Original Article Journal of Clinical Orthopaedics 2018 Jan-June;3(1):10-12

By-passing the perfect circle method of femoral distal interlocking Screw Insertion (DISI) in Interlocking nailing – a technical note and retrospective study

Vatkar A, Kale S, Chaudhari P, Dhar S

Abstract

Interlocking nailing in femoral shaft fractures is a world wide accepted and practised procedure. One of the main step is Distal interlocking screw insertion (DISI). This procedure requires lot of time and significant x ray exposure. We have devised a technique to do Distal interlocking with minimal exclusive AP X Rays shoots in a short span of time. We did a retrospective study of 27 cases, with a average time of 8.29 minutes and average AP x ray shoots of 11.26.

Introduction:

Interlocking Intramedullary nail fixation is a standard treatment modality for fixation of femur shaft fractures[1,2]. Proximal locking of screws is easily done by the jig provided with the implant. But, distal locking is still widely done by free hand method[3]. This is due to inability of distal jigs to accurately align with the holes of the nail every time. Free hand technique is technically taxing, requires lot of time and is X ray dependent. Every step of interlocking requires X Ray c arm shoots to ascertain the level and position of interlocking hole. This considerably increases radiation exposure given to the patient during surgery[4-10]. There is also a rising concern of increased cancer rates in Orthopedic surgeons who are exposed to radiation, with a relative risk of 5.37% with respect to general population[11]. A number of techniques have been devised for decreasing the radiation exposure in OT, but many of them are either their prohibitive costs make them less accepted in developing countries like India[12]. Our hypothesis is about a technique in which only AP C arm shoots are used along with IM nailing long guide wire to insert screws in distal interlocking holes.

[1]Department of Orthopedics, DY Patil Medical College, Navi Mumbai

Address of Correspondence
Dr. Sachin Y Kale
Professor, Department of Orthopedics
DY Patil Medical College, Navi Mumbai
Email: sachinkale@gmail.com

Surgical technique:

Our technique was evolved due to common problems faced by us during Perfect circle method of Free hand interlocking screw insertion. In perfect circle method, the radio-opaque battery drill interferes with the X Ray imaging of distal holes. It becomes difficult to ascertain the path of drill bit, at every step in insertion. The small diameter of the C arm also interferes with use of a long drill bit along with a battery drill as seen in the picture.

In this method,

Step 1. We Take an AP shoot and find the notch of distalmost locking hole, along with the BP handle with knife which is placed on the skin above the femur, perpendicular to thigh. This shows the position of distalmost locking hole Then we take a small 0.5 cm incision on the lateral side of thigh approximately in middle of palpable anterior and posterior cortex of femur.

Step 2. Next we insert drill bit loaded on a drill machine from the incision site. Second X-ray shoot is taken to see the position of drill bit. We ascertain it to be at the notch of the locking screw hole and perpendicular to the shaft of bone. Anterior and posterior cortices are gauged by the drill bit and a hole is made in the midpoint of the shaft.

Step 3. A guide wire is inserted in the femur nail till the distal end of nail. An artery forceps is clamped to the end of the guide wire, which goes in the nail. Then the guide wire is slightly retracted proximal to the level of distal locking holes. The level at which the artery forceps is clamped to the guide wire ascertains the length of the entire nail.

Step 4. The drill bit is now proceeded in the medullary canal. It may go in the locking hole or hit the nail or it may go anterior/ posterior of the nail. In any of the later 3 scenario the drill bit is manipulated in small proportions till the bit goes in the hole. This is confirmed by again inserting the guide wire on which the artery forceps is clamped. If the artery forceps clamped level remains more outside than before, that means the drill bit has gone in the

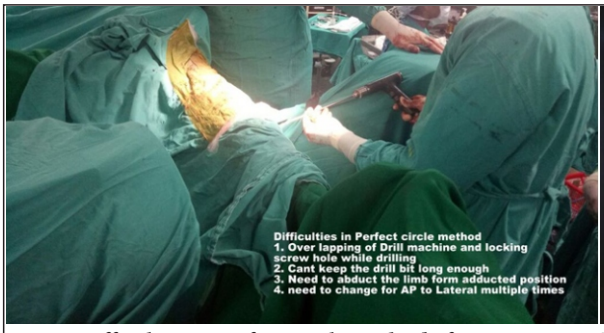

Fig.1: DIfficulties in Perfect Circle method of DISI.

