(International Print/Online Journal)

SJIF IMPACT FACTOR: 5.565
PUBMED-National Library of Medicine ID-101739732

ISSN (Print): 2209-2870
ISSN (Online): 2209-2862

International Journal of Medical Science and Current Research (IJMSCR)
Available online at: www.ijmscr.com
Volume 7, Issue 1 , Page No: 20-27
January-February 2024

IJMSCR

# Removal of Broken Helical Blade In Proximal Femur Fractures - A Novel Technique

**[1]*Dr. Karan Maggo, [2]Dr. Nitish Kumar , [3]Dr. Vikas , [4]Dr. Kanchan,**
[1,2]Senior Resident Orthopedics, [3]Associate Professor, [4]Senior Resident,
[4]Department of Radio Diagnosis, [1,2,3]Central Institute of Orthopedics,
Vardhman Mahavir Medical College and Safdarjung Hospital

***Corresponding Author:**
**Dr. Karan Maggo**
Senior Resident Orthopedics, Central Institute of Orthopedics,
Vardhman Mahavir Medical College and Safdarjung Hospital

Type of Publication: Original Research Paper
Conflicts of Interest: Nil

**Abstract**

**Introduction** - Mechanical failure of the implant is an increasingly common challenge in patients of proximal femur fractures managed with Cepahlomedullary Nail. Broken implant removal especially removal of helical blade is an uphill task requiring adequate pre-operative evaluation along with a well identified plan and complete armamentarium. Cases with broken helical blade in proximal femur fractures are rare and only a few cases have been reported in literature with different methods of removal. Reported here is a case of non-union proximal femur fracture with broken implant and helical blade with a novel, indigenous and cost-effective method of implant removal.

**Case Report** - 62-year-old elderly female patient with previous history of left hip surgery presented with a history of repeat slip and fall with complaints of pain in left hip. Radiographs done in emergency department revealed a non-union of previous intertrochanteric fracture with broken Proximal femoral Nail – A2 and broken helical blade. Patient was taken up for implant removal and revision of fixation. After removal of broken cephalomedullary nail, removal of broken helical blade was attempted using described techniques but was unsuccessful. A novel technique was then tried where in an instrument was made using the long coupling screw for DHS screw removal (from DHS set kept as backup) and a T-handle. This was attached to the broken helical blade and blade gently tapped out. Fixation was done using a Proximal Femoral Locking Plate and good fixation was achieved.

**Conclusion** – Complete armamentarium of instruments as back up allowed for an indigenous, cost effective, reproducible and safe technique for removal of broken helical blade.

**Keywords**: Proximal femur fracture, Implant failure, Removal of broken implant

## Introduction

Hip fractures are an emergent cause of disability and morbidity in the developed nations and is being increasingly recognized as an important cause of increased health burden and disability adjusted life years in the developing countries. In Indian population prevalence rate of intertrochanteric fractures is 152-400 fractures per 100,000 population. [1] . Increased life expectancy, increased BMI and increasing incidence of osteoporosis amongst the elderly are amongst important risk factors for increased incidence of intertrochanteric fractures in Indian population with the mean age of the fractures was 62.04 ± 12.15 years however the age distribution of the fractures is under 60 in males and over 60 in females. [2] Intramedullary devices have long since been established as the treatment of choice for the intertrochanteric fractures especially in unstable types with decreased blood loss and operating time with the

use of intramedullary systems reported in literature when compared to Dynamic Hip Screw (DHS). [3] With the progressively increased use of Proximal Femoral Nail - A (PFN-A), complications like head perforation by the helical blade, varus collapse, cut-out of the blade, implant failure, fracture near the tip of the blade, and so on have been increasingly been observed. [4] Implant failure with without or without breaking of implant has been associated with non-union of such fractures. Failure of an intramedullary implant in a patient with intertrochanteric fracture has been attributed to many factors such as the pattern of the fracture (pathological fracture, unstable fracture pattern, subtrochanteric extension), poor fracture reduction during primary surgery and patient factors leading to delayed union/nonunion such as metabolic abnormalities, higher BMI, pre-existing co-morbidities [5]. When taking the implant characteristics into consideration, the lag screw aperture in the barrel or distal barrel taper have been ascertained as biomechanically weakest sites with higher risks of implant failure at these sites [6]. Only a few cases of broken implant and their removal have been discussed in literature and fewer so have been reported for broken Helical blade of PFNA as the proximal blade fracture is rare and under-reported in the literature. One such case and a novel technique for removal of helical blade in a patient of proximal hip fracture has been described in our report

## Case report

### Clinical History -

A 62-year-old elderly female patient presented to the emergency department with alleged history of slip and fall at home and complained of pain and inability to move her left hip. She had no other complaints and was on treatment for Hypertension which was well controlled.

