



## COMPARATIVE STUDY OF OUTCOME OF FEMUR NAIL WITH ENTRY FROM PYRIFORMIS FOSSA VS GREATER TROCHANTER

**DR. AMIT KUMAR**

(ASSO. PROF), ORTHOPEDICS, CIVIL HOSPITAL, AHMEDABAD

**DR PIYUSH MITTAL**

(ASSO. PROF), ORTHOPEDICS, CIVIL HOSPITAL, AHMEDABAD

### ABSTRACT

**INTRODUCTION** Intramedullary nailing is the best modality for femoral shaft fractures as it is biological fixation with good apposition with minimal tissue damage and fixation is bio mechanically superior to plates and fixators with immediate rehabilitation and fewer complications. (1,3,5)The optimal entry point for antegrade intramedullary nailing of femoral shaft fractures remains controversial. Since the study by Ricci et al, there have been a number of randomized, controlled trials (RCTs) and cohort studies comparing the efficacy of the 2 entry points on various patient-and procedure-related outcomes.(2,7,10) As per our knowledge, there has been very less systematic review of the literature on optimal entry point during antegrade nailing of femoral shaft fracture.

**AIMS AND OBJECTIVE** To compare the operative and fluoroscopic time required for IM nail fixation, time taken for taking entry, the amount of blood loss, incision length and other complication in the form of iatrogenic neck femur fracture in surgery of femoral shaft fractures using the GT (greater trochanter) versus PF (Pyriformis fossa) entry point. A secondary objective was to determine whether there were any differences in complications (delayed and non union), fracture alignment and healing and functional outcomes in the form of thorensen score, LEM (lower extremity measure) and HHS (harris hip score) between the 2 entry points.

**MATERIALS AND METHODS** The study included 50 patients with 25 in each group i.e greater trochanter and pyriformis fossa group. Only 2 part simple transverse fracture was taken into consideration.

**DESIGN:** Prospective comparative study

**OBSERVATION AND RESULTS** GT entry showed better results as compared to PF group as there was statistical difference in total operative time, total fluoroscopy shoots taken, number of shoots while taking entry and incision length. These differences were magnified in obese patients with BMI>30. Functional outcome in terms of thorensen score, harriship score and radiological outcome in the form of union rates didn't showed any statistical difference in both groups.

**CONCLUSION** An antegrade femoral nail for trochanteric insertion resulted in equally high union rates, equally low complication rates, and functional results similar to conventional antegrade femoral nailing through the piriformis fossa. (3,8,9)The greater trochanter entry portal represents a rational alternative for antegrade femoral nailing with the benefit of decreased fluoroscopy time and decreased operative time in normal patients and benefits are more marked in those who are obese.

**KEYWORDS :** HEMOGLOBIN ; VITAMIN-A ; IRON DEFICIENCY ANEMIA

### Introduction:

Hip and Knee joint are the two major weight bearing joints in the lower extremity. The femur is the longest, strongest, largest and heaviest tubular bone in the human body and one of the principal load-bearing bones in the lower extremity. Fractures that involve the Femur shaft affect knee and hip function and stability. Now a days, the incidence of vehicular accidents has increased, not only that the pattern of fractures has also changed dramatically.<sup>(2,3,4,5)</sup> With the active usage of IITV in orthopedics, an era in management of fractures changed drastically. The age old methods of open reduction were dumped, instead closed reduction and fixation took over. These were established recently with concept of biological healing of fractures.<sup>6,7</sup>

For femoral fractures, interlock nail is now the preferred mode of treatment. Some scientists have also started MIPPO for fracture femur.

The use of intramedullary (IM) nailing is currently the gold standard treatment for the vast majority of femoral shaft fractures. Despite major advances in the design and engineering of these devices, there remains significant debate regarding the ideal entry point for antegrade nailing. Kuntscher's original IM nail was straight and introduced in antegrade fashion through the tip of the greater trochanter (GT) to minimize the risk of intracapsular infections, osteonecrosis of the femoral head, and iatrogenic femoral neck fractures.<sup>(9,10,11)</sup> However, because the tip of the GT is not colinear with the anatomic axis of the medullary canal, the insertion of a straight nail was reported to occasionally result in varus malreduction of the proximal fracture fragment, eccentric reaming of the medial cortex, and fracture comminution.<sup>(12,14,16)</sup> As a result, Hansen and Winquist recommended using an entry point more medial to the GT at the junction of the femoral neck and the GT. At the same

time, McMaster introduced the piriformis fossa (PF) entry, which is colinear with the medullary canal, as the entry point for antegrade nailing. In the following years, the PF became the starting point of choice, due to its favorable biomechanical results.

