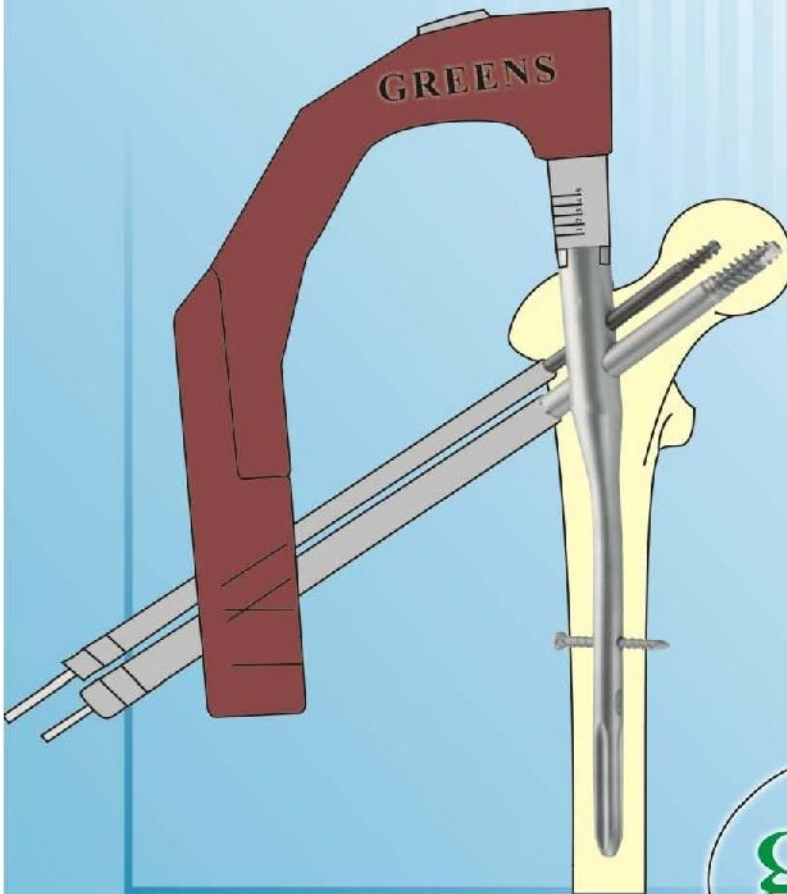


GREENS SURGICALS

ISO 9001 : 2000 Certified Company

**PFN- Proximal Femoral Nail
Standard PFN and Long PFN**





The venture GREENS SURGICALS has been necessitated by the hitherto prevailing communication gap between the practitioners and the manufacturers of the equipments and implants. Therefore, I have taken a humble step to bridge this perceptual gap, with the hope that there will be a better synergy between the two.

As a practitioner myself, I can well imagine the challenges of the operation theater. There are occasions when the situation demand innovations for better results. And this is exactly where a practitioner-manufacturer has inherent advantages. He can better grasp and respond to the specific requirements, if so requested. True to this spirit, we are trying our best to come to your expectations and fulfilling our ever-expanding requirements. We are persistently involved in design development and manufacture of various Implants and Instruments according to the needs of orthopaedic surgeons. In recognition of our honest efforts, we have also been awarded with ISO 9001:2000 and certification which is Internationally recognized.

Dr. Vinay Kumar
M.B.B.S (Hons) Gold Medalist,
M.S (Orth.) MCh (Orth.) U.K

CONTENTS

1	Principles of PFN	2
2	Advantages of GREENS PFN	3
3	Implants of Standard PFN	4
4	Indications/Contra-Indications	5
5	Preparation for Operation	5
6	Surgical Technique for Standard PFN	7
7	Important Technical Points to avoid Pitfall	19
8	Flow Chart- Steps of Operation	20
9	Implants for Long PFN	22
10	Surgical Technique for Long PFN	23
11	PFN Instruments	27

PFN- Proximal Femoral Nail



Principles of PFN:-

This is an interlocking device to fix the fractures around trochanteric region of the femur. Two-point fixation in the neck is used to prevent rotation of proximal fragment. The longer proximal screw (femoral Neck screw) is like a load bearing screw and shorter screw (hip pin) acts as a derotation screw. Dynamisation is possible using the dynamic hole in the distal part of the nail.

Advantages of GREENS PFN: -

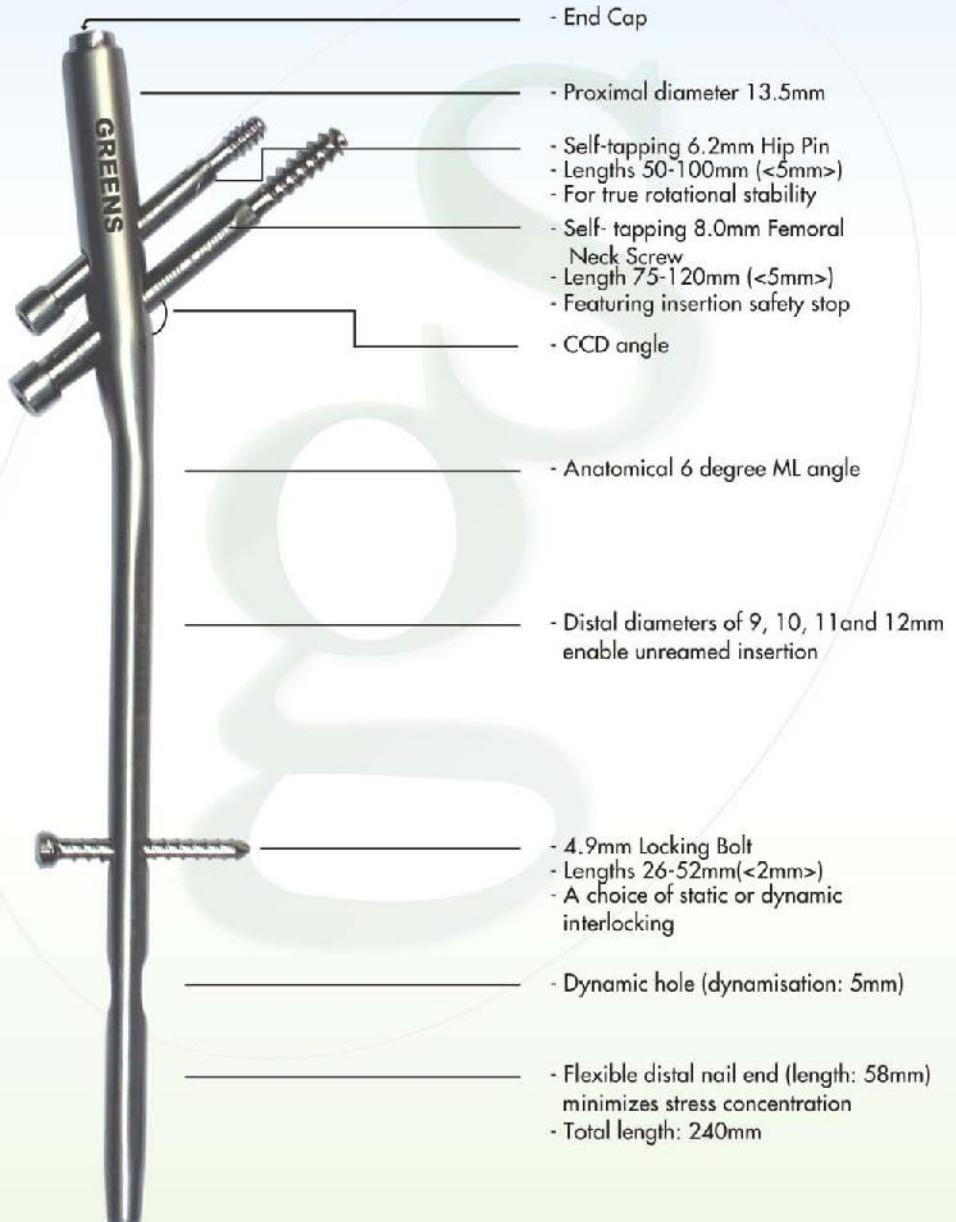
1. The proximal diameter of PFN nail is kept at 13.5mm to prevent splintering of the trochanteric bone and to ensure the easy entry.
 - * Proximal Dia. of Imported Nail(Brand Name S...) = 17mm
 - * Proximal Dia. of Some Indian Companies Nail(Brand Name Y, S...) = 15mm
 - * Proximal Dia. of Greens PFN Nail = 13.5mm
2. Low profile of proximal two screws, occupies less space in the femoral neck minimising bone loss.

