International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2018; 4(1): 867-872

www.orthopaper.com
Received: 15-11-2017
Accepted: 16-12-2017

Dr. R Sreeraj
Senior Resident, Department of Orthopaedics, Govt Medical College, Kozhikode, Kerala, India

Dr. Jojo Inassi
Assistant Professor, Department of Orthopaedics, Govt Medical College Kozhikode, Kerala, India

Correspondence
Dr Jojo Inassi
Assistant Professor, Department of Orthopaedics, Govt Medical College Kozhikode, Kerala, India

Clinical and functional outcome of proximal femoral nailing in unstable intertrochanteric fractures

Dr. R Sreeraj and Dr. Jojo Inassi

DOI: https://doi.org/10.22271/ortho.2018.v4.i1m.125

Abstract
The objective of this study was to assess the clinical and functional outcome of proximal femoral nailing in 40 patients who had attended our institution, Government medical college Kozhikode between January 2015 and January 2016 with unstable intertrochanteric fractures. They were followed up for one year. Clinical and functional outcome was assessed according to the Harris hip score. Most of the patients belong to AO/OTA type 31A23 (47.5%) followed 31A22 (27.5%). The average blood loss was found to be between 90 ml -150ml with an average of 103ml. Most of the patients had a radiological union by 16-22 weeks with maximum number of radiological union occurring in 16 weeks. There were no intra operative complications. Post operatively 3 patients (7.5%) were having z effect, 4 patients varus collapse, 1 had abutment of nail, there was one case of deep wound infection which healed after debridement and antibiotics. We had excellent result in 11 patients, good result in 18, fair in 7 and poor in 4. From our study we conclude PFN is a very good implant for fixation of unstable inter trochanteric fractures in elderly. The procedure takes only short time with less blood loss. Ideal reduction without distraction is important to prevent mechanical complications.

Keywords: Unstable intertrochanteric fracture, proximal femoral nail, Harris hip score

Introduction
Due to increasing number of aging population, the incidence of inter trochanteric fractures is on the rise [1]. It is predicted that total number of hip fractures will reach 2.6 million by 2025 and 4.5 million by 2050 [11]. There are two options for treating inter trochanteric fractures mainly intramedullary and extra medullary fixation [2]. PFN is the commonest intra medullary device used for fixing inter trochanteric fractures whereas dynamic hip screw is the common extra medullary device used for fixing [3] the fracture. DHS is considered the gold standard for treating inter trochanteric fractures [4]. But there are more implant failures when DHS is used in unstable inter trochanteric fractures. Compared with intra medullary implant, DHS is considered to be having a biomechanical disadvantage because of the longer distance between the implant and the weight bearing axis [5]. Keystone for the success of treating inter trochanteric fracture is stable fixation and early mobilization. There are factors which are surgeon dependent like choice of implant, adequacy of reduction, good surgical technique for achieving good stable fixation. But factors like fracture geometry, bone quality, comminution are out of control of the surgeon [6].
Most of the complications in inter trochanteric fracture fixation occur in unstable fractures. The factors which lead to instability and failure of fixation include loss of postero medial support, reverse oblique fractures, lateral wall comminution, sub trochanteric extension, broken greater trochanter and severe osteoporosis [7]. There is no universally accepted consensus over the choice of implant for treating inter trochanteric fractures in elderly patients. Various meta-analysis have suggested that there is no superiority of one treatment method over another in unstable inter trochanteric fracture treatment [8, 9, 10].
Associated medical conditions like diabetes, hypertension, pulmonary, renal and cardiac problems also have an impact on the fracture treatment and rehabilitation. Life threatening complications like hypostatic pneumonia, catheter sepsis, cardio respiratory failure and decubitus ulcer will also create problems for managing elderly patients with trochanteric fractures.

All the above mentioned conditions makes the surgery an emergency surgery for early mobilization and rehabilitation [12]. In this study we tried to find out the functional outcome of unstable inter trochanteric fractures treated using PFN

Materials and methods

After attaining institutional research approval we have conducted a prospective analytical study between January 2015 and November 2016. There were 40 patients between 45to 80 years of age. All patients with unstable inter trochanteric fractures who are medically fit to undergo surgery were included. All surgeries were done within first 10 days of injury. Patients with pathological fractures, polytrauma and patients with previous injuries around the hip were excluded. In this study we have used nails of uniform length of 25 mm in all 40 cases. All patients were evaluated using haemogram, RBS, serum electrolytes and LFT. CXR and ECG were routinely taken. X-ray of the affected hip both AP and lateral were taken. We took a medical consultation prior to surgery. Patients were given preoperative skin tractions during waiting period for surgery.

Surgical technique

After obtaining the informed consent, preoperative prophylactic antibiotic, 1gm Cefotaxime was given 30 minutes prior to the surgery. Surgery was performed in supine position in fracture table with affected side in 10 - 15 degree adduction. Closed reduction was achieved by traction and gentle rotation, adequacy of reduction was checked using an image intensifier. A 5cm incision was made just proximal to greater trochanter and fascia and gluteus medius split in line of incision, tip of greater trochanter identified. Entry point was slightly lateral to the tip of greater trochanter and position was confirmed with image intensifier in both AP and lateral view. After rechecking the fracture reduction appropriate size PFN was inserted and the wound closed in layers. Post operatively IV Cefotaxime 1gm bd for 3 more days and post-operative analgesia using epidural anaesthesia for 48hrs were given.

