



International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2020; 6(1): 379-382
© 2020 IJOS
www.orthopaper.com
Received: 17-11-2019
Accepted: 21-12-2019

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A prospective study on outcomes of stainless steel proximal femoral nail for unstable intertrochanteric fractures in rural population

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DOI: <https://doi.org/10.22271/ortho.2020.v6.i1g.1894>

Abstract

Introduction: Intertrochanteric fractures are common in geriatric population. They account for 34% of all hip fractures. Surgical treatment with proximal femoral nail (PFN) is being replaced with newer generation nails. Stainless steel PFN is still being widely used in resource limited settings.

Material and Methods: This is a prospective study in a tertiary care hospital serving rural populations in southern India. The study included 20 patients with unstable intertrochanteric fractures with a minimum follow-up of 6 months. Intra-operative bleeding, surgical time, radiation exposure in seconds were recorded. Patients were evaluated at each visit by Harris hip score. Duration of hospital stay, time to union and mobility status were recorded.

Results: The mean operating time in our study was 70.15 (SE + 9.39) minutes. The mean C arm exposure in our study was 119.60 seconds (SE + 8.16). The average blood loss per patient was 221 ml (SE +41.66). The mean duration of stay in hospital in our study was 17.5 days. In our study, 14 patients had excellent results, 4 patients had good results, 1 patient had fair result and 1 case had a poor result according to Harris Hip Score.

Conclusion: Stainless steel proximal femoral nailing remains a relevant choice for unstable intertrochanteric fractures in rural and resource limited settings.

Keywords: Intertrochanteric fractures, stainless steel, proximal femoral nail, unstable

1. Introduction

Intertrochanteric fractures of the hip are very common fractures encountered by orthopaedic surgeons across the world ^[1]. The incidence is expected to increase with the rise in geriatric population ^[2]. Various surgical treatments are available like dynamic hip screw (DHS), proximal femoral nail (PFN), proximal femoral locking plate (PFLP), proximal femoral nail anti-rotation (PFNA), etc. In resource limited settings, stainless steel (SS) DHS and PFN are still popularly used due increased cost of newer implants ^[3]. DHS is the preferred treatment for stable IT fractures, whereas PFN or other cephalo-medullary fixation techniques are useful in unstable IT fractures ^[4]. In this article, we would like to discuss the functional outcome of SS PFN in unstable intertrochanteric fractures.

2. Material and Methods

2.1 Study design: This prospective study was done in the department of orthopaedics, at a tertiary care hospital in rural part of southern India. Institutional Ethics Committee approval was obtained. Study period was from October 2015 to January 2017 with a minimum follow-up of 6 months. Twenty consecutive patients presenting with closed unstable intertrochanteric fractures to the casualty and the orthopaedic out-patient department were included in the study, fulfilling the inclusion and exclusion criteria described below.

2.2 The inclusion criteria

1. Closed unstable intertrochanteric fractures.
2. Presentation < 2 weeks from the date of injury.
3. Patients with age > 50 years.
4. Pre-injury ambulatory status.

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2.3 The exclusion criteria

1. Patients with head injury
2. Medically unfit for surgery.
3. Pathological fractures & Refractures.

2.4 Pre-operative workup

All fractures were classified according to Evans classification. All patients satisfying the inclusion criteria were assessed both clinically and radiologically before decision for a surgical intervention is made. In all the patients, preoperative Buck's skin traction was applied to the fractured lower limb. Oral or parental NSAIDs and tramadol were used for pain management.

Preoperative work-up was done by routine blood work-up and x-rays of chest and traction internal rotation view of hip. Venous doppler was done to rule out deep vein thrombosis (DVT) in patients presenting after more than 3 days of injury. Preoperative medical fitness was taken in all cases. A pre-anaesthetic examination was carried out a day prior to the surgery. A written consent for the surgery was obtained from all patients.

