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Proximal Femoral Nail Antirotation and Intertan in Treatment of Unstable Intertrochanteric Fractures - A Comparative Study

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Abstract: ***Purpose: To compare intraoperative and postoperative outcomes of two cephalomedullary implants in treatment of unstable intertrochanteric fracture. Method: A comparative follow up study was conducted at a tertiary care hospital of north India in which we included 144 hemodynamically stable patients of unstable intertrochanteric fracture who were treated with two cephalomedullay implants viz Proximal femoral nail antirotation (PFNA) and Inter-Tan. The implants were randomly selected and the surgeons were blinded regarding use of implant till it was opened during surgery. The two implants were compared for intraoperative complications, operative time, post operative healing, Visual analogue score for operation site pain and hip pain, radiological and Harris hip score were compared during follow up at 14th day, 1month, 3month and 06 month duration. Mean and standard deviations were calculated and normal distribution of continuous data was tested by using independent sample t-test and ANOVA. Results: Total 144 patients were studied of which 72 were in each group. Both the implants were comparable for intraoperative complications except for blood loss during surgery which was marginally higher in Inter-Tan cases. The operative time was significantly high in cases of Inter-Tan implant. Hip pain was more in cases of PFNA implant. VAS and Harris hip score were comparable in both the groups. Conclusion: This study compared two newer cephalomedullary nails which are comparably effective in managing unstable intertrochanteric fractures. The advantage of both implants lies in their ability to stabilize the fracture, follow up studies are required to understand biomechanical properties of these implants.***

Keywords: Intertrochanteric fracture, cephalomedullary nail, Proximal femoral nail antirotation (PFNA), Inter-Tan

1. Introduction

Intertrochanteric fractures are the commonest fractures seen in elderly population due to the osteoporotic bones[1]. The incidence of these fractures has increased due increased life expectancy in present developing world[2]. In newer era cephalomedullary nails are considered the best options for fixation of pathological fractures in elderly[3]; they also have a theoretical advantage of being less invasive and mechanically superior in providing a buttress to limit fracture collapse. Multiple previous studies have attempted to compare dynamic hip screw and cephalomedullary nail fixation[4]. However, a comparative study between two cephalomedullary nails in management of unstable intertrochanteric fractures is not studied in details. Our study compares Proximal Femoral Nail Anti-rotation (PFNA) and Inter-TAN in management of unstable intertrochanteric fractures in elderly patients. Our aim is to evaluate clinical result comparing PFNA with Inter-TAN, including operative time, intra and post-operative complications, intra-operative blood loss, functional and radiological follow up using Harris Hip score (HHS) and Visual analogue Scale (VAS) for patient satisfaction. We hypothesized that PFNA would be superior in treatment for intertrochanteric fractures compared with Inter-TAN.

2. Material and Methods

We conducted a prospective comparative study at department of Orthopedics at a tertiary care center in Northern India. The study was done on 144 patients; sample size was calculated using Cochran's formula with incidence of intertrochanteric fractures being 15% of all admissions at orthopedic department. Patients with unilateral intertrochanteric fracture were assessed clinically and were hemodynamically stabilized. Patients were subject to radiographs of pelvis with both hips in antero-posterior and lateral views and full length in AP and Lateral views on affected side. Post adequate anesthesia clearance these patients were subjected to surgery within three days of admission. Selection of type of cephalomedullary nail was randomized and the surgery is performed under image intensifier control using standard techniques. During postoperative period static hip strengthening exercise was started. Patients were discharged on fifth postoperative day and followed up on day 14 for suture removal, and were further assessed clinically and radiologically at 6 weeks, 3 months and then 6 months. Functional outcome were recorded according to modified Harris Hip Score, VAS and complications during follow up period. Statistical analysis was performed using SPSS version 21.0 software. Categorical variables have been shown by frequency and percentage in various tables and figures. Mean and standard deviation was calculated and normal distribution of continuous data was tested using independent sample 't'test

and ANOVA. The p-value of <0.05 was considered to be statistically significant.

