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PFN in trochanteric fractures: Clinico radiological outcome study

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Abstract
Intertrochanteric fractures are common in elderly osteoporotic population. Our study aims to analyse the clinico radiological outcome in these fractures operated using Proximal Femur Nail. This is a prospective study was conducted in our department involving 52 patients between June 2014 to June 2016. All patients more than 18 years of age with intertrochanteric fractures less than 2 weeks of injury were included. Pathological fractures, patients with previous hip surgeries, polytrauma and associated neurological problems like stroke were excluded. Fractures classified by AO system and fixed using Proximal Femur Nail. Optimal position of cervical screw in immediate postop and mean lateral sliding of cervical screw during every follow up were analysed. Harris Hip Score is used to analyse the functional outcome at 1 year. Optimal Placement of screw achieved in 76% of patients with mean clinico radiological union time of 15.4 weeks. Lateral sliding of lag screw is more in unstable A3 fractures with mean lateral slide of the lag screw at the end of 1 year was 4.9mm.Proximal Femur Nail is useful impant in unstable intertrochanteric fractures. Complications can be minimised by strictly following the principles of fracture fixation.

Keywords: Intertrochanteric fractures, PFN, Harris hip score, screw cut out, "Z" effect

Introduction
Intertrochanteric fractures are one of the most common fractures in elderly osteoporotic population [1]. They cause significant increase in morbidity and mortality in these age group. These fractures if treated conservatively are associated with considerable period of immobilisation which increases the risk of deep vein thrombosis, bed sore related complications, etc. Therefore early stable fixation and early mobilisation becomes mandatory to prevent the potential complications of immobilisation. Though various implants are available for fracture fixation, Short Proximal Femur Nail (PFN) provides stable construct even in unstable fractures and allows early mobilistion and early weight bearing in this population.

Materials and methods
Our study is a prospective study involving 52 patients admitted with intertrochanteric fractures in Government Royapettah hospital, Chennai between June 2014 to June 2016. All patients with age more than 18 with intertrochanteric fractures less than 2 weeks of injury were included in our study. Patients with previous surgeries in hip or proximal femur, pathological fractures, associated co-morbid like stroke and polytrauma are excluded from the study as they interfere with functional outcome. Each patient was stabilized hemodynamically in the casualty. Fractures classified using AO system of classification as below and about 65% of patients belonged to AO type A2 pertrochanteric multifragmentary type. 1. A1-Pertrochanteric Simple, 2. A2-Pertrochanteric Multifragmentary, 3. A3-Intertrochanteric fracture. Standard preoperative evaluations were done and surgery done in supine position on fracture table under C arm guidance under spinal anesthesia. The135° angled Short PFN of length 250mm was used. The diameter of nail was assessed intraoperatively. Our hospital protocols for antibiotic and DVT prophylaxis were followed. Standard rehabilitation protocol were followed in all patients such as hip, knee, patients such as hip, knee, ankle mobilization exercises from 2nd

POD, partial weight bearing from 7th day. Suture removal done on 12th day and all patients were followed at 3rd week ,6th week and then once in two months All patients were followed up for minimum period of one year and datas like duration of surgery, blood loss, optimal placement of cervical screw mean union time, lateral sliding of cervical screw were analysed. Functional outcome using Harris Hip Score was analysed at the end of one year.

Results

Demographic characteristics and various observations including average duration of surgery, blood loss, placement of the lag screw, lateral sliding of the lag screw, clinic-radiological union time, functional outcome based on Harris hip score were analysed and documented. Of the 52 patients, 28 patients (54%) were male and 24 patients (46%) were female. Average duration of surgery was 45 mins and average blood loss was about 150ml. Based on Morihara *et al.* [2] study, optimal position of the lag screw in the post-operative radiograph analysed by drawing to parallel lines in AP radiograph dividing the femoral head into three equal parts and drawing two parallel lines in lateral radiograph dividing the femoral head into three equal parts as shown in the figure 1.

