Proximal Femoral Nailing in Trochanteric Fractures

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ABSTRACT

Trochanteric fractures, one of the commonest fractures treated by an orthopedic surgeon, typically occur in an elderly population with osteoporotic bones, mostly as a result of low velocity injury. The main stay of treatment for these fractures is fixation with screw–side plate device or intramedullary device. Recently, intra-medullary device is gaining popularity due to their distinct biomechanical advantages and ease of application. This prospective study was conducted in the Department of Orthopaedic Surgery, Kathmandu Medical College Teaching Hospital. A total of 110 patients with trochanteric fractures attended our hospital from August 2008 till July 2013, and 45 patients were treated using proximal femoral nail (PFN). These patients were evaluated in terms of per-operative blood loss, duration of surgery, need of post-operative analgesia, immediate post-operative rehabilitation and final functional outcome at one year follow-up. Out of 45 patients treated with PFN, 38 were included in this study. Amongst the 7 excluded patients, two were lost on follow-up, four had other associated fractures and one died because of cardiac co-morbidity. The patients were evaluated at 1 week, 3 weeks, 6 weeks, 3 months, 6 months and 1 year postoperative period. The evaluation was primarily done by taking radiographs and functional outcome scores using Harris Hip Scoring system. There were 17 males and 21 females (M: F: 0.80:1) with the mean age of 70.67 years (range: 50 to 98 years). The mean per-operative blood loss was 65.83 ml (range: 30 to 120 ml) and the mean duration of surgery was 42.20 min (range: 23 to 90 min). In all cases parenteral analgesia was required on the first postoperative day only, following which oral analgesics was advised as required. Sixty percent of the cases were ambulatory from the first post-operative day and the rest were ambulatory from the second postoperative day. All but one fracture united within 3 months and non of them required any form of assistance in their daily activities. One patient had delayed union and was administered 2 doses of platelet-rich-plasma, at two weeks interval, following which signs of union were evident by the end of 9 months. PFN, once thought as an implant for unstable trochanteric fractures only, can be a good option for all grade inter-trochanteric fractures. PFN helps in better restoration of preoperative walking ability and early return to function.

Key words: Dynamic hip screw, Inter-trochanteric fractures, Proximal femoral nail

INTRODUCTION

The incidence of pertrochanteric femoral fractures has increased significantly during recent decades, and this tendency will probably continue in the near future due to the rising age of the population.[1,2] Several implant designs have been developed in order to facilitate ambulation and to reduce the risk of complications when treating unstable trochanteric and subtrochanteric fractures.[3–5].This issue is of even more importance as the one year mortality rate after fractures around the hip is as high as 15%-30%.[6] The goal of the treatment of these fractures is stable fixation, which allows early mobilization of the patients. In order to achieve this objective, several intramedullary nails have been developed which may challenge the previous role of the compression screw as the standard method of fixation.[7] In this study, we aimed to assess the operative time, intra-operative blood loss, post-operative analgesia, post-operative rehabilitation status and functional status at the end of one year in all types of intertrochanteric femoral fractures treated using proximal femoral nail.

MATERIALS AND METHODS

This prospective study was conducted in the Department of Orthopaedic Surgery, Kathmandu Medical College Teaching Hospital from August 2008 to July 2013. A total of 110 patients with trochanteric fractures attended our hospital during this time frame, out of which 45 patients were treated with PFN. Informed consent was taken from all the patients. Seven patients were excluded from the study as 2 were lost on follow-up, 4 had other associated fractures and one patient died on first postoperative day due to cardiac co morbidity. These 38 patients were evaluated in terms of operative blood loss, duration

of surgery, postoperative analgesia requirement and functional outcome at one year follow-up. Boyd and Griffin classification system was used to classify the fractures prior to surgery.

