

**A STUDY OF MANAGEMENT OF
SUBTROCHANTERIC FRACTURE FEMUR BY
PROXIMAL FEMORAL NAILING**

**A STUDY DONE AT ALLURI SITARAMA RAJU
ACADEMY OF MEDICAL SCIENCES
ELURU**



**DISSERTATION SUBMITTED TO
UNIVERSITY OF SEYCHELLES
AMERICAN INSTITUTE OF MEDICINE**

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE

M.Ch (Orthopaedic Surgery)

Submitted By

Dr. SURBRAMANYAM YADLAPALLI

M.S (ORTHO), MRCS (UK)

DECEMBER 2011

CONTENTS

PART I

1. Introduction	1
2. Aim & Objective	2
3. Review of literature	3
4. Applied anatomy of subtrochanteric region of femur	7
5. Biomechanics of hip and proximal femur	8
6. Classification of Subtrochanteric fractures	10
7. Proximal femoral nailing system	12
8. Operative procedure	16
9. Assessment of results	19

PART II

1. Materials and methods	22
2. Data entry card	24
3. Case sheets of patients	27
4. Observations	64
5. Discussion	76

PART III

1. Summary & Conclusions	79
2. Bibliography	80
3. Master chart of patients	84

INTRODUCTION

Civilization and modernization has brought certain problems along with its own benefits to the citizens of the world over. Fast life styles, rapid and high speed transportation, risky infrastructural projects and modern commando warfare activities have brought in with them morbidity and mortality due to trauma in general and fractures of femur in particular.

Among the femoral shaft injuries upper femoral fractures present a peculiar problem of securing effective neutralization of deforming forces. The mechanical stresses at this level are very high, as they occur at the junction between the trabecular and cortical zone and also because of the deforming forces due to peculiar muscle insertion to the proximal and distal fragments. These factors have made subtrochanteric fractures demand special consideration in orthopaedic trauma, because defective union of this fracture can lead to high disability levels for an individual and thereby loss of valuable man days

Orthopaedic fraternity is always on the lookout for an effective and suitable method to treat the upper femoral fractures in the best possible way. In this process surgical management of these fractures and the surgical implants used have also gone through an array of changes in their procedures and designs. Various upper femoral devices like dynamic condylar screw, dynamic hip screw with barrel plate, gamma nail, proximal femoral nail etc are being used by various centres and each centre claims reasonably satisfactory results with each type of device. The present study was conducted to assess the utility and effectiveness of Proximal Femoral Nail evolved by AO-ASIF in 1997, for various types of upper femoral fractures

AIMS & OBJECTIVES

To evaluate the results of internal fixation of Subtrochanteric fractures of the femur with ***PROXIMAL FEMORAL NAIL – AO Type Design***

REVIEW OF LITERATURE

In 1902 **HIBBS**¹ treated subtrochanteric fractures conservatively in the position of flexion, abduction and external rotation stating that it improves the reduction by bringing distal fragment into alignment with proximal fragment. **SARMIENTO**² in 1960's initially attempted to treat subtrochanteric fractures with femoral cast bracing but later advised against it because of poorer results. **MOONEY'S**, in 1975 also noted poor results with cast brace in terms of varus angulation. Observing the high rate of complications associated with operative treatment of type IIIA subtrochanteric fractures, **SEINSHEIMER**³ in 1978 suggested conservative treatment of these fractures. Couple of years later **JC DE LEE, T.O.CLANTON & C.A.ROCKWOOD**⁴ also conservatively treated these fractures with preliminary traction followed by ambulatory long leg quadrilateral cast bracing with pelvic band and reported good results with this technique. In 1981 **DE LEE**⁴ et al reported good results with 90-90 traction followed by a single hip spica and recommended this for patients with inoperable or open fractures. **WADDEL**⁵, emphasized the role of traction treatment in extensively comminuted subtrochanteric fractures analyzing that it worked well as the deforming muscle forces are dissipated. However satisfactory results are observed in only 50% of displaced fractures. Difficulty in neutralizing the deforming forces on fracture fragments leading to malunion and complications of prolonged bed rest have lead surgeons to favour internal fixation in most of the subtrochanteric fractures.

Initial attempts to treat proximal femoral fractures by operative intervention were made by **DELBET**⁶ in 1910 with a thick screw with higher pitch that purchased better into the bone. **CLEVELAND**⁷ in 1947, and **EVANS**⁸ in 1951 used Moore-Blount plate, Neufled plate and Lorenzo screw respectively, but reported high rates of implant failure. In 1942 **G.KUNTSCHER**⁹, used Cloverleaf Nail for the treatment of subtrochanteric fractures. In 1940's and 1950's Jewett nail was well popularized by **BOYD & GRIFFITH**¹⁰, **KRIK WATSON & CAMPBELL**¹¹. Though Jewett nail initially showed promising results, **TEITGE FIELDING & MAGILATO**¹⁵ noted 35-55% failure rates depending upon the type of subtrochanteric fracture. The AO group in 1969 designed angle plate with 'U' profile and fixed angle of 95 and 135 degrees. **ARONOFF**¹² in 1971, **DISTEFANO**¹³ in 1972, **CECH**¹⁴ in 1974 and **FEILDING**¹⁵ used these plates and reported high rates of complications in terms of varus and rotational deformities, non union, implant failure and medial shift of distal fragment. AO blade plate became a popular device for subtrochanteric fractures in late 1970's and in 1978 **HANSON & TULLOS**¹⁶ reported 87.5% union rates with this device. **WADDEL**⁵ in 1979 used sliding hip screw for subtrochanteric fractures and stated that it is a better implant for type I and II fractures. Couple of years later Dynamic Hip Screw designed by AO/ASIF group was popularised in 1992 by **SCHLEMNINGER** etal, **CLAWSON** and **MASSIE** for selected subtrochanteric fractures, as they noted complication rates of 32% with AO blade plate. **WADDEL**⁵ later reported 10% failure rates with this device.

Intramedullary device with an inbuilt screw was introduced by **ZICKEL**¹⁷ in 1966 and he stated that it provided excellent strength and good control of varus and rotation of proximal fragment, but it lacked rotational control over distal fragment as there was no facility for distal locking.

The effectiveness of this implant for subtrochanteric fractures was further analyzed by **WADDEL**⁵ in 1979 and he noted shortening frequently and also observed that it required additional fixation for grossly comminuted fractures. Closed nailing techniques started to gain importance in early 1980's and attempts to treat subtrochanteric fractures with this technique has shown high rates of union, low rate of infection than previous implants. In 1986 the development of 3rd generation interlocking intramedullary nails took place. **RUSSEL TAYLOR NAIL** was introduced in late 1980s & in 1990, **HALDER** introduced **GAMMA NAIL**. **HALDER S C**¹⁸ in his study on 421 patients reported that Gamma nail transmits weight closer to the calcar than Dynamic Hip Screw and had less operative complications in unstable peritrochanteric fractures. However few complications including the fracture of base of greater trochanter and fractures of shaft of femur at the distal end of the nail have been reported. A search for a new implant for addressing these issues have lead to the development of **PROXIMAL FEMORAL NAIL** by **AO – ASIF GROUP**.

PROXIMAL FEMORAL NAIL was designed in 1997 to overcome implant related complications and facilitate the operative treatment of unstable peritrochanteric fractures. **HUBER SM, HEINING SM, EULER E**¹⁹ studied the biomechanics of Proximal Femoral Nail and showed a significant reduction of distal stress and an increased stability compared with the Gamma Nail. **SIMMERMACHER RK, BOSCH**²⁰ in 1999 and **A.HERRERA**²¹ in their respective studies on Proximal Femoral Nail showed a relatively low percentage of complications and low incidence of implant failure as compared to Gamma nail. In 2002, **SUDAN M, SADOWSKI C**²² in their prospective randomized study on 206 patients, compared Dynamic Hip Screw with Proximal Femoral Nail and stated the advantages of this intramedullary nail.

A year later **CHRISTIAN BOLDIN** et al²³ in his study concluded that proximal Femoral Nail is a good minimally invasive implant for unstable proximal femoral fractures. In 2005, **DANIEL F.A.** et al²⁴ also suggested Proximal Femoral Nail as a useful treatment option for subtrochanteric fractures because of low rates of femoral shaft fractures and failure of fixation associated with this implant. A comparative study by **WOO-KIE MIN** et al²⁵ in 2007, on Proximal Femoral Nail and Gamma Nail for Reverse oblique trochanteric fractures reported better biomechanical results with PFN group, in terms of less sliding of lag screw and less change of neck shaft angle. In 2008, **MSG BALLAL**²⁶ emphasized that good reduction with minimal dissection, use of appropriate length of nail and proper positioning of the nail and screws are necessary to avoid failure or revision with Proximal Femoral Nail and in the same year **SI YONG PARK**²⁷ et al concluded that lesser trochanteric fragment and posteromedial defect played an important role in the stability after intramedullary hip nailing and attributed the fixation failures in the PFN group excessive sliding of the femoral neck screw.

APPLIED ANATOMY OF SUBTROCHANTERIC REGION

SUBTROCHANTERIC REGION OF THE FEMUR is defined as the region between lesser trochanter and junction of proximal and middle thirds of femur. In this region femur is covered circumferentially by well vascularised muscle groups. Anteriorly and laterally it is covered by vastus medialis, vastus intermedius, Vastus Lateralis and medially by adductor brevis and adductor longus and posteriorly by vastus Lateralis and Adductor brevis.

Unbalanced muscle pull following a closed subtrochanteric fracture is the main cause of fracture fragment displacement. The iliopsoas, with its insertion to the lesser trochanter, typically causes the proximal fragment to flex and externally rotate and the short abductors that insert onto the greater trochanter cause the abduction of the proximal fragment. Distal fragment because of the unopposed pull from the adductor magnus, always displaces it medially and further aggravates the deformity.

BIOMECHANICS OF HIP AND PROXIMAL FEMUR

Forces applied to the hip during ambulation produces stresses in the proximal femur because of combined effects of axial, bending and torsional loads. Normally the proximal femur is loaded so that the medial cortex is compressed and the lateral cortex is under tension. Major compressive stresses in the femur are greatest in the medial cortex 1 to 3 inches below the lesser trochanter, i.e. the subtrochanteric region and this region is considered to be one of the highly stressed region in the body. Tensile stresses of about 25% less occur at the lateral cortex slightly proximally.

Following the fracture, unbalanced muscle pull results in displacement of the fracture and this displacement is difficult to neutralize. The iliopsoas, with its insertion to the lesser trochanter, typically causes the proximal fragment to flex and externally rotate and the short abductors that insert onto the greater trochanter cause the abduction of the proximal fragment. Distal fragment because of the unopposed pull from the adductor magnus, always displaces it medially and further aggravates the deformity. In addition comminution of the medial cortex further adds to the injury. In addition comminution of the medial cortex further adds to the insult of this highly stressed area.

Cephalomedullary nails are able to provide necessary bending and torsional stability to combat the displacement of the fracture fragments. Proximal femoral nail being an intra medullary device is a load sharing device and has the inherent advantage of shorter lever arm, thereby decreasing the tensile strain on the implant²⁹

The hip screw and the anti rotational screw proximally provide increased rotational stability of the head-neck fragment. The two distal locking screws control the rotational stability of the distal fragment. A biomechanical analysis by **TENCER etal**³⁰ on various implants used for subtrochanteric fracture have found that bending stress, torsional stress, load to axial failure are superior in cephalomedullary implants than all the other implants. Another biomechanical evaluation done by **PAUL R.T. KUZYK etal**³¹ in 2009, on reverse oblique trochanteric fractures concluded that intramedullary devices were significantly stiffer and had a greater load to failure than the 135 degree and 95 degree constructs, especially with a gap between the bony fragments. Indirect fracture reduction, preserving the fracture hematoma, less soft tissue dissection, decreased amount of blood loss add to the decreased overall morbidity.

