

Original Research Article

Functional results of minimally invasive cheap fixation technique for all types of intertrochanteric femoral fractures using enders nail and cannulated cancellous screws

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ABSTRACT

Background: The objective was to study functional results of fixation of intertrochanteric fractures of femur using enders nail and cannulated cancellous screws.

Methods: This was a prospective observational study. The study was conducted on 30 patients of intertrochanteric femoral fractures who underwent fixation by enders nailing and cannulated cancellous screws in Department of Orthopaedics, GMCH, Aurangabad from January 2018 to January 2021. Patients were assessed functionally using Harris hip score, visual analogue score, and radiological assessment at 3, 6, and 12 months.

Results: All patients showed radiological union within 3 months. Functional assessment was done with Visual analogue scale (VAS) in which mean VAS score was 0.9 (range 0-3), mean Harris hip score which was 86 (range 81-90). One patient developed superficial infection at incision site which was treated by giving appropriate antibiotics and one patient complained of prominent nail on medial side of knee which was treated by implant removal after union of fracture.

Conclusions: Fixation of intertrochanteric femur fractures using enders nailing and cannulated cancellous screws achieves good stability with minimal complications and improved patients' outcome in terms of less intraoperative blood loss, less chances of infection, less operative time with minimal patient morbidity and good functional outcome.

Keywords: Cancellous screws, Endersnails, Intertrochanteric fractures

INTRODUCTION

Intertrochanteric fractures of femur are defined as fractures occurring along intertrochanteric line which extends from greater to lesser trochanter and involving greater and lesser trochanter and also fractures involving extracapsular neck region. Intertrochanteric fractures of femur constitute approximately 34% of all the fractures around hip¹ and most of these fractures occur in elderly osteoporotic females with age more than 65 years.²⁻⁴ Nowadays, in most of the intertrochanteric fractures of

femur, operative management is the treatment of choice for early ambulation of patients from bed and thereby reducing further complications associated with the fracture. The goal of operative management is stable fixation of fracture.

Enders' nails have been introduced in 1966 and have become one of the methods of fixation of intertrochanteric femoral fractures. Enders' nails for intramedullary fixation of intertrochanteric femoral fractures were originally developed by Ender and Simon Weidner and they were

further modified by Kuntschner.⁵ Enders nailing is one of the important treatment modality for fixation of intertrochanteric fractures of femur as it is biological with minimal blood loss and it is technically less demanding with cost effective modality when compared with Dynamic hip screw and Proximal femoral nail. With enders nailing stress fracture and osteomyelitis which are complications of treatment of fracture are eliminated.⁶ But enders nail alone cannot provide rotational stability to fracture so, we inserted cannulated cancellous screws in addition to enders nail which provided rotational stability to the fracture and hence good functional and radiological outcome and better patient outcome. As it is technically less demanding with cost effective and less intraoperative as well as postoperative complications with reduced operative time and less intraoperative radiological exposure of image intensifier in comparison with Dynamic hip screw and Proximal Femoral Nail with longer working length having less chances of stress fracture in future as compared to Dynamic hip screw and Proximal Femoral Nail, so enders nailing will be considered as good alternative to other methods of fixation of intertrochanteric femur fractures. To study functional results of fixation of intertrochanteric fractures of femur using enders nail and cannulated cancellous screws.

Objective of study was to study functional results of fixation of intertrochanteric fractures of femur using enders nail and cannulated cancellous screws.

METHODS

Inclusion criteria

Patients having intertrochanteric femoral fractures with medical comorbidity, patients with intertrochanteric fracture of femur operated within one week of injury, patients with acute trauma cases having intertrochanteric and other associated minor fractures were included.

Exclusion criteria

Any patient of intertrochanteric femur fracture with associated significant head, chest injury, patients with intertrochanteric femur fracture having compound injury over thigh were excluded.

This was a prospective observational study that was conducted on 30 patients during a period of January 2018 to January 2021 having intertrochanteric femoral fractures admitted in Government Medical College and Hospital Aurangabad in the department of orthopaedics. We conducted study on elderly patients having intertrochanteric femur fracture having medical and surgical comorbidity along with non-comorbid patients as well. All patients after admission were thoroughly enquired about previous comorbidities and we're examined clinically for neurovascular status and investigated with x ray pelvis with both hips AP view and lateral view of involved hip. All routine blood

investigations were done for surgical fitness. Patients were evaluated for 12 months after fixation of fractures using enders nailing and cannulated cancellous screw (Turbo Screw). Functional evaluation was done using Visual Analogue Scale (VAS), Harris hip score. Implant used: 4.5- and 3-mm stainless steel enders nails, 6.5 mm cannulated cancellous screws (turbo screw).

