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## A study to compare the intra operative parameters (including complications) using Piriformis fossa entry antegrade femoral nail and greater trochanter entry antegrade femoral nail in fracture shaft of femoral

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### Abstract

Femoral shaft fractures can be managed conservatively or surgically. Conservative management in the form of skeletal traction followed by hip spica or cast brace has limited indication. With time, it has become essential to treat these patients surgically unless and until surgery is contraindicated. In this comparative study, a cohort of 60 patients with fracture shaft of femur was included. Participants were divided by random number table method into groups with 30 patients in each group. In the first group Piriformis fossa entry Antegrade femoral nailing was used and in the second group Greater Trochanter entry femoral nail was used for fixation of femoral diaphysis fracture. Fluoroscopy time, duration of surgery, incision length and blood loss was less in GT group than PF group with significant statistical result. There was decreased fluoroscopy time and decreased operative time in patients who were obese.

**Keywords:** fracture shaft of femoral, Greater Trochanter Entry, Piriformis fossa entry

### Introduction

Fracture of the shaft of the femur is a commonly encountered injury in orthopedic practice. As femur is the longest weight bearing bone in the body with surrounding soft tissue envelope, it is usually fractured due to high energy trauma and may result in prolonged morbidity and extensive disability unless treatment is appropriate. Femoral fractures are observed in all age groups, young males (between the ages of 15 and 35 years) are affected most commonly; where it tend to be due to high energy road side accidents. These fractures are also seen in elderly females who sustain it after trivial trauma.

Several techniques are now available for its treatment. It can be life threatening, because of open wounds, hemorrhagic shock, fat embolism, and ARDS<sup>[1, 2]</sup>. There may be physical impairment due to fracture shortening, malalignment, and prolonged immobilization. This may lead to increased morbidity. So the aim of fracture treatment is to obtain union of the fracture, in near anatomical position, with minimal impairment of function. The spectrum of injury is so great that no single method of treatment is relevant to all diaphysis fracture femur. The type and location of fracture, degree of comminution, and age of the patient influence the method of treatment. The technique chosen should cause minimal soft tissue and bone damage. The goal should be to achieve anatomic alignment and early mobilization with functional rehabilitation of limb.

Femoral shaft fractures can be managed conservatively or surgically. Conservative management in the form of skeletal traction followed by hip spica or cast brace has limited indication. With time, it has become essential to treat these patients surgically unless and until surgery is contraindicated. The surgical treatment has seen revolutionary changes over period of time.

Intramedullary fixation of femur shaft fracture with the use of intramedullary nails, carried out in a biological way, is currently the best modality and the established mode of treatment for the femur shaft fractures. Basically there are two technique of intramedullary nailing, one is antegrade and the other is retrograde nailing.

Antegrade intramedullary nailing is the most commonly used technique, which can be done with either piriformis entry portal or greater trochanter entry portal. The piriformis entry portal is widely considered as the standard starting point in antegrade nailing due to anatomical

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alignment of the piriformis fossa with the long axis of femoral shaft. As a consequence easy insertion of straight nails can be achieved. The piriformis fossa is located near superior gluteal nerve that innervates abductor musculature, as well as near the branches of medial circumflex femoral artery and superior gluteal nerve, and may result in vascular damage to femoral head and paralysis of gluteal muscles respectively. Furthermore, abductor and external rotator musculature are dissected in the way of entry point. Complication have been reported such as iatrogenic fracture of the femoral neck, septic arthritis of hip joint, avascular necrosis of the femoral head, persistent pain at the hip region, weakness of abduction at hip and heterotopic ossification [3, 4, 5].

