National Journal of Clinical Orthopaedics

ISSN (P): 2521-3466
ISSN (E): 2521-3474
© Clinical Orthopaedics
www.orthoresearchjournal.com
2018; 2(4): 188-194
Received: 19-08-2018
Accepted: 23-09-2018

Dr. Vivek Pradhan
Consultant, Manipal Hospital, Jaipur, Rajasthan, India

Dr. Subhash Jain
Assistant professor, NIMS, Jaipur, Rajasthan, India

Dr. Shalini Agrawal
Assistant Professor, GMCH, Udaipur, Rajasthan, India

Dr. SL Sharma
Senior Professor, S.M.S.MC, Jaipur, Rajasthan, India

Correspondence
Dr. Subhash Jain
Assistant professor, NIMS, Jaipur, Rajasthan, India

Comparative prospective study of proximal femoral nail and locking compression plate in subtrochanteric fractures of femur

Dr. Vivek Pradhan, Dr. Subhash Jain, Dr. Shalini Agrawal and Dr. SL Sharma

Abstract
Introduction: Subtrochanteric fractures of the femur account for 7-44% of all proximal femur fractures. Conservative treatment in these fractures has no role. Two principal options exist for unstable fractures. Either angular locking plate or a sliding neck screw via a closed technique. Proximal femoral nail (PFN) is a newer implant used for internal fixation of peritrochanteric fractures.
Objectives: To compare the Radiological and Functional Outcome of Subtrochanteric Fractures treated with proximal femoral nail (PFN) and locking compression plate (LCP) and to evaluate the results.
Methodology: The present study was a prospective randomized study on patients with subtrochanteric fractures admitted in department of Orthopaedics, S.M.S. Hospital, Jaipur during May 2012 to Dec 2013. Patients were allotted in PFN (Group 1) and LCP (Group 2) group on random number basis (Chit box method) with 26 patients in each group.
Results: The mean duration of surgery in group 1was 53.85 min and in group 2 was 70.77 min. There was increase requirement of blood transfusion in group 2(statistically significant). Mean full weight bearing time was 11.68 weeks in group 1 and 12.40 weeks in group 2(not statistically significant). Mean time for union in group 1 was 13.88 + 1.64 weeks while in group 2 14.16+ 1.99 weeks (not statistically significant). There was increased infection rate in group 2(11.53%) as compare to group 1(3.84%). There was 7.69% varus malunion in group 2 compare to 3.84% varus in group 1. There was 3.84% delayed union in group 1 compare to 7.69% in group2. Limb length discrepancy of 1 cm was present in 3.84% in PFN while 7.69% in LCP group. Complications in both group were comparable. Functional outcome was evaluated in terms of modified Harris hip score. Average score in group 1 was 91.36 and 86.32 in group 2 (statistically significant). Patients in group 2 had experienced more pain around hip.
Conclusion: To conclude PFN to be a safe, reliable and successful implant for subtrochanteric femoral fractures. PFN combines the intrinsic advantage by taking less operative time, high rate of union, minimal soft tissue damage, less infection rate and early postoperative rehabilitation.

Keywords: subtrochanteric fractures, PFN (proximal femoral nail), LCP (locking compression plate)

Introduction
Fractures of the proximal femur are among the most often encountered by the orthopaedic surgeon. These fractures are associated with substantial morbidity and mortality [1]. Subtrochanteric fractures of the femur account for 7-44% of all proximal femur fractures. Although fractures in this area affect all age groups there tend to be bimodal distribution of the fracture.
Conservative treatment in these fractures has no role in definitive management. The morbidity and mortality associated with non-operative treatment has been quite high and associated with high rate of non-union and malunion [6].
The treatment goal is to achieve anatomic reduction with a stable fracture fixation to allow early functional rehabilitation. Over the past decades, subtrochanteric fractures were predominantly treated by implants, such as the dynamic hip screw (DHS), dynamic condylar screw, angular blade plates or by cephalomedullary nails.
Two principal options exist for unstable fractures. Either any kind of angular locking plate at the lateral femoral cortex or a sliding neckscrew penetrating the head-neck fragment through an intra-medullary nail implanted via a closed technique.
Proximal femoral nail (PFN) is a newer implant used for internal fixation of peritrochanteric

fractures. It allows controlled secondary impaction, along the axis of compression neck screw. An additional feature to DHS is that in PFN anti-rotation hip pin that prevent rotational movements at fracture site thus augment the healing process. Moreover it is a weight sharing implant as comparing to weight bearing implant DHS.

