

Role of Retrograde Multiple Enders Nail Fixation in Intertrochanteric Fractures in Elderly Population

Akhil Bansal¹, Amit Kumar Tandiya², Vinod Kumar Rawat², Saurabh Sharma³, Naresh Meena¹

¹Associate Professor, Department of Orthopaedics, Gandhi Medical College, Bhopal, Madhya Pradesh, India

²PG Resident, Department of Orthopaedics, Gandhi Medical College, Bhopal, Madhya Pradesh, India

³Assistant Professor, Department of Orthopaedics, Gandhi Medical College, Bhopal, Madhya Pradesh, India

Received: 27-08-2025 / Revised: 25-09-2025 / Accepted: 27-10-2025

Corresponding Author: Dr. Vinod Kumar Rawat

Conflict of interest: Nil

Abstract:

Background: Condylcephalic intramedullary Ender nailing was once a popular technique for treating intertrochanteric fractures of the femur. It offers several advantages, including short operative time, minimal soft tissue trauma, limited blood loss, and early mobilization, especially suitable for elderly and comorbid patients. However, improper technique may lead to complications such as nail migration, knee irritation, and reduced range of motion.

Aim and Objective: To evaluate the functional outcome and complications associated with properly performed Ender's nailing in intertrochanteric femur fractures, and to assess its applicability in osteoporotic and medically compromised patients.

Materials and Methods: A prospective study was conducted on 20 elderly patients (>50 years) with intertrochanteric femur fractures treated with Ender's nails at Gandhi Medical College and associated Hamidia Hospital, Bhopal, from December 2020 to November 2022. All fractures were classified according to the Boyd and Griffin classification. Operative time, blood loss, technical difficulties, and postoperative complications were recorded. Functional outcomes were assessed using the Harris Hip Score, with follow-up at regular monthly intervals for one year.

Results: Among 20 patients (12 males, 8 females), the mean operative time was 50 minutes, and the average blood loss was approximately 30 mL. All fractures achieved union within three months. Common complications included nail backout in 3 patients and malunion in 2 cases. There were no cases of delayed union, non-union, or infection. Osteoporosis was a significant factor contributing to mechanical complications. External rotation deformity was minimal and could be corrected using nails with an anteversion bend.

Conclusion: Ender's nailing remains a useful technique for stable intertrochanteric fractures, particularly in elderly or high-risk patients with poor skin condition or multiple comorbidities. When performed with correct technique and case selection, it significantly reduces operative time and blood loss, although complications like malunion and implant irritation may still occur. Its use in unstable fracture patterns remains limited and warrants further comparative studies.

Keywords: Ender's Nail, Intertrochanteric Fracture, Osteoporosis, Intramedullary Fixation, Elderly Patients.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

The goal of the fracture treatment has shifted from just union of the fracture to the maximal functional recovery of the limb as early as possible and prevent the complications of nail-plate fixation of intertrochanteric and subtrochanteric fractures of the femur like early postoperative mortality, delayed union and non-union of the fracture, wound infection and osteomyelitis, persistent pain in the hip, diminished walking capacity, and ultimately the need for additional operations on the hip. Various modalities of management, ranging from

conservative to different surgical procedures with different implants have been described for the treatment of intertrochanteric fractures, with merits and demerits of each [1-3]. However, after the introduction of the ender's nail in 1969 for the treatment of intertrochanteric fractures, ender's nails is the only device which is still being used by many orthopaedician, mainly in elderly age group, without modification. The advantages of using ender's nailing over other implants are ease of the procedure, decrease operative time, blood loss with

early mobilization. The aim of this study was to assess functional outcomes in patients having intertrochanteric fractures as per Harris hip score and to note any complications developed, failure and the type of technical errors encountered with Enders nail.

