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New method to remove tibial intramedullary nail through original suprapatellar incision: A case report

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Abstract

BACKGROUND

Since 2006, introducing a tibial intramedullary nail *via* the suprapatellar approach has been established; however, nail removal must be carried out using classic infrapatellar access, which can lead to complications. Here, we report a new method to remove the intramedullary nail through the original suprapatellar incision.

CASE SUMMARY

A 39-year-old man was hit by a vehicle in 2019. He was immobilized with a 10-mm × 330-mm tibial intramedullary nail *via* the suprapatellar approach due to left middle tibial fracture. Two years later, the patient requested for the implant to be removed. We used a new method to remove the tibial intramedullary nail through the original suprapatellar incision, and the operation went smoothly.

CONCLUSION

This case report indicates that suprapatellar access can be used to remove the intramedullary nail *via* the original incision without infrapatellar access, thus avoiding surgical complications.

Key Words: Suprapatellar approach; Nail removal; Infrapatellar access; Case report

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Core Tip: A 39-year-old man was immobilized with a 10-mm × 330-mm tibial intramedullary nail *via* the suprapatellar approach due to left middle tibial fracture. The end cap of the nail was purposely not inserted. Two years later, we used a novel method to remove the tibial intramedullary nail through the original suprapatellar incision.

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INTRODUCTION

The advantages of intramedullary nail internal fixation, such as small trauma, central fixation, and closed reduction, are consistent with the biological osteosynthesis concept; thus, intramedullary nail internal fixation has become the gold-standard treatment for tibial shaft fracture[1].

Removal of the tibial intramedullary nail *via* the infrapatellar approach is simple, and it is performed under direct vision through the original incision. Thus, researchers tend to use the infrapatellar approach to remove the internal fixation inserted *via* the suprapatellar approach[2]; however, with this approach, new scars form, and the patellar ligament and the infrapatellar fat pad can become damaged[3].

The other option is to remove the tibial intramedullary nail *via* the suprapatellar approach. However, this method remains controversial because there are many difficulties in using the original incision to remove the internal fixation. In this paper, a quick and simple method of nail extraction *via* the original suprapatellar incision is proposed. To the best of our knowledge, this is the first report of this type of removal.

CASE PRESENTATION

Chief complaints

A 33-year-old man requested for the implant to be removed.

History of present illness

The patient who was hit by a car in 2019 had a history of multiple fractures. These fractures, including left mid-tibial fracture, were fixed with a 10-mm × 330-mm suprapatellar tibial nail. The end cap of the nail was purposely not inserted. Two years later, the patient requested for the implant to be removed.

History of past illness

The patient had a history of internal fixation.

Personal and family history

The patient had no genetic or familial disease history.

Physical examination

Multiple surgical scars were visible on the left calf, and there was no sign of limited motion in the left knee joint.

Laboratory examinations

No abnormalities were observed on preoperative examination.

Imaging examinations

An X-ray examination showed that the broken end of the tibia had bony union (Figure 1).

FINAL DIAGNOSIS

The patient's final diagnosis was bony union after multiple fractures.

TREATMENT

The patient was examined before surgery and had no contraindications. After

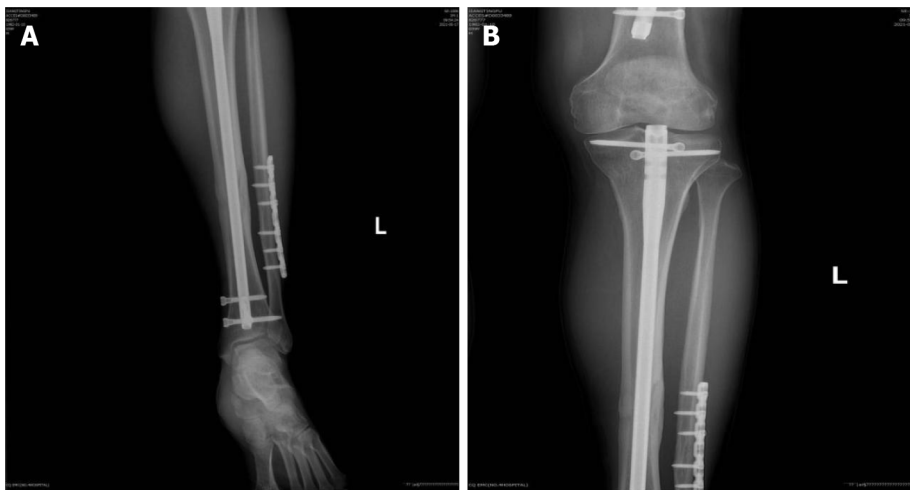


Figure 1 X-ray images of the patient's left proximal tibia. A: Antero-posterior X-ray view of the left proximal tibia showing complete bony union; B: Antero-posterior X-ray view of the left distal tibia showing complete bony union.