2.5 Implant

Stainless steel Proximal femoral nail we used is a cephalomedullary implant, which has biomechanical advantages over extramedullary implants. The Western version has a proximal diameter of 17.5mm; load bearing femoral neck screw of 11.0mm and derotation screw of 6.5mm. Indian version has a proximal diameter of 13mm; load bearing femoral neck screw of 8mm and derotation screw of 6mm to suit the proximal femur of Indian patients. Distal locking screws are of size 4.9mm and distance between the proximal screws is 5 mm in both the versions [5]. We used Short PFN in all cases. Femoral nail cap was not used.

2.6 Post-operative follow up

Serial radiograph and Harris hip scoring criteria were used to assess the radiological and functional outcomes respectively. Patients were assessed at 2 weeks, 4 weeks, 2 months, 3 months and 6 months.

2.7 Statistical analysis

Data was entered using the software Epi info version 7.2.1.0 and analysed using software SPSS version 24.0. Categorical study variables like gender, age group, side of the fracture, mode of injury, post-operative shortening, functional outcome, post-operative complications was described in terms of frequency and percentage. Continuous variables like age, blood loss, operating time, radiation exposure, duration of stay in hospital, etc. were described in mean and standard deviation. Association between age, sex and side of fracture to the functional outcomes were assessed using fisher exact probability test.

3. Results

Mean age of the study participants was 65.6 years (Figure 1). Male to female ratio of 3:1 was noted. Right hip was more commonly (65%) involved. The trivial household trauma (self-fall) was the mode of injury in the majority of the patients (80%) followed by road traffic accidents (20%).

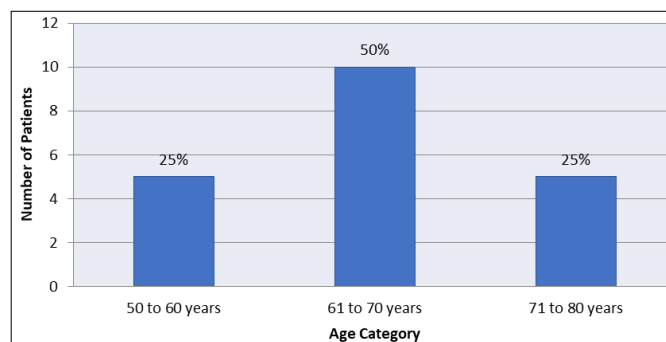


Fig 1: Age distribution among study participant

In our study 14 patients (60.9%) were operated within 7 days from the time of injury, 6 patients (26.1%) operated after 7 days from the time of injury due to associated comorbid conditions like diabetes mellitus, hypertension, cardiac status after obtaining fitness for surgery from anaesthesia. The mean time interval between injury and surgery was 5.15 days in our study. Mean blood loss was 221 ml (SD 41.66) (table 1).

Table 1: Blood loss during surgery

| Blood loss in ml | Number of patients | Percentage (%) |
|------------------|--------------------|----------------|
| <150 ml | 0 | 0 |
| 151 to 200 ml | 7 | 35.0 |
| 201 to 250 ml | 11 | 55.0 |
| > 250 ml | 2 | 10.0 |
| Mean + SD | 221 + 41.66 | |

Table 2: C arm exposure during surgery

| C arm exposure | Number of patients | Percentage (%) |
|--------------------|--------------------|----------------|
| 101 to 110 seconds | 3 | 15.0 |
| 111 to 120 seconds | 5 | 25.0 |
| 121 to 130 seconds | 10 | 50.0 |
| 131 to 140 seconds | 2 | 10.0 |
| Mean + SD | 119.60 + 8.16 | |

The mean C arm exposure in our study was 119.60 seconds (SD 8.16) (table 2). The operating time was calculated from skin incision to skin closure. The mean operating time in our study was 70.15 (SD 9.39) minutes. The mean duration of stay in hospital in our study was 17.5 days.

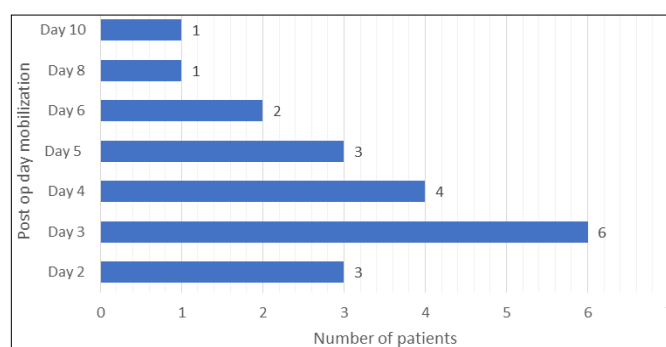


Fig 2: Post op day mobilization

Patients were mobilized by a physiotherapist on the third postoperative day with the help of a walker (figure 2). Postoperative shortening was seen in only one patient. There

was 2 cm shortening of the operated limb compared to the normal limb. The fractures united by 10 to 15 weeks in 15 patients, 15 to 20 weeks in 2 patients, less than 10 weeks in 2 patients and more than 20 weeks in 1 patient. More than half of the patients (65.2%) united during 10 to 15 weeks with a mean of 13.10 ± 2.92 weeks. 11 out of 20 patients were able to walk without support at the end of 6 months follow up. Seven patients used a cane and two patients used a walker for walking long distances. 17 patients had no complications at the end of 6 months (table 3).

The functional results were graded according to Harris Hip Scoring System, wherein, a score of more than 90 suggests excellent result, a score in between 80 and 90 suggest good result, a score in between 70 and 80 indicates fair result and a score below 70 implies poor result. In our study, 14 patients

had excellent results, 4 patients had good results, 1 patient had fair result and 1 case had poor result.

Table 3: Complications

| Complications | Number of patients | Percentage (%) |
|-----------------------|--------------------|----------------|
| Nil | 17 | 85.0 |
| Screw back out | 1 | 5.0 |
| Screw cut out | 1 | 5.0 |
| Superficial infection | 1 | 5.0 |
| Total | 20 | 100.0 |

Among the 15 male patients, 10 had excellent, 3 good, 1 fair and 1 poor results. Among the 5 females, 4 had excellent and 1 had good results. No significant difference (p value 0.86) was observed between the outcomes of both sexes.

Table 4: Age category with functional outcome

| Age category | Excellent n(%) | Fair | Good | Poor | Total | p value |
|----------------|----------------|----------|----------|----------|-------|---------|
| 50 to 70 years | 13 (80.0) | 0 | 1 (10.0) | 1 (10.0) | 15 | 0.004 |
| 71 to 80 years | 1 (20.0) | 1 (20.0) | 3 (60.0) | 0 | 5 | |
| Total | 14 | 1 | 4 | 1 | 20 | |

4. Discussion

The mean age in the study conducted by Kumar R ^[6] *et al.* was 62.3 years. The mean age in the study by Yamauchi K, *et al.* ^[7] was 79.7 years. The average age of patient was 67.8 years in study by Bhahat, *et al.* ^[8] in 2013. Females are more commonly affected than males due to post-menopausal osteoporosis. Chang KP, *et al.* ^[9] reported an epidemiological study of 229 hip fractures. They suggested that, with an increase in age, there was an increase in the incidence rates of hip fractures in both male and female patients. Even then, the most striking difference in incidence between sexes [116 (women) and 0 (men) per 100,000 person- years] was seen in the 60- 64 year age group, this difference decreased as the age progresses [2597 (women) and 1187 (men) per 100,000 person- years in the 85+ year age group]. Our study group consisted of more males than females (3:1) and majority (50%) were aged between 60 to 70 years of age.

The most common associated medical problem was anaemia in 6 cases (40%), followed by hypertension in 4 cases (26.7%) and diabetes in 3 cases (20%). Preoperative blood transfusion was done in 4 patients (26.7%) in view of anaemia. The mean blood loss in our study was 221 (SD 41.66 ml). The results were comparable with Schipper I.B. *et al.* ^[10] in which the mean blood loss was 220 ml. In a study by Pajarinen J *et al.* ^[11] *et al.* the mean blood loss was 330 ml. The mean operating time in our study was 70.15 ± 9.39 minutes. In comparison, Pajarinen J *et al.* ^[11] reported a mean operating time of 55 minutes.

