Original Article

Short term follow up study of proximal femoral nail antirotation (PFNA) in case of unstable peritrochanteric fractures

Amarendra Nath Roy[1], Sabyasachi Santra[2]

Comminutedperitrchanteric fracture is a challenging problem in term of choice of implant for promoting osteosynthesis. These fracture presents with two challenges instability due to posteromedial and lateral comminution.Intramedullary implant has been treatment of choice. Proximal femoral nail with antirotation screw seem to be viable option for treatment of these fracture as two screw provides compression and rotatonal stability.

[*J Indian Med Assoc* 2018; **116:** 40-2]

Key words **: Peritrochanreic fracture, proximal femoral nail(antirotation)**

Peritrochanteric fracture is one of the most common cases that orthopaedic surgeons deal during daily practice. The incidence of peritrochenteric fracture has increased significantly with increase in life expectancy. They are more common in females who are osteoporotic; trivial fall being most common mechanism of injury[1,2]. The preferred treatment of choice is operative and the goal of treatment is to achieve stable acceptable anatomical reduction with rigid internal fixation for early ambulation and to prevent the dangers associated with prolonged recumbancy[3]. There are mainlytwo types of internal fixation- extramedullary and intramedullary devices, the choice of device is controversial[3,4]. Proximal femoral nail (antirotation) nail is viable option for unstable peritrochanteric fracture

Initially extramedullary device, namely Sliding Hip Screw (SHS) was used widely for pertrochenteric fracture management. However, studies have reported that this implant is not appropriate for unstable fracture patterns as they are associated with high failure rates. This led to introduction of intramedullary devices[5]. Although a wide variety of nails have been generated during the course of evolution Proximal Femoral Nail(PFN) and Proximal Femoral Nail Antirotation (PFNA), both being variety of Cephalo-medullary nails, are commonly used nowadays. InPFN IM nail two screws are used, one of which acts as a lag screw and gives compression and the other screw acts as a derotation screw. Where as in case of PFNA one Helical blade is used which imparts both stability, compression and derotation. To observe the outcome of PFNA the following study was undertaken.

Department of Orthopaedics, Mursidabad Medical College, Mursidabad 742101

[1]MS (Ortho), Assistant Professor

[2]MS (Ortho), Associate Professor, Department of Orthopaedics, Sagore Dutta Medical College, Kolkata 700058 and Coressponding author

Materials and Methods

The study was conducted between august 2016 to december 2017. 50 patients with peritrochanteric fractures belonging to AO 31-A2 and A3 were operated. Patients with severe comorbidities, polytrauma and open wound were excluded. 40 patients fulfilling the criteria were operated with PFNA. Informed consent was taken in all patients. All patients underwent spinal or epidural anaesthesia and were placed in a fracture table in supine position prior to closed reduction of fracture. If closed reduction couldn't be achieved open reduction was performed. Duration of operation, intraoperative blood loss, and implant related issues and number of c arm shots required were recorded. All patients received prophylactic antibiotic doses and post operative thromboprophylaxis. Clinical and radiological assessments were done during follow ups at 2 weeks, 6 weeks, 3 months, 6 months, 9 months and 1 year. Non weight bearing physiotherapy was started from first post op day. Patients were allowed to bear weight from 4 to 6 weeks depending on post operative serial X rays.

Results

50 patients underwent stabilisation of peritrochanteric fractures during the 16 month study period. The mean patient age was 65 years (range: 58 to 79 years), and the study sample comprised 22male and 28 female patients. There were 43 (86 %) AO 31A2 and 7 (14 %) AO31A3 fractures. The median number of days from admission to surgery was 4days (range: 3-6days). In 41 patients were treated by closed reduction while open reduction was required in 9 patients.

Postoperatively 2 patients developed superficial wound infection, one in either group which were resolved with change in injectable antibiotics according to culture sensitivity. There is no evidence of DVT or thromboembolism in either group. The median length of hospitalisation

was 4 days (range: 4-6days). Patients are regularly followed up as per given protocol. Clinical and radiological assessments are done during the follow ups

Functional Assessment

Was done at the end of 1 year according to following criteria: persistent pain, use of walking aids, return to pre fracture status and Harris Hip Score.