Special features of GREENS PFN Instrumentation: -

1. *Insertion Handle* and *aiming arm* are **Radiolucent** so lateral view is not obstructed in the image intensifier.
2. Other Interlocking like Tibia, Femur, Reconstruction and Supra Condylar nailing may be done with the same Insertion handle and instruments.
3. Sleeves are common for all Interlocking.
4. Provision for hammering by a Slotted hammer or Ram.
5. All Instrumentations are arranged in container including tray for the implants.
6. All the cannulated drill bits and cannulated reamers are calibrated.



Implants for Standard PFN



- End Cap
- Proximal diameter 13.5mm
- Self-tapping 6.2mm Hip Pin
- Lengths 50-100mm (<5mm>)
- For true rotational stability
- Self-tapping 8.0mm Femoral Neck Screw
- Length 75-120mm (<5mm>)
- Featuring insertion safety stop
- CCD angle
- Anatomical 6 degree ML angle
- Distal diameters of 9, 10, 11 and 12mm enable unreamed insertion
- 4.9mm Locking Bolt
- Lengths 26-52mm (<2mm>)
- A choice of static or dynamic interlocking
- Dynamic hole (dynamisation: 5mm)
- Flexible distal nail end (length: 58mm) minimizes stress concentration
- Total length: 240mm

Indications/ Contra-Indications

Standard PFN

Indications

- ✎ Pertrochanteric fractures
- ✎ Intertrochanteric fractures
- ✎ High subtrochantric fractures

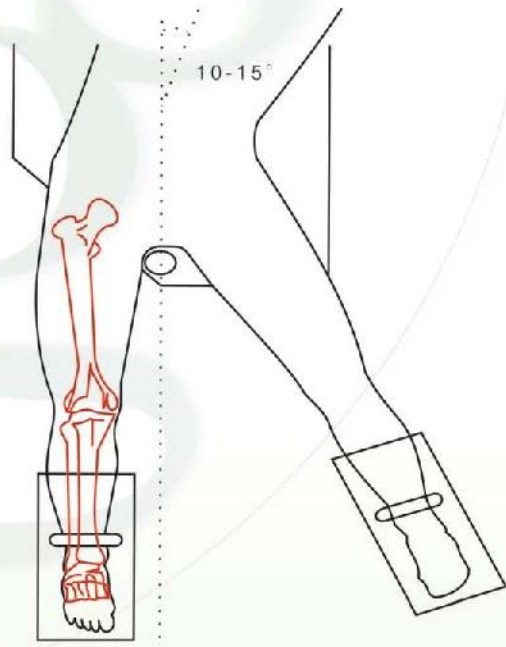
Contraindications

- ✎ Low subtrochanteric fractures
- ✎ Femoral shaft fractures
- ✎ Isolated or combined medial

Preparation

Patient positioning

Position patient supine on an extension table or a radiolucent operating table. Position the C-arm of the image intensifier in such a way that it can visualize the proximal femur both in the lateral and AP planes. For unimpeded access to the medullary cavity, abduct the upper part of the body by about 10-15 degree to the contra lateral side (or adduct the affected leg by 10-15 degree).



Patient positioning

Determine CCD angle

Take an AP X-ray of the unaffected side pre-operatively. Determine the CCD angle using a goniometer or the preoperative planning template.

Reduce fracture

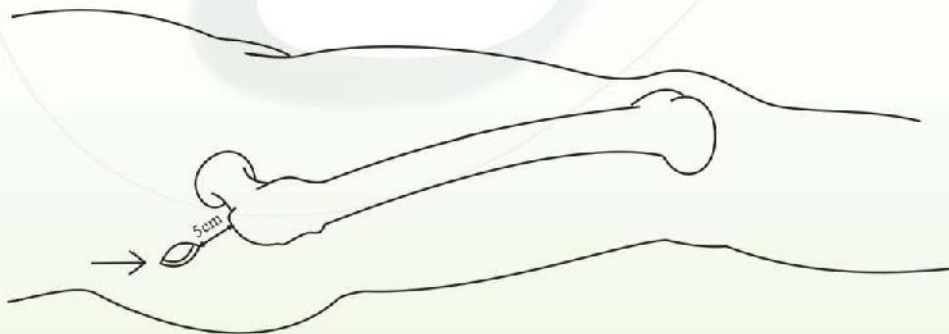
If possible, carry out closed reduction of the fracture under image Intensifier control. Exact reduction and secure fixation of the patient to the operating table are essential for easy handling and a good surgical result.

Determine nail diameter

Nail diameter should be measured in consideration of the X-ray magnification.

Approach

Palpate the greater trochanter. Make a 5cm Long incision approximately 5 to 8cm proximal from the tip of the greater trochanter. Make a parallel incision in the fasciae of the gluteus medius and split the gluteus medius in line with the fibres.



SURGICAL TECHNIQUE FOR STANDARD PFN

1. Determine nail insertion point and insert Guide Wire

In the AP view, the nail insertion point is normally found on the tip or slightly lateral to the tip of the greater trochanter in the curved extension of the medullary cavity.

The medio-lateral angle of the implant is 6° . The nail is positioned with convexity medially. This means that *Guide Wire* must be inserted laterally at an angle of 6 degrees to the shaft. The *guide wire* can be inserted either with the Universal Chuck or T-Handle or with cannulated rasp inserted over a 2mm dia K.wire or steinmann Pin. The central position of the guide wire is confirmed in the lateral view.

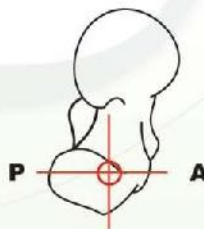
In lateral view, place the *guide wire* in the center of the medullary cavity to a depth of about 15cm (fig. 1 a).

Note:

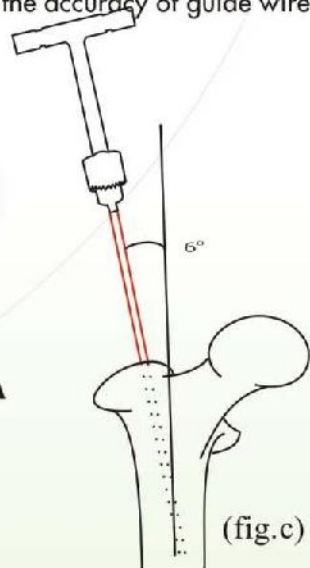
A nail is placed over the anterior surface of thigh and the accuracy of guide wire



(fig.a)



(fig.b)

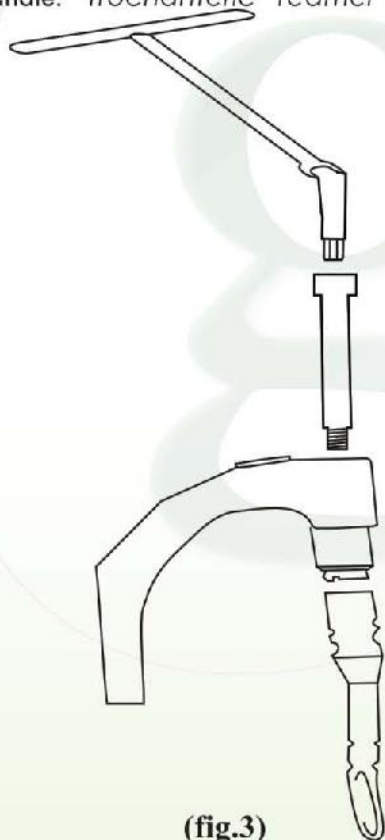


(fig.c)

(fig.1)

2. Opening of the femur

Protection sleeve 16.5/14.5 (solapur type, Inst.10) is slipped over the guide wire. The oval exit of the protection sleeve should face laterally over the tip of the greater trochanter (fig.2). Guide the cannulated 14.0mm trochanteric reamer (Inst.11) over the guide wire through the protection sleeve and ream manually with the Universal Chuck with T-Handle. Trochanteric reamer is



(fig.3)



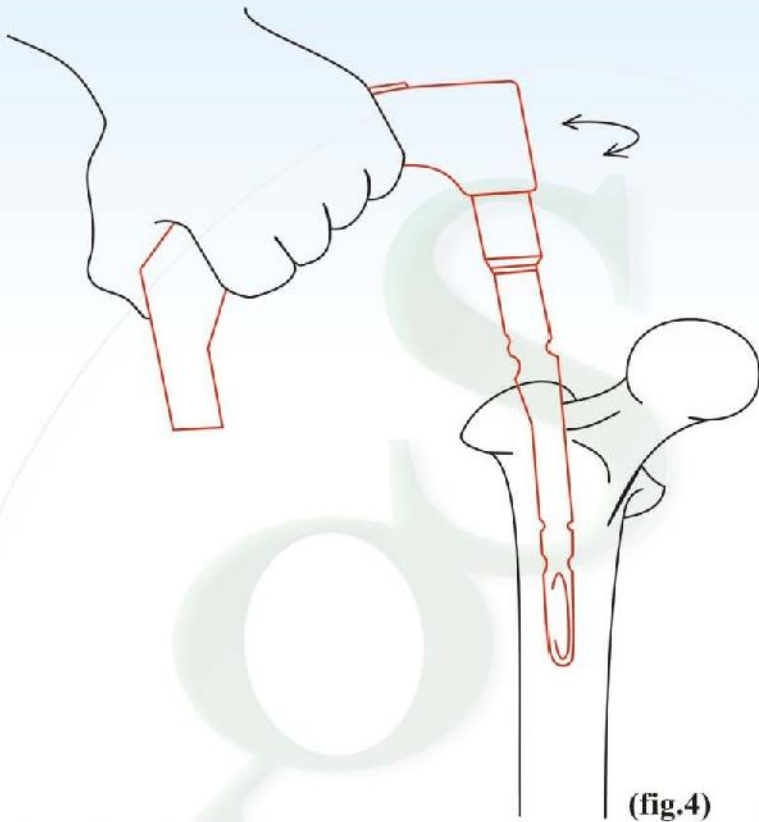
Solapur Type Sleeve

(fig.2)

3. Assemble instruments

Guide the Nail connecting bolt (Inst.24) through the Insertion Handle (Inst.1) and secure the nail tightly to the insertion handle using the hexagonal polyaxial wrench (Inst.25). The nail diameter has already been determined during preparations for surgery.

Ensure that the connection is tight to avoid deviation when inserting the screws through the aiming arm (Inst.2). Do not attach the aiming



(fig.4)

4. Insertion of Standard PFN

Carefully insert the nail manually as far as possible into the femoral opening. Slight twisting hand movements help insertion (fig.4), if the nail cannot be inserted, select a smaller size nail diameter. Insertion can be supported by light blows. *Adaptor* (Inst. 18) is fitted on the mounted protection shield. *Hammer guide* (Inst. 19) should be fitted with *adaptor*. With *slotted hammer* (Inst. 20) light blow may be given to insert the nail.

Caution

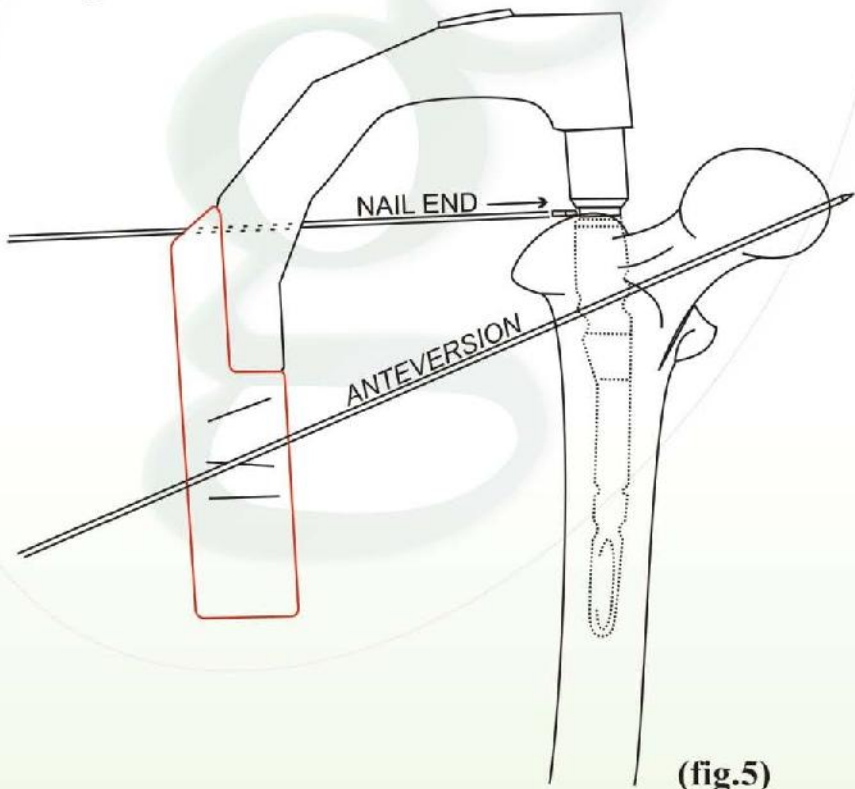
Avoid unnecessary use of force. In smaller medullary canals, ream the distal part to