Materials and Method

In this study 20 elderly people more than 50 years with intertrochanteric femur fracture was treated with enders nail at the Department of Orthopaedics and Traumatology, Gandhi Medical College and associated Hamidia Hospital Bhopal from December 2020 to November 2022. This was a prospective study. Written and informed consent was taken. Inclusion criteria were elderly people more than 50 years, both sex, Intertrochanteric fracture, willing for surgery with osteoporotic bone. Exclusion criteria were patients age less than 50 years, disorders of bone metabolism other than osteoporosis, deformity over proximal femur, medically unfit, and patients not giving consent for surgery. We used enders nail made of stainless steel of 4.5 mm diameter and of appropriate length. The principle of Three-point fixation of using ender's nailing in intertrochanteric fracture—Fanning, Spanning and Jamming was applied in all cases. All the types of intertrochanteric fracture were included in the study. The fractures were classified according to Boyd and Griffin Classification. Roentgenographic grading of osteoporosis of the proximal end of femur by the method of Singh et al. was used whenever possible. Grade 1 was the most severe, in grade 6, 5 and 4, the principal tensile trabeculae were present but progressively decreased in thickness. They were discontinuous or missing in grade 3, 2 and 1.

Technique of Ender's Nailing: All procedures were performed under spinal or general anesthesia. After the anaesthesia, patient was positioned on the fracture table in supine, Closed reduction of the fracture was under C Arm and table was locked. The procedure was performed under all aseptic precautions and in most of the intertrochanteric fractures reduction in internal rotation was considered and was accomplished by positioning of the patella 20 to 30 degrees internally from middle position. If cerclage was needed, always done before inserting the nail. Nailing usually was performed from medial side. A longitudinal incision was made about 3-4 cm from the proximal adductor tubercle, the muscles were bluntly separated, bone holding clamp was applied and the window was opened in the bone by using of the awl. Size of ender nail was determined by keeping it over drapes under C-Arm. For stable intertrochanteric fracture the proximal tip of the inserted nails should reach upto 1cm of the

subchondral plate of the femoral head. For unstable fracture, in which sliding of the fragments might be expected, the tip of the selected nail should reach up to center of the femoral head. First pair nail to be inserted was bent at the tip, and not only to enable them to negotiate the femoral calcar curve but also to place their tips inferior to those of subsequent nails so as to spread out the nails in the femoral head and trochanter. The distal 1/3rd shaft is held with bone holding forceps to prevent complication such as an iatrogenic supracondylar femur fracture. The second or subsequent nails were slightly bent and aimed to the centre and proximal part of femoral head. The nails used were bent 10-15 degrees, 5-6 centimeter distal to the tip, in order to increase the rotational stability of the assembly. All the nails are tied with cerclage wire through the eyeholes with SS wire or K wire at the base to prevent backing out.

Traction was released after one or two nails had crossed the fracture site. Postoperatively, derotation boot or cast given for a period of 15 days to prevent rotation. Patient was allowed to sit up in the bed immediately. Knee mobilization was started after 2 weeks. Partial Weight bearing was started after 6 weeks postoperatively.

Results

The patients with intertrochanteric femur fracture, 20 in total out of which 12 were male and 8 were female with ages range above fifty years were included in the study. The average delay from injury to nailing was 5 days, and the average hospital stay was 14 days. The estimated average operative blood loss was 30 ml, and 200 milliliters of packed red cells, on average, was given to patients with a low hematocrit, regardless of the amount of intra operative blood loss in stable intertrochanteric fractures. The average operative time was fifty minutes. In unstable patients it was difficult to cross the fracture site and insert nails properly into the femoral head. These difficulties resulted in operative times longer than sixty minutes.

Complication and mortality: There were no early postoperative complications. However, 3 patients had nail backout and 2 patients had malunion at final follow-up. Patients were followed for from every month for up to 12 months post operatively but not having major complications such as early postoperative mortality, delayed union and non-union of the fracture, wound infection and osteomyelitis, persistent pain in hip, diminished walking capacity, Supracondylar fracture femur, femoral neck fracture, and various position of head in relation to the neck. All the patients healed within three months.



Figure 1: Preoperative X-ray showing intertrochanteric Fracture boyd and Griffin type 2



Figure 2: Showing post operative x-ray with enders nail in situ with K wire bent at end to prevent backing out of enders nail



Figure 3: showing backing out of enders nail

Discussion

It is generally well known that postero medial cortical instability and osteoporosis increase the failure rate of fixation of intertrochanteric and subtrochanteric fractures, and this knowledge has led to the development of various kinds of treatment. One such treatment is osteotomy of the greater trochanter and medial displacement of the distal fragment of the fractured femur. The displacement is considered an important strategy to achieve stability at the fracture site [7,8,9,10]. Other treatments involve specialized nails designed with the purpose of either diminishing the stress at the fracture site (telescoping nails) or making the nail strong enough to sustain that stress until the fracture is healed (I-beam [10], screw [11] or blunt cylinder [12]). McKibbin recently pointed out that a certain amount of motion at the fracture site is needed in order for the external callus to develop and that excessive motion is the cause of delayed union and non-union. [16] Pankovich et al. used the term dynamic controlled motion to describe the favorable extent of motion of fracture fragments fixed with Ender nails. [17]