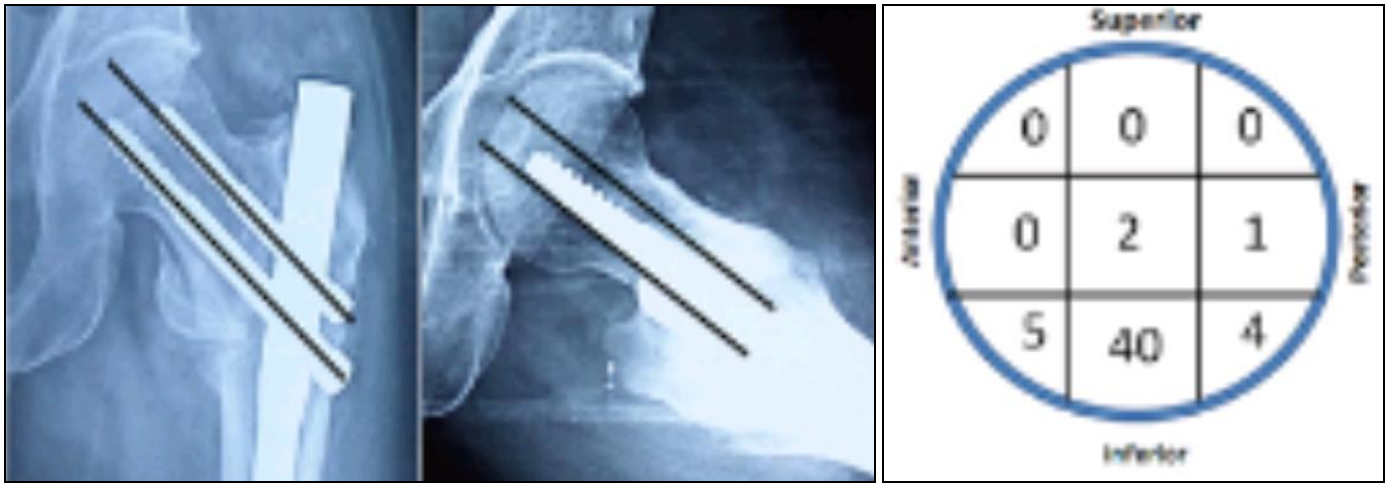


Fig 1: To calculate the optimal position of the lag screw placement based on Morihara *et al*. study

Optimal placement of lag screw i.e. Inferocentral position is achieved in 76% (40 out of 52 patients). Lateral sliding of the lag screw was analysed in AP radiograph during post op follow up and its mean at the end of one year was found be 4.9mm. Mean Clinico radiological union time was15.4 weeks. On functional outcome evaluation at the end of one year 28% had Excellent, 42% had Good, 18% had Fair, 12% had Poor results based on Harris Hip Score. We encountered 3 complications with respect to implant failure such as Z effect, Reverse Z effect, screw cut out that were managed by implant removal and cemented hemiarthroplasty. One fracture at the distal lock site at the end of surgery managed by revision with long PFN. One patient had deep infection that lead to implant removal. Overall complication rate is about 10%.

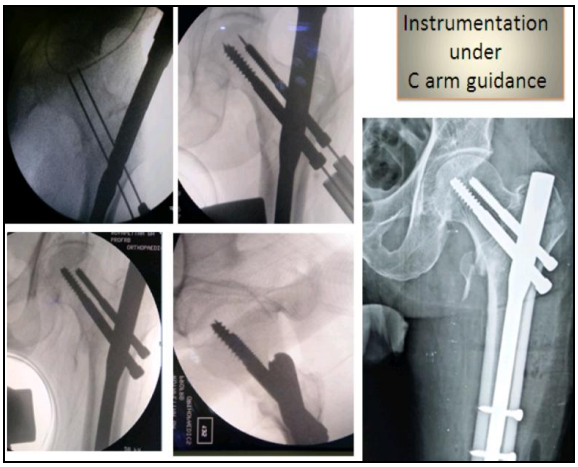
Table 1

Age of the patient	Total no. of patients	Mean harris hip score
30-40 y	09	82
40-50 y	08	80
50-60 y	15	80
60-70 y	20	79

