

Original Research Article

Gamma nail in the management of intertrochanteric fractures of femur in adults

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ABSTRACT

Background: Intertrochanteric fracture is an extracapsular fracture of the proximal femur. Gamma nail is a cephalomedullary nail that is emerging as the treatment of choice for intertrochanteric fractures. For intertrochanteric fractures, the use of cephalomedullary devices has increased dramatically to 67% among surgeons over the years. Aims of this study was to observe the results of operative treatment of intertrochanteric fractures with Gamma 3 trochanteric nail.

Methods: This prospective study was conducted in the Post Graduate Department of Orthopaedics of Government Medical College, Srinagar. This study included 30 cases of intertrochanteric fractures who attended hospital for bone and joint surgery.

Results: Excellent results were obtained in 80% patients and good results were obtained in rest 20% with an average Harris hip score of 93.8. Average time to union was 11.6 weeks. There were no non-unions, screw cut outs or peri-implant fractures. The most common complication was varus malunion occurring in 20% patients. However, significant malunion (greater than 10 degrees) was present in only one patient among them.

Conclusions: This study finds Gamma 3 nail to be a versatile, easy to use and dependable implant in intertrochanteric fractures. Gamma 3 nail is an ideal implant for stable as well as unstable intertrochanteric fractures and is a distinct advance over the previous methods of treatment, though it has an initial learning curve.

Keywords: Intertrochanteric fracture, Gamma nail

INTRODUCTION

Intertrochanteric fractures of the femur are an extracapsular fracture of the proximal portion of femur (AO 31.A), located in the metaphyseal bone in the region between the lesser and the greater trochanters. There are 2 main options for the treatment of these fractures; dynamic hip screw and cephalomedullary nails like gamma nail. Most commonly these fractures are fixed using DHS (Dynamic Hip Screw) where a large screw is placed in the femoral head which in turn is secured to a

plate on the lateral aspect of the proximal femur. As the plate is lateral to the load bearing axis, this is at a biomechanical disadvantage. Any defect in the medial cortex due to imperfect reduction or comminution etc applies a varus stress to the fixation at every weight-bearing step. This can cause failure of the implant. So, Gamma nail was developed to overcome some of these problems. The gamma locking nail system is a cephalomedullary nail, developed for the treatment of trochanteric hip fractures in the mid 1980's and was first brought into clinical use in 1988.¹ Gamma nail is

biomechanically better as it transmits weight closer to the hip joint fulcrum.² It has the advantage of being minimally invasive and less traumatic operative technique, better cosmetics, less infection rate, less blood loss, greater strength and stability.³⁻⁶

Design of gamma nail

The Gamma nail which is used now a days and which we have used in our study is actually a modification of the original nail and is known as Gamma 3 Nail (G3N) which was introduced in 2003.¹ Gamma 3 implant has the following components:

Trochanteric gamma 3 nail

It is available in angles of 125⁰, 130⁰ and 135⁰. Angle of anteversion in all the 3 angles is 0⁰ but the medio-lateral angle is 4⁰. The proximal diameter of the nails is 15.5mm and the length is 180 mm. Distal diameter is 9, 10 or 11 mm. This nail has 1 distal locking hole.

Lag screw

Lag screw has self-tapping threads and cutting flutes at the tip. It has a diameter of 10.5 mm with core diameter of 6.7 mm. It is available in length ranging from 70-120 mm with 5 mm increments.

Set screw

It is designed to fit into one of the four grooves of the shaft of the lag screw to prevent both rotation and medial migration of the lag screw. However, sliding of the lag screw to the lateral side for dynamic compression is possible. Its dimensions are 8 mm and 17.5 mm.

Distal locking screw

The screw is fully threaded, with reduced diameter at screw neck. The screw has a short self-tapping tip with short cutting flutes. Diameter of the screw is 5mm and is available in length from 25-50 mm with 2.5 mm increments.

Aim of this study was to observe the results of operative treatment of intertrochanteric fractures with Gamma-3 trochanteric nail.

Objectives of this study were to study the effectiveness of implant with regards to early mobilisation of the patients and recovery of knee and hip range of motion.

METHODS

This prospective study was conducted in the Post Graduate Department of Orthopaedics of Government Medical College, Srinagar. This study included 30 cases of intertrochanteric fractures of femur.

