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CLINICAL EVALUATION OF UNSTABLE INTER-TROCHANTERIC HIP FRACTURE BY INTRAMEDULLARY NAIL (PROXIMAL FEMORAL NAIL) - A PROSPECTIVE CLINICAL STUDY

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ABSTRACT

Introduction: Dynamic hip screw and cephalomedullary nails are currently considered as a standard treatment for inter-trochanteric fractures. Although both clinical and biomechanical studies suggest that intramedullary implants have a mechanical advantage over extramedullary implants. We report the results of 118 unstable inter-trochanteric hip fractures internally fixed with proximal femoral nail

Materials and methods: Between Dec 2013 and Dec 2015, 138 patients with unstable inter-trochanteric fractures were internally fixed with proximal femoral nail.Number of patients requiring open reduction, duration of surgery and hospitalization, post-operative complications, implant-specific complications were recorded in a predefined proforma; serial post-operative radiographs taken. Functional outcomes were assessed according to the Harris Hip scoring (HHS) system.

Results: Mean HHS at one year follow up was 93.356 (range-60-100). There were four superficial infection, one lag screw migration in to joint (fixation revised) and one implant failure (converted to hemiarthroplasty). Union was achieved in 117 cases. Fourteen patients expired due to unrelated reasons and six patients could not complete the follow up.

Conclusion: We have used proximal femoral nail for fixation of unstable inter-trochanteric fractures with less operative time, good clinico-radiological outcome and low complication rate.

Level of evidence: IV

KEYWORDS : inter-trochanteric, intramedullary nail (PFN

INTRODUCTION:

Incidence of inter-trochanteric fractures has increased because of rising elderly population and increased incidence of osteoporosis and both clinical and biomechanical studies suggest that intramedullary nails have advantage of both biomechanical stability and minimal surgical exposure over extramedullary 3 implants1,2. The short term goals for treatment of inter-trochanteric fracture is to achieve union and provide stable construct to allow early mobilization while the long term goals are to restore pre-fracture level of mobility1,2. Use of both short and long nails has been reported with positive clinical results. There is a risk of developing stress fracture at the tip of short nails, particularly in osteoporotic bone and in addition these large diameter short nails were associated with intraoperative insertional fractures. Use of long nail reduced the rate of late femoral shaft fractures at the distal tip of the nail, but curve mismatch between the nail and the femoral bow in the setting of osteoporosis often makes the placement of long nail technically difficult. Newer generation cephalomedullary nails (both short and long) were developed, combined with changes in biomaterials, including more flexible titanium implants and adjusting the radius of curvature to provide a more anatomic fit for the geriatric femur3,4,5. We report the results of 118 unstable inter-trochanteric hip fractures internally fixed with proximal femoral nail.

MATERIALS AND METHODS

Study design Between Dec 2013 and Dec 2015 Dept of orthopaedics,sancheti institute of orthopaedics and rehab Pune (Maharashtra) and between aug 2018 to aug 2019 at govt. medical college khandwa (mp) .138 patients with unstable inter-trochanteric fractures (AO-OTA, 31-A2!118 and 31-A3!20 patients) were internally fixed with proximal femoral nail at our institute. All stable inter-trochanteric fractures (AO-OTA, 31-A1), open fractures, pathological fractures, polytrauma patients or other lower limb fractures which hampers immediate post-operative mobilization were excluded.. Standard radiographs (anteroposterior and cross table lateral view of the involved hip with whole thigh) were taken pre-operatively, immediate post-operatively, at 6 weeks, 12 weeks, 6 months and at 1 year. Patients were followed up for a mean of 13 months (range, 12-25 months).

Surgical technique

All procedure were performed in the lateral decubitus position on a radiolucent operating table under image guidance. Closed/open reduction of the fracture was achieved using standard reduction techniques. Entry point of the nail was located at the tip or just medial to the tip of the greater trochanter. A guide wire was inserted into the femoral canal ensuring that it is not eccentrically located in both planes. Flexible, cannulated reamers of progressively increasing diameters were used to ream the intramedullary 5 canal followed by reaming of the proximal femur up to the lesser trochanter using 15.5 mm tapered reamer. The long nail was assembled using standard technique and inserted in to the femoral shaft over the guide wire with gentle mallet blows. The intramedullary guide wire was removed followed by insertion of the lag screw guide wire through 125/130 degree CCD in to the centre of the femoral head which was then reamed with 10.2 mm lag screw reamer. The 10.5 mm lag screw was inserted over this guide wire with drilling and manual impactor turning to achieve compression. Cleveland zones6 and tip apex distance (TAD)7 was used to evaluate the optimal placement of lag screw in the femoral head. Set screw was inserted to prevent rotation of the lag screw. Distal locking was performed using standard technique.

Post operative rehabilitation

Ankle pumps and isometric quadriceps exercises were started immediately and weight bearing as tolerated with a walker was allowed from the next day.

Outcome assessment

Functional outcomes were assessed according to the Harris Hip scoring (HHS) system8. Number of patients requiring open reduction, duration of surgery and hospitalization, post-operative complications, implant-specific complications were recorded in a predefined proforma; serial post-operative radiographs were assessed for fracture reduction maintenance, union and implant position. On immediate post-operative radiograph, fracture reduction was assessed using Garden 6 Alignment Index (GAI)9 and fracture gap measurement. Fracture union was defined as painless weight bearing clinically and callus formation in atleast three cortices in two perpendicular radiographic views.

Statistical analysis:

It is a descriptive study. We used “chi square” to look any association between variables. “T test” was used to compare between two groups for various parameters which are continuous values. Further “paired sample test” was also done to look for any significant change at different times.