Locking compression plate was introduced in the 21st century as a new implant. Proximal femoral LCP is a limited-contact, angular-stable plate designed for treatment of complex, comminuted and osteoporotic fractures of interand subtrochanteric femoral region. The plate is anatomically precontoured to the metaphyseal zone of theproximal femur.

Aims and objectives

1. To compare the Radiological and Functional Outcome of Subtrochanteric Fractures treated with proximal femoral nail (PFN) and locking compression plate (LCP).
2. To evaluate the results of above procedures in terms of benefits and complications.

Materials and methods

The present study was a hospital based prospective randomized study on patients with subtrochanteric fractures admitted in department of Orthopaedics, S.M.S. Hospital, Jaipur during May 2012 to December 2013. Patients were allotted in PFN and LCP group on random number basis (Chit box method).

Sample size: Calculated at 80% study power and α error of 0.05%, minimum sample required in each group comes to 26 patients per group.

(A) Inclusion Criteria

1 Subtrochanteric femoral fractures
2 Patient giving informed consent for the study
3 Skeletally mature patients

(B) Exclusion Criteria

1. Compound fractures
2. Infections, unsuitable skin condition like blebs, burns, and bedsores.
3. Inability to walk before fracture.
4. Poor anesthetic

Preoperative planning

All patients were evaluated clinically at the time of admission. X-ray of pelvis with both hips AP view and lateral view of involved hip with ipsilateral femur were taken.

Patients put on Below Knee Skin traction/Thomas splint. Routine investigations and Pre anesthetic checkup of all patients done.

Operative Technique

All Surgeries was done under spinal anesthesia. All patients in PFN group were taken on the fracture table in supine position under and in LCP group patients were on simple table.

Locking Compression Plate (LCP)

After painting and draping lateral surface of upper part of femur and base of trochanter was exposed by lateral approach.

Lateral approach typically is performed by a straight incision from the greater trochanter, extending approximately 10 cm distally. After a longitudinal incision of the iliotibial band, the fascia of the vastuslateralis is incised in an L shape at its proximal insertion and the muscle is flipped anteriorly to visualize the lateral aspect of the proximal femur.

The proximal fragment is first fixed to the plate, and the plate is then reduced to the femoral shaft. To facilitate reduction, a strong K-wire or Schanz pin can be temporarily fixed to the greater trochanter as a joystick to reduce the proximal segment. The plate can be held to the shaft by a reduction clamp and perfect anatomic reduction and head/neck/shaft angle must be ensured again under fluoroscopy. Fixation done by screws. Wound closed in layers. A negative suction drain wasused.

Fig 1: Locking compression plate

Proximal femoral nail (PFN)

Using the fracture table the hip should be placed in a slight adduction position to facilitate the insertion of the nail. About 5 cm cranial to the tip of the greater trochanter the skin is incised for about 5 cm. After passing the fascia and muscles curved owl is inserted at the tip of the greater trochanter under C-arm control. The owl is advanced into the femoral shaft in such a way that it is located in the middle of the shaft in both directions. The proximal part of the femoral shaft is reamed manually with a 13 mm reamer. After mounting the nail on the radiolucent insertion device the nail can be introduced manually into the femoral shaft.

Via the aiming arm, which is attached to the insertion device, first the guide wire for the neck screw is introduced into the femoral neck in such a way that the screw will be placed into the lower half of the neck on the AP view and centrally on a lateral view. Thereafter, the guide wire for the antirotational hip pin is introduced. The guide wires should be parallel in both planes and their tips form a horizontal line on the AP view (fig). The hip pin is introduced first with the tip just about 25 mm medial to the fracture line, thenneck screw is inserted. Afterwards depending on the type of fracture, distal interlocking either statically or dynamically is achieved via the same aiming arm in short PFN and free hand technique in long PFN.

