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Research Article

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A prospective study of Surgical management of inter Trochanteric femoral fractures with short PFN (proximal femoral nail)"

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Abstract

Osteoarthritis, a disabling disease that induces high degrees of disability and high health costs in all parts of the globe can be very disabling despite advanced surgical joint replacement and remedial procedures. Adversely impacted in the face of injury plus aging shoulder osteoarthritis alone is an immense burden and multiple observed reversibility challenges. Discussed herein are data spanning 25 years of study 2000-2025 of shoulder osteoarthritis and proprioception and its ramifications. It reveals support for the idea that subnormal proprioception, a sensory modality involved in mediating reflex and coordinated movements, is an important feature of the osteoarthritis disease process, and hence worthy of efforts to detect this abnormality at the outset of the condition, as well as to intervene to heighten or normalize joint proprioception in symptomatic cases.

Keywords: Glenohumeral Joint, Older Adults, Muscle, Osteoarthritis, Proprioception, Shoulder

Introduction

Intertrochanteric and femoral neck fractures account for 90% of the proximal femoral fractures occurring in elderly patients1 which is due to a result of road traffic accident or fall from height. Intertrochanteric fractures is defined as fracture extending from extra capsular basilar neck region along the lesser trochanter before medullary canal development.2 Intertrochanteric fractures were treated conservatively until 1960 before the introduction of internal fixation implants. Because of high complications and mortality rates, nowadays this method is reserved for patients who cannot undergo operative procedures.

The primary goal of the treatment is early mobilization3 to avoid secondary complications which can be achieved by open reduction and internal fixation. Intertrochanteric femur fractures may be repaired with either a Dynamic hip screw or a trochanteric nail.4 Intertrochanteric fractures occur at varying rates in different countries.5

Due to its predictable fracture union, the dynamic hip screw has been regarded as the preferred device. When utilised for unstable intertrochanteric fractures, dynamic hip screws are more likely to cause issues than intramedullary nails. It has been observed that up to 28% of fractures experience mechanical failure, which includes disengagement of the screw and barrel, the loss of purchase of the compression screw within the femoral head, and ripping out of the side plate. Significant limb length loss and a delay in rehabilitation and ambulation may also result from over-impacting the fracture fragments with the side plate and lag screw.6

A short proximal femoral nail with a length of 250 mm and a proximal diameter of 15 mm is therefore developed to enable easy insertion and reduce the risk of femoral fracture. The nail has a Medio-lateral angle for easy insertion and a flexible distal tip to avoid stress generation and refracture.

Here is an effort to study the results of Short Proximal Femoral Nail in the management of intertrochanteric fractures by analysing the factors which influence the post-operative mobility.

Objectives

- To evaluate the functional and radiological outcome of inter trochanteric fractures treated by Short PFN.

- To evaluate the advantages and disadvantages of Short PFN fixation in management of inter trochanteric fractures.

Materials and Methods

Source of data: 70 cases of intertrochanteric fracture of femur from Chigateri General Hospital and Bapuji Hospital attached to J.J.M Medical College, Davangere and Rangaraya medical college, Kakinada, Andhra Pradesh in the period from October 2022 to September 2024 were included in study.

Cases were followed up for a minimum period of 12 months. At 4,6,9,12,16 weeks and then two monthly follow up till 12 months.

A thorough clinical examination was carried out. The initial radiographs included AP view of the pelvis with both hip, AP & Lateral view of the affected femur with the hip joint. The level of fracture was determined and special attention was paid to the possibility of an extension of a fracture line into the cervical or trochanteric region. If any extension was found the case was excluded from the study.

Patient and the family were explained about the nature of the fracture, prognosis of non-operative and operative treatment and also regarding the need for closed/open reduction and internal fixation in their case. The patient and his family members were explained about the study and consent was taken if they agree to be a part of the study.

Inclusion criteria:

Cases of intertrochanteric fractures , both stable & unstable

Age more than 18 years.

Closed type of fractures.

Patients willing for treatment and given informed written consent.

Exclusion criteria:

Femoral neck fractures.

Patients with advanced arthritis or with a pathological fracture.

Patients medically unfit for surgery.

Compound fractures associated with neurovascular injuries, and pelvic fractures.

Patients not willing for treatment.

Study design- Prospective study

The final result were evaluated using Modified Harris Hip scoring system. This score ranges from <70 to 100 points representing worst and excellent hip function respectively.

Results

1) Age Distribution:

Age	No. of patients	Percentage
21-30	3	4.3
31-40	6	8.6
41-50	3	4.3
51-60	10	14.2
61-70	19	27.1
71-80	20	28.6
81-90	9	12.9

2. Sex Distribution:

Out of 70 patients, 44 are male and 26 are female.

Sex	No. of patients	Percentage
Male	44	62.9
Female	26	37.1

Table - 2: Sex Distribution**.**

3. Mode Of Injury

In this study, 14 Patients had history of road traffic accident (RTA) and 56 patients had history of self fall (SF).

Mode of Injury	No. of Patients	Percentage
Road traffic accident	14	20
Self fall	56	80

Table 3: Mode of Injury.

4. Side of Fracture

In this study, 40 patients sustained fracture on the right side and 30 patients sustained fracture on left side.

Side of fracture	No. of patients	Percentage
Right	40	57.1
Left	30	42,9

Table 4: Side of Fracture.

5. Boyd and Griffin type of intertrochanteric fracture

In this study, type 1 were 7 patients , type 2 were 44 patients , type 3 were 13 patients , type 4 were 6 patients.

Fracture type	No. of patients	Percentage
I	7	10
II	44	62.9
III	13	18.6
IV	6	8.6

Table 5: Boyd and Griffin type of Intertrochanteric Fracture.

6. Associated injuries

In this study, associated injuries were encountered in 19 patients.

Associated injuries	No. of Patients	Percentage
Ipsilateral both bones forearm fracture	3	4.3
Ipsilateral clavicle fracture	5	7.1
Ipsilateral colles fracture	6	8.6
Ipsilateral patella fracture	2	2.9
Head injury (concussion)	3	4.3
Ipsilateral rib fractures	2	2.9

Table 6: Associated Injuries.

7. Nail Size Used:

The most commonly used nail length was 250mm x 12mm.

Nail size(mm)	No. of patients	Percentage
250mm *9mm	5	7.1
250mm *10mm	12	17.2
250mm *11mm	17	24.3
250mm *12mm	36	51.4

Table 7: Nail Size Used.

8. Intra- Operative and Intermediate Post-Operative Complications

Complications were seen in 11 patients.

Intra-operative and Immediate Post-Operative Complications	No. of patients	Percentage
Shattering of greater trochanter	4	5.7
Superficial wound infection	7	10

Table 8: Intra- Operative and Intermediate Post-Operative Complications

9. Post-operative mobilization

Partial weight bearing on the operated limb with the help of walker was started on average day of 3rd – 4th post-op day. Patients with significant communication at the fracture site were advised delayed weight bearing.

10. Duration of hospital stay:

Hospital stay duration ranged from 8-23 days.

11. Average operating time:

Operative time is calculated from time of skin incision to skin closure & dressing. In this study it was on an average of 1hr15mins.

12. Secondary procedures

In 6 patients with colles fracture, 4 were treated with k wires and 2 were treated conservatively. In 3 patients with ipsilateral both bones forearm fracture treated with plating, 3 patients with ipsilateral Clavicle fracture treated with pre-contoured LCP, 2 patients with ipsilateral patella fracture treated with tension band wiring(TBW) and 2 patients with ipsilateral Rib fracture were treated conservatively with rib binder.

