



## **Cannulated Cancellous Screw and Ender's Nail Fixation in Stable Intertrochanteric Femur Fracture in Elderly Patient with Co-Morbid Condition**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Background:** Intertrochanteric Femur fracture is common in elderly patient with co-morbidity. There was a concept introduced for the biological fixation of intertrochanteric femur fractures by combined use of enders nailing and cannulated compression screws which provides additional rotational stability. The clinical experience of authors revealed that Ender nailing alone cannot provide secure fixation in elderly patients with osteoporosis.

**Aims and Objectives:** We conducted a study to evaluate the functional outcomes of a combined fixation procedure using Ender nails and a cannulated compression screw for intertrochanteric fractures.

**Study Design:** This is a prospective observational type of study.

**Place and Duration of Study:** Department of Orthopaedics, NHL medical college between January 2015 to June 2018.

**Methodology:** 52 patients with intertrochanteric fractures were treated using intramedullary Ender nails and cannulated compression screw from January 2015 to June 2018. Elderly comorbid patients with osteoporosis and those which require stable fixation with less operative time and minimally invasive procedure were included in this study, Three Ender nails of 4.5mm each were

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passed across the fracture site into the proximal neck. This was reinforced with a 6.5 mm cannulated compression screw passed from the sub trochanteric region, across the fracture into the head.

**Results:** All the fractures showed radiological within 13 weeks. The functional assessment was done with modified Harris hip score (Tables 1, 2) and the mean was  $86.3 \pm 3.41$ , 26 patients were excellent, 20 patients were good, 4 patients were fair and two patients were poor with respect to total score. The analysis of this study fulfils the objectives of good functional outcome.

**Conclusions:** The Ender nailing combined with compression screw fixation in cases of intertrochanteric fractures in high risk elderly patients could achieve reliable fracture stability with minimal complications.

*Keywords: Compression screw; ender nails; osteoporosis; inter-trochanteric fracture.*

## 1. INTRODUCTION

Intertrochanteric femur fractures are defined as fractures occurring in the region involving greater and lesser trochanter region and extracapsular neck region. The Intertrochanter femoral fractures make up approximately 34% of all hip fractures [1] and the largest number of fractures occur in Osteoporotic female older than 65 years [2,3,4]. Operative management, is now the treatment of choice in most of the cases of intertrochanteric femur fractures which provides good functional outcome. The goal of operative treatment is strong, stable fixation of the fracture fragments. The Ender nail for intramedullary fixation of intertrochanteric fractures of the femur was developed by Ender and Simon Weidner [5] and further simplified by Kuntscher. Biological fixation provided by the nail with minimal blood loss and less technically demanding procedure makes enders nailing an important treatment modality for intertrochanteric femur fractures, But enders nail alone had difficulty in providing rotational stability. Bearing this in mind, we added a cannulated compression screw to the Ender nails in an attempt to maintain fracture reduction. Hence we conducted a study to evaluate the efficacy of a combined fixation procedure using Ender nails and a cannulated compression screw for intertrochanteric fractures in elderly comorbid patients.

## 2. MATERIALS AND METHODS

This is a prospective observational study that was conducted in the Department of Orthopaedics, In VS General hospital, Ahmedabad during the period of January 2015 to June 2018. The study includes 52 Patients with intertrochanteric fractures of femur, attending Orthopaedics outdoor and emergency department in this hospital. Patients were evaluated regarding pre-injury mobility status on the basis of their ability to walk within their place

of residence. We included elderly patients with medical and surgical comorbidities in our study with intertrochanteric femur fractures. All patients after arrival were thoroughly inquired about previous comorbidities and clinically examined along with neurovascular status and investigated with xray pelvis with both hips AP view and cross table lateral of involved hip.

### 2.1 Implant (Fig. 1)

4.0/ 4.5 mm Ender's nails, 6.5 mm cannulated cancellous screws and Instrumentation set.



Fig. 1.

