immobility. Not much attention was paid to these trochantric fractures till 19th centuary and mortality rate of these fractures was very high, those who survived remained morbid due to bed sores, deep vein thrombosis, shortening of the limb cystitis, joint stiffness, coxa vara, etc.[1] In 1965 Horowitz[2] reported a mortality rate of 34.6% for trochanteric fracture treated by traction and 17.5 % for fractures treated by internal fixation. Taking it into consideration, surgery by internal fixation of the fracture is ideal choice. The primary goal of treatment has to be early mobilization to avoid secondary complications, which can be achieved by open reduction and internal fixation. In trochantric fractures which are treated without surgical intervention, malunion with coxa vara deformity, resulting in shortening of limb and limp are commonly seen.[1]

Various operative procedures with different implants have been described in the literature for the treatment of intertrochantric fractures. It is universally accepted that the treatment of

intertrochantric fractures should be stable internal fixation as early as possible. Stable fixation is the keystone of successful union of trochanteric fractures. Kaufer. Matheull and Sonstegard[3] listed the variables that determine the strength of fracture fragment and implant assembly. Crawford et al[4] carried out a study and compare the complications. D.H.S. fixation and Intramedullary nail for I-T fractures and found that D.H.S fixation has more complications and a higher rate of reoperation.

Inspite of improvement and modifications in conservative line of treatment, the ideal anatomical and functional result could not be achieved; prolonged immobilisation in bed was another important threat to life of elderly patients. The basic problem was not of union, but of complications arising due to immobilisation in bed till fracture heals. Therefore a new intramedullary device, proximal femoral nail was designed in 1996 which gives an advantage of minimally invasive surgery.[5] Use of proximal femoral nails helps to prevent excessive fracture impaction or collapse and so consecutive limb shortening. It is biomechanically sounder and has the advantages like smaller incision and less blood loss. So here is an effort to study the results of surgical management of intertrochanteric fractures with proximal femoral nails (P.F.N).

MATERIALS AND METHODS

The present prospective descriptive study was conducted in department of orthopaedics, Hindurao Hospital, Delhi. The study consists of 30 adult cases of either sex who was diagnosed with intertrochanteric fracture, satisfying the inclusion criteria and treated with closed/open reduction and internal fixation with proximal femoral nail (P.F.N)**.** The patients in study group were randomly selected and were informed about the study in all respect and informed consent was obtained from all patients. After the patients with intertrochanteric fractures were admitted to hospital, all necessary clinical details were recorded in performa which was prepared for this study. The required information was collected through interview, clinical examination, analyzing case papers and by follow up at intervals of 1, 2, and 6 months. Inclusion criteria was patient who has been diagnosed as having intertrochanteric fractures, patients more than 20 years of age and patient who were fit for surgery. Exclusion criteria was skeletally immature individuals, patients unfit for the surgery, patients with compound fractures, patients with pathological fractures, patients admitted for re operation and patient not given written consent for surgery. Patients admitted with Intertrochanteric fracture were examined and investigated with X-ray pelvis with both hips AP and Lateral view (whenever possible) and also effected side hip with femur, full length AP and Lateral. Skin traction or skeletal traction was applied to all cases. Investigations as per requirement were carried out.

Physician opinions were taken as to the fitness of patient before surgery as and when necessary. X-ray were reviewed again and classified with using Orthopaedic Trauma Association (OTA)/A.O classification. All fractures were treated using a proximal femoral nail. All patients were assessed by using the Kyle"s criteria at the follow-ups. Performa specially made for the study was used. Data collected at the end of the study was statistically compared and analyzed with the similar studies done before. Preoperative Protocol was followed. Proximal Femoral Nail (P.F.N) Implant System with a standard length P.F.N. of 240 mm with distal diameter of 10-12mm and the neck –shaft angle of 1350 and with 60 medio lateral angulation was used. We did not used end cap. Patient were given spinal or epidural anesthesia and shifted to a radiolucent fracture table in a supine position. Operative leg was put on traction. Opposite limb was put in a full abduction as to give space for the C-arm in between the legs. Reduction was achieved by traction and internal rotation primarily and adduction or abduction as required. Reduction was checked in a C-arm with anterior- posterior and lateral view. Patient was scrubbed, then painted and draped under sterile condition. A 5cm incision was taken above the tip of the greater trochanter and deepened to the gluteus medius muscle. Tip of the greater trochanter palpated and minimal muscle attachment was cleared off. After this, PFN was fixed. The final position of the nail was checked in the C-arm in both views- AP and lateral and the wound was closed in layer. Total time of the surgery and blood loss (it was counted approximately by counting 50 ml per mop used) were noted intra-operatively.