13. Fracture union :

Time of union ranged from 8-24 weeks with mean union time in this study

14. Delayed post-operative complications

Complications	No. of patients	Percentage
Varus deformity	3	4.9
Screw back out	1	1.4
Limb shortening	2	2.9
Joint stiffness	2	2.9

Table 9: Delayed Post Operative Complications.

15. Functional outcome:

According to modified Harris hip scoring in this study, 33 patients had excellent results, 23 patients had good results and 14 patients had fair results.

Functional results	No. of patients	Percentage
Excellent	39	55.7
Good	23	32.9
Fair	14	11.4
Poor	0	0

Table10: Functional Outcome.

In this study 70 patients with both stable & unstable fractures were studied. Average age is 75 years **(Table 1)** which was slightly high compared to the Indian, western authors with similar studies.

Mundla MKR et al. 24 found that the most common mode of injury for intertrochanteric was slip and fall (70%) followed by road traffic collision (20%).[7]

In this study males were 62.9% and females were 37.1% **(Table 2)**. In Celebi et al[8] series

27.3% were females and 72.7% were males. Majority of this factures are result of self fall which is 80% **(Table 3)** and is comparable to most of the Indian studies. In this study 57.1% right and 42.9% of left sided femurs were effected **(Table 4)**.

In this study mean time of interval between injury and surgery was 6 days (range 2 to 10 days). Comparable with the series of Sadowski et al and Boldin C et al[9] which operated on 6th day 35% and 33% respectively. In our series regarding associated fractures, colles fracture was most frequent. Other long bone, patella fractures and head injury and chest injury are mostly related with road traffic accident **(Table 6)**. Average duration of surgery in our series was 85 min, range (55-140) min, comparable with Celebi et al[8] series-110 min. As experience gained over time the duration decreased greatly. this signifies the learning curve of Short PFN. In this study the mean time for usage of c-arm is 644.25 secs. Results were higher than the series Kostal. R et al 2003[10] of 80 sec and Pavelka. T et al 2003 of 90 sec[11] lack of expert c-arm technician maybe the cause of more radiation exposure when compared to other studies.

During post-operative period, 7 patients had superficial wound infections **(Table 8)** which were treated proper intravenous antibiotics and regular sterile dressings. In this study there were no delayed and non unions . In the studies by A. Lenich et al and Ekstrom et al[12] reported no case of non-union in their series. Complications regarding union are related to fracture pattern, prolonged injury-operation interval, per-operative reduction and post-operative complications especially varus collapse**.** 3 Patients developed Varus deformity with abductor lurch, 1 patient had screw back out because of early weight bearing on the operated limb. 2 patients had developed limb shortening **(Table 9)**. Neck screw cut out, Z effect and reverse Z effect had not been encountered.

In this study Harris hip score was excellent for 39 patients. Good for 23 patients. Fair for 8 patients. Peng-Han Ye et al reported, 26 patients reached an excellent result, 37 good, 18 poor and 9 bad **(Table 10)** according to Harrison hip score.[13]

Here are the few clinical pictures of cases with their pre-operative, post-operative, follow up images and movements achieved at hip joints post-operative.