5. Insertion of hip pin and femoral neck screw

Tightly secure the appropriate *Aiming Arm* to the *insertion handle*. Insert these screws using the drill sleeve systems consisting of *protection sleeve*(Inst.3), *trocár* (Inst.5), *wire sleeve* (Inst.6), *drill sleeve* (Inst.8) and *reamer sleeve* (Inst.4).

Note:

The upper end of the nail can be checked by inserting a 2.0 mm wire through the *insertion handle* (fig.5). To ensure the correct ante version of the implant, an additional *guide wire* can be inserted Ventral to the femoral neck into the femoral



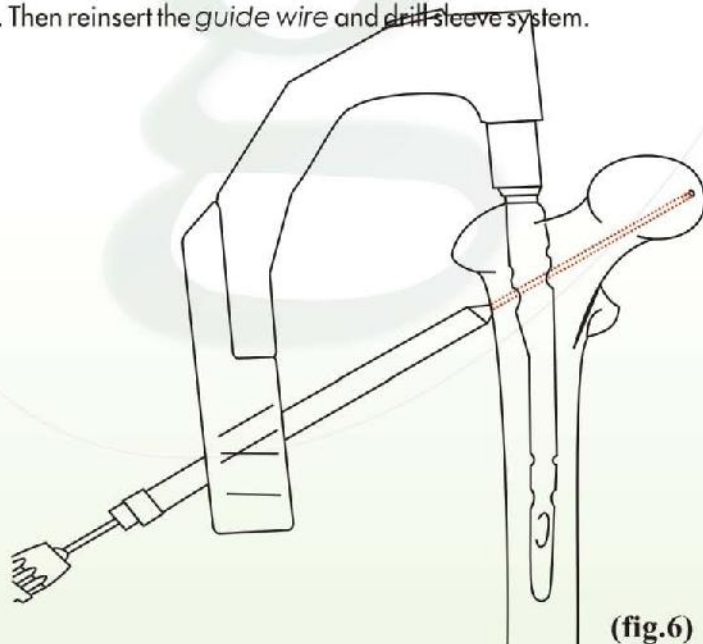
(fig.5)

6. Insertion of Guide wire for femoral neck screw

Make a stab incision and insert the Drill Sleeve System through the *aiming arm* to the bone. Mark the femur and remove the *trocarr*. Insert a new 2.0mm *Guide Wire* through the *wire sleeve*; check direction and position under image intensifier in AP and lateral views. Choose a position in the caudal area of the femoral head so that both proximal screws can be inserted. Insert the *guide wire* 5mm deeper into the femoral head than the planned femoral head screw. The final position of the *guide wire* should be in the lower half of the femoral neck (fig.6). In the lateral view, the wire should be positioned in the center of the femoral neck (fig.7b).

Note:

If the nail has to be repositioned, remove *guide wire*, *protection sleeve* and *wire sleeve*. The nail can now be repositioned by rotation, deeper insertion or partial retraction. Then reinsert the *guide wire* and *drill sleeve* system.



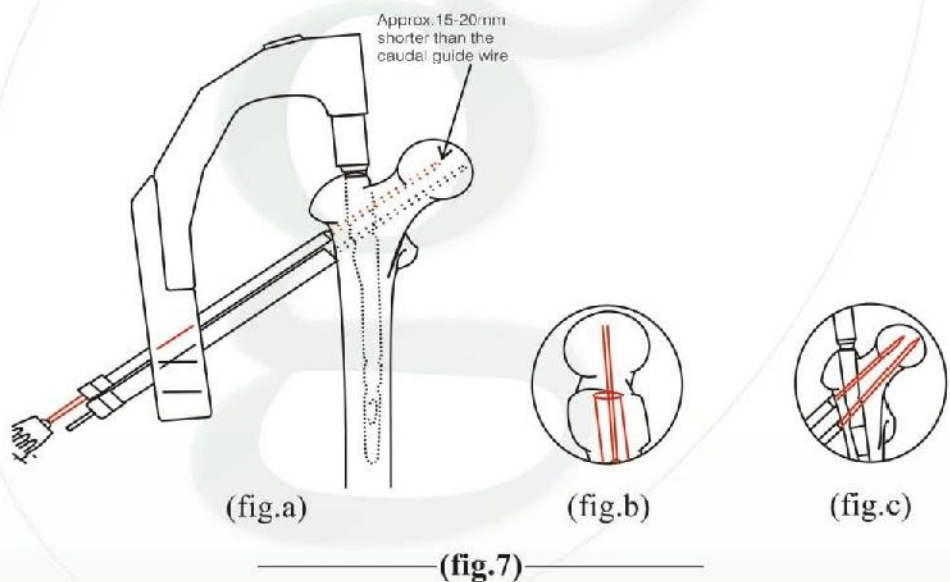
(fig.6)

7. Insertion of Guide Wire for hip pin

Insert the Drill sleeve system through the drill hole on the *aiming arm* to the bone. Then remove the *trocar* and insert a second, new 2.0mm *guide wire* through the wire sleeve into the bone. The tip of the guide wire should be positioned at least 20mm medial to the fracture line and 5mm deeper than the planned hip pin, but approx. 15-20mm less deep than the planned femoral neck screw (fig.7a).

