

# Prebent Steinmann Pin to Remove the Broken Retrograde Intramedullary Nail After Tibiototalcaneal Arthrodesis



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**Abstract:** A retrograde intramedullary nail is an implant option for tibiototalcaneal arthrodesis because it provides mechanical strength and compression at the fusion site, while being less invasive to soft tissue. However, some fusion failures result in implant overloading, resulting in implant failure. The accumulated stress at the level of the subtalar joint will most likely cause implant breakage. It is challenging to remove the broken tibiototalcaneal nail's proximal part. Several surgical procedures for removing the broken tibiototalcaneal nail have been reported. In this article, we present a surgical technique for removing a broken tibiototalcaneal nail by punching out the proximal part of the broken nail using a prebent Steinmann pin. It has the advantage of being less invasive and not requiring any specific tools to punch out the nail.

## Introduction

Tibiototalcaneal arthrodesis is a salvage operation for tibiotalar and subtalar joint arthrosis, deformity, and previous failed ankle surgery.<sup>1</sup> If untreated, a progressive deformity may put more strain on the nearby joints during weight bearing, which can cause subtalar or talonavicular arthrosis.<sup>2</sup> Retrograde intramedullary nail is one implant option used in tibiototalcaneal arthrodesis because it provides mechanical strength and compression at the fusion site, while being

less invasive to soft tissue.<sup>3-6</sup> However, some fusion failures result in implant overloading, resulting in implant failure.<sup>1,7</sup> The accumulated stress at the level of the subtalar joint will most likely cause implant breakage. The proximal part of the broken implant cannot be easily removed from the insertion wound, making implant removal challenging for surgeons. Moreover, soft tissue preservation concerns discourage invasive surgical approaches. Several surgical techniques have been reported to remove the broken tibiototalcaneal nail.<sup>8-10</sup>

In the present article, we propose a surgical technique for the removal of the broken tibiototalcaneal nail using the pre-bent Steinmann pin to punch out the proximal part of the broken tibiototalcaneal nail. It has the advantage that it is less invasive and doesn't need any special tools to punch out the nail.

## Preoperative Evaluation

Plain radiographs and blood tests are used for evaluation. The plain radiograph is expected to show a broken nail at the tibiototalcaneal joint with no bony fracture (Fig 1). The infection is investigated using a blood test for complete blood count (CBC), erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP).

## Surgical Technique (With Video Illustration)

### Patient Positioning

The patient is lying on a radiolucent table in the supine position during the procedure. Before preparation

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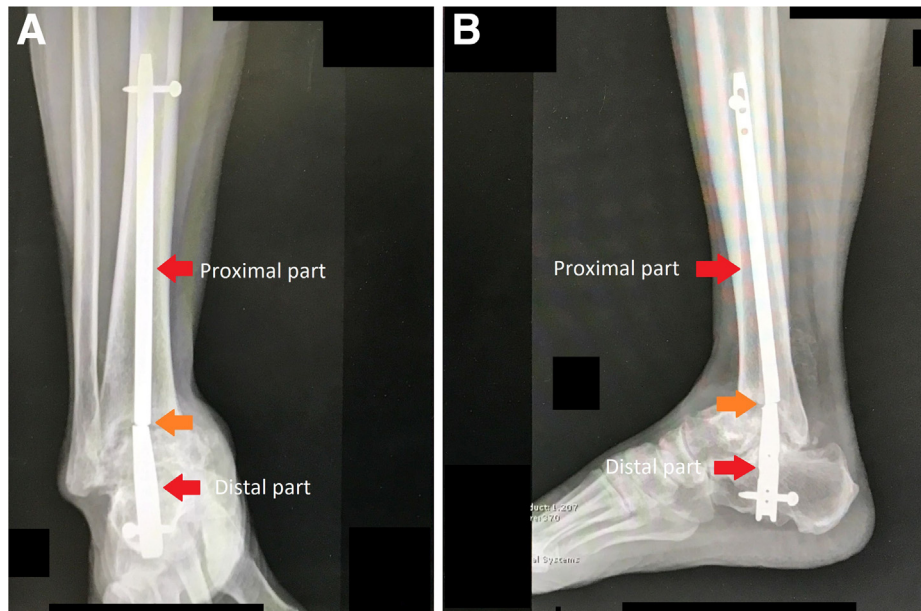
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**Fig 1.** Plain radiographs (A) anteroposterior view (B) lateral view of the right ankle showing the broken tibiototalcaneal nail (orange arrow).