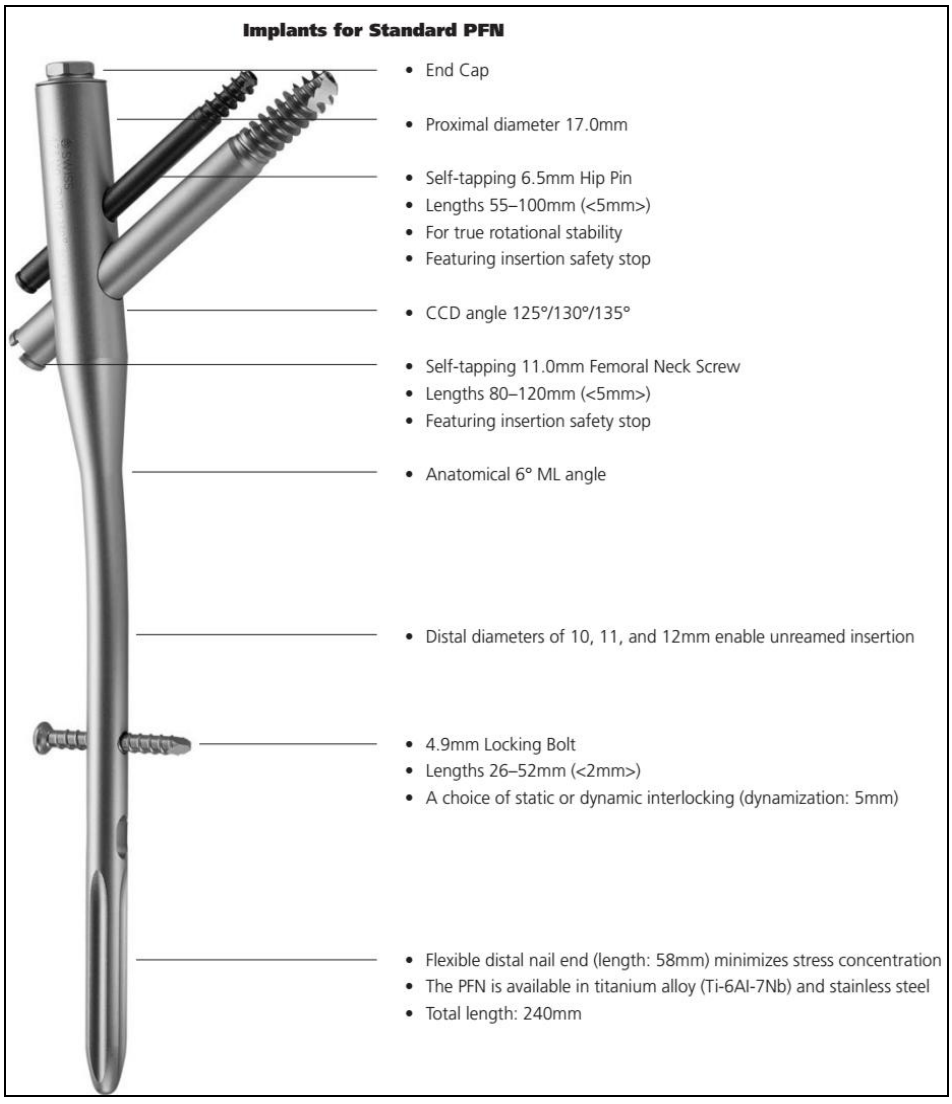
Post-operative care

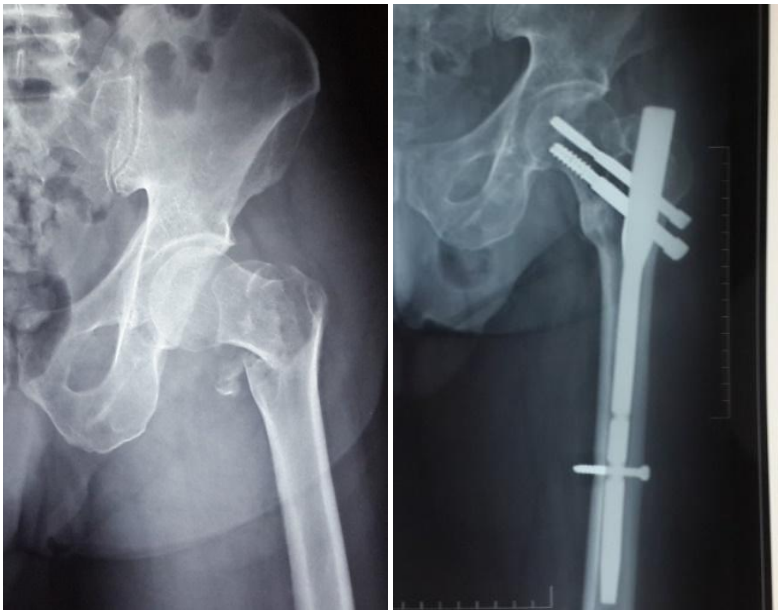
Patients were made to sit in 1st post-operative day and started quadriceps and knee mobilization. Sutures were removed on 10th day and patients were allowed touch down weight bearing from 2nd week onwards and full weight bearing as tolerated. Most of the patients were changed to cane from walker by 5th week and most were able to walk independently by 12 weeks.

All patients were followed every 4weeks till 6months and every 3months till one year. At every visit, patient was assessed regarding hip and knee function, fracture union and deformity, both clinically and radiologically.

The data was entered were entered in MS excel and further analysis done using the software PASW Statistics 18.

The statistical test were performed were Pearson chi square and student T test, the level of significance was set at 5% (p value< 0.05). Functional assessment was done using Harris Hip Score.



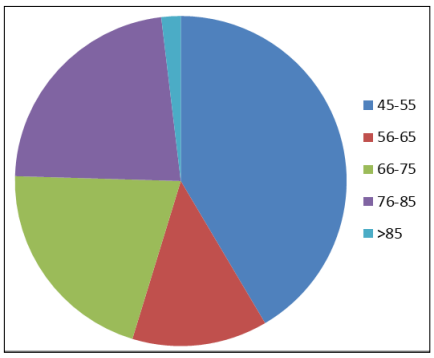


Pre operative One year follow up

Results

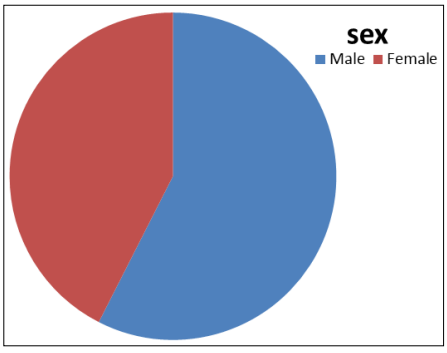
Out the 40 patients 12 patients (30%) were in 75 and 85 years, 11 patients (27.5%) in 66 to 75 age group. We had only one patient above the age of 85.