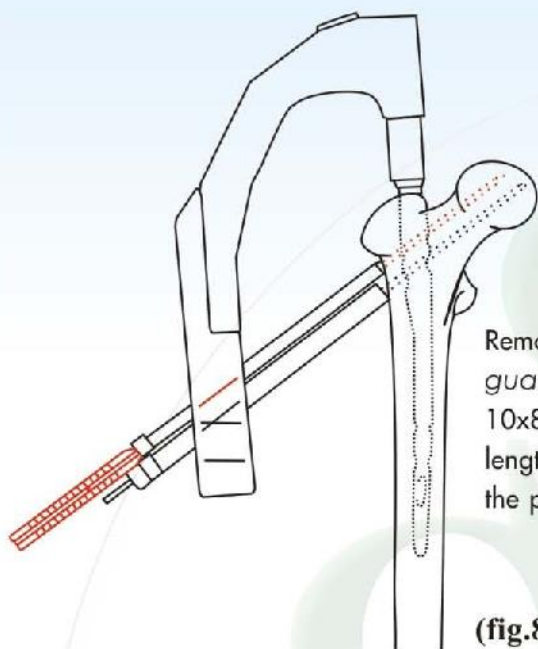
Note :

The use of hip pin is essential to avoid rotation. As only the femoral neck screw has a



8. Measure length of hip pin

It is recommended to start with the insertion of the hip pin to prevent possible rotation of the medial fragment when inserting the femoral neck screw.

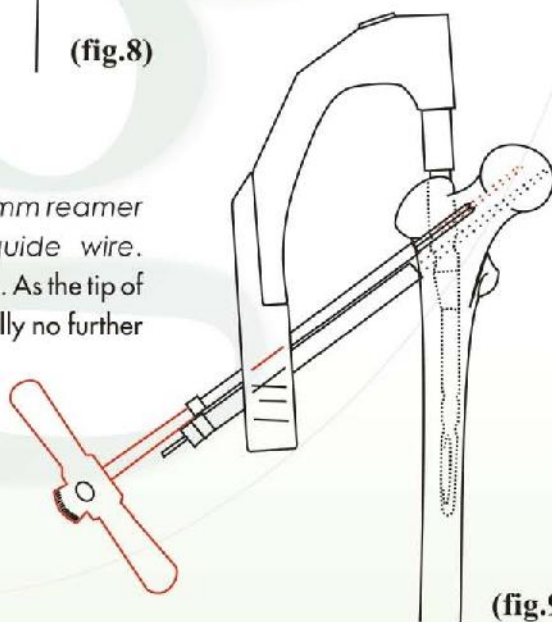


Remove the drill sleeve. Guide the *depth gauge* through the *protection sleeve* 10x8 (Inst.4) to the bone and determine the length of the required hip pin. The length of the pin is indicated on the *depth gauge*

(fig.8)

9. Drill hole for hip pin

Advance the *cannulated 6.2mm reamer* (Inst.12) over the *2.0mm guide wire*. Maximum drilling depth: 45mm. As the tip of the hip pin is self-tapping, usually no further



(fig.9)

Note:

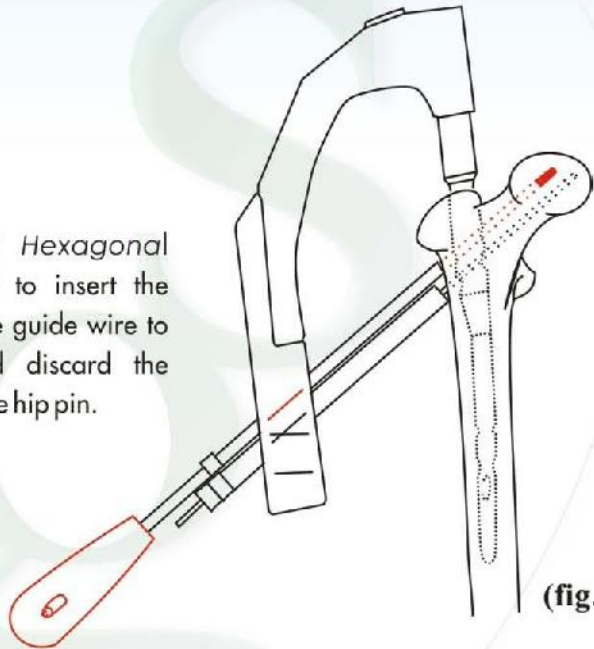
Ensure that *reamers* depth does not exceed 45mm (There is

10. Procedure in hard bone

In hard or young bone, further drilling and tapping with the *cannulated 6.2mm Tap* (Inst.29) is recommended up to the length of the hip pin as measured Previously.

11. Insertion of hip pin

Use the *Cannulated Hexagonal Screw driver* (Inst.17) to insert the selected hip pin over the guide wire to the stop. Remove and discard the *2.0mm guide wire* of the hip pin.



(fig.11)

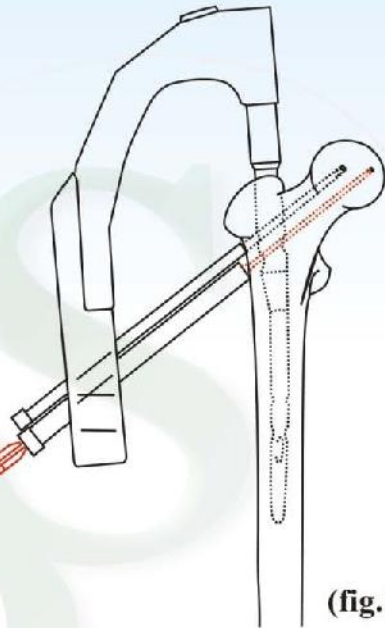
Caution

Do not insert the hip pin with undue force. Ensure that the lateral end of the hip pin clearly protrudes from the lateral cortex. Check under image intensification that hip pin is not inserted too far.

12. Measure length of femoral neck screw

1. Drill hole to the appropriate length by calibrated drill bit under image. Screw length may correspond with the scale printed on the calibrated drill bit or *depth gauge* may be used. This will also give direct measurement.

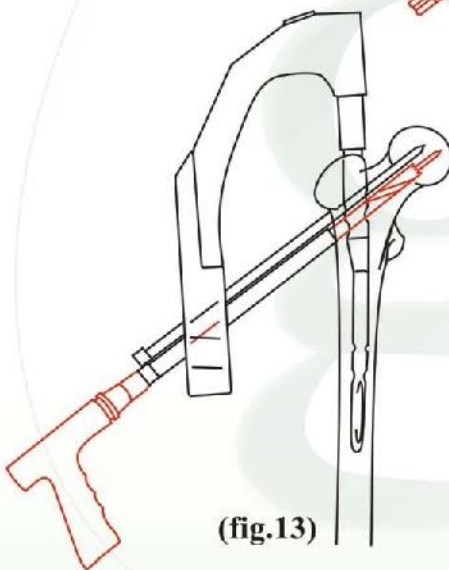
2. Length of the *guide wire* and sleeve may be measured. If the length of the guide wire projecting outside the sleeve and length of the sleeve is known then portion of the *guide wire* inserted inside bone may be calculated provided sleeve rests on the bone. The correct screw length is 5mm short of calculated length of the



(fig.12)

13. Drill hole for femoral neck screw

Over the 2.0 mm guide wire for femoral neck screw drill with 5.5mm *cannulated calibrated drill bit* (Inst.15) to the desired length under image (fig.13). Take out the drill bit. Advance the *cannulated 8.0mm reamer*(Inst.13) over the 2.0mm *guide wire* maximum upto 45 mm. Tapping may or may not be done depending on the quality of bone due



