

Case Series

EFFECTIVENESS OF MINI HACKSAW BLADE ON HANDLE FOR REMOVING BENT INTRAMEDULLARY NAILS: A CASE SERIES**A. V. Shabi¹, Suresh Kumar Vadivelu², Karthickeyan Periyasamy², Dinesh Vellaian²**

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Abstract

Intramedullary nail fixation is the gold standard for femoral shaft fractures; however, complications such as bent nails can arise, complicating removal. This case series presents three patients treated at a rural-based tertiary care hospital for bent intramedullary nails, using a cost-effective method involving a metal-cutting mini-hacksaw blade mounted on a handle. In each case, the bent nail was removed by using an open approach with continuous irrigation to prevent thermal necrosis. The first patient achieved excellent union nine months post-surgery, whereas the second and third patients showed successful healing with stabilization using an LRS fixator and Ilizarov fixator, respectively. This method enables efficient nail removal with minimal soft tissue damage and prevention of thermal necrosis through continuous irrigation. This study showed that this simple, low-cost method effectively helps to remove bent intramedullary nails in resource-limited settings.

INTRODUCTION

Intramedullary nail fixation is widely accepted as the gold standard for the management of femoral shaft fractures. However, complications such as bending of the intramedullary nail can arise because of non-union or premature weight-bearing before fracture union. Bent nails are more challenging to remove than broken nails, requiring specialized techniques and careful planning. This case series explores a cost-effective and efficient method using a mini-hacksaw blade mounted on a handle to remove bent nails in three cases.

CASE PRESENTATION**CASE 1**

A case of femoral fracture shaft operated 2 months ago with open reduction and internal fixation with IMIL Nail for femur elsewhere presented to our OPD with deformity of the right thigh for the past 20 days. The evaluation revealed a comminute fracture shaft of the femur with bent intramedullary in situ, with a sagittal plane deformity of 45°.

We planned to open the fracture site, remove the unhealthy butterfly fragment, and remove the bent intramedullary nail by cutting the nail with the help of a hand-powered metal cutting mini-hacksaw blade mounted in the handle with continuous irrigation of normal saline to remove the metal debris and to prevent thermal necrosis.

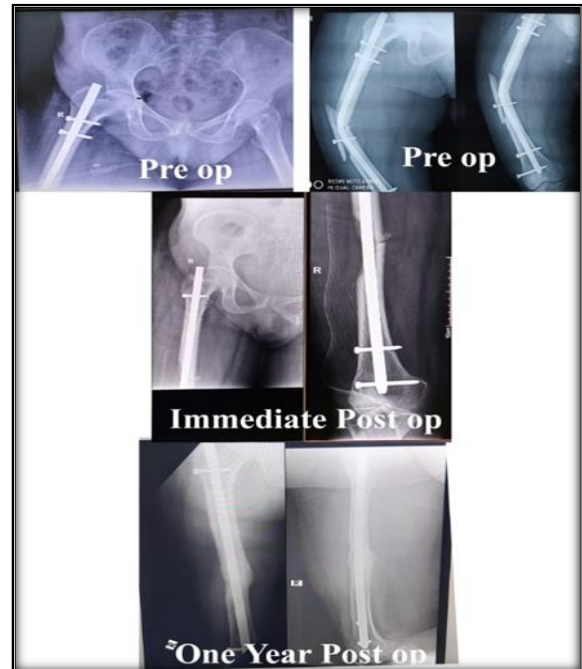


Figure 1: X-rays showing management of bent intramedullary femoral nail: pre-op, post-op, and one-year follow-up

Once the nail is wholly divided, the proximal and distal parts of the nail are removed through the fracture site after removing the locking bolts; both fracture ends are freshened and made transverse

using an oscillating saw; the fracture site is stabilized with one size larger intramedullary interlocking femur nail with two distal and one proximal locking, as the patient's hemodynamic status was not stable; therefore, we could not perform bone grafting. Bone grafting was planned as a second-stage procedure after six weeks. Active knee mobilization was initiated on the 3rd postoperative day, and the patient was discharged on the 12th postoperative day after suture removal.

The patient did not come back for bone grafting at six weeks post-OP. However, the patient came nine months after the surgery and was found to have excellent radiological and clinical union.



