IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 19, Issue 7 Ser.5 (July. 2020), PP 19-22
www.iosrjournals.org

Antigrade Nailing Of Femoral Shaft Fractures: Comparison of Entry Points

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Abstract:
Background*: Intramedullary nailing is gold standard for femoral shaft fractures fixation with good apposition with minimal tissue damage. Patients can start with immediate rehabilitation and with fewer complications. The optimal entry point for antegrade intramedullary nailing of femoral shaft fractures has been the topic of debate. 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. The piriformis fossa and greater trochanter has been commonly described as starting points for antegrade femoral nailing.*
Materials and Method:s*This study was conducted on limited number of patients during a period of one year. The patients with femoral diaphyseal fractures were admitted for antegrade nailing. Patients were divided in two groups randomly for piriformis fossa entry point and greater trochanter entry point. Total number of patients in each group was 20 (n= 20). Functional outcome was analyzed at final follow up using Harri's hip score.*
Results*: There was no significant difference observed in both clinical and functional outcome in both groups however intraoperative time and fluoroscopic time in the two groups was significant (P <0.001).*
Conclusion:*Femoral nailing through the greater trochanter entry portal with specifically designed nails can be considered as an alternative to femoral nailing compared to Piriformis fossa entry portal with the benefit of reduced requirement for fluoroscopy and decreased operative time in patients more so in the obese patients.*
Key Word*: Fracture shaft femur,Antegrade Nailing, GT entry, Piriformis entry.*

Date of Submission: 23-06-2020 Date of Acceptance: 11-07-2020

I. Introduction

Intramedullary nailing is well established for the treatment of fractures of the femoral shaft. The current entry point for most antegrade nails is the Piriformis fossa.[1–4] Well-recognized but rare complications of femoral nailing include iatrogenic fracture and fat embolism, but little attention is paid to the often persistent pain in the trochanteric region and loss of muscle strength and endurance in the upper leg after the fracture has healed.[5,6] Percutaneous access to the Piriformis fossa is rather demanding and proper direction of the penetrating device in line with the intramedullary canal is essential.[7,8] Misdirection may result in violation of the subtrochanteric femoral cortex or even fracture of the femoral neck.[5] Furthermore, this technique requires inevitable surgical dissection through the abductor and external rotator musculature of the hip. In addition, nail entrance through the Piriformis fossa bears some risk of iatrogenic injury of the medial circumflex femoral artery and superior gluteal nerve with subsequent vascular damage to the femoral head and paralysis of the gluteal muscles respectively.[9–13] These problems may ultimately result in reduced daily function for the patient and are associated with moderate pain, a discrete limp, muscle weakness, and some loss of endurance. Nail introduction through the tip of the greater trochanter appears to reduce the risk of damage to vascular and nervous structures and the abductor and external rotator musculature of the thigh.[13–17] Therefore, nails specifically designed for insertion through the tip of the greater trochanter have gained popularity.[18,19] The purpose of this study was to compare results of femoral shaft fracture treated with cephalon medullary nailing through the Piriformis fossa greater trochanter to nailing through the.

II. Material And Methods

This Prospective randomized study was performed a in a limited number of patients in NSCB Medical College between JULY 2019 to JUNE 2020 after obtaining clearance from the institutional ethics committee and informed consent of the subjects. The patients with femoral diaphyseal fractures were admitted at OPD or emergency department of this institution were randomly selected for antegrade nailing through PF group and greater trochanter entry (GT group) approach. Total number of patient in each group was 20.

Study Design: Prospective randomized study
Study Location:NSCB Medical College, Jabalpur, Madhya Pradesh
Study Duration:JULY 2019 to JUNE 2020
Sample size: 40
Sample size calculation: The sample size was calculated to be 40.
Subjects & selection method:The study population was selected randomly from patients who presented to NSCB medical college with Fracture shaft of femur either in OPD or Emergency.

Inclusion criteria
1. Close fracture shaft of femur.
2. Skeletally mature patient.
3. Patient giving consent for the study.