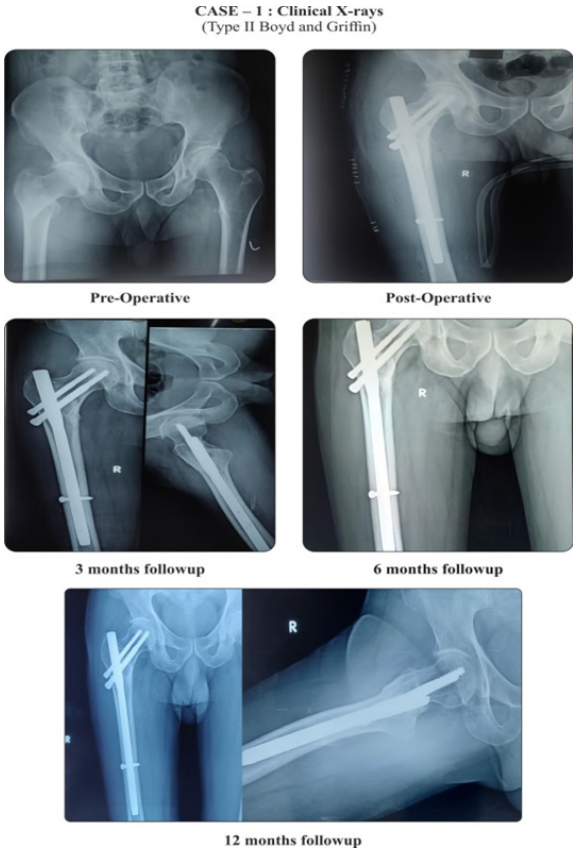

Figure 1: Plain radiograph of right hip anteroposterior and lateral view showing Pre-operative, post-operative and follow up images at 3,6 and 12 months respectively.

Figure 2: Pictures showing significant range of right hip movements like hip flexion with knee in extension, hip extension with knee in extension, cross leg sitting and weight bearing during follow up.

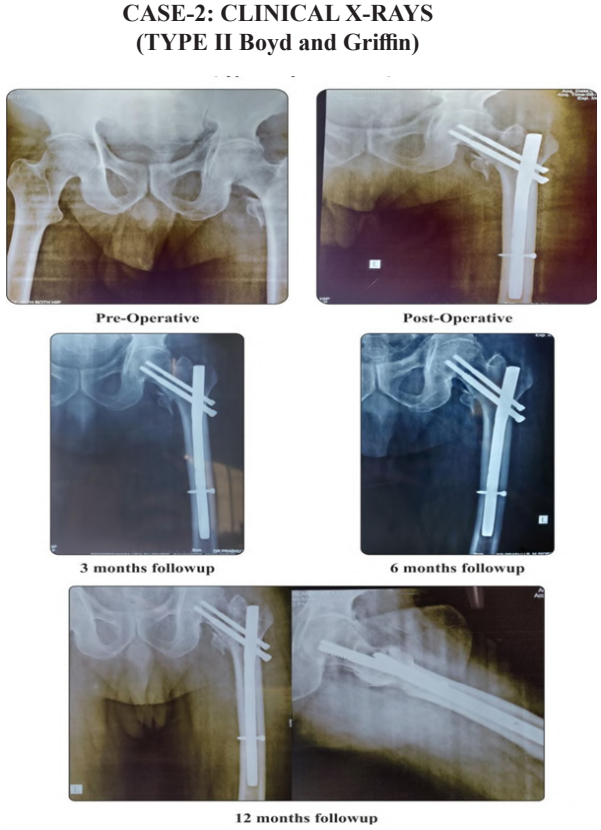

Figure 3: Plain radiograph of left hip anteroposterior and lateral view showing Pre-operative, post-operative and follow up images at 3,6 and 12 months respectively.

Figure 4: Pictures showing significant range of left hip movements like hip flexion with knee in extension, hip extension with knee in extension, cross leg sitting and weight bearing during follow up.

(Type III Boyd and Griffin)