Post-Operative Protocol was followed. IV antibiotics were continued for first 5 days and then it was shifted to oral. Static quadriceps exercises were started on the fourth postoperative day. Active quadriceps and hip flexion exercise were started on 6th and 7th post-operative day. Patients were advised to walk (non weight bearing walking) on axillary crutches as soon as tolerable usually after suture removal. Partial weight bearing walking was started at about 4 weeks post operatively. Full weight bearing walking was allowed after assessing for radiological and clinical union.

All patients were followed up at an interval of one month, two month and six months. At every visit, patient was evaluated clinically and radiologically regarding hip and knee function, fracture union, implant failure, infection, etc.

Table 1: Reduction of fractures

Reduction	Number of patients	Percentage
Closed	27	90
Limited open	3	10

Table 2: Intraoperative complications

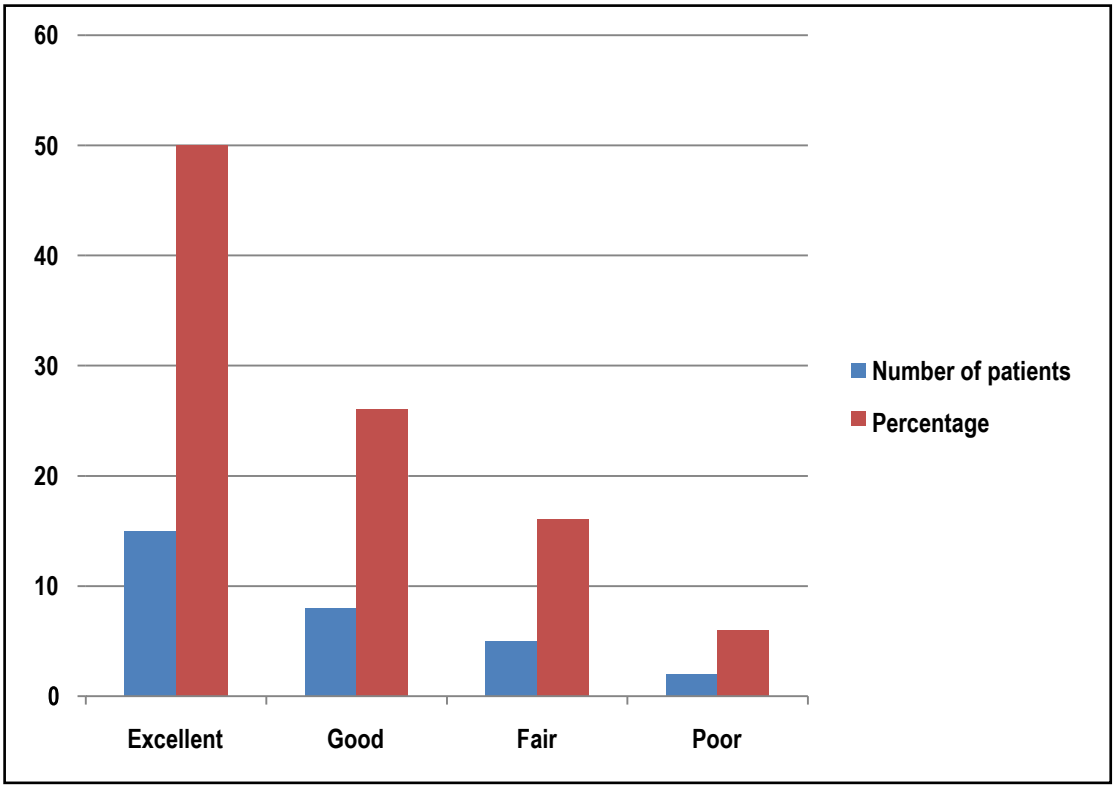
Intra operative	Number of patients	Percentage
Failure to put derotation screw	3	10
Varus angulation	1	3
Open reduction	3	10
Fracture of lateral cortex	1	3
Femoral fracture	0	0

Table 3: Delayed complications

Delayed complication	Number of patients	Percentage
Hip joint stiffenss	3	10
Knee joint stiffenss	1	3
Shortening >1 cm	1	3
Varus angulation	1	3
Z – effect	1	3
Delayed union	0	0