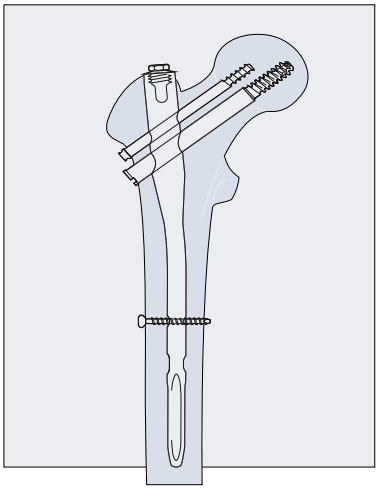


Fig 2: Proximal femoral nail

Post operative care

Active toe and ankle movements, static quadriceps exercises, deep breathing exercises, started as early as effect of anesthesia gone. Post op radiograph should be taken to check the reduction of fracture fragments. Appropriate antibiotic given. Patient is made to sit on next post-operative day and knee bending exercises started, Stitches removed after two week and partial weight bearing allowed around 6 weeks. Follow-up will be done at two week, one month, 6 weeks and then monthly till last follow up. At each follow up functional evaluation of the patients was done to note the range of movements, limb length, scar condition. Patients were evaluated radiologically at monthly interval to look for implant failure, varus collapse or signs of nonunion. Final assessment was done on the basis of Harris hip score.

Results

Type of Fracture

Seinsheimer classification was used to classify fracture. Table 1 shows the distribution of fracture type among patients.

Table 1: Distribution of fracture type according to Seinsheimer classification in both groups

Group	Seinsheimer's classification						Total
	IIA	IIB	IIC	IIIA	IIIB	IV	
Group 1	7(26.9%)	8(30.7%)	1(3.8%)	6(23.07%)	3(11.5%)	1(3.8%)	26
Group 2	4(15.4%)	9(34.6%)	1(3.8%)	3(11.5%)	6(23.07)	3(11.5)	26
Total	11	17	2	9	9	4	52

Most common type of fracture encountered in our study was type IIB. Least common pattern of fracture encountered in our study was IIC type.

Partial weight bearing

Most patients in our group initiated partial weight bearing at 6 weeks.

Table 2: Comparison of partial weight bearing time in between two groups

Partial weight bearing (at weeks)	Group-I (PFN)		Group-II (LCP)	
	No.	%	No.	%
74=4	4	15.38	3	11.54
6	17	65.38	17	65.38
8+	5	19.24	6	23.08
Total	26	100.00	26	100.00

11% 0f LCP patients and 15% of PFN patients started early weight bearing because of stable fracture construct while 19% of PFN and 23% of LCP patients started weight bearing at or after 8 weeks. This delaying was due to comminution of fracture fragments.

Average time of initiation of partial weight bearing in PFN group was 6.15 weeks and 6.62 weeks in LCP group. There was no significant difference.

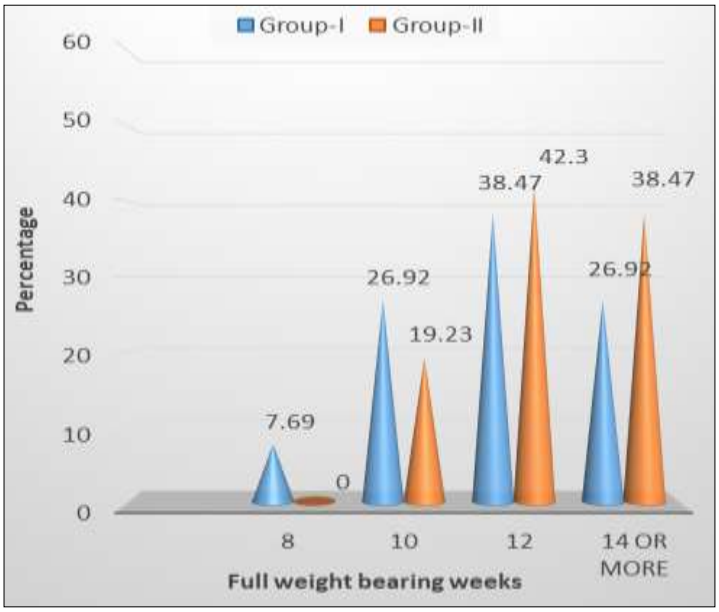
Full weight bearing

The criteria to initiate full weight bearing clinically as having no pain, tenderness, or need of aids to assist ambulation and radiographically as both fragments of the trabeculae having been connected.

Distribution according to full weight bearing (at weeks) of group-I & group-II patients

Table 3: Comparison of full weight bearing time in between two groups

Full weight bearing (at weeks)	Group-I (PFN)		Group-II (LCP)	
	No.	%	No.	%
8	2	7.69	0	0.00
10	7	26.92	5	19.23
12	10	38.47	11	42.30
14 or more	7	26.92	10	38.47
Total	26	100.00	26	100.00



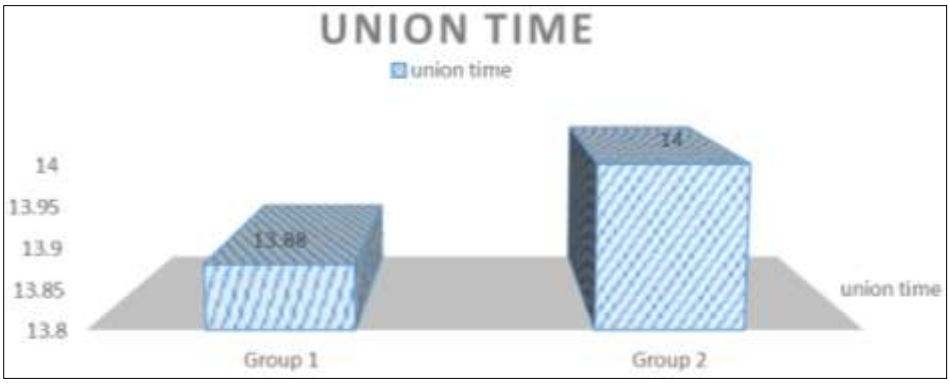
Graph 1: Full weight bearing time in between two groups

In our study patients from PFN group started early weight bearing compare to LCP group because PFN is intramedullary implant and having load sharing property. It transmits the force along the long axis of femur.

Time of Union

Table 4: Comparison of union time in between two groups

Parameter	Mean ±Sd		P-value	Significance
	Group-I (PFN)	Group-II (LCP)		
Union of bone (in wks)	13.88 ± 1.67	14.32 ± 1.8O	> .05	NS



Graph 2: union time in between two groups

Complications

This table shows all the complications seen in our study.

Table 5: Comparison of all the complications seen in both groups

Complications	Group 1 (PFN)		Group 2(LCP)	
	No. Of Patient	Percentage	No. Of Patient	Percentage
Infection	1	3.84%	3	11.54%
LL discrepancy	1	3.84%	2	7.69%
Malunion/Nonunion	1	3.84%	2	7.69%
Delayed union	1	3.84%	2	7.69%
Implant failure	1	3.84%	1	3.84%

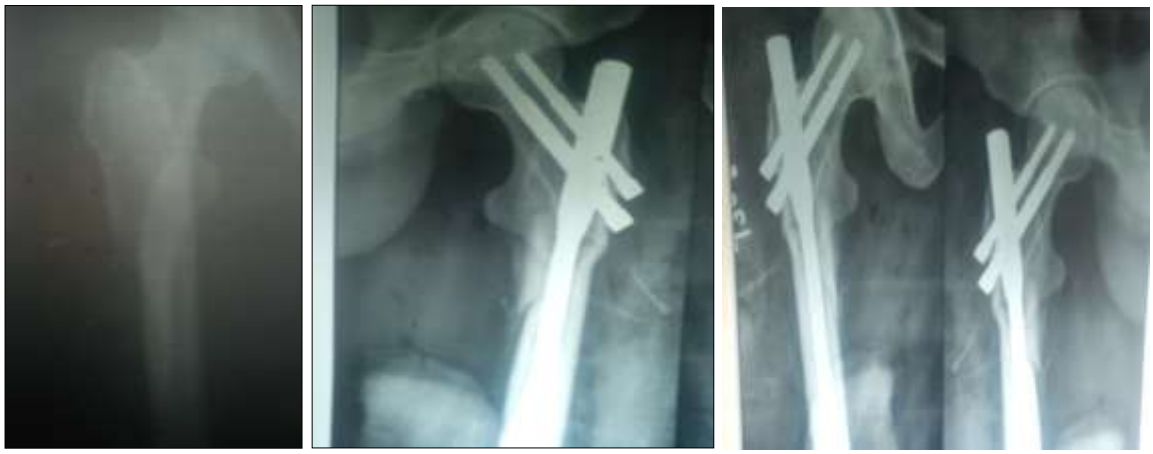
Final result

Final result in our study was determined by modified harris hip score.18 patients in group 1 had excellent score while 10 patients in group 2 had excellent score.

Table 6: Functional outcome according to Modified Harris Hip Score in both groups

Modified Harris Hip Score	Group-I (PFN)		Group-II (LCP)	
	No.	%	No.	%
< 69	1	3.84	2	7.69
70-79	1	3.84	2	7.69
80-89	6	23.07	12	46.16
90 +	18	69.25	10	38.46
Total	26	100.00	26	100.00

Case 1: Proximal Femur Nail



pre operative radiograph Immediate post op 3 month Post operative radiograph

6 months post op AP 6 months post op lateral view

Case 2: Locking Compression Plate

Pre-Operative Radiograph Immediate post op 3 months post op

10 months post op AP view 10 months post op Lateral view

Discussion

Subtrochanteric femur fractures needs high attention because of high deforming force at this level. The implant of choice for stabilisation of subtrochanteric fractures is still debatable.

Extramedullary conventional implants like DHS, dynamic condylar screw (DCS) or angle blade plate in subtrochanteric femur fractures are associated with secondary varus collapse, implant failure and limb shortening on weight bearing due to medialisation of distal fragment. New Extramedullary implant like locking compression plate could reduce the above complications by givingangular stability but again have potential disadvantage of extensive surgical exposure, severe soft tissue damage, infection and blood loss.

Intramedullary implants have advantage of percutaneous insertion, load sharing ability and short moment arm providing biological as well as biomechanical advantage. Proximal femoral nail is latest (3rd generation) in this category which have shown to prevent fracture of femoral shaft by having small distal diameter which reduces stress concentration at the tip. Also entry point through tip of greater trochanter results in less damage to tendinous musculature in piriform fossa. These are technical demanding surgeries.

Most of the patients in our study were 20-37 year (47%) of age group. The second peak of age group was 40-60 years. Mean age was 42.03+- 12.31 years. Male to female ratio in our study was around 6:1. This can be explained by more aggressive lifestyle and more outdoor work of male. RTA was most common mode of injury in both the groups in our study (65%) followed by fall from height (26%).

The mean duration of surgery in our study in group 1 was 53.85 min and in group 2 was 70.77 min. The time duration in PFN group was from minimum 40 min to maximum 1 hour 30 minutes and in LCP group ranges from minimum 50 min to maximum 1 hour 45 min. PFN is basically technical procedure and surgeon aware of PFN can do this procedure in minimal time with minimal incision. In LCP there is larger incision and anatomical reduction of fragments required which may take longer duration.

There was increase requirement of blood transfusion in LCP compare to PFN group. 96.15% patients in LCP group with an average of 1.15 units and 26.92% in PFN group with an average of 0.23 units required blood transfusion which was significant statistically. Results can be explained by the fact that nailing is a closed procedure in majority of the cases. There is less soft tissue stripping and fracture hematoma is not disturbed. In 5 cases out of 26 opening of fracture site required (proximal extension of incision for proximal screws-mini open) and in these cases 1 unit blood required.

Mean full weight bearing time in our study was 11.68 weeks in PFN group and 12.40 weeks in LCP group. This difference was not statistically significant. Early weight bearing in PFN group can be explained because PFN is intramedullary implant which has load sharing ability and transmit the weight along long axis of femur.

Mean time for union in PFN group was 13.88± 1.64weeks while in LCP group 14.16± 1.99 weeks. Union was slight earlier in PFN group then LCP because fracture site was not opened in majority of cases and minimal soft tissue and periosteal stripping done in PFN group (Although difference not statistically significant).

Complications in both group when compared to other studies were comparable and there was no significant difference in both group. There were no complications like z effect, screw migration in joint or fracture of femoral shaft around the tip of PFN.

Functional outcome was evaluated in terms of modified Harris hip score. This score takes into account pain, limp, support, distance walked, climbing of stairs, putting on shoes and socks, enter public transportation, limb length discrepancy and range of motion. The total score is 100, with outcome graded as excellent, good, poor and fair. There was significant difference in both groups. Average score in PFN group was 91.36 and 86.32 in LCP group. Patients in LCP group had experienced more pain around hip which was due to bursitis because of friction at the level of greater trochanter.

In our study union time (radiological outcome) were more or less similar in both group but infection, duration of surgery and functional outcome shows intramedullary implant PFN a better option than extramedullary implant.

Summary and conclusion

Functional outcome in our study indicates PFN to be a safe and successful implant for subtrochanteric femoral fractures. PFN (proximal femoral nail) combines the intrinsic advantage of closed intramedullary nail by taking less operative time, less exposure, less disturbance to the fracture milieu. In addition it

acts as a buttressing in preventing medialisation of shaft and due to its position close to weight bearing axis the stress generated on the intramedullary implant is negligible.