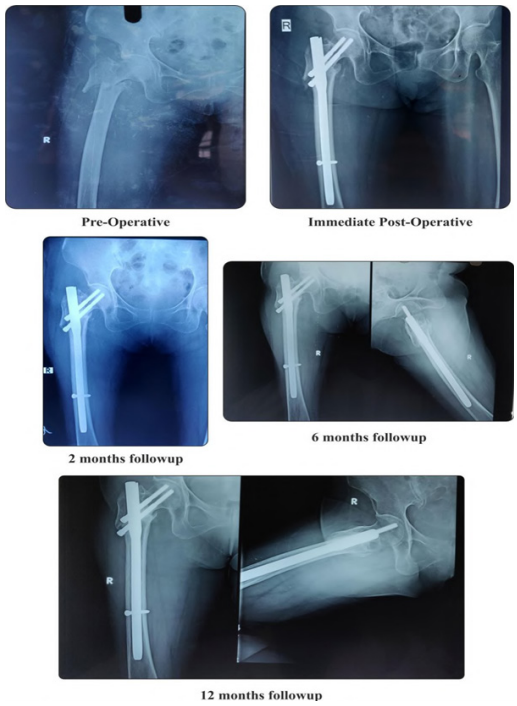

Figure 5: Plain radiograph of right hip anteroposterior and lateral view showing Pre-operative, post-operative and follow up images at 3,6 and 12 months respectively.

CASE – 3 : CLINICAL PHOTOGRAPHS

Figure 6: Pictures showing significant range of right hip movements like hip flexion with knee in extension, hip extension with knee in extension, cross leg sitting and weight bearing during follow up.

Discussion

In Inter trochanteric fractures, success in treatment depends on many factors like age of the patient, general health, time from fracture to treatment, adequacy of treatment, existing medical illness, stability of the fracture.

For best way to access the greater trochanter for the entry point, patient position on the fracture table is important i.e the operated lower limb should be adducted to 10-15 degrees. The c-arm should be positions in such a way that the proximal femur is properly visualized in both AP & lateral views. The entry point of the nail was taken at the tip or lateral to the tip of greater trochanter. As the nail has 6 degrees of valgus angle if entry is medial to the tip of greater trochanter it causes more distraction at the fracture site.

The lag screw is inserted 5mm from subchondral bone in the lower half in AP view & in centre of the neck in Lateral view. De-rotation screw is fixed parallel and 10-15 mm smaller to the lag screw in AP view and the 2 screws should be overlapping in lateral views.

The PFN is a very effective load bearing device that incorporates the principles and theoretical advantages of all the intra medullary devices. Proximal part of nail has more diameter which gives additional stiffness to the implant. It also combines the advantages of closed intramedullary nailing, a dynamic femoral neck screw, minimal blood loss, shorter operative time and early weight bearing than DHS[14] which leads to early union[15]· The lateral entry point of PFN is convenient as many patients needing this procedure are elderly, less active and overweight. Patients with narrow femoral canal and abnormal curvature of the proximal femur are the relative contra indications to intra medullary fixation with PFN.[16,17] For stable intertrochanteric fractures, dynamic hip screw therapy is favored; intramedullary nailing is mostly used for relatively unstable fractures.[18]

The gamma nail and the long PFN are plagued with technical and mechanical failure rates of about 4- 18%.[19] So, to eliminate technical and biomechanical failures, the short Proximal Femoral Nail (PFN) has been devised.

The gamma nail is associated with specific complications like anterior thigh pain, fracture at the tip of the nail. But Proximal femoral nail is long and has smaller diameter at the tip which reduces the stress concentration at the tip. The entry point of the Proximal femoral nail is at the tip of the greater trochanter so it reduces the damage to the hip abductors[20] unlike the nails which has entry through pyriformis-fossa.

Limitation

The most common pre-operative problems encountered in this study are Jig-Nail assembly. The entire procedure is technically demanding procedure, so maintenance of the instrumentation set is very important. Another problem encountered was finding an entry point in a fractured greater trochanter and other important factor was the cost of the implant as Proximal femoral nail is costly than the dynamic hip screw.

Conclusion

It is found Short PFN to be more useful in unstable and reverse oblique patterns due to the fact that it has better axial telescoping and rotational stability. It has shown to be more biomechanically stronger because they can withstand higher static and several folds higher cyclical loading than dynamic hip screw. So, the fracture heals without the primary restoration of the medial support. The implant compensates for the function of the medial column.

In our study one of the important factor was the cost of the implant as Proximal femoral nail is costlier than the dynamic hip screw, but at the end it didn't cause much of the difference because of advantages of PFN.

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