

FUNCTIONAL OUTCOME AND ASSOCIATED COMPLICATIONS OF INTERTROCHANTERIC FRACTURE TREATED WITH TROCHANTERIC FEMORAL NAIL: A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Introduction: As age increases, fall becomes more often so as intertrochanteric fracture of femur. Because of early mobilization, The Trochanteric Femoral Nail (TFN) is found effective and suitable in Indian population as it is smaller in size than Proximal Femoral Nail (PFN). **AIM:** To clinically evaluate the functional outcome and associated complications of intertrochanteric fracture treated with trochanteric femoral nail. **Methodology:** Study was done in 30 patients with intertrochanteric fractures treated with trochanteric femoral nail. Patients were followed up at 6 wks, 3 months, and 6 months. The intraoperative blood loss, duration of surgery, intra operative complications, post-operative complication, duration of hospital stay were studied. Functional outcome was assessed based on Kyle's criteria. **Results:** In our series of 30 cases there were 22 male and 8 female, maximum age of 90 yrs and minimum age of 20 yrs, most of the patients were between 60 to 70 yrs. Mean age of 58 yrs. 63.3% of cases were admitted due to Domestic fall and 36.7% due to road traffic accidents with common predominance of both sides. AO Type 31A2 fracture accounted for 40 % of cases. Mean duration of hospital stay is 14 days and mean time of full weight bearing is 6 wks. Good to excellent results are seen in 81% cases, Fair in 16%, 3% case with poor results according to Kyle's criteria. **Conclusion:** Trochanteric femoral nail to be more useful in unstable and reverse oblique patterns due to the fact that it has better axial telescoping and rotational stability. Intertrochanteric fractures treated with Trochanteric femoral nail have better functional outcome with less complication rate.

Keywords: Trochanteric Femoral Nail, Intertrochanteric fractures; Functional outcome.

INTRODUCTION

As age increases, fall becomes more often so as intertrochanteric fracture of femur. The increased prevalence of osteoporosis increases intertrochanteric fractures [1]. Trivial fall accounts for 90% of intertrochanteric fractures in elderly due to osteoporotic bone [2,3]. But in young individuals high energy trauma such as motor vehicle accident or fall from height [3].

These intertrochanteric fractures leads to high rates of morbidity and mortality as they need prolonged immobilization, but recent advances in modalities of internal fixation have improved results [4]. The primary goal of treatment is early mobilization, which can be achieved by good reduction and internal fixation. The dynamic hip screw has been considered the device of choice because it is time tested implant in fracture union. The drawback of sliding hip screw is loss of hip offset and shortening of the leg. Now fourth generation of intramedullary nails like proximal femoral nails gained

popularity [5].

Proximal femur nail were not found to be very effective in Indian population as there is anthropometric variation of proximal femur which may lead to an increased difficulty in placement of femoral neck screws. The Trochanteric Femoral Nail (TFN) is found effective and suitable in Indian population as it is smaller in size than Proximal Femoral Nail (PFN) [6]. Here is an effort to study the results of Trochanteric Femoral Nail in the management of intertrochanteric fractures by analyzing the factors which influence the postoperative mobility.

MATERIAL AND METHODS

Study design: Prospective observational study.

Ethics approval: The study was approved by IEC.

Study location: Department of Orthopedics, Shri B M Patil Medical College, Vijayapura, Karnataka, India.

Study period:

Sampling size: Consecutive sampling method was used. The study involved 30 confirmed cases of intertrochanteric fractures

Study population: In the study confirmed cases of intertrochanteric fractures of either sex were treated with intramedullary fixation "Trochanteric femoral



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nail”.

Following inclusion and exclusion criteria were used.

Inclusion criteria: Patient who has been diagnosed as having intertrochanteric fractures and treated with Trochanteric femoral nail. Patients more than 18 years of age,

Exclusion criteria: Patients with sub trochanteric extension, with compound fractures, pathological fractures.

Methodology:

Patients admitted with Intertrochanteric fracture were examined and investigated with X-ray pelvis with both hips AP and Lateral view (whenever possible). Skin traction was applied to all cases. X-ray were reviewed again and classified with using Orthopedic Trauma Association (OTA) classification. All fractures were treated using a Trochanteric femoral nail were followed up at 6 weeks, 3months, and 6 months. During the follow up period the intraoperative blood loss, duration of surgery, intra operative complications, postoperative complication, duration of hospital stay were studied. Functional outcome was assessed based on Kyle’ [7] criteria were noted. All patients at 6 months of follow up (after fracture union) were assessed clinically and functionally as per the following criteria. Patients were followed up for a minimum of 6months.

Excellent: a. Fracture united, b. No pain, c. No infection, d. Full range of motion at hip, e. No shortening, f. Patient able to sit crossed leg and squat, g. Independent gait.

Good: a. Fracture united, b. Occasional pain, c. No infection, d. Terminal restriction of hip movements, e. Shortening by half an inch, f. Patient able to sit crossed leg and squat, g. Use of cane back to full normal activity.