3. Results

This study included 144 patients with unstable intertrochanteric fracture femur, we compared the radiological and functional outcomes in the PFNA and InterTAN group. Patent satisfaction within two groups was recorded in terms of relief from pain using Visual Analogue Scale (VAS). A total of 66 Males and 78 Females were included in the study, the gender distribution was equitable and no significant difference was observed in two groups. (p-0.503) (Fig 1). The mean age of the patients in PFNA and InterTAN were 62.8 and 60.2 respectively (p=0.340) (Table 1). The two groups did not show any statistically significant difference in associated co morbidity profile. Both the groups showed similar profile of fractures with 93 (64.6%) with Boyd and Griffin type II.27 (37.5%) and 43 (59.7%) patients had intra-operative complications such as superficial infection, deep infection, DVT, thigh pain, hip pain > 6 weeks, non-unions, implant failures, Intra-operative lateral wall fractures, postoperative thigh pain, screw cut out, problems with distal locking (especially in long Inter-Tan) and intra-operative fractures in PFNA and Inter-Tan Group respectively. There was no significant difference observed in intraoperative complications in both groups (p > 0.05). (Table 2) Most common intraoperative complication was superficial infection in 09 (12.5%) in PFNA group and 11 (15.3%) in inter-Tan group. Implant failure was seen in 02 patients in inter-Tan group. VAS and HSS score was comparable between two groups with no significant difference on Post Op Day 1, 6weeks, 3months and 6months (Fig 2 & Fig 3). Mean operative time was significantly longer in Inter-Tan group which was 76.2+_ 17 minutes compared to PFNA group which was 59.7+_ 13.7 minutes (Fig 4). Intraoperative blood loss was marginally more in InterTan group.

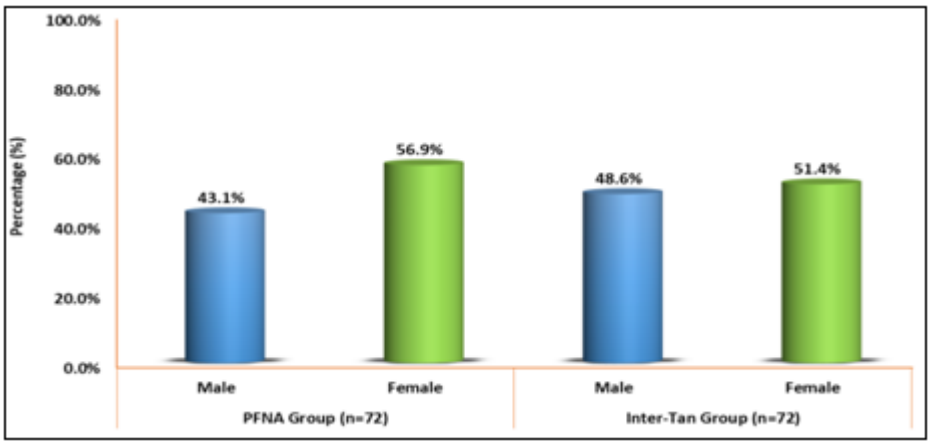

Figure 1

Table 1

Age (Years)	PFNA Group (n=72)	Inter-Tan Group (n=72)	Total (n=144)
< 45	0 (0%)	2 (2.8%)	2 (1.4%)
45-50	12 (16.7%)	18 (25%)	30 (20.8%)
51-55	12 (16.7%)	11 (15.3%)	23 (16%)
56-60	7 (9.7%)	6 (8.3%)	13 (9%)
61-65	6 (8.3%)	9 (12.5%)	15 (10.4%)
66-70	13 (18.1%)	8 (11.1%)	21 (14.6%)
71-75	14 (19.4%)	7 (9.7%)	21 (14.6%)
> 75	8 (11.1%)	11 (15.3%)	19 (13.2%)
Mean ± SD (Range)	62.8±10.5 (45 – 82)	60.2±11.2 (44 – 78)	61.5±10.9 (44 – 82)
Median (IQR)	65 (54 – 71)	60 (50 – 70)	61 (51 – 71)

