

# Comparative Study of Helical Blade PFN and Double Hip Screw PFN for Intertrochanteric Fracture Fixation

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## ABSTRACT

**Background and Objectives:** Hip fractures are becoming more prevalent due to increased lifespan and osteoporosis. Proximal femoral nailing is the preferred method of treating unstable intertrochanteric fractures. There are two types of constructs in proximal femoral nailing; one is a double sliding screw and the other is single antirotation screw or a single helical blade for proximal fragment fixation. This study compares the single screw and double screw constructs for treating unstable intertrochanteric fractures. Patient reported outcomes and radiological union of the fractures have been used as outcomes measures.

**Materials and Methods:** A retrospective analysis of Thirty patients treated for intertrochanteric fractures using the proximal femoral nails have been considered, 10 of them had single helical blade nailing and 20 had nailing with a double screw construct. Patients were asked to take an over the phone survey that evaluated their condition through four categories; mobility, pain, sleep and complications by an independent observer who was not involved in the patient's care.

**Results and Conclusion:** It was found that helical blade fixation was superior to screw fixation in the categories of mobility and complications. However, there was no significant difference between the nailing systems in pain and sleep categories. This finding indicates that although helical proximal femoral nails prove to have some benefits over the screw proximal femoral nails, further research is needed to investigate which nailing is the best treatment option.

**Keywords:** Intertrochanteric, proximal femoral nailing, helical blade

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## INTRODUCTION

Hip fractures are becoming more common due to an increase in lifespan.<sup>[1]</sup> Dynamic Hip Screw (DHS) and Proximal Femoral Nail (PFN) are recognized implants for fixing intertrochanteric fractures. DHS fixation has been shown to be more suitable for the treatment of stable fractures, but results have not been reproducible in unstable fractures.<sup>[2]</sup>

In the past two decades, PFN fixation has been the more preferred method in treating unstable patterns of intertrochanteric fractures. PFN fixation method has been shown to be biomechanically more stable than DHS fixation.<sup>[3,4]</sup> Additionally, the addition of an antirