Cannulated Cancellous Screw and Ender’s Nail Fixation in Intertrochanteric Femur Fracture in Elderly Patient With Co-Morbid Condition

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Abstract:

Background: Intertrochanteric Femur fracture is common in elderly patient with co-morbidity

Aims & Objectives: Clinico-radiological evaluation of results of Ender’s nail and cannulated cancellous screw fixation in case of intertrochanteric fracture of femur in elderly patient with pre-existing co-morbidity condition, and functional recovery in those patients.

Results: The patients mainly belong to elder age group with co-morbid condition and all operated within two weeks of fracture. All the fractures were united within an average period of 13 weeks with a range of 10 – 16 weeks. In an average, 20% of the patients had accurate anatomical reduction and the neck-shaft angle was same as on unaffected side, 65% of the patients had 3 to 5 degree of variations in the neck-shaft angle compared to unaffected side, and 15% of patients had more than 10 degree of variation in the neck-shaft angle compared to unaffected side.

Conclusion: The combined use of Ender’s nail and cannulated cancellous screw may provide good fracture reduction and stability and good functional outcome in elderly patient with intertrochanteric femur fracture.

Keywords: Intertrochanteric, co-morbidity, neck-shaft angle

I. Introduction

Intertrochanteric fracture of femur involves those occurring in the region extending from the extra-capsular basilar neck region to the region along the lesser trochanter, proximal to the development of the medullary canal. Injury creates a spectrum of fractures in the proximal metaphyseal region of bone, with damage to the intersecting cancellous compression and tensile lamellar networks and the weak cortical bone. Attachments of different muscle in these region causes displacement of the fracture fragments. The Intertrochanter femoral fractures make up approx. 34% of all hip fractures(1) and the largest number of fractures occur in female older than 65 years(2,3,4). The intertrochanteric fracture were more common in severely osteoporotic women(5,6), because the fall of an elderly person from an erect position typically generate at least 16 times the energy necessary to fracture the proximal femur(7). Four factors contribute to determining whether a particular fall results in a fracture of hip region-(a) The faller must be oriented to impact near the hip;(b) Protective responses must fail; (c) Local soft tissues must absorb less energy than necessary to prevent fracture, and (d) The residual energy of the fall applied to the proximal femur must exceed its strength. Fall with a rotational component are more common with extra-capsular hip fracture(8).

The treatment of intertrochanteric fracture evolves from non-operative to operative over decades. Non-operative treatment with traction and prolonged bed rest should only be considered in non-ambulatory or severely demented patients with controllable pain, or patients with terminal disease with less than 6 weeks of life expected. Severe medical comorbidities that preclude surgical treatment and active infectious diseases that preclude insertion of a surgical implant are also relative contraindications. Operative management, which allows early rehabilitation and offers the best chance for functional recovery, is now the treatment of choice for virtually all intertrochanteric Femur fractures. The goal of operative treatment is strong, stable fixation of the fracture fragments. The following variables as those that determine the strength of the fracture-implant assembly: (a) Bone quality, (b) Fragment geometry, (c) Reduction, (d) Implant design, and (e) Implant placement. Multiple modalities of surgical treatment must be mastered and available for the surgeon’s treatment since the fracture patterns are not uniform, the morphology of the femur has significant variations, and the pre-existing comorbidities of the elderly patients confound simple algorithm. The type of implant used has an important influence on complications of fixation. Sliding devices like the dynamic hip screw have been extensively used for fixation. However, if the patient bears weight early, especially in comminuted fractures, these devices can penetrate the head or neck, bend, break or separate from the shaft. Intramedullary devices like the proximal femoral nail have been reported to have an advantage in such fractures as their placement allowed

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the implant to lie closer to the mechanical axis of the extremity, thereby decreasing the lever arm and bending moment on the implant. They can also be inserted faster, with less operative blood loss and allow early weight bearing with less resultant shortening on long- term follow- up. The dynamic hip screw (DHS) was introduced by the AO/ASIF. This technique has produced results that are equal to or better than several types of osteotomies\textsuperscript{(10,11,12)} and it remains the mainstay of treatment today.