Table 1. Patients with different grades of fractures

Boyd and Griffin Classification		
Fracture type	**n**	**%**
I	6	15.8
II	14	36.8
III	15	39.5
IV	3	7.9

Table 2. Cross tabulation of category and types of fractures

		Boyd and Griffin types				
		I	**II**	**III**	**IV**	**Total**
Category	Stable	6	10	0	0	
	Unstable	0	4	15	3	
Total		6	14	15	3	38

All the surgeries were performed under spinal anesthesia by placing the patients supine on a fracture table. Intravenous first generation cephalosporin (Inj. Cefazolin 1 gm) was administered just before starting the surgery. Reduction was done before making an incision and confirmed using image intensifier. Entry point was made just lateral to the tip of the trochanter using a 2-4 cm skin incision. Fixation was completed using a lag screw and an anti-rotation screw proximally and a single distal locking screw. Isometric quadriceps exercises and knee range of motion exercises were started from fi rst postoperative day. Those patients who were relatively pain free and motivated were allowed toe-touch ambulation on same day. Hip range of motion exercises started from second postoperative day. All patients were allowed toe-touch ambulation for the first postoperative week followed by partial weight bearing ambulation (25%-50% of the body weight) from seventh postoperative day until three weeks. The weight bearing was gradually increased to 75% of the body weight at 3-6 weeks and single crutch walking ambulation was initiated at 6 postoperative weeks. Unassisted full weight bearing ambulation was allowed to all the patients from 3 months after the surgery.

The patients were evaluated using plain radiographs after surgery at 3 weeks, 6 weeks, 3 months, 6 months and 1year duration, and observed for signs of union, lag-screw cut out, fracture compression and fracture femur. The functional outcome was assessed using Harris Hip Scoring System at one year period.

RESULTS

In our study, there were 17 males and 21 females (M: F: 0.80:1) with mean age of 70.67 years (range: 50-98 years). The mean blood loss was 65.83 ml (range: 30—120 ml) and the mean duration of surgery was 42.2 minutes (range: 23-90 minutes). We observed that the duration of surgery gradually decreased as the surgeons and the operation theatre staffs gained experience and became more familiar with the steps and the instrumentation. Since the incision required for the surgery was small (2-4 cm) we found that the need of parenteral analgesic was limited to the first postoperative day only, after which the patients were comfortable on oral analgesic that was administered as required. As this surgery require lesser soft tissue dissection we found that 60% of the patients were ambulatory from first postoperative day. All but one patient had radiologic and clinical evidence of union in 3 months' time. In one patient we suspected delayed union based on the radiographic picture for which two doses of platelet rich plasma was administered in two weeks interval after 3 months. In this patient, clear signs of union was evident at 9 postoperative months. None of the patients had cut out of femoral head, shortening of the neck due to fracture compression or femoral fracture.

The mean Harris Hip Score was 89.93 (range: 77.8-97). The score was poor in one patient (2.63%), moderate in five patients (13.16%), good in ten patients (26.31%), very good ion 17 patients (44.73%) and excellent in five patients (13.16%). The patient with the poor score was a 98 year old man who was not well compliant with the prescribed rehabilitation regime. The mean Harris Hip Score in Boyd and Griffin type I, type II, type III and type IV fractures were 90.17, 89.56, 91.40 and 87.40 respectively. The P-value for these were found to be more than 0.05, suggesting that there was no significant difference in the functional outcome in different sub-types of trochanteric fractures treated with PFN. In our series none of the patients had lag screw cut out or fracture of the femur distal to the nail.

Table 3. The relationship between the fracture type and Harris hip score

Boyd and Griffin Classification						
		I	**II**	**III**	**IV**	
Harris hip score 12	Poor	0	0	1	0	1
	Moderate	1	1	3	0	5
	Good	1	7	1	1	10
	Verygood	3	5	7	2	17
	Excellent	1	1	3	0	5
Total		6	14	15	3	38

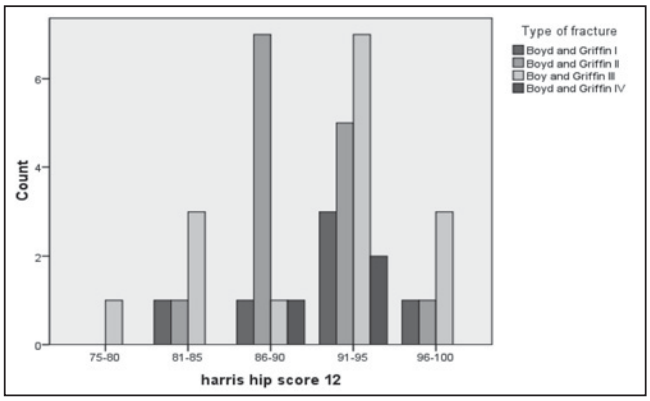

Fig 1. Bar chart showing relationship between the fracture type and Harris hip score