Age	Frequency	Percent
45-55	9	22.5
56-65	7	17.5
66-75	11	27.5
75-85	12	30.0
>85	1	2.5
Total	40	100.0



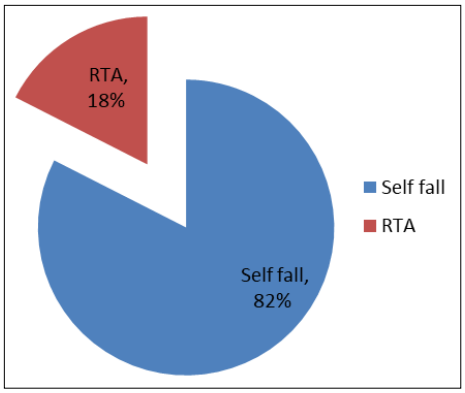
57.5% patients were male (23) and rest were female

Sex	Frequency	Percent
Male	23	57.5
Female	17	42.5
Total	40	100.0

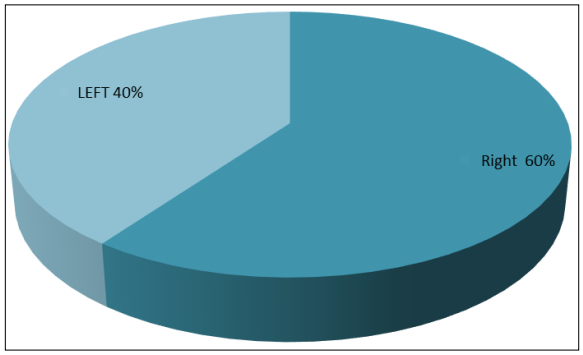


Fall in the household environment was the most common mechanism of injury

	Frequency	Percent
Self-fall	33	82.5
RTA	7	17.5

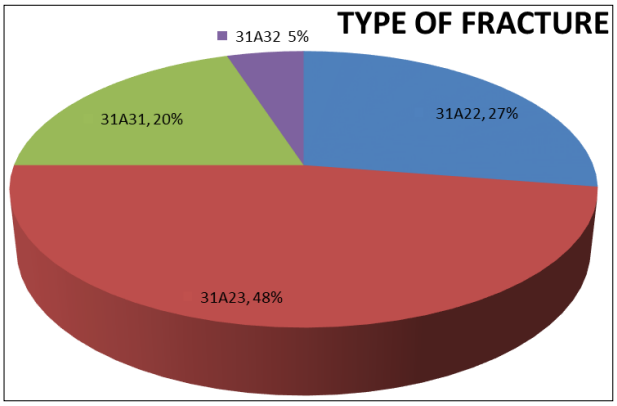


Right side was the predominant side 60%



Most of the patients belonged to AO/OTA type 31A23 (47.5%) followed 31A22 (27.5%)

Classification	Frequency	Percent
31A22	11	27.5
31A23	19	47.5
31A31	8	20.0
31A32	2	5.0
Total	40	100.0

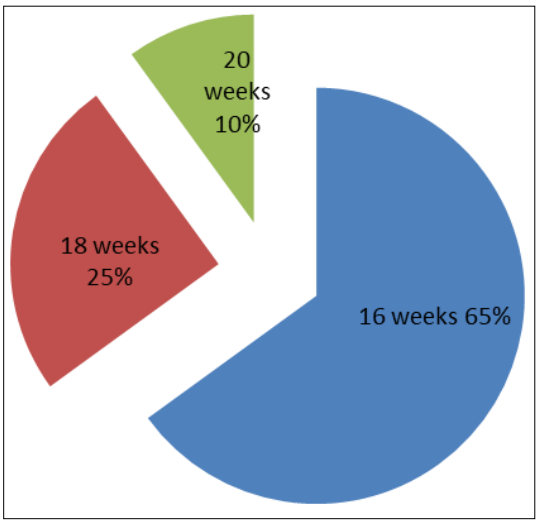


62.5 % patients had surgery done within the 1st week and only one patient had surgery after 10 days in due delay in obtaining cardiac fitness for surgery.