#### 2.1.1 Surgical technique

After spinal or general anaesthesia is given patient is taken on to the fracture table and tied with help of bandage to the foot attachments of traction table. Traction is given by means of traction unit and slight internal rotation is done to get a proper reduction in AP and lateral views, Once the fracture is reduced in both the views a 3 cm longitudinal incision is made on lower medial side of thigh just below the medial epicondyle of femur, skin, subcutaneous tissue, deep fascia is cut or split to expose the bone entry is taken with the help of entry awl and entry is widened with the help of artery forceps and 2 enders nails are introduced from the medial side one by one and enders nail are fanned out till it reaches the head

than similarly one enders nail is introduced from the lateral side and advanced crossing the fracture site until it reaches the greater trochanter. Reduction is confirmed in both the views. The tip of the nail must be flush with the distal part of femur. Distally, the nails should lie

flushed with the medial cortex of the femur, above the epicondyle. One or two 6.5 mm cancellous cannulated screws are introduced from base of greater trochanter in the head of femur under image intensifier control, through a small incision at lateral side of thigh.

**Intra operative photos:**



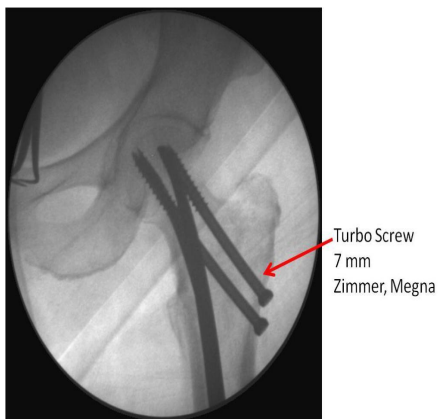
**Fig. 2. Positioning the patient**



**Fig. 3. Painting and draping done**



**Fig. 4. Insertion of the nail**



**Fig. 5. Intraoperative iitv image**



**Fig. 6. Intraoperative iitv image**

### 2.1.1.1 Postoperative rehabilitation protocol

After the patients are vitally stabilised in the postoperative period quadriceps and hamstring strengthening is done from the 1st postoperative day along with ankle mobilisation and calf pumps. DVT stocking and DVT Prophylaxis is also given to prevent the risk of pulmonary embolism. Non weight bearing ambulation is done from the second postoperative day as per tolerated by the patient. Removal of sutures is done after 10 days. Patient is allowed partial weight bearing after 6 weeks and full weight bearing after 12 weeks as per tolerated by patient. Log rolling is done to prevent development of pressure sores. Patients are then followed up at every 4 weeks for first 3 months and every 8 weeks for next 6 months. During each followup functional and radiological assessment is done using modified Harris hip score and radiographs AP and lateral view of the involved hip. Neck shaft angle is calculated during each follow up.

Total Harris hip score [6] is interpreted as excellent when score is 90 to 100, as good when score is 80 to 89, as fair when score is 70 to 79, and as poor when score is less than 70.

The statistical method used is Mean and standard deviation.

## 3. OBSERVATIONS AND ANALYSIS

In our study, 52 patients were. Most of the patients were in the elderly age group above 70 years of age, Mean age of patients was  $72 \pm 4.67$  years. In our study both right and left side were equally involved. Diabetes and Hypertension were the two most common comorbidities observed in most of the patients. Most of the patients in our study sustained fracture due to trivial trauma i.e. after a simple fall down in bathroom or wet floor. Patients were operated after 5 days on an average because of the comorbid conditions which required time for optimal stabilisation.

In the postoperative period quadriceps and hamstring strengthening exercises were done from the next postoperative day. Sutures were removed after two weeks. Non-weight bearing walking with bilateral axillary crutch was allowed after effect of spinal anaesthesia was over i.e. after 48-72 hrs. Patients were regularly followed every month for the first 3 months and every 2 months upto 1 year. During each follow up

patients were assessed clinically, functionally and radiographically. Functional assessment was done by modified Harris Hip score after full weight bearing is achieved. Radiological assessment is done by pelvis with both hip and involved hip lateral radiograph by neck shaft angle... The average neck-shaft angle of the fractured hip in the last follow-up X-ray was  $128.55 \pm 2.45$  degree, with a range of 115 to 135 degree. Partial weight bearing walking was allowed after assessing for radiological and clinical union, usually at 6-8 weeks. Full weight bearing was achieved within 4 months in all patients.

All the intertrochanteric fractures fixed with enders nail united with average duration of 3 months  $\pm 0.56$  months. 31 patients had no leg-length discrepancy, 19 patients had leg-length discrepancy less than one cm, and two patients had leg-length discrepancy of 1.5 cm which was managed by shoe raise. The functional assessment was done with modified Harris hip score (Tables 1, 2) and the mean was  $86.3 \pm 3.41$  with a range from 73 to 95, and 26 patients were excellent, 20 patients were good, 4 patients were fair and two patients were poor with respect to total score (Table 3, Graph 1). The analysis of this study fulfils the objectives of good functional outcome.