CLASSIFICATION OF SUBTROCHANTERIC FRACTURES

1. FIELDING AND MAGLIATO¹⁵ Devised a three part anatomical classification in 1966.

TYPE 1: Fracture at the level of lesser trochanter

TYPE 2: Fracture within 1 inch below lesser trochanter

TYPE 3: Fracture within 1 to 2 inches below lesser trochanter

2. RUSSEL TAYLOR classification^{32, 38} : This classification is based on current techniques and principals of closed intramedullary nailing and continuity of lesser trochanter and extension of fracture lines into greater trochanter (or) posteriorly into pyriform fossa. It disregards the degree of comminution.

TypeI: Fracture does not extend into pyriform fossa.

TypeIA: Comminution and fracture line extend from below lesser trochanter to femoral isthmus

TypeIB: Fracture line and comminution involve area of lesser trochanter to isthmus.

TypeII: Fracture extends into Pyriform fossa.

TypeIIA. No significant comminution (or) fracture of lesser trochanter is seen.

TypeIIB. Comminution of medial cortex and loss of continuity of lesser trochanter are seen.

3. In 1978 **SEINSHEIMER**³ developed a classification based on fracture pattern. Significance of this classification is that it identified fractures with loss of medial cortex stability, which is known to have a higher rate of implant failure

TYPE I: Undisplaced (or) Less than 2mm displacement

TYPE II: Two Part Fracture.

TYPE IIA. Transverse fracture

TYPE IIB. Spiral Fracture with lesser trochanter attached to proximal fragment.

TYPE IIC. Spiral Fracture with lesser trochanter attached to distal fragment

TYPE III: Three Part Fracture.

TYPE IIIA: Three part spiral fracture with lesser trochanter as a part of third fragment.

TYPE IIIB: Three part spiral fracture with third part a butterfly fragment.

TypeIV: Comminuted fracture with four (or) more fragments

TypeV: Subtrochanteric-Intertrochanteric configuration.

In this study we have followed **SEINSHEIMER**'s classification, as in this classification subtrochanteric fractures are classified according to the number of major fragments and the location and shapes of the fracture lines³. This helps us to identify specific type of fracture patterns that are associated with high complication rates.

PROXIMAL FEMORAL NAIL SYSTEM

A proximal femoral nail was designed by AO – ASIF group in 1997 for the treatment of proximal femoral fractures. PFN being an intramedullary nail is positioned closer to the mechanical axis of femur and therefore is subjected to smaller bending moment than laterally placed plate and screw devices. The short lever arm also decreases tensile strain on the implant there by reducing risk of implant failure. Additional anti rotational screw increases the rotational stability of the head-neck fragment. The nail can be inserted percutaneously without opening the fracture site and the length being only 250mm, predrilling is not absolutely necessary. It has the facility of static or dynamic locking distally. The nail is tapered towards the end to minimize the risk of postoperative fracture at the nail tip and also the distal locking screws are placed more proximally, to avoid abrupt changes in stiffness of the construct. This nail has only 6° mediolateral angle which not only makes insertion of the nail easier but also reduces the risk of intraoperative fracture

COMPONENTS OF PROXIMAL FEMORAL NAIL

PROXIMAL FEMORAL NAIL

The nail has proximal diameter of 15mm to match with wide medullary canal of proximal femur and distal end of the nail is tapered to 9 – 12 mm . It has 6° medio lateral angle. The proximal part of nail above the mediolateral angular bend has two holes for insertion of neck screw and anti rotational screw. The distal end of the nail has two holes for insertion of interlocking screws. The upper hole is a static hole and lower hole is a dynamic hole which allows dynamization up to 5mm.

The nail is available in angles of 125°, 130°, 135° to match with various femoral neck – shaft angles and diameters of 9,10,11,12 mm sizes and the total length of nail is 250mm. The proximal end of the nail also has threads for insertion of end cap which prevents in growth of bone into the nail

FEMORAL NECK SCREW

This is an 8.0mm screw which bears 80-90% of load under axial loading and gives main stability in the proximal fragment for fracture fixation the screw is available in lengths from 70-110mm

ANTI ROTATION HIP SCREW

This is a 6.4 mm stabilization screw, which bears 10-20% of load and provides the rotational stability for the proximal fragment and the screw is available in lengths from 70-110mm.

DISTAL LOCKING SCREWS :

These are 4.9 mm screws inter locking screws

COMPONENTS OF PROXIMAL FEMORAL NAIL SYSTEM

INSERTION HANDLE

It is used for insertion of nail along with conical locking bolt and locking nut. The lugs on the handle must engage the positioning notches at the upper end of nail for insertion. It is used for insertion of proximal neck screws and distal locking screws. The holes in the insertion handle position the locking instruments.

THREADED CONICAL BOLT AND CONICAL NUT

The threaded bolt is screwed by hand into the nail and assembled with insertion handle. Once the lugs of the handle have engaged in notches, firm tightening is achieved with wrench.

DRIVING PIECE AND DRIVING HEAD

These are used for insertion of nail with a hammer. Driving piece is screwed onto the threaded conical bolt and driving head is screwed onto the proximal end of the driving piece for insertion with a hammer. The hole in the neck of the driving head allows insertion of Tommy bar.

RAM GUIDE

This is used for insertion and extraction of nail with ram. It is hollow to allow passage of guide rod during insertion. It is connected to conical bolt with the help of connecting piece.

RAM

This is 1300 grams in weight, is slid over the ram guide and used to insert the nail by simply letting it fall a short distance, nail is driven 5 to 10 mm at a time. The ram is also used for removal of nail.

LOCKING INSTRUMENTS

PROTECTION SLEEVES : 11mm/8mm

These are inserted through insertion handle for proximal neck screws and distal locking screws to guide different instruments used for insertion of screws.

DRILL SLEEVES

These drill sleeves accept 6.5mm / 5.0mm drill bits

TROCAR : 8.0mm

This trocar is used with 11mm / 8mm protection sleeves for insertion through soft tissues.

DRILL BITS: 6.5mm, 5.0mm, and 4.0mm.

The 6.5 mm drill bit and 5.0mm drill bit are used to drill holes for 8.0mm femoral neck screw and 6.4 mm anti rotation hip screw respectively. These two drill bits are cannulated for drilling over a guide wire and are marked to know the length of screws to be inserted. The 4.0mm drill bit is used to drill hole for 4.9mm distal locking bolts.

DEPTH GAUZE FOR LOCKING BOLTS

This depth gauze measures up to 115mm. It has a long neck allowing measuring for locking bolts through distal locking holes in insertion handle

HEXAGONAL SCREW DRIVER

This large hexagonal screw driver is used for insertion of 8.0mm femoral neck screw, 6.4mm anti rotational hip screw and 4.9mm distal locking bolts.

OPERATIVE PROCEDURE

PATIENT POSITIONING

Patient lying supine on Albee's fracture table allows good roentgenographic control and enable manipulation of leg and application of traction.

REDUCTION OF FRACTURE

After positioning the anaesthetised patient supine on fracture table, taking care to avoid undue pressure or tension on any part of the body, closed reduction of fracture is performed. The Uninjured limb is held in well leg holder so that it remains out of the way by putting it in 90 – 90 ° leg holder. Reduction is achieved by aligning distal fragment to flexed and externally rotated proximal fragment by rotating the foot of effected extremity. If Reduction is not achieved with ease, a unicortical 5mm threaded joystick is used to control proximal fragment after draping the patient. If closed reduction is not successful or not acceptable an open reduction is performed

PROCEDURE

A Slightly curved lateral incision is made from the level of trochanter proximally for about 6 to 9cm. The length of incision varies with the size of the patient. Under fluoroscopic guidance, a 3.2mm pin is inserted into the tip of greater trochanter, taking care to centre it on both antero posterior and lateral views. The pin is then driven 5cm into proximal femur. An alternative to this method is to use an awl, under fluoroscopic guidance to provide the opening. The awl should be inserted up to the point of largest outer diameter under fluoroscopic guidance and then removed. A guide wire is then inserted into proximal fragment.

The 9mm end cutting reamer is used above fracture site after the position of guide wire is verified by fluoroscopy. The cannulated manipulator for proximal fragment is then introduced over guide wire. Using the cannulated manipulator fracture is reduced and guide wire is passed into distal fragment. A unicortical threaded pin in proximal fragment can be used as joystick to help in reduction and can be used at this stage if reduction is difficult to achieve. Now distal fragment is reamed with 9mm reamer. Reaming must be carried out carefully in proximal fragment to avoid further comminution and lateral drift as the proximal nail diameter is 15mm. Loss of lateral portion of greater trochanter due to eccentric reaming precludes good proximal purchase and essential failure of fixation.

While reaming in lateral view care must be taken that it is as centered to head & neck as possible so that screws can be inserted without cortical penetration. The reaming process is continued at 0.5 mm increments until 1mm more than the selected nail size is reached and the proximal fragment entry point is widened with entry point widener. The selected nail is then assembled to jig and passed over the guide wire and pushed manually by rocking movements and the terminal position is hammered to the desired level and anteversion is adjusted by comparing with opposite hip or setting the anteversion of 15°. Skin is marked opposite to inferior hole of drill guide. Skin, fascia are incised and drill sleeves are inserted until they reach lateral femoral cortex and checked by image intensifier. Now a 3.2mm guide pin is inserted through inferior drill sleeves and checked under image intensifier so that it should be 4mm above the calcar and inferior in the neck. If not the position of nail is adjusted. Now sleeves are placed in proximal hole and guide pin is inserted and the final position of guide pins is checked under image intensifier before drilling.

Now the distal screw hole is drilled with 6.4 mm drill up to 5mm of subchondral bone. The length of screw to be inserted is read from calibrations on drill bit and it is tapped up to 5mm of subchondral bone and tapped with 8.0 mm tap and appropriate 8.0 mm screw is selected and inserted into the inferior hole of the nail. Now proximal screw site is drilled with 5.0 mm drill bit and tapped with cortical tap of 6.4 mm and the screw is inserted. Then the distal interlocking screw is inserted through the insertion handle. Skin is marked over holes and small incision is made in lateral thigh. Blunt dissection is carried out to the lateral cortex. Over the drill sleeve 4 mm drill bit is passed and is drilled across femur. This is checked on fluoroscopy in both anteroposterior and lateral views and appropriately sized screw is selected and inserted. Then the second interlocking screw is also inserted in the same manner.

ASSESSMENT OF RESULTS

The results of the treatment of subtrochanteric fractures using Proximal Femoral Nail AO type were assessed by HARRIS HIP SCORE system³³. This system is slightly modified according to the needs of the Indian patients. i.e in place of “put on shoes and socks” we have used “squatting” and in place of “sitting” we have used “cross legged sitting”

HARRIS HIP EVALUATION(Modified)

1. Pain

- None or ignores the pain
- Slight, Occasional, no compromise in activities
- Mild pain, no effect on average activities, Rarely moderate pain with unusual activity, may take aspirin
- Moderate pain, tolerable but makes concessions to pain
- Totally disabled, crippled, pain in bed, bedridden

2. Limp

- None
- Slight
- Moderate
- Severe

3. Support

- None
- Cane for long walks
- Cane most of the time
- One crutch
- Two canes
- Two crutches
- Not able to walk

4. Distance walked

- Unlimited
- Six blocks
- Two or Three blocks
- Indoors only
- Bed to chair

5. Stairs

- Normally without using a railing
- Normally with a railing
- In any manner
- Un able to do stairs

6. Squatting

- With ease
- With difficulty
- Unable

7. Cross legged sitting

- With ease
- With difficulty
- Unable

8. Enter public transportation

- Yes
- No

9. Flexion contracture _____ (Degrees)

Leg length discrepancy _____ (Cms)

ABSENCE OF ALL DEFORMITIES (All yes = 4, less than 4 =0)

- | | | |
|---|-----|----|
| - Less than 30 fixed flexion contracture | Yes | No |
| - Less than 10 fixed adduction | Yes | No |
| - Less than 10 fixed internal rotation in extension | Yes | No |
| - Leg length discrepancy less than 3.2 cms | Yes | No |

10. Range of motion (In degrees)

- Flexion
- Adduction
- Abduction
- External rotation
- Internal rotation

RANGE OF MOTION SACLE

- 211 – 300
- 161 – 210
- 101 – 160
- 61 – 100
- 31 – 60
- 0 - 30

RANGE OF MOTION SCORE _____

TOTAL HARRIS HIP SCORE _____

RESULT

- 0 -69 POOR**
- 70 – 79 FAIR**
- 80 – 89 GOOD**
- 90 – 100 EXCELLENT**

MATERIAL AND METHODS

The present study consists of the patients admitted to orthopaedic units of ASRAM Hospital between May 2007 and October 2009. 1267 fracture cases were treated in Department of Orthopaedics, Alluri Sitarama Raju Academy of Medical Sciences, Eluru during this period. Of these 264 patients were admitted for femoral fractures. Of the 264 femoral fractures 21 patients above the age of 20 years with subtrochanteric fractures were included in this study . Among the 21 patients, 11 were females and 10 were males. The mean age of presentation was 50.8 years. The most common mechanism of injury was a simple fall in females and high velocity injuries (fall from height, Road traffic accidents) in males. Seinsheimer type IIIA fracture pattern was the most common type to be seen. Pathological fractures and subtrochanteric fractures of femur with ipsilateral femoral shaft or neck fractures were excluded from the study.

