

Functional Outcome of Proximal Femoral Nail in Unstable Peritrochanteric Fractures of Femur

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Abstract

Aim of the Study: To assess the functional outcome of Intramedullary fixation of unstable peritrochanteric fractures with interlocking proximal femoral nail.

Materials and Methods: This was a prospective study of 20 patients of peritrochanteric fractures treated with proximal femoral nail. The age group varied from 32-years to 72-years and average age was 52.7 years. The duration of the study was from April 2016 to March 2018. The mean follow up was 10.75 months. Of the 20 patients 14 were male and 6 were female.

Results: Two fractures (10%) united by 10 weeks, fourteen (70%) fractures united by 10 to 15 weeks, four (20%) fractures united by 20 weeks. All the patients were ambulated as early as 3 weeks with aids and at the end of 6 weeks all patients were allowed full weight bearing. The mean Harris hip score at the end of 3 months was 78.65 and at end of 6 months was 85.05.

Conclusion: Proximal Femoral Nail is a significant advancement in the treatment of unstable peritrochanteric fractures which has the unique advantage of closed reduction, preservation of fracture hematoma, less tissue damage, early rehabilitation and early return to work.

Keywords: Intramedullary; Peritrochanteric fractures; Proximal femoral nailing; Harris hip score

Introduction

Fractures around the trochanteric region of femur are one of the commonest fractures encountered in orthopaedics. The incidence of this fracture increases with advancing age. Growing number of population and road traffic accidents have resulted in an enormous increase in these types of fractures. In younger patients the fractures usually result from high energy trauma like RTA and fall from height and accounts for only ten percent. Older patients suffering from a minor fall can sustain a fracture in this area due to osteoporosis or pathological fracture and this accounts for 90%.

Until 1960's non-operative treatment was the option available for these type of fractures in the form of traction with prolonged bed rest with fracture healing occurring in ten to twelve weeks (usually) followed by a lengthy programme of ambulation training. These are associated with complications of prolonged recumbence like decubitus ulcer, UTI, joint contractures, pneumonia and thrombo-embolic complications resulting in high mortality rate.

During this century a better understanding of the biomechanics of the fracture and the development of better implants have led to radical changes in treatment modalities.

After 1960's the first successful implants were fixed angle-nail plate devices like Jewett and Holt nail which provided stabilization of femoral head and neck fragment to the femoral shaft but failed to provide controlled impaction. This gave rise to sliding - nail plate devices like Massie nail and Ken-Pugh nail which provided both. Then modification of this resulted in the introduction of sliding hip screws like DHS in which the nail portion was replaced by a blunt ended screw with a large outside thread diameter to improve proximal fragment fixation and decrease the risk of screw cutout by eliminating sharp edges. Then the concept of bidirectional sliding came into play by the introduction of Egger's plate and Medoff plate. The sliding hip screw device with its modification has been used widely and successfully for more than a decade for the treatment of these fractures.

In unstable trochanteric fractures where there is loss of postero-medial cortex continuity, when load is applied increased bending force on the DHS lead to implant breakage, screw cutout or separation of plate from shaft. This lead to the introduction of Intramedullary devices which theoretically due to its position provides more efficient load transfer and shorter lever arm can decrease tensile strain thereby decreasing the risk of implant failure. Though Zickel introduced his nail long ago it was not very popular due to higher incidence of complications, so was the case with Ender's nail. Zickel nail was later modified and renewed interest is being given to intra medullary fixation with devices like the IMHS (intra medullary hip screw), Gamma nail, Russell-Taylor reconstruction nail, ATN (Ante grade trochanteric nail), TFN (Trochanter fixation nail) and the PFN (Proximal femoral nail) due to advantages of reduced operating time, less blood loss, better biomechanical stability and earlier mobilization provided by this devices.

In 1997, PFN (Proximal femoral nail) was introduced in Czechoslovakia by Synthes company which has the biomechanical advantage of all IM devices and considered to be as a second-generation nail.

Goal of this study

The present study was done to assess the functional outcome of proximal femoral nail in unstable peritrochanteric fractures of femur.

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Received May 22, 2018; Accepted May 31, 2018; Published June 14, 2018

Citation: Patel I, Modi DR (2018) Functional Outcome of Proximal Femoral Nail in Unstable Peritrochanteric Fractures of Femur. J Trauma Treat 6: 425. doi: 10.4172/2167-1222.1000425

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Materials and Methods

A total of 20 cases with peritrochanteric fractures presenting in the Department of Orthopaedics from April 2016 to March 2018 were treated with proximal femoral nail.

All the fractures were classified according to the Boyd and Griffin classification for peritrochanteric fractures. Eleven patients were classified as type II, four patients were classified as type III, five patients were classified as type IV. All of them are were unstable trochanteric fractures.

The average interval from injury to the time of surgery was 5 days. All the patients were managed initially with skin traction before being taken up for surgery. Patient with Colle's fracture and fracture shaft of humerus were treated with CMR with POP immobilization for Colle's fracture on the day of admission and ORIF of fracture shaft of humerus after internal fixation of the trochanteric fracture. Preoperatively, AP X-ray of the pelvis and whole length x-ray of the femur was taken.