Table 2

	PFNA Group (n=72)	Inter-Tan Group (n=72)	Total (n=144)	Chi Square Value	p – value
Superficial infection	9 (12.5%)	11 (15.3%)	20 (13.9%)	0.232	0.630
Deep infection	4 (5.6%)	14 (19.4%)	18 (12.5%)	6.349	.012*
DVT	6 (8.3%)	10 (13.9%)	16 (11.1%)	1.125	0.289
Thigh pain	5 (6.9%)	7 (9.7%)	12 (8.3%)	0.364	0.546
Hip pain > 6 weeks	7 (9.7%)	6 (8.3%)	13 (9%)	0.085	0.771
Non unions	1 (1.4%)	1 (1.4%)	2 (1.4%)	0.000	1.000
Implant Failures	2 (2.8%)	0 (0%)	2 (1.4%)	2.028	0.154
Lateral Wall Fractures	1 (1.4%)	3 (4.2%)	4 (2.8%)	1.029	0.310
Thigh pain	3 (4.2%)	2 (2.8%)	5 (3.5%)	0.207	0.649
Screw cut out/ back out	1 (1.4%)	0 (0%)	1 (0.7%)	1.007	0.316
Distal Interlocking Problem	0 (0%)	3 (4.2%)	3 (2.1%)	3.064	0.080
Intraop Fractures of Greater Trochanter	2 (2.8%)	4 (5.6%)	6 (4.2%)	0.696	0.404