Upon arrival the patients were assessed clinically and were stabilized haemodynamically. They were then subjected for radiographs of Pelvis with both hips Antero posterior view and full length thigh Antero posterior and lateral views. Following radiographs patients were admitted to orthopaedic wards and were maintained on skin traction over a Bohler - Braun frame till surgery. Appropriate blood investigations were done and surgical fitness was obtained. All the patients were operated on a fracture table in supine position under image intensifier control using standard techniques. Patients were discharged on the tenth post operative day following sutures removal, of their post operative period was uneventful

Patients were assessed clinically and radiologically on the 2nd post operative day, at 6 weeks, 3 months and then between 6 months to 1 year depending upon the fracture union. These findings are documented according to a protocol that was developed. Healing was judged by both clinical (pain & motion at fracture site and radiological (bridging callus filling the fracture site or trabeculations across the fracture site) criteria and functional outcome was reviewed according to the Harris Hip score (modified)³³.

CASE STUDY PROFORMA

1. General Data

- Name -
- Age - Sex –
- Occupation -
- Address -
- IP No. -

2. Chronological Data

- Date of injury -
- Date of Admission -
- Date of Surgery -
- Date of Discharge -

3. Mode of Injury

- RTA Fall Others
- Details of Injury -

4. Pre Existing systemic Illness -

5. Examination –

- Side – Unilateral – Right Left Bilateral
- Type of Injury – Open Closed
- Distal Neurovascular status
- Associated Injuries

6. Radiographs –

- Seinsheimer type –
- Associated Osteoporosis – Present Absent

7. Management

Primary Management

- Traction – Skin Skeletal
- If open - Debridement -

Definitive Management

- Procedure - Closed Open
- Details of implant –
 - Nail - Length - Diameter -
 - Hip screw - Position - length -
 - Anti rotational screw Position - length -
 - Distal screws – No. - Size -
- Reduction –

Post Operative Management

- Antibiotics
- Suture removal
- Physiotherapy – Quadriceps strengthening exercises
- Hip / knee Bending exercises -
- Mobilization
 - Non weight bearing -
 - Partial weight bearing -
 - Full weight bearing -

Postoperative Complications

Early complications –

- Infection – Superficial- Deep -
- Wound gaping -
- Epidermal necrosis -
- Seroma -
- Haematoma -
- Decubitus ulcer -

Late complications -

- Cutting out of screws -
- Z' effect of screws -
- Reverse Z effect of screws -
- Varus collapse -
- Nail breakage -
- Diaphyseal fracture -
- Limb length discrepancy -
- Hip stiffness -
- Delayed union -
- Non union -

Secondary treatment if any

- Debridement
- Bone grafting
- Revision surgery

FOLLOW UP

1st FOLLOW UP

2nd FOLLOW UP

3rd FOLLOW UP

ASSESSMENT AT FINAL FOLLOW UP

HARRIS HIP SCORE - _____

RESULT - _____

CASE SHEET - 1

1. General Data

- Name - P.Yesu Babu
- Age - 30 Sex – M
- Occupation – Manual labourer
- Address – Ganaparru village, West Godavari Dist.
- IP No. – 09008516

2. Chronological Data

- Date of injury - 26-01-09
- Date of Admission -28-01-09
- Date of Surgery -04-02-09
- Date of Discharge - 16-02-09

3. Mode of Injury

- RTA Fall Others
- Details of Injury – Fall from a tree

4. Pre Existing systemic Illness – ----

5. Examination –

- Side – Unilateral – Right Left Bilateral
- Type of Injury – Open Closed
- Distal Neurovascular status - Normal
- Associated Injuries - None

6. Radiographs –

- Seinschmer type – Type IV
- Associated Osteoporosis – Present Absent

7. Management

Primary Management

- Traction – Skin Skeletal

Definitive Management – Proximal Femoral Nail – AO type

- Procedure - Closed Open
- Details of implant –
 - Nail - Length – 25cm Diameter – 10mm
 - Hip screw - Position – Inf/cent length – 90mm
 - Anti rotational screw Position – Sup/Cent, length – 85mm
 - Distal screws – No. - 2 Size – 36mm/34mm
- Reduction – Good

Post Operative Management

Post operatively patient was on intravenous antibiotics for 3 days. Check x ray was done 48 hours after the surgery and it was found to be satisfactory. Quadriceps strengthening exercises, hip and knee bending exercises were taught on 2nd post operative day. Suture removal was done on 10th post operative day and the patient was discharged the following day with advice, not to weight bear on the right leg

FOLLOW UP

1st Follow up

Patient turned up for the first time on 30/03/09. He complained of mild pain in the right thigh and on examination minimal tenderness was noted in the proximal one third of thigh. Patient had 0-110 degrees of flexion in the hip and 0-120 degrees of flexion in the knee.

No limb length discrepancy was noted. Radiograph of the right hip with femur showed that the union was in progress. Patient was advised to continue hip and knee mobilization exercises in bed with non weight bearing on the right leg.

2nd Follow up

Patient attended the Ortho OPD on 20-05-09 for the second time. He had no pain at the fracture site and also full range of movements in the right hip and knee. Check x ray showed that union is satisfactory and the position of the implant was good. Patient was advised to weight bear on the right lower limb.

3rd Follow up

Nearly 9 months after the surgery patient turned up for the last time. Patient had no pain at the fractures site and is walking comfortably for long distances. He is also squatting and sitting cross legged with ease. He has near full range of movements of the hip and knee. Check x ray showed that fracture has united well.

HARRIS HIP SCALE(MODIFIED) SCORE – 100

RESULT - EXCELLENT

7. Management

Primary Management

- Traction – Skin Skeletal

Definitive Management – Long Proximal femoral nail – AO type

- Procedure - Closed Open
- Details of implant –
 - Nail - Length – 36cm Diameter – 9mm
 - Hip screw - Position – Inf/Post length –85 mm
 - Anti rotational screw Position – Sup/Post, length -85mm
 - Distal screws – No. – 1(Dynamic slot) Size – 40 mm
- Reduction – Poor – Proximal fragment is flexed

Post Operative Management

Post operatively patient was on intravenous antibiotics for 2 days. Check x ray was done 48 hours after the surgery and it was satisfactory. Patient was in the hospital for 10 days and was discharged following suture removal. His post operative period was uneventful.

Follow up

1st Follow up

Patient came for his follow up for the first time on 25/5/09. He was pain free and on examination his operative wound was healthy and he had 0-110 degrees of flexion in the hip and 0-120 degrees of flexion in the knee. Limb length discrepancy of 1 cm was seen. As the radiograph showed no callus formation patient was advised to continue non weight bearing on the right leg.

2nd Follow up

Patient attended the Ortho OPD for his second visit on 13-7-09. On examination he had full range of movements of the right hip and knee. Check x ray showed that union was in progress and the position of the implant was good. Patient was advised to weight bear on the right lower limb

3rd Follow up

Patient turned up for the last time on 19-10-09. He had no pain at the fractures site and was walking comfortably. He had no difficulty with squatting and sitting cross legged and had full range of movements of the hip and knee. Check x ray showed that fracture has united.

HARRIS HIP SCALE(MODIFIED) SCORE – 100

RESULT - EXCELLENT

CASE SHEET - 3

1. General Data

- Name - Pathipadu Srinu
- Age - 30 Sex – M
- Occupation – Manual labourer
- Address – Gundagolu gramam, West Godavari Dist.
- IP No. – 07010204

2. Chronological Data

- Date of injury - 11-6-07
- Date of Admission -14-6-07
- Date of Surgery -07-07-07
- Date of Discharge - 18-07-07

3. Mode of Injury

- RTA Fall Others
- Details of Injury – Fall from a tree 15 feet high

4. Pre Existing systemic Illness – Had fever upon admission for 2 ½ weeks

5. Examination –

- Side – Unilateral – Right Left Bilateral
- Type of Injury – Open Closed
- Distal Neurovascular status - Normal
- Associated Injuries - None

6. Radiographs –

- Seinschmer type – Type IV
- Associated Osteoporosis – Present Absent

7. Management

Primary Management

- Traction – Skin Skeletal

Definitive Management – Proximal Femoral Nail – AO type

- Procedure - Closed Open
- Details of implant –
 - Nail - Length – 25cm Diameter – 9mm
 - Hip screw - Position – Inf/Ant length – 80mm
 - Anti rotational screw Position – NA length – NA
 - Distal screws – One outside No. - 2 Size – 36mm/34mm
- Reduction – Acceptable

Post Operative Management

Post operatively patient was on intravenous antibiotics for 3 days. Check x ray was done 48 hours after the surgery and it was noted that one of the distal interlocking screw was not in the screw hole. Quadriceps strengthening exercises, hip and knee bending exercises were taught on 2nd post operative day. Suture removal was done on 10th post operative day and the patient was discharged the following day with advice, not to weight bear on the right leg

FOLLOW UP

1st Follow up

Patient turned up for the first time on 18/9/07. He complained of mild pain in the right thigh and on examination minimal tenderness was noted in the proximal one third of thigh.

Patient had 0-90 degrees of flexion in the hip and 0-100 degrees of flexion in the knee. Shortening of 2 cms was noted in the right lower limb. Radiograph of the right hip with femur showed no callus formation at the fracture site. Patient was advised to continue hip and knee mobilization exercises in bed with non weight bearing on the right leg.

2nd Follow up

Patient attended the Ortho OPD on 26-10-07 for the second time. He had no pain at the fracture site and also full range of movements were noted in the right hip and knee. Check x ray showed that union was in progress and the position of the implant was good. Patient was advised to weight bear on the right lower limb and shoe raise of 2 cms was also given.

3rd Follow up

Patient turned up in our department for the third time on 30-11-07. Check x ray done showed that the fracture is uniting and the patient was advised to weight bearing.

4th Follow up

Nearly 1 year after the surgery patient turned up for the last time. Patient had no pain at the fractures site and is walking comfortably for long distances. He is also squatting and sitting cross legged with ease. He has near full range of movements of the hip and knee. Check x ray showed that fracture has united.