Table 4: Results according to Kyle's criteria

Results	Number of patients	Percentage
Excellent	15	50
Good	8	26
Fair	5	16
Poor	2	6



Graph 1: Bar graph showing results according to Kyle's criteria

RESULTS

Blood loss was counted intra operatively by number of mops used during the surgery. One mop equal to 50m1 blood loss approximately. The average blood loss was 1.62 mops so 8lml (50-1 50m1). 3 patients required pre-operative blood transfusion as their pre-operative hemoglobin was less. None required blood transfusion post-operatively. Average operating time was 65mins (45min-95min) after anesthesia. We had a greater operating time in the beginning of this study, which was greatly reduced in the later part of our study. This observation signifies the learning curve of Proximal Femoral Nailing (P.F.N.). Fracture was reduced anatomically by closed means. If that was not achieved then it was achieved by limited open reduction during surgery. Near anatomical reduction was achieved in 27 (90%) patients out of 30 patients (table 1). In our study, we were able to do closed reduction in most (90%) of the cases, but we have to do open reduction in 3 (10%) cases.

All the cases in our study group were fresh factures who underwent operative procedure (CRIF/ORIF with PFN) at the earliest possible time in our set up. The delay was due to the associated medical illness of the patient resulting in longer duration of time required to take fitness for surgery. All the patients were operated at an average interval of 9 days from the day of trauma.

Intraoperatively, no mortality in any of our patient in the study group. There are many complications which can occur intraoperatively, but we have considered the following complications in our study group. In 3 (10%) patients, there was

failure to put derotation screw, varus angulation in 1 (3%) patient, fracture of lateral cortex in 1(3%) patient, open reduction in 3 (10%) patients (table 2).

Regarding post-operative complications, we had 1 case (3%) of superficial wound infection in immediate post-operative period, which was adequately managed with regular dressing and appropriate antibiotics. None required any debridement or revision surgery. Post operatively, we noted no mortality in any patient of our study group. The complications which we have considered in our study includes hip joint stiffness, knee joint stiffness, shortening, varus angulation, delayed union, Z- effect and implant failure. We had 3 (10%) patients of hip joint stiffness, 1(3%) patient of knee joint stiffness, 1 (3%) patient of shortening and 1 (3%) patient of varus angulation, 1 (3%) patient of Z – effect and no case of implant failure and delayed union (table 3).

The average hospital stay was 14.033 (10-22) days from date of admission to date of discharge. It varied in patients due to factors like availability of operation theatre and comorbid conditions of the patients, which results in longer hospital stay. According to Kyle's criteria, we had excellent to good results in 23(76%) patients, fair in 5(16%) patients and poor in 2 (6%) patients (table 4, graph 1).

DISCUSSION

The average intra operative blood loss was very minimal. Blood loss was measured intra-operatively by the numbers of mops used during the surgery .One mop roughly equals to 50 ml of blood loss. In our study average blood loss was 81 ml, and it was more in the patients, who required open reduction. Only 3(10%) of our patients required pre-operative blood transfusion but none post operatively. Kumar R et al.[6] in their study had an average blood loss of 100 ml in the PFN group and 250 ml in DHS group. In our study, we were able to do close reduction in most of the cases (90%) but have to do open reduction in 3 (10%) cases after the failure of close reduction.

Post operatively, the patients were give I.V. antibiotics for 5 days and then shifted to oral antibiotics. Suction drainage was removed 48 hours after the surgery. Static quadriceps exercises started on 4th post-operative day, and active quadriceps exercises on 6th or 7th post-operative day. Patients were allowed non – weight bearing walking on axillary crutches after suture removal, which is usually on 12th post-operative day. On the first follow up after one month, patients were allowed for partial weight bearing walking. We have one (3%) case of superficial wound infection in immediate post-operative period, which was adequately managed with regular dressing and appropriate antibiotics in ward and did not require any debridement. In the study carried out by Gadegone WM et al,[7] there were 7% cases of superficial wound infection.

In our study, we have 3(10%) cases of hip joint stiffness, so full range of hip movement was only possible in 27 (90%) cases. So, our study findings are comparable to Gadegone WM et al[7] study. We have Z effect in one (3%) case, which was mostly due to improper placement of hip screw and cervical screw and early mobilization of patients. All these patients required revision with a different size screw and fracture healed after revision. This was comparable to W.M.Gadegone[29] et al. study which had 3% cases of Z-effect.