## 4. DISCUSSION

Intertrochanteric femur fractures in today's era can be fixed with variety of implants available like DHS, Proximal femur nail etc. Enders nail alone cannot provide stable fixation for intertrochanteric femur fractures in osteoporotic patients because of lack of rotational stability by the nail, it requires augmentation by cannulated compression screw to augment the rotational stability hence both providing axial and rotational stability. The main aim of any fixation device is to provide a stable fixation, enhance the union, cause early mobilisation and should be minimally invasive and technically less demanding, Enders nail plus cannulated cancellous screws fulfils this criteria and provides good functional outcomes in elderly patients with comorbid conditions [7].

Stable intertrochanteric fractures are fixed with dynamic hip screw and unstable intertrochanteric femur fractures are fixed with proximal femoral nail [8]. Dynamic hip screw (DHS) fixation causes joint penetration and cut out in osteoporotic patients [9]. DHS fixation is associated with excessive soft tissue stripping and bony loss

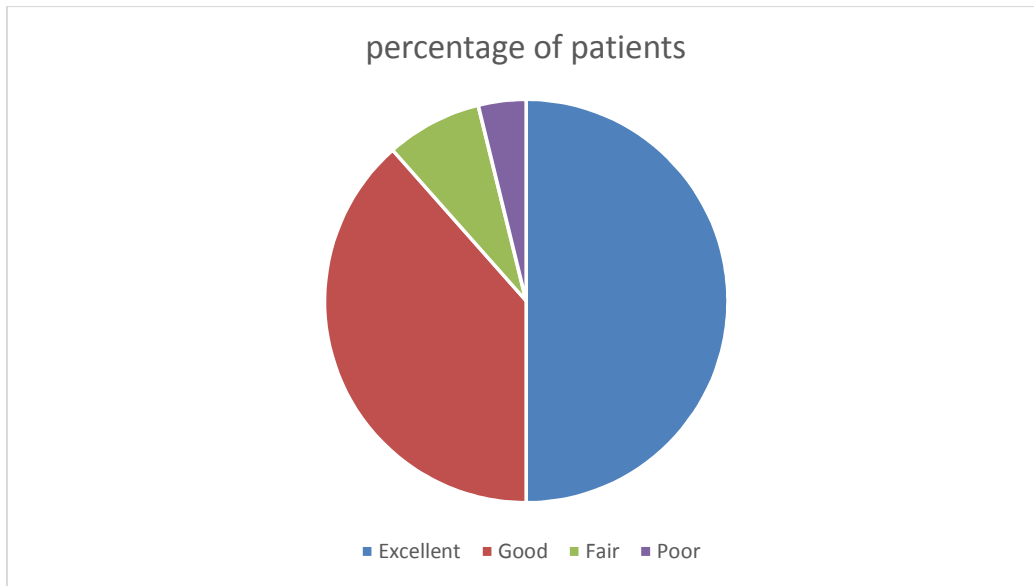
which can be detrimental for elderly osteoporotic individuals with comorbid condition. Proximal femoral nail (PFN) is technically demanding and dependent on the status of piriform fossa. In a patient with fracture involving piriform fossa, PFN is not ideal PFN causes back out of screws and z effect [10] Ender nails alone have also

been used in fixation of intertrochanteric fractures [11]. Past authors reported an unacceptably high failure rate with Ender nails alone [12]. The Ender nail used alone did not provide rotational stability and was associated with an increased risk of migration and joint penetration proximally or distally [13].

