



ISSN: 2395-1958
IJOS 2018; 4(4): 909-915
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www.orthopaper.com
Received: 26-08-2018
Accepted: 30-09-2018

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Outcomes of proximal femoral nail in subtrochanteric femur fractures through medial entry

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DOI: <https://doi.org/10.22271/ortho.2018.v4.i4l.120>

Abstract

Introduction: Subtrochanteric Fractures of Femur accounts for 10-34% of all hip fractures. Several Methods of treatment of this Fractures have been reported like DHS (Dynamic hip screw), Angled blade Plate, Proximal Femur Locking Plate and Intramedullary devices. Currently Intramedullary Devices like Proximal Femur Nail are used by many giving satisfactory results in subtrochanteric femur fractures. In such situation as Suggested by Richardu *et. el.* slight medial entry leads to valgus alignment which is desired along with the anatomical reduction while nailing subtrochanteric fractures. In the study conducted by perez *et al.* Suggested that slight more medial entry also protected abductors and caused no damage.

Materials and Methodology

- All the patients of subtrochanteric femur fractures treated with long proximal femur nail through medial entry will be called for follow up and data is collected as per the performa
- Functional assessment will be done using Harris Hip Score.

Discussion: Utizizing the tip of the trochanter as a starting point led to both varus and valgus malalignments.

Using the Trochanteric Fixation Nail (TFN) with a lateral to the tip of the trochanter, starting point demonstrated 6.83° varus and a gap of 8.03 mm. A medial starting point resulted in 6.6° valgus with a mean gap of 3.88 mm and a tip starting point showed 0.3° varus and 3.56 mm of gapping.

In the above conducted study there was a valgus angulation at the proximal femur due to medial entry of the proximal femur nail.

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

Keywords: proximal femur nail, subtrochanteric femur fractures, varus alignment, medial entry

1. Introduction

Currently intramedullary devices like proximal femur nail are used by many giving satisfactory results in subtrochanteric femur fractures.

Proximal Femur Nail has several advantages like less soft tissue, less blood loss, restoration of mechanical axis, superior bending stiffness which is similar to the intact femur. It resist to the medialisation of the shaft due to the muscle pull of adductors causing more efficient load sharing across the fracture

Proximal Femur Nails are designed for entry from the tip of trochanter, as it is more subcutaneous than the pyriform fossa, reduces the risk of damage to medial circumflex femoral artery and superior gluteal nerve. But this resulted in varus malalignment of the proximal fragment with too lateral of the entry point. An ideal entry point suggested by the manufacturers also results in slight varus deformity.

In such situation as suggested by Richardu ^[7] *et al.* slight medial entry leads to valgus alignment which is desired along with the anatomical reduction while nailing subtrochanteric fractures. In the study conducted by perez *et al.* Suggested that slight more medial entry also protected abductors and caused no damage.

2. Purpose of the study

The purpose of this study is to evaluate the results of subtrochanteric femur fractures treated

with long proximal femur nail with entry medial to the tip of greater trochanter from 2014 -2016 treated at VSGH.

3. Inclusion criteria

All skeletally mature Patients with subtrochanteric fractures and treated with long proximal femur nail.

4. Exclusion criteria

Patient lost to follow up
Patient not willing to give consent

5. Study design

This is a prospective, observational, longitudinal type of study

6. Materials and Methodology

permission from ethical committee was taken Patient data is collected from OOT register VSGH from 2014-2016.All the patients of subtrochanteric femur fractures treated with long proximal femur nail through medial entry will be called for follow up and data is collected as per the performa. Patients were followed up at 2, 4, 6 weeks and then monthly with clinical and radiographic assessment until fracture union. Fracture union was considered when bridging callus was visible on 3 of 4 cortices on anteroposterior and lateral radiograph. Functional assessment will be done using Harris Hip Score.

7. 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 down	Others

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
- TT/Antibiotics
- Iv fluids
- Blood
- Debridement if open.

