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Research Paper

# Evaluation of unstable trochanteric fractures treated with natural nail and proximal femoral nail: A prospective comparative study

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## Abstract

**Introduction:** Unstable trochanteric fractures are challenging to treat compared to stable types because of a high complication rate. Most of these fractures were treated by a sliding hip-screw system and cephalomedullary nails. Cephalomedullary nails have a specific advantage over dynamic screw with regard to union rates and complications. The natural nail is a special type of cephalomedullary nail which provides good compression at the fracture site intraoperatively. It has good functional and radiological results compared to conventional proximal femoral nailing.

**Materials and Methods:** This study was undertaken in patients who were operated between 1<sup>st</sup> January 2015 to 28<sup>th</sup> February 2017 at M S Ramaiah Hospital, which is a tertiary care hospital in Bangalore. The study included 62 patients with unstable trochanter fracture treated by cephalomedullary nailing. Forty-two cases were fixed with Zimmer natural nail whereas in 22 cases conventional proximal femoral nail was used. Both groups were followed at 6 weeks, 3, 6 months. At each follow up radiological and clinical assessment was done by RUSH score and mobility score.

**Results:** This prospective comparative study showed several advantages of the natural nail over conventional proximal femoral nails. The average surgery duration with natural n group was  $56.55 \pm 8.33$  and with a proximal femoral nail, the group was  $108.41 \pm 15.1$ . Post-operative mobilization and fracture union was early in natural nail group. Complications like screw cutout delayed union and infection was more with proximal femoral nailing group.

**Conclusion:** Natural nail is better than conventional proximal femoral nails as the average duration of surgery, blood loss and hospital was significantly less. Radiological results and functional results were better for natural nail group and were statistically significant. Short and long term complications are very less with the natural nail.

**Keywords:** Natural nail, proximal femur nail, trochanter fracture, unstable

**INTRODUCTION**

Unstable intertrochanteric fractures are challenging to treat as they are associated with high morbidity and mortality. Approximately 40% of all intertrochanteric fractures are unstable types [1-6]. The mainstay of treatment of these fractures is stable fixation and early mobilization. Many types of fixation methods have been described for the treatment of these complex fractures. Currently, cephalomedullary nails have been the most commonly used internal fixation because of its biomechanical advantages over extra medullary fixation. Though these nails are commonly used these are not without complications [7-11]. The geometry of these nails doesn't match exactly with the proximal femur anatomy and hence complications like screw cut out, femoral shaft fracture, pain in the thigh and hip are seen. In order to address these complications, newer implants like Zimmer Natural Nail have been designed. We hereby compare clinicoradiological results of unstable trochanter fractures treated with Zimmer natural nail and proximal femoral nails.

**MATERIALS AND METHODS**

This study was undertaken in patients who were operated between 1<sup>st</sup> January 2015 to 28<sup>th</sup> February 2018 at Ramaiah Hospital, which is a tertiary care hospital in Bangalore. The study included 62 patients with unstable trochanter fracture treated by cephalomedullary nailing. In both groups, short nails were used. Length of the natural nail was 180 mm whereas for proximal femoral nail was 240 mm. Forty-two cases were fixed with Zimmer natural nail whereas 22 cases conventional proximal femoral nail was used. All the surgeries were done in a single center by the same team of surgeons. Both groups were followed at 6 weeks, 3, 6 months. At each follow up radiological and clinical assessment was done by RUSH score and mobility score. Duration of the study was six months from the date of surgery.