In the mid-to-late 1970's, flexible intramedullary devices for the fixation of intertrochanteric fractures were introduced in the form of the Ender's nail and the condylocephalic nail. The advantage of these devices were due to their intramedullary position, which places them closer to the resultant force across the fracture and reduces the bending moment on the device. In addition, the use of distal sites of insertion to decrease operative time and loss of blood, compared with the use of proximal sites, was reported\textsuperscript{(13,14)} . This operative technique was made possible by the use of image intensification and was promoted as a closed method for the fixation of intertrochanteric fractures. However, a high prevalence of varus deformity, as well as pain in the knee caused by distal migration of the pins, were reported in association with this procedure. These problems led to a high rate of re-operation for extraction of the pins and correction of deformity. A high rate of failure due to loss of reduction, shortening, and external rotation resulted both from Ender nails and from condylocephalic nails. The first-generation nail for treatment of intertrochanteric fractures, the Gamma nail, was associated with a relatively high incidence of peri-implant fracture of 2.2% to 17%, approximately 4 times greater than seen with compression hip screws\textsuperscript{(15,16)} . The current third-generation nails such as the proximal femoral nail (PFN), which incorporate multiple screws into the femoral head, show cut out rates of 0.6% to 1.4%, whereas the tendency to varus displacement was low in comparison with other implants\textsuperscript{(17)}.

The longest experience has been with the use of Ender's nail. Ender and Simon Weidner\textsuperscript{(18)} popularized the concept of closed condylocephalic nailing for intertrochanteric fractures in 1970, and mainly indicated for intertrochanteric fracture in elderly. There are two main problems which complicate the treatment of elderly patients; first the poor general condition renders an immediate and extensive open reduction and fixation very risky, and second, the location of fracture in the area of the femur where bending stress is highest; and was associated with significant incidence of complications, including rotational deformity, supracondylar femur fracture, proximal migration of the nail through femoral head, and back- out of nail with resultant knee pain and stiffness. The Ender’s nailing alone cannot provide secure fixation in elderly patients with osteoporosis. The insertion of cannulated cancellous screw after Ender’s nail is introduced, resulted in controlled collapse of the fracture, in which the cannulated cancellous screw acts as guide and directs the collapse of fracture in its direction. So the neck- shaft angle remains maintained and the varus malunion resulting from Ender’s nail alone can be prevented. Hence we conducted a study to evaluate the results of closed reduction and internal fixation using Ender’s nail and 6.5 mm cannulated cancellous screw for intertrochanteric fracture of Femur.

II. Materials And Methods

This is a prospective observational study that was conducted in the Department of Orthopedics, IPGME&R and SSKM Hospital, Kolkata during the period of December 2015 to February 2017. The study includes 40 Patients with intertrochanteric fractures of femur, attending Orthopaedics outdoor and emergency department in this hospital. The patients in the study were evaluated by a detailed history, clinical and radiological examination. Detailed history includes patient identification which includes name, age, sex, gender and residential address. Patients were evaluated regarding pre-injury mobility status on the basis of their ability to walk within their place of residence, their ability to walk outside and their ability to go shopping and each activity was assigned a score on the basis of its level of difficulty, quality of bone, presence of osteoporosis, pre-existing co- morbidities like diabetes, hypertension, COPD, Asthma, bleeding disorders and multiple fractures. Mode and time of injury were noted. Thorough clinical examination of patients were done to rule out associated intra-abdominal, intra-thoracic, head and neck injuries and to rule out other associated osteoporosis related fractures such as a distal radius or proximal humeral fracture. The affected limb was thoroughly examined to rule out vascular or neurological injury. Ipsilateral knee and spine examined for associated injury. Anteroposterior radiograph of pelvis showing both hips, and lateral view of involved proximal femur were obtained. We included those patients having age $\geq 50$ years, with multiple co- morbid conditions like diabetes, hypertension, COPD, Asthma, bleeding disorders and multiple fractures, and duration of the Intertrochanteric fracture $\leq$ two week. We exclude young active patients $< 50$ yrs age, fracture $> 2$ weeks duration, fracture with lateral wall comminution and open fractures. We also exclude the patients who became anaesthetically unfit or died or loss of follow-up within six months of operation.