RESULTS:

138 patients with unstable inter-trochanteric fractures (AO-OTA, 31-A2!118 and 31- A3!20 patients) were enrolled. Among these 60.9% (n=84) were females and the rest were males.. 36.2% (n=50) patients were between 50-64 years of age, 39.1% (n=54) were between 65-80 years of age and the rest were above 80 years of age. Mean duration of union was 13.1 weeks (range 12-16 weeks). Mean follow up was for 13 months (range 12-25 months). Mean HHS at one year follow up was 93.356 (range-60-100). Mean HHS was recorded at 6 weeks, 3 months, 6 months and at 1 year follow up and has been depicted in figure 1.

Mean HHS of younger patients and male patients were better at each follow up depicted in figure 2 and 3.There were four superficial infection, one lag screw migration in to joint (fixation revised) and one implant failure (converted to hemiarthroplasty). Union was achieved in 117 cases. Fourteen patients expired due to unrelated reasons and 6 patients could not complete the follow up.

Figure 1: Mean HHS

Duration	6 Weeks	3 Months	6 Months	1 Year
Mean HHS	70.91	83.01	92.03	93.36

Figure 2: Mean HHS according to age groups

	6 Weeks	3 Months	6 Months	1 Year
50-64 Years	75.28	86.67	95.48	96.7
65-80 Years	68.70	82.46	90.72	91.60
>80 Years	68	78.70	87.82	90.36

Figure 3: Mean HHS according to groups

	6 Weeks	3 Months	6 Months	1 Year
Males	72.55	82.77	92.33	94.33
Females	69.86	83.17	91.83	92.69

DISCUSSION

As the incidence of inter-trochanteric fractures are increasing, orthopaedic surgeons around the world are still debating over the technique and optimal implant design which is biomechanically stable, minimally invasive, causes minimal amount of blood loss, allows early weight bearing, has low complication rates and is technically less challenging. Earlier extramedullary implant (sliding hip screw with a side plate) was standard for all the inter-trochanteric fractures, but now, with the advent of intramedullary devices, unstable inter-trochanteric fractures are amenable to biomechanically stable construct having fewer complications9. Both short and long intramedullary devices have been favoured as an implant of choice for unstable intertrochanteric. We have used long version of the nail in majority cases to prevent any refracture of the distal femur .Short nails were used in those patients who were at high risk for surgery so that the operative duration could be kept to a minimum. Patients undergoing short nail were not included in this study Cut-out of the lag screw, one of the most common complication, is associated with position of the screw in the head and it is expressed as a combination of Cleveland Zone and TAD14,15.Cleveland zones 5, 6, 8 and 9 are located in a region with no rotational forces, whereas zone 4 or 7 has high rotational forces, thus increasing the chances of cut-out16 . TAD is sum of the distance from the tip of the screw to the apex of the femoral head on antero-posterior and lateral views. One study suggested that with TAD25 mm there were 44% cutouts17. We had no cut-outs in our series even though we had 4 patients with TAD>25 mm.

Figure 5: Cleveland Zone

No cases of intra operative femoral shaft fractures were noted in our study. A study reported (5.6%) intra operative femoral shaft fractures in their series of 107 intertrochanteric fractures19. Optimal reaming of the femoral canal can decrease the incidence of this complication. There were 4 cases of intra-operative lateral wall fractures while drilling with 10.2 mm lag screw reamer in our series. Boopalan et al.20 reported 21% incidence of intra operative lateral wall fracture and Gotfried21 reported 24 cases of lateral wall fractures in their study

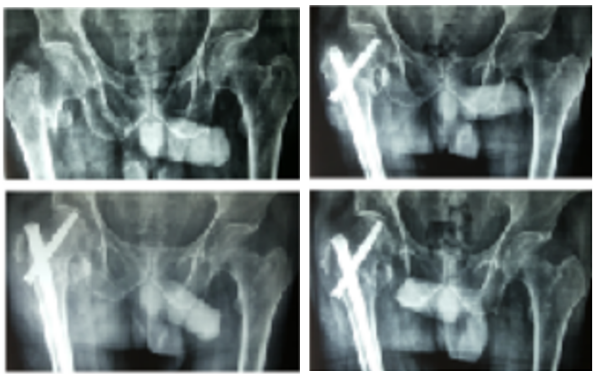

Figure 6: (A) Inter-trochanteric fracture. (B) Immediate post-operative X-ray

Figure 6: (A) Inter-trochanteric fracture. (B) Immediate post-operative X-ray (C) Screw migrated into joint (D) Re-migrated after screw being revised

Strengths of the study are that it is a prospective study with minimal attrition rate in follow up and standardized surgical technique as all cases were operated by single senior experienced trauma surgeon. Serial radiograph analysis and clinical outcome scoring were performed by a single blinded observer who was not involved in the primary care of the patient which significantly reduced the observer bias. However, we do acknowledge a few limitations in our study. The sample size was relatively small and there was no control cohort to compare the results of this nail with other fixation devices.

CONCLUSION

We recommend proximal femoral nail for fixation of unstable intertrochanteric fractures with less operative time, good clinico-radiological outcome and low complication rate. We feel that this device is safe and user friendly. However, proper operative technique is important for achieving fracture stability and to avoid any major complications. Further investigation through a long term randomized trials are required to prove its promising results

ABBREVIATIONS

PFN- proximal femoral nail
PFNA II- Proximal femoral nail antirotation II
AP view- Antero-posterior view

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