CLINICAL TECHNIQUE

A Simple Technique to Locate the Nail Tip in a Buried Interlocking Nail in Femur while Extraction

Mugundhan Moongilpatti Sengodan[1], Yuganeswaran Marasamy[2]

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Abstract

Aims and background: At times, when interlocking nailing is done, the nail is buried into the medullary canal, and the nail tip is no longer visible. When the nail has to be extracted for some reason, the greater trochanter with abductor attachment has to be nibbled more than what is really necessary to locate the nail tip.

Technique: We have found a simple technique to locate the nail tip, thereby reducing the chance of damage to the bone and soft tissue. So far, we have used this technique in eight cases. The mean operating time was 34 minutes. Number of mean fluoroscopic exposure was six.

Conclusion: It is an easily reproducible technique without the need for any specialized instruments.

Clinical significance: This new technique is very handy in the extraction of buried femoral nails without substantial injury to the abductor mechanism, even for inexperienced surgeons.

Keywords: Buried femur nail tip, Extraction, Innovative technique.

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Introduction

At times, when interlocking nailing is done, the nail is buried into the medullary canal, and the nail tip is no longer visible. Later, when the interlocking nail needs to be removed, it will be very difficult to locate the nail tip even with the aid of an image intensifier, as there will be significant new bone formation over the nail tip. Sometimes, it may lead to significant damage to the bone and soft tissue overlying the area to visualize the nail tip and engage the extraction rod to the nail. In the case of the femur, the greater trochanter with abductor attachment has to be nibbled more than what is really necessary. We have found a simple technique to locate the nail tip, thereby reducing the chance of damage to the bone and soft tissue.

Surgical Technique

The patient is put in a lateral position, and the proximal locking screws are removed in a conventional manner. The trochanteric region is exposed (Fig. 1). The proximal-most locking hole is usually a dynamic hall (Fig. 2; yellow arrow). Under image guidance, a new drill hole (Fig. 2; red arrow) is made in the lateral cortex of the femur just distal to the proximal-most locking screw hole (Fig. 2; green arrow) in an oblique fashion so that it reaches the dynamics slot in the nail. A 300 mm long 1.8 mm K-wire is slightly curved in the tip. Then the K-wire is inserted with a T-handle into the oblique hole and into the nail (Fig. 3). Once its position within the cannula of the nail is confirmed with the C-arm, then the K-wire is gently hammered in over the T-handle till it exits through the tip of the nail and through the bone (Fig. 4). A cannulated hand trimmer of 8 mm is introduced over the K-wire from the proximal end and bone is reamed to reach the tip of the nail (Fig. 5). Once the nail tip is located, the nail is removed in a conventional manner by connecting the extractor assembly (Fig. 6) after removing the remaining locking screws.

[1]Department of Orthopaedics, Coimbatore Medical College, Coimbatore, Tamil Nadu, India

[2]Department of Orthopaedics, Government Medical College, Tiruppur, Tamil Nadu, India

Corresponding Author: Mugundhan Moongilpatti Sengodan, Department of Orthopaedics, Coimbatore Medical College, Coimbatore, Tamil Nadu, India, Phone: +91 9842242824, e-mail: Mugundhan@yahoo.com

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Results

We have used this technique so far in eight cases of femoral nail removal from December 2021 to January 2023. The mean operating time was 34 minutes (25–39 minutes). Number of mean fluoroscopic exposure was six (four to eight). The mean radiation time was 10 seconds (7–13 seconds). In none of the cases do we need to resort to alternate techniques. There was no damage to the soft tissues around the trochanter, especially the abductors. No additional bone was nibbled in order to find the tip or to connect the extractor assembly to the nail.

Discussion

Extracting the intramedullary femoral nail is terribly simple most of the time. But in a few cases, it may be simply terrible where the nail tip is well buried into the medullary canal.

Gösling et al., in a retrospective analysis of 164 femoral nail removals, concluded that the surgeon's qualification ($p = 0.041$)

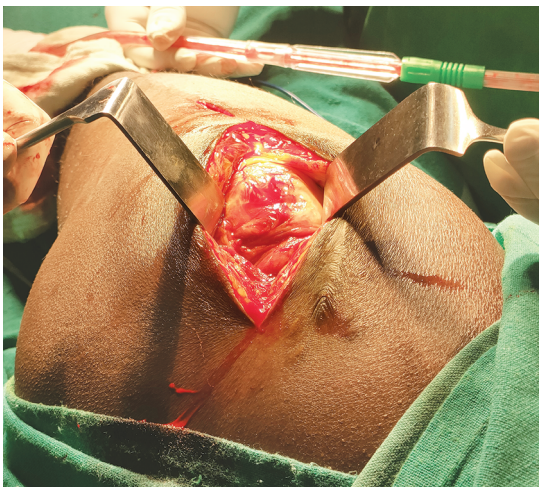

Fig. 1: Intraoperative picture showing the exposed trochanteric region of the left femur