Patient also gave history of similar incident in 2019 wherein she underwent an operative procedure. The specific details of aforementioned procedure were not available.

### Investigations -

Patient was stabilized and investigations undertaken to assess nature of injury.

Radiographs of pelvis with bilateral hip and isolated affected hip in Antero-Posterior and Cross-table Lateral views were undertaken. The radiograph (Fig. 1) revealed fracture of intertrochanteric region of left proximal Femur and implant failure with broken pre-existing proximal femoral nail (PFN-A). Considering the previous history, patient was considered to be suffering from non-union of previous intertrochanteric fracture with implant failure due to subsequent trauma. Blood investigations revealed to be within normal limits with no sign of regional or systemic infection.

A plan for implant removal followed by revision of fixation along with bone grafting was made

### Surgical technique -

The surgery was performed with the patient on a fracture table and standard positioning done and image intensifier was used for assistance during surgery.

After appropriate part preparation, standard draping was applied.

The original incision was utilised for the revision surgery; the incision was extended proximally and distally by 2 cm each.

Surgical dissection was extended down to the bone after splitting the vastus lateralis muscle; Maintaining a stringently subperiosteal plane, the vastus intermedius and medialis origin were lifted subperiosteally and two curved Hohmann retractors were introduced to aid in retraction.

Under the guidance of the image intensifier, first distal locking bolts were removed. (Fig. 2a and 2b) Outer broken part of the helical blade was removed manually from the lateral wall of the femoral cortex. Distal broken fragment of nail was removed subsequently from the fracture. Proximal broken fragment of nail was removed from the entry site of nail leaving distal broken fragment of helical blade. Attempt was made to remove the broken remnant of helical blade using PFN-A2 (indigenous manufactured) removal instruments and AO - nail removal instrumentation which was not successful. Depth of the broken remnant of helical blade obscured any attempts at application of pliers or bone nibbler to attempt extraction of the remnant. It was after these unsuccessful trials that an instrument was made using the long coupling screw for DHS screw removal (from DHS set kept as backup) and a T-handle (Fig. 3). Coupling screw was inserted into the broken fragment and rotated clockwise to jam into



Volume 7, Issue 1; January-February 2024; Page No 20-27

the broken fragment. Once the instrument found fixed under image intensifier, the T-handle was gently tapped outwards (Fig. 4). The screw fragment was retrieved from lateral window in femoral cortex for the Helical blade (Fig. 5a and 5b). Confirmation of removal of all fragments of broken helical blade was made on the side table before procedure was continued (Fig. 6). In view of fracture being in non-union, the fracture was fixed using a proximal femoral locking plate (PFLP) along with autologous and artificial bone grafting procedures (Fig. 7).

## Discussion

Increased life expectancy and prolonged active lifestyle in elderly population has brought about an increase in the number of per trochanteric fractures in Indian population. Introduction of cephalomedullary nails in management of per-trochanteric fracture has allowed for lesser operative time, decreased blood loss and early rehabilitation while complications such has screw cut-out, non-union, implant failure associated with breakage of bolts, compression screws or the nail itself have been observed in small number of cases from time to time. Despite improvement in metallurgy, nail designs and removal instrumentation, Implant failures and related complications have always been technically challenging undertakings for patients and surgeons alike.