HARRIS HIP SCALE(MODIFIED) SCORE – 97

RESULT - EXCELLENT

CASE SHEET - 4

11. General Data

- Name - M.Rama Mani
- Age - 40 Sex – F
- Occupation –House wife
- Address – Subba Raju peta, Nidadavolu
- IP No. – 07021905

12. Chronological Data

- Date of injury - 04-07-07
- Date of Admission -07-07-07
- Date of Surgery -12-07-07
- Date of Discharge - 23-07-07

13. Mode of Injury

- RTA Fall Others
- Details of Injury – Fall from a table 7 feet high

14. Pre Existing systemic Illness – Nil

15. Examination –

- Side – Unilateral – Right Left Bilateral
- Type of Injury – Open Closed
- Distal Neurovascular status - Normal
- Associated Injuries - None

6. Radiographs –

- Seinschmer type – Type III A
- Associated Osteoporosis – Present Absent

7. Management

Primary Management

- Traction – Skin Skeletal
- If open - Debridement - None

Definitive Management - Proximal femoral nail – AO type

- Procedure - Closed Open
- Details of implant –
 - Nail - Length – 25cm Diameter – 10mm
 - Hip screw - Position – Inf/central length –90 mm
 - Anti rotational screw Position – Sup/Cent, length -80mm
 - Distal screws – No. – 1(Dynamic slot) Size – 32 mm
- Reduction – Good

Post Operative Management

Post operatively patient developed pyrexia on the 2nd post op day. Intravenous antibiotics were continued for 4 days and fever eventually subsided. Check x ray was done 48 hours after the surgery and it was satisfactory. Active exercises of the hip and knee were started on the 5th post operative day. Patient was discharged on 10th post operative day with advice of strict non weight bearing on the left leg

FOLLOW UP

1st Follow up

Patient came for her follow up for the first time on 11/10/08. She started weight bearing with out medical advice as her pain started improving.

On examination her operative wound was healthy and she had 0-130 degrees of flexion in the hip and 0-120 degrees of flexion in the knee. No limb length discrepancy was noted. Check x ray showed that fracture has united.

2nd Follow up

Patient attended the Ortho OPD for the second visit on 26-6-08. She was pain free and she got back to her house hold duties. She was able to squat and sit cross legged comfortably. She was walking long distances without any aid and was climbing stairs comfortably. On examination she had full range of movements of the left hip and knee. Check x ray showed that the fracture has united well and the position of the implant was also good.

HARRIS HIP SCALE(MODIFIED) SCORE – 100

RESULT - EXCELLENT

CASE SHEET - 5

1. General Data

- Name - Saidu Venkata Rao
- Age - 35 Sex – M
- Occupation – Electrician
- Address – Bimadolu mandalam, West Godavari Dist.
- IP No. – 08031476

2. Chronological Data

- Date of injury - 15-10-08
- Date of Admission - 15-10-08
- Date of Surgery - 21-10-08
- Date of Discharge - 01-11-08

3. Mode of Injury

- RTA Fall Others
- Details of Injury – Fall from a electric pole

4. Pre Existing systemic Illness – Nil

5. Examination –

- Side – Unilateral – Right Left Bilateral
- Type of Injury – Open Closed
- Distal Neurovascular status - Normal
- Associated Injuries - None

6. Radiographs –

- Seinschmer type – Type III B
- Associated Osteoporosis – Present Absent

7.Management

Primary Management

- Traction – Skin Skeletal

Definitive Management – Proximal Femoral Nail – AO type

- Procedure - Closed Open
- Details of implant –
 - Nail - Length – 25cm Diameter – 10mm
 - Hip screw - Position – Cent/Post length – 95mm
 - Anti rotational screw Position – Sup/Post, length – 85mm
 - Distal screws – One outside No. - 2 Size – 34mm/34mm
- Reduction – Acceptable

Post Operative Management

Post operatively patient was on intravenous antibiotics for 2 days. Check x ray was done 48 hours after the surgery and it was found satisfactory. Quadriceps strengthening exercises, hip and knee bending exercises were taught on 2nd post operative day. Suture removal was done on 10th post operative day and the patient was discharged the same day with advice, not to weight bear on the right leg

Follow up

1st Follow up

Patient turned up for the first time on 15/12/08. He complained of moderate pain in his right thigh and on examination minimal tenderness was noted in the proximal one third of thigh. Patient had 0-100 degrees of flexion in the hip and 0-110 degrees of flexion in the knee.

No limb length discrepancy was noted. Radiograph of the right hip with femur showed no callus formation at the fracture site. Patient was advised to continue hip and knee mobilization exercises in bed with non weight bearing on the right leg.

2nd Follow up

Patient attended the Ortho OPD for his second visit on 29-01-08 for the second time. He had significant improvement in pain at the fracture site> He had full range of movements of the right hip and knee. Check x ray showed that the fracture has united but back out of the Anti rotational hip screw was noted. Patient was advised to weight bear on the right lower limb.

3rd Follow up

Patient turned up for the last time on 24-10-09. He was absolutely pain free and he got back to his job. On examination he had full range of movements of the hip and knee. He was squatting and sitting cross legged comfortably. Check x ray done showed that the fracture has united well.

HARRIS HIP SCALE(MODIFIED) SCORE – 100

RESULT - EXCELLENT

CASE SHEET - 6

1.General Data

- Name - B.Vijay
- Age - 24 Sex – M
- Occupation – Shop keeper
- Address – Eluru, West Godavari Dist.
- IP No. – 07021704

2.Chronological Data

- Date of injury - 06-10-07
- Date of Admission -07-10-07
- Date of Surgery -12-10-07
- Date of Discharge - 25-10-07

3.Mode of Injury

- **RTA** Fall Others
- Details of Injury – Driver of a motor bike, hit by a car

4.Pre Existing systemic Illness – Nil

5.Examination –

- Side – Unilateral – Right **Left** Bilateral
- Type of Injury – Open **Closed**
- Distal Neurovascular status - Normal
- Associated Injuries - None

6.Radiographs –

- Seinschmer type – Type III A
- Associated Osteoporosis – Present **Absent**

7.Management

Primary Management

- Traction – Skin Skeletal

Definitive Management

- Procedure - Closed Open
- Details of implant –
 - Nail - Length – 25cm Diameter – 10mm
 - Hip screw - Position – Inf/Post length –95mm
 - Anti rotational screw Position – Sup/Post, length –90 mm
 - Distal screws – No. - 2 Size – 30mm/34mm
- Reduction – Good

Post Operative Management

Post operatively patient was on intravenous antibiotics for 2 days. Patient was taught quadriceps and hip & knee bending exercises on 1st post operative day. Check x ray was done 48 hours after the surgery and it was satisfactory. Patient was discharged on 10th post operative day following suture removal. His post operative period was uneventful.

FOLLOW UP

1st Follow up

Patient attended the OPD for the first time on 03/12/07. He had no pain at the fracture site and on examination his operative wound was healthy and he had full range of movements of the hip and knee. No limb length discrepancy was seen and the radiograph that were taken showed that the fracture union was in progress and the patient was advised partial weight bearing.

2nd Follow up

Patient came back for his check up on 07-01-08. He was mobilizing full weight bearing without and had full range of movements of the left hip and knee. Check x ray showed that fracture has united well. There was no limb length discrepancy as well.

3rd Follow up

Patient turned up for the last time on 11-09-08. He was walking comfortably and he got back to his work as well. He had no difficulty with squatting and sitting cross legged and had full range of movements of the hip and knee. Check x ray showed that fracture has united well.

HARRIS HIP SCALE(MODIFIED) SCORE – 100

RESULT - EXCELLENT

CASE SHEET - 7

1. General Data

- Name - M.Rama Krishna
- Age - 42 Sex – M
- Occupation – Carpenter
- Address – Bimadolu, West Godavari District
- IP No. – 09014853

2. Chronological Data

- Date of injury - 15-01-09
- Date of Admission - 16-01-09
- Date of Surgery - 19-01-09
- Date of Discharge - 30-01-09

3. Mode of Injury

- **RTA** Fall Others
- Details of Injury – Passenger in a auto. Auto got toppled

4. Pre Existing systemic Illness – Nil

5. Examination –

- Side – Unilateral – Right **Left** Bilateral
- Type of Injury – Open **Closed**
- Distal Neurovascular status - Normal
- Associated Injuries - Intra articular fracture of distal end radius

6. Radiographs –

- Seinschmer type – Type II A
- Associated Osteoporosis – Present **Absent**

7.Management

Primary Management

- Traction – Skin Skeletal

Definitive Management – Short Proximal femoral nail – AO type

- Procedure - Closed Open
- Details of implant –
 - Nail - Length – 25cm Diameter – 9mm
 - Hip screw - Position – Inf/Post length – 100 mm
 - Anti rotational screw Position – Not applied
 - Distal screws – No. – 2, Size – 34mm/32 mm
- Reduction – Good

Post Operative Management

Post operatively patient was on intravenous antibiotics for 2 days. Quadriceps strengthening exercises and hip & knee bending exercises were started on 1st post operative day. Check x ray was done on the 2nd post operative day and it was found to be satisfactory. Patient's post operative period was uneventful and he was discharged on the 10th post operative day following suture removal.

FOLLOW UP

1st Follow up

Patient attended the OPD for the first time after surgery on 13/03/09. He was pain free and on examination his operative wound was healthy and he had near full range of movements of the hip and knee. There was no limb length discrepancy. Radiograph showed satisfactory progress of the union and the patient was advised to partially weight bear on his left leg.

2nd Follow up

Patient attended the Ortho OPD for his second visit only after 7 months on 21-08-09. He had no pain and even got back to his job. On examination he had full range of movements of the left hip and knee. There was no limb length discrepancy. Check x ray showed that the fracture is well united and the position of the implant was good.

HARRIS HIP SCALE(MODIFIED) SCORE – 100

RESULT - EXCELLENT

7.Management

Primary Management

- Traction – Skin Skeletal
- If open - Debridement - Nil

Definitive Management

- Procedure - Closed Open
- Details of implant –
 - Nail - Length – 25mm Diameter – 12mm
 - Hip screw - Position –Cent/ Cent length – 85mm
 - Anti rotational screw Position - NA length –
 - Distal screws - No. - 2 Size – 36mm & 34mm
- Reduction – Good

Post Operative Management

Post operatively in the post operative ward patient developed angina and was ventilated shifted to intensive care unit for 5 days. Following that she recovered well from the 4th post operative day. She was on intravenous antibiotics for 6 days. Check x ray was done on the 4th post operative day and it was satisfactory. She started doing Quadriceps strengthening exercises and hip & knee bending exercises. Patient was in the hospital for 2 weeks and was discharged on 16th post operative day.

Follow up

1st Follow up

Patient came for her follow up for the first time on 31/3/08. She had moderate pain and on examination her operative wound was healthy.

She had 0-100 degrees of flexion in the hip and 0-100 degrees of flexion in the knee. No limb length discrepancy was noted. Check X ray showed satisfactory progress of fracture union and patient was advised to partially weight bearing on the right leg.

2nd Follow up

Patient attended the Ortho OPD for his second visit on 19-05-08. her pain at the operative site improved but still had mild pain. On examination she had good range of movements of the right hip and knee. Check x ray showed that has united and the position of the implant was good. Patient was advised full weight bearing on the right lower limb

3rd Follow up

Patient turned up for the last time on 02-03-09. She had slight pain at the fracture site on and off and was walking with the help of a stick. She had difficulty with squatting and sitting cross legged and had good range of movements of the hip and knee. Check x ray showed that fracture has united well.