**INCLUSION CRITERIA**

1. Intertrochanteric trochanteric fracture with posteromedial comminution
2. Intertrochanteric trochanteric fracture with sub trochanteric extension
3. Intertrochanteric trochanteric fracture with reverse oblique pattern

**EXCLUSION CRITERIA**

1. Stable trochanteric fracture
2. Pathological fractures
3. Age <50
4. Associated other fractures
5. Poor pre-fracture walking ability
6. Previous fracture around the same hip

**ADVANTAGES OF NATURAL NAIL**

1. Bows in femoral nails correspond to nail length, reflecting the anterior femoral bow relative to patient height
2. Nail tips are designed to help the passage of the nail through the medullary canal
3. Left and right versions available for the antegrade femur and cephalomedullary nails
4. Fluted design moderates stiffness and facilitates easier nail placement

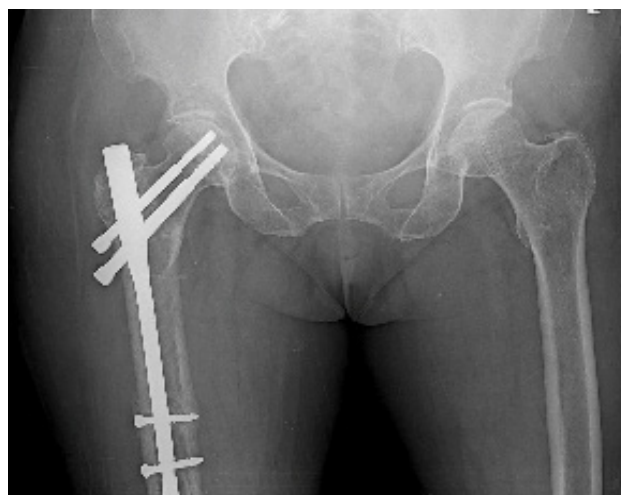
**DISCUSSION**

Trochanteric fractures are one of the common fractures seen

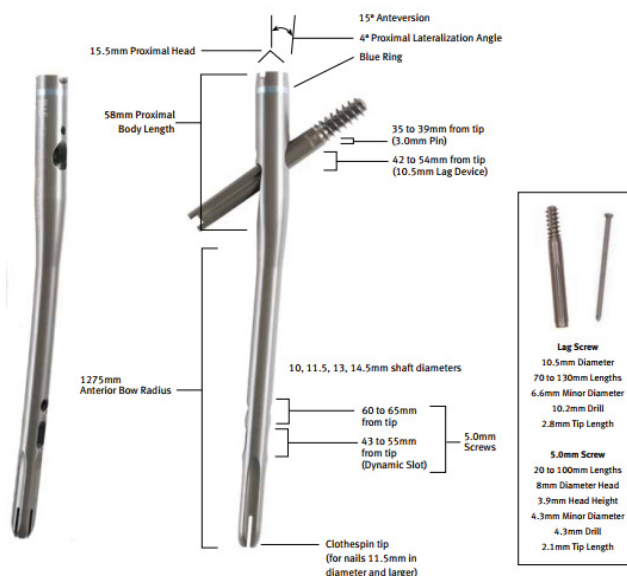
in elderly and the incidence is increasing with increasing age. Approximately 45% of these trochanteric fractures are unstable and are challenging to treat [1-8]. Many fixation methods have been devised in the management of these fractures. Since many of these patients are associated with comorbidities, optimal management of these unstable trochanteric fractures and early mobilization is the main objective. Intramedullary nails are being commonly used in treating these fractures as they give good stability and minimally invasive. The designs of these cephalomedullary nails continue to evolve for better stability and less post-operative complications [9-12].

Proximal femur nailing with two lag screws was designed to improve the rotational stability thus resisting screw cut out and subsequent fixation failure. Proximal femur nail with two lags screw is technically difficult and leads to a longer duration of surgery (Fig. 1). There is also a specific complication with two lag screws are known as Z-effect phenomenon where the proximal lag screw migrates medially (protrusion) and inferior screw migrates laterally. This phenomenon is seen with varus fixation site and posteromedial comminution allowing collapse at the fracture site.