Fair: a. Fracture united, b. Moderate hip pain, c. No infection, d. Flexion restricted beyond eighty degrees, e. Noticeable limb shortening up to one inch, f. Patient not able to sit crossed leg, g. Patient walks with support of walker, h. Back to normal activities with minimal adjustments.

Poor: a. Fractures not united, b. Pain even with slightest movement at hip or rest, c. Infection, d. Range of movements at hip restricted, Flexion restricted beyond sixty degrees, e. Shortening more than one inch, f. Patient not able to sit crossed leg or squat, g. Patient cannot walk without walking aid, h. Normal activities not resumed.

RESULTS

The study involved 30 confirmed cases of Intertrochanteric fractures of either sex. There were 22 males and 8 females in the study. All the cases were treated with Intramedullary fixation “Trochanteric femoral nail”. The age distribution was from 18 to 90 years. The average age was 58 years and the largest group of patients

being from 60 to 70 years. 19 (63%) patient had fracture due to domestic fall and 11 (37%) patient due to road traffic accident. All the fractures were classified as per Orthopedic Trauma Association (OTA) classification. In which 31A1 were considered stable fractures. 31A2 and 31A3 were unstable fractures. In our study, ten patients were 31A1, twelve were 31A2, and eight were 31A3 type. Average operating time was 55mins (32min-95min) after anesthesia. Closed reduction was achieved in 27 patients (90%), whereas 3 (10%) patient required open reduction.

The average operating time was 55 minutes from the incision to closure. The average hospital stay was 14 days. It was more in patients with co-morbid conditions and complications with highest being 26 days.

The average hospital stay was 14.11 days (10 minimum – 26 maximum) from date of admission to date of discharge.

Table 1. Fracture pattern

Type of fracture	No of patients	Percentage
31A1	10	33.3
31A2	12	40
31A3	8	26.7

Table 2. Intra and post- operative complications

Complications	No of patients
Difficulty in achieving closed reduction	3(10%)
failed to achieve anatomical reduction	1(3.3%)
fixation of fracture in varus angulation	1 (3.3%)
Jamming of Instruments	1 (3.3%)
Greater trochanter splintering	1 (3.3%)
Post-operative early complications	
Shortening	2 (3%)
Rotation deformity	0 (0%)
Superficial infection	2 (6.7%)
Delayed complications	
Nil	25 (83.3)
Shortening	2 (6.7)
Varus Mal union	2 (6.7)
Z-EFFECT	1 (3.3)

Intra-operative complication: In three of our patient we had to do open reduction, while in one cases we failed to achieve anatomical reduction. Greater trochanter splintering was seen in one patient which was healed well Later and in one case of fixation of fracture in varus angulation.

Post-operative complication: Total Post-operative complications in our study were 17%. Early post-

operative complications were shortening of 2 mm is seen in 2 patient and in two patient superficial infection was seen.

Late complications were in one case the 'Z'- effect of implant failure was seen. Early weight bearing, improper screw placement, stress risers were the causes of this failure. Two patients had Varus Mal union in our study.

Results were evaluated by Kyle's criteria⁷ in our series we had 36.7% excellent, 43.3% good, 16.7 % fair and 3.3% poor results.

The average intra operative blood loss was very minimal. The average was 81ml and it was more in patients who required a limited open reduction. Only four (11 %) of our patients required intra or post-operative transfusion. But many of them had very low preoperative hemoglobin.

Radiation exposure was calculated in seconds, it was 599.11 seconds by the C-arm. Stable fractures required less exposure than the unstable fractures. This is far below the toxic levels of the radiation. Infection was present in 6.7% of the patient it was superficial which was treated with antibiotics and dressing in the ward, none required debridement or revision and healed well.

Table 3. functional outcome according to Kyle's Criteria 7

Results	No of patients	Percentage
Excellent	11	36.7
Good	13	43.3
Fair	5	16.7
Poor	1	3.3
Total	30	100.0

RADIOLOGICAL PHOTO GRAPHS



Figure 1. Pre operative X ray



Figure 2. Immediate post operative



Figure 3. Follow up at Six Months

INTRA OPERATIVE COMPLICATION



Figure 4. Greater Trochanter Splintering

POST OPERATIVE COMPLICATION



Figure 5. Z effect at 1.5 months



Figure 6. Union of fracture after revision surgery.

DISCUSSION

The successful treatment of Intertrochanteric fractures depends on many factors like [8]: Age of the patient, patient's general health, time from fracture to treatment, the adequacy of treatment, concurrent medical illness. Stability of the fixation. At present it is generally believed that all Intertrochanteric fractures should be internally fixed to reduce the morbidity and the mortality of the patient. But the appropriate method and the ideal implant by which to fix the Intertrochanteric fracture is still in a debate. Because each method having its own advantages and the disadvantages.

In the present study 30 patients of Intertrochanteric fractures were studied. In our study the average age was 58 years. We had an 22 male patients and 8 fe-

male patients. The most common mode of injury in our study was domestic fall 63.7%, which is comparable to most of the Indian studies. This was also affected by the age as the older the patient are more likely getting the fracture by domestic falls. In our study 33% were stable fracture pattern and 67% were unstable.

