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A prospective study of surgical management of intertrochanteric femur fracture in adults with short proximal femoral nail

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Abstract

The AO/ASIF proximal femoral nail (PFN) is a new device designed for the treatment of the unstable intertrochanteric femur fracture. This study reports the outcome in such fractures treated using the short PFN (proximal femoral nail). All patients presenting to our department with unstable trochanteric femur fractures were treated operatively using the short proximal femoral nail. A total of 40 patients were included in the study and were followed-up at regular interval of 1, 3, 6 and 12 month. The functional outcome of the patients was assessed by modified Harris hip score at regular intervals.

Results: All 40 patients treated with short pfn. In this study first follow up was at 4 weeks, radiological union was noted in 9(22.5%) patients. At second follow up at 12 weeks, clinical union was noted in 85% of patients and radiological union noted in 90% patients. At 6 month follow up all 40 patients showed signs of clinical and radiological union. Post-op 1 patient has superficial wound infection and 3(7.5%) patients operated with short PFN showed varus deformity. Patient were functionally evaluated by modified Harris Hip Score at regular follow-ups. In our study 87.5% of cases showed good to excellent results and rest 12.5% of cases showed fair results.

Conclusions: It is concluded from our study that short proximal femoral nail is an stable and suitable implant for Proximal Femoral Fractures and its use in unstable intertrochantric fractures is very encouraging.

Keywords: Proximal femur fracture, intertrochanteric fracture, proximal femoral nail

Introduction

Intertrochanteric fracture is one of the most common fractures of the hip especially in the elderly. The incidence of intertrochanteric fracture is rising because of the increasing life expectancy superadded with osteoporosis. These fractures are three to four times more common in women and the mechanism of injury is usually due to low-energy trauma like a simple fall [1]. Intertrochanteric femoral fractures have become an area of great interest globally they are most frequently operated fracture type. They are associated with the highest post-operative fatality rate among surgically treated fractures. Causes include high energy trauma mechanisms like road traffic accidents and fall from heights as well as low energy trauma like fall from standing height account for approximately 90% of hip fractures in age>50years. The elderly population shows high incidence of hip fractures due to osteoporosis [1].

The evolution of surgical fixation methods can be traced from external fixation, open reduction and internal fixation with plates, to flexible and rigid intramedullary nail [1]. Due to advantages of perceived stable fixation and low complications and higher union rate Rigid intramedullary nailing has been suggested as a treatment option in these patients with intertrochanteric fractures [2].

In 1996, the AO/ASIF developed the proximal femoral nail (PFN) as an intramedullary device for the treatment of unstable per-, intra- and subtrochanteric femoral fractures [3]. With introduction of two lag screws which provide more stable fixation and prevent rotation of proximal fragment [1]. Hence, the aim of this study is to evaluate the functional outcome, advantages, union rate and complications of proximal femoral fractures in adults using proximal femoral nail.

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Materials and Methods

This prospective study was conducted at Bapuji and Chigateri General Hospital attached to JJM Medical College, Davangere for a period of one year from July 2019 to July 2020. A total of 40 patients who presented with intertrochanteric fracture of femur were studied.

Patients with Intertrochanteric fractures who are willing for surgical management are admitted during the study period. All patients are assessed clinically and evaluated radiologically. Informed and written consent was taken from all the patients before the surgical management of fractures.

All cases who satisfy the inclusion criteria i.e 1] Patients greater than 18 years of age 2] Patients with unstable Intertrochanteric fractures as per Boyd and Griffin classification. 3]Patients who gave consent for surgical management as per our protocol 4] Regular visits in the out-patient department are surgically managed with proximal femoral nail were followed for regular intervals at the end of 1st, 3rd, 6th, 12th months after surgery for the union rate and complications associated with the procedure. The functional outcome of surgically managed patients are documented with modified Harris Hip score.

Exclusion criteria were 1] Patients less than 18 years of age 2] Patients with neck of femur and femoral shaft fractures 3] Patients with pathological fractures around hip 4]Patients with compound hip fractures associated with neurovascular injuries and pelvic fractures 5]Patients with old malunited fractures 6]Patients who are not fit for surgery 7] Patients refusal for surgical management as per our protocol.