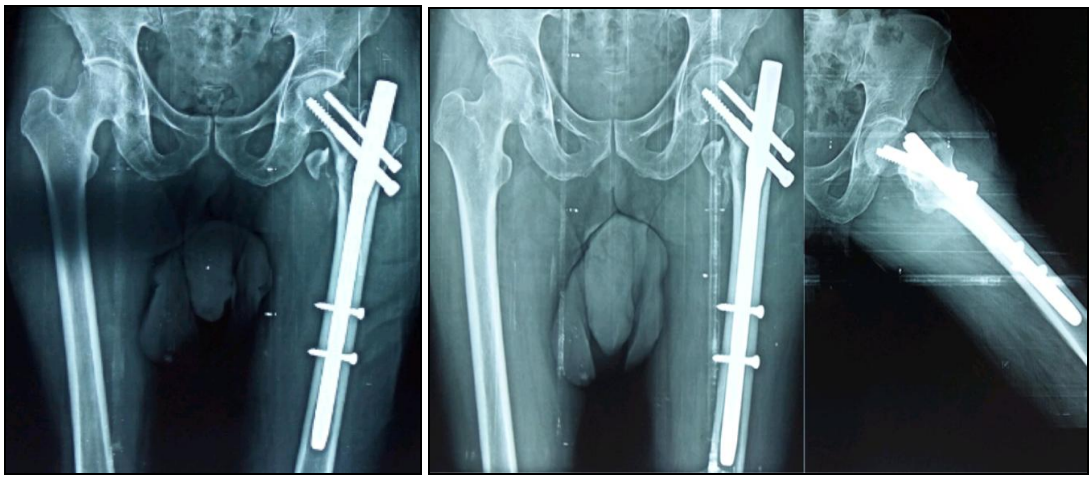
Table 2

Type of fracture	Mean Harris hip score	Lateral sliding of lag screw
A1	85	3.4
A2	83	4.0
A3	78	6.1

70/M patient A2 type fracture



Instrumentation under C-arm guidance



Immediate post-op **two year follow up**

Fig 2: Case illustration

Fig 3: Complication 1: "Z" effect

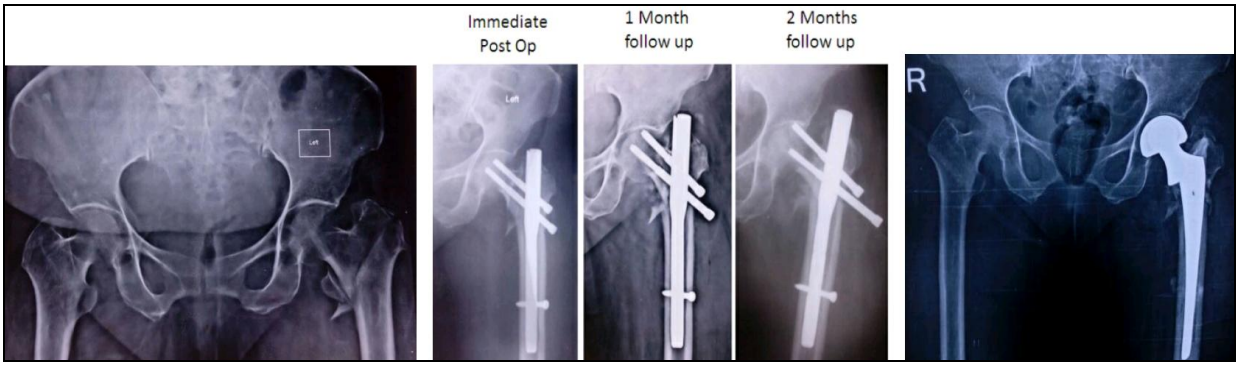


Fig 4: Complication 2: Reverse "Z" effect

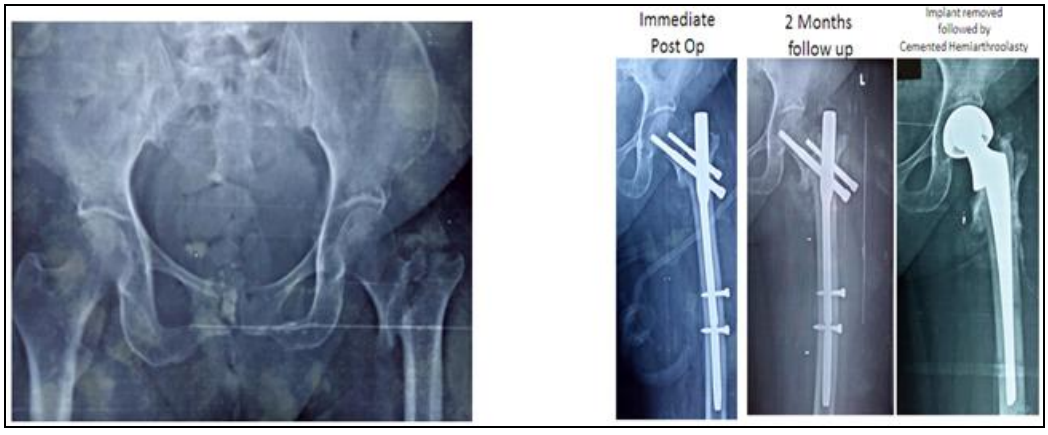
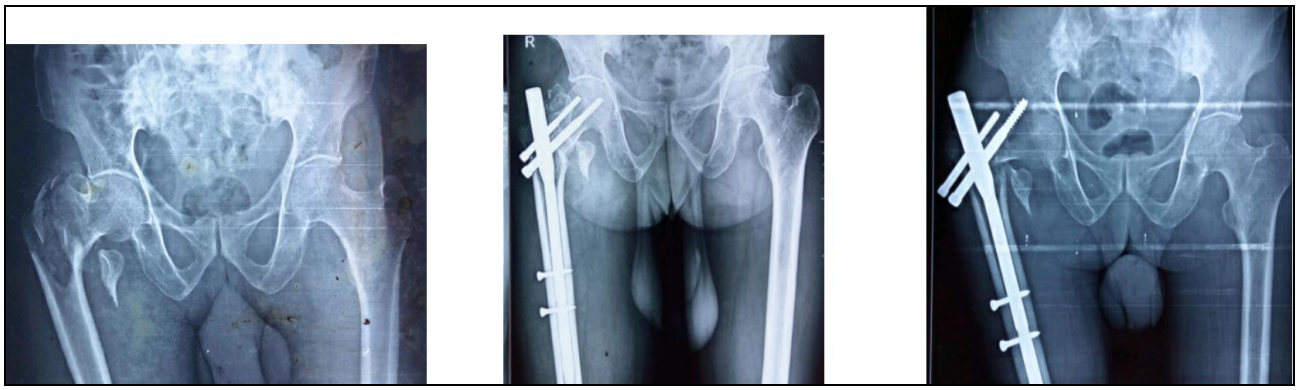