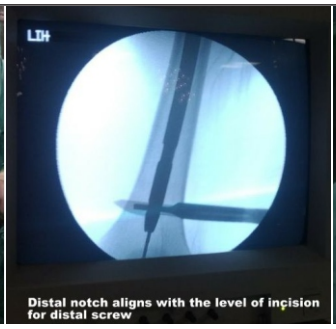

Fig.2: Xray C arm shoot showing BP handle with Knife.

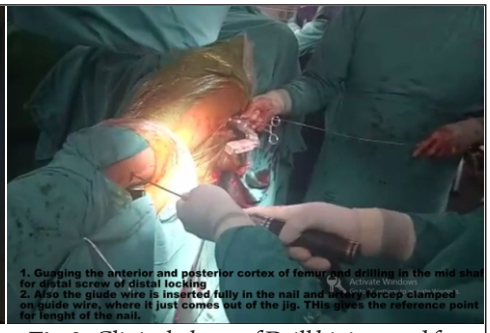

Fig.3: Clinical photo of Drill bit inserted from incision site.

hole. When the guide wire hits the metallic drill bit inside the locking hole, it gives a typical hard stop and 'tick tick' sound. Hence it is named as 'TICK TICK method'. The drill bit is inserted more and the far cortex of femur is also drilled. The drill bit is removed.

Step 5. Length of screw is ascertained by depth gauge. Distalmost locking screw is inserted along the drilled hole. Again 'tick tick' method is used to confirm the correct position of locking screw in the hole.

This method has been described by Dr Tanna in his book with credits of the method to Dr B Shivshankar of Sholapur[13].

Step 6. Again same procedure is used to put the proximal screw of distal locking. Here the reference point of the artery forceps clamped is changed to the point where guide wire is at the distalmost screw of distal locking.

Material and methods:

27 cases were done at our institute in a span of 12 months, with this method.Out of them 17 were male and 10 were female patients. All were closed femur fractures. Average age of our study patient was 40.1 years (32 to 78 years) .Patients are treated by Femoral interlocking nail. Standard Lateral entry on greater trochanter was taken is all patients. All patients were operated on a fracture table in supine position. Only Isometric Quadriceps exercises and Range of motion exercises were started as tolerated by patient. Partial weight bearing mobilization was started on post operative day 2 of surgery.

Data retrieval and evaluation

Discussion:

Interlocking screws are inserted to give rotational stability to the construct. Proximal locking is easily and reliably done by proximal screw jigs. The accuracy of jigs decreases as the distance between the proximal attachment of the jig to nail and locking screw sleeve hole increases. Hence distal locking screw jigs have been less accurate. So, freehand distal locking is generally done[14].

Various surgical navigation systems like electromagnetic hole locators[15,16] and laser illumination of locking holes[17], have been devised to decrease the time and increase accuracy. But these are not reproducible due to lot of infrastructure built up and staff training[18]. Our technique is evolved to decrease the operative time and radiation by skipping the perfect circle method. No lateral C arm shoots are required in our technique. Also the time required for insertion of interlocking screw is less than the conventional methods. There are few potential pain points in our described method. It's a trial and error method while inserting the drill bit in screw hole. Hence it may require a few attempts before drill enters in the Screw hole. As the drill bit is of smaller diameter than screw which is actually inserted, there may be small mismatch of the hole to screw. This can cause the screw to be inserted with more tightness than normal. Sometimes the near cortex hole done by drill bit needs to be widened in order to

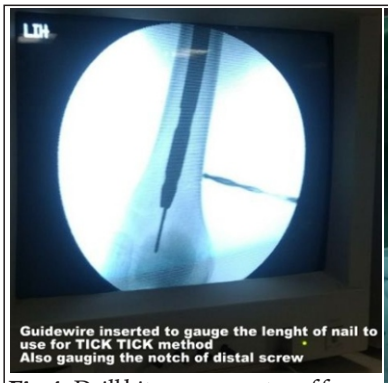

Fig.4: Drill bit on near cortex of femur with Guide wire inside the Nail completely.