Most of the surgeries were completed within 2 hours. Average length of surgical incision was 9.3 cm.

The average blood loss was found to be between 90 ml - 150ml with an average of 103ml as calculated by measuring the weight of the mops contaminated with blood and blood in the suction drain[13].

Most of the patients had a radiological union by 16-22 weeks with maximum number of radiological union occurring in 16 weeks



Post operatively 3 patients (7.5%) were having z effect, 4 patients varus collapse, 1 had abutment of nail, there was one case of deep wound infection which healed after debridement and antibiotics

Complications	No of patients	Percentage
Z effect	3	7.5%
Malunion	4	10%
Abutment of nail	1	2.5%
Reverse Z effect	0	0
Breakage of nail	00	0
Bolt breakage	00	0

Functional assessment using HHS after 1 year had excellent result in 11 patients, good result in 18, fair in 7 and poor in 4.

Outcome	Frequency	Percent
Excellent	11	27.5
Good	18	45.0
Fair	7	17.5
Poor	4	10.0

Discussion

The treatment of intertrochanteric fractures has gone through many evolutions in the past. In the early 1930s Smith Peterson nail and Jewett nail [31] were used in the treatment of inter trochanteric fractures but the first successful treatment was done using fixed angle devices like Jewett nail, holt nail consisting of triflanged nail fixed at 130 -150 angle. But the collapse of the fracture fragment lead to inadvertent penetration of the tip of the nail to the joint. Later modifications were done at fracture site to reduce such complication in the form of valgus osteotomy to increase the limb length but rotational problems cannot be corrected by these osteotomies. Later Sliding nail plate devices were introduced to allow collapse and impaction of fracture while maintaining the neck shaft angle and controlling rotation. But these implants were also not without problems. When medialisation of femoral shaft was done by more than one third of the diameter, there was high chance of fixation failure. Implant cut out was a major problem in severely osteoporotic persons and wrong screw placement. As solution for all these problems lezius introduced intramedullary fixation for intertrochanteric fracture in 1950. Because of its location in the medullary cavity it is a load bearing device compared to sliding hip screw. The shorter lever arm decreases the tensile strain on the implant decreasing the rate implant failure. It also incorporates the principle of controlled fracture impaction. The surgery is more soft tissue friendly requiring less dissection, blood loss and small incision. Russel Taylor [22] reconstruction nail were used in intertrochanteric fractures with reverse obliquity and trochanteric fractures with sub trochanteric extension**.** Gamma Nail [23] introduced by Halder was an excellent intramedullary device for the treatment of trochanteric fractures but it lost its popularity due to inability to use in sub trochanteric extension fractures because of short length and extensive learning curve.

AO/ASIF developed PFN as an intramedullary device for the treatment of unstable trochanteric and sub trochanteric fractures in 1996. The greatest advantage of this device was that it can be introduced by a closed technique there by retaining the fracture hematoma and increasing the healing potential of the fracture. It also minimizes blood loss, infection and wound complication. It can be dynamically locked and has a high rotation stability and mechanical stress concentration at the implant bone interface is very low.

Inter trochanteric fractures are one of the most common fractures in elderly osteoporotic bone. Most commonly it is due to low energy trauma like simple fall. The incidence is predicted to be doubled by 2040 [12]. In a review conducted on world wide geographic variation of hip fractures, the Asian and Latin American population are at low risk of hip fractures when compared to Swedish and North American population but three quarters of world population are living in Asia and so its contribution to the pool of hip fractures will more in coming years [14]. Although it is thought that women are at a higher risk of hip fractures compared to men, the risk of hip and other osteoporotic fractures is identical for men and women [15]. In this study we found that most of the patients were between the age 75 -85 (35%) and 57.5% were male- the reason being similarity in the osteoporosis at later age. The most common mechanism was fall.