Surgical technique

The patient is placed in a supine position on a radio-transparent fracture table to allow verification through fluoroscopy. Once reduction of the fracture is achieved, the alignment of the medial cortex in AP view and reduction of the proximal fragment and shaft fragment in lateral view was checked. After preparation and incision was made five to six cm in size extending proximally from the tip of the greater trochanter. The entry point was made just medial to the tip of trochanter According to the guide, the nail is introduced through the tip of the greater trochanter. The medullary cavity is reamed 0.5 by 0.5 mm if required. The nail is implanted, and a guide wire is introduced into the femoral neck until attaining countersinking 5 mm below the subchondral cancellous. In the case of the PFN, a 6.4-mm anti-rotational hip screw is placed into the femoral neck through the proximal part of the nail. Then, an 8.0-mm load bearing neck screw is placed. Then distal locking is performed using fluoroscopy imaging for verification. Regarding the postoperative management, sitting was allowed 24 h post-surgery in all cases and weight bearing was initialized after 4weeks post-intervention according to patient's tolerance level.

Results

During the period of study 40 cases of intertrochanteric femur fracture were treated with short PFN and the patients were followed up at 1, 3, 6 and 12 months interval. Out of the 40 patients studied average age of the patient is 62 years(46-89years) Most of the patients sustained trauma after trivial fall (92.5%) and 7.5% as a result of road traffic accident (RTA). Out of 40 patients treated with proximal femoral nail 22 were male and 18 were female with right side involvement in 26 patients and left side involvement in 14 patients. Average interval between the trauma and the surgery was 6 days (range

2-14 days).

Average surgery time was 68min (range 35-90min). All the patients treated with short PFN closed reduction was achieved. Average blood loss was 162ml (range 140-360ml). 8 patients required blood transfusion post-surgery because of low haemoglobin. In our series no other complications like deep vein thrombosis, systemic infection, acute respiratory distress syndrome and fat embolism was seen. Post-surgery patients were mobilized with knee range of motion exercises in mean 3 days (range 2-4 days) and quadriceps strengthening exercises with walking with non-weight bearing was started on post-op day 5. Partial weight bearing was achieved after mean 4weeks (range-3-6 weeks). Full weight bearing was achieved after mean 88 days (range 78-96days) post-surgery. In this study first follow up was at 4 weeks, radiological union was noted in 9(22.5%) patients. Eight patients had no pain, 16 had slight pain, 7 had moderate pain, and no patient had severe pain 4week follow-up evaluation.

At second follow up at 12 weeks, clinical union was noted in 85% of patients and radiological union noted in 90% patients. At 6 month follow up all 40 patients showed signs of clinical and radiological union. Pain at the fracture site was noted in 3 patients (7.5%). Immediate post-op complication was 1 patient has superficial wound infection which was treated with IV antibiotics. Post-op 3(7.5%) patients operated with short PFN showed varus deformity. Patient were functionally evaluated by modified Harris Hip Score at regular follow-ups. In our study 87.5% of cases showed good to excellent results (excellent=16, good=19). Rest 12.5% of cases showed fair results (fair=5).



Fig 1: Pre-op x-ray



Fig 2: Immediate post-op x-ray

**Fig 3:** 3rd month follow-up x-ray.**Fig 4:** 6th month follow-up x-ray.**Fig 5:** 12th month follow-up x-ray.

Discussion

The incidence of intertrochanteric femoral fractures has been increasing in parallel with the gradually increasing human lifespan, and they are one of the most important causes of mortality and morbidity among this population [4]. To reduce the morbidity and mortality associated with conservative management of intertrochanteric fractures, surgical management of the intertrochanteric fractures is advocated as the best modality of management of these fractures.