Procedure

Patient was placed in supine position on a standard fracture table. The pelvis was placed in a horizontal position. The affected leg was adducted to allow access to trochanteric region. Closed reduction was done by traction and slight internal rotation of the femur. The alignment of the medial cortex in AP view and reduction of the proximal fragment and shaft fragment in lateral view was assessed.

Lateral linear incision of 5 to 6 cm size extending proximally from the tip of greater trochanter was made. The point of entry is made just medial to the tip of trochanter at the junction of its anterior one-third and posterior one-third with a curved bone awl. The guide wire was inserted using a tissue protector and a guide pin-centering sleeve well beyond the subtrochanteric region. The 15 mm cannulated proximal femoral reamer was used to ream the proximal femur for up to 7 cm. Distal reaming of the femoral canal was done with graded cannulated reamers up to more than 1 size of the distal diameter of the nail.

Then the proximal femoral nail (Stainless steel- Nebula) was inserted with the help of the jig over the guide wire. Excessive force or hammering was avoided. Guide wire was removed and drill sleeves were inserted into the proximal targeting guide. Through a stab incision over the lateral thigh the drill sleeve is pushed upto the lateral cortex of femur with the help of a trocar. The cervical guide pins for the load bearing cervical lag screw (8.0 mm) and for the derotation-hip pin were passed into the head and neck using the guide pin sleeves under fluoroscopic control in the desired position.

The guide pin is advanced to 5 mm from the articular surface of the femoral head and reaming is done using cannulated drill with a guide wire *in situ*. The load bearing cervical lag screw of adequate length is inserted into the sub chondral bone upto 5mm from the articular surface with the screw driver under image control, followed by the insertion of derotation-hip pin of adequate length into the upper half of neck. Distal locking also is done with the aid of the image intensifier. Patients were mobilized with physiotherapy on the first post-operative day. Patients were allowed partial weight bearing with bilateral elbow crutches as tolerated. Sutures were removed on the 12th post-operative day. After 3 weeks weight bearing was gradually increased. Patients were evaluated clinically and radiologically at 3 weeks for the first 3 months and thereafter monthly for the next 3 months and the once in two months for the next 6 months. Clinical union was observed as the absence of tenderness or pain with full weight bearing. During follow up the Harris hip score was evaluated at 3 months and 6 months

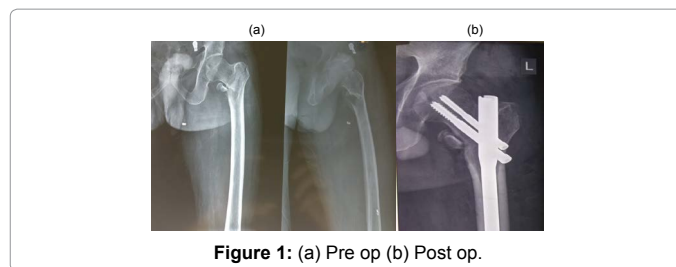


Figure 1: (a) Pre op (b) Post op.

Dousa et al.	Pavelka T et al.	Pajarinen J et al.	Our study
61 mins	56 mins	55 mins	71.5 mins

Table 1: Average operating time.

post operatively. Various parameters like pain, limp, use of support, distance walked, sitting, stair climbing, absence of deformity, range of motion were evaluated using the Harris hip score (Figure 1).

Results

Two fractures (10%) united by 10 weeks, fourteen (70%) fractures united by 10 to 15 weeks, four (20%) fractures united by 20 weeks. The age group varied from a minimum of 32 years to a maximum of 72 years and average age was 52.7 years. The mean follow up was 10.75 months. Of the 20 patients 14 were males and 6 were females. Right side was involved in 7 patients and in 13 patients the left side was involved. 13 patients were sedentary workers and 7 patients were manual laborers. All the patients were ambulated as early as 3 weeks with aids and at the end of 6 weeks all patients were allowed full weight bearing. The mean Harris hip score at the end of 3 months was 78.65 and at end of 6 months was 85.05.

The operating time was calculated from the start of surgical incision to wound closure. In the initial cases our operating time was on the higher range, with experience the operating time reduced. Operating time varied from 58 to 84 minutes. The blood loss was calculated from the number of surgical mops that were used, each corresponding to 50 ml blood. Blood loss varied from 150 to 350 ml. The average blood loss was 230 ml. The duration of image intensifier usage was calculated in seconds (Table 1).

In this current study the union rate was 95.0% with one case of varus malunion (5.0%). In our series we had 1 case of superior cut out of lag screw with severe varus deformity that lead to re-operation (5.0%) and varus deformity in another 1 case (5.0%) which was less than 10° and he was comfortable, so no intervention was done. We had 3 cases of abductor lurch in the post-operative period (15.0%) which improved with progression of time.