Alternatively, greater trochanteric entry portal can be used to combat some of these complications. The potential advantage of using the trochanteric tip as the starting entry portal includes less operative time and less intraoperative fluoroscopy exposure. Also, it minimize avascular necrosis of the femoral head and iatrogenic femoral neck fractures. Trochanteric entry is technically easier to obtain specially in obese patients and it is more forgiving in terms of anterior translation as the bone is cancellous here. Furthermore, because the outer surface of the trochanter is relatively flat, it is less likely for an awl to slip, as is often the case at the piriformis fossa. However, trochanter entry portal is not collinear with the central axis of the medullary canal, and is located more laterally. This malalignment of the greater trochanter with the long axis of the femoral shaft has been thought to be responsible for the complications such as eccentric reaming of the proximal fragment, comminution of the fracture site and varus fracture malalignment [6, 7].

### Methodology

Randomization was carried out through the use of random number table method after the patients consent. Patients were randomized to receive either a nail which employs a piriformis fossa entry portal, or a nail which employs a trochanteric entry portal. An informed consent was taken after explanation that the fracture fixation can be done by both of the methods.

The patients were operated under regional anesthesia on a fracture table. Prophylactic antibiotic was given half an hour before incision. The surgical team included an orthopedic surgeon, at least one orthopedic resident and nurse. Surgery was performed on a traction table, in supine position.

In this comparative study, a cohort of 60 patients with fracture shaft of femur was included. Participants were divided by random number table method into groups with 30 patients in

each group. In the first group Piriformis fossa entry Antegrade femoral nailing was used and in the second group Greater Trochanter entry femoral nail was used for fixation of femoral diaphysis fracture.

The sample size was 30 patients per group on assumption of power: 0.85, Type 1 error: 0.05, and effect size: 0.8 with variables; intraoperative parameters (including complications), postoperative parameters (including complications) and postoperative functional outcome.

### Inclusion Criteria

1. Age: 20 to 60 years.
2. Duration of injury: Less than 7 days.
3. Closed traumatic fracture of the femoral diaphysis.
4. ASA category I and II.

### Exclusion Criteria

1. Polytrauma patients.
2. Pathological fractures, previous, concomitant or fracture of any of the lower extremity.
3. Segmental Femoral shaft fractures.
4. Associated Inter Trochanteric, Sub Trochanteric or femoral neck fractures.
5. Bilateral shaft of femoral fractures.
6. Patients who are medically unfit to undergo surgery.
7. Pregnant female.
8. Poor soft tissue condition around hip region.
9. Bleeding disorders.
10. ASA category III, IV, V and VI.
11. Patients unable to give informed consent.

A major trauma was assessed with primary survey and secondary survey as per ATLS protocol. Fractures was assessed and classified according to AO/OTA and Winquist classification.

### Results

Of the total 60 patients of fracture shaft femur, 30 patients were treated with closed reduction and internal fixation done with antegrade interlocking nail via greater trochanter entry portal and other 30 patients were treated with closed reduction and internal fixation done with antegrade interlocking nail via piriformis fossa entry portal.

GT group-Closed reduction and internal fixation with interlocking nail via greater trochanter entry portal.

PF group-Closed reduction and internal fixation with interlocking nail via piriformis fossa entry portal.

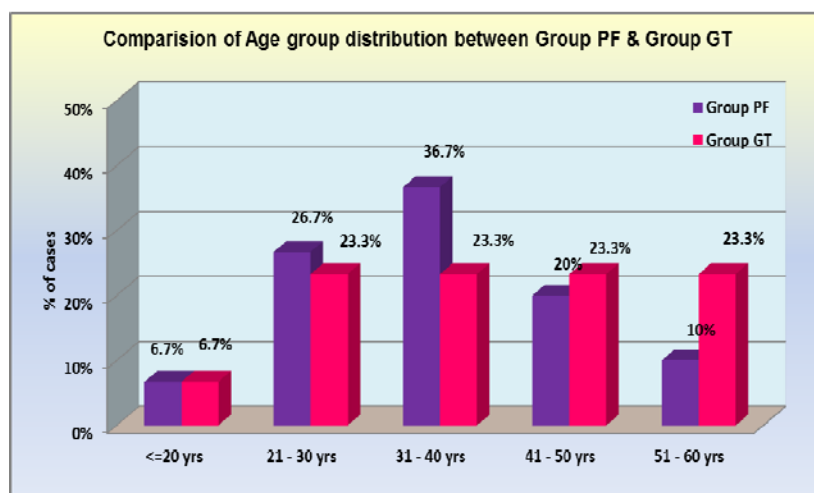


Fig 1: Age Distribution

**Table 1:** Distribution of groups

Procedure	Frequency	%
CRIF With ILN Via GT Portal	30	50%
CRIF With ILN Via PF Portal	30	50%
Total	60	100%