The Zimmer natural nail used in the study has a proximal anterior bow, 4-degree lateral lateralization angle and lag screw placement are at 15-degree anteversion. The design of the nail mimics the anatomy of the proximal femur (Fig. 2 and 3). The fluted tip helps in easy insertion and this flexible tip helps to minimize the pressure inside the bone



**Fig. 1.** Anteroposterior radiograph with proximal femur nail in situ



**Fig. 2.** Design of natural nail

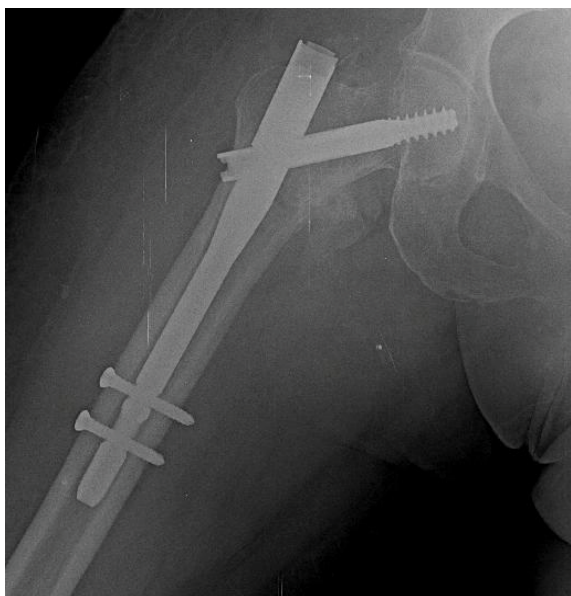


Fig. 3. Anteroposterior radiograph of right hip with natural nail in situ

Table 1. Parameters included in the study

Variable	ZNN group*	PFN group**
No of Patients	42	22
Age	68	64
Gender	Female: 14 Male: 26	Female: 10 Male: 12
Side	Right:26 Left: 14	Right: 13 Left: 9
Comorbidities	DM type 2: 18 Hypertension: 16 Hypothyroid: 6 Others: 8	DM type 2: 13 Hypertension: 8 Hypothyroid: 3 Others: 3
Surgery duration	56.5 mins	108.4 mins
Blood loss	100 ml	200 ml
Fluoroscopy images	55	115

\*ZNN: Zimmer Natural Nail; \*\*PFN: Proximal Femoral Nail

if impingement does occur. This system also helps us to reduce the fracture percutaneously before locking screw is placed.

Baseline parameters included in the study are shown in Table 1. The average surgery duration was 56.55 ± 8.3 minutes for natural nail as compared to 108.41 ± 15.1 minutes for proximal femoral nailing group. Applying t-test it was statistically significant. The blood loss was relatively less for natural nail group.

The duration of surgery was longer in the proximal femoral group was due to the insertion of two lag screws and frequent zig mismatch problems with proximal femoral nail than with natural nail.

Radiological results assessed by RUSH score and functional results were assessed by mobility score of Parker as shown in Tables 2 and 3 respectively. Both scores were better for natural nail group compared with the proximal femoral nail group. RUSH scores and mobility scores of parker were statistically significant (p-value <0.05)

Post-operative complications were more with a proximal femoral

Table 2. RUSH score for ZNN and PFN group

RUSH score	ZNN	PFN
6 wks	22	16
3 months	24	20
6 months	20	24

Table 3. Functional outcome: Mobility score of PARKER

Parker mobility score	ZNN	PFN
6 wks	4	2
3 months	6	4
6 months	9	7

Table 4. Postoperative complications: Post-operative complications

Complication	ZNN group	PFN group
Lag screw cutout	1	2
Lag screw back out	0	1
Infection	1	1
Delayed union	0	1



Fig. 4. Lag screw backout in proximal femur nail

nailing group (Table 4). Two patients had lag screw cutout and one patient had lag screw back out (Fig. 4). These three patients underwent additional secondary surgery. One patient had an infection and underwent implant removal and external fixation.

The complications were less with natural nail group. One patient had screw cutout which necessitated implant removal and total hip replacement. One patient had a surgical site infection but responded well to wound debridement.

**CONCLUSION**

Results of our study imply Zimmer natural nail has better efficacy, stability and low post-operative complications compared to conventional proximal femoral nailing with two lag screws. The surgery duration and intraoperative blood loss are significantly low. Patients with natural nail group had better mobility and radiological scores.

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