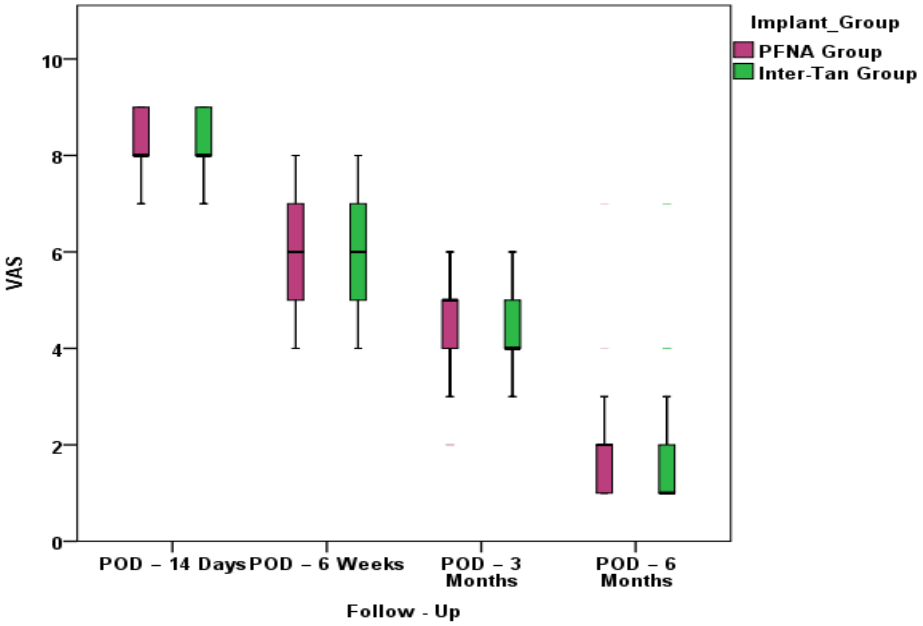

Figure 2

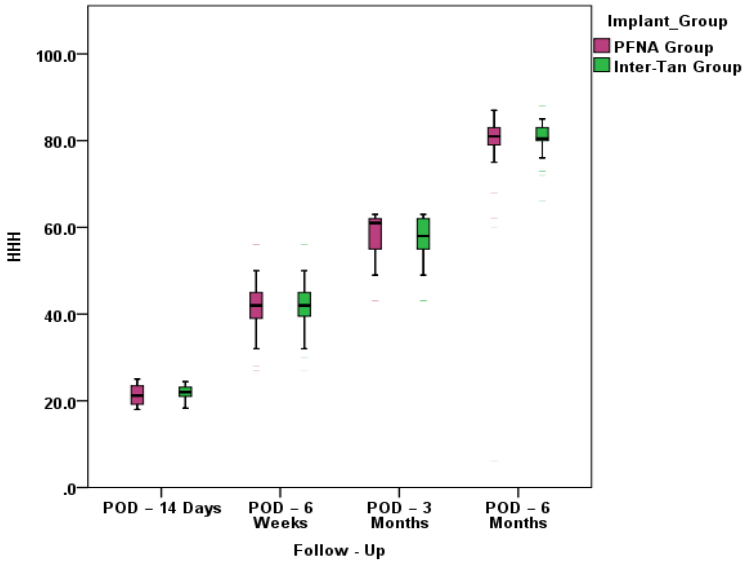

Figure 3

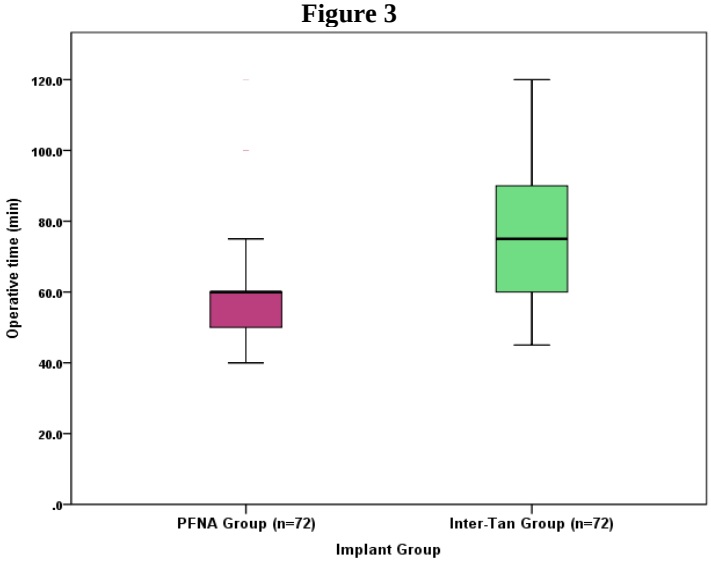

Figure 4

4. Discussion

Unstable intertrochanteric and femoral neck fractures are amongst the very common morbidity dealt by geriatric age group[5]. These fractures are not only a result of osteoporotic status of bone but lead to further immobilization of aged patients resulting in debilitating status[6]. Boyd and Griffin classified the intertrochanteric fractures and first time considered instability in both sagittal and coronal planes. It included fractures from the extracapsular part of neck to a point 5cm distal to the lesser trochanter. Classification by boyd and Griffin is

Type 1: Fracture that extend along intertrochanteric line.

Type 2: Comminuted fractures with the main fracture line along the intertrochanteric line but with multiple secondary fracture lines (may be in coronal plane).

Type 3: Fractures that extend to or are distal to the lesser trochanter.

Type 4: Fractures of the trochanteric region and proximal shaft with fractures in at least two planes.

Present day management of intertrochanteric fractures mainly depends upon patient's general condition. Non operative and conservative approach has a very limited scope and is considered only when the general condition of patient is extremely guarded. Closed/ open reduction and internal fixation is usually the modality of choice, total hip arthroplasty has a limited role and is in evolving stage used in extremely soft osteoporotic bones and as salvage to failed surgeries[7].