Fig 5: complication 3: fracture at distal lock site.

Fig 6: complication 4: implant failure-screw cut out



Discussion

This study has shown that proximal femur nail is an ideal implant for intertrochanteric fractures. Overall time and blood loss is minimal in PFN when compared to other procedures [3, 4]. In our study, the mean duration of surgery was 45 mins and average blood loss was 150 ml which is much less compared to other procedures.

In our study the mean Harris hip score in the age group of 30-40 years was 82, in the age group of 40-50 years it was 80, in the age group of 50-60 years it was 80, in the age group 60-70 years it was found to be 79. This age wise mean Harris hip score does not seem to be significantly different.

The PFN is provided with 2 screws in head with different size. The larger Lag screw aids in carrying most of the load and comparatively smaller derotation screw provides the rotational stability. According to Schipper *et al*, when the derotation was 10 mm shorter than the lag screw, the percentage of the total load carried by the hip pin ranged from 8 to 39% (mean, 21%) [5]. the cut-out of the femoral head can be avoided and unacceptable implant failure or fracture displacement were reduced significantly [6]. In our study also during surgery this was considered and derotation screw used was 10mm shorter than the lag screw, thus reducing the overall incidence of cut-out and implant failure.

In a prospective study after analyzing the mechanical failure for the implant in a series of 230 patients T.R.C. Davis *et al*. [7] published that the reason behind the screw cut out is mainly due to the position of fixation device (posteriorly placed screw more cuts out more than centrally placed) followed by fracture pattern and least due to the bone quality. In our study it is shown that infero-central placement of screws is achieved in 40 out of 52 patients, accounting to 76% of the subjects.

To avoid the complications like "Z" effect, screw cutout and paradoxical reverse "Z" effect it essential to assess the sliding distance of lag screw from the early postoperative period. Excessive sliding of lag screw is early indication of the "Z" effect and restriction of normal sliding is an early indication of the screw cutout or penetration of screw into the joint [2]. Changing the weight bearing protocol to non-weight bearing based on the sliding measurement can avoid such complications. In our study mean lateral sliding of lag screw is about 4.9mm at the end of one year with maximum of 6.1mm in A3 type of fractures. In our study A1 type had a mean lateral sliding of lag screw of about 3.4mm, in A2 mean was 4.0 mm.

In a study by Pajarinan *et al*. [8], they found that fixing the unstable intertrochanteric fractures initially in a slightly valgus position helps in preventing the excessive varus that may occur during initial 6 weeks. In the article published in 2017 SICOT, Wasudeo M. Gadegone *et al*. [9] went one step ahead to find the solution to prevent the implant failure in unstable intertrochanteric fractures by augmenting the fixation by additional Poller screw missing the nail or by using encerclage wire thereby preventing the lateral blow out. But in the critical analysis from the Norwegian Hip fracture register between 2005 to 2010, based on the observation of 7643 operated Type A1simple two part fractures Kjell Matre MD [10] *et al*. concluded that sliding hip screw is better in Type A1 simple two part fractures than intramedullary nails like PFN as the latter is associated with more number of reoperations within 1st postoperative year

Good anatomical reduction of the fracture, and proper positioning and length of the lag screw and derotation screws are crucial for the PFN procedure and reported to yield excellent outcomes [11, 12].

Conclusion

Based on our results, we suggest that PFN is the implant of choice in intertrochanteric fractures but, complication may happen in any best hands that can be avoided by strictly following the principles of fixation, vigilant follow up and early identification of complication postoperative period.

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