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# Proximal Femoral Nail for Unstable Peritrochanteric Fractures. Is it a Panacea ?

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## ❖ Abstract ❖

Proximal femoral nail is a third generation cephalo medullary nail designed specifically for more biological treatment of unstable communited peritrochanteric fractures than the extra medullary implants. Even then one may land in a difficult situation on table in some problematic fractures in which there is marked communition, angulation, sagging, or displacement of fragments by strong muscle pull that lead to malposition of nail in the proximal fragment.

35 patients who had sustained peritrochanteric fractures that had been fixed with PFN during 2004-2005 and were available for follow up in 2005 were reviewed. The average age of the patient was 40 yrs (28-70 years).

After an average follow up duration of 6 months the results in term of prevention of varus and rotational alignment were found to be encouraging.

Though PFN is emerging as a good biological alternative for difficult peritrochanteric fractures it is not completely full proof. Marked communition with postero-medial void, posterior sag, severe angulations and displacements as well as faulty instruments can all lead to problems. So caution and experience is needed to avoid disaster on table in such problematic fractures.

## Introduction

Peritrochanteric fractures include intertrochanteric fractures, subtrochanteric fractures, subtrochanteric fractures with intertrochanteric extension and isolated fractures of greater and lesser trochanter. 50% of these are intertrochanteric fractures which occur in the region between the greater and lesser trochanter. 15-20 % are subtrochanteric fractures that occur at the site of high bio mechanical stresses which is usually between the lesser trochanter and a point 5 cm distal to it. They have a bimodal distribution occurring in the elderly (above 60) due to low energy mechanisms such as minor fall and in young adults (22-40 years) due to high energy mechanisms such as motor vehicle accidents, gun shot wounds or fall from height. 17 % are pathological fractures. Because of very high compressive forces acting on postero-medial cortices these fractures are associated with high rates of non-union and implant fatigue failure.

Of the various classifications some are listed below.

### (I) Boyd and Griffin classification of intertrochanteric fractures (1949)[1]

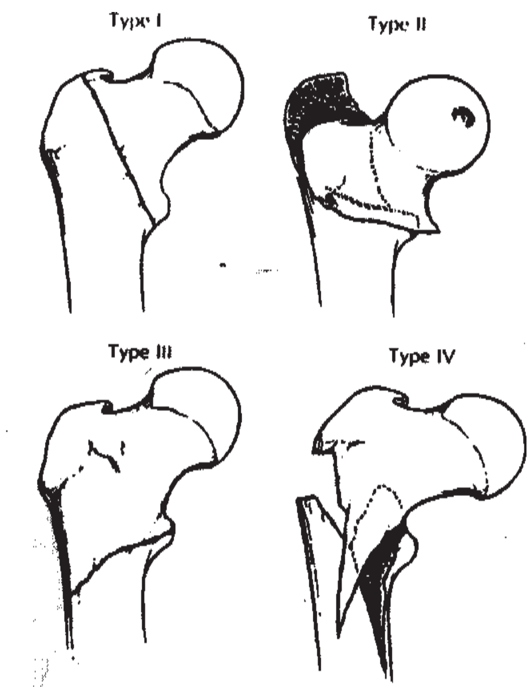
**Type I :** Single fracture line along the intertrochanteric line, stable and easily reducible.

**Type II :** Major fracture line along the intertrochanteric line with communition in coronal plain.

**Type III :** Fracture at the level of lesser trochanter with variable communition and extension in subtrochanteric region.

**Type IV :** Fractures extending into the proximal femoral shaft in at least two planes.

**BOYD & GRIFFIN**




### (II) Evans Classification [2]

**Type I :** Primary fracture line extending from lesser trochanter proximally and laterally, sub divided based on initial stability and stability after reduction.

**Type II :** Reverse obliquity fractures, inherently unstable despite an adequate reduction due to pull of abductors on proximal fragment and that of adductors on distal fragment.

### (III) Fielding classification

**Type I :** At the level of lesser trochanter

**Type II :** Less than 2.5 cm below lesser trochanter.

**Type III :** 2.5 – 5 cm below lesser trochanter

### (IV) Seinsheimer Classification

**Type I :** Undisplaced fractures or one with less than 2 mm of displacement

**Type II :** Two part fractures,

***IIA :*** Two part transverse femoral fractures

***IIB :*** Two part spiral fracture with lesser trochanter attached to proximal fragment.

***IIC*** : Two part spiral fracture with lesser trochanter attached to distal fragment.

**Type III :** Three part fractures,

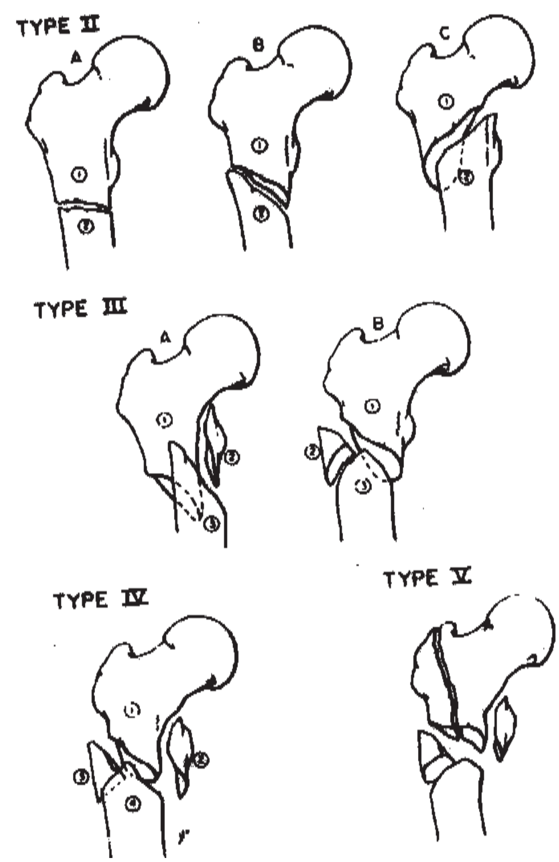
***IIIA :*** Three part spiral with lesser trochanter a part of third fragment.

***IIIB :*** Three part spiral in which third fragment is BFF.

**Type IV :** Communited with four or more fragments.

**Type V :** Subtrochanteric - intertrochangteric configuration.

**EVANS**



**(V) Russell Taylor classification**

**Type I :**Fracture with intact pyriformis fossa

***IA :*** Lesser trochanter attached to proximal fragment.

***IB :*** Lesser trochanter detached from proximal fragment.

**Type II :** Fractures that extend into pyriformis fossa.

***IIA :*** Stable postero-medial cortex.

***IIB :*** Communition of pyriformis fossa and lesser trochanter, associated with varying degree of femoral shaft communition.

Non operative methods of treatment like DRB Cast and 90-90 traction have largely been abandoned as they are associated with complications like venous thrombosis and pressure sores due to prolonged Immobilization and mortality rate of 34.6%.

Operative treatment is done with intra-medullary or extramedullary implant. One goal of operative treatment is to achieve a strong and stable fixation of fracture fragment that will permit the patient to be ambulatory within a short period of time. This stable fixation is determined by,

1. Bone quality
2. Fracture geometry
3. Reduction
4. Implant design
5. Implant placement

It is important before treatment to distinguish by X-rays whether the fracture is stable or unstable based on fracture geometry and whether reduction can restore cortical contact medially and posteriorlly.

Extra medualry devices include sliding compression hip screws that provide compression in the intertrochanteric plane and compression and slide plates that provide additionl compression axially. Intramedullary implants commonly used are simple kuntschers nail, interlocking nail, KY nail, enders nail, Zickel, gamma nail, recon and PFN. PFN has bio mechanical advantage over standard compression hip screws because it can be inserted with less exposure of fracture, less blood loss and gives length and rotational control.

**Material and methods :**

**Proximal femoral nail :** PFN is made of ultra high strength stainless steel alloy which has sufficient strength to allow early weight bearing even in unstable fractures. Proximal locking is achieved through an antirotation bolt or stabilization screw and femoral neck screw or cervical screw. Distal configuration allows static and dynamic locking. The nail has a $6^0$ medio lateral implant angle for easy insertion, flexible distal tip to avoid stress and refracture complications and longitudinal slots throughout the nail that accelerate regeneration of the endosteal blood supply. Nail sizes are 9, 10, 11 and 12 mm with fixed length of 250 mm. Cervical screw is of 8 mm cannulated with length varying from 70 – 110 mm. Stabilization screw is of 6.4 mm cannulated with length varying from 60 – 100 mm.

**Patients and treatment protocol :** 35 patients who had sustained unstable peritrochanteric fractures were managed with PFN at S.C.S.M.Govt.Hospital & Bhandari Hospital, Solapur from May,2003. The age group of the patients was from 28 to 70 years.and the sex ratio was 25 males : 10 females All the patients were put on skeletal traction in abduction pre operatively. X-rays of affected hip with thigh were taken in antero posterior and lateral planes and the personality of fracture, with reference to displacement, comminution and distance of fracture from lesser trochanter was carefully noted, so as to expect possible intraoperative difficulties.

Spinal or epidural anaesthesia was commonly used.

Patient was given supine position on fracture table and fracture reduction achieved by close technique *i.e.,* traction and manipulation. Oblique skin incision is taken just proximal to the greater trochanterl. Dissection of fascia and gluteus maximus is done and trochanteric fossa palpated. Entry was made in mid plane of femur with curved awl and enlarged with cannulated reamer. Under image control, a guide wire was passed through the entry portal and across the fracture site into the distal fragment. Proper size nail was passed over guide wire and its position confirmed on AP and lateral X-rays. After doing proximal and distal interlocking wound was closed in layers and aseptic dressing done. Active quadriceps exercises, ankle and toe movements, knee mobilizing exercises were started on second post op day. Stitches were removed on $10^{th}$ post op day. Non weight bearing ambulation with bilateral axillary crutches was begun at 4 weeks and partial weight bearing started at 8 weeks post operatively. Full weight bearing was commenced once radiological evidence of consolidation was seen. At each follow up, the patients were clinically assessed for pain, limb length discrepancy and active as well as passive movements at hip, knee and ankle. Radiographs were taken to assess the progress of fracture healing and implant failure.

### Problematic Situations

In our series, we encountered intra-operative problems in the following situations —

**1. When there is marked angulation / displacement of the proximal fragment :** The main difficulties faced here are –

Proper entry portal due to the excessive abduction and/or flexion of the fragment

Anatomic reduction of the fracture, overcoming the displacing muscle forces

**2. When there was medial or posterior void due to comminution :** In these situations, the long guide wire and then the nail, even after proper entry, tend to pass in the medial or posterior deficient area, thus getting malpositioned in the angulated proximal fragment due to the void and then may further enter the distal fragment, but with either varus or extension at fracture site, as proximal fragment abduction / flexion angulation could not be controlled.

**3. Sagging of the distal fragment in communited fractures :** Due to comminution especially at entry portal and sag of the distal shaft, the nail enters the distal fragment without much hold on the proximal head-neck fragment and varus and distal sag persisted . Here perfect reduction and its maintenance till the final sitting of the nail was the key factor for a good result.

**4. Technical difficulties due to improper instrumentation , especially in the earlier cases :** With refining of the instrumentation, thankfully, we did not face much intraoperative problems later in the series. Newer instruments like the strong curved awl for easy entry have made life easy.

### Possible Solutions

Our own intraoperative innovations when faced with a difficult situation and suggestions from colleagues led us to find out some solutions for the above-mentioned problems during P.F.N. surgery.

**1. Use of K-wires :** Two K-wires, one anterior and one posterior , along the neck-head at the beginning of the surgery, can help to hold the fractured fragments in proper valgus reduction or to pull an abducted proximal fragment in adduction, while adducting the limb for proper entry through the tip of trochanter. Also toggling with them like joy-sticks can help in fracture reduction during passage of guide-wire / nail.

**2. Use of a Steinman pin :** Just like in Diaphyseal fractures, a Steinman pin is very useful to manipulate the fragment – the abducted / flexed proximal fragment can be pushed into proper alignment with it or angulated fragment may be rotated into proper position by impaling trochanter through the entry portal incision.

Steinman Pin may also be used as a strut in the deficient area ( just like a poller screw ) to prevent migration of guide wire / P.F.N. in that void in proximal fragment, till proximal locking is done.

It can also be used to elevate the sagging shaft either by impaling it or like a lever by passing it posteriorly.