Amongst the operative options stable intertrochanteric fractures are very well managed by dynamic hip screw[7]. For unstable intertrochanteric fractures various options viz sliding hip screw[8], trochanter stabilizing plates, proximal femur locking plates, dynamic condylar screw and cephalomedullary hip screws are available. In newer era Cephalomedullary hip screws are considered the best options for unstable intertrochanteric fractures, this includes Gamma Nails, Proximal femoral nail, Proximal femoral nail antirotation (PFNA) and Inter Tan[9, 10]. The cephalomedullary nails offers advantage of reduction of unstable fragment, preventing collapse and thus shortening of fractures femoral neck, less blood loss, and early weight bearing[11]. With advantages the procedure is definitely more skill demanding and increases operative time. A number of studies have suggested advantage of cephalomedullary nails, **Loric et al**[12] 2007 suggested biomechanical advantage of cephalomedullary nails in unstable fractures by virtue of its intramedullary placement and inhibition of excessive sliding. **Babhulkar et al**[13] in 2006 suggested upon rotational stability of cephalomedullary nails, **Kulkarni et al**[14] in 2006 suggested Dynamic hip screw as gold standard for stable trochanteric fractures and unstable fractures should be treated by cephalomedullary nails. Study by **Orr Erez et al**[15] in 2012 on particular devices suggested that complications associated Inter-Tan nail were similar to the previous devices, **Rucker AH et al**[16] in 2009 suggested that Inter-Tan device provided a reliable stability against rotation and minimized the neck malunion through linear intraoperative compression of head /neck segment. **Yanfeng Huang et al**[17] in 2013 compared the biomechanical stability of inter-Tan and PFNA, they suggested the biomechanical function of Inter-Tan was better than PFNA suggesting Inter-Tan to be more firmer and biomechanically superior to PFNA. A study by **Sheng Zhang et al**[18] in 2013 to compare operative outcomes in inter-Tan and PFNA suggested a comparable intraoperative complications and length of hospital stay between two groups and patients of PFNA experienced shorter operative time, less blood loss and less femoral neck shortening. Incidence of post-operative thigh pain was higher in cases with PFNA. A study by **WeiguangYu et al**[19] suggested that Inter-Tan is better for unstable intertrochanteric fractures and PFNA is good option for those complicated with lateral greater trochanter fracture. A Meta-analysis by **Leo Nherera et al**[20] in 2018 compared Inter-Tan and PFNA and concluded that twin screw integrated Inter-Tan was more effective when compared to a single screw PFNA resulting in fewer complications and revisions. No difference was observed in non-unions, Harris hip score. Intraoperative blood loss was less in PFNA.

Our study compared the two cephlomedullary nails viz Inter-Tan and PFNA in 144 patients of unstable intertrochanteric fracture femur. Both the groups have 72 patients with comparable age and gender allocation. Type of fracture (Boyd and Griffin classification) and co-morbidities affecting the outcome were equally distributed in both the group with no statistical difference. In our study the intra and postoperative complication vizsurperficial infection, deep infection intra-operative fractures of greater trochanter, DVT, non-union, malunionetc suggested equal distribution and no statistically significant difference. VAS and Harris Hip score on follow up suggested no significant difference in both the groups. The operative time was significantly high in Inter-Tan Group with a p value <0.0001 which is in sync with previous studies done on this subject. However in cases with intraoperative complications the operative time was comparable in two groups. Intraoperative blood loss was more in inter-Tan group however it was not statistically significant as contrary to previous studies; in our study the hip pain was high in PFNA group which is similar to previous studies.

5. Conclusion

This study compared the clinical outcomes of two Cephalomedullary nails, PFNA and Inter-Tan in 144 cases of unstable intertrochanteric fractures in a tertiary care hospital of north India. Various studies across the world have attempted to compare these two modalities however there have been different results in all studies, to our knowledge no study on clinical outcome is done in Indian population who are definitely known to be with early onset osteoporotic bones with more trivial trauma resulting in unstable intratrochanteric femur fractures. Our study suggested a comparable outcome between two groups in terms of intraoperative complications and postoperative results, however intra-operative time was definitely more in inter-tan group which can be attribute to its two integrated screw design which is proved to be better for improving rotational stability. The intraoperative blood loss was

significantly more in Inter-Tan group which is a direct repercussion of increased operative time. Although the VAS and Harris Hip score were comparable between two groups, hip pain was more in PFNA cases again in accordance with previous studies. Our study showed that both cephalomedullary nails are comparable in treatment of unstable intertrochanteric fractures. Selection of the nail by the surgeon is a matter of cost effectiveness, skills and expertise of the surgeon and availability of the implant. Further follow up studies are required to understand the biomechanical factors for stability and difference in long term results between two implants.