PFN is an ideal implant in unstable intertrochanteric fractures Kairui Zhang *et al* in a meta-analysis comparing PFN and DHS in the treatment of intertrochanteric fractures concluded that the current evidences indicate that PFN is a better option than DHS in the treatment of intertrochanteric fractures [16]. In

yet another study comparing the outcome of type 2 (Boyd and Griffin) intertrochanteric fractures involving 30 patients using PFN and DHS, it was found that PFN bettered DHS in terms of blood loss, duration of surgery, early weight bearing and mobilization, reduced hospital stay and other complications [17]. In a comparative study the treatment of unstable intertrochanteric fractures involving 77 patients of AO 31A2 and 31A3 using screw or helical proximal nail, Jeetendra Bajpayee *et al* concluded that both were effective in osteoporotic and unstable intertrochanteric fractures in Indian patients where the bones are narrow and the neck diameter is small [18]. In a randomized comparative study involving unstable intertrochanteric fractures using Gamma Nail and PFN, it was concluded that the results were comparable in both groups and the complications were similar and were mainly due to surgeon or fracture related and not due to choice of implant [19]. Another comparative study conducted in Regional Hospital Durres Albania found that patients treated with PFN had a better HHS initially but in long term both implants had the same functional outcome but they concluded that PFN may be a better option for intertrochanteric fractures than DHS [20]. In our study most of the patients were having comminuted fractures and belonged to AO type 31 A 23. From our experience involving 40 unstable intertrochanteric fractures, we also think that PFN is a good option for the treatment of comminuted intertrochanteric fractures.

There is less blood loss and shorter operating time with PFN when used for treating intertrochanteric fractures. In a retrospective review of 26 cases of intertrochanteric fractures treated by PFN Anjum MP *et al* found that they had less blood loss, shorter operating time and less complications [21]. In yet another study using PFN for intertrochanteric fractures authors found that the cases were not only having less per operative bleeding and operating time but were also relatively free of long term complications. We also found that PFN was having less blood loss and shorter operating time Radiological union in PFN is usually seen from 3 months onwards [17]. In a study involving 70 cases of trochanteric fractures treated with PFN 84% of patients showed radiological union without fracture line 6 months [24]. In yet another comparative study to find the functional and radiological outcome unstable intertrochanteric fractures treated with DHS and PFN S Mittal *et al* found out that the average time for radiological union in DHS was 18.35 weeks and that for PFN was 17.5 week [25]. Our results are also comparable with other studies, maximum number of radiological union occurring by 16th week.

The most common complications related to PFN include nonunion, implant cut out, Z effect, reverse Z effect and varus collapse. Most of the mechanical complication after PFN are due to poor quality of reduction [26]. The Knife effect or Z effect is due to medial comminution which results in migration of proximal screw more medially and distal screw laterally [27]. Placement of the screw in the postero inferior area of neck and keeping the tip apex distance (TAD) less than 25mm, will prevent implant cut out. Keeping the entry point of nail slightly medial to tip of greater trochanter can help to prevent the varus angulation. Releasing the traction before locking will help to reduce the fracture site distraction [29]. Rarely breakage of nail can occur [28]. We had 3 patients (7.5%) with Z effect, 4 patients with varus collapse, 1 with abutment of nail and there was one case of deep wound infection which healed after debridement and antibiotics.

