

## Case Report

### Surgical Tips; Removal Of Bent Intramedullary Nail

Haidar Nasuruddin<sup>1</sup>, Aminudin Che-Ahmad<sup>1</sup>, Jeffrey Jay<sup>2</sup>, Muhamad Syafiz Ahmad Ismani<sup>3</sup>.

#### Abstract

Intramedullary nailing is the gold standard for diaphyseal femoral shaft fractures. It has been shown to lead to a high union rate with a low incidence of complications. However, refracture with subsequent nail bending has always been challenging to remove and more challenging as compared to removal of a broken nail. Removal has been reported using expensive and not readily available tools such as diamond tipped drill or high-speed burr. We are reporting a case of a successful bent intramedullary nail removal using a relatively cheap and available tool, which is the Lowman clamp.

**Keywords:** Bent intramedullary nail; femur fracture; refracture; fracture fixation, device removal.

*International Journal of Human and Health Sciences Vol. 07 No. 03 July'23 Page : 267-270  
DOI: <http://dx.doi.org/10.31344/ijhhs.v7i3.585>*

#### Introduction

There are few surgical options in managing diaphyseal femoral shaft fractures. Intramedullary nailing has consistently led to a high union rate, with a low incidence of complications. It is considered as the gold standard for this kind of fracture (Wild et al, 2010). However, refracture with subsequent nail bending had been reported in the literature and has always been described as technically very challenging to remove.

#### Case Reports

A 19-year-old gentleman who was successfully treated with an interlocking nail insertion for closed right femur fracture 4 months prior to current admission, involved in another motor vehicle accident and sustained refracture over the previous united fracture site. The refracture was complicated with a bent interlocking nail approximately 45° with anterolateral apex. Otherwise, he had no other known medical illnesses.



**Figure 1.** X-ray showing the bent angle around 45°

1. Department of Orthopaedic, Traumatology and Rehabilitation, Kulliyah of Medicine, IIUM, Kuantan, Pahang, Malaysia
2. Department of Orthopaedic, Hospital Tengku Ampuan Afzan, Kuantan, Pahang, Malaysia.
3. Department of Orthopaedic, Traumatology and Rehabilitation, Sultan Ahmad Shah Medical Centre, IIUM, Kuantan, Pahang, Malaysia

**Correspondence to:** Department of Orthopaedic, Traumatology and Rehabilitation, Kulliyah of Medicine, IIUM, Kuantan, Pahang, Malaysia. E-mail: [drhaidar@iium.edu.my](mailto:drhaidar@iium.edu.my)

Removal of bent nail and reinsertion of a larger-diameter intramedullary nail was planned. Related literature was studied through and preoperative planning was done. The patient however could not financially afford assistive orthopaedic devices available in market.

Under general anaesthesia, the patient was put supine on traction table. Proximal and distal screws were removed percutaneously. Initially, straightening of nail in situ using external force (closed manipulation) including F tool was attempted but failed. Then, retrograde removal using intramedullary extractor had caused slight comminution of the cortex, so the attempt was aborted. Attempt to remove antegradely the protruding nail antegradely using K-nail extractor was also tried but futile.



**Figure 2.** Protruded nail tip

Finally, the nail was successfully extracted by applying Lowman clamp tool to the part of the nail which distal to the bent and clamping it towards the bone. The nail was then gradually extracted retrogradely using the standard nail extractor. Post removal measurement showed that the bent angle had reduced to 20°. A larger nail was then inserted antegradely with no difficulty. Total surgical time was approximately 4 hours. Estimated blood loss was around 500ml. Post-operative care was uneventful. The patient was discharged well. Unfortunately, the patient did not return for follow up, due to financial constraint.



**Figure 3.** Gradual retrograde extraction with Lowman device clamping the distal segment of the nail to the bone



**Figure 4.** The extracted nail with less bent angle

### Discussion

Implant failure reported in intramedullary fixation is rare. It occurs mostly secondary to trauma. It is more challenging to remove a bent nail than a

broken one because it is difficult to retrieve the bent nail through the intramedullary canal. There is no universally accepted guideline or method but there is a few individual case reports discussing on different successful methods in extracting bent nail. The writer will discuss and summarize the various techniques in removing bent intramedullary nail which have been used and reported in the literature.

The first approach is by using external force to straighten the nail in situ. Patterson and Ramser in 1991 were among the first to report removal of bent intramedullary nail. In their case, the nail was Russell-Taylor femoral nail which was inserted for midshaft femur fracture. The nail was deformed after approximately 2 years later by subsequent trauma. The bent nail was straightened extra corporeally without using any specific device, removed using standard method, then replaced with a larger nail<sup>6</sup>. The fracture healed without complications. However, the degree of bent was not mentioned in the report.

This method was later applied and elaborated further by Shishir et al. The femoral nail was bent around 30° with varus angulation. Under general anesthesia, they put the patient on the floor, with a sandbag placed at the apex of the deformity, acting as a fulcrum. One assistant literally stood on the distal thigh, giving controlled pressure over the distal femur, distal to the bent, causing straightening of the nail<sup>8</sup>. In addition to the usage of body weight, an F-tool can also be used to assist the straightening. This approach however, does not work in high strength nails. Excessive forces on the other hand, may break the bone cortex or bent the nail in S-shaped fashion making it more difficult for removal<sup>3</sup>.