In our study, we have one (3%) case of shortening > 1cm, while in Gadegone WM et al[7] study there was no case of shortening. In a study carried out by Pajarinen,[8] he concludes that mean shortening of femoral neck in patients with P.F.N. are much less (1.3mm)than in those with DHS (6.1mm). At the follow up, there was no complaint of anterior thigh pain or the fracture of the femoral shaft at the tip of the nail.

Results were evaluated by Kyle's criteria[9] in our series we had 50% excellent, 26% good, 16 % fair and 6% poor results. It was similar to W.M. Gadegone et al[7] and Pavelka et al[10] who concludes that use of PFN may have a positive effect on the speed at which walking is restored.

In the series of 295 patients with trochanteric fractures treated with PFN by Domingo et al[11] the average age of the patient was 80 years, which possibly accounted for 27% of the patients developed complications in the immediate postoperative period, while in our study group, average age of the patients were 65 years. Domingo et al[11] concludes that surgical techniques of PFN nailing is not complex, number of complications are acceptable and comparable to other implant systems.

In another study, Jain HK et al[12] assessed the efficiency of PFN in trochanteric femoral fractures, they evaluated the results by Kyle's criteria which are as follows: Excellent (51.66%), good (31.33%), fair (13.33%), poor (3.33%) which are comparable to our study.

Similar results were reported in Yassuri Gal et al[13] in a study, which showed 90% of patients have good to excellent results and in Fogagnola et al[14] study which showed 92% of the patients have good to excellent results. Simmermacher RK et al[5] reported technical failure of PFN, after poor reduction, malrotation or wrong choice of screws in only 4.6% of cases (total 191 patients) .they concludes that the result of PFN implant are favourable in comparison to any other currently available implants for treatment of unstable trochanteric femoral fractures. In their study anatomical fracture reduction was possible in 86% cases, while in our study, it is around 90% but we have to do open reduction in 3 (10%) cases.

Metin uzun et al[15] carried out a study of 35 patients and concluded that the correct position of osteosynthesis material and use of intramedullary nail providing stronger fixation of proximal part may reduce mechanical complications in unstable intertrochanteric fractures. Ozkun k et al[16] carried out a study on patients diagnosed with intertrochanteric fractures and treated with proximal femoral nailing (P.F.N).as per their study, the mean duration of surgery was 48 mins and time of fracture union is 8.6 wks whereas in our study, the mean duration of surgery was 65 mins and union time was 2-3 months depending on type of fracture.so the findings in both studies are comparable.

Dynamic hip screw remains the implant of choice due to its favourable results and low rate of complications. It provides control compression at the fracture site. Its use has been supported by its biomechanical properties which have been assumed to improve the healing of the fracture.[17] But Dynamic hip screw requires a relatively larger exposure, more tissue trauma and anatomical reduction. All these increase the morbidity, probability of infection and significant blood loss. It also causes varus collapse leading to shortening and inability of the implant to survive until the fracture union. The plate and screw device will weaken the bone mechanically. The common causes of fixation failure are instability of the fractures, osteoporosis, lack of anatomical reduction, failure of fixation device and incorrect placement of the screw.[18,19]

We found proximal femoral nail to be more useful in unstable and reverse oblique patterns due to the fact that it has better axial telescoping and rotational stability. It has shown to be more biomechanically stronger because they can withstand higher static and several fold higher cyclical loading than dynamic hip screw. So the fracture heals without the primary restoration of the medial support. The implant compensates for the function of the medial Column.[10]

The gamma nail is associated with specific complications[20] like anterior thigh pain, fracture at the tip of the nail. Radford PJ et al[21] shown that trochanteric fractures which are treated with gamma nail have less intra operative blood loss and wound infection in comparison to dynamic hip screw (DHS), but have high incidence of femoral shaft fracture which is due to implant design. But proximal femoral nail (P.F.N) is long and it has smaller diameter at the tip which reduces the stress concentration at the tip.[22] Its position is near to the weight bearing axis so the stress generated on the implant is negligible.

Proximal femoral nail also acts as a buttress in preventing the medialization of the shaft. The low rate of femoral shaft fracture and failure of fixation suggests that Proximal Femoral Nail (PFN) is useful for treatment of unstable trochanteric fractures.[23] The entry point of the Proximal femoral nail is at the tip of the greater trochanter so it reduces the damage to the hip abductors unlike the nails which has entry through pyriformis fossa.[24] The hip screw and the compression cervical screw of the Proximal femoral nail adequately compress the fracture, leaving between them adequate bone block for further revision if the need arise.