The functional results our study showed excellent results in 11 patients and good results in 18 and poor in 4 patients, rest in fair group. It was calculated using Harris Hip Score. In a comparative study of DHS and PFN for intertrochanteric fractures, the average HHS at the end of 12th month was 89.08 for DHS and 90.33 for PFN and there was no significant difference between both groups [17]. In another study it has been found that there is a negative correlation between HHS and ASA score and patients age [30]. According to Ranjeetesh *et al* when comparing the functional outcome of DHS and PFN, the HHS for PFN was better initially and was almost same by 6 months and there was not much significant difference in HHS in 1 year and they concluded that DHS is a better implant for younger and PFN is ideal for older patients and osteoporotic fractures [32].

The limitations of our study were that our study included only a small number of patients and we had only a short term follow up.

Conclusion

PFN is a very good implant for fixation of unstable inter trochanteric fractures in elderly. The procedure takes only short time with less blood loss. Ideal reduction without distraction is important to prevent mechanical complications.

References

1. Cummings SR, Rubin SM, Black D. The future of hip fractures in the United States. Numbers, costs, and potential effects of postmenopausal estrogen. Clin Orthop Relat Res. 1990; 252:163-66.
2. Bridle SH, Patel AD, Bircher M, Calvert PT. Fixation of intertrochanteric fractures of the femur. A randomized prospective comparison of the gamma nail and the dynamic hip screw. J Bone Joint Surg Br. 1991; 73(2):330-34.
3. Radford PJ, Needoff M, Webb JK. Aprospective randomised comparison of the dynamic hip screw and the gamma locking nail. J Bone Joint Surg Br. 1993; 75(5):789-93.
4. Jonnes C, SM S, Najimudeen S. Type II Intertrochanteric Fractures: Proximal Femoral Nailing (PFN) Versus Dynamic Hip Screw (DHS). Archives of Bone and Joint Surgery. 2016; 4(1):23-28.
5. Anand J. The Elements of Fracture Fixation, Churchill Livingstone, New York, NY, USA, 1997.
6. Kulkarni GS, Limaye R, Kulkarni M, Kulkarni S. Intertrochanteric fractures. Indian J Orthop. 2006; 40:16-23.
7. Knobe M, Gradl G, Ladenburger A, Tarkin IS, Pape H-C. Unstable Intertrochanteric Femur Fractures: Is There a Consensus on Definition and Treatment in Germany? Clinical Orthopaedics and Related Research. 2013; 471(9):2831-2840. doi:10.1007/s11999-013-2834-9.
8. Audigé L, Hanson B, Swiontkowski MF. Implant-related complications in the treatment of unstable intertrochanteric fractures: meta-analysis of dynamic screw-plate versus dynamic screw-intramedullary nail devices. Int Orthop. 2003; 27:197-203. doi: 10.1007/s00264-003-0457-6
9. Jones HW, Johnston P, Parker M. Are short femoral nails superior to the sliding hip screw? A meta-analysis of 24 studies involving 3279 fractures. Int Orthop. 2006; 30:69-78. doi: 10.1007/s00264-005-0028-0
10. Parker MJ, Handoll HH. Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in