(fig.13)

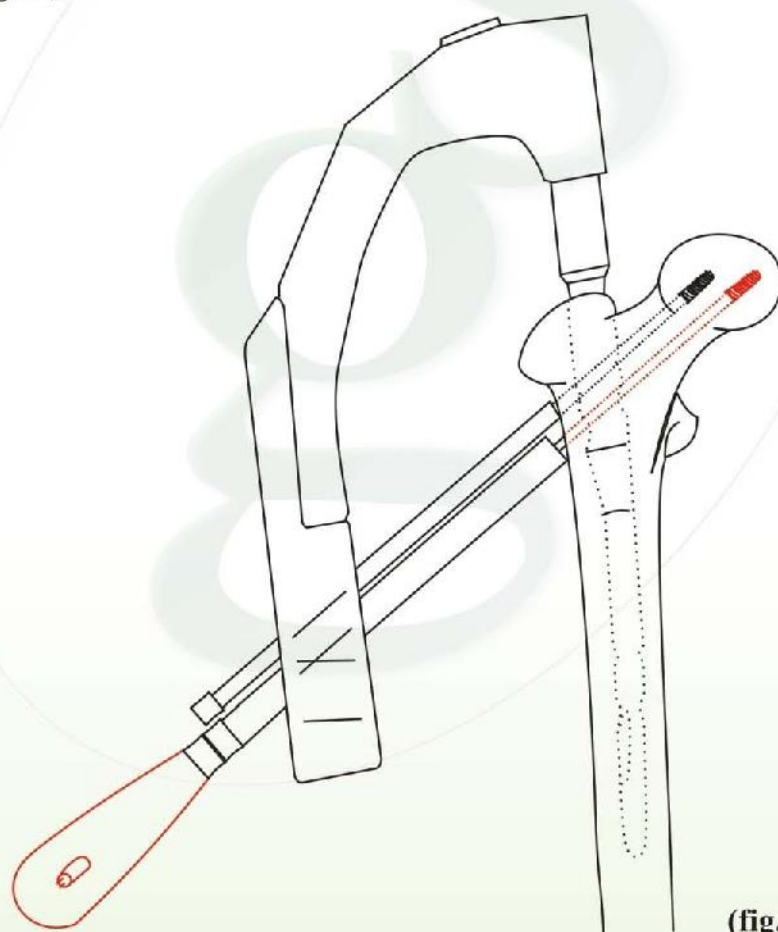
Note:

If the *guide wire* has been bent slightly during insertion, the reamer can be guided over it using careful forward and backward movements. If the guide wire has been bent to a greater extent, it should be reinserted or replaced by a new guide wire. However, in some cases it is possible to cautiously complete reaming without a *guide*

14. Insertion of Femoral neck screw

Assemble the Wrench for Femoral neck Screw and secure it tightly to the selected femoral neck screw. Insert the femoral neck screw over the 2.0mm guide wire and tighten it with *cannulated screw driver* to the stop (fig.14).

Remove and discard the 2.0mm guide wire of the femoral neck screw. Finally, remove both *protection sleeves* from the *aiming arm*. Check under image intensification that the femoral neck screw protrudes slightly over the lateral cortex (fig.15).

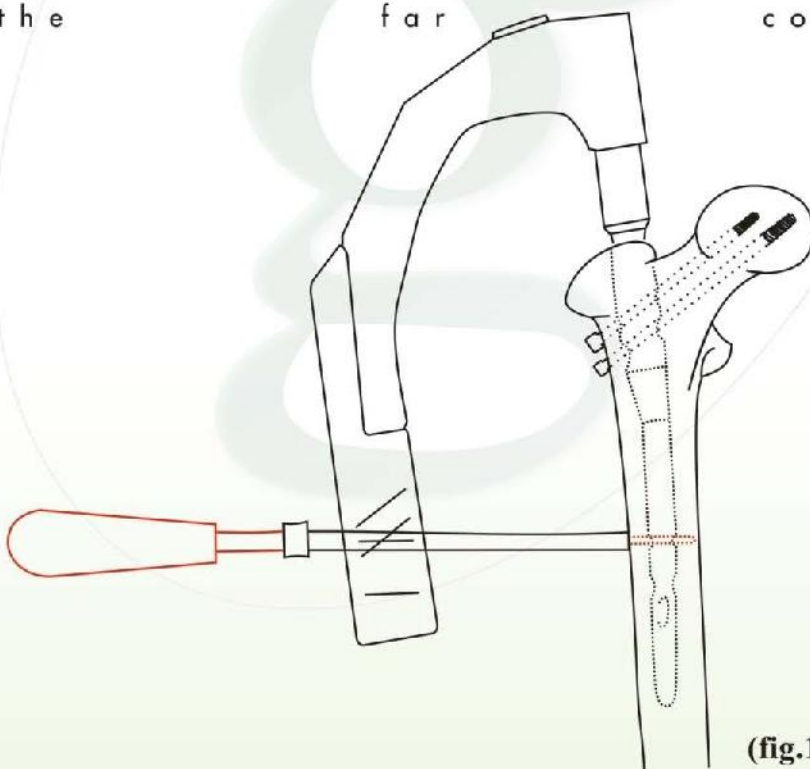


(fig.14)

15. Drill hole for distal locking

Distal locking is usually performed with a single locking bolt. For static interlocking, Use the cranial locking hole only for static interlocking, and the caudal locking hole for dynamic interlocking. Subtrochanteric fractures may be double-locked. Postoperative removal of the static locking bolt allows secondary dynamization.

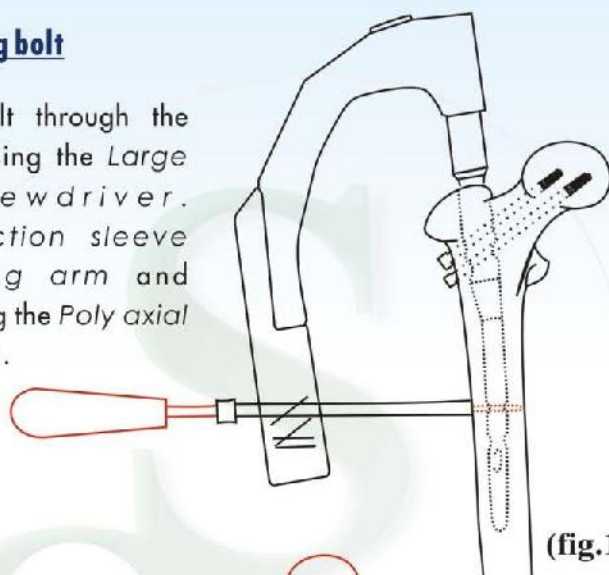
Make a stab incision and insert the Drill Sleeve System through the locking hole selected in the aiming arm to the bone. Insert 10x8 mm protection sleeve. Trocar (8.0 mm) is passed to make trocar point. Trocar is replaced with 8.0x2.0 mm wire sleeve. Wire passed through both cortices (fig. 15). Wire sleeve replaced with 8x4.0 mm drill sleeve. Over the wire 4.0mm cannulated drill bit (Inst.31) inserted and hole is made through both cortices. Length of the screw may be measured using depth gauge. Add 2 to 4.0mm to the reading to ensure that the thread engages the far cortex.