Rigid plate screws, however, caused complications, including delayed union and non-union, wound infections and implant failure. In addition to bone fragments being devascularized, healing by callus formation is slow in the open reduction with DHS. Postoperative varus collapse, limb shortening and medial displacement of the distal fragment, as critical complications, were reported with DHS, which is one of the most widely used techniques for intertrochanteric fractures. Furthermore, plate fracture secondary to failure in a bending mode may occur. Intramedullary nails have a biomechanical advantage over DHS due to the fixation device within the medullary canal and also as it is loading sharing. The bending strength is considerably less than with DHS. Therefore, the use of long intramedullary nails that end at the supracondylar region of the femur has been advocated [13,14]. Although Ender nailing is a relatively simple procedure which is accomplished in a short period of time and with minimum trauma and loss of blood, when applied to intertrochanteric fractures. It is quite clear from the present study that the rate of complications was higher in unstable intertrochanteric fractures and osteoporotic bone than in stable fractures. In the unstable fractures, it was more difficult to insert the nails properly across the fracture site and into the femoral head, and consequently the operative time was usually longer. More postoperative complications, in particular proximal and distal migration of nails and failure of fixation, were evident. Functional results were clearly better in the stable fractures than in the unstable fractures. In Ender nailing of intertrochanteric fractures, the nails are subject to

minimum bending stress due to their central position within bone [15]. •Therefore, fatigue failure is unlikely to occur. It did not occur in the present study. Theoretically, delayed union and non-union are unlikely to occur after Ender nailing because the nails allow some pistoning of the fracture fragments and, to a lesser degree, some rotational and bending motion (dynamic controlled motion). Early formation of external callus is the result and healing is aided by the retention of blood supply to the fracture fragments, undisturbed by local operative trauma. In present study malunion and delayed union was in only two patient of an unstable intertrochanteric fracture. The fracture eventually did heal, ten months after nailing. Pistoning of the fragments along the Ender nails, however, was responsible for distal and proximal migration and penetration of the nails into the hip joint, possibly because some fragments were nailed in a distracted position. Few reports have included data concerning ranges of motion of the hip and knee following various treatment modalities. In the study of Roberts et al., twenty-nine patients were treated surgically with nail-plate fixation. Motion of the hip was normal in six patients, good in seven, fair in nine and poor in seven. In sixteen patients a flexion contracture of the involved hip developed, and ten patients also had a flexion contracture of the ipsilateral knee. Our results as regards range of motion were superior.

Jones et al. noted that in one-third of their patients an external rotation deformity developed following Ender nailing. They explained the deformity as a result of rotation of the fracture fragments relative to each other. The Ender nails were curved in only one plane, and were inserted into the femoral head while the distal fragment was held in some internal rotation, but during reduction of the fracture the neck loses all anteversion.

Waddell and Czitrom [18] made an anteversion bend at the tip of the nail and found that detail of technique effective in controlling external rotation. Although the results of our cadaver studies indicated that insertion of nails curved in only one plane into the femoral neck from bilateral supracondylar portals would control the tendency for external rotation, this deformity was not completely eliminated in our clinical cases. We have recently used nails with the anteversion bend and found them to be more effective in controlling external rotation.

Complications and failures after Ender nailing still are relatively frequent. In order to keep them at a minimum, Ender emphasized that careful selection of nails of appropriate length is of the greatest importance. The nails have to be just long enough so that their tips reach the subchondral bone in the femoral head. Fan-shaped placement of the nails in the femoral head is also important; so are stacking the nails in the femoral canal in order to prevent their

proximal or distal migration, accurate placement of the portal holes, and proper positioning of the distal end of each nail.