HARRIS HIP SCALE(MODIFIED) SCORE – 75

RESULT - FAIR

CASE SHEET - 9

1. General Data

- Name - V.Satyavathi
- Age - 70 Sex – F
- Occupation – House wife
- Address – Kovalli, Denduluru mandalam.
- IP No. –07024163

2. Chronological Data

- Date of injury - 02-12-08
- Date of Admission - 03-12-08
- Date of Surgery - 15-12-08
- Date of Discharge - 26-12-08

3. Mode of Injury

- RTA **Fall** Others
- Details of Injury – Fall at home

4. Pre Existing systemic Illness – Known diabetic. Underwent open reduction and internal fixation for Right distal end femur fracture

5. Examination –

- Side – Unilateral – **Right** Left Bilateral
- Type of Injury – Open **Closed**
- Distal Neurovascular status - No
- Associated Injuries - No

6. Radiographs –

- Seinschmer type – Type III A
- Associated Osteoporosis – **Present** Absent

7. Management

Primary Management

- Traction – *Skin* Skeletal
- If open - Debridement - None

Definitive Management

- Procedure - *Closed* Open
- Details of implant –
 - Nail - Length – 25cm Diameter – 10mm
 - Hip screw - Position – Inf/Cent, length – 85mm
 - Anti rotational screw Position – NA length –
 - Distal screws – No. - 1 Size – 32mm
- Reduction – Good

Post Operative Management

Post operatively patient's rehabilitation was poor because her previous surgery for distal end femur fracture. She also had uncontrolled blood sugar levels for few days. She was on intravenous antibiotics for 3 days. Check x ray was done on 2nd post operative day and it was satisfactory. Quadriceps strengthening exercises were started on 5th post operative day. Hip & knee bending exercises were delayed till the 10th post operative day. Good control of her blood sugar levels and satisfactory range of movements of the hip & knee were achieved by 15th post operative day and she was discharged the following day.

FOLLOW UP

1st Follow up

Patient turned up for the first time on 03/03/08. She had moderate pain but was mobilizing non weight bearing till date. On examination her operative wound was healthy and she had no tenderness noted at the fracture site. She had a flexion of 90 degrees and full abduction and adduction of the hip. But she had minimal restriction of internal rotation. She had only 80 degrees of flexion at the knee and limb length discrepancy of 2 cms was noted. Radiograph taken showed good union of the fracture and the patient was advised to weight bear

2nd Follow up

Patient attended our OPD for last time on 03-11-09. She had moderate pain at the fractures site and was walking wit the support of a cane most of the time. She was unable to squat and sit cross legged and had 0-100 degrees of flexion at the hip. She had full abduction and adduction but some restriction of internal rotation was noted. She had only 0-90 degrees of flexion at the knee. Check x ray showed that fracture has united completely and the implant is well in situ.

HARRIS HIP SCALE(MODIFIED) SCORE – 50

RESULT - POOR

7. Management

Primary Management

- Traction – Skin Skeletal
- If open - Debridement - None

Definitive Management

- Procedure - Closed Open
- Details of implant –
 - Nail - Length – 25cm Diameter – 10mm
 - Hip screw - Position – Cent/Post length – 105mm
 - Anti rotational screw Position – Sup/Post, length – 95 mm
 - Distal screws – No. - 1 Size – 38mm
- Reduction – Poor

Post Operative Management

Post operatively patient was on intravenous antibiotics for 2 days. Check x ray was done on the 2nd post operative day and it was noted that the entry point of the nail was a bit distal but the reduction was satisfactory. Post operative period was uneventful and the patient was discharged on the 11th post operative day with advice to continue quadriceps strengthening exercises and hip & knee bending exercises in bed.

FOLLOW UP

1st Follow up

Patient turned up in our out patient department for the first time on 14/07/08. She had moderate pain at the fracture site. On examination her operative wound was healthy and he had 0-80 degrees of flexion in the hip

contd...

and 0-90 degrees of flexion in the knee. There was no limb length discrepancy and Check x ray showed that fracture has union is progressing and position of the implant was also satisfactory. Patient was advised to continue non weight bearing on the left leg and to continue bending exercises of the hip and knee.

2nd Follow up

Patient attended the OPD for the 2nd time on 28-08-08. She had moderate at the fracture site. She was doing her hip and knee bending exercises and on examination she had 0-110 degrees of flexion, 30 degrees of abduction, 20 degrees of adduction, 30 degrees of external rotation and 10 degrees of internal rotation. No limb length discrepancy was noted. Check x ray showed satisfactory union of the fracture and the patient was advised to weight bear on the left limb

3rd Follow up

Patient came for her final follow up 07-05-09. She was complaining of moderate amount of pain because of which she was unable to walk long distances. On examination her range of movements of the hip were same as her previous visit. She had 0-100 degrees of flexion in her hip. She had difficulty squatting and sitting cross legged but was able to manage the stairs with support. No limb length discrepancy was noted. Check x ray showed that the fracture has united well.

HARRIS HIP SCALE(MODIFIED) SCORE – 41

RESULT - POOR

CASE SHEET - 11

1. General Data

- Name - P.Kamakshamma
- Age - 63 Sex – F
- Occupation – House wife
- Address – Ponangipunta, Eluru
- IP No. – 08031305

2. Chronological Data

- Date of injury - 16-10-08
- Date of Admission – 17-10-08
- Date of Surgery - 22-10-08
- Date of Discharge - 07-11-08

3. Mode of Injury

- RTA **Fall** Others
- Details of Injury – Fall at home

4. Pre Existing systemic Illness – Hypertension, Anaemia

5. Examination –

- Side – Unilateral – Right **Left** Bilateral
- Type of Injury – Open **Closed**
- Distal Neurovascular status - Normal
- Associated Injuries - Nil

6. Radiographs –

- Seinschmer type – Type III A
- Associated Osteoporosis – **Present** Absent

7. Management

Primary Management

- Traction – Skin Skeletal
- If open - Debridement - Nil

Definitive Management

- Procedure - Closed Open
- Details of implant –
 - Nail - Length – 25mm Diameter – 9mm
 - Hip screw - Position – Sup/ Ant length – 85mm
 - Anti rotational screw Position – Sup/Ant, length – 85mm
 - Distal screws - No. - 1 Size – 34mm
- Reduction – Unsatisfactory – Proximal fragment abducted

Post Operative Management

Post operatively patient had localised redness and warmth at operative site which settled with parenteral antibiotics and was on intravenous antibiotics for 3 days. She was started on quadriceps strengthening exercises; hip and knee bending exercises were taught on 2nd post operative day. The same day patient developed confusion due to electrolyte imbalance and sustained a fall from bed as she was trying to get out. On examination movements of the hip were painful and shortening of 3 cms was noted. Check x ray was done and it showed cut out of the anti rotational hip screw. Patient refused removal of the cut out screw. Suture removal was done on 10th post operative day and the patient was discharged the following day with advice, not to weight bear on the right leg

FOLLOW UP

1st Follow up

Patient came back to the OPD for the first time on 19/12/08. She complained of marked pain in the left hip and was on regular analgesics. On examination minimal tenderness was noted in the proximal one third of thigh and movements of the hip were painful and restricted. Shortening of 3 cms was noted in the left lower limb. Radiograph of the left hip with femur showed cut of the anti rotational screw and no callus formation was seen at the fracture site. Patient was admitted and the cut out screw was removed.

2nd Follow up

Patient attended the Ortho OPD on 29-01-09 for the second time. She had moderate pain at the fracture site and also her range of movements were restricted. Check x ray showed that fracture was uniting. Patient was advised to weight bear on the right lower limb and was encouraged to do hip and knee bending exercises.

3rd Follow up

Patient turned up for the last time on 02-11-09. Patient still had moderate pain at the fractures site and is walking with the support of a crutch. She was finding it tough to go out doors and was unable to squat and sit cross legged. She had a flexion of 90 degrees, abduction of 30 degrees, adduction of 20 degrees, external rotation of 20 degrees and 10 degrees of internal rotation at her hip. Check x ray showed that fracture has united and the implant was well in situ.

HARRIS HIP SCALE(MODIFIED) SCORE – 29

RESULT - POOR

CASE SHEET - 12

1. General Data

- Name - M.Bullama
- Age - 70 Sex – F
- Occupation – House wife
- Address – Unguturu mandalam , West Godavari District.
- IP No. –09003166

2. Chronological Data

- Date of injury - 07-01-09
- Date of Admission - 07-01-09
- Date of Surgery - 12-01-09
- Date of Discharge - 23-01-09

3. Mode of Injury

- RTA Fall Others
- Details of Injury – Fall at home

4. Pre Existing systemic Illness – Known Hypertensive on treatment.

5. Examination –

- Side – Unilateral – Right Left Bilateral
- Type of Injury – Open Closed
- Distal Neurovascular status - No
- Associated Injuries - No

6. Radiographs –

- Seinschmer type – Type III A
- Associated Osteoporosis – Present Absent

7.Management

Primary Management

- Traction – Skin Skeletal
- If open - Debridement - None

Definitive Management

- Procedure - Closed Open
- Details of implant –
 - Nail - Length – 25 cm Diameter –10mm
 - Hip screw - Position – Inf/Cent, length –85mm
 - Anti rotational screw Position – NA length –
 - Distal screws – No. - 2 Size – 32/ 34mm
- Reduction – Good

Post Operative Management

Post operatively patient's rehabilitation was good. She had 1 unit of blood transfused and was on parenteral antibiotics for 2 days. She also had uncontrolled blood sugar levels for few days. Check x ray was done on 2nd post operative day and it was satisfactory. Quadriceps strengthening exercises were started on 3rd post operative day. Hip & knee bending exercises were started the following day. There was satisfactory range of movements of the hip & knee by 10th day. Suture removal was done on 10th day and she was discharged the following day with advice not to weight bear on the right leg.

Follow up

1st Follow up

Patient turned up for the first time on 09/03/09. She had mild pain and was mobilizing non weight bearing till date. On examination her operative wound was healthy and she had no tenderness noted at the fracture site. She had a flexion of 110 degrees and full abduction and adduction of the hip. But she had minimal restriction of internal rotation. She had 110 degrees of flexion at the knee and no limb length discrepancy was noted. Radiograph taken showed good progress of fracture union. She was advised to continue non weight bearing on her right leg

2nd Follow up

Patient attended our OPD for second time on 04/05/09. She had mild pain at the fractures site and was having good range of movements in her hip and knee. No limb length discrepancy was noted. Check x ray showed that fracture has united well and the implant is well in situ. She was advised to weight bear on her right leg.

3rd Follow up

Patient came to our OPD on 25-07-09 for the third time. She had mild pain and was using a cane for mobilization. She had a moderate limp and had some discomfort in climbing stairs. she had difficulty in squatting and sitting cross legged also. On examination she had good range of movements of the hip and knee and no limb length discrepancy was noted. She had a Harris hip score of 65 and her functional outcome at 6 months was not satisfactory. She was asked to come for her next follow up 6 months later.

4th follow up

This time patient presented to the emergency department 06-08-09 with history of another fall onto her right side. She had severe pain in her right thigh. On examination deformity of the thigh was noted and crepitus could be elicited in the upper femur. Radiographs were taken and was found that there is a fracture in the subtrochanteric region corresponding to the previous fractures site with the nail broken at the distal interlocking screw. She was admitted and 1 week later she was subjected for a repeat surgery, where the broken nail was removed and the fractures was stabilized with an interlocking intramedullary nail.