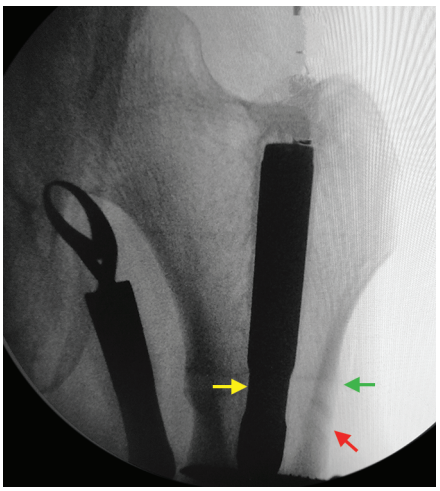

Fig. 2: Intraoperative fluoroscopic image showing the femur nail with buried tip; green arrow showing the path of the removed proximal-most locking screw; yellow arrow showing the dynamic hole in the nail; and red arrow showing the oblique path drilled to pass the K-wire

Fig. 3: Intraoperative picture showing the K-wire inserted through the oblique hole mounted in a T-handle

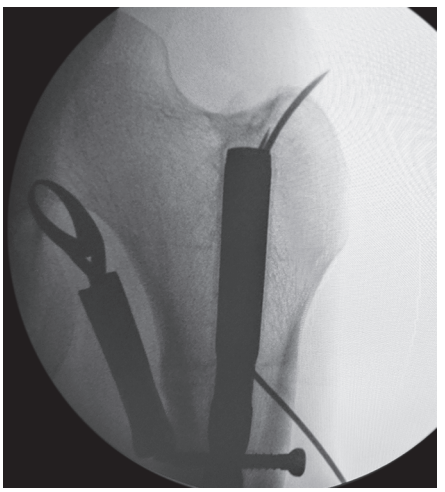

Fig. 4: Intraoperative fluoroscopic image showing the K-wire inserted through the oblique hole and exiting through the nail tip and trochanter

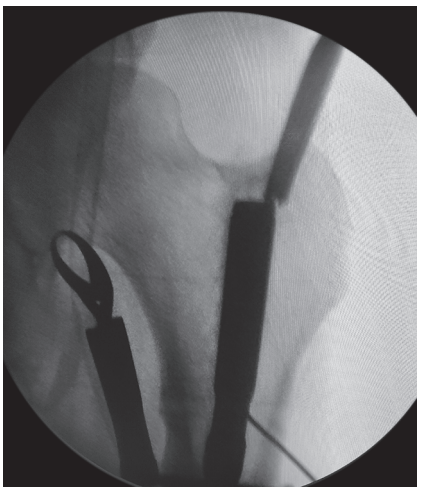

Fig. 5: Intraoperative fluoroscopic image showing the cannulated reamer reaming over the K-wire exiting through the trochanter to reach the nail tip

Fig. 6: Intraoperative fluoroscopic image showing the extraction assembly being connected to the nail tip

and nail depth ($p < 0.0001$) were the only variables that influenced operation time.[1] Husain et al. reported a mean operating time of 119 minutes for femoral nail removal,[2] while Georgiadis reported an average operating time of 98 minutes.[3] The mean operating time was 34 minutes (25–39 minutes) in our study. And even an inexperienced surgeon can reproduce our technique as it is very simple.

Gösling et al. noticed frequent fluoroscopic imaging to determine and visualize the correct path to the nail with an average radiation time of 91 seconds with a median of 54 seconds in their study.[1] Georgiadis reported a fluoroscopy time of 66 seconds.[3] In our study, the mean radiation time is only 10 seconds.

Minimally invasive techniques using cannulated reamer were described in the literature to locate the buried tip of the femoral nail.[3–6] Georgiadis stressed the difficulty of correct guide-wire placement in buried nails.[3] In our technique, as we pass the guide wire through the dynamic locking slot of the nail under image guidance, this problem was addressed.

Drill-guided femoral nail extraction technique described by Misailidis et al. required the drilling of multiple holes around the greater trochanter to assess the location of the nail tip. They were concerned about the potential bone weakening due to the multiple drill holes.[7] In our technique no such concerns are there.

Marintschev et al. described a navigation technique but with major limiting factors like the cost of the navigation system, as well as the need for specialized education and experience of the surgeon in computer-assisted surgery.[5] With the technique described by us, no specialized instrumentation or expertise is needed.

Many studies of femoral nail extraction were concerned about the extensive soft tissue dissections, abrogating the initial efforts to perform minimally invasive index surgery of nail insertion. Furthermore, postoperative morbidity due to iatrogenic damage to the glutei and heterotopic ossifications were also issues of concern.[5] In our technique, as we locate the nail tip in an indirect manner, the damage to the glutei is very minimal.

Conclusion

The technique that we have described here is very simple and easily reproducible, with no specialized instrument or expertise required. It could be useful in preventing damage to the abductor mechanism in an attempt to locate the nail tip for nail removal.

Clinical Significance

This new technique is very handy in the extraction of buried femoral nails without substantial injury to the abductor mechanism, even for the inexperienced surgeon.

Orcid

Mugundhan Moongilpatti Sengodan https://orcid.org/0000-0003-0540-2087
Yuganeswaran Marasamy https://orcid.org/0009-0001-9864-5282

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