After thorough pre-anaesthetic check up with pathological, biochemical and radiological examination, patients were deemed fit for surgery.
Implants Used For Fracture Fixation (Figure :1)
4.0/ 4.5 mm Ender’s nails, 6.5mm cannulated cancellous screws and Instrumentation set.

Surgical Technique
After proper anaesthesia, patients were positioned on a fracture table in supine position. Both the legs were widely abducted and feet were fixed in the boots of the traction device of the fracture table. Closed reduction of the fracture was done by combination of traction and rotation under image intensifier control in both anteroposterior and lateral views. After proper draping, a longitudinal skin incision 5-7 cm long, beginning just distal to the medial epicondyle and extending proximally, was made. The deep fascia was split just anterior to the medial inter-muscular septum, and the vastus medialis was reflected anteriorly to expose the femur subperiosteally, just above the superior medial geniculate artery, with special care to it. With drill or awl an opening is made, which is at least 15 mm wide, to accommodate two 4.0/ 4.5 mm Ender’s nails side by side. Two Ender’s nails of proper size were inserted, making an effort to fan within neck and head of femur in both AP and Lateral view. The first nail’s tip is slightly anteverted. 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
Result And Analysis

In our study, 40 patients were studied. Among them 75% of the patients were in the age group more than 60 years and 25% of the patients were in the age group less than 60 years, with mean age of approx. 65 yrs. This indicate that maximum patients are elderly and have same physiological age, and the intertrochanteric fractures are more common in elderly. The male: female ratio in our study was 1.86:1, where 65% patients were males, which indicate higher incidence in male. This may be due to that males are more exposed to RTA, as in our study out of 28 male patients, twelve had injury due to RTA. In our study both right and left side were equally involved. Among co-morbidities, diabetes and hypertension were most frequently associated (>90%). This indicate that systemic medical illness may have impact on intertrochanteric fracture. In our study, low velocity trauma (LVT) was the most common (70%) mode of injury. This indicate that decreased bone mass index with age, especially in females, and poor protective responses with age, causes fractures with simple trauma. Seventy five percent of the fractures were of AO type 31A2. Fractures with lateral wall comminution i.e. AO type 31A3 were excluded from inclusion criteria. In our study, 35% patients were operated within a week and 65% patients were operated after a week. This may be due to the fact that all patients had pre-existing co morbidities which had taken time for optimization prior to surgery.

In our study the average intra-operative blood loss were of 60-70 ml. The low amount of blood loss is an important factor in surgery in elderly patients. In the post-operative period, antibiotic and analgesic coverage for seven days were given. Hip and knee physiotherapy were started from the next post-operative day. All the patients were discharged after assessment of wound at first postoperative dressing. Sutures were removed after two weeks. Non-weight bearing walking with bilateral axillary crutch were allowed after effect of spinal anaesthesia was over i.e. after 48-72 hrs. In our study the range of follow-up period was 6 to 14 months with the mean of 11.5 months. There was no loss of follow-up. The patients were followed up regularly at 4 week intervals for the first 6 months, and then at 3 month intervals. At each follow-up, patient was assessed clinically, radiologically and functionally. Radiological assessment was done by digital X-ray of pelvis with both hip AP view and Lateral view of the operated hip with femur. Knee was also X-rayed as and when indicated. Functional assessment was done by modified Harris hip score. In our study all fractures were united within an average period of 13 weeks, with a range 10 – 16 weeks. In an average, 20% of the patients had accurate anatomical reduction and the neck-shaft angle was same as on unaffected side, 65% of the patients had 3 to 5 degree of variations in the neck-shaft angle compared to unaffected side, and 15% of patients had more than 10 degree of variation in the neck-shaft angle compared to unaffected side. The average neck-shaft angle of the fractured hip in the last follow-up X-ray was 128.55 degree, with a range of 115 to 135 degree. The average difference between the neck-shaft angle of fractured side and the normal side, in the last follow up X-ray was 4.80 degree. In our study, none of the patients had any systemic complications. Post-operative period

Total Harris hip score 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.
was uneventful in most patients, except two patients who developed superficial infection at nail entry points which was managed with dressings and antibiotics according to culture and sensitivity. Partial weight bearing walking was allowed after assessing for radiological and clinical union, usually at 12 to 14 weeks. Full weight bearing was achieved within 6 to 9 months in all patients, 20% had knee pain with decreased range of motion and 15% patients had decreased range of motion in hip. One patient had back-out of Ender’s nail and 5 cases had cannulated cancellous screw cut-out or back-out. All these 6 cases were treated with removal of implants as soon as radiological union occurred.

In our study all the fractures were united, but two of them were united with external rotation deformity and three of them had varus deformity. In our study, 60% of the patients had no leg-length discrepancy, 35% of the patients had leg-length discrepancy less than one cm, and 5% of the 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 and the mean was 86.3 with a range from 73 to 95, and 16 patients were excellent, 20 patients were good and 4 patients were fair with respect to total score. The analysis of this study fulfils the objectives of a good functional outcome.

The limitations of our study are low sample size, non-comparative study, exclusion of lateral wall comminution fractures and short follow-up period.

Thus, analysing the result of this study and comparing with other studies, this method of treatment could be a suitable option for fracture stability with minimal complications and good functional recovery in case of intertrochanteric fracture in elderly.

IV. Summary

This study, was conducted at department of Orthopaedics, IPGMER& SSKMH, with the objective to see whether results of combined use of Ender’s nail and cannulated cancellous screw will provide best functional recovery in case of intertrochanteric fracture in elderly with pre-existing co-morbid condition. In our study, 40 elderly patients were selected on random basis, from those who attended the outpatient department and emergencies during December 2015 to February 2017, having intertrochanteric fracture of less than two week duration, intertrochanteric fracture with subtrochanteric extension, multiple fractures, and associated medical co-morbidities that can be controlled before surgery.

V. Conclusion

The Ender’s nail for the treatment of pertrochanteric fractures have been used since long time and the early results were very promising, but subsequently the complications associated with its use decreased the popularity among the surgeons, and new systems of intramedullary and extramedullary fixations gained popularity. Because of their fan-shaped positioning in the femoral head, the Ender’s nail guarantee a good grip in the proximal fragment, and transfer the force during weight bearing process to the entire length of femoral shaft. Ender’s nail allow good surface contact of the fracture site by collapsing the fragments along the nails; this may cause their ends to back-out by a few mm at the entrance hole, without, however causing knee pain. Mechanically, this system is advantageous because of the medial course of the nails and the low bending stress imposed on them. Bio-dynamically, it is advantageous because the fracture site takes an active part in the weight bearing process because of the telescoping effect, and is brought under physiologic compression because of the muscle tension and weight bearing.

The advantages are remote reduction and atraumatic intramedullary fixation through a small opening far distal from fracture site, decreased blood loss, deceased mortality, minimal surgical trauma secondary to not opening the fracture site, and decreased anaesthetic and operative time. The intramedullary implants are biomechanically more acceptable particularly regarding bending stress at weight bearing site. 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, 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.
Photograph Case 1

Fig 6: # IT Femur (Left)

Fig 7: United # Left Femur AP & Lateral (24 weeks)
Case 2

Fig 8: Clinical photograph at 24 weeks follow up

Fig 9: IT# Femur (Right)

Fig 10: United # Right Femur (27 weeks)
Fig 11: Clinical photograph at 27 weeks follow up

Bibliography