adults. Cochrane Database Syst Rev. 2010; 9:CD000093
11. Gulberg B, Johnell O, Kanis JA. World-wide projection for hip fractures. Osteoporos Int. 1997; 7(5):407-13.3.
12. Kulkarni GS, Limaye R, Kulkarni M, Kulkarni S. Intertrochanteric fractures. Indian J Orthop. 2006; 40(1):16-23.
13. Lee MH, Ingvertsen BT, Kirpensteijn J, Jensen AL, Kristensen AT. Quantification of surgical blood loss. Vet Surg. 2006; 35(4):388-93.
14. Dhanwal DK, Dennison EM, Harvey NC, Cooper C. Epidemiology of hip fracture: Worldwide geographic variation. Indian Journal of Orthopaedics. 2011; 45(1):15-22. doi:10.4103/0019-5413.73656.
15. Kanis JA, Odén A, McCloskey EV *et al*. Osteoporos Int. 2012; 23:2239.
16. Zhang K, Zhang S, Yang J *et al*. Proximal Femoral Nail *vs*. Dynamic Hip Screw in Treatment of Intertrochanteric Fractures: A Meta-Analysis. Medical Science Monitor : International Medical Journal of Experimental and Clinical Research. 2014; 20:1628-1633. doi:10.12659/MSM.890962.
17. Jonnes C, SM S, Najimudeen S. Type II Intertrochanteric Fractures: Proximal Femoral Nailing (PFN) Versus Dynamic Hip Screw (DHS). Archives of Bone and Joint Surgery. 2016; 4(1):23-28.
18. Jeetendra Bajpai, Rajesh Maheshwari, Akansha Bajpai, Sumit Saini. Treatment options for unstable trochanteric fractures: Screw or helical proximal femoral nail, Chinese Journal of Traumatology. 2015; 18(6):342-346. ISSN 1008-1275
19. Schipper IB, Steyerberg EW, Castelein RM, van der Heijden FH, den Hoed PT, Kerver AJ *et al*. Treatment of unstable trochanteric fractures. Bone & Joint Journal. 2004; 86-B(1):86-94. Accessed January 13, 2018
20. Myderrizi Neritan. Proximal femoral nailing is better choice in treatment of intertrochanteric fracture in elderly people. International Surgery Journal. [S. l.], 2016; 3(2):781-785. ISSN 2349-2902
21. Anjum PM, Hussain Faisal N, Hussain N, Mehboob I. Treatment of intertrochanteric femoral fractures with a proximal femoral nail (PFN): a short follow up. Nepal Medical College journal NMCJ. 2009; 11:229-31.
22. Russel TA. Fractures of hip and pelvis: In Crenshaw AH (Ed): Campbell's Operative Orthopaedics (8th ed). St Louis: CV Mosby. 1992, 895.
23. Halder SC: The Gamma nail for peritrochanteric fractures JBJS, 1990; 74B(3):340.
24. Punit Tank J, Rajesh Solanki A, Harshad kumar A, Nirav Rathi, Janak Mistry, Hiren B *et al*. Results of Proximal Femoral Nail in Intertrochanteric Fracture of Femur. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) e-ISSN: 2279-0853, p-ISSN: 2279-0861. 2016; 15(4):17-24. 10.9790/0853-1504101724 www.iosrjournals.org 17 | Dr
25. Mittal S, Bhuyan SK, Ailani R, Tontanahal S. Comparison of the functional and radiological outcomes of unstable intertrochanteric fractures treated with dynamic hip screw and proximal femoral nail- A prospective randomized controlled study. International Journal of Orthopaedics Sciences. 2017; 3(3):81-85.
26. Koyuncu Ş, Altay T, Kayalı C, Ozan F, Yamak K. Mechanical failures after fixation with proximal femoral nail and risk factors. Clinical Interventions in Aging. 2015; 10:1959-1965. doi:10.2147/CIA.S96852.
27. Werner-Tutschku W, Lajtai G, Schmiedhuber G *et al*. Unfallchirurg, 2002; 105:881.
28. Von Rüden C, Hungerer S, Augat P, Trapp O, Bühren V, Hierholzer C. Breakage of cephalomedullary nailing in operative treatment of trochanteric and subtrochanteric femoral fractures. Arch Orthop Trauma Surg. 2015; 135(2):179-85.
29. Vaibhav Bagaria, Farokh Wadia. Complications Related to Intertrochanteric fractures. Journal trauma international. 2015 1(1):1(1):25-30.
30. Mehmet Fatih Korkmaz, Mehmet Nuri Erdem, Zeliha Disli, Engin Burak Selcuk, Mustafa Karakaplan. Abdullah Outcomes of trochanteric femoral fractures treated with proximal femoral nail: an analysis of 100 consecutive cases. Gogus Clin Interv Aging. 2014; 9:569-574. Published online 2014 Apr 3. doi:10.2147/CIA.S59835
31. Jewett EL. One piece angle nail for trochanteric fractures JBJS, 1941; 23:803- 810.
32. Ranjeetesh Kumar, 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. Published online 2012 Jun 16. doi: 10.1016/j.jcot.2011.12.001