The success of proximal femoral nail depended on good surgical technique, proper instrumentation and good C-arm visualization. All the patients were operated on fracture table. The present study found advantages such as reduction with traction is easier, less assistance is required, manipulation of the patient is reduced to minimum, trauma to patient is decreased and better use of C-arm with better visibility. Placement of the patient on the fracture table is important, for better access to the greater trochanter the upper body is abducted away 10-15°. Position of the C-arm should be such that proximal femur is seen properly in AP and lateral view.

The anatomical reduction and secure fixation of the patient on the operating table are absolutely vital for easy handling and good surgical result. If reduction was not achieved by traction and manipulation then nail reduction was done, in which nail was introduced in the proximal fragment and reduction was tried by rotational movements and compression by the nail. If still reduction was a problem, then it was achieved by limited open reduction at the fracture site.

In our study 10% (3 cases) patients required limited open reduction. The entry point of the nail was taken on the tip or the lateral part of the greater trochanter. As the nail has 6° of valgus angle, medial entry point causes more distraction of the fracture. The cervical screw is inserted 5mm away from the subchondral bone in the lower half in the AP view and center on the neck in the lateral view. The hip pin is placed parallel to the cervical pin in AP view and overlapping it in the lateral views It should be 10mm shorter than the cervical pin from the subchondral bone. This ensures that the hip (superior) screw will not take the weight load but only fulfill the anti- rotational function. Failure to do this leads to the “Z - effect”, in which the cervical pin backs out and the hip pin pierces the joint or the vice-versa. Distal locking was done with the interlocking blot and both static and dynamic holes were locked in all the nails in our study.

So from the above discussion, it can be said that as an intramedullary device, proximal femoral nail (P.F.N) offers several advantages over any other currently available implants like superior stabilisation of fracture, more efficient load transfer, controlled fracture impaction so prevent excessive fracture collapse, less shortening, decrease overall morbidity of the patient, early mobilisation of the patient and overall fewer complications.

In our study one of the important factor was the cost of the implant as Proximal femoral nail is costly than the dynamic hip screw, but at the end it didn’t cause much of the difference as less operative time thus reducing the cost, no or less need of transfusion of blood, post-operative antibiotics were used less, reducing the cost of the drugs, less hospital stay as well as early return to daily activities.

CONCLUSION

Though literature in the past suggests that dynamic hip screw (D.H.S.) is the gold standard for the treatment of stable as well as unstable type of inter trochanteric femoral fractures .but with our study and the current literature available regarding surgical management of intertrochanteric fractures by Proximal Femoral Nail (P.F.N.), we can conclude that proximal femoral nail (P.F.N.) can be considered the most judicious, effective and rational method of treating Intertrochanteric Femoral Fractures specially the unstable and reverse oblique type of intertrochanteric femoral fractures. But Proximal Femoral Nail (P.F.N.) fixation is technically demanding so require higher surgical skill and expertise, proper fracture table, good instrumentation and image intensifier control. It has a steep learning curve. Thus, we can conclude that Proximal Femoral Nail (P.F.N.) fixation after proper training and technique is an effective and safe implant option for treatment of intertrochanteric fractures specially in unstable and reverse oblique type of intertrochanteric fractures.

REFERENCES

1. Faich JA, Liebekk A, Slungaard U. Epidemiology of hip fractures in Norway. Acta Orthop Scand 1986; 56: 12-16.

2. Horowitz BG. Retrospective analysis of hip fracture. surg. Gynaecol. Obstet. 1966; 123:565.

3. Kaufer H, Matthews LS, Sonstegard D. Stable fixation of intertrochanteric fractures. J Bone Joint Surg Am. 1974 Jul; 56(5):899-907.

4. Crawford CH, Malkani AL, Cordray S, Roberts CS, The trochanteric nail versus the Sliding hip screw for intertrochanteric hip fractures; a review of 93 cases. J Trauma. 2006; 60: 325-329.

5. Simmermacher RKH, Bosch AM, Van der Werken C. The AO/ASJF- Proximal femoral nail: a new device for the treatment of unstable proximal femoral fractures. Injury 1999; 30: 327-32.

6. Kumar R, Singh RN, Singh BN. Comparative prospective study of proximal femoral nail and dynamic hip screw in treatment of intertrochanteric fracture femur. Journal of clinical orthopaedics and trauma. 2012 Jun 1;3(1):28-36.