Definitive management

- Procedure
 - Open
 - Closed
- Details of implant-
Nail- length- Diameter-
Hip screw- length- Position-
Antirotation screw- length- Position-
Distal screws- size- number-
- Reduction

Postoperative management

- Antibiotics
- Suture removal
- Physiotherapy-quadiceps strengthening exercises.
- Hip/Knee bending exercises.
- Mobilisation
 - Non weight bearing
 - Partial weight bearing
 - Full weight bearing

Postoperative Complications

Early complications-

- Infection
 - Superficial
 - Deep
- Wound gaping
- Epidermal necrosis
- Seroma
- Hematoma
- Decubitus ulcer

Late complications-

- Cutting out of the screws-
- Z effect of screws
- Reverse z effect of screws
- Varus collapse
- Nail breakage
- Diaphyseal fracture
- Limb length discrepancy
- Hip stiffness
- Delayed union
- Nonunion.

8. Follow up proforma

- Duration
- Knee bending
- Pain:
 - No pain
 - Slight
 - Moderate
 - Severe
- Limp
- Hip ROM:
 - Flexion
 - Extension
 - Adduction

- Abduction
- Limb length
- Walking
 - Non weight bearing
 - Partial weight bearing
 - Full weight bearing
- Sitting cross legged
- Squatting
- Ambulatory capacity:
 - Independent
 - With stick
 - With walker

Radiological assessment

- Union
- Implant
 - Back out of screws
 - Cutting of screw
 - Breakage of nail or screw
- Bone structure
 - Normal
 - Osteoporotic
- Neck shaft angle
- Varus/valgus

Table 1: Harris Hip score

Harris Hip Score	Hip ID:
	Study Hip: <input type="checkbox"/> Left <input type="checkbox"/> Right
	Examination Date (MM/DD/YY): / /
	Subject Initials:
	Medical Record Number:
Interval: _____	
Harris Hip Score	
<p>Pain (check one)</p> <p><input type="checkbox"/> None or ignores it (44)</p> <p><input type="checkbox"/> Slight, occasional, no compromise in activities (40)</p> <p><input type="checkbox"/> Mild pain, no effect on average activities, rarely moderate pain with unusual activity; may take aspirin (30)</p> <p><input type="checkbox"/> Moderate Pain, tolerable but makes concession to pain. Some limitation of ordinary activity or work. May require Occasional pain medication stronger than aspirin (20)</p> <p><input type="checkbox"/> Marked pain, serious limitation of activities (10)</p> <p><input type="checkbox"/> Totally disabled, crippled, pain in bed, bedridden (0)</p> <p>Limp</p> <p><input type="checkbox"/> None (11)</p> <p><input type="checkbox"/> Slight (8)</p> <p><input type="checkbox"/> Moderate (5)</p> <p><input type="checkbox"/> Severe (0)</p> <p>Support</p> <p><input type="checkbox"/> None (11)</p> <p><input type="checkbox"/> Cane for long walks (7)</p> <p><input type="checkbox"/> Cane most of time (5)</p> <p><input type="checkbox"/> One crutch (3)</p> <p><input type="checkbox"/> Two canes (2)</p> <p><input type="checkbox"/> Two crutches or not able to walk (0)</p> <p>Distance Walked</p> <p><input type="checkbox"/> Unlimited (11)</p> <p><input type="checkbox"/> Six blocks (8)</p> <p><input type="checkbox"/> Two or three blocks (5)</p> <p><input type="checkbox"/> Indoors only (2)</p> <p><input type="checkbox"/> Bed and chair only (0)</p> <p>Sitting</p> <p><input type="checkbox"/> Comfortably in ordinary chair for one hour (5)</p> <p><input type="checkbox"/> On a high chair for 30 minutes (3)</p> <p><input type="checkbox"/> Unable to sit comfortably in any chair (0)</p> <p>Enter public transportation</p> <p><input type="checkbox"/> Yes (1)</p> <p><input type="checkbox"/> No (0)</p>	<p>Stairs</p> <p><input type="checkbox"/> Normally without using a railing (4)</p> <p><input type="checkbox"/> Normally using a railing (2)</p> <p><input type="checkbox"/> In any manner (1)</p> <p><input type="checkbox"/> Unable to do stairs (0)</p> <p>Put on Shoes and Socks</p> <p><input type="checkbox"/> With ease (4)</p> <p><input type="checkbox"/> With difficulty (2)</p> <p><input type="checkbox"/> Unable (0)</p> <p>Absence of Deformity (All yes = 4; Less than 4 =0)</p> <p>Less than 30° fixed flexion contracture <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Less than 10° fixed abduction <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Less than 10° fixed internal rotation in extension <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Limb length discrepancy less than 3.2 cm <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Range of Motion (*Indicates normal)</p> <p>Flexion (*140°) _____</p> <p>Abduction (*40°) _____</p> <p>Adduction (*40°) _____</p> <p>External Rotation (*40°) _____</p> <p>Internal Rotation (*40°) _____</p> <p style="text-align: center;">Range of Motion Scale</p> <p>211° - 300° (5) 61° - 100 (2)</p> <p>161° - 210° (4) 31° - 60° (1)</p> <p>101° - 160° (3) 0° - 30° (0)</p> <p>Range of Motion Score _____</p> <p>Total Harris Hip Score _____</p>