**Table 2:** Comparison of no. of shots between GT group and PF group

	Group PF (n=30)		Group GT (n=30)		P Value
	Median	IQR	Median	IQR	
Shots	203	134 - 283.50	61.5	34 - 123.75	<0.001

**Table 3:** Comparison of duration of surgery between GT group and PF group

	Group PF (n=30)		Group GT (n=30)		P Value
	Mean $\pm$ SD	Min - Max	Mean $\pm$ SD	Min - Max	
Duration	102.53 $\pm$ 15.00	68 - 130	80.13 $\pm$ 12.40	60 - 110	<0.001

**Table 4:** Comparison of intraop. Complications between GT group and PF group

Complications	Group PF		Group GT		P Value
	Frequency	%	Frequency	%	
No	30	100.0%	29	96.7%	1.000
Yes	0	0.0%	1	3.3%	
Total	30	100%	30	100%	

**Table 5:** Comparison of intraop. Blood loss between GT group and PF group

	Group PF (n=30)		Group GT (n=30)		P Value
	Mean $\pm$ SD	Min - Max	Mean $\pm$ SD	Min - Max	
Blood Loss	142.67 $\pm$ 26.90	80 - 180	115 $\pm$ 25.96	80 - 180	<0.001

**Table 6:** Comparison of incision length between GT group and PF group

	Group PF (n=30)		Group GT (n=30)		P Value
	Mean $\pm$ SD	Min - Max	Mean $\pm$ SD	Min - Max	
incision	6.53 $\pm$ 0.68	5 - 8	5.27 $\pm$ 0.45	5 - 6	<0.001

**Table 7:** Corelation of BMI with fluoroscopy time and duration of surgery in PF group

		BMI	duration	Shots
BMI	R	1.000	0.640	0.644
	P value		<0.001	<0.001
duration	r	0.640	1.000	0.644
	P value	<0.001		<0.001
Shots	r	0.644	0.664	1.000
	P value	<0.001	<0.001	

## Discussion

Intramedullary nailing is the preferred treatment for the majority of femoral shaft fractures. This treatment yields excellent results with respect to fracture union and alignment. However, several articles have documented notable dysfunction and pain about the hip joint following femoral nailing. The reported problems included hip and thigh muscle weakness, with the deficit persisting for two years or longer in some patients. Persistent pain was reported in some of patients, and interfered with activities of daily living in some patients. The ideal starting point for antegrade femoral nailing is controversial. A number of studies have attempted to determine the ideal starting point for antegrade femoral nailing. The current study is to directly compare use of the greater trochanter to the piriformis fossa starting portals with nails specifically designed for each starting point. Total 60 patients were included in this comparative study done at Central Institute of Orthopaedics over a period of 18 months. Patients were divided by table of random numbers into two groups and were operated with closed reduction and internal fixation with interlocking nail via either PF entry portal or GT

entry portal and the data was compared in terms of intra-operative, post-operative parameters and functional outcome in long term follow up.

We found that fracture of femur was most common in 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> decade of life with mean age of 35yrs in PF group and 38 yrs in GT group, with age ranging from 20 to 60 yrs.

Winqvist *et al.* [8], in his series reported 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> decade as a common age group i.e. 70% middle age group population, with mean age 29 years age group.

William ricci *et al.* [9], in his study reported 2<sup>nd</sup> and 3<sup>rd</sup> decade as a common age group, with mean age of 28 for GT group and 29 PF group.