The debate surrounding the optimal entry point was revived with the advent of the IM nail featuring a proximal valgus bend. These nails were specifically designed to address the pitfalls associated with inserting a straight nail through the GT. Ricci et al were the first to directly compare the GT and PF entry points during antegrade nailing of femoral shaft fractures. Results from their study demonstrated no difference in union rate and complications between the 2 entry points.<sup>(2,10)</sup> However, they reported significantly shorter operative and fluoroscopy times with the GT entry point. Furthermore, other investigators have advocated the use of GT entry in obese patients, citing increased ease of use in that patient population. Since the study by Ricci et al, there have been a number of randomized, controlled trials (RCTs) and cohort studies comparing the efficacy of the 2 entry points on various patient-and procedure-related outcomes. To the current authors' knowledge, there has been no systematic review of the literature on optimal entry point during antegrade nailing of femoral shaft fractures.

**Materials and methods :** The present study was performed at civil hospital, Ahmedabad, B.J. MEDICAL COLLEGE, Ahmedabad, Gujarat, patients from august 2015 to april 2017. This study includes comparison of entry points taken during surgery in interlocking nail in femoral shaft fractures.

**Type of study:** Comparative randomised prospective study

**Selection of patients:**

**Inclusion criteria**

1. All traumatic fractures of femoral shaft

2. all adults with the fracture (>20 years of age)
3. closed fractures and simple two part fractures only.
4. Transverse fracture only.
5. No associated other injury and comorbidities
6. patient giving written consent

**Exclusion criteria**

- 1) Pathological fracture
- 2) Below 20 years and above 60
- 3) Segmental femoral fractures
- 4) Bilateral shaft femur, segmental fractures.
- 5) Head injury
- 6) Poor soft tissue around hip joint
- 7) Bleeding disorders
- 8) Polytrauma, comorbidities
- 9) Patient not giving written consent for the study

50 patients with shaft femur fracture were included in this study and were randomly assigned into two groups i.e one having taken entry from piriformis fossa and other from greater trochanter. Procedure was done in supine position on traction table with the use of a rigid reamer one size more than corresponding nail diameter. Although in our study we used the same nail design in both the groups, the nail i.e designed for piriformis fossa entry. All nails were cannulated, closed section, interlocking. The nails used for the GT group, was identical to those used for the PF group. Two proximal holes for locking in head through neck, one proximal dynamic hole Fifty six patients treated by 1 of 3 surgeons for a femoral shaft fracture with antegrade nailing between august 2015 to april 2017 were included. Two patients who expired early in the postoperative period and 4 with insufficient follow-up were excluded from analysis. At final follow up only, only 50 patients were present, i.e 25 in each group.

Mean body mass index was (23.6). The average age was 36.6 years (range 20-60). patients were followed up for 6 months on monthly basis. The criteria used intraoperatively were total operative time and fluoroscopy time, time taken in taking entry, reamer used and nail diameter, blood loss, complications like iatrogenic fracture and malignment. On follow up, functional outcome based on thorensen score, the lower-extremity measure (LEM), hipp harris score, abductor power, fracture healing and late complications including AVN were analysed.

**Rehabilitation**

Post operatively patients were advised static quadrices exercise and knee range of motion. Antibiotics were given for first 5 days by intravenous route and 7 days later by oral route, the sutures were removed after 2 weeks. Non weight bearing crutch walking up to 6 weeks, after 10-12 weeks weight bearing crutch walking is advised.<sup>(12,13,14)</sup>

An immediate post operative x ray was also done, later on repeated at 6 weeks, 3 months, 4 months and 6 months

**Observation and results**

**Table 1. comparison of total fluoroscopy time GT vs PF entry**

IITV SHOOTS	GT entry group		PF entry group		P value
	Median	range	Median	range	
	88	56-128	154	88-192	>0.001

