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CLINICO-RADIOLOGICAL AND FUNCTIONAL OUTCOME OF INTERTROCHANTERIC FEMUR FRACTURES TREATED BY PROXIMAL FEMORAL NAIL ANTIROTATION2 (PFNA2)

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ABSTRACT **Introduction:** Intertrochanteric femur fractures commonly occurin the elderly patients usually due to low energy trauma and in young patients due to high velocity trauma. It is treated by extramedullary as well as intramedullary implants.Among intramedullary implants, proximal femoral nail antirotation(PFNA2) is become much popular due to better functional outcome. Purpose of this study is to analyze clinico-radiological and functional outcome of intertochanteric fractures treated by PFNA2.Material and **Methods:** The study was conducted at the Department of Orthopaedics, Assam Medical College & Hospital, Dibrugarh from June,2019 to May,2020.Results: The functional outcome was assessed with Harris hip score. The mean Harris hip score was 87.9 at final follow-up Conclusion:PFNA2 is safe and effective fixation implant for treatment of intertrochanteric femur fracture due to less blood loss, less intraoperative complications, minimal soft tissue damage and good union rate.

KEYWORDS : Proximal femoral nail antirotation (PFNA2), Harris hip score, intertrochanteric femur fracture

Introduction

Intertrochanteric fracture is one of the commonest fractures encountered in orthopaedics and also the most devastating injuries of the elderly. The incidence of this fracture increases with advancing age. In younger patients, the fractures usually result from high-energy trauma like RTA and fall from height and accounts for only 10%. A fracture can be both stable and unstable. The fracture is said to be unstable if it has comminution of the postero-medial cortex, reverse oblique type of fractures and fractures with subtrochanteric extension. This fracture can be treated conservatively and operatively. Earlier in conservative treatment morbidity and mortality was found higher, so operative treatment in the form of rigid internal fixation has become much popular for early mobilization to avoid complications.[1]

The strength of the fracture fragment - implant assembly depends upon various factors including (a) bone quality, (b) fragment geometry, (c) reduction, (d) implant design and (e) implant placement. Out of these factors, surgeon can only control the quality of the reduction, choice of implant and its placement.The types of implant used in these fractures have been divided into extramedullary implants and intramedullary nails.The sliding hip screw is a widely used extramedullary implant in the treatment for hip fractures. However, various studies have reported it being unsuitable for unstable intertrochanteric fractures. Compared to extramedullary devices, intramedullary nails can be inserted with less exposure of the fracture, less blood loss, although they may require more fluoroscopic exposure. Biomechanically, nails allow for stable anatomical fixation of more comminuted fractures without shortening the abductor moment arm or changing the proximal femoral anatomy. The common IM devices used for unstable intertrochanteric fractures today include Proximal Femoral Nail (PFN) and Proximal Femoral Nail Antirotation (PFN-A).[2]

The Proximal Femoral Nail Antirotation (PFN-A) system was introduced by AO and was further refined as PFN-A2 in 2009. The major development is the helical blade which is supposed to compact the cancellous bone into the femoral head, thereby increasing the rotational stability of cervicotrochanteric fragments and decreasing load on the femoral head.The PFN-A2 blade may thus be a more biomechanically suitable implant for unstable trochanteric fractures. The Proximal Femoral Nail Antirotation 2 (PFN-A2) device was recently introduced and appears to be better suited to the typical Asian population, who has smaller femurs.[3]

There is paucity of study in the available literature for the results of PFN-A2 in both stable and unstable trochanteric fractures. We, therefore, wish to take up a study with the objectives to assess the clinical and functional outcome, to evaluate the duration of healing & to assess complications as above, in our setup to help out the people of this region.

METHODOLOGY

A Hospital based prospective outcome study was conducted at the Department of Orthopaedics, Assam Medical College & Hospital, Dibrugarh from June, 2019 to May, 2020.Study population includes all patients who underwent fixation withPFN - A2for all types of intertrochanteric fractures.Fracture of <3 weeks duration with AO/OTA 31A1,2,A34 were included in the study. Age <18 years, associated hip pathology and pathological fracture, open fractures, fractures associated with any vascular or nerve injury, fracture of >3 weeks duration, patients not giving informed consent, & patients who are medically unfit for surgery were excluded from the study. Pelvis with both hips – AP views, Involved side hip with femur full length-AP and Lateral view in all patients and Chest-PA view done pre operatively.The patient was placed in supine position on fracture table with adduction of the affected limb by 10 to 15º and closed reduction of the fracture was done by traction and gentle rotation.The unaffected leg was flexed and abducted as far as possible in order to accommodate image intensifier.The tip of the greater trochanter was located by palpation in thin patients and in healthy patients we used image intensifier. 5 cm incision was made approximately 5 to 10 cm proximal from the tip of the greater trochanter. Parallel incision of the fasciae of the gluteus medius was made and gluteus medius was split in line with the fibres. Tip of the greater trochanter was exposed.In AP view, under IITV, the entry point was made which was usually on the tip or slightly lateral to the tip of the greater trochanter in the 6° curved extension of the medullary cavity. In lateral view, the guide wire position was verified, and it was straight and in the centre of the medullary cavity. Over the guide wire, a cannulated flexible reamer was inserted through the protection sleeve and reaming was done.After confirming satisfactory fracture reduction ,nail was inserted manually by slight twisting hand movements as far as possible through the entry point.

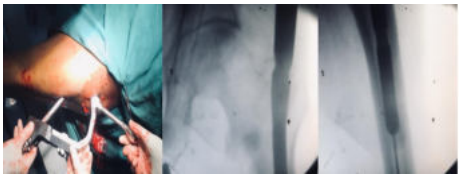

Figure 1: PFN – A2 nail inserted under IITV guidance

Under IITV guidance, appropriate 130° aiming sleeve was inserted and fixed firmly to the insertion handle Buttress Nut was firmly secured to the Protection Sleeve for PFNA Blade insertion, and inserted through the aiming arm.11.0/3.2 mm Drill Sleeve and 3.2 mm Trocar passed through the protection sleeve.Marking on the 130° Aiming Arm was observed and stab incision in the area of the trocar tip was made. Sleeve assembly was advanced through the soft tissues in direction of

the lateral cortex & inserted until it clicked into the aiming arm.Protection Sleeve was advanced to the lateral cortex using slight clockwise turns of the Buttress Nut.Trocar was removed. New 3.2 mm Guide Wire was inserted through the 11.0/3.2 mm Drill Sleeve into the bone. In the AP view, the position of the guide wire was in the lower half ofthe femoral neck and in lateral view, the wire was positioned in the centre of the femoral neck.The guide wire was inserted subchondrally into the femoral head up to a distance of at least 5mm from the joint.

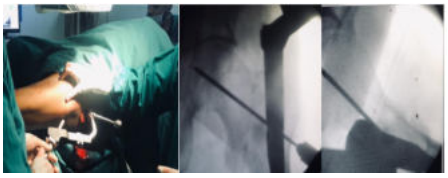

Figure2: Guide wire inserted- in the AP view, position was in the lower half of the femoral neck, in lateral view, position - in the centre of the femoral neck.

Measuring Device was guided for 3.2 mm Guide Wire and advanced to the protection sleeve and the length of the required blade was determined which should be approximately 5–10 mm below the joint level.The 11.0/3.2 mm Drill Sleeve was carefully removed without changing the position of the guide wire cannulated 11.0 mm Drill Bit was pushed over the 3.2 mm Guide Wire and drilled to open the lateral cortex. Measured length of the blade was set on the cannulated 11.0 mm Reamer by fixing the Fixation Sleeve in the corresponding position which prevented further drilling. Slight anticlockwise pressure was used to insert the inserter into the selected PFNA blade which unlocked the PFNA blade and made it to rotate freely.Both blade and Inserter were inserted over the 3.2 mm Guide Wire through the protection sleeve. PFNA blade was aligned and inserted, and at the same time the button was pressed on the protection sleeve.Handle of the inserter was holded and the blade was manually inserted over the guide wire as far as possible into the femoral head. IITV was used to check the position of the PFNA blade.

Figure 3: Helical blade of appropriate size inserted and locked

Inserter was turned clockwise to the stop. The PFNA blade was now locked .Button was pressed on the protection sleeve to remove the inserter .Guide wire was removed and disposed. Protection sleeve and buttress nut was released and removed. Stab incision was given and drill sleeve assembly was inserted for distal locking bolt and bolt was inserted after drilling done with 4 mm drill bit. Protection sleeve and the aiming arm was removed. After the fixation was over, lavage was given using normal saline. Incision was closed in layers. No drain was applied .Sterile dressing was applied over the wounds and compression bandage given. All patients were followed up clinicoradiologically at an interval of 1 month, 3 months & 6 months.At every visit patients were assessed clinically regarding hip function using Modified Harris Hip Score.

Statistical Analysis: The statistical analysis of data was performed using the computer program, Statistical Package for Social Sciences (SPSS for Windows, version 20.0.Chicago, SPSS Inc) and Microsoft Excel 2010.Results on continuous measurements are presented as mean ± standard deviation Charts and bar diagrams were prepared using appropriate tools.