Inclusion criteria

- Intertrochanteric fractures, both stable and unstable
- Both sexes
- Age above 18 years.

Exclusion criteria

- Associated fracture of neck of femur, subtrochanteric extension or associated fracture of shaft of femur.
- Pathological fractures.
- Open fractures.
- Fractures > 3 weeks old.

Operative technique

The patient was placed in a supine position on the fracture table and closed reduction of the fractures was done. A small incision was made at the tip of greater trochanter and the incision was deepened through the fascia lata, thus exposing its tip of greater trochanter. The correct entry point was located at the junction of the anterior third and posterior two-thirds of the tip of the greater trochanter and entry was made by a Curved Awl under C-arm guidance.

A 3 mm guidewire was passed, and reamers were used to ream the shaft of the femur. In order to accommodate the proximal part of the Gamma3 Nail, the proximal 80 mm region was reamed up to 15.5 mm reamer. The selected gamma 3 nail was assembled to the targeting device (Jig). The nail was inserted by hand until the axis of the lag screw hole was in alignment with the center of the femoral neck. The Lag screw was placed in the central position of the femoral head in the AP and lateral views.

The handle of the Lag screwdriver was kept either parallel or perpendicular (90°) to target arm to ensure that the set screw is able to fit into the lag screw slots. The set screw was then inserted. After tightening the set screw, it was unscrewed by one quarter (1/4) of a turn, to ensure a free sliding of the lag screw. Then 5mm distal screw was locked using the jig. End cap was used to close the proximal part of the nail. Wound was closed back in layers.

RESULTS

Our study consisted of 30 patients with a mean follow-up of 12 months. Mean age of patients was 64.8 years (Range 36-86 years). Patients were assessed on the basis of age, sex, mechanism of injury, side of involvement, hospital stay, comorbidities, time to union, complications (if any), Harris hip score and results as shown in Table 1. We had almost equal number of males and females in our study with a ratio of 1.1:1. Simple fall was the most common mechanism of injury (66.7%). Simple fall as the most common mechanism of injury was also found in studies done by Huang et al, Kempf et al and Bojan et

al.^{7,5,8} This was followed in frequency by fall from height in 6 patients (20%) and road traffic accident in 4 cases (13.3%). We had slightly more right sided fractures with 57% prevalence. Comorbidities were present in 20 patients out of 30. These included diabetes mellitus, hypertension, chronic obstructive pulmonary disease, hypothyroidism and cataract as shown in Table 1. This

was consistent with the studies of Bojan et al, and Huang et al, who found comorbidities in 73.7% and 68.3% of their patients respectively.^{8,7} Majority of the patients, 22 (73%) had to spend 3-8 days at hospital, while 8 (27%) were admitted for more than 9 days. Average days of stay was 6.4 with a range of 3-12 days.

Table 1: Baseline characteristics of all the patients in the present study.