**Table 1. Modified Harris hip score**

<h2>Harris Hip Score</h2>	<b>Hip ID:</b> _____
	<b>Study Hip:</b> <input type="checkbox"/> Left <input type="checkbox"/> Right
	<b>Examination Date (MM/DD/YY):</b> /    /
	<b>Subject Initials:</b>
	<b>Medical Record Number:</b> _____
<b>Interval:</b> _____	
<b>Harris Hip Score</b>	
<p><b>Pain (check one)</b></p> <p><input type="checkbox"/> None or ignores it (44)</p> <p><input type="checkbox"/> Slight, occasional, no compromise in activities (40)</p> <p><input type="checkbox"/> Mild pain, no effect on average activities, rarely moderate pain with unusual activity; may take aspirin (30)</p> <p><input type="checkbox"/> Moderate Pain, tolerable but makes concession to pain. Some limitation of ordinary activity or work. May require Occasional pain medication stronger than aspirin (20)</p> <p><input type="checkbox"/> Marked pain, serious limitation of activities (10)</p> <p><input type="checkbox"/> Totally disabled, crippled, pain in bed, bedridden (0)</p> <p><b>Limp</b></p> <p><input type="checkbox"/> None (11)</p> <p><input type="checkbox"/> Slight (8)</p> <p><input type="checkbox"/> Moderate (5)</p> <p><input type="checkbox"/> Severe (0)</p> <p><b>Support</b></p> <p><input type="checkbox"/> None (11)</p> <p><input type="checkbox"/> Cane for long walks (7)</p> <p><input type="checkbox"/> Cane most of time (5)</p> <p><input type="checkbox"/> One crutch (3)</p> <p><input type="checkbox"/> Two canes (2)</p> <p><input type="checkbox"/> Two crutches or not able to walk (0)</p> <p><b>Distance Walked</b></p> <p><input type="checkbox"/> Unlimited (11)</p> <p><input type="checkbox"/> Six blocks (8)</p> <p><input type="checkbox"/> Two or three blocks (5)</p> <p><input type="checkbox"/> Indoors only (2)</p> <p><input type="checkbox"/> Bed and chair only (0)</p> <p><b>Sitting</b></p> <p><input type="checkbox"/> Comfortably in ordinary chair for one hour (5)</p> <p><input type="checkbox"/> On a high chair for 30 minutes (3)</p> <p><input type="checkbox"/> Unable to sit comfortably in any chair (0)</p> <p><b>Enter public transportation</b></p> <p><input type="checkbox"/> Yes (1)</p> <p><input type="checkbox"/> No (0)</p>	<p><b>Stairs</b></p> <p><input type="checkbox"/> Normally without using a railing (4)</p> <p><input type="checkbox"/> Normally using a railing (2)</p> <p><input type="checkbox"/> In any manner (1)</p> <p><input type="checkbox"/> Unable to do stairs (0)</p> <p><b>Put on Shoes and Socks</b></p> <p><input type="checkbox"/> With ease (4)</p> <p><input type="checkbox"/> With difficulty (2)</p> <p><input type="checkbox"/> Unable (0)</p> <p><b>Absence of Deformity (All yes = 4; Less than 4 =0)</b></p> <p>Less than 30° fixed flexion contracture    <input type="checkbox"/> Yes    <input type="checkbox"/> No</p> <p>Less than 10° fixed abduction    <input type="checkbox"/> Yes    <input type="checkbox"/> No</p> <p>Less than 10° fixed internal rotation in extension    <input type="checkbox"/> Yes    <input type="checkbox"/> No</p> <p>Limb length discrepancy less than 3.2 cm    <input type="checkbox"/> Yes    <input type="checkbox"/> No</p> <p><b>Range of Motion (*Indicates normal)</b></p> <p>Flexion (*140°)    _____</p> <p>Abduction (*40°)    _____</p> <p>Adduction (*40°)    _____</p> <p>External Rotation (*40°)    _____</p> <p>Internal Rotation (*40°)    _____</p> <p style="text-align: center;"><b>Range of Motion Scale</b></p> <p>211° - 300° (5)                      61° - 100 (2)</p> <p>161° - 210° (4)                      31° - 60° (1)</p> <p>101° - 160° (3)                      0° - 30° (0)</p> <p><b>Range of Motion Score</b> _____</p> <p><b>Total Harris Hip Score</b> _____</p>





**Graph 1. Percentatge of patients as per modified Harris hip score**

**Table 2. Grading of Modified Harris hip score**

Modified Harris hip score	Functional outcome
<70	Poor
70-79	Fair
80-89	Good
90-100	Excellent

**Table 3. Distribution of patients as per Modified Harris hip score**

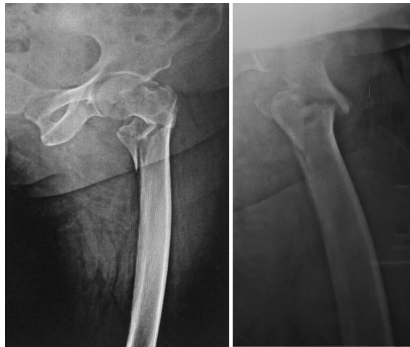
Functional outcome	No of patients	Percentage
Excellent	26	50
Good	20	38.46
Fair	04	7.69
Poor	02	3.84