Results and observation

We conducted a prospective study in 60 cases of stable and unstable trochanteric fractures treated with PFN – A2 during the period from June 2019 to May 2020 at Department of Orthopaedics, Assam Medical College & Hospital, Dibrugarh , Assam In our study maximum cases were in age group of 70-79 years (36.67%).The mean age presentation was 69.13 ± 10.81 years which comprises of 56.67 % of females &43.33 % of males.In the study, there were 48 cases (80%) due to domestic fall while there were 12 cases (20%) due to road traffic accident (RTA). 32 (53.33%) patients were found to have right side proximal femoral fractures while 28 (46.67%) patients were having fracture on the left side. Broadly, AO 31A2 type comprises 56.67 % of total cases. (34 cases), AO31A1 type comprise 20 % (12 cases) & AO31A3 type comprise 23.33 % (14 cases) of total cases. Majority of patients were operated on 7th day following injury. In rest of total 34 cases operative procedure was delayed due to medical problems (Hypertension and Diabetes) and financial constraint of patients. The mean time taken from injury and definitive surgery was 7.85 ± 1.09 days, mean incision length was 6.74 cm with SD 0.94., mean blood loss was 84.15 ml with SD 5.08 and mean duration of operation was 59.42 minutes with SD 5.52. In 3 cases (5%) operated by PFN – A2, there was ill fitting of jig, difficulty during closed reduction encountered in 2 cases (3.33%), Iatrogenic fracture of greater trochanter in 3 cases (5%), difficulty encountered in distal locking in 2 case (3.33%) &lateral blow out fracture in 1 case (1.67%). In total 18.33% cases were associated with intraoperative complications.3 cases (5%) of urinary tract infection were encountered which was treated by systemic antibiotics depending on the urine culture report and 2 cases (3.33%) of respiratory infection was encountered. The systemic complication rate was 8.33 % in this study. Among local wound complications, superficial would infection was seen in 3 cases (5%). One patient (1.67%) developed deep wound infection. & anterior thigh pain developed in 4 cases (6.67 %). The total number of clinical complications (both systemic and local) was 21.67 % in this study .We have encountered Lateral migration of helical blade in 3 cases (5 %). The neck screw cut out was not seen in any case. There was no any case of nail breakage and bolt breakage.

Table 1: Time of union

Time of union (in week)	Number (n)	Percentage (%)
10–12	12	20.00
>12–14	44	73.33
>14–16	3	5.00
>16	1	1.67
TOTAL	60	100.00
Mean ± S.D.	12.46 ± 2.20 weeks	

44 cases had their union time between 12 – 14 weeks, 12 cases union time lied between 10 – 12 weeks, 3 cases, union time was between 14 – 16 weeks, 1 case union time went upto 24 weeks leading to delayed union. Average time of union in the study was 12.46 ± 2.20 weeks.Varus deformity was noted in 3 cases (5 %) and valgus was seen in 1 case (1.67%). Delayed union was seen in one case (1.67%). No cases were associated with non-union.. In 8.34 % of total cases, union related complications was observed. The mean shortening was 0.63 ± 0.38 cm.

Mean time taken for tip toe touch weight bearing with the help of axillary crutch was 2.18 days with SD 1.94 , for partial weight bearing with axillary crutch on both side was 2.63 weeks with SD 0.73 and for full weight bearing ambulation was 12.46 weeks with SD 2.20.

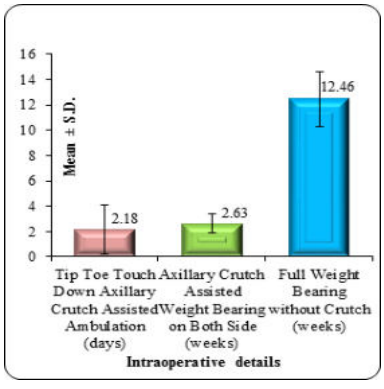

Figure 4: Period of mobilization

Table 2: hip function (harris hip score)

HARRIS HIP SCORE	AT 1 MONTH		AT 3RD MONTH		AT 6TH MONTH	
	n	%	n	%	n	%

Excellent	0	0.00	0	0.00	32	53.33
Good	0	0.00	31	51.67	23	38.33
Fair	0	0.00	26	43.33	2	3.33
Poor	60	100.00	3	5.00	3	5.00
TOTAL	60	100.00	60	100.00	60	100.00

The range of movement was calculated by the Modified Harris Hip Scoring system. 53.33% of cases (32 cases) got excellent functional outcome followed by 38.33 % cases (23 cases) had Good outcome, fair results in 2 case (3.33%) & poor results in 3 cases (5 %) were obtained. Average time for which patients was admitted in our hospital was 13.03 +/-1.46 days.

Discussion

Most of patients in our study were from age group 7th decade of life. Mean age in years for group operated by PFN-A2 = 69.13 ± 10.81 years (range 40- 85 years.)In the study done by Kasha et al.3, mean age of the patients was 69.4 years. Mallya et al.6 also found mean age group for 2 comparative groups as 69.6 years & 69.85 years.

