ABSTRACT
Extraction of broken implant is a challenging task for orthopaedic surgeons. Many times it requires innovative ideas or some unusual methods, all of which has not been listed in literature. We hereby report such a case of 40-year-old male who presented with severe limping and history of previously treated right femur fracture. The radiographs showed an intramedullary nail which was segmentally broken. Femur nail was broken at the non-united fracture and below the fracture at the level of distal interlocking screw. We successfully removed a broken implant by using such one innovative - close retrograde method. The segments of broken nail were removed through knee arthrotomy without opening the fracture site. Non-union was treated by exchange nailing without bone grafting and patient recovered well on follow up. To our best of knowledge very few cases of extraction of segmentally fractured nail have been reported in literature until now.

Key-Words: Broken Implant; Fracture Non-Union; Trans-Articular Method; Exchange Nailing

Introduction
The success of treating femur fractures by interlocking intramedullary nail (IMN) is well established.[1] Implant failure, such as breakage of the nail, is an uncommon complication. It is usually associated with delayed union or non-union of fractures. Other contributing factors include the design of the implant, location of the fracture, stability of fracture fixation, infection, and the protocol of rehabilitation. The breakage of intra medullary nail is a serious complication and it is a challenging task to remove the hardware and to further treat the fractures. Because untreated such cases will causes significant morbidity and even non-functional limb. Extraction of intramedullary nail is of utmost importance and requires few unusual and innovative methods. Many of the methods have been described in literature but it has to be individualized. As each of such case pauses a different situation one has to analyze the situation and plan accordingly. This case describes the usefulness and effectiveness of such techniques which can significantly improve the outcome.

Case Report
A 40-year-old male had a road traffic accident in Banaras and sustained a closed fracture of his right femur. The femoral fracture was fixed with a closed interlocking IMN in Banaras. He complained of persistent limping even after the surgery. Because of the persistent symptom, he returned to Mumbai 5 months after the first operation for further management. He presented to us after 6 months of surgery having symptoms of limping and pain. He could walk with a stick for 2 hours. However, he could not walk unaided. The range of motion of right hip and knee was full. There was no neurovascular deficit. The radiographs of his right femur showed fracture in the shaft fixed with an intramedullary locking nail, which was broken at two sites one at the primary bone fractured site with non-union and other at the upper distal locking hole. The one proximal locking bolt was in situ. The radiographic picture suggested that the probable cause of breakage of IMN was a smaller size nail and aggressive post-operative protocol.

We planned to remove the broken implant and revise the fracture fixation by exchanging the broken nail with another well-fitting IMN after rimming. We expected following challenges:
(1) The nail was segmentally fractured.
(2) Nonunion of femur fracture.
(3) No information concerning previous surgery
We decided to remove the broken implant by close method. We removed proximal locking screw first then passed a guide wire through proximal part of nail. Because of the formation of sclerotic bone around the tip of the nail, we could not pass the guide wire through the middle part of broken nail to facilitate nail removal. Eventually, we decided to proceed with transarticular retrograde technique for the removal of the broken nail through a medial para patellar arthrotomy. The knee was slightly flexed to 30 degree. Medial arthrotomy was performed and the medullary cavity was opened through the intercondylar notch with an awl. We tried first to engage a ball tipped guide wire through distal fragment and middle fragment. We succeed in passing it through distal fragment but we could not engage in middle segment of broken nail, as there was no control over it. We used a distal guide wire along with distal part of broken nail to stabilize the middle part of broken nail. We removed the proximal part of nail by jamming the rimmer in the upper part through proximal incision. Under fluoroscopic control we passed rimmer through proximal end of femur and hammered the middle fragment slowly, using the retrograde guidewire in distal broken fragment as guide. The distal part of broken nail was driven out through the distal wound in knee first. Then a remaining middle portion was removed through retrograde method with using a rimmer and retrograde guide wire. An 11 mm interlocking nail was then inserted after proper rimming with 12 mm locking at both ends. We did not used bone graft. After 1 year of follow up fracture was united and patient was able walk freely without pain.

**Discussion**

Broken Implant removal is always a difficult job. Removal of an IMN can be particularly challenging and the removal of a broken one can be extremely difficult. However, it becomes mandatory to remove the broken implant in case of non-union of fractures. Bypass fixation with an Ilizarov ring fixator, leaving the broken piece in situ, has been used for more distal femoral non-union with success.[2] However, it is not applicable for proximal femoral non-union with a long broken distal nail portion. The literature does offer many ingenious methods for their removal. The “AO” group recommends extracting the proximal fragment, followed by over-reaming of the medullary canal down to the distal nail fragment. A long extraction hook is then used to extract it.[3] Other described methods include using the modified Kuntscher reaming guide; Ender’s nail; hand reamer; femoral head cork screw extractor; smaller nail impaction; grasping device, such as forceps; or multiple guide wires wedged into the nail cavity.[4] The principle is to make a tight fit engagement in the distal nail and then the broken nail is pulled out. It may work for the AO nails and the like, with slot and relatively large central canal. However, many new nails with different designs have emerged. Some of these nails are unslotted with very narrow central canal. This technique of tight fit engagement does not work...
for them. For nails with narrow central canal, Marwan and Ibrahim passed a 1.4 mm cerclage wire down the broken nail and retrieved it through the distal locking hole with another loop of wire.[5] The cerclage wire was folded a few times to block the nail hole and the broken nail was removed together with the wire. This method sounds simple and no special instrument is required, but it is easier said than done. The wire can slip and the folded wire may become an obstruction itself in the narrow medullary cavity. Some manufacturers have designed special instrumentation to tackle this difficult problem. The Synthes extraction kit is able to extract the distal broken nail even if it is a solid nail. Overreaming proximally is needed. However, this special instrument is not available in every hospital. Krettek et al described the removal of a broken solid femoral nail using simple push-out technique.[6] He opened a lateral cortical window in the distal femur and inserted a narrow Hohmann retractor beneath the tip of the broken nail, using the retractor as a shoehorn to guide the broken nail out when it was pushed from above. This technique was not suitable in our case because of the greater length of the distal nail fragment. Retrograde techniques, such as those described by Maini and Jain and Magu et al were not applicable to our case as the distal tip of the broken nail was blocked by a pedestal of sclerotic bone.[7,8,9] Although our retrograde push-out technique involves more soft tissue dissection through a parapatellar arthrotomy, it is a safe and direct approach to tackle this difficult problem. We made use of this technique to successfully remove the broken nail with extremely lower morbidities and complications just like retrograde intramedullary nailing of femur. However, there is a theoretical risk of subsequent knee stiffness and patellar maltracking if appropriate repair is not performed.

Conclusion

In conclusion, there is no simple or easy way to remove a broken IMN and no universally successful technique for every situation. Every surgeon should equip himself with all the available armamentarium and techniques when tackling this challenging problem. Transarticular retrograde technique is one of the useful tools, which the surgeons should bear in mind.

References


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