The second approach is by weakening the nail prior to straightening it. Sameer et al reported a case of removal of bent intramedullary tibia nail. It was angulated posteromedially but the degree of bent was not mentioned. Correction of deformity as described by Patterson and Ramser was tried but failed. The anterolateral part of the tibia was opened up, exposing the nail. Trial of cutting the nail with metal cutting saw caused injury to the surrounding soft tissue, therefore they made a window on the anterolateral aspect of the nail with the help of metal cutting drill. As the nail had been weakened, the deformity was partially corrected by applying external force<sup>7</sup>.

A similar approach but with different tools had also

been reported. Ahsan and Kasper used a high speed drill in 2 cases with 25° bent angle to perforate the nail and thus weakening it<sup>1</sup>. While Heffernan et al used similar approach but they used a high speed burr with diamond cutting head to partially section the bent femoral nail at the apex (anterior), leaving a thin remnant of metal at the posterior aspect of the nail. The nail was then straightened using an F tool<sup>2</sup>.

Vaseileious et al used a more radical approach. The case reported by him was a bent femoral nail with a relatively larger apex angle, approximately 60°. After a futile effort of trying to straighten or cut the nail (the method tried was not mentioned), they created a longitudinal bone window along the anterolateral part of the femoral shaft, starting from the fracture site, extending proximally to the greater trochanter. A new nail was inserted and the osteotomized bone window was secured using plate and cerclage wire<sup>9</sup>.

In authors' opinion, the usage of Lowman tool in this case could be improved by clamping it to another plate, in addition to the bone. This will reduce the risk of a new fracture. The use of this tool for removal of intramedullary nail could not be found during literature review but other low-cost options were recorded in a few case reports.

Odendaal et al had shown that using standard industrial materials was inexpensive yet fruitful. In those country, specialized orthopaedic instrumentation such as diamond tipped drill and high speed burr were expensive and not obtainable. They used a 30mm diameter cutting disk which was mounted on regular orthopaedic drill and another 100mm diameter cutting disk which was mounted on common angle grinder<sup>5</sup>. Another inexpensive device that can be used is a jumbo cutter<sup>4</sup>. In Malaysia, the industrial grinder and cutting disks would cost only around MYR100 while jumbo cutter would cost below MYR200. However, using these industrial devices are off label. Further ethical discussion is needed before applying them.

## Conclusion

In conclusion, removal of a bent intramedullary poses a great challenge to the operating surgeon. It needs a meticulous and thorough pre-operative preparation. All the options available should be well planned and used in step-by-step ladder, from the minimally invasive to an open technique. Lowman

clamp could be used in the attempt to remove the bent nail as it is relatively easy to apply, less force needed, less costly, and most of the time readily available in the common orthopaedic surgery set.

### Conflict of interest

Authors declare that they have no conflicts of interest.

### Ethical clearance

Authors declare that they have no conflicts of interest.

### Authors' contribution

Authors were involved equally in the patient management, literature review and manuscript preparation.

---

### References

1. Ahsan A.F., Kasper S.N. How to remove a bent intramedullary nail. *Acta Orthopaedica Scandinavica* 2011, 69:6, 638-639.
2. Heffernan M.J., Leclair W., Li X. Use of F-tool for the removal of bent intramedullary femoral nail with a sagittal plane deformity. *Orthopaedics* 2012 35(3):e438-e441.
3. Kockesen T.C., Tezer M., Tekkesin M., Kuzgun U. Traumatic femoral diaphyseal fracture and a bent intramedullary nail in a case with a completely healed femoral diaphyseal fracture. *Acta Orthopaedica et Traumatologica Turcica*. 2002;36:177-80.
4. Dhanda, M. S., Madan, H. S., Sharma, S. C., Ali, N., & Bhat, A. (2015). Jumbo Cutter for Removal of A Bent Femoral Interlocking Nail: A Cost Effective Method. *Journal of clinical and diagnostic research : JCDR*, 9(6), RD06–RD7.
5. Odendaal, J., Peacock, E., Cruz, J., Noor, S. & Gollogly, J. (2016). How to remove a bent intramedullary nail inexpensively: a technical trick. *Asian Biomedicine*, 10(3) 277-280.
6. Petterson R.H., Ramser J.R. Technique for treatment of a bent Russell-Taylor femoral nail. *J Orthop Trauma* 1991; 5(4) 506-8.
7. Sameer A, Ahswani S, Uttam C, Nitesh G. Removal of a bent tibial intramedullary nail: a rare case report and review of literature. *Chinese Journal of Traumatology* 2011. Vol 14 107-110.
8. Shishir S.M., Deniese P.N., Kanagasabai R., Najimudeen S., Gnanadoss J.J. A worthwhile attempt to remove a bent intra-medullary femoral nail before attempting extensive procedures. *J Curr Res Sci Med* 2015;1:44-8.
9. Vaseileious I.S., Stamatis K., Helias K., Ioannis P.S. Bent intramedullary femoral nail: surgical technique of removal and reconstruction. *Case Reports in Orthopaedics*. Vol 2011; 614509.
10. Wild M, Gehrman S, Jungbluth P, Hakimi M, Thelen S, Betsch M, Windolf J, Wenda K. Treatment strategies for intramedullary nailing of femoral shaft fractures. *Orthopedics*. 2010 Oct 11;33(10):726.