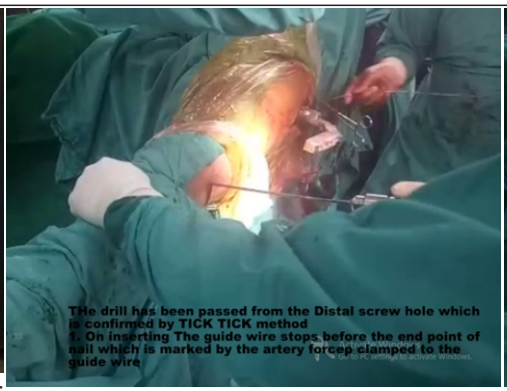

Fig.5: Insertion of Drill bit in the screw hole confirmed by TICK TICK Method.

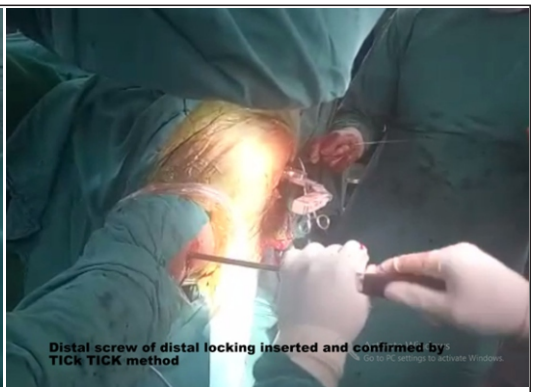

Fig.6: Screw inserted in the Distal most hole of distal locking and confirmed by TICK TICK method.

manipulate the drill bit anterior or posterior. This may act as a stress riser and can potentially cause an iatrogenic fracture. But so far we have not come across any such complication. Also, using only AP shots and manipulation to negotiate in locking screw, requires some practice but learning curve is not that steep.

Table for Procedure of Distal locking screw fixation in Femur Interlocking nail

Sr NO	Time required for Distal Screw of Distal Locking		Time required for Proximal Screw of Distal Locking		Number of C arm Shoots	Length of Incision On skin		Number of times C arm shifted to lateral
						Distal screw	Proximal Screw	
	Minutes	Seconds	Minutes	Seconds				
1	6	10	3	20	12	0.8 cm	0.7 cm	0
2	6	30	3	30	11	0.7 cm	0.6 cm	0
3	6	0	3	25	11	0.8 cm	0.7 cm	0
4	6	15	3	0	12	0.8 cm	0.6 cm	0
5	6	30	3	20	12	0.5 cm	0.5 cm	0
6	6	10	3	30	13	0.5 cm	0.5 cm	0
7	5	40	3	20	11	0.5 cm	0.6 cm	0
8	5	50	3	20	12	0.5 cm	0.5 cm	0
9	5	10	3	10	10	0.5 cm	0.5 cm	0
10	5	50	3	10	12	0.6 cm	0.5 cm	0
11	5	15	2	30	12	0.5 cm	0.5 cm	0
12	5	45	2	20	10	0.6 cm	0.6 cm	0
13	5	0	2	30	10	0.5 cm	0.5 cm	0
14	5	30	2	10	13	0.7 cm	0.6 cm	0
15	5	40	2	30	11	0.5 cm	0.5 cm	0
16	5	50	2	30	12	0.5 cm	0.5 cm	0
17	5	40	2	10	13	0.5 cm	0.5 cm	0
18	5	15	2	35	11	0.5 cm	0.6 cm	0
19	4	50	2	10	10	0.5 cm	0.5 cm	0
20	5	30	2	45	11	0.5 cm	0.5 cm	0
21	5	20	2	10	10	0.6 cm	0.5 cm	0
22	5	10	2	15	11	0.5 cm	0.5 cm	0
23	5	0	2	10	10	0.5 cm	0.5 cm	0
24	5	15	2	30	11	0.5 cm	0.5 cm	0
25	5	10	2	20	12	0.6 cm	0.6 cm	0
26	5	10	2	5	10	0.5 cm	0.5 cm	0
27	5	20	2	10	11	0.5 cm	0.5 cm	0
Average	5.59		2.7		11.26			