References

[1] Cooper C, Campion G, Melton LJ 3rd. Hip fractures in the elderly: a world-wide projection. Osteoporos Int.1992 Nov; 2 (6): 285-9.
[2] Gulberg B, Duppe H, Nilsson B. Incidence of hip fractures in Malmo¨, Sweden (1950–1991). Bone.1993; 14 (Suppl 1): 23–29.2.
[3] Kannus P, Oarkkari J, Sieva¨nen H. Epidemiology of hip fractures. Bone.1996; 18 (Suppl 1): 57–63.
[4] Yoon YC, Kim CH, Kim YC, Song HK. Cephalomedullary Nailing versus Dynamic Hip Screw Fixation in Basicervical Femoral Neck Fracture: A Systematic Review and Meta-Analysis. Yonsei Med J.2022 Aug; 63 (8): 744-750. doi: 10.3349/ymj.2022.63.8.744.
[5] Hung WW, Egol KA, Zuckerman JD, Siu AL. Hip fracture management: tailoring care for the older patient. JAMA.2012 May 23; 307 (20): 2185-94.
[6] Sambrook P, Cooper C. Osteoporosis. Lancet.2006 Jun 17; 367 (9527): 2010-8.
[7] Ravikumar KJ, Marsh G. Internal fixation versus hemiarthroplasty versus total hip arthroplasty for displaced subcapital fractures of femur-- 13 year results of a prospective randomised study. Injury.2000 Dec; 31 (10): 793-7.
[8] Shih Y, Bartschat NI, Cheng EY. Sliding Hip Screw and Side Plate for Intertrochanteric Hip Fractures. JBJS EssentSurg Tech.2022 Feb 16; 12 (1): e19.00038.
[9] Butt MS, Krikler SJ, Nafie S, et al. Comparison of dynamic hip screw and Gamma nail: a prospective, randomized, controlled trial. Injury.1995; 26: 615–618.
[10] Huang SG, Chen B, Zhang Y, Nie FF, Ju L, Li M, Zhang YH. Comparison of the Clinical Effectiveness of PFNA, PFLCP, and DHS in Treatment of Unstable Intertrochanteric Femoral Fracture. Am J Ther.2017 Nov/Dec; 24 (6): e659-e666.
[11] Jin L, Zhang L, Hou Z, Chen W, Wang P, Zhang Y. Cephalomedullary fixation for intertrochanteric fractures: an operative technical tip. Eur J OrthopSurgTraumatol.2014 Oct; 24 (7): 1317-20.
[12] Weil YA, Gardner MJ, Mikhail G, Pierson G, Helfet DL, Lorich DG. Medial migration of intramedullary hip fixation devices: a biomechanical analysis. Arch Orthop Trauma Surg.2008 Feb; 128 (2): 227-34.
[13] Babhulkar S. An operative manual of proximal femoral fractures. Indian J Orthop.2016 Nov-Dec; 50 (6): 697.
[14] Kulkarni, GS &Limaye, Rajiv & Kulkarni, Milind& Kulkarni, Sunil. (2006). Intertrochanteric fractures. Indian Journal of Orthopaedics.40.
[15] Erez O, Dougherty PJ. Early complications associated with cephalomedullary nail for intertrochanteric hip fractures. J Trauma Acute Care Surg.2012 Feb; 72 (2): E101-5.
[16] Ruecker AH, Rupprecht M, Gruber M, Gebauer M, Barvencik F, Briem D, Rueger JM. The treatment of intertrochanteric fractures: results using an intramedullary nail with integrated cephalocervical screws and linear compression. J Orthop Trauma.2009 Jan; 23 (1): 22-30.
[17] Huang Y, Zhang C, Luo Y. A comparative biomechanical study of proximal femoral nail (InterTAN) and proximal femoral nail antirotation for intertrochanteric fractures. IntOrthop.2013 Dec; 37 (12): 2465-73.
[18] Zhang S, Zhang K, Wang Y, Feng W, Wang B, Yu B. Using three-dimensional computational modeling to compare the geometrical fitness of two kinds of proximal femoral intramedullary nail for Chinese femur. ScientificWorldJournal.2013; 2013: 978485.
[19] Zhang H, Zeng X, Zhang N, Zeng D, Xu P, Zhang L, Chen D, Yu W, Zhang X. INTERTAN nail versus proximal femoral nail antirotation-Asia for intertrochanteric femur fractures in elderly patients with primary osteoporosis. J Int Med Res.2017 Aug; 45 (4): 1297-1309.
[20] Nherera L, Trueman P, Horner A, Watson T, Johnstone AJ. Comparison of a twin interlocking derotation and compression screw cephalomedullary nail (InterTAN) with a single screw derotationcephalomedullary nail (proximal femoral nail antirotation): a systematic review and meta-analysis for intertrochanteric fractures. J OrthopSurg Res.2018 Mar 2; 13 (1): 46.