(fig.15)

16. Insertion of Locking bolt

Insert the locking bolt through the protection sleeve using the Large Hexagonal Screwdriver. Remove the protection sleeve followed by aiming arm and insertion handle using the Poly axial Hexagonal wrench.



17. Insertion of End Cap

Align the end cap with the nail axis using the 4.5mm hexagonal screw driver in order to prevent tilting. Screw the end cap completely onto the nail until its surface comes in level with end of the nail.

In order to avoid losing the end cap and to facilitate insertion, the end cap can also be inserted through the trochanteric sleeve.



Important Technical Points to avoid Pitfall: -

1. The anteversion of femoral neck should be neutralised either by rotating the leg medially or by rotating the *universal handle* posteriorly (10-15°) before finally impacting the nail (before bend portion of Nail touches the trochanter).
2. Traction is used to attain correct neck shaft angle (compared to healthy side). This ensures proper *guide wire* placement and prevents limb length discrepancy.
3. The first screw to be inserted is hip pin (6.2mm) and is cranial to femoral neck screw (8.0mm).
4. The hip pin should cross 20mm beyond fracture line and 15 to 20mm shorter than femoral neck screw.
5. Femoral neck screw should pass through caudal half of neck of Femur.
6. Drilling with drill bit may not be required for the hip pin because it is self- Tapping. *Cannulated reamer 6.2mm* may be inserted to pierce through proximal Cortex upto maximum length of 45mm.
7. Reamers matches with screw sizes so it should not be inserted more than 45mm Otherwise chances of loosening of screws are there.
8. If the bone is hard in young patient tapping may be done before insertion of hip Pin and femoral neck screw.

STEPS OF OPERATION

Making Trochanteric Opening

Position the patient and reduce the fracture

Mark the skin 5cm above tip of Trochanter.

Put the STEINMANN PIN on tip of Trochanter.

Continue to introduce it upto 15cm in the medullary cavity under image.

Introduce SOLAPUR type SLEEVE over STEINMANN PIN.

Ream the trochanter over STEINMAN PIN or GUIDE PIN.

Preparation of Medullary cavity

Introduce REAMING ROD.

May be reamed with FLEXIBLE REAMER at least 1mm over nail size.

Place GUIDE WIRE with the help of plastic medullary nail.

Remove SOLAPUR type SLEEVE

Sleeve in PFN nail with Jig or over GUIDE WIRE & place in proper position.

Put a mark over bone surface with TROCAR for Femoral neck Screw.

Put the GUIDE WIRE for Femoral neck Screw.

**Nail introduction
& Hip Pin Fixation**

CHECK :- If wire is not in position
check the reduction and by altering
the traction correct the CCD angle.

Then put the GUIDE WIRE for Hip Pin.

Check the GUIDE WIRE position in
AP & Lateral view.

Ream the proximal cortex for HIP
PIN (max 45mm).

Introduce self tapping HIP PIN (6.2mm).

Over the GUIDE WIRE for femoral
neck, sleeve in 5.5mm cannulated
drill bit.

Drill 5mm more than desired femoral
neck screw.

**Femoral Neck
Screw Placement**

Ream Proximal cortex maximum 45mm.

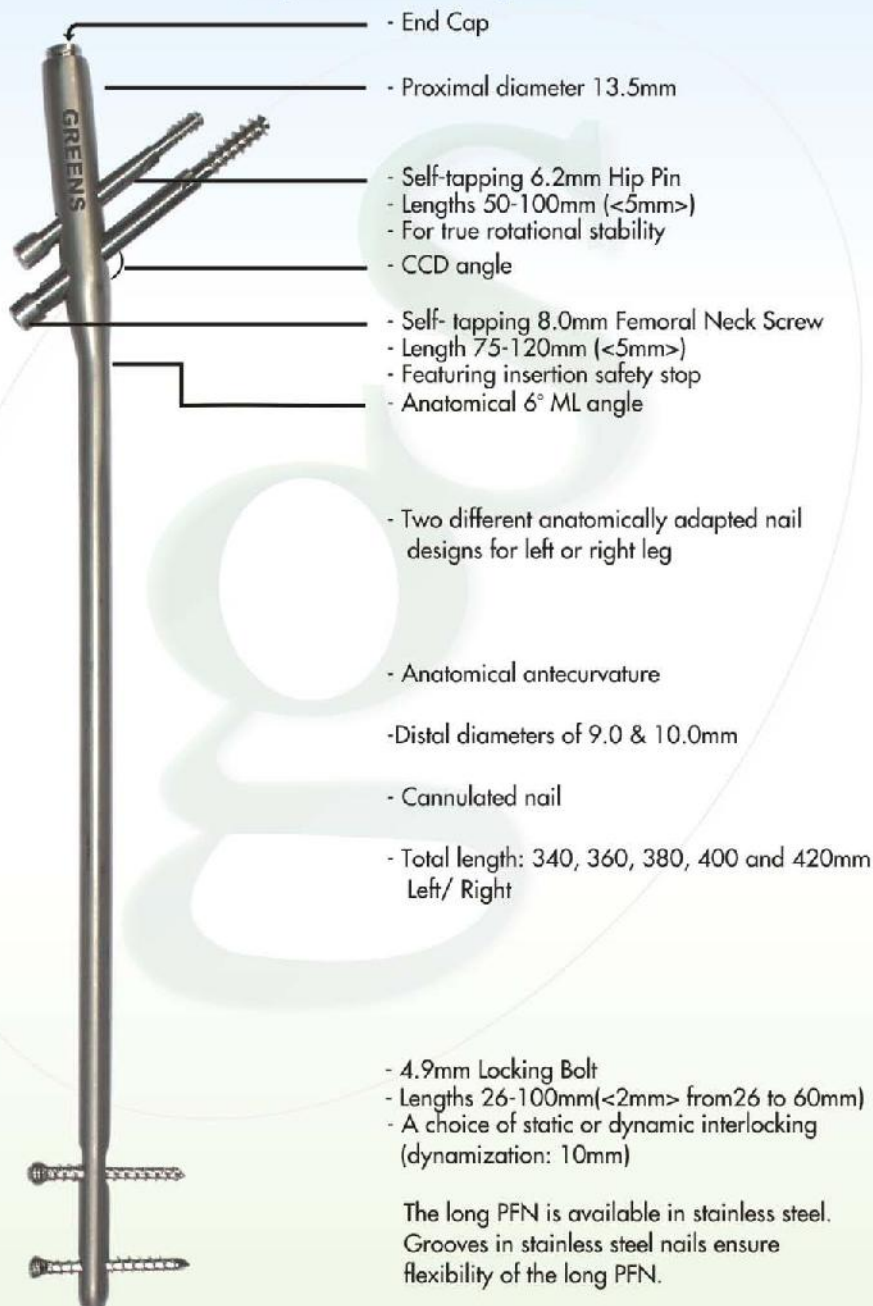
Tapping may be done.