References

1. Tanna DD. Interlocking tibial nailing without an image intensifer. J Bone Joint Surg 1994;76B:670.
2. Lam SW, Teraa M, Leenen LP, van der Heijden GJ. Systematic review shows lowered risk of nonunion after reamed nailing in patients with closed tibial shaft fractures. Injury 2010;41:671-5.
3. Rohilla R, Singh R, Maggu N, Devgun A, Siwach R, Gulia A. Nail over nail technique for distal locking of femoral intramedullary nails. Int Orthop 2009;33:1107-12
4. Miller ME, Davis ML, MacClean CR, Davies JG, Smith BL, Numpries JR. Radiation exposure and associated risks to operating room personnel during use of fluoroscopic guidance for selected orthopaedic surgical procedures. J Bone Joint Surg 1983;65A:1-4.
5. Riley SA. Radiation exposure from fluoroscopy during orthopaedic surgical procedures. Clin Orthop 1989;248:257-60.
6. Sanders R, Koval KJ, DiPasquale T, Schmelling G, Stenzler S, Ross E. Exposure of the orthopaedic surgeon to radiation. J Bone Joint Surg 1993;75A:326-30.
7. Barry TP. Radiation exposure to an orthopaedic surgeon. Clin Orthop 1984;182:160-4.
8. Levin PE, Schoen RW, Browner BD. Radiation exposure to surgeon during closed interlocking intramedullary nailing. J Bone Joint Surg 1987;69A:761-6.
9. Skjeldal S, Backe S. Interlocking medullary nails—radiation doses in distal targeting. Arch Orthop Trauma Surg 1987;106:179-81.
10. Mehlman CT, DiPasquale TG. Radiation exposure to the orthopaedic surgical team during fluoroscopy. J Orthop Trauma 1997;11:392-8.
11. Singer G. Occupational radiation exposure to the surgeon. J Am Acad Orthop Surg 2005;13:69-76.
12. Soni, et al.: Interlocking nail without image intensifier Journal of Surgical Technique and Case Report | Jan-Jun 2012 | Vol-4 | Issue-1
13. Page 66, Book Tanna's Interlocking nail, ISBN-13: 978-9352500604
14. Windolf et al. BMC Musculoskeletal Disorders 2012, 13:8
15. Vandeweerd JM, Perrin R, Launois T, Brogniez L, Clegg PD, Desbrosse FG: Use of computed tomography in standing position to identify guidelines for screw insertion in the distal phalanx of horses: an ex vivo study. Vet Surg 2009, 38:373-379.
16. Tornetta P, Patel P, Ricci WM: Distal Locking Using an Electromagnetic Field Guided Computer Based Real Time System. San Diego, California;2009, October, 2009.
17. Jaesuk Choi, Jihun Kim, Jae Youn Hwang, Minkyu Je, Jun-Young Kim, Shin-Yoon Kim PLoS One. 2017; 12(4): e0174407.
18. Rivkin G, Liebergall M: Challenges of technology integration and computer-assisted surgery. J Bone Joint Surg Am 2009, 91:13-16

Conflict of Interest: NIL
Source of Support: NIL

How to Cite this Article

Vatkar A, Kale S, Chaudhari P, Dhar S. By-passing the perfect circle method of femoral distal interlocking Screw Insertion (DISI) in Interlocking nailing – a technical note and retrospective study. Journal of Clinical Orthopaedics Jan-June 2018; 3(1):10-12