Case 1. 65 years female with left trochanteric fracture

Case 1.Fig. 1 Pre-operative X-ray

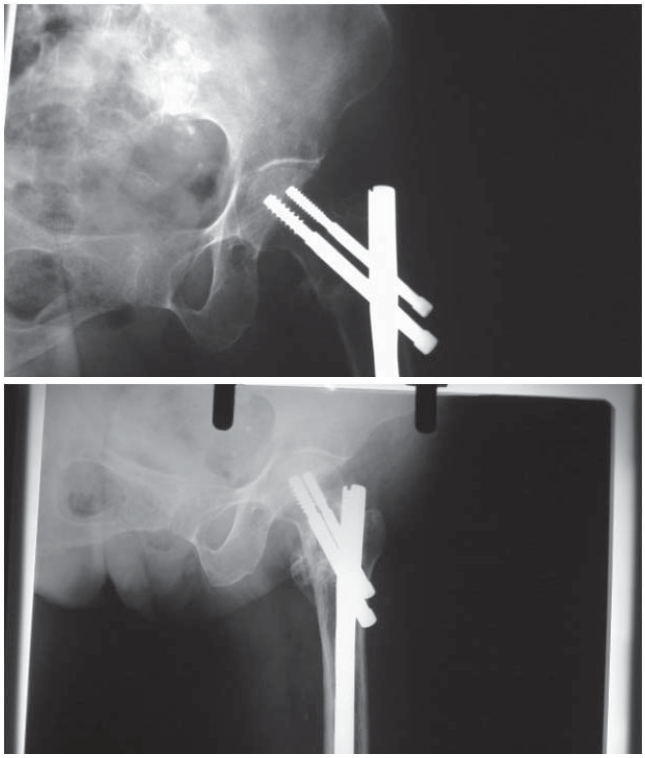

Fig. 2, 3 One year postoperative radiographs (antero-posterior and lateral views)

Case 2. 60 years male with right trochanteric fracture

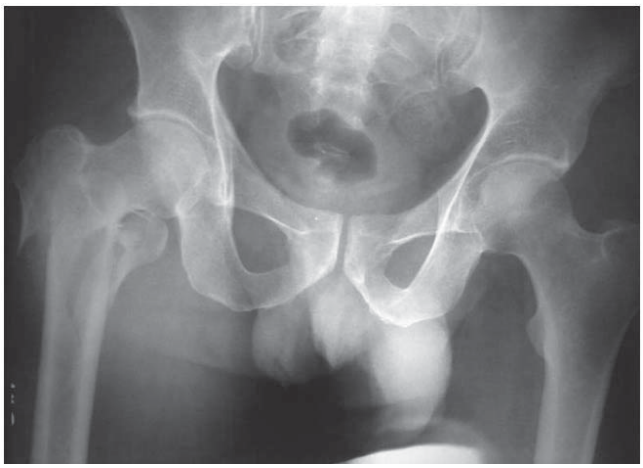

Fig 4. Pre-operative X-ray

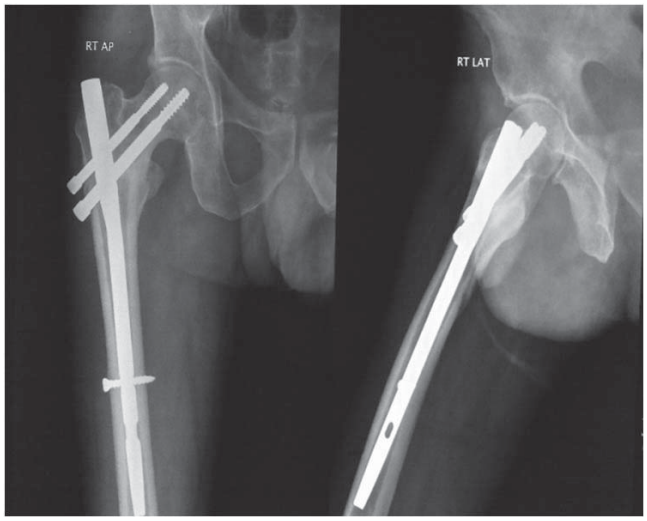

Fig. 5 One year post-operative radiographs (antero-posterior and lateral views)