Surgical technique

Surgical site was cleaned with betadine scrub and covered with sterile pads and bandaged one night before surgery. Intravenous antibiotic (third generation cephalosporins) was administered once the night before (12 hours prior to surgery) and second dose was given 30 min prior to surgical incision. Hairs over skin over surgical site were removed 10 min prior to surgery.

After spinal or general anaesthesia was given. Patient was taken on traction table and tied with the help of bandages to foot attachment of the table. Traction was given and slight internal rotation of thigh was done to achieve reduction at fracture site. Reduction was confirmed in both anteroposterior and lateral views using image intensifier and was found adequate. After confirming reduction, painting and draping was done. Using 3.5 mm k wire, reduction was held in its position which was passed from lateral border of greater trochanter towards head through neck anteriorly so that it should not obstruct the entry of enders nails. The fixation using k wire was temporary which was removed after insertion of enders nails and turbo screws.

3-5 cm longitudinal incision was taken over medial aspect of thigh just above medial condyle of femur. Skin, subcutaneous tissue, deep fascia was cut and muscle was split to reach upto bone. Entry was taken in bone with the help of curved awl and entry was enlarged with the help of artery forceps.³ Stainless steel enders nails of 4.5 mm diameter and of appropriate length were inserted from entry point at lower end of femur one by one and were advanced till they reached subchondral bone of head of femur. Similarly, one enders nail of size 3 mm was introduced from lateral side of lower end of femur and was engaged into greater trochanter after crossing the fracture site. Reduction was confirmed in both anteroposterior and lateral views using image intensifier and was found to be stable.

With 3.5 mm k wire *in situ* which was holding reduction temporarily, small stab incision taken over lateral border of greater trochanter through which guidewire is passed from lateral border of greater trochanter and is advanced through neck into head of femur going centrally. Position of guidewire is confirmed under image intensifier over which one or if needed two 6.5 mm cannulated cancellous screws (turbo screws) were passed which provides additional rotational stability at fracture site and helped in better radiological and functional outcome of patient. After passing turbo screw, k wire which was inserted for

temporary reduction of fracture was removed and again reduction was confirmed after removal of k wire in both views which was found to be stable. Thorough wash given using normal saline and surgical site was closed in layers and sterile dressing was applied.

Post-operative protocol

Intravenous third generation cephalosporins were given for 24 hours postoperatively and oral antibiotics were given for further 3 days. After stabilization of patient vitally, in postoperative period, quadriceps and hamstring strengthening was done from first postoperative day. Ankle dorsiflexion and plantar flexion was also started simultaneously along with calf pump. Non weight bearing ambulation was done from second postoperative day using walker as tolerated by the patient. Suture removal was done on post operative day 14. Patient was allowed partial weight bearing after 6 weeks and full weight bearing after 12 weeks postoperatively as tolerated by the patient. Knee and hip range of motion was initiated after 2 weeks postoperatively. Derotation bar/boot was not applied as

turbo screw provided rotational stability to fracture. Log rolling was done to prevent development of pressure sores. Patients were then followed up at 3 months, 6 months, 12 months. During each follow up functional and radiological assessment was done using Harris hip score, visual analogue score, range of hip motion and AP and lateral view of involved hip.

Total Harris hip score was calculated as excellent when score was 91-100, as good when score was 81-90, as fair when score was 71-80 and as poor when score was <70.⁷ VAS score was classified as no pain (0), mild pain (1-3), moderate pain (4-6), severe pain (7-9) and unbearable pain (10). Ethical approval for conducting the study was taken from the Ethical committee of the local institution.

Statistical analysis

The data pf patients who fulfilled the inclusion criteria were tabulated in electronic spreadsheet (Microsoft Excel 2010) and data was analyzed using SPSS 20.0.