Males were predominantly prone to fracture shaft of femur due to high incidence found in motor vehicular accidents. 66% (39 patients) of our study patients were male, of which 19 patients were in PF group and 20 patients were in GT group.

William ricci *et al.* [9] reported 59.3% male predominance in 91 patients in his study, of which 25 patients were in PF group and 29 patients were in GT group.

In our study there is slight predominance of right side (53.3%) which is not significant. There is no site predominance in any

of other study done yet.

J. Stannard *et al.* [10] in 2011 in series showed that patient demographics did not differ significantly between the two groups and the fracture classification and anatomic location also did not differ significantly between the two groups.

In our study average fluoroscopy time required for PF group (203 sec) were greater than that required for GT group (61.5 sec) with p value less than 0.001. The fluoroscopy time was more in obese patient in PF group as compared to GT group.

In our study, the mean operative time for PF group was 102.5 min and for GT group was 80.15 min. The statistical analysis showed that the operative time for PF group is greater than GT group. The data showed significant result with p value less than 0.001.

In our study the mean incision length for PF group was 6.53 cm and for GT group was 5.27 cm with a p value less than 0.001 that proves that result is significant.

In our series, blood loss during the surgery in PF group was around a mean of 142.67 ml and in GT group was around a mean of 115 ml with a p value less than 0.001. The results are significant which showed that there is less blood loss during surgery via GT entry portal.

In our study we correlated the Body mass index to fluoroscopy and duration of surgery, the result was significant showing that in obese patients the duration of surgery and fluoroscopy time is less if they are operated via GT portal.

William Ricci *et al.* [9] in his series showed that the average operative time for the PF group was 75 minutes (range 31–131 minutes); for the GT group it was 62 minutes (range 14–193), (P = 0.08). The average fluoroscopy time for the PF group was 153 seconds (range 16–662); for the GT group it was 95 seconds (range 20–375). This 61% increase in fluoroscopy time for the PF group was significant (P, 0.05). These differences were magnified in patients who were obese (body mass index .30) where the operative time was 30% greater (P, 0.05) and the fluoroscopy time was 73% higher (P, 0.02) in the PF group.

J. Stannard *et al.* [10] in 2011 in his series showed that, the mean operative time was 104 minutes (range, forty-one to 233 minutes) in PF compared with seventy-five minutes (range, thirty-five to 187 minutes) in GT (p < 0.0001). The mean incision length was 72 mm (range, 25 to 190 mm) in Group PF compared with 38 mm (range, 20 to 85 mm) in Group GT (p < 0.0001). The mean fluoroscopy time was 149 seconds (range, 48 to 311 seconds) in Group PF compared with 118 seconds (range, 29 to 320 seconds) in Group GT (p = 0.0005).

Michael Archdeacon *et al.* [11] in his study showed that operative time averaged 84 minutes, and average blood loss was 219 cubic cm.

J. Starr *et al.* [12] in 2006 in his study concluded that the 2 groups did not differ with regard to blood loss, incision length, and duration of surgery or intraoperative complications. But Body mass index was found to be significantly linked to duration of surgery (P<0.001) and length of hip incisions (P<0.001), but not to estimated blood loss (P=0.3).

In our study there was no intraoperative complications in PF group and in GT group one patient had greater trochanter fracture while insertion of the nail and the data is insignificant.

In immediate follow up period in our group, there was no malalignment in PF group but in GT group 2 patients (6.7%) out of 30 patients showed malalignment with p value 0.492 and the data shows no significant difference.

VAS in immediate post op period in both group showed significant difference with p value less than 0.001. Average VAS in PF group was 79.13 and in GT group were 73.1.

## Conclusion

In this comparative study comparing interlocking nailing via either greater trochanter entry portal or piriformis fossa entry portal for fracture shaft femur, we found that interlocking nailing done via greater trochanter portal has significantly better intraoperative in long term follow up

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