Cases with implant failure in per-trochanteric fractures are uncommon and those involving breakage of helical blade are rarer still. In the earliest reported case of a broken helical blade, Stover md et al [7] reported a surgical technique that involves using the AO broken screw extraction bolt set. Here, a reverse threaded conical extraction bolt is locked to the spiral blade and a T- handle is connected to the extraction bolt. The extraction bolt and the T handle is then struck to remove the broken helical blade. This method has not been reproducible in subsequent attempts. Mandal et al [8] a reverse threaded conical extraction bolt from the AO broken screw extraction set is screwed into the central guide wire channel of the embedded medial spiral blade fragment through the femoral entry hole. The other end of the conical bolt is grasped with an extraction pliers along with its fitted slap hammer from the AO TENS nail set. The embedded spiral blade is extracted by gentle blows with the slap hammer. Surrounding metaphyses needs to be drilled to apply extraction pliers, to prevent bone loss, this method wasn't utilised. Imam et al [9] in their methodology utilised a tap (4mm) to attach to the centre of the spiral blade. This was then rotated into the central tunnel in the blade screw to advance it into the blade. Once a hold is achieved, the tap was gently retracted out with the broken part of the blade. Cao et al [10] used the method of drilling a unicortical hole by a 5-mm tungsten carbide bur at the broken side of the blade and a 2-mm double-strand steel wire was threaded through the drilled hole. The wire was twisted and tied up to the AO extraction screw by a strong loop. Then, gentle blows are applied on the combined hammer in the direction of the blade. This allows the broken blade to be extracted. Unavailability of carbide drill bit precluded this method in our setting. Papinocolous et al [11] converted implant failure to hemi-arthroplasty and undertook fractological study of the broken implant. We however sought to preserve the normal anatomy of the patient's hip and performed an internal fixation using Proximal Femoral Locking plate.

## 4. Conclusion

We report an indigenous, cost effective, reproducible and safe technique that is effective in our experience and which was able to utilise readily available inventory and prevent bone loss from surrounding metaphyses allowing second fixation procedure to address non-union.

## 5. Clinical Message:

Undertaking a technically challenging task such as an Implant removal merits an availability of complete armamentarium of instruments and a certain willingness to try new ideas to manage such a case. The routinely described methods of implant removal might fail and therefore surgeon must be prepared with complete armamentarium of instruments, and ready to try new techniques.

## References

1. Dhanwal DK, Siwach R, Dixit V, Mithal A, Jameson K, Cooper C. Incidence of hip fracture in Rohtak district, North India. Arch Osteoporos [Internet]. 2013;8(1–2). Available from: http://dx.doi.org/10.1007/s11657-013-0135-2
2. Ahuja K, Sen S, Dhanwal D. Risk factors and epidemiological profile of hip fractures in Indian



Volume 7, Issue 1; January-February 2024; Page No 20-27

population: A case-control study. Osteoporos Sarcopenia [Internet]. 2017;3(3):138–48. Available from: http://dx.doi.org/10.1016/j.afos.2017.08.097