Out of 60 patients there were 26 males and 34 females. Comprising 43.33% & 56.67% respectively. Kasha et al.3 in their study, found that out Of the 78 patients, female: male ratio was 47:31 with ratio of 1.51 :1.Mathur et all found that out of 50 patients, there were 28 females and 22 males with ratio of 1.27 : 1. Most common mechanism of injury was self fall (80%), followed by RTA which contributes remaining 20 %. Kumar et al.7 found that among 44 patients, there were 34 patients (77.27%) with fracture occurred due to accidental fall and in 10 patients (22.72%) it was due to RTA. Radaideh et al.—8noted that out of total 50 patients,46 patients (92%) with fracture due to Simple fall at home and 4 patients (8%) suffered due to RTA.

Majority of patients in present study were operated on 7th day\ following injury (26/60) - 43.33%.Average time lapse for surgery:7.85 ± 1.09 days.Kasha et al3 average time between injury and surgery was 2 days, Vaquero et al9 average time was 2 days.

Duration of operation was 59.42 minutes with SD 5.52. with range between (45 – 69 minutes). Turgut et al.10 found mean operation time was 57.2 minutes ± 14.7 (range: 30 to 100) minutes, Kripalani et al.–11observed the average duration of surgery was 50.01 minutes, ranging from 30 minutes to 95 minutes, comparable to our study

3 cases (5%) developed urinary tract infection. Respiratory infection was encountered in 2 case (3.33%). The systemic complication rate was 8.33% in our study group. Kasha et al.3observed UTI in 3 patients (3.84%), respiratory infection in 2 patients (2.56%) out of 78 patients. Zehir et al.12 in their study within 96 cases, found 9 cases (9.37%) of UTI, 4 cases (4.16%) of respiratory infection, 7 cases (7.29%) of DVT. (1.67%) developed deep wound infection and anterior thigh pain - 4 cases (6.67%). Mathur et al.1and Kashid et al'2also found similar findings .Total number of clinical complications (both systemic and local) was 21.67 % in our study group.

There was 3 cases (5%) of Lateral Migration of Helical Blade but no any case of Cut out of Neck Screw, Breakage of Nail Bolt Breakage out of 60 cases.Kasha et al3found out of 78 patients there were 6 patients (7.6%) had asymptomatic backing out of blade, blade cut out, nail fracture. Mallya et al.6observed one case of screw back out out of 40 case (2.5%), which was treated with implant removal.

Average time of union in our study was 12.46 weeks with SD 2.20.Kasha et al.3found average time taken for fracture union was 14 ± 3 weeks.Raj et al.13 observed mean union time around 12 weeks in their study.3 cases (5%) presented with varus deformity and 1 case (1.67%)presented with valgus deformity with limb lengthened around 0.5 cm in valgus deformity case. Total union related complications occurred around 8.34 % of total cases. The results were comparable to Kripalani et al–11 in which they noted varus deformity in 8(7.3%) and valgus deformity in 2(1.8%) patients out of 110 patients, Kashid et al'2 observed that out of 25 cases there was 1 case of non-union in either of the groups which required a second surgery and 1 case (4%) out of 25 case went into varus malalignment,

At 6 month follow up of our cases, maximum 53.33% of cases (32 cases) got excellent functional outcome, 38.33% cases (23 cases) had Good outcome, Fair results were obtained in 2 case (3.33%) & in 3 cases (5%) had poor results. The mean Harris hip score at 6 month follow up period was 87.9 which showed good outcome at 6 months follow up.Raj S et all3 found excellent in about 32% cases,60% good cases., 8 % fair results and no poor results out of 25 cases, comparable to our results. Mathur et all at final follow-up, the mean postoperative Harris hip score was 86 points (range 60-100 points). Out of 50 patients, excellent- 40 cases (80%), good - 7 cases (14%), fair - 3 cases (6%) and there were no poor results, comparable to our study.

Conclusion

Intertrochanteric femur fracture is most common fracture of the hip, especially in the elderly patients usually due to low energy trauma and in young patients due to high velocity trauma. The decision for operative treatment of trochanteric fractures must take into considerations the patient's age, severity of fracture, level of activity, any medical comorbid conditions or ill health. To reduce the complications associated with long term immobilization, early surgical intervention was advocated in majority of the patients.

Among Intramedullary device, PFN-A2 has superior performance over other intramedullary devices especially in elderly osteoporotic fractures, which is attributed to compaction of cancellous bone by it's helical blade. Intraoperatively it also provides advantage of less blood loss, less intraoperative complications, minimal soft tissue damage, good intraoperative reduction in fracture table under minimal fluoroscopic guidance and post operatively early mobilization.

The study was not without it's limitations, chiefly with regards to non randomization, small number of patients and short duration of follow up. With such Methodological limitations, interpretation of this study remains limited. Therefore, on a larger sample size with a longer duration of follow up, a randomized controlled studies should be implemented to conclusively ascertain the outcome.

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