7. Gadegoen W M, Salphale Y S. Proximal femoral nail — an analysis of 100 cases proximal femoral fractures with an average follow up of 1 year. International Orthopaedics 2007 June; 3 1(3): 403-8.

8. Fractures and Diclocation in Adults,Cambell's operative Orthopaedics,12th ED:Volume 3;2748
9. Kyle RF, Gustilo RB, Premer RF. Analysis of six hundred and twenty two cases of intertrochanteric fractures of the-femur. J Bone Joint Surg Am l979; 61: 216-221.
10. Pàvelka T, Houcek P. Linhart M, Matejka J. Osteosynthesis of hip and femoral shaft fractures using the PFN-long. Acta Chir Orthop Traumatol Cech. 2007 Apr; 74(2): 91-8.
11. Domingo U, Cecilia D, Herrera A, Resines C. Trochanteric fractures treated with a proximal femoral nail. Int Orthop 2001; 25: 298-301.
12. Jain HK, Dhakar S, Sharma M, Jain M, Sharma H. Efficacy of proximal Femoral Nail in peritrochanteric femoral fractures of elderly patients. Int J Biological Med Res. 2012;3(3):1910-3.
13. Al-Yassari G, Langstaff RJ, Jones JW, Al-Lami M. The AO/ASIF proximal femoral nail (PFN) for the treatment of unstable trochanteric femoral fracture. Injury. 2002 Jun 1;33(5):395-9.
14. Fogagnola F, Kujri JRM, Paccola CA,intramedullary fixation of peritrochanteric hip fractures with AO/ASIF proximal femoral nail (P.F.N.),--Arch orthop , Trauma surgery 2004;124(1):31-37
15. Uzun M, Ertürer E, Oztürk I, Akman S, Seckin F, Ozcelik IB. Long-term radiographic complications following treatment of unstable intertrochanteric femoral fractures with the proximal femoral nail and effects on functional results. Acta Orthop Traumatol Turc. 2009 Nov 1;43(6):457-63.
16. Ozkan K, Eceuiz E, Unay K, Tasyikan L, Akman B. Treatment of reverse oblique trochanteric fractures with proximal femoral nail. International Orthopaedics (2011) vol 35 ,issue 4 : 595 -598.
17. Pajarinen J, Lindahl J, Michelsson 0, Savolainen V, Hirvensalo E. Pertrochanteric Femoral Fractures Treated With a Dynamic Hip Screw or a Proximal Femoral Nail. A Randomized Study Comparing Post-Operative Rehabilitation. The Journal of Joint and Bone Surgery (Br). Jan 2005; 87 (l):76-81
18. Curtis MJ, Jinnh RH, Wilson V, Cunningham BW. Proximal femoral fractures; a biomechanical study to compare extramedullary and intramedullary fixation. Injury1994; 25: 99-104.
19. Kim WY, Han CH, Park JI, Kim FJY. Failure of intertrochanteric fracture fixation with a dynamic hip screw in relation to preoperative fracture stability and osteoporosis. Int Orthop 2001; 25: 360-62.
20. Rosenblum SF, Zuckerman JD, Kummer FJ, Tam bs. A biornechanical evaluation of the gamma nail. J Bone Joint Surg Br 1992; 74: 352 -57.
21. Radford PJ, Needoff M, Webb JK. A prospective randomized comparison of the dynamic hip screw and the gamma locking nail. J Bone Joint Surg Br 1993; 75 B: 789-93.
22. Dousa P, Bartonicek J, Jehlicka D, Skala-Rosenbaum J. Osteosynthesis of trochanteric fractures using proximal femoral nails. Acta chirurgiae orthopaedicae et traumatologiae Cechoslovaca. 2002;69(1):22-30.
23. Menezes DF, Gamulin A, Noesberger B. Is the proximal femoral nail a suitable implant for treatment of all trochanteric fractures? qlin Orthop Relat Res 2005; 439: 221-27.
24. Moein CA, Verhofstad MH, Bleys RL, Van der Werken C. Soft tissue injury related to choice of entry point in antegrade femoral nailing: piriform fossa or greater trochanter tip. Injury. 2005 Nov 1;36(11):1337-42.

Source of Support: Nil. **Conflict of Interest:** None Declared.

Cite this article as: Atul Pandey, GBS Kohli. Assessment of Outcome and Complications of Proximal Femoral Nail in the Management of Intertrochanteric Fractures. Int J Med Res Prof. 2018 Sept; 4(5):173-78. DOI:10.21276/ijmrp.2018.4.5.040