| Age/sex | Mechanism of injury | Hosp. stay (days) | Comorbidities | Time to Union (weeks) | Complications | Haris Hip score | Results |
|---------|---------------------|-------------------|---------------|-----------------------|---------------|-----------------|---------|
| 50/M | SF | 8 | --- | 10 | Shortening | 93 | E |
| 63/M | RTA | 4 | --- | 10 | --- | 97 | E |
| 67/M | SF | 5 | HTN | 14 | Coxa-vara | 90 | E |
| 80/F | SF | 4 | HTN | 16 | --- | 96 | E |
| 75/F | FFH | 12 | HTN | 14 | --- | 96 | E |
| 71/M | SF | 4 | --- | 10 | Coxa-vara | 88 | G |
| 53/F | SF | 10 | HPT | 12 | --- | 99 | E |
| 60/F | FFH | 12 | HTN | 16 | Bedsore | 96 | E |
| 36/M | RTA | 3 | --- | 8 | --- | 100 | E |
| 61/F | SF | 11 | HTN | 12 | Shortening | 85 | G |
| 79/M | SF | 4 | DM | 14 | Infection | 94 | E |
| 57/F | SF | 4 | HTN | 10 | --- | 97 | E |
| 58/M | RTA | 4 | --- | 10 | Shortening | 92 | E |
| 82/M | SF | 12 | --- | 14 | Stiffness | 89 | G |
| 55/F | SF | 6 | --- | 10 | Stiffness | 92 | E |
| 70/M | SF | 7 | HTN | 12 | --- | 98 | E |
| 69/F | SF | 4 | DM | 16 | Bedsore | 95 | E |
| 60/F | SF | 4 | --- | 10 | --- | 97 | E |
| 86/M | FFH | 5 | DM | 12 | Bedsore | 85 | G |
| 75/F | FFH | 12 | HTN | 14 | Coxa-vara | 96 | E |
| 70/M | SF | 11 | DM | 12 | Bedsore | 89 | G |
| 52/F | FFH | 5 | DM | 8 | Coxa-vara | 92 | E |
| 50/M | SF | 5 | COPD | 14 | Shortening | 98 | E |
| 72/F | RTA | 5 | Cataract | 14 | --- | 98 | E |
| 61/M | SF | 5 | HTN | 12 | Coxa-vara | 96 | E |
| 64/F | SF | 4 | COPD | 10 | --- | 97 | E |
| 75/M | SF | 11 | HTN | 12 | Bedsore | 94 | E |
| 70/F | FFH | 4 | HTN | 16 | Stiffness | 93 | E |
| 63/F | SF | 3 | --- | 10 | Coxa-vara | 91 | E |
| 59/F | SF | 5 | --- | 12 | --- | 99 | E |

SF: Simple fall; FFH: Fall from height; RTA: Road traffic accident; HTN: Hypertension; DM: Diabetes mellitus; HPT: Hypothyroidism; COPD: Chronic Obstructive pulmonary Disease; E: Excellent; G: Good

Majority of the patients (86.7%) had achieved union in 14 weeks. Rest 13.3% achieved it over the next 2 weeks. Average time to union was 12 weeks.

Mild coxa vara (10 degrees or less) deformity as a complication was seen in 6 (20%) patients. At 6 months, 3 patients had knee stiffness with a restriction of flexion in terminal 10⁰-20⁰ of arc. These patients were sent to physiotherapy department. Limb shortening was seen in 4 patients out of 30. Out of these 30 patients, 2 patients had

shortening <1cm, one had a shortening of 1.5cm and other had 2cms shortening. Bed sores were found in 4 patients (13.4%). However, these were grade 1 and 2 and all patients healed uneventfully after proper wound care. There was 1 case of superficial infection in the form of mild pus discharge which healed with daily dressings and oral antibiotics. There was no case of peri-implant fracture or screw cut-out. Yang et al and Georgiannos et al in their studies also had no case of peri-implant fracture.^{9,1}



Figure 1: Pre-operative radiograph.

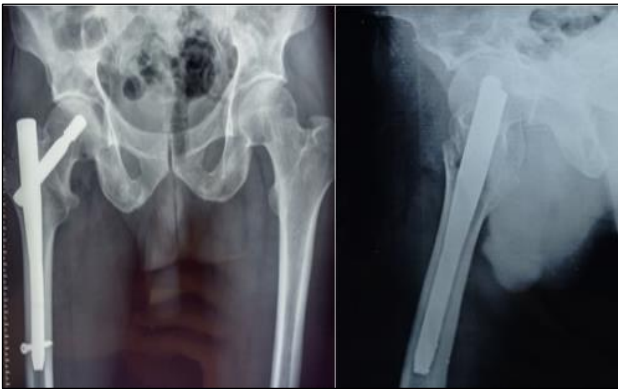


Figure 2: Immediate post-operative radiographs AP and lateral views.



Figure 3: Final radiographs AP and lateral views.



Figure 4: Patient sitting cross-legged and during prayers at final follow-up.



Figure 5: Patient squatting and sitting on chair at final follow-up.



Figure 6: Surgical site at final follow-up.