We combine the enders nail and compression property of cannulated cancellous screws in fixation of intertrochanteric femur fracture [14]. This combination tended to augment the fracture stability in presence of osteoporosis [15]. However, the combined procedure brought union in all cases which could be listed as a merit [16]. Knee pain is the most common complication after enders nail and cannulated cancellous screw fixation due to impingement by the nail tip over the femoral condyles. Combination fixation of intertrochanteric fractures with Ender nails and compression screw is technically less demanding, minimally invasive, entails less operative time (beneficial factor in high risk cases) and least traumatic with minimal blood loss. This method can be used irrespective of the status of pyriformis fossa and has proved to be an ideal alternative procedure for fixation of

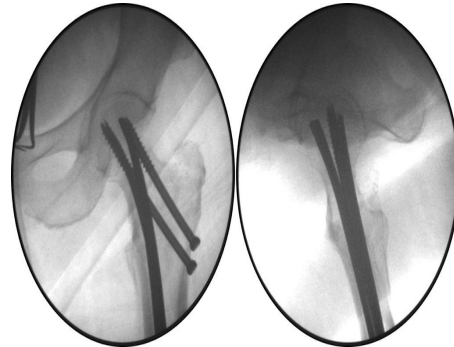
intertrochanteric fractures in elderly patients with high risk co-morbidities and osteoporosis.

Enders nailing being the intramedullary implants are biomechanically more superior than other extramedullary implants for the fixation of intertrochanteric emur fractures [17]. Enders nail helps in transfer of force during weight bearing to the entire length of femur shaft and allows good controlled collapse of the fracture during weight bearing. Enders nailing combined with cannulated compression screw is biomechanical system of fracture fixation because it provides biological fixation as fracture site is not opened and mechanical system as active fracture collapse occurs during the weight bearing of individual muscle tension and transfer of force occurs through the fracture site and entire length of the femur [18].

**Clinical Case 1:** Clinical photographs (Figs. 11, 12) showing knee and hip range of motion. Pre-operative X-ray (Fig. 7) of left hip joint of a 74-year-old female with intertrochanteric fracture. Post-operative antero-posterior and lateral (Fig. 8) radiographs of left hip showing satisfactorily maintained fracture reduction and implant in situ. Six months and 10 months follow-up antero-posterior and lateral radiographs (Fig. 9) of left hip showing fracture union with good alignment and clinical photographs (Figs. 11, 12) showing hip and knee range of motion.



**Fig. 7. Preoperative xray**



**Fig. 8. Postoperative xray**



**Fig. 9. 6 months follow up**



**Fig. 10. 1 year follow up xray**



**Fig. 11. Cross legged sitting**



**Fig. 12. Hip and Knee Flexion**

**Clinical Case 2:** Pre-operative X-ray (Fig. 13) of right hip joint of a 64-year-old female with intertrochanteric fracture. Post-operative antero-posterior and lateral (Fig. 14) radiographs of right hip showing satisfactorily maintained fracture reduction and implant in situ. Six months and 10 months follow-up antero-posterior and lateral radiographs (Fig. 15) of right hip showing fracture union with good alignment and Clinical photographs (Figs. 17, 18) showing hip and knee range of motion.



**Fig. 13. Preoperative xray**



**Fig. 14. Postoperative xray**



**Fig. 15. 6 months followup**



**Fig. 16. Cross legged sitting**



**Fig. 17. Squatting**



**Fig. 18. Straight leg raising**



## 5. CONCLUSION

In our study, combining the use of intramedullary implant Ender's nail and cannulated cancellous screw, and after analysing the result of this study and comparing with other studies [19], conclusions are as follow- 1) This method of closed reduction and internal fixation provide good functional recovery in elderly patients. 2) This method of operation is technically easy, minimally invasive, taking less intra-operative time, and having less intra-operative blood loss and other complications. 3). This method of operation have less post-operative infections.4) The use of Cannulated Cancellous Screws passed along with Ender's nail helps in Controlled Collapse of the fracture and keeps the fracture reduced and fixed in anatomical position. This method provides good axial and rotational stability.

Thus for the treatment of intertrochanteric fractures in elderly patients with co-morbidity, the combined use of Ender's nail and cannulated cancellous screw may provide good fracture reduction and stability and good functional outcome.

## CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

## ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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