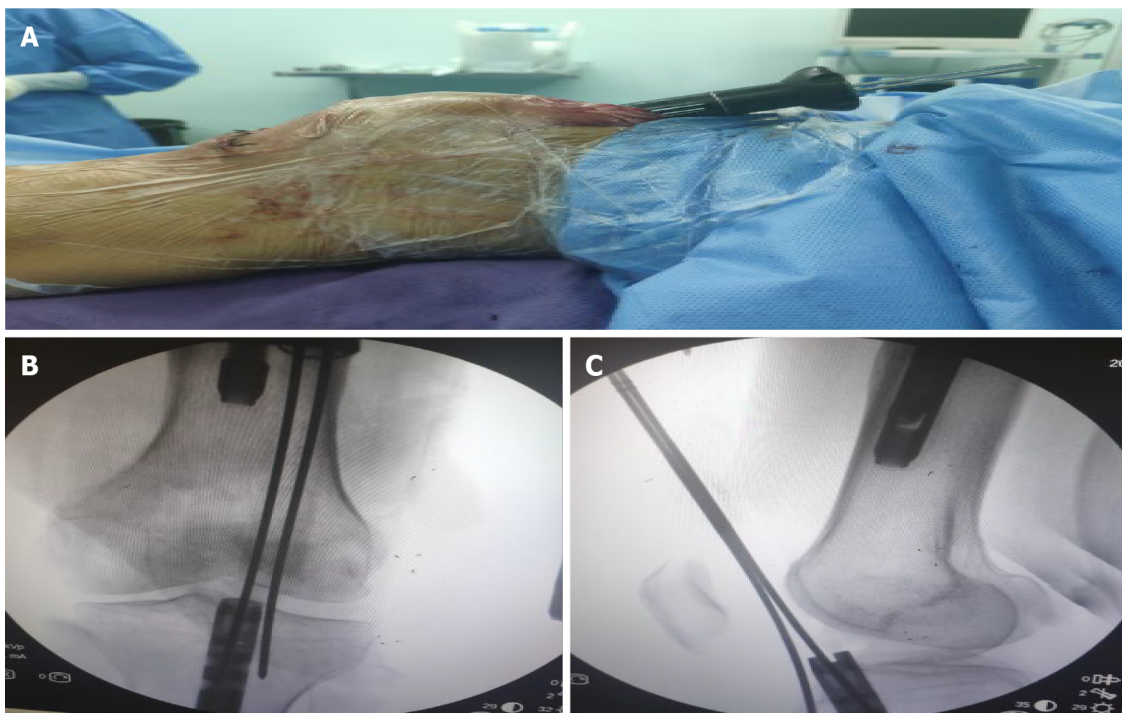


Figure 2 Insertion of the guide needle through the nail. A: The guide needle was inserted through the nail *via* the suprapatellar approach and was assisted by a multi-holed guide pin sleeve; B: Antero-posterior X-ray view showing insertion of the guide needle into the cavity of the intramedullary nail; C: Lateral X-ray view showing insertion of the guide needle into the cavity of the intramedullary nail.

administering epidural anesthesia, the proximal locking nail was removed. Then, the knee was bent 30°, and a multi-holed guide pin sleeve was fine-tuned to allow a 2-mm guide needle to be accurately inserted into the cavity of the intramedullary nail with a depth of at least 2–3 cm *via* the original suprapatellar incision. The results were confirmed by intraoperative X-ray (Figure 2). A hollow jig was used to screw the end of the nail along the guide needle. This process accurately removed the bone on top of the nail without damaging surrounding structures, such as the meniscus and ligaments. After the jig was screwed into the end of the intramedullary nail and tightened, intraoperative fluoroscopy was used for confirmation (Figure 3). The proximal and distal locking nails were removed, and the intramedullary nail was retracted using a mallet (Figure 4).