Total post-operative complications in our study were 17%. We had "Z - effect" in 3.3% of patients which was mostly due to improper placement of the hip screw or cervical screw and early mobilization of the patients. All these patients required revision with a different size screws and fracture healed well after revision. This was comparable to W. M. Gadegone et al [9] it was slightly lower than their study.

There was no case of non-union. 3% of our patients had greater trochanter splintering while inserting the nail but no other intervention was required and all the fractures healed well.

Infection was present in 6.7% of the patient it was superficial which was treated with antibiotics and dressing in the ward, none required debridement or revision and healed well. At the follow up there was no complaint of anterior thigh pain or the fracture of the femoral shaft at the tip of the nail.

Results were evaluated by Kyle's criteria's7 in our series we had 36.7% excellent, 43.3% good, 16.7 % fair and 3.3% poor results. It was similar to W. M. Gadegone et al [9] & Pavelka et al [10] that the use of TFN may have a positive effect on the speed at which walking is restored.

The success of Trochanter femoral nail depended on good surgical technique, proper instrumentation and good C-arm visualization. All the patients were operated on fracture table. We found following advantages. Reduction with traction is easier, less assistance is required, Manipulation of the patient is reduced to minimum, Trauma to patient is decreased and better use of C-arm with better visibility.

Placement of the patient on the fracture table is important, for better access to the greater trochanter the upper body is abducted away 10-15°. Position of the C-arm should be such that proximal femur is seen properly in AP and lateral view.

The anatomical reduction and secure fixation of the patient on the operating table are absolutely vital for easy handling and good surgical result. If reduction was not achieved by traction and manipulation then nail reduction was done, in which nail was introduced in the proximal fragment and reduction was tried by rotational movements and compression by the nail. If still reduction was a problem, then it was achieved by limited open reduction at the fracture site.

In our study 10% patients required limited open reduction which was higher than Christian Boldin et al as

they required in 9% [11]. The entry point of the nail was taken on the tip or the lateral part of the greater trochanter. As the nail has 6° of valgus angle medial entry point cause more distraction of the fracture.

The hip pin is inserted 5mm away from the subchondral bone in the lower half in the AP view and center on the neck in the lateral view. The cervical pin is placed parallel to the hip pin in AP view and overlapping it in the lateral view. It should be 10mm shorter than the hip pin from the subchondral bone. This ensures that the cervical screw will not take the weight load but only fulfill the anti-rotational function. Failure to do this leads to the "Z - effect". In which the cervical pin backs out and the hip pin pierces the joint or the vice-versa. Distal locking was done with the interlocking bolt and both static and dynamic holes were locked in all the nails in our study.

In our study one of the important factor was the cost of the implant as Trochanteric femoral nail is costly than the dynamic hip screw, but at the end it didn't cause much of the difference as:

- I. Less operative time thus reducing the cost
- II. No or less need of transfusion of blood
- III. Post operative antibiotics were used less thus reducing the cost of the drugs
- IV. Less hospital stay
- V. Early return to daily activities.

Dynamic hip screw introduced by clawson in 1964 remains the implant of choice due to its favorable results and low rate of complications. It provides control compression at the fracture site. Its use has been supported by its biomechanical properties which have been assumed to improve the healing of the fracture [12]. But dynamic hip screw requires a relatively larger exposure, more tissue trauma and anatomical reduction. All these increase the morbidity, probability of infection and significant blood loss. It also causes varus collapse leading to shortening and inability of the implant to survive until the fracture union.

The plate and screw device will weaken the bone mechanically. The common causes of fixation failure are instability of the fractures, osteoporosis, lack of anatomical reduction, failure of fixation device and incorrect placement of the screw.[13]

We found Trochanteric femoral nail to be more useful in unstable and reverse oblique patterns due to the fact that it has better axial telescoping and rotational stability. It has shown to be more biomechanically stronger because they can withstand higher static and several fold higher cyclical loading than dynamic hip screw. So the fracture heals without the primary restoration of the medial support. The implant compensates for the function of the medial column.[10]

The gamma nail is associated with specific complications like anterior thigh pain, fracture at the tip of the nail. But trochanteric femoral nail is has smaller diameter at the tip which reduces the stress concentration at the tip.

Its position is near to the weight bearing axis so the stress generated on the implant is negligible. Trochanteric femoral nail also acts as a buttress in preventing the medialisation of the shaft. The entry point of the Trochanteric femoral nail is at the tip of the greater trochanter so it reduces the damage to the hip abductors unlike the nails which has entry through pyriformis fossa [14]. The hip screw and the anti rotation cervical screw of the Trochanteric femoral nail adequately compress the fracture, leaving between them adequate bone block for further revision should the need arise.

CONCLUSION

Trochanteric femoral nail to be more useful in unstable and reverse oblique patterns due to the fact that it has better axial telescoping and rotational stability. Intertrochanteric fractures treated with Trochanteric femoral nail have better functional outcome with less complication rate.

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