Discussion

Several fixation devices have been developed to overcome the difficulties encountered in the treatment of unstable trochanteric fractures. Until recently most of these fractures were treated by sliding hip screw. Since these devices performed less well in unstable trochanteric fractures with high rates of failure, intra medullary devices have become increasingly popular. Schipper IB et al. [1] described that the proximal femoral nail is an effective load bearing device that incorporates the principles and theoretical advantages of all the intra medullary devices and considered to be the second-generation nail. Rosenblum et al. [2] described that biomechanically the PFN is stiffer, it has a shorter movement arm (i.e. from the tip of the lag screw to the centre of the femoral canal) whereas the DHS has a longer movement arm (i.e. from the tip of the lag screw to the lateral cortex). The DHS

with a longer movement arm undergoes significant stress on weight bearing and hence higher incidence of lag screw cutout and varus malunion (Rosenblum et al. 1992). Leung et al. [3] said the larger proximal diameter of PFN imparts additional stiffness to the nail. It also combines the advantages of closed Intramedullary nailing, a dynamic femoral neck screw, minimal blood loss, shorter operative time and early weight bearing than DHS.

The gamma nail was the first intra medullary devices available from 1988 specifically designed for the treatment of these fractures. Follow up studies showed serious implant related complications like fracture of femoral shaft upto 17%, failure of fixation upto 7% and complications of distal locking in 10% because of these well described and persistent problems, the PFN was developed to improve the rotational stability of the proximal fracture fragment and the tip of the nail was re-designed with reduction of the distal diameter of the nail to decrease the risk of intra and post - operative fractures of the femoral shaft by a significant reduction in bone stress. Since its introduction in 1997 several clinical studies have shown good results with few intra operative problems and a low rate of complications [1].

Average operating time in our series was 71.5 minutes. In our initial cases operating time was in a higher range (90 mins.). With experience the operating time reduced (58 mins.). Results were comparable to the series of Dousa et al. [4], Pavelka et al. [5], Pajarinen J et al. [6]. In comparison mechanical failure of DHS occurs in 10 to 20% cases primarily due to cutting out of the lag screw superiorly [7].

The operative blood loss in patients treated with DHS using Medoff plate is higher-350 ml compared to PFN-200 ml [8]. Full weight bearing is delayed in patients treated with DHS [3]. Restoration of walking ability is gained more significantly faster in patients treated with PFN than DHS [6]. Despite the short lever arm screw cutout and shaft fractures have been more commonly reported in patients treated with Gamma nail than PFN [9]. Pilot studies has shown good outcome with few complications after treatment with PFN when compared to Gamma nail [1].

Kish et al. did a study on 46 patients with unstable peritrochanteric and subtrochanteric fractures [10]. The patients in this study were allowed immediate full weight bearing. There was 1 case of shortening more than 1 cm, 1 case of cutting out was observed. They concluded that the use of a PFN appears to be advantageous and a beneficial alternative to DHS in elderly patients with unstable peritrochanteric and subtrochanteric fractures as it allows the patient immediate full weight bearing thus decreasing the post-operative morbidity.

Menezes et al. reviewed 155 consecutive patients who were treated with a proximal femoral nail [11]. Fixation failure occurred in three patients (2%) which included one cutout, one delayed union, and one lateral displacement of the antirotation screw.

Madsen et al. found that despite the theoretically increased forces needed to generate sliding, the rate of femoral head cutout in intramedullary devices was not found to be significantly increased when compared post-operatively with that of DHS [12].

Multiple factors have been implicated like implant design, fracture stability, operative technique, surgeon skills & learning curve in the outcome of good results. Optimal reduction of the fracture, conformation of reduction in both AP and lateral views and accurate positioning of the nail and screws remain of crucial importance and should be obtained at all times to prevent the important complication of screw cutout. Reduction in distal nail diameter, pre-reaming of femoral canal one size bigger than the implant and meticulous placement of the

distal locking screws without creating additional stress risers decrease the complication rate of femoral shaft fractures.

Patients with narrow femoral canal and abnormal curvature of the proximal femur are the relative contra indications to intra medullary fixation with PFN. We have followed these recommendations in this series. We have not encountered any per operative or post-operative femoral shaft fractures.

The limitation of this study is the small sample size and short period of follow-up.

In short, the PFN with distinct advantages over DHS can be proved as a better implant with adequate surgical technique. The requirement and follow up based changes in design of PFN from the pioneer Gamma nail will certainly decrease the complication rates and increases all the postulated advantages of Intramedullary devices used in the treatment of trochanteric fractures.

Conclusion

Intra medullary nailing with PFN as claimed has distinct advantages over DHS like reduced operating time, less blood loss, rigid fixation and positive effect on the speed of restoration of walking. It also has advantage over Gamma nail in rotational stability of proximal fragment and reduction in the complication rate of femoral shaft fractures.

Finally, we conclude that the PFN is a significant advancement in the treatment of unstable peritrochanteric fractures which has the unique advantages of closed reduction, preservation of fracture hematoma, less tissue damage, early rehabilitation and early return to work.

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