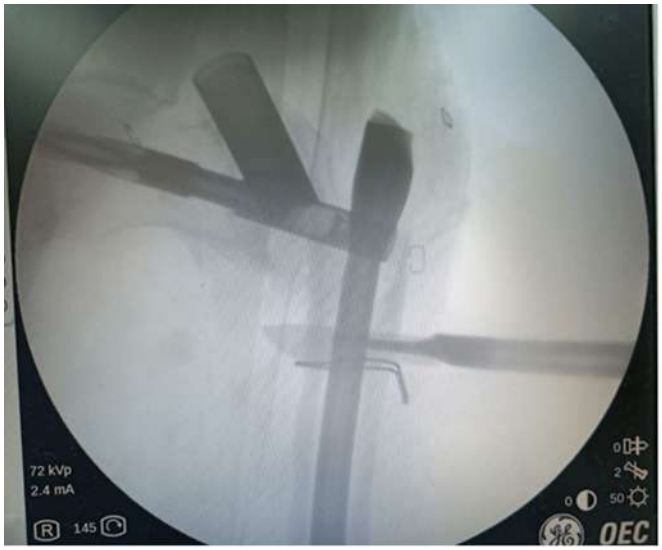
3. Mittal R, Banerjee S. Proximal femoral fractures: Principles of management and review of literature. J Clin Orthop Trauma [Internet]. 2012;3(1):15–23. Available from: http://dx.doi.org/10.1016/j.jcot.2012.04.001
4. Audigé L, Hanson B, Swiontkowski MF. Implant-related complications in the treatment of unstable intertrochanteric fractures: meta-analysis of dynamic screw-plate versus dynamic screw-intramedullary nail devices. Int Orthop [Internet]. 2003;27(4):197–203. Available from: http://dx.doi.org/10.1007/s00264-003-0457-6
5. Johnson NA, Uzoigwe C, Venkatesan M, Burgula V, Kulkarni A, Davison JN, et al. Risk factors for intramedullary nail breakage in proximal femoral fractures: a 10-year retrospective review. Ann R Coll Surg Engl [Internet]. 2017;99(2):145–50. Available from: http://dx.doi.org/10.1308/rcsann.2016.0297
6. Koyuncu Ş, Altay T, Kayalı C, Ozan F, Yamak K. Mechanical failures after fixation with proximal femoral nail and risk factors. Clin Interv Aging [Internet]. 2015;10:1959–65. Available from: http://dx.doi.org/10.2147/CIA.S96852
7. Stover MD, Lin I, Bosse MJ. Removal of a broken Synthes proximal spiral blade. J Orthop Trauma [Internet]. 1998;12(3):190–1. Available from: http://dx.doi.org/10.1097/00005131-199803000-00010
8. Mandal S, Mohan TRM, Malik S. A new method of removal of fractured AO spiral blade from proximal femur. Inj Extra [Internet]. 2006;37(5):202–3. Available from: http://dx.doi.org/10.1016/j.injury.2005.11.012
9. Imam MA, Harb Z, Elliott D. A simple reproducible technique for the retrieval of broken proximal femoral blades, a technical note and review of literature. J Clin Orthop Trauma [Internet]. 2020;11(Suppl 1):S7–10. Available from: http://dx.doi.org/10.1016/j.jcot.2019.10.003
10. Cao M, Yang Z-M, Lu H-D. A succinct technique for the extraction of the proximal femoral nail anti-rotation (PFNA) after unlocking failure: a case report. J Orthop Surg Res [Internet]. 2020;15(1):300. Available from: http://dx.doi.org/10.1186/s13018-020-01821-4
11. Papanikolopoulos D, Kalligeros C, Polyzos A, Spitas V, Soranoglou V. Proximal femoral nail mechanical failure: A case report and biomechanical study. Cureus [Internet]. 2022;14(3):e23694. Available from: http://dx.doi.org/10.7759/cureus.23694