From a biomechanical point of view the use of an intramedullary nail combined with a sliding neck screw appears to be the more appropriate technique [5]. In prior biomechanical studies of hip implants, intramedullary nails were demonstrated to be biomechanically superior to dynamic hip screw and angled blades [6]. This superiority is thought to be a consequence of the efficient load transfer due to the closed proximity of the nail is in close proximity to the mechanical axis. Furthermore, there is a lower risk of mechanical failure due to load reduction on the implant due to the shorter lever arm and a controlled fracture impaction. The nail is intramedullary and medialization of the distal end is

prevented, especially in reverse oblique fracture types [7]. The intramedullary device inserted via a semiclosed procedure is to be preferred in elderly patients. The best treatment for these fractures remains controversial. DHS fixation is widely preferred but failure of fixation still occurs in up to 20% of cases [8].

Common causes of fixation failure include fracture instability, osteoporosis, lack of anatomical reduction, implant failure, and incorrect screw placement in the femoral head (leading to 'cut-out' of the screw [9]). The need for internal fixation and early mobilisation of patients with trochanteric fractures of the femur is generally accepted, not only to reduce the morbidity/mortality rates associated with prolonged immobilisation, but also to improve the functional result through avoiding malunion and encouraging mobility [10]. Meta-analyses have demonstrated that the rates of iatrogenic fracture with >intramedullary nailing have improved over time, and the risk of femoral shaft fracture with nail insertion has decreased dramatically [11].

There are different surgical options for the treatment of intertrochanteric femur fracture eg: dynamic hip screw,

intramedullary devices. The recent trend is to use less invasive procedures for reduction and fixation of the fracture with intramedullary devices for unstable fractures. A new device was developed by AO/ASIF: the proximal femoral nail (PFN), with an additional anterotational hip pin preventing rotation and collapse of the head-neck fragment and an especially shaped tip together with a smaller distal shaft diameter resulting in less stress concentration at the tip^[12].

The unstable patterns include reverse obliquity fractures, transtrochanteric fractures, fractures with a large posteromedial fragment implying loss of the calcar buttress, and fractures with subtrochanteric extension. These fractures, in general, should be treated with an intramedullary nail because of the more favorable biomechanical properties of an intramedullary nail compared with a sliding hip screw. An intramedullary nail is located closer to the center of gravity than is a sliding hip screw, and therefore the lever arm on the femoral fixation is shorter. Intramedullary nails can more reliably resist the relatively high forces across the medial calcar that are typically borne by the implant in an unstable fracture. The intramedullary position of the implant also prevents shaft medialization, which is a common complication associated with the transtrochanteric and reverse obliquity fracture patterns. Recognizing the unstable patterns preoperatively and choosing to use an intramedullary nail decrease the risk of fixation failure. When there is doubt about the status of the calcar, however, an intramedullary nail is preferable to a sliding hip screw^[13].

Intramedullary implants inserted in a less-invasive manner are better tolerated by the elderly. PFN has all the advantages like decreasing the moment arm, it can be performed by closed technique, preserving the fracture hematoma which is an important consideration in fracture healing. It also decreases blood loss, infection risk, minimizes soft tissue dissection and wound related complications^[14]. The PFN implant also acts as a buttress in preventing the medialization of the shaft. The entry portal of the PFN through the trochanter limits the surgical insult to the tendinous hip abductor musculature, only unlike those nails which require entry through the pyriformis fossa^[15].

The present study was undertaken to assess the efficacy and the functional outcome following closed reduction and internal fixation of intertrochanteric fracture of femur with short PFN. A total of 40 patients sustained with intertrochanteric fracture were enrolled and evaluated. Patients underwent closed reduction and internal fixation using short PFN.

At second follow up at 12 weeks, clinical union was noted in 85% of patients and radiological union noted in 90% patients. At first, second and third follow ups the range of motion showed gradual increase in mean flexion, abduction, external rotation and internal rotation during subsequent follow ups. The inference obtained from the study was such short PFN for displaced intertrochanteric femur fracture results in overall good results that is nearly 87.5% of the patients had excellent to good result and 12.5% patient had fair result.

Conclusion

It can thus be concluded that, proximal femoral nail system (PFN) for the treatment of intertrochanteric femur fractures leads to a satisfactory functional outcome in most of the patients (87.5%). The PFN is a useful device in the treatment of unstable trochanteric femoral fracture. It creates a biomechanically stable construct allowing early weight bearing. This allows early mobilisation and early recovery of

range of movements of the hip joint with minimal soft tissue damage.

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