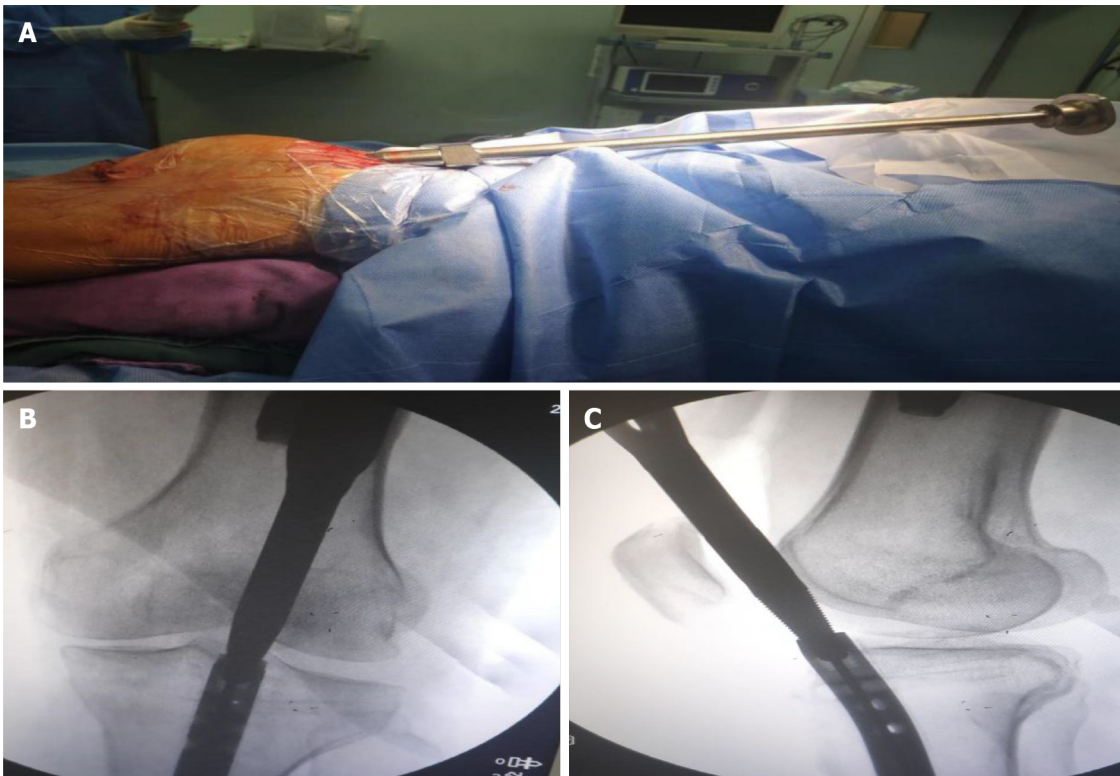


Figure 3 A jig was screwed into the tail of the nail. A: A hollow jig was rotated along the guide needle and screwed into the tail of the nail; B: Anteroposterior X-ray view showing that the clamp was screwed into the end of the intramedullary nail and tightened; C: Lateral X-ray view showing that the clamp was screwed into the end of the intramedullary nail and tightened.



Figure 4 The intramedullary nail was struck out of the tibia using a mallet through the suprapatellar approach.

OUTCOME AND FOLLOW-UP

Two weeks postoperatively, the patient's wound had healed well. At the 4-mo postoperative follow-up, the patient did not complain of pain in the left knee joint. The left knee could extend 0° and flex 120° (Figure 5). The Kujala score was 95 on the left knee.

DISCUSSION

Tibial intramedullary nail placement can be achieved by both suprapatellar and infrapatellar access. The suprapatellar approach has more advantages than the infrapatellar approach[4-8]; however, how best to remove the nail *via* the original suprapa-



Figure 5 Knee range of motion at the 4-mo follow-up.

tellar incision used for nail insertion is uncertain.

When using the traditional method to remove the intramedullary nail through the original suprapatellar incision, it is necessary to first remove the bone above the intramedullary nail with a hollow drill, remove the end cap, and take out the end of the intramedullary nail and screw it into the target device to remove the intramedullary nail. Because the whole process is not performed under direct vision, the operation is difficult and time-consuming. The main difficulty lies in how to accurately remove the bone above the intramedullary nail. If care is not exercised, the meniscus and anterior and posterior cruciate ligaments can become damaged. The cap should then be safely removed without being lost in the joint space. Therefore, most surgeons have no choice but to use the infrapatellar access to remove the internal fixation, but this often leads to new scar formation. Moreover, surgical incision can also damage the saphenous nerve, the patellar ligament, and the infrapatellar fat pad, resulting in a high probability of postoperative knee pain.

A previous study has shown that the end cap of an intramedullary nail stops bony in-growth of tissue[9]. To facilitate the method presented in this paper, the end cap was not used in the initial nail placement, and bony in-growth of tissue enclosed the end of the nail. To remove the tibial intramedullary nail, a guide needle was inserted into the cavity of the intramedullary nail. The results were confirmed by intraoperative X-ray. A hollow jig was used to screw the end of the nail along the guide needle. This process accurately removed the bone on top of the nail. Thus, the difficulty in removing the nail *via* the original incision was greatly reduced. The whole process was easy, and no special tools were needed. Due to the use of a sleeve during surgery to protect important tissues within the joint, the likelihood of damage to the patellofemoral joint was greatly reduced.

However, this novel approach has some potential limitations that should be noted. First, removal of the bone above the intramedullary nail may lead to possible entry of large bone fragments into the articular cavity. Second, after intramedullary nail removal, the intramedullary content entering the joint cavity may lead to joint cavity extravasation and increase the risk of infection.

CONCLUSION

In this study, removal of the intramedullary nail *via* the original suprapatellar incision

was simple and reliable, did not require special equipment, and did not require infrapatellar access, which reduced the likelihood of complications.

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