Volume 7, Issue 1; January-February 2024; Page No 20-27

**Figure 1. Pre-operative Radiographs**


**Figure 2. Intra-operative Nail Removal Steps**



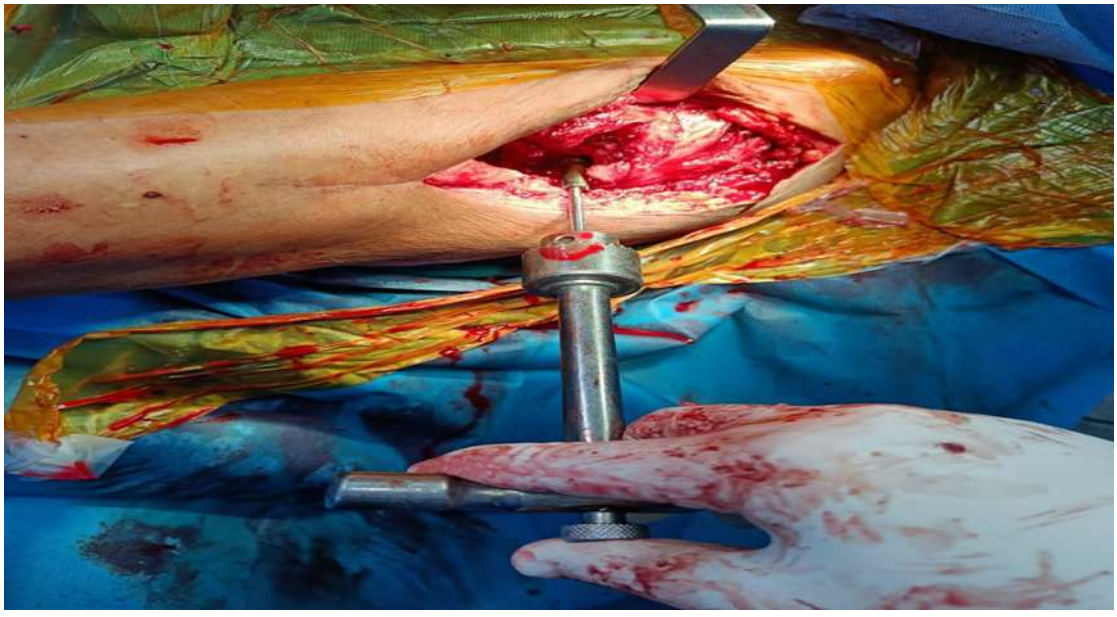




Volume 7, Issue 1; January-February 2024; Page No 20-27

**Figure 3. Custom instrument made for blade removal**

**Figure 4. Intra-operative image showing extraction of helical blade**





Volume 7, Issue 1; January-February 2024; Page No 20-27

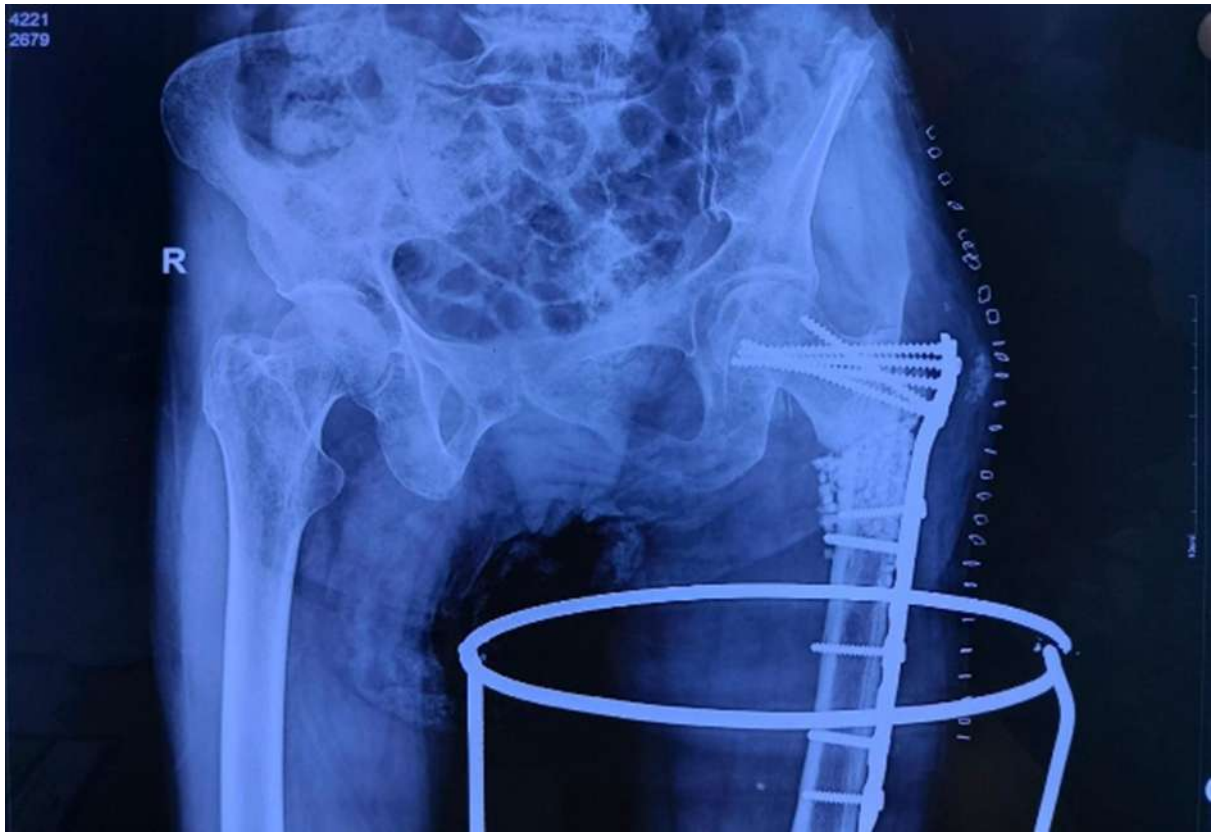
**Figure 5a and 5b. Image Intensifier images Intra-operative showing extraction of blade**


**Figure 6. Image showing extracted helical Blade**



Volume 7, Issue 1; January-February 2024; Page No 20-27

**Figure 7. Post operative Image with fixation with Proximal Femoral Locking Plate**






Volume 7, Issue 1; January-February 2024; Page No 20-27