Table 2: Grading of Harris hip Score

Score	Functional outcome
<70	Poor
70-79	Fair
80-89	Good
90-100	Excellent

- Radiological
 - Union: Fracture lines
 - Entry of nail
 - Neck shaft Angle
 - Varuus/valgus

8. Observations

1. Mode of injury causing fracture

60% of the patients suffered injury due to RTA, 33.3% suffered due to fall down

Incidence based on Seinschemers classification

Distribution of the patients as per seinschemers classification.

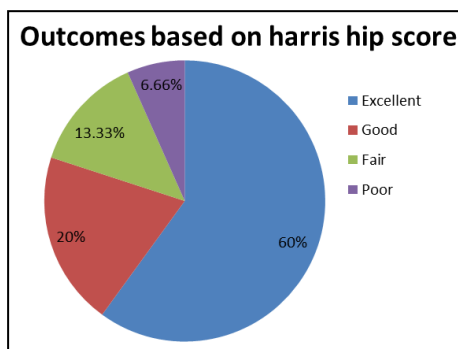
Most commonly seen fractures pattern in this study is Seinschmer's type III A.

Assessment at final follow up

Overall result based on Harris hip score

Table 3: Distribution of patients as per Harris hip score

	No of patients	Percentage
Excellent	18	60.00
Good	06	20.00
Fair	04	13.33
Poor	02	6.66



Graph 1: Distribution of patients based on Harris hip score

9. Discussion

The pull of the hip flexor and abductor muscles makes antegrade nailing of subtrochanteric femur fractures difficult, independent of starting point.

The varus deformity commonly seen is worse in subtrochanteric fractures because of the very high proximal medial fracture line and the malalignment produced by the contraction of the gluteus medius musculature.

The anatomy of the greater trochanter is variable and the rotation, abduction, and flexion positions of the proximal femur associated with a subtrochanteric fracture can make this starting point difficult to visualize and at best a very "inexact" procedure.

Often subtrochanteric fractures are well aligned on the fracture table, yet introduction of the nail with its proximal bend can produce a deformity.

Second-generation intramedullary nailing of subtrochanteric femur fractures through a piriformis fossa entry site has been shown to have a propensity toward a varus deformity [24, 25].

Utilizing the tip of the trochanter as a starting point led to both varus and valgus malalignments [26].

Using the Trochanteric Fixation Nail (TFN) with a lateral to the tip of the trochanter, starting point demonstrated 6.83° varus and a gap of 8.03 mm. A medial starting point resulted in 6.6° valgus with a mean gap of 3.88 mm and a tip starting point showed 0.3° varus and 3.56 mm of gapping [26].

Streubel PN [27]. In his study concluded that the ideal entry

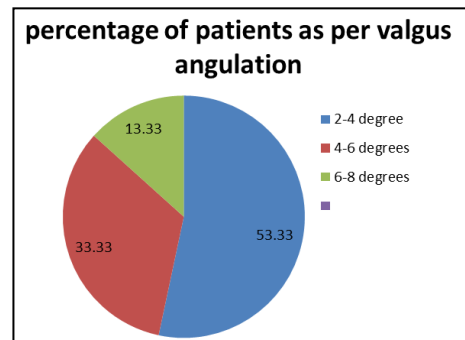
point ranged from 16 mm medial to 8 mm lateral to the trochanteric tip (mean, 3 mm medial; standard deviation, 5 mm). In 70% of patients, the ideal entry point was medial to and in 23% lateral to the tip of the greater trochanter and the trochanteric tip represents the ideal starting point in only the minority of cases.