5th Follow up

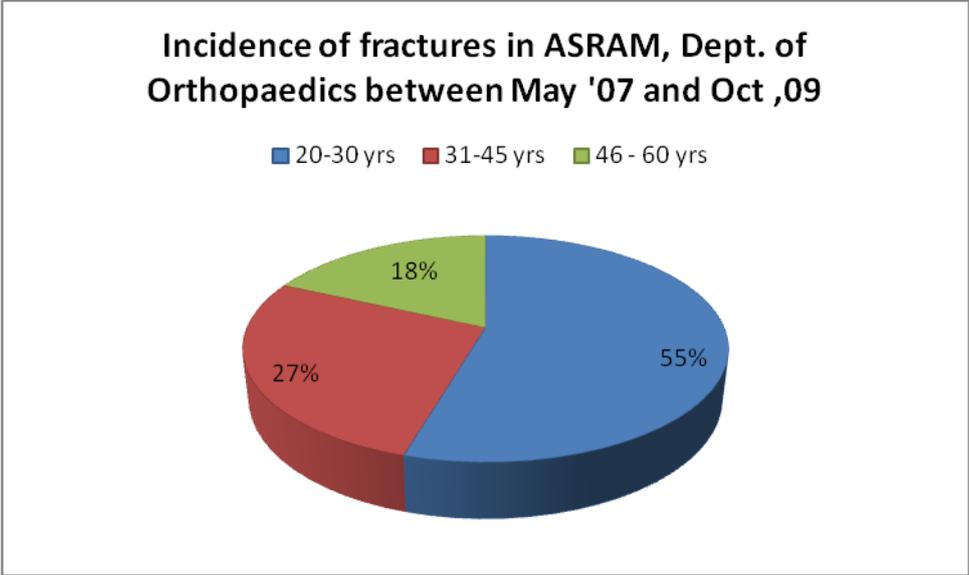
She came for her follow up on 22/10/09 and she was mobilizing non weight bearing. She had good range of movements in her hip and in knee she had 0 – 100 degrees of flexion. Check x ray showed that the union is in progress and she is due for her follow up on 28/11/09

OBSERVATIONS

1. INCIDENCE OF FRACTURES IN DEPT. OF ORTHOPAEDICS, ASRAM BETWEEN MAY 2007 AND OCTOBER 2009

Total NO. of fractures	Lower limb fracture		Upper limb fractures	Other fractures
1267	583		349	335
	Femoral fractures		Other fractures	
	264		319	
	Upper femoral fractures	Other fractures		
	216		48	
	Subtrochanteric fractures	Other fractures		
	21	195		

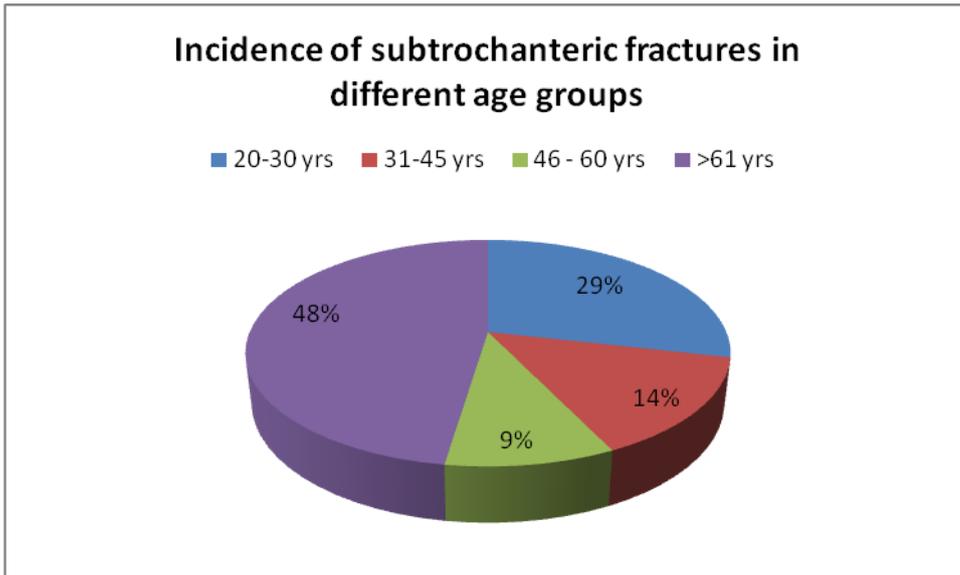
A total number of 1267 fractures were admitted in our department between May 2007 and October 2009. Of these 46% (583) were lower limb fractures, 28% (349) were upper limb fractures and 26% (335) were other fractures that include spine, pelvis etc. Of the lower limb fractures 45.2% (264) were femoral fractures. Of the femoral fractures 81.81% (216) were upper femoral fractures and subtrochanteric fractures account for 9.72% (21) of these fractures.



2.AGE OF THE PATIENT WITH SUBTROCANTERIC FRACTURES

AGEGROUP	NUMBER OF PATIENTS	PERCENTAGE
20 -30	6	28.5%
31-45	3	14.2%
46-60	2	9.5%
>61	10	47.6%
TOTAL	21	100%

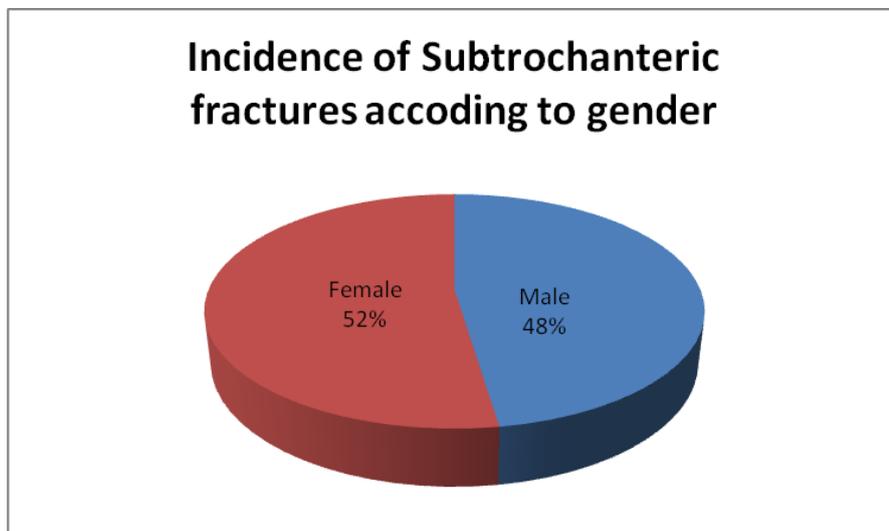
The youngest patient in our series is 23 years old and the oldest is 80 years. Maximum number of patients in this study are of elderly age group and the mean age is 50.8 years



3. SEX AND TYPE OF INJURY

SEX	NUMBER OFPATIENTS	PERCENTAGE
Male	10	47.6%
Female	11	52.3%
Total	21	100%

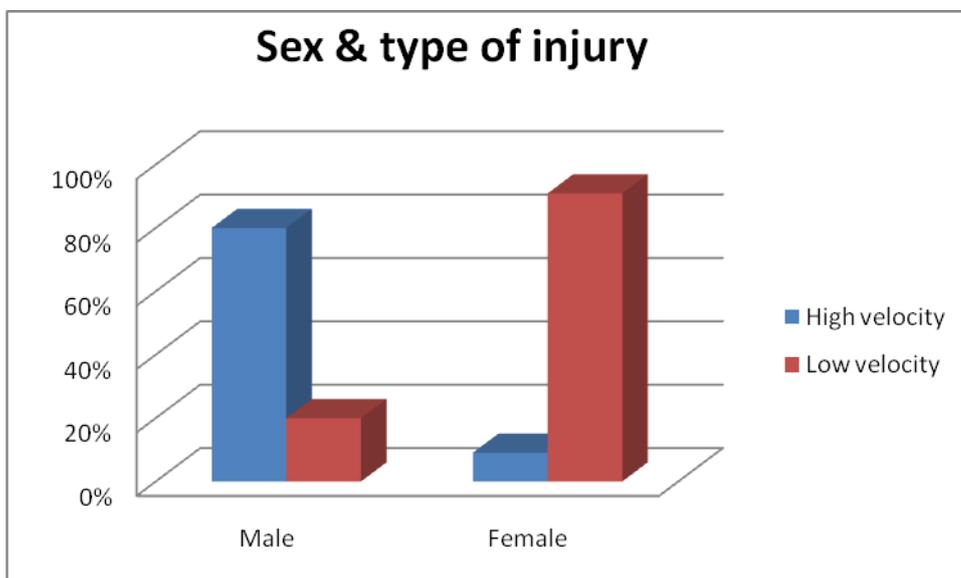
In the present study, it is seen that subtrochanteric fractures are slightly more common in females than males.



<i>SEX</i>	<i>HIGH VELOCITY INJURY</i>	<i>LOW VELOCITY INJURY / CONVENTIONAL TRAUMA</i>
Male	8 (80%)	2(20%)
Female	1 (9.1%)	10 (90.9%)
Total	9	12

In the present series 80% (8) males sustained this injury because of high velocity injury. Where as in females they are most often caused by low velocity injury compared to their counter parts. In this study 90.9% (10) females sustained injury because of low velocity injury.

Average age in males is 36 years and infemales is 64.27 years. This also signifies that female patients are older than male patients and so were more predisposed to low velocity trauma.



4. ADMISSION – OPERATION INTERVAL

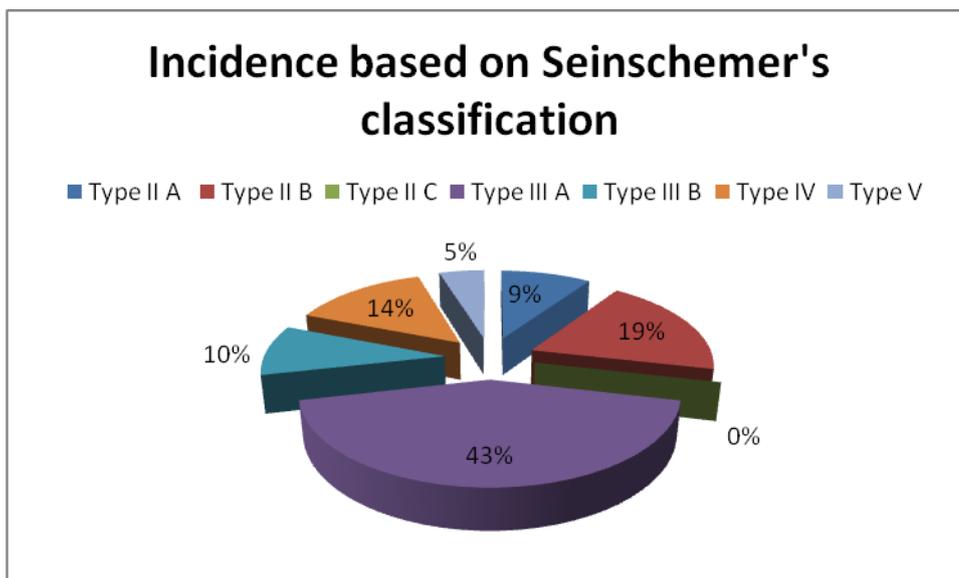
Mean	<i>PRESENT SERIES</i>
	6.6 Days

The mean injury operation interval in the current series is 6.6 days. This increased interval is mainly due to uncontrolled pre existing illness at the time of presentation.

5. INCIDENCE BASED ON SEINSCHEMER’S CLASSIFICATION

	TYPE II			TYPE III		TYPE IV	TYPE V
	A	B	C	A	B		
Percentage	9.52%	19.04%	0	42.85%	9.52%	14.23%	4.76%

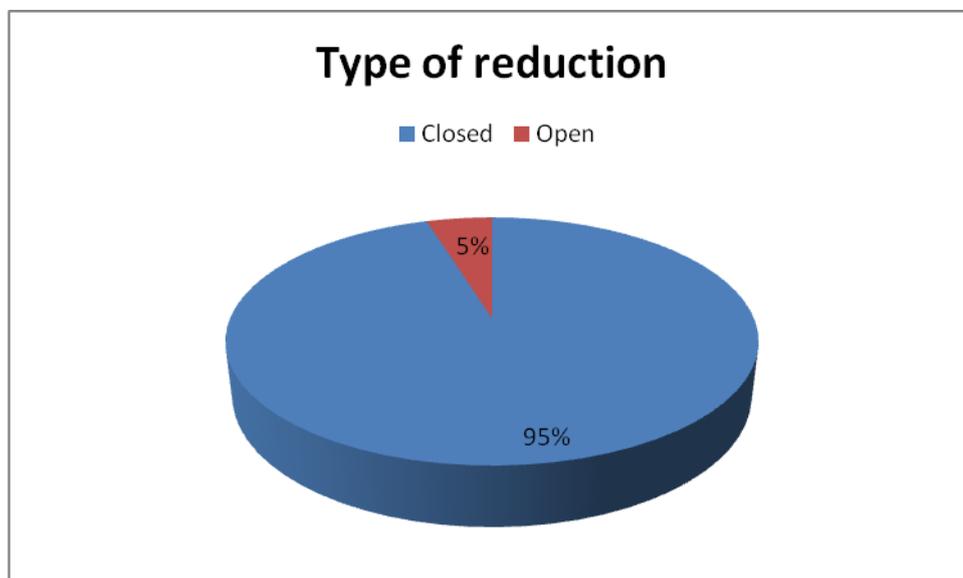
Most commonly seen fractures pattern in this study is Seinschemer’s type III A.