Figure 2: Range of motion and functional recovery following bent femoral nail removal and fracture stabilization with revision surgery

CASE 2

A 26-year male patient with a case of fracture shaft of the femur operated with an intramedullary interlocking nail 2 ½ months back elsewhere presented in our OPD with pain and deformity of the right thigh, on evaluation, found to have an ununited fracture shaft of the femur with bent intramedullary interlocking femur nail in situ with 30° sagittal plan deformity as the patient had evidence for subclinical infection we have proceeded by exposing the fracture site, through the fracture site we removed the bent nail by cutting the nail using hand powered metal

cutting Mini Hacksaw blade mounted in handle with continuous irrigation of normal saline to remove the metal debris and to prevent thermal necrosis. Once the nail was completely divided, the proximal and distal parts of the nail were removed through the fracture site after interlocking bolts were removed. The fracture ends were freshened, and the fracture was reduced and stabilized using an LRS fixator. The fracture united uneventfully and the LRS was removed.



Figure 3: Pre-op



Figure 4: Post-op



Figure 5: After LRS removal

CASE 3

A 55-year-old male who had a fractured shaft of the femur operated with open reduction and internal fixation with IMIL Nail 4 months back, presented with deformity in the left thigh with discharging sinus in the left thigh.

On evaluation, an infected non-union of the femur with a bent intramedullary interlocking nail in situ with a 35° sagittal plane deformity was found.

We opened the fracture site, and the bent nail was cut into two using a metal cutting Mini Hacksaw blade mounted on the handle with continuous irrigation with normal saline. The proximal and distal parts of the divided nail were removed through the fracture site after the distal and proximal locking bolts were removed. The fracture ends were freshened until the bleeding edges were stabilized with an Ilizarov fixator. The patient was discharged on the 12th POD

after suture removal. The fracture united by the 11th month. Postoperatively, frame removal was performed.



Figure 6: Pre-op



Figure 7: Post-op



Figure 8: After Ilizarov's removal

DISCUSSION

In our case series, we utilized a hand-powered, metal-cutting mini-hacksaw blade mounted on a custom

handle, offering a simple and cost-effective solution for removing bent intramedullary femoral nails. This technique, inspired by Demir et al., differs in that the mini-hacksaw blade minimizes soft tissue dissection and damage.^[1] Simultaneously, the handle significantly reduces the laborious intensity and makes the process more efficient. In most reported cases, fixation after nail removal is typically performed using intramedullary interlocking (IMIL) nails or plate fixators. In our study, fixation was tailored to clinical needs. IMIL nails were used in one case, a Limb Reconstruction System (LRS) fixator in another, and an Ilizarov fixator in the third case.



Figure 9: Surgical Procedure per- operative Image



Figure 10: Mini Hacksaw blade mounted on Handle and Removed Bent Nail (cut into two Pieces)

Various techniques for removing bent intramedullary nails have been described in the literature, including

simple extirpation, in situ straightening using external maneuvers,^[2] partial weakening and straightening before removal, or complete severing of the nail and removing it in two pieces using tools such as metal cutting saws or jumbo cutters.^[3] Other methods involve straightening the nail with reduction clamps and plates,^[4] creating cortical windows or corticotomy for direct removal,^[5] and using high-speed cutting tools such as carbide burrs,^[6] diamond-tipped burrs,^[7] or conical side-cutting burrs,^[8] novel techniques, such as combining burrs with specialized tools,^[9] or closed, non-invasive methods to unbend the nail,^[10] and regular hacksaw blade to cut and remove a bent femoral nail have also been reported.^[11]

In our series, the mini-hacksaw blade method provided a practical alternative to these approaches. Its compact design allowed us to minimize soft tissue dissection while improving ergonomics and reducing surgical fatigue. Although minimally invasive and non-invasive techniques exist, we opted for an open technique because our cases involved non-fresh fractures. This approach enabled us to freshen the fracture site, continuously irrigate the surgical field to prevent thermal necrosis, and efficiently remove the metal debris.

The most common cause of bent nails reported in the literature is secondary trauma in a united long-bone fracture with an implant in situ. However, in our series, the bent nails resulted from early weight bearing before fracture union. We addressed this issue comprehensively by choosing an open technique, reducing the risk of soft tissue damage, and ensuring proper fixation. Our method proved to be a reliable and efficient solution for removing bent intramedullary femoral nails, particularly in open surgery cases.

CONCLUSION

In our series, we used a cost-effective, simple, less laborious, and less time-consuming method for complete cutting with a metal cutting mini-hacksaw

blade mounted in the handle and removing the bent nail in resource limited setting.

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