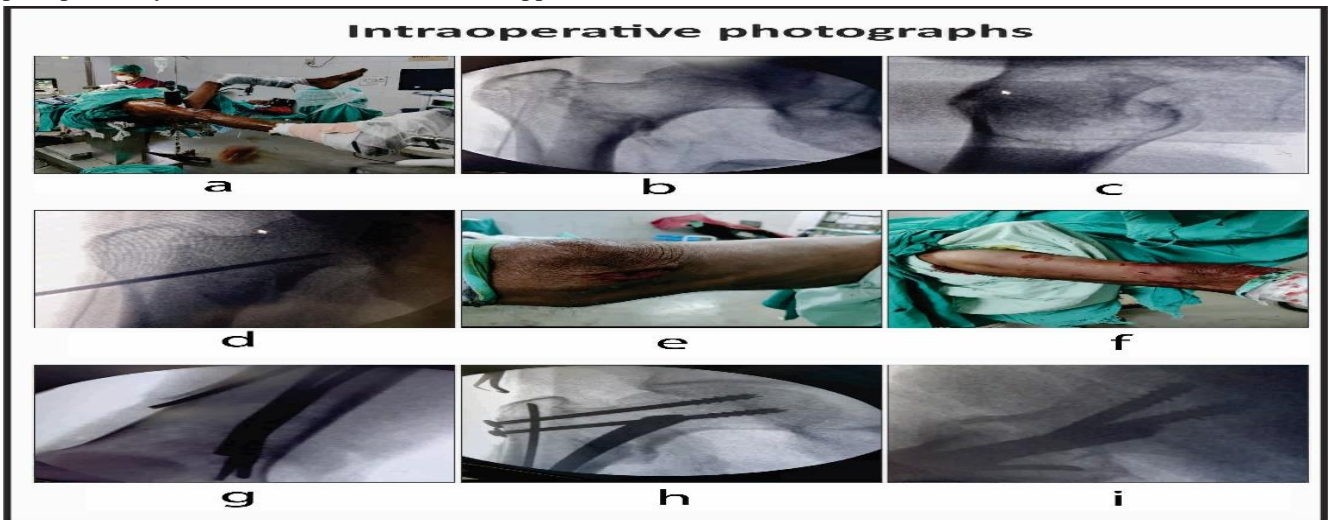


Figure 1 (a-i): Intra-operative images showing patient position, provisional reduction and fixation of fracture, entry site of nail and fixation using cannulated cancellous screws.

RESULTS

30 patients of intertrochanteric femur fracture were followed up for a period of 12 months in our study with age group of 60 to 80 years in which males were 40% and females were 60% (Table 1 and 2). In our study maximum patients were between 66-70 years.

Table 1: Age distribution of patients.

S. no.	Age group	No. of cases	Percentage
1	60-65	3	10
2	66-70	18	60
3	71-75	6	20
4	76-80	3	10

Table 2: Sex distribution of patients.

S. no.	Sex of patient	No. of cases	Percentage
1	Male	12	40
2	Female	18	60

Table 3: VAS score.

S. no.	Pain	Score
1	No pain	0
2	Mild	1-3
3	Moderate	4-6
4	Severe	7-9
5	Unbearable	10

Patients were functionally evaluated using VAS and Harris hip score. Our mean VAS score was 0.9 (range 0-3), mean Harris hip score was 86 (range 81-90) (Table 3 and 4).

Table 4: Harris hip score.

S. no.	Score	Result
1	<70	Poor
2	71-80	Fair
3	81-90	Good
4	91-100	Excellent

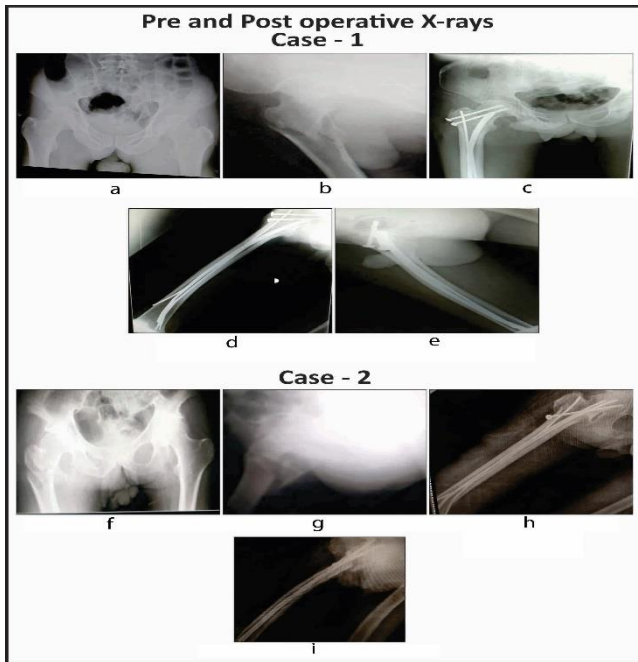


Figure 2 (a-i): Pre-operative and post-operative follow-up X-ray after one year showing fracture union.