6. TYPE OF REDUCTION

	CLOSED	OPEN
PERCENTAGE	95.23%	4.76%

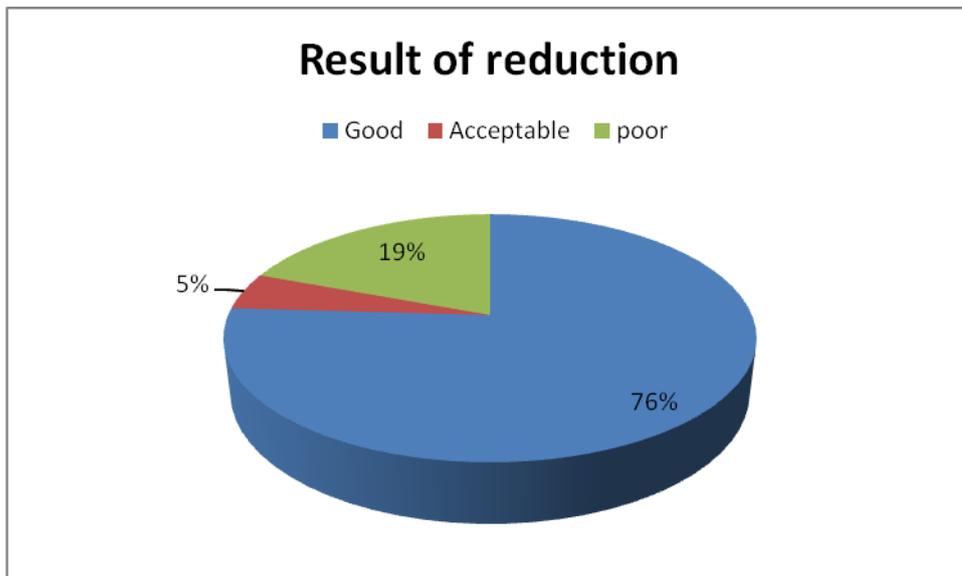
Intra operatively reduction of the fracture was achieved through closed means in 95.23% (20) of cases. Open reduction was performed in only 1 patient who had high injury operation interval



7. RESULT OF REDUCTION

	GOOD	ACCEPTABLE	POOR
Percentage	76.01%	4.76%	19.04%

Reduction was good in 76% (16) of the cases. Poor reduction was noted in 4 patients. Three of them were of elderly age group and had poor outcome at final follow up.



8. FRACTURE UNION

	PRESENT STUDY
AVERAGE TIME FOR UNION	3.04 months

9. COMPLICATIONS

S NO.	COMPLICATION	PERCENTAGE
1.	Superficial infection	4.76%
2.	Deep infection	0
3.	Cut out of screw	4.76%
4.	Reverse 'Z' effect of hip screws	0
5.	'Z' effect of hip screws	0
6.	Shaft fracture	4.76%

In the present series, 4.76% (1) of cases had superficial infection and no deep infections were recorded. Cut of the anti rotational screw was noted in 1 patient. Fracture of the shaft with breakage of the nail was noted 4.76% (1) of patients.

10. ASSESSMENT AT FINAL FOLLOW UP

A. Pain

QUALITY OF PAIN	NO. OF PATIENTS	PERCENTAGE
None or ignores it	8	38.09%
Slight occasional	7	33.33%
Mild	3	14.28%
Moderate	2	9.52%
Totally disabled	1	4.76%

Majority of the patients (71.42%) in this study had either no pain or slight pain which did not effect their activities. Onle one patient had severe pain. 14.28% (3) of patients had mild pain which was relieved with analgesics.

b. Limp

	NO. OF PATIENTS	PERCENTAGE
None	8	38.09%
Slight	10	47.61%
Moderate	3	14.28%
Severe	0	--

In the current study majority of patients had no or slight limp that did not effect their activities. 14.28% (3) had moderate limp which was mainly due to shortening.

c. Walking Ability

	NO. OF PATIENTS	PERCENTAGE
None	10	47.6%
Cane for long walks	6	28.56
Cane most of the time	4	19.04%
Crutch	1	4.76%
Not able to walk	0	0

In our study 47.6% (10) patients did not require any support for walking and 28.56% (6) of patients cane for long walks. Only 1 patient was mobilizing with the help of crutch. The requirement of the cane is primarily because of old age of the patients and associated osteoarthritis

d. Stairs

	NO. OF PATIENTS	PERCENTAGE
Normally without using a railing	8	38.09%
Using a railing	11	52.38%
In any manner	1	4.76%
Unable	1	4.76%

In this series, 38.09% (8) of patients could climb stairs with any support but 52.38% (11) required the support of railing. One patient was unable to climb the stairs. This difficulty was commonly seen in geriatric age group patients.

e. Squatting

	NO. OF PATIENTS	PERCENTAGE
With ease	7	33.33%
With difficulty	10	47.6%
Unable	4	19.04%

Squatting was possible in 33.33% (7) with ease and with difficulty 47.6% (10). 4 patients were not able to squat. The difficulty in squatting was primarily seen in old age patients with osteoarthritis.

f. Sitting cross legged

	NO. OF PATIENTS	PERCENTAGE
With ease	7	33.33%
With difficulty	10	47.6%
Unable	4	19.04%

In our study, squatting was possible in 80.93% (17) of the patients, but 47.6% (10) of these patients had some difficulty while doing so. 4 elderly patients were unable to sit cross legged and this was primarily because of knee osteoarthritis.

g. Limb length discrepancy

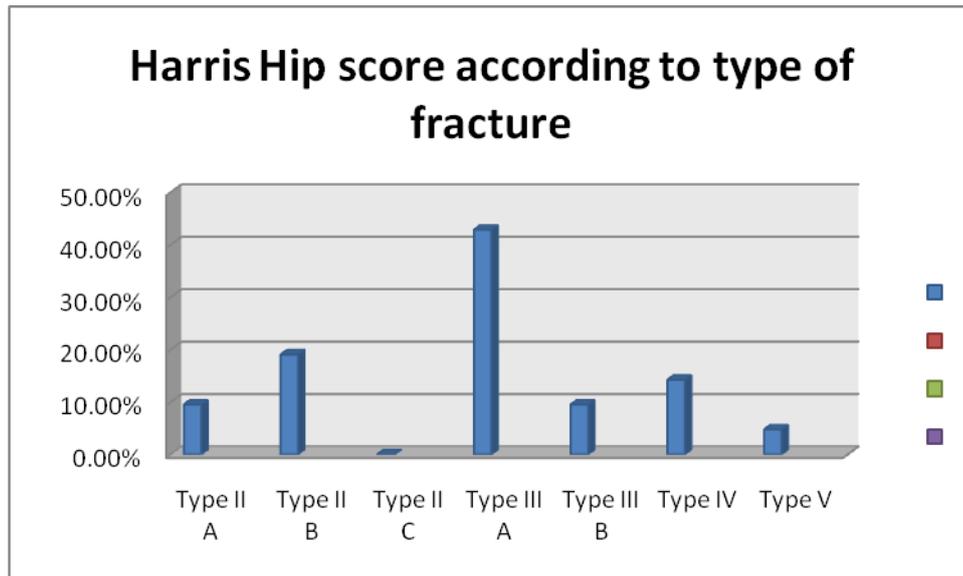
	NO. OF PATIENTS	PERCENTAGE
2 cms or more	2	9.52%
Less than 2 cms	1	4.76%

Of the 21 patients in this series, 2 patients had shortening of more than 2 cms which required shoe raise. 1 patient had less than 2 cms of shortening and it did not require any treatment.

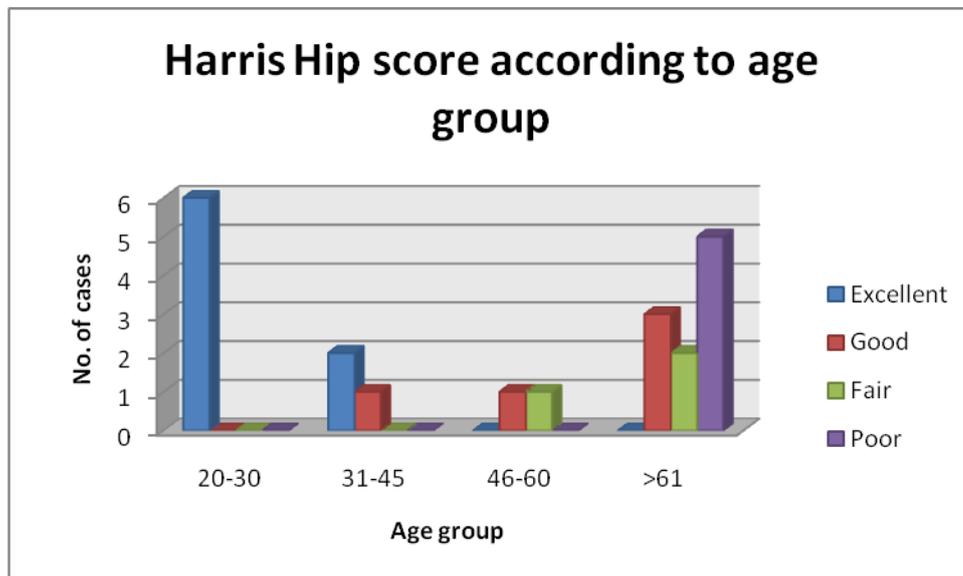
11. OVERALL RESULT BASED ON HARRIS HIP SCORE

Harris Hip score	Mean score
	80.76

In the current series, the mean Harris Hip score was 80.76 and it was ranging from 100 - 29.



12. Overall result based on the age group of the patient



In this series all the patients between 20 – 30 years had excellent result irrespective of the type of fracture. Older age group patients had relatively poor results and 50% (5) of them had poor results and another 50% (5) had good to fair results. In this study excellent outcome was not seen in the older age group patients.

DISCUSSION

Fractures of the long bones are a major social and economic problem. Of the long bone fractures Subtrochanteric fractures of the femur have peculiar anatomic and mechanical characteristics which poses problems in their management. Closed intramedullary devices have a mechanical advantage that effectively addresses these factors. The benefit of minimal surgical exposure, more efficient load transfer through calcar femorale and decreased tensile strain on the implant because of its shorter lever arm makes proximal Femoral Nail a good choice of implant for subtrochanteric fractures of the femur. Various studies have considered Proximal Femoral Nail as an acceptable minimally invasive implant for Subtrochanteric fracture.

The incidence of subtrochanteric fracture is relatively low. In our study 21 subtrochanteric fractures accounted for 9.7% of all proximal femoral fractures. In other studies 7% - 34% of all femur fractures occurred in the subtrochanteric region^{36, 37}. Most of our patients were of the elderly age group, the average age being 50.8 years. This is significantly lower compared to that quoted by other authors in literature, **BOLDIN ET AL**²³ 73 yrs, **I.B.SCHIPPER SERIES**¹³ 82.2 years. Slight female preponderance of 52.3% was noted in our patients and it was also reported by **BOLDIN ET AL**²³ (70%) and **I.B.SCHIPPER**³⁴ (82%). 61.9% of the subtrochanteric fractures involved the right femur in this series as compared to 52% in **I.B.SCHIPPER** series³⁴ and 38.09% involved the left as compared to 48% in **I.B.SCHIPPER** series³⁴. In 57.14% of patients fracture is a result of trivial fall and majority of them are elderly age group patients especially females. High velocity injuries like road traffic accidents and fall from heights accounted for 42.85% of these fractures and most of them were males.