Prasarn [28] in his study concluded that rigid femoral nails introduced through a lateral entry portal have been associated with a higher risk of iatrogenic fracture and malreduction.

In the above conducted study there was a valgus angulation at the proximal femur due to medial entry of the proximal femur nail

Table 4: Distribution of patients as per valgus angulation

Degrees of valgus angulation	No of Patients	Percentage
2-4 degrees	16	53.33
4-6 degrees	10	33.33
6-8 degrees	04	13.33



Graph 2: Distribution of patients as per valgus angulation

10. Conclusion

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.

Out of 30 cases of Subtrochanteric fractures treated with Proximal Femoral Nail, 24 patients had Excellent to good outcome at their final follow up. Poor outcome was seen in 02 patients. 2 of these patients had poor reduction intraoperatively.

The mean Harris Hip score at their final follow up was 80.76 which is comparable to international publications in the literature.

On follow up radiological examination at 6months 10 patients had 2-4 degrees of valgus angulation, 16 patients had 4-6 degrees of valgus angulation and 4 patients had 6-8 degrees of valgus angulation with no varus collapse.

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

50 year old male patient with history of RTA treated with proximal femur nail showing immediate and 6 months follow up X-ray.



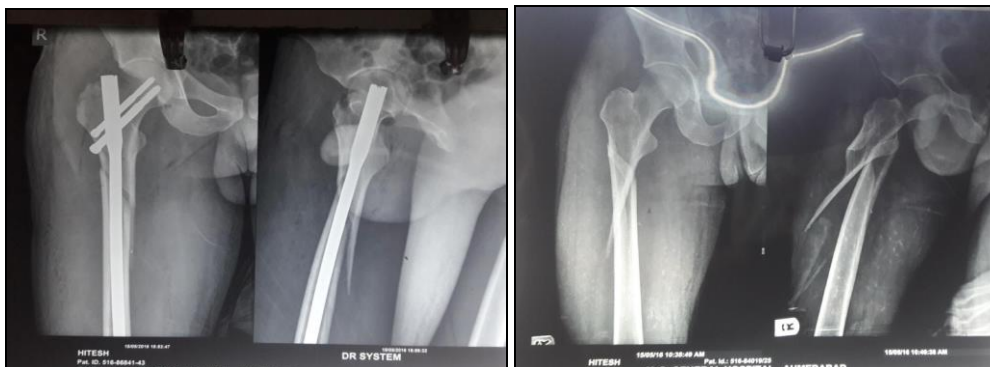
X-ray 1: Preoperative

X-ray 2 Postoperative

X-ray 3: 6 months follow up Figure no 1(hip and knee flexion)

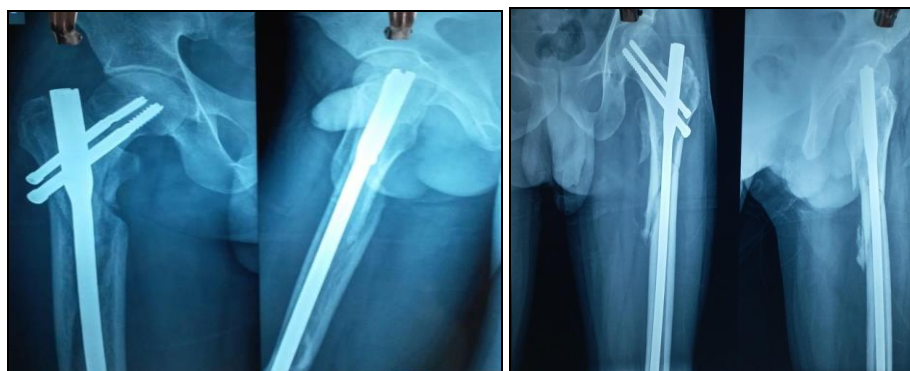


Fig 2: 28 year old male patient with history of RTA treated with proximal femur nail showing immediate and 6 months follow up X-ray



X-ray 4: Preoperative

X-ray 5: Postoperative



X-ray 6: 6 months follow up

X-ray 7: 1 Year follow up



Fig 3: Squatting



Fig 4: Hip and knee flexion

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