Introduce femoral neck screw (8.0mm).

Distal Locking

Distal locking should be done with
4.9mm locking bolt.

Implants for Long PFN



- End Cap

- Proximal diameter 13.5mm

- Self-tapping 6.2mm Hip Pin
- Lengths 50-100mm (<5mm>)
- For true rotational stability
- CCD angle

- Self-tapping 8.0mm Femoral Neck Screw
- Length 75-120mm (<5mm>)
- Featuring insertion safety stop
- Anatomical 6° ML angle

- Two different anatomically adapted nail designs for left or right leg

- Anatomical antecurvature

- Distal diameters of 9.0 & 10.0mm

- Cannulated nail

- Total length: 340, 360, 380, 400 and 420mm
Left/ Right

- 4.9mm Locking Bolt
- Lengths 26-100mm (<2mm> from 26 to 60mm)
- A choice of static or dynamic interlocking
(dynamization: 10mm)

The long PFN is available in stainless steel.
Grooves in stainless steel nails ensure flexibility of the long PFN.

Long PFN

Indications

- ✍ Low and extended subtrochanteric fractures
- ✍ Ipsilateral trochanteric fractures
- ✍ Combination of fractures (trochanteric area/shaft)
- ✍ Pathological fractures

Contraindications

Isolated or combined medial femoral neck fractures

PREPARATION

SURGICAL TECHNIQUE FOR LONG PFN

The Surgical technique of Long PFN is based on the PFN standard surgical technique. In order to follow the correct procedure, please refer to the respective steps in the standard technique. This part only shows the steps regarding insertion and distal interlocking of the Long PFN, which differ from the standard technique. Usually the 130° nail is most suitable for most indications.

Patient Positioning:

Please ref. to the PFN Standard Surgical technique.

Determine CCD angle:

Please ref. to the PFN Standard Surgical technique.

Reduce Fracture:

Please ref. to the PFN Standard Surgical technique. Very different type of special fracture types, may be considered accordingly.

Determine Nail length:

Please ref. to the PFN Standard Surgical technique. Available nail Dia is 9 & 10mm and Length vary from 34 to 42cm at the difference of 2cm.

SURGICAL TECHNIQUE FOR LONG PFN

Approach

Please ref. to the PFN Standard Surgical technique.

1. Determine nail insertion point and insert guide wire

Please ref. to the PFN Standard Surgical technique.

In the lateral view, place the *guide wire* in the center of the medullary Cavity.

2. Open femur

Please ref. to the PFN Standard Surgical technique.

Optional opening may be done by *cannulated rasp* or *cannulated cutter*.

3. Reaming of Shaft

In some cases reaming might be necessary. Open the femur, insert the *reaming rod* and start reaming with a 8.0mm fixed reamer and continue reaming with a progressive size reamer (diameter gradually increasing by 0.5mm). The diameter of the last reamer used should be 1-2mm larger than that of the nail.

Note: Position the reaming rod in the center of the medullary cavity to ensure correct Positioning of the nail.

4. Assemble Instruments

Please ref. to the PFN Standard Surgical technique. (Page-8)

Note:

Choose the appropriate nail for the left or right Femur.

5. Insert Long Proximal Femoral Nail

Please ref. to the PFN Standard Surgical technique. (Page-9)

6. Insertion of Hip pin and Femoral neck screw

Please ref. to the PFN Standard Surgical technique. (Page-10)

7. Distal Locking

Please ref. to the PFN Standard Surgical technique. (Page-17)

Dynamization :

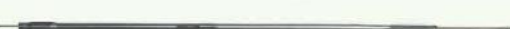
If immediate dynamization is required, only use the caudal locking slot. For secondary dynamization insert both locking bolts and remove the static bolt at a later date. Static interlocking may be done if locking bolt is placed at the proximal end of the capsule (dynamic) hole and for dynamic interlocking locking bolt placed at the distal end of the dynamic hole.

8. Insert End Cap

Please ref. to the PFN Standard Surgical technique. (Page-18)

-----Subject to alteration-----

PFN INSTRUMENTS



1. Dr. Vinay Universal Insertion handle for PFN™
2. Dr. Vinay Universal Aiming Arm for PFN™
3. Protection sleeve 12 x 10 mm
4. Protection/Reamer sleeve 10 x 8 mm
5. Trocar 8.0 mm
6. Wire Sleeve 8 x 2.0 mm
7. Wire Sleeve 10 x 2.0 mm
8. Drill Sleeve 10 x 5.5mm
9. Drill Sleeve 8 x 4.0 mm
10. Protection Sleeve for Trochanteric reamer-solapur type- 16.5 x 14.5 mm
11. Trochanteric reamer cannulated 14.0 mm
12. Hip Pin reamer cannulated- 6.2 mm
13. Femoral Neck Screw reamer cannulated 8.0 mm
14. Universal handle for reamer s
15. Cannulated drill bit 5.5mm



16. Guide wire 2.0mm-1pc



17. Screw driver cannulated 5.5



18. Adaptor for inserter-extractor guide



19. Inserter extractor guide/hammer guide



20. Slotted hammer



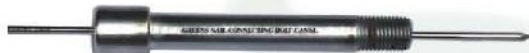
21. Tomy Bar for Adaptor /Pin wrench



22. Curved Awl



23. Depth gauge



24. Nail connecting bolt cannulated



25. Hexagonal polyaxial wrench-8.0mm



26. Guide Wire 2.5mm-95cm



27. Reaming Rod with olive point 2.5mm-95cm



28. Cannulated Tap 8.0mm

29. Cannulated Tap 6.2mm

30. Drill Bit plain 4.0mm

31. Drill Bit Cannulated
4.0mm

Additional Attachments: -



Distal Jig for Femur Interlocking™



Distal Jig for Tibia Interlocking™



Jig for Supra Condylar Interlocking™

Innovative Master Instrumentation

Answer to all Interlockings of lower limb

- 1. Proximal Femoral Nail (PFN)**
- 2. Reconstruction Nail**
- 3. Femur Interlocks**
- 4. Supracondylar Interlocks**
- 5. Tibia Interlocks**

All in One Set.



GREENS SURGICALS

(ISO 9001:2000 & CE Certified Company)

5400/7, NEW CHANDRAWAL, JAWAHAR NAGAR, DELHI-7

Ph: 55163876, 23851794, 23859955 (Off),
27444040(Fact)

Fax: 91-011-23859955

E-mail: greensurgicals@vsnl.net

Web Site: www.greensurgicals.com

Innovated by:

Dr. Vinay Kumar

M.B.B.S (Hons) Gold Medalist,

M.S (Orth) M.Ch (Orth) U.K