In **W.M.GADEGONE's** series³⁵ 75% of the fractures were due to domestic falls and this can be explained by the higher mean age group of the patients in this study. Vehicular accidents resulted in the remaining 25% of subtrochanteric fractures in their study. Fractures were classified according to Seinsheimer's classification and type III A fracture pattern constituted the highest percentage 42.85% (9) of all fracture patterns. **SEINSHEIMER**³ in his original study also noted high incidence of type III A fracture pattern (38.29%) than other fracture patterns. Admission – operation interval in our study varied from 3 – 26 days. Mean interval was high in our series. It was 6.6 days which is more when compared to **I.B.SCHIPPER's** series³⁴ where it was 2 days. Most of the patients with delayed injury – operation interval had pre existing uncontrolled medical problems. These medical co morbidities especially in elderly age group patients with associated degenerative joint disease of the knee significantly affected their final functional outcome.

The mean duration of hospital stay in our series was 19.09 days which is at par with **I.B.SCHIPPER's series**³⁴ (19 days). Intra operatively fracture reduction was achieved by closed means in 94% (20) of patients and 1 patient with delayed injury – operation interval required open reduction. The result of the reduction was considered good in 76% (16) of the patients and acceptable in 4.76% (1) of patients. Poor reduction was noted in 19.04% (4) of patients and it was associated with poor outcome. In **I.B.SCHIPPER's series**³⁴ reduction was good to acceptable in 96.2% of their patients and poor reduction was seen only in 2.9% of their patients. Post operatively 1 patient in this study had superficial infection(4.76%) and this settled with parenteral antibiotics. I.B.Schipper noted 4.1% superficial infections and 2.5% deep infections.

We did not encounter any deep infections in our series. Cut out of hip screw was noted in 1 patient (4.76%) and it was following a fall in the post operative period. 6% of patients in **I.B.SCHIPPER's** series had this problem. 1 patient had fracture shaft of femur with breakage of the nail noted at the distal locking screw hole that was not locked. I.B.Schipper noted this problem in 2% of his patients . The average time for radiological union was 3 months in the present study whereas in I.B.Schipper series it was approximately 4 months. 71.42% (15) of the patients in our series had no or slight pain that did not effect their activities. Only 1 patient who had cut out of the anti rotational screw had severe pain that restricted her activity significantly. 85.7% (18) of these patients had no or slight limp. 47.6% (10) of the patients mobilized without any walking aids. Cane was required for long walks in 28.56% (6) of patients and most of the time in 19.04% (4) of patients. Only one patient required crutch for mobilization. Difficulty squatting and sitting cross legged noted in 47.6% (10) of patients. Most of these patients were of geriatric age group who had associated degenerative disease of the knee. Limb length discrepancy was noted in 3 patients of which 2 of them had shortening of more than 2 cms. They were patients with Seinsheimer's type IV and type V fracture patterns. Final outcome was excellent to good in 61.9% (13) of patients. It was fair in 14.28% (3) of patients and poor in 23.8% (5) of patients. Younger age group patients irrespective of their fracture pattern had excellent outcome in our series. Most of the poor results were seen in the elderly age group patients with associated Osteoarthritis of the knee. The mean Harris Hip score was in our series was 80.76% which was higher than I.B.Schipper series³⁴ where the mean was 77.6.

SUMMARY AND CONCLUSION

The incidence of Subtrochanteric fractures of the femur is on the rise because of fast and high speed automobiles and modern lifestyles and increased life expectancy of the elderly age group patients. The deforming forces, high mechanical stresses and morbidity of the fractures in this region have always challenged the ingenuity and skills of the orthopaedic surgeon. Various devices have evolved in an attempt to effectively neutralize these forces. Closed insertion technique, shorter lever arm decreasing the tensile strain on the implant and increased purchase of the proximal fragment are the added advantages of Cephalomedullary nails over other fixation devices in subtrochanteric fractures. This study was conducted to analyze the results of Subtrochanteric fractures treated with this Proximal Femoral Nail – AO Type

In our series of 21 cases of Subtrochanteric fractures treated with Proximal Femoral Nail, 14 patients had Excellent to good outcome at their final follow up. Poor outcome was seen in 4 patients. 3 of these 4 patients had poor reduction intraoperatively. All these patients also belonged to geriatric age group who had associated degenerative joint disease of the knee affecting the final functional outcome. The mean Harris Hip score at their final follow up was 80.76 which is comparable to international publications in the literature.

From this sample study, we conclude that Proximal Femoral Nail is a good implant for the treatment of Subtrochanteric fractures of femur provided optimal reduction of the fracture and good positioning of the nail and screws are achieved.

BIBLIOGRAPHY

1. Hibbs, R.A : The Management of the Tendency of the Upper Fragment to Tilt Forwards in Fractures of the upper third of femur. New York, Med.J.,75: 177-179, 1902
2. Sarmiento, Augusto: Functional Bracing of Tibial and Femoral shaft Fractures. Clin Orthop. , 82: 2 – 13, 1972
3. Seinsheimer, F ., III: Subtrochanteric fractures of the femur. J.Bone Jt. Surg., 60-A: 300-306, 1978
4. JC DeLee, TO Clanton and CA Rockwood : Closed treatment of subtrochanteric fractures of the femur in a modified cast-brace ., J Bone Joint Surg Am. 1981 :63 : 773-779
5. . WADDELL, J. P.: Subtrochanteric Fractures of the Femur: A Review of 130 Patients. J. Trauma, 19: 582-592, 1979.
6. Delbet P. Les fractures du femur. Paris librairie alcan., 1920
7. Cleveland, M.Bosworth, D.M. and Thompson, F.R. Intertrochanteric fractures of the femur: A survey of treatment in traction and by internal fixation J. Bone & Joint Surg.,29: 1049 – 1067. ., , 1947
8. Evans, E. M. : The treatment of trochanteric fractures of the femur. J. Bone Jt. Surg., 31-B: 190-203, 1949
9. Baumgaertal J. Operative treatment of experimental comminuted subtrochanteric fractures
10. Boyd, H. B and Griffin, L.L. classification and treatment of trochanteric fractures.. Arch. Surgery., 1949; 88; 58
11. Watson HK, Campbell RD, Wade PA : Classification, treatment and complications of Subtrochanteric fracture. J Trauma 4 : 457 – 480, 1964
12. Aronoff, P. M.; Davis, P. M., JR.; and Wickstrom,J. K.:Intramedullary Nail Fixation as Treatment of Subtrochanteric Fractures of the Femur. J. Trauma, 11: 637-650, 1971.
13. Distefano, V.J.Nixon.; and Klein, K.S: Stable fixation of the difficult Subtrochanteric fracture. J.Trauma, 12: 1066 – 1070, 1972

14. Cech, O., and Sosna, A.: Principles of the Surgical Treatment of Subtrochanteric Fractures. *Orthop. Clin. North America*, 5: 651-662, 1974
15. Fielding, J. W., and Magliato, H. J.: Subtrochanteric Fractures. *Surg., Gynec. and Obstet.*, 122: 555-560, 1966
16. Hanson, G. W. , and Tullos, H. S. : Subtrochanteric Fractures of the Femur Treated with Nail-Plate Devices. A Retrospective Study. *Clin.Orthop.*, 131: 191-194, 1978.
17. Zickel R. E. : An Intramedullary Fixation Device for the Proximal Part of the Femur. Nine Years' Experience. *J. Bone and Joint Surg. , 58-A:866-872*, Sept. 1976.
18. Halder S C.: The Gamma Nail for peritrochanteric fractures.; *JBJS (Br)* 1992. 74: 340 – 344
19. Huber S M. Heining. : Pertrochanteric fracture fixation. Photoelastic stress measurement company DHS, Gamma nail & PFN. ; *JBJS (Br)* 1997; 79 B: 166
20. Simmermacher R K, Bosch A M.; The AO Proximal femoral nail - A new device for unstable proximal femoral fractures. ; *Injury* 1999; 30 : 327 – 332
21. A. Herrera, L.J. Domingo, A.Calvo, A.Martinez, J.Cuenca. : A comparative study of trochanteric fractures treated with the Gamma nail or the proximal femoral nail.; *International Orthopaedics* 2002; 26: 365 – 369
22. Sudan M, Sadowski C etal. : Peritrochanteric fractures. Is there an advantage of intramedullary nail? ; *J Orthop Trauma* 2002; 16 : 386 – 393
23. Christian Boldin, Franz J Seibert, Florian Fankhauser.: etal.: "The proximal femoral nail (PFN)—a minimal invasive treatment of unstable proximal femoral fractures . *Acta Orthop Scand* 2003; 74(1): 53 - 58.
24. Daniel F.A. Menezes, Axel Gamulin etal. : Is the Proximal femoral nail a suitable implant of all the trochanteric fractures? : *CORR*; 2005; 439 : 221 – 227
25. Woo-kie Min, Shin – Yoon etal. :Proximal femoral nail for the treatment of Reverse obliquity intertrochanteric fractures compared with Gamma nail. : *J of Trauma* ; 2007; 73 : 1054 – 1060

26. MSG Ballal, N Emms, G Thomas. : Proximal femoral nail failures in extra capsular fractures of the hip. : J of Orthopaedic Surgery 2008; 16(2) : 146 -9
27. Si Yong Park, Kyu Hyun Yang etal. : The treatment of Reverse obliquity intertrochanteric fractures with the intramedullary nail. : J of trauma; 2008; 65 : 852 – 857.
28. Currey J. : The biomechanical properties of bone.: Clin Orthop 1970; 73: 203 -231
29. Schipper I B etal. : Biomechanical evaluation of Proximal femoral nail. : CORR 2002; 405: 277 – 286
30. Tencer, A. F.; JOHNSON, K. D.; Johnston, D. W. C. ; and Gill, K.: A Biomechanical Comparison of Various Methods of Stabilization of Subtrochanteric Fractures of the Femur. J. Orthop. Res. , 2: 297-305, 1984.
31. Paul R.T. Kuzyk, Joel Lobo etal. : Biomechanical evaluation of extramedullary versus intramedullary fixation for Reverse obliquity Intertrochanteric fractures. ; J of Orthop Trauma 2009 ; 23; 1. : 31 - 38
32. Fractures in adults – Rockwood and Greens; 6th Edition
33. Harris W H (modified) JBJS 1969; 51:1
34. Schipper I B etal Treatment of Unstable trochanteric fractures :JBJS 2004; 86 B : 86 – 94
- 35 . Bergman GD, Winquist RA, Mayo KA etal. : Subtrochanteric fractures of the femur fixation using the Zickel Nail. : J Bone Joint Surg 1987; 69: 1032 – 1040
- 36.Velasco RU, Comfort T. : Analysis of treatment problems in Subtrochanteric fractures of the femur. ; J of Trauma 1978: 18 : 513 - 22
37. W.M. Gadegone, Y.S. Salphale. : Proximal femoral nail – An analysis of 100 cases of Proximal femoral fractures with an average follow up of 1 year.; International Orthopaedics 2007; 31 : 403 – 408
38. Russel TA, Taylor JC. : Subtrochanteric fractures of the femur. In : Browner BD, Jupiter JB, Levine AM. : Skeletal trauma 2nd Edition, Philadelphia, PA: WB Saunders; 1992 p. 1832 – 78

LIST OF ABBREVIATION USED

#	: Fracture
A – OP	: Admission – operation interval
F FT	: Fall from height
RTA	: Road traffic accident
S & F	: Slip and fall
R	: RIGHT
LF	: Left
S CLASS	: Excellent
DM	: Diabetas mellitus
HT	: Hypertension
SA	: Spinal anaesthesia
S	: Short
L	: Long
Y	: Yes
ARS	: Anti rotational screw
NB	: Nail breakage
W E	: With ease
W D	: With difficulty
E X	: Excellent
F	: Female
M	: Male
MOI	: Mode of injury
AO	: The Arbeitsgemeinschaft fur osteosynthesen
ASIF	: Association of study of internal fixation