Discussion

The aim of the study is to evaluate the clinical and radiological outcome of the patient having unstable pertrochantric fractures treated by intramedullary fixation PFNA. Initially extramedullary implant sliding hip screw (SHS) was widely used in the treatment for hip fractures. However, studies have reported that this implant is not appropriate for unstable fracture patterns that include reverse oblique fractures, fractures with a large posteromedial fragment implying loss of the calcar buttress and fractures with subtrochanteric extension. There intramedullary devices (IMD) are more preferable owing to less exposure of the fracture, less blood loss, although they may require more fluoroscopic exposure. Biomechanically, since a nail is located closer to the centre of gravity and force transmission, the lever arm is shorter and there is less stress on the implant. Intramedullary placement also prevents shaft medialization, which may commonly happen with unstable fracture patterns. The intramedullary nail acts as an internal splint that controls but does not prevent micromovements of the fragments. It provides a relative stability that leads to an indirect healing through callus formation . When the canal is not reamed, intramedullary nailing generates minimal trauma to the endosteum and, therefore, the blood supply is maximized through the uninjured endosteum and periosteum.

The proximal femoral nail (PFN) was introduced by the AO/ASIF group in 1998 whilePFNA (Antirotation system) was introduced in 2003. If we compare both the nails, the main difference in implant design is noted in their proximal parts. Both the nails have their proximal diameter of approximately 17 mm. In PFN there are two slots for proximal bolts- one for lag screw (11 mm) and one for derotation screw (6.5 mm). Thus 17.5 mm of femoral head is being occupied by two bolts. In PFNA a single helical blade of diameter 12 mm is being used thus occupying less femoral head and restoring more blood supply femoral head leading to less chance of AVN. Moreover the helical blade of PFNA is a unique one. It has a smooth lateral end and a telescopichelical blade on medial end. Large surface and large core diameter guarantee maximum compaction and optimal hold in bone thereby increasing stability caused by bone compaction around the PFNA blade which has been proven to retard rotation and varus collapse. Due to bone compaction there is less destruction of bone stock compared to PFN[9].

PFNA claimed better rotation, and angular stability with single screw and better functional outcome in treating unstable intertrochantric fractures[6]. Accurate reduction of the fracture is very essential for proper fixation with proximal femoral nail either PFN or PFNA. The most important technical aspect of this surgery is maintaining the proper neck shaft angle and placing the lag screw or helical blade in inferior-central portion of the head. Both are interlinked as screw placement angle is prefixed in both the nails and hence unless good neck shaft angle is achieved by good reduction, it is impossible to put the screw correctly. If accurate reduction is not achieved by closed method, one may need to go for open reductionthe entry point determination is also a crucial step, which is the tip of trochanter.

Our study shows less operative time, less blood loss, less fluoroscopy time with PFNA. The PFNA involves gentle tapping of the helical blade over a guide pin thereby avoiding the steps involved in reaming of canals for lag screw and de-rotation screw as required in a PFN. The positioning of the single guide wire for insertion of helical blade is also easier as compared to two guide wires for PFN. The mean blood loss was significantly lower in PFNA. The decrease in blood loss in PFNA is attributed to decreased duration of surgery and smaller surgical incision for the placement of PFNA Blade. However the amount of blood loss was not severe enough to necessitate a blood transfusion in any case. Exposure to X–rays, as determined by the number of intraoperative c-arm shots taken showed significantly lower scores for PFNA. Deciding the length of nail is important especially in osteoporotic patients or pathological fractures to reduce post operative complications like femoral shaft fracture at distal locking site. In our study 36 short and 14 long nails were used. Apart from osteoporosis where fracture mainly occurs due to stiff implant in a weak bone, shaft of femur fracture may also occur due to inadequate reaming, too

Postoperative picture 2days

Post operative picture 1 month

much force application during nail insertion or mismatch of femoral bow with that of nail.

There are three phenomenon which needs to be explained in order to understand the mechanism of fracture union by both these nails. Compression is a manoeuvre performed by the surgeon to compress the fracture, when no bending and torsional forces are acting across the hip joint. In PFN manual compression can be applied. Impaction is post surgical compression, passively performed by a patient, when the hip joint is subjected to cyclic bending and torsional forces provided by a sliding fixation device. If the fixation device imparts torsional or rotational stability (like DHS and PFN) then it is called controlled impaction[8,9].