The mean C arm exposure in our study was 119.60 ± 8.16 seconds, which is comparable to other studies [12, 13]. There was one incidence of postoperative superficial surgical site infection in a patient. Postoperatively, one patient had shortening of 2 cm. The mean POD of mobilization in this study was 4.25 ± 2.05 days. Delay in mobilisation compared to other fractures is probably due to elderly age of the patients.

Restoration of walking ability was earlier in patients treated with proximal femoral nail than dynamic hip screw ^[11]. Studies have shown comparable outcomes after treatment with both proximal femoral nail and gamma nail ^[10]. Multiple factors have been implicated like implant design, fracture stability, operative technique, surgeon skills and learning curve in the outcome of good results ^[14]. Optimal reduction of

the fracture, confirmation of reduction in both anteroposterior and lateral views and accurate positioning of the nail and screws should be obtained at all times to prevent screw cut-out. Reduction in distal nail diameter and pre-reaming of femoral canal to a size bigger than the implant decrease the complication rates of femoral shaft fractures. Patients with narrow femoral canal and abnormal curvature of the proximal femur are the relative contraindications to intramedullary fixation with proximal femoral nail. Patients with small neck size (<24.5mm) sometimes do not accommodate two screws, such cases need to be preoperatively planned for other implants ^[5, 15].

The duration of stay in hospital varied from 2 weeks to 4 weeks in our study. The mean duration of stay in hospital was 17.5 days (SD 4.8) in our study. Socioeconomic factors make it expensive for the disabled post-operative patient to visit hospital multiple times for wound care, sometimes more than the surgical costs itself, hence in such cases patients are discharged after sutures are removed and mobilised adequately. In the study conducted by Schipper B *et al.* ^[10] the mean duration of stay was 21.4 days. The mean duration of stay in hospital was 12.96 days in the study conducted by Kumar R *et al.* ^[6] The patients were followed up at 4 weeks, 2 month, 3 months and 6 months post operatively. In our study, none of patients were lost to follow up.

In our study, the fractures united by 10 to 15 weeks duration in 15 patients, 15 to 20 weeks in 2 patients, less than 10 weeks in 2 patients and more than 20 weeks in one patient. 65.2% fractures united during 10 to 15 weeks with a mean of 13.10 ± 2.92 weeks. At the end of 6 months 11 patients walked without any support, 7 patients walked with the help of a cane, 2 patients used a walker. In one patient there was proximal screw back out at 3 month follow up. One patient had screw cut out on follow up. The other 17 patients had no complications and performing their day to day activities. Significant difference (p 0.004) was noted in functional outcome between age groups (table 4).

Pajarinen J *et al.* ^[11] treated 108 patients with intertrochanteric femoral fractures. In results they suggested that the use of the proximal femoral nail may allow a faster post- operative restoration of walking ability, when compared to the dynamic hip screw.

Bhahat U *et al.* ^[8] in 2013 did a comparative study between

proximal femoral nailing and dynamic hip screw in the treatment of intertrochanteric fracture of femur. They observed that even though the PFN has more radiation exposure than DHS, it has lesser bleeding, less operative time, earlier ambulation and better Harris hip score in early periods. In the long term both the implants had similar functional outcomes. The strengths of our study are that it systematically discusses the versatile implant which is slowly being replaced by newer and costlier implants. Limitations of our study are low sample size and being a hospital based study it has selection bias.

5. Conclusion

Proximal femoral nailing is a good choice of fixation of unstable intertrochanteric fractures in adults provided right implant is chosen and the proper surgical technique is followed. The procedure offered excellent pain free mobile hip, with easy rehabilitation and rapid return to functional level. Proximal femoral nailing reduced the complications of prolonged immobilization, prolonged rehabilitation. The procedure offers early mobilization, rapid return to pre injury level, improved quality of life and provides a long-term solution in elderly patients with unstable intertrochanteric fractures of the femur with extramedullary implants and comparable results with newer cephalomedullary implants. Hence, stainless steel PFN is suitable implant for unstable intertrochanteric fractures, especially in price sensitive patients in developing countries. There is a need for cost analysis between stainless steel PFN and other cephalomedullary fixations.

6. Acknowledgement: Nil

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