Conclusions

It appears from the present study that main advantages of ender nailing are economic, Short operative procedure, minimally traumatic, little blood loss in stable fracture patterns. but in unstable intertrochanteric fractures complications like Malunion, implant irritation and implant failure are common. enders Nail can be done in setting of stable intertrochanteric fracture, severe comorbidities, open intertrochanteric femur fracture and poor skin condition .in unstable intertrochanteric fracture enders nailing is questionable and further studies with large patient volume and comparison to other modalities is required.

References

1. General Principles of Fracture Management. Campbell's Operative Orthopedics 10th international edition, 2003, 3.
2. David La Velle G. Fractures of Hip; Campbell's Operative Orthopaedics. International Edition, 2003, IV-I.
3. Bucholz RW, Heckman JD, Koval KJ, Zukerman JD. Rockwood and Green's fractures in adults. 6th ed. Philadelphia: Lippincott Williams and Wilkins, 2005.
4. Hrubina M, Skoták M, Běhounek J. Complications of Dynamic Hip Screw Treatment for Proximal Femoral Fractures. Actachirurgiae orthopaedicae ettraumatologiae Cechoslovaca. 2010; 77:395-401.
5. Shrihari LK, Sunil Mannual, Sapan DS. A clinical study of distal femoral fractures treated by retrograde femoral nailing–biological and biomechanical advantages with review of literature. International Journal of Orthopaedics Traumatology & Surgical Sciences. 2016; 2(2): 371-377
6. Sarathy PM, Madhavan Prakash, Ravichandran MK. Nonunion of intertrochanteric fractures of the femur. Treatment by modified medial displacement and valgus osteotomy. The Journal of bone and joint surgery.British.1995; 77:90-2. 10.1302/0301-620X.77B1.7822404.
7. DIMON, J. H., III, and HUGHSTON, J. C.: Unstable Intertrochanteric Fractures ofthe Hip. J. Bone and Joint Surg., 49-A: 440-450, April 1967.
8. Harrington, K. D., and Johnston, J. O.: The Management of Comminuted Unstable Intertrochanteric Fractures. J. Bone and Joint Surg., 55-A: 1367-1376, Oct. 1973.
9. Kaufer, H.; Matthews, L. S.; and Sonstegard, D. A.: Fixation Mechanics of Intertrochanteric Fractures. In The Hip: Proceedings of the Sixth Open Scientific Meeting of The Hip Society, pp. 207-222. St. Louis, C. V. Mosby, 1978.
10. Sarmiento, Augusto, and Williams, E. M.: The Unstable Intertrochanteric Fracture: Treatment with a Valgus Osteotomy and I-Beam NailPlate. A Preliminary Report of One Hundred Cases. J. Bone and Joint Surg., 52-A: 1309-1318, Oct. 1970.
11. Schumpelick W., and Jantzen, P. M.: A New Principle in the Operative Treatment of Trochanteric Fractures of the Femur. J. Bone and Joint Surg. , 37-A: 693-698, July 1955.
12. Hot.T, E. P., JR.: Hip Fractures in the Trochanteric Region: Treatment with a Strong Nail and Early Weight-Bearing. A Report of One Hundred Cases. J. Bone and Joint Surg. ,45-A: 687-705, June 1963.
13. Gardner MJBMS, Kopjar B, Helfet DL, et al. Radiographic outcomes of intertrochanteric hip fractures treated with the trochanteric fixation nail. Injury 2007;38(10):1189-1196
14. Gill JJ, Chin PC, Rafiei P, et al. Intertrochanteric hip fractures treated with the trochanteric fixation nail and sliding hip screw. J Surg OrthopAdv 2007;16(2):62-66.
15. ENDER, H .G .: Treatment of Pertrochanteric and Subtrochanteric Fractures of the Femur with Ender Pins. In The Hip: Proceedings of the Sixth Open Scientific Meeting of The Hip Society, pp. 187-206. St. Louis, C. V. Mosby, 1978.
16. McKibbin, B., 1978. The biology of fracture healing in long bones. J. Bone Joint Surg. Br. Vol. 60-B (2), 150–162.
17. Pankovich AM. Flexible intramedullary nailing of long bone fractures: a review. J Orthop Trauma. 1987;1(1):78-95. doi: 10.1097/00005131-198701010-00014. PMID: 3333515.
18. Waddell JP, Czitrom A, Simmons EH. Ender nailing in fractures of the proximal femur. J Trauma. 1987 Aug;27(8):911-6. doi: 10.1097/00005373-198708000-00011. PMID: 3612869.