and draping of the leg and ankle in the standard sterile fashion, fluoroscopy is set up for intraoperative imaging, and a tourniquet is wrapped around the proximal thigh to control bleeding.

### Removing the Distal Part

A stabbed incision is made to remove the distal locking screw under fluoroscopic guidance. A plantar

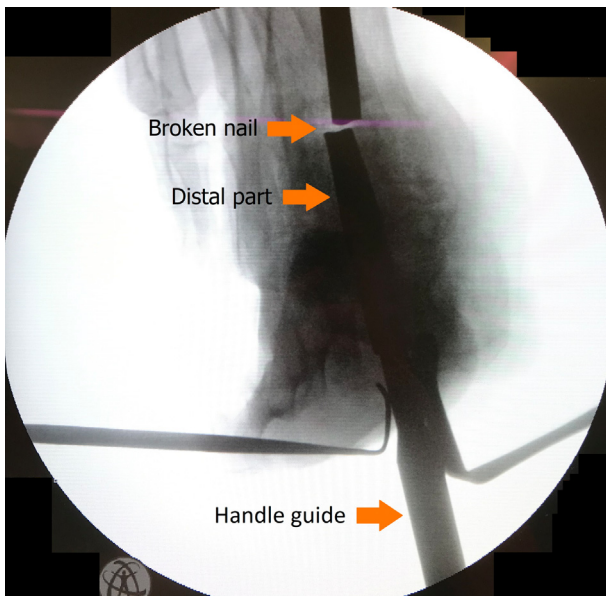
incision is made at the previous scar, and the distal part of the nail is simply removed by connecting with the handle guide (Fig 2, Video 1).

### Removing the Proximal Part

A stabbed incision is made to remove the proximal locking screw under fluoroscopic guidance. The anterior cortex of the tibia is then perforated with a 6.0-mm drill bit, about 2 cm above the proximal nail's tip. A Steinmann pin (Orthopeasia, Samutprakarn, Thailand) with a 4.0-mm diameter is bent with a plate bender and connected to the T-handle (Orthopeasia, Samutprakarn, Thailand) with the blunt end facing out (Figs 3 and 4, Video 1). The prebent Steinmann pin (Orthopeasia, Samutprakarn, Thailand) is inserted through the anterior cortical opening and passes through the nail until it reaches the proximal part of the broken nail; then, it is slapped with a hammer until the broken nail's proximal part is driven through the plantar opening incision (Figs 4 and 5, Video 1). The removed nail and prebent Steinmann pin (Orthopeasia, Samutprakarn, Thailand) are shown in Fig 6. Finally, the retrograde nail (DePuy Synthes) is revised and allograft is added for tibiototalcaneal fusion in the ordinary method (Fig 7).

### Postoperative Care

In order to increase the chance of a successful union, postoperative care includes a short leg slab for 2 weeks before switching to a short leg cast after the swelling has subsided. The non-weight bearing period lasts for 12 weeks. After beginning to walk, the patient remains an additional 2 months wearing a walker boot (Fig 7).



**Fig 2.** Right ankle, intraoperative fluoroscopy, anteroposterior view. Distal part of nail was removed by connecting with guide handle.