DISCUSSION

The treatment of trochanteric fractures depends on various factors like, the age of the patients, adequacy of treatment and stability of fixation.The appropriate method and the ideal implant used to fix these fractures are topic still open to debate, with proponents of the various approaches each claiming over the other antegrade intramedullary nailing of trochanteric fractures with the use of Gamma nail was first introduced by Halder in 1980s.[8] Earlier reports suggested some substantial advantages including, minimally invasive surgical technique, shortened operative time, decreased blood loss, improved biomechanics, greater stability of fixation, earlier patient mobilization and shorter lengths of stay. [9–12] However, there was a high rate of technical complications, including fractures of the femur distal to the nail. [12–14] Due to the complications encountered with Gamma nail, the AO/ASIF in 1996 developed Proximal Femoral Nail (PFN) with the length of 240mm, proximal

diameter of 14mm, shaft diameter ranging from 10-12 mm, tip shaped to reduce the stress and lateral bend of 6 degree. Various authors have suggested intramedullary device to be superior for certain subsets of patients, particularly those with reverse obliquity pattern, lateral wall or posteromedial comminution and fractures extending to the femoral neck or subtrochanteric region.[15–17] This was based on biomechanical principles, cadaver studies,[18,19] and clinical series.[5,10,20] In a study conducted by Klinger HM *et al* the mean operative time was 43 minutes.[21] There are studies done by various authors who have found that blood loss to be less in patients treated by intramedullary fixation of trochanteric fractures. Our study is consistent with all these literature findings with the mean operative time of 42.20 minutes (range: 23 – 90 minutes) and the mean blood loss of 65.83 ml (range: 30 – 120ml).[22, 23]

As the surgery is minimally invasive the postoperative analgesic requirement was also less. The postoperative rehabilitation was easier with patients being less painful and could be made ambulatory from first postoperative day. The mean hospital stay in our study was 11.73 days (range: 5- 28 days). This was consistent with the study done by Klinger HM *et al* who found that with PFN the mean hospital stay was 20 days.[21] The better restoration of function is also attributed to lack of compression at the fracture site which prevents subsequent shortening of the neck in the patients treated with PFN.[7] We had similar findings in our series with none having femoral neck shortening as a result of compression at fracture site.

In a study conducted by Madsen *et al,* [20] 98% of the patients were able to withstand physiologic loads after intramedullary fixation at 6 months after surgery. Similarly, Chevalley and Gamba *et al* found that 100% of their patients tolerated physiologic loads at 7.2 months after surgery.[24] Pajarinen *et al* in his study found that patients treated with PFN regained their preoperative walking ability at 4 months.[7] In our series all patients tolerated full weight bearing ambulation at 3 months postoperative period. It has been seen that the rate of clinical failures decreased from 0% to 4.5% with the use of second generation nail like PFN.[13,25–27] Saudan *et al* used PFN in 100 patients and reported no fractures and the rate of femoral head cut out with the use of second generation nail was found to be ranging from 2.5% to 8.3%.[22] In our study we did not encounter any case of femoral shaft fractures distal to the nail and none had femoral head cut out. Thigh pain which is said to occur in patients where nailing is performed was not seen in any of our patients. There are various studies which report occurrence of thigh pain in 0% to 14% of the cases.[13, 27] The lack of much complication in our study might be due to the small frame and subsequent lesser weight of the Nepalese population, which exerts lesser stress on the implant. A more extensive study comparing DHS with PFN in this population might be required for better understanding the various theories that are related to the treatment of trochanteric fractures.

As the functional outcome of patients treated with PFN is not significantly different in different grades of trochanteric fractures, PFN which once thought an implant of choice for unstable trochanteric fractures can be a good option for more stable trochanteric fractures. This study also shows that PFN helps in better restoration of preoperative walking ability of the patients and early return to function.

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