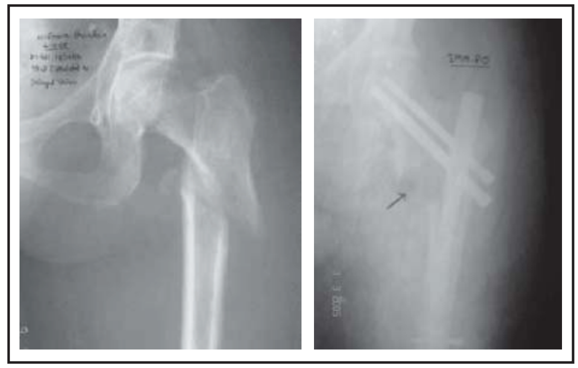
### Results

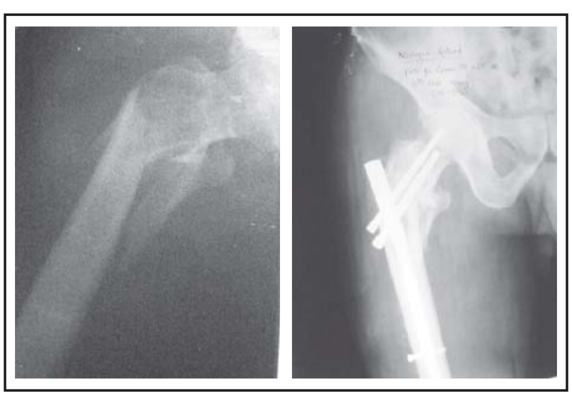
35 fractures in 35 patients (25 males and 10 females) in age group ranging from 28 – 70 years constituted the material for this retrospective study.

There were 26 high energy motor vehicle accidents, 9 moderate energy fall accidents. Associated fractures and medical condition were evaluated. Fractures were classified as per Seinschimer system Fracture Classification by Seinschimer system —

| | |
|---|---|
| Type IIA | 5 |
| Type IIB | 4 |
| Type IIC | 4 |
| Type IIIA | 3 |
| Type IIIB | 5 |
| Type IIIC | 3 |
| Type IV | 5 |
| Type V | 6 |

All the patients, except one, were operated within first two weeks of injury. One patient was a case of 21/2 months old delayed union (type II B ), treated by skeletal traction elsewhere, Operative time ranged from 90 – 160 minutes. In majority of patients 1 unit of blood was transfused. Clinical and radiological union was achieved within three months



in 20 fractures, 3.5 months in 9 fractures, by 4 months in 5 fractures and by 5 months in 1 fracture. There were no cases of non union or implant failure. 30 patients regained full range of hip and knee movements. 4 patients had limitation of hip abduction and one had moderate restriction (upto 80°) of hip flexion. Varus angulation and shortening of less than 2.5 cm was seen in two cases, while antero posterior angulation was observed in one patient. Superficial infection was seen in two patients and was managed by oral antibiotics uneventfully. Fortunately, conversion to other modality of fixation, like 95° DHS with sliding plate etc. was not required in any case due to the steps taken as mentioned above.

### Discussion

Various intramedullary and extrameduallry implants have been used for management of peritrochanteric fractures.

The extramedullary implants include the traditional 135° DHS or 95° DHS with side plate, which are associated with more blood loss, more exposure of fracture site and more chances of infection. The introduction of biological plating by sliding plate technique has definitive advantages like closed nailing; but extramedullary implants are load bearing and thus implant failure is more common. Intramedullary implants, in constrast, are more in line with wt. bearing axis and hence are load sharing, with less stress on the implant and less chances of mechanical failure. Still there are drawbacks of intramedullary nails some of which are given below.[3]

**Enders nail :** Lack of stable fixation, Migration of nail, Knee irritation.

**Kuntschers nail :** Varus angulation, Rotational mal-alignment.

**Routine Interlocking Nails :** Lack of fixation in proximal fragment

**Zickel nail / Gamma nail :** Operative trochanteric communition & cutout of screw through head.

Proximal femoral nail (P.F.N.), being a cephalo-medullary implant, provides fixation in the femoral head and neck. The cervical screw transmits the forces acting on the proximal femur to the intramedullary nail. The gliding connection between the screw and nail allows compression and collapse of fracture fragment and increase stability so that early load bearing is possible. The stabilization screw ensures rotational stability of P.F.N. during operation and subsequent healing process.

But is this nail a panacea for all these fractures, especially the unstable ones ? Our experience over more than 2 years shows that in comminuted and markedly displaced fractures, there can be difficult and frustating situations as outlined above and experience and application of certain innovative techniques is mandatory to achieve good reduction and stable fixation. The same experience has been shared by a few other colleagues in various forums, even to the extent that some have reverted back to minimally invasive percutaneous plate osteosynthesis (MIPPO) technique for comminuted inter/ sub trochateric fractures.

## Conclusion

Proximal femoral nail ( P.F.N.) offers excellent cepholo-medullary fixation in difficult peritrochanteric fractures. But in extensive communition and marked angulations/ displacements / sagging, the technical difficulties may warrant the use of some innovative techniques. Otherwise biological plate (MIPPO) technique also offers a good alternative and should be kept ready on table.

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