**Table 2. fluoroscopy timing in taking entry**

GT group	PF GROUP	P value	Significance
Mean+/-SD 6.75+/-4.50	Mean+/-SD 11.25+/-2.50SD	<0.001	significant

**Table 3. total operative timing**

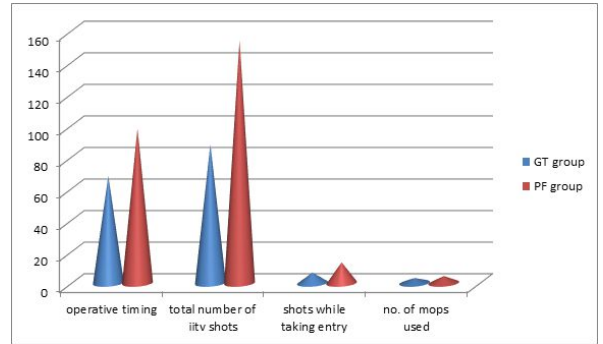
Group GT	Group PF	P value
Mean +/- SD 68.05+/-12.16	Mean +/- SD 98.14+/-18.45	<0.001 significant

**Table 4. comparison of incision length**

GT group	PF group	P value
Mean+/- SD 6.00 +/-0.68	Mean +/- SD 7.5 +/-0.75	<0.001 significant

**Table 8: comparison of intra op blood loss (no. of Mops used)**

GT group	PF group	P value
Mean +/- SD 3.25+/-1.0	Mean +/-SD 4.5+/-1.0	<0.001



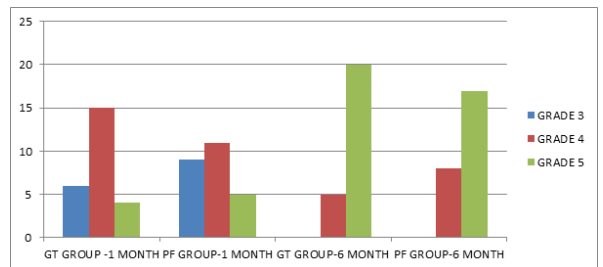
**Table no. 6**

Complications	No. of patient		Percentage	
	GT	PF	GT	PF
Non union	0	0	0	0
Intra op ICNF	0	3	0	12
Isolated Greater trochanter fracture	1	0	4	0
Femoral head osteonecrosis	0	2	0	8

**Table 5: Comparison of trendelenburg test in both groups i.e PF entry and GT entry at 4 months**

	Group PF		Group GT		P value
	Frequency	%	Frequency	%	
Negative	21	84%	25	100%	P<0.05 significant
Positive	04	16%	00	00%	
Total	25	100%	25	100%	

ABDUCTOR MUSCLE POWER ON FOLLOW UP AT 1 MONTH AND AT 6 MONTH



**THORESEN SCORE**

**TABLE NO. 8 AT FINAL FOLLOW UP**

SCORE	NO. OF PATIENTS	
	GT	PF
POOR	2	1
FAIR	2	2
GOOD	6	8
EXCELLENT	15	14

There were 2 infectious complications, 1 from each group. The average operative time was 44% higher in PF group, the mean time was 98.14+/-18.45 min for piriformis insertion and 68.06+/-12.16 min for trochanteric insertion (P <0.001). The average fluoroscopy time was 75% greater for the PF group (154secs) than for the GT group (88s) (P <0.001). These differences were magnified in patients who were obese (body mass index > 30) where the operative time was 60% greater (P < 0.02) and the fluoroscopy time was 80% higher

in the PF group ( $P < 0.02$ ). Patients from both groups had a similar initial decline and subsequent improvement in function overtime. The average number of C-arm shots to perform the entry point in piriform fossa is significantly higher as compared to trochanter (mean is 11.25 in PF and 6.50 in GT respectively) ( $P < 0.001$ ). In obese patient the mean operative time (70.56 in GT and 120.80 in PF) showed more marked difference and the average number of C-arm shots (7.33 in GT and 14 in PF) less in GT group than PF group. Twenty two of the 25 fractures from the GT group (88%) and 21 of the 25 fractures from the PF group (84%) healed after the index procedure within 4 months. In all other patients in both groups, union occurred till 6 months i.e. final follow up.