Clinical follow-up photographs



Figure 3: Follow-up photograph showing cross-leg sitting.



Figure 4: Follow-up photograph showing squatting.

Complications

In our study one patient had superficial infection at incision site after one week postoperatively which was treated by giving appropriate antibiotics and one patient developed complication of prominent nail on medial side of knee after 6 months post-operatively which was treated by implant removal. No other complications like non-union, implant breakage or stress fracture was observed in our study.

DISCUSSION

There are various treatment modalities available for treatment of intertrochanteric femoral fractures in current day to day practice like Dynamic Hip Screw, Proximal Femoral Nail, etc. Enders nails are nowadays used as another treatment modality for treatment of intertrochanteric femur fracture. But enders nails alone cannot provide rotational stability to fracture, so cannulated cancellous screws (Turbo screws) are used along with enders nails which provide rotational stability to the fracture and hence provides better healing potential and less complications in future like delayed union and non-union. Enders nails with Turbo screws fulfils the criteria of providing stable fixation, enhance early fracture union as being biological, helps in early mobilization of patient, minimally invasive, less traumatic and technically less demanding as well as cost effective and hence it provides excellent functional outcome in patients in old age group having comorbid condition.⁸ Choice of implant for fixation of intertrochanteric fracture depends on stability of fracture, so stable fractures are fixed with Dynamic hip screw while unstable fractures are fixed with Proximal femoral nail.⁹ Fixation with dynamic hip screw is associated with drainage of fracture hematoma and excessive stripping of soft tissues and also associated with excess blood loss. So, it's not a biological mode of fixation and not suitable for patients with comorbid conditions. In osteoporotic patients, dynamic hip screw is associated with joint penetration and cut out of screws.¹⁰

Also if proximal femoral Nail is used in patients with intertrochanteric fracture having fracture extending into pyriform fossa it will also cause screw back out and lead to Z effect.¹¹ In bulky patients it is also difficult to take entry at proximal femur while using proximal femoral Nail which is not a problem when enders nail is used as its entry point is over medial and lateral aspect of thigh which is easier site with less difficulty in insertion of nails as compared to proximal femoral Nail which in turn minimizes surgeons fatigue and results into lesser operative time with better patient outcome. Enders nails alone cannot provide rotational stability to intertrochanteric fractures and is associated with the complications like backing out of the nails as well as penetration of nails in proximal and distal direction into joint which has shown by many authors.¹² That's why we used combined modality of treatment for stabilization of intertrochanteric femoral fracture by using enders nails and cannulated compression screws (Turbo screws) which provides compression at fracture site as well as provides rotational stability additionally, which is not provided by using enders nail alone.¹³ This combined treatment modality provides additional stability in cases of osteoporosis.¹⁴ This method has been proved to be excellent alternative method for fixation of intertrochanteric fracture in all patients including those having comorbidities and also in cases of osteoporosis. Being an intramedullary implant, it acts as a load sharing device also they are biologically as well as mechanically more suitable and more superior as compared to other extramedullary implants which are used for fixation of intertrochanteric femur fracture.¹⁵ Even in cases of comminuted fracture it provides excellent results with good union at fracture site being biological one. Enders nailing allows controlled collapse of fracture during weight bearing. As enders nails are present intramedullary, so they are subjected to less bending stress due to their central position in femoral canal and hence less chances of stress fracture are there.

Limitation of the study

This is a short-term study conducted during the COVID pandemic when surgical patients had drastically reduced and needs a long-term study.

CONCLUSION

In our study, we used both enders' nails and cannulated cancellous screws (Turbo screws) for fixation of intertrochanteric fractures of femur which showed excellent results. Being biological it preserves fracture hematoma and hence helps in early union and less chances of non-union and malunion being providing stable fixation. Using Cancellous screws (Turbo Screws), it also provides excellent rotational stability which prevents loss of reduction in future and gives excellent functional outcome. This technique is biological with minimum soft tissue stripping, has advantage of less operative time with minimum blood loss, less chances of infection, providing

controlled collapse of fracture and gives excellent functional and radiological outcome. Can be used in bulky patients in which there is difficulty in inserting implant from proximal site of femur as in this treatment modality site of entry of nails is distal femur where there is no question of obstruction to entry of nails even in obese patient as encountered in case of entry through proximal end in other treatment modalities like dynamic Hip screws and Proximal Femoral Nails.

So combined use of enders nailing with cannulated cancellous screws (Turbo screw) is excellent treatment modality for treatment of intertrochanteric femur fractures.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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