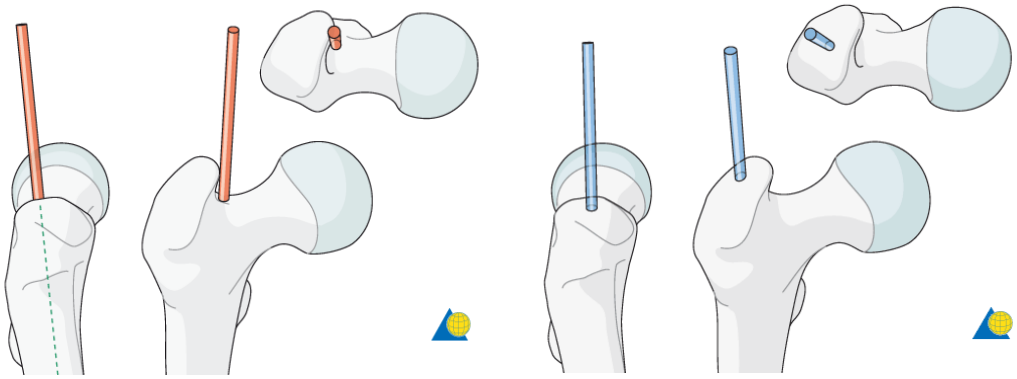
Exclusion criteria
1. Open fracture shaft femur.
2. With vascular injury.
3. Pathological fractures.
4. Fractures >3 weeks old.
5. Medically unfit patients.
6. Patient refusing consent.
7. Bilateral femoral shaft fractures.

Procedure methodology:

All patients were treated in the supine position using a similar technique. Before nail insertion, all fractures were reduced under image intensifier control on the fracture table with boot traction. After a short longitudinal skin incision approximately 5 cm cranial to the greater trochanter tip, the fascia layers were dissected sharply.

Piriformis fossa was palpated by blunt dissection. Entry point was made with curved pointed awl and medullary cavity was perforated at piriformis fossa, after confirming under image intensifier.

The Tip of greater trochanter was palpated by finger. Entry point was made with straight pointed awl and medullary cavity was perforated at tip of greater trochanter, after confirming under image intensifier. Reaming was performed with a soft tissue protector. All nails were locked both proximally and distally.



Rehabilitation

Muscle strengthening of the thigh was emphasized postoperatively as well as range of motion of the knee. Active hip and knee ROM exercises were started as soon as pain subsided.

Patients were ambulated within 24–48 h after surgery using toe-touch weightbearing in cases of stable fracture and satisfactory stable fixation. Suture removal was done after 14days of surgery. Guarded weight bearing was allowed as soon as bridging callus was seen in X-ray, usually after 4–6 weeks.

Full weight bearing was started when the fracture site was completely bridged by callus and fracture site clinically became nontender. Patients were then examined at 6 weekly intervals until absolute fracture union was obtained clinicoradiographically. Patients were followed up at 6 months and 12 months.

Patients were evaluated both clinically and radiologically using criteria by Harris Hip scoring system at 12 month postoperatively.

III. Result

Operative and fluoroscopy time

The mean operative time for the PF group was 112. 7 minutes; for the GT group it was 90.7 minutes. The mean fluoroscopy time for entry portal in the PF group was 10.08 seconds (range 2–18) and number of C-arm shots for the entry point was around 12, While for the GT group the mean fluoroscopy time for entry portal was 5.88 seconds and number of C-arm shots taken for the entry point was around 8.This increase in fluoroscopy and operating time for the PF group was significant. These differences were magnified in patients who were obese (body mass index >30) where the operative time (PE= 130.8, GT=100.6) and the fluoroscopy time was higher (PE=16, GT=8.33) in the PF group.

Healing: 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 was few cases in which malalignments was observed. All fractures were united by 6 months.