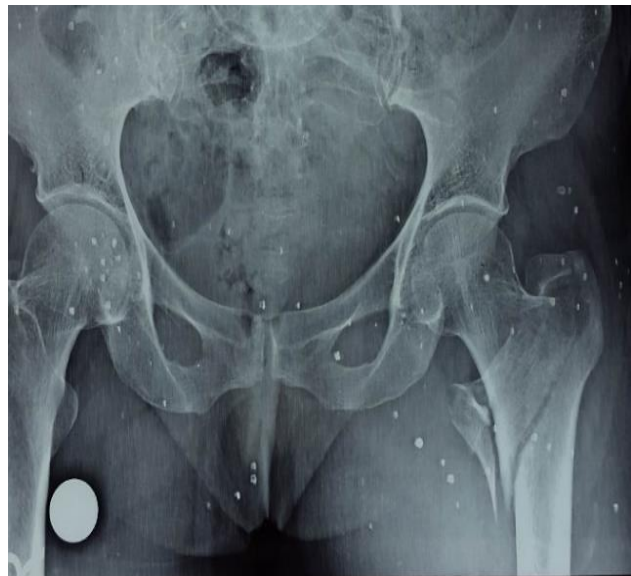


Figure 7: Pre-operative radiograph.

Haris Hip score (HHS) was used for evaluation 6 months after surgery. Score was between 85-100. Average score

obtained was 93.8 and it was almost equal to the result obtained by Vidyadhara et al in 2007 (HHS 94).¹⁰

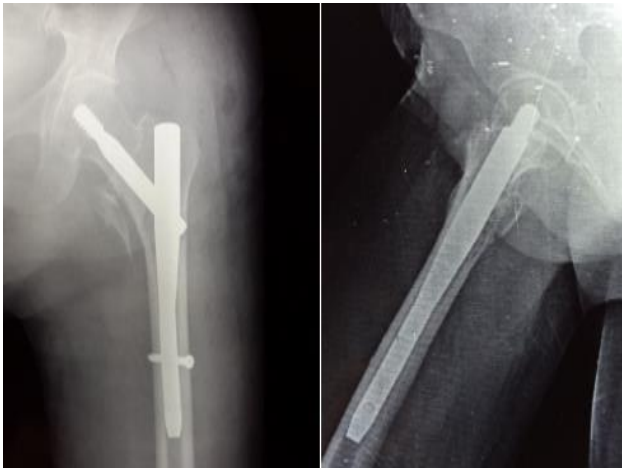


Figure 8: Immediate post-operative radiographs AP and lateral views.



Figure 9: Post-operative radiographs at final follow-up.



Figure 10: Patient sitting cross-legged and offering prayers at final follow-up.



Figure 11: Patient standing on the operated leg and sitting on chair at final follow-up.



Figure 12: Patient squatting at final follow-up.



Figure 13: Surgical site at final follow-up.

Patients with HHS of 90-100 were considered excellent (80% in our study) and those with a score of 80-89 were considered good (20% in the present study). None of our patients had fair or poor result.

DISCUSSION

Intertrochanteric fractures are very frequently encountered by orthopaedicians. Even if surgery is performed impeccably, results can still be poor if adequate rehabilitation is not performed. Treatment of intertrochanteric fractures is three parts. First is surgical

management, second is post-operative rehabilitation, and third is treatment of the underlying cause i.e. osteoporosis. All the steps are important. Various intramedullary and extramedullary implants are available and excellent results have been reported with their use. Dynamic hip screw remains the work horse for intertrochanteric fractures in developing countries, while intramedullary devices have taken over in developed countries. Intramedullary devices are rapidly gaining popularity especially in the unstable fractures, because of their mechanical and biological advantages.

The modern intramedullary devices like the Gamma 3 Intertrochanteric nail have been refined over decades to overcome the shortcomings of the previous intramedullary devices while retaining their advantages, like closed fracture treatment, less dissection, maintaining the haematoma etc.

CONCLUSION

This study finds Gamma 3 nail to be a versatile, easy to use and dependable implant in intertrochanteric fractures. Following conclusions were made:

- Gamma3 nail is an excellent implant with a natural progression over previous implants.
- This technique involves less dissection and less blood loss.
- Peri-implant fractures and cut-out were not encountered during the study.
- Union was achieved in all cases.
- Functional results of this series were good to excellent and were better than most of other series in literature.

Gamma 3 nail is an ideal implant for stable as well as unstable intertrochanteric fractures and is a distinct advance over the previous methods of treatment, though it has an initial learning curve.

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Conflict of interest: None declared

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

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