PFN also have advantage over previous generation cephalomedullary nail (Gamma nail). It has shown to prevent fracture of femoral shaft by having a small distal shaft diameter which reduces stress concentration at the tip. Additional anti rotational 6.4 mm hip pin provides rotational stability of proximal fragment.

To conclude PFN is reliable implant for subtrochanteric fractures leading to high rate of union, minimal soft tissue damage and early postoperative rehabilitation. Intramedullary fixation in subtrochanteric fractures has distinct biological and biomechanical advantage but the operation is technically demanding.

References

1. Reska M, Vever Kova L, Divis P, Koneeny J. scriptamedica (BRNO). 2006; 79(2):115-112.
2. George Haidukewych J, Joshua Longford. Editors Buchloz, Robert W; Heckman, James D; Court brown, charls M; Torenttapavl- Rockwood and Greens fracture on Adults, 7th edition.
3. Bedi A, Tonale T. Subtrochanteric femur fractures, Orthopclin N Am. 2004; 35(4):479-483, review.
4. Naill Craig JA, Chellapan Shivaji, Nocola Maffuli. Bullatin. Hospital for joint disease. 2001; 60(1):35-46.
5. Seinsheimer F. Subtrochanteric fractures of femur, J Bone joint surg Am. 1978; 60:300-306.
6. Velasco RV, Comfort TH. Analysis of treatment problems in subtrochanteric fracture of femur, J Trauma. 1978; 18(7):513-529.
7. Banan H, Al-saloti A, Jimulia T, Hart AJ. The treatment of unstable, extra capsular hip fractures with the AO/ASIF proximal femoral nail - Injury. 2002; 33(5):401-405.
8. Sidhu AS, Brar BS, Mann HS, Arvind Kumar Gursukhman, Sindhu DS. Proximal femur nail- A minimally invasive method for stabilization of pertrochanteric and subtrochanteric fractures. Pb Journal of Orthopaedics. 2010; 12th:1.
9. Gadegone WM, Salphale-Proxmal YS. Femoral nail-an analysis of 150 cases of proximal femoral fractures with an average follow up of 1 year. Intorthop (SICOT). 2007; 31(3):403-408.
10. Rakesh Kumar, Pramod Saini, Vishal Shekhawat, Joshi N, Mahesh Bansal. Biological fixation of comminuted subtrochanteric fractures with proximal femur locking compression plate. Injury. 2013; 44(2) 226-231.
11. Lu-Sheng Jiang, Lei Shen, Li Yang Dai-intramedullary. Fixation of subtrochanteric fractures with long proximal femoral nail or long gamma nail: Technical notes and primary results. Ann Acad Med Singapore, 2007; 36(10):821-826.
12. Hassenbohler EA, Agudelo JF, Morgan SJ, Smith WR, Hak DJ, Stahel PF. Treatment of complex proximal femoral factures with the proximal femur locking compression plate. Int. Orthopaedics. 2007; 30(8):618-623.
13. Rahme DM, Harris IA. Intramedullary nailing v/s fixed angle blade plating for subtrochanteric femoral fractures: a prospective randomized controlled trial- Journal of orthopaedic surgery. 2007; 15(3):278-281.
14. Deepinderjit Singh, Rajesh Kapila, Rakesh Sharma. Evaluation of clinical outcome of subtrochanteric fractures of femur fixed with proximal femoral nail. Pb Journal of Orthopaedics. 2012; XIII:1.
15. Russell Taylor. Classification of subtrochanteric fractures. Skeletal Trauma. 1998; 2:1891-1897.
16. Lunsjo Karl *et al*. Extra medullary fixation of 107 sub trochanteric fractures. Acta Ortop scand. 1999; 70(5):459-466.
17. Whatley JR, Garland DE, White cloud T, Whickstrom J. Sub trochanteric fractures of the femur: treatment with ASIF blade plate fixation. South Med J. 1978; 71:137.
18. Dialogue AO. 15: Proximal femoral nail, 2002, II.
19. Scientific Poster #6 Femur OTA-Treatment of Proximal Femoral Fractures Using LCP Distal Femur Fixation Jung Jae Kim, MD (e-Zimmer); Hyoung Keun Oh, MD2 (n), 2007.
20. Chang-Wug Oh, Jung-Jae Kim, Young-Soo Byun. Minimally invasive plate osteosynthesis of sub trochanteric femur fractures with a locking plate; prospective series of 20 fractures Arch Orthop Trauma Surg. 2009; 129:1659-1665.