Functional status estimation:Patients from both groups had a similar initial decline and subsequent improvement in function over time (P > 0.05). Harris hip score at 4 months was GT 75.37 (+/-) 7.25 and PE was 66.67 (+/-) 8.14 with p value>0.002 So the results show that GT has better functional outcome than PF group in terms of Harris-Hip Score but at 6 months follow up, differences were insignificant. There were no significant differences in Range of motion of knee and hip joint as compared to unaffected side.

Complications: No statistically significant difference in the overall risk of nonunion was observed between patients treated with a GT-entry vs PF-entry IM nail.

Also there was no statistically significant difference in the overallrisk of delayed union among patients treated with a GT-entry vs a PF-entry IM nail.

Three patients in the PF-entry group had a malunion:2 healed in varus and 1 healed with femoral recurvatum. onepatients in the GT-entry group healed in varus, and one healed in slight procurvatum.

Table No.-1
Distribution according to site of fracture of Group-A & Group-B subjects

Fracture Grade	Group		Total
	A	B	
Distal/3	3	4	7
Middle /3	12	13	25
Upper/3	5	3	8
Total	20	20	40

Table No.-02
Operative and Fluoroscopy Times in patients

	GT group	PF group	p-value	Significance
Operative time(min)	**88.7 (range 80-102)**	**111. 6 (range 100–124)**	**< .001**	**HS**
Fluoroscopic time (seconds)	**5.12 (range 2–9)**	**10.88 (range 2–18)**	**< .001**	**HS**
Number of C-arm shots	**7 (range 6-10)**	**13 (range 10-14)**	**<.001**	**HS**

IV. Discussion

In our study, the mean operative time of piriformis entry nailing and trochanteric entry nailing was 111.6 min. and 88.7 min. respectively which is statistically highly significant (P < 0.001). The average number of C-arm shots to perform the entry point in piriform fossa is significantly higher as compared to trochanter (mean is 13 and 7 respectively) (P < 0.001).

Functional status assessment was done using HARRIS HIP Scoring System. Excellent functional status(90% and81%) and good functional status(10% and16%) was seen in the GT group and the PF group.

Kuntscher originally popularized the technique of closed, antegrade, intramedullary nailing using an open section, straight, cloverleaf nail for fractures of the femoral shaft. He suggested the lateral decubitus position and the use of the tip of the greater trochanter as the preferred entry portal to minimize risks such as intracapsular infection, avascular necrosis of femoral head, and iatrogenic femoral neck fracture[21,22].

The entry portal was further refined by Bohler, who in 1948 stated: ‘‘the awl is placed on the greater trochanter at the junction of the middle and posterior third [22] . The piriformis fossa starting point became the

standard for antegrade nailing since Winquist, et al. indicated they ‘‘strongly preferred’’ this starting point with the patient in the lateral decubitus position [1] .

Although no specific data were presented, they described eccentric reaming of the medial cortex of the proximal fragment and comminution of the fracture site, especially in the more proximal fractures or varus malalignment when the lateral starting point that Kuntscher had advised was used. The main advantage of a PF starting point is its collinear alignment with the long axis of the femoral shaft. This reduces the risk of iatrogenic fracture comminution and varus malalignment compared to off-axis entry points such as trochanteric entry points [19] .

Disadvantages of this entry point include relative technical difficulty obtaining the proper entry site, especially in obese patients [23,24] . This difficulty also reflected in comparatively higher operative time and fluoroscopy shots required in this entry portal.This entry point is also very sensitive to anterior-posterior translation, with anterior positioning being associated with extreme hoop stresses increased risk of iatrogenic bursting of the proximal segment [19] .

V. Conclusion

Our study demonstrates that use of the GT entry point during antegrade IM nailing is associated with decreased operative and fluoroscopy times, with no difference in nonunion and delayed union rates when compared with the PF entry point.Healing rates, complication rates, and functional results were similar to those found with antegrade nailing through the piriformis fossa. Further research is required to determine the effect of each entry point on the surrounding soft tissue structures and functional outcomes.

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