Patients from both groups had a similar initial decline and subsequent improvement in function over time ( $P > 0.05$ ). Harris-hipp score at 4 months was GT 73.37 (+/-) 8.25 and PF 68.67 (+/-) 8.04 with  $p$  value  $< 0.002$ . So the results show that GT has better functional outcome than PF group in terms of Harris-Hipp Score but at 6 months follow up, differences were insignificant. LEM score showed no statistically significant difference between the two groups. LEM Score for PF group was 88.7 +/- 12.08 and in GT group it was 86.08 +/- 14.92 at 6 month follow up. There were no significant differences in Range of motion of knee and hip joint as compared to unaffected side. Radiological union in follow up at 6wks, 8 wks, 12wks and 18wks show no significant difference and took almost similar time in both the groups, and there were no new malalignments observed. All fractures were united by 6 months.

### Discussion

Entry through Piriformis Fossa has an advantage that it is a colinear trajectory with the long axis of the femoral shaft but too medial entry can result in neck femur fracture and development of AVN changes in follow up as seen in our study, in obese patients, markedly increased entry time is noted. Though lateral placement through the trochanter may cause varus alignment of proximal fractures but in our study as we used the one size smaller diameter nail in GT group than PF group so no varus alignment of proximal fractures were seen.<sup>(7,9,14,15)</sup>

In our study the average fluoroscopy time required for the PF group (154 seconds) was greater than that of GTE group (88 seconds) with  $p$  value less than 0.001. Bulky patients showed marked significance in terms of time for entry and fluoroscopy. Inter group marked significance noted in high bmi vs low bmi in terms of entry time and total fluoroscopy times. These differences were magnified in patients who were obese (body mass index  $> 30$ ) where the operative time was 60% greater ( $P < 0.05$ ) and the fluoroscopy time was 80% higher in the PF group. Hence, in obese patients the duration of surgery and fluoroscopy time is less if they are operated by the GT portal. William Ricci et al.; in his series showed that the average operative time for PFE group was 75 minutes and for the GTE group was 62 minutes.<sup>(2,10)</sup> Similar are our deductions in the present study. J. Stannard et al.; in 2011, in his series, showed that the mean operative time was 104 minutes in PF as compared to 62 minutes in the GT group. This finding matches very closely with our conclusions (98.14 minutes and 68.08 minutes respectively). Michael Archdeacon et al.; in his study showed that the mean operative time averaged 84 minutes and the average blood loss was 219 cc. In our study, blood loss were kept to as low as 110-155cc. J. Starr et al.; in 2006 concluded that the two groups did not differ with regard to blood loss, incisional length and the duration of surgery or intra-op complication. Our study concludes positively the benefits of the GTE entry technique.

Patients with two part fracture with medial comminution in upper 3rd femur showed marked difference in total operative time within the group. Valgus band of nail observed in 6 cases in GT entry group especially in upper 3<sup>rd</sup> fractures. So, Proximal static lock was not done in these 6 patients in GT entry due to mismatch in assembly probably due to valgus bending of proximal part of nail as we used the same nail for gt entry and pf entry i.e. the nail designed for PF entry.

Walking distance at 6 months did not show any significant differences between both groups. Hip abductors showed time dependant improvement in both groups with the GT group improving faster as compared to PF group.

Two patients in PF entry showed AVN changes at 6 months follow up which can attributed to more medial entry in piriformis and hampering the vascularity in femoral neck. Hence GT entry may avoid damaging blood supply to the femoral head and resultant AVN, femoral neck fractures and septic arthritis. Abductor strength significance difference noted intergroup in initial 2 follow ups but at 6 month follow up it was insignificant. Trendelenburg test was negative in all the GT group patients at 6 months while in PF group 5 patient showed positive trendelenburg test upto 6 months but in the long term, there were no significant differences.<sup>(16,17,18)</sup>

Both the entry point with the same nails have same clinical and secondary outcomes with marked differences in time taken for entry and fluoroscopy time and operative time. Especially hafty patients which showed quite better results in terms of time taken and blood loss with GT entry.

### CONCLUSION

An antegrade femoral nail through trochanteric insertion resulted in equally high union rates, equally low complication rates, and functional results similar to conventional antegrade femoral nailing through the piriformis fossa. The greater trochanter entry portal represents a rational alternative for antegrade femoral nailing with the benefit of decreased fluoroscopy time and decreased operative time in normal patients and benefits are more marked in those who are obese.

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