This specific feature hastens the process of fracture healing. PFN being intramedullary, restricts excessive sliding and prevents severe controlled impaction which is common in DHS.The impaction of the proximal fragment leads to lateral slide of both the proximal screws in PFN, thereby causing Z-effect phenomenon where proximal screws slide to opposite direction. Reverse Z-effect means lateral migration of anti-rotation (hip) pin.Collapse is fracture displacement impaction with loss of reduction frequently leading to varus malalignment. In PFN compression, impaction and collapse – all these 3 phenomemon can occur. In PFNA there is provision of intraoperative controlled compression, inbuilt 5mm which can be extended upto 8 mm,thus leaving no room for impaction. Moreover there is a lateral locking system which diminishes rate of impaction and collapse in PFNA. In our study, the overall mean lateral slide of lag screw in PFN group, excluding the cases with screw cut out was 3.03 mm whereas in PFNA group mean lateral slide of lag screw was 0 mm.

Regarding post operative complications 07 patients had anterior thigh pain. Postoperative femoral fracture at distal locking site is 3. These cases were managed by conversion to long nails with or without cerclage wiring.Cut out/ Z effect without Loss of reduction was in 1 patient whereas 1 patient had Cut out/Z effect with Loss of reduction (varus malalignment) whereas these complications are nil in PFNA group and it is statistically significant. Only 1 patient had shortening >2 cm who was managed by shoe rise. Reoperation needed for 4 patients, 3 for per implant fracture and 1 for z effect.

Functional assessment done at the end of 1 year was found to be satisfactory in PFNA with less persistent pain, better return to pre fracture status and good Harris Hip Score.

Conclusion

So, PFNA is a better choice in fixation of peritrochanteric fractures of femur.

References

1 Xu YZ, Geng DC, Mao HQ, Zhu XS, Yang HL — A comparison of the proximal femoral nail antirotation device and dynamic hip screw in the treatment of unstable pertrochanteric fracture. *J Int Med Res* 2010; **38:** 1266-75.

2 Halder SC — The Gamma nail for peritrochanteric fractures. *J Bone Joint Surg Br* 1992; **74:** 340-4.

3 Akinci O, Akalin Y, Reisog?lu A, Kayali C — Comparison of long-term results of dynamic hip screw and AO 130 degrees blade plate in adult trochanteric region fractures. *Traumatol Turc* 2010; **44:** 443-51. Acta Orthop Sadowski

4 C, Lu¨bbeke A, Saudan M, Riand N, Stern R, Hoffmeyer P — Treatment of reverse oblique and transverse intertrochanteric fractures with use of an intramedullary nail or a 95 degrees screw-plate: a prospective, randomized study. *J Bone Joint Surg Am* 2002; **84:** 372-81.

5 Haidukewych G, Israel A, Berry D — Reverse obliquity fractures of the intertrochanteric region of the femur. *J Bone Joint Surg Am* 2001; **83:** 643-50.

6 Zeng C, Wang YR, Wei J, Gao SG, Zhang FJ, Sun ZQ, *et al* — Treatment of trochanteric fractures with proximal femoral nail antirotation or dynamic hip screw systems: a meta-analysis. *J Int Med Res* 2012; **40:** 839-51.

7 Takigami I, Matsumoto K, Ohara A, Yamanaka K, Naganawa T, Ohashi M, *et al* — Treatment of trochanteric fractures with the proximal femoral nail antirotation (PFNA) nail system – report of early result. Bull NYU HospJt Dis. 2008:66(4):276-9. Nikoloski AN, Osbrough AL, Yates PJ. Should the tip-apex distance (TAD) rule be modified for the proximal femoral nail antirotation (PFNA)? A retrospective study. *J Orthop Surg Res* 2013; **8:** 35.

9 Mora A, Marimon I, Rius M, Brill W, Corral A, Gaya S — PFN versus PFNA in treatment of trochanteric femoral fractures: A prospective study. *Bone and joint journal Orthopaedic Proceedings* 2011; **93:** 136.