**Fig 3.** Pre-bent 4.0-mm diameter Steinmann pin connected to the T-handle.

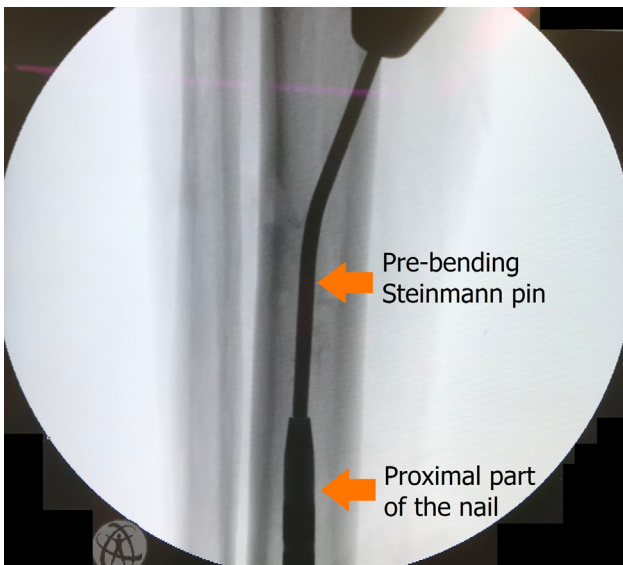
**Discussion**

Broken tibiototalcaneal nail removal technique was previously reported in various ways, such as partial fibulectomy (9), a ball-tip guide wire (8), and cement extractor hook (10).

Kyung et al. described the partial fibulectomy technique.<sup>9</sup> The lateral approach with the partial fibulectomy technique provided advantages that allow for direct visualization for the removal of the broken nail and gives the opportunity to completely prepare the subtalar fusion bed. But the breakage site was exposed by making a large bone defect at the lateral cortex of the talus and subtalar joint.



**Fig 5.** Right ankle in the supine position. The prebent Steinmann pin is introduced through the anterior cortical opening and passes through the nail until it reaches the proximal part of the broken nail. Then it is slapped with a hammer until the broken nail's proximal part is driven through the plantar opening incision.



**Fig 4.** Right tibia, intraoperative fluoroscopy, and antero-posterior view. The prebent Steinmann pin is inserted into the tibial opening through the anterior cortex opening and passes through the nail.



**Fig 6.** (A) Prebent Steinmann pin. (B) Removed broken tibiototalcaneal nail.



**Fig 7.** Postoperative plain radiographs of the antero-posterior view (A) and lateral view (B) of the right ankle showing the tibiototalcaneal nail is revised and allograft is added for fusion in the ordinary method.

**Table 1.** Advantages and Disadvantages

Advantages	No special instrument is required to remove the broken intramedullary nail. Cost-effective There is no need for a knee arthrotomy or injury to the knee cartilage. Minimally invasive and less soft tissue trauma This technique is easy and reproducible.
Disadvantages	This technique may increase the risk of radiation exposure during intraoperative fluoroscopy.

**Table 2.** Pearls and Pitfalls

Pearls	Using the Steinmann pin that fits into the nail hole diameter Bending the Steinmann pin carefully to fit the tibial and nail's curvature
Pitfalls	A tibial fracture during hammering may occur from the Steinmann pin's inappropriate curvature.

cement extractor hook from the Moreland hip revision set (DePuy Synthes, Raynham, MA).<sup>10</sup> We propose a technique that could create an easier way to remove the proximal part of the broken tibiototalcaneal nail by using a Steinmann pin with a larger diameter than the nail hole. We bent the Steinmann pin to make the curve to allow the Steinmann pin to pass through the intramedullary canal and nail hole from the anterior tibial cortex without knee arthrotomy to antegrade hammering the nail, which can injure the knee cartilage. With just one small opening on the anterior tibial cortex and the prebent Steinmann pin, surgeons can use this technique to push the proximal part of the

broken nail down through the plantar opening incision and easily remove it.

There are advantages to the present technical note. The broken intramedullary nail can be removed without the use of a special instrument. There is no need for a knee arthrotomy or injury to the knee cartilage during removal of the broken nail. This technique is easy and reproducible. However, it may increase the risk of radiation exposure during intraoperative fluoroscopy. Advantages and disadvantages and pearls and pitfalls of the procedure are further described in [Tables 1](#) and [2](#).

In conclusion, this technique is a reproducible, minimally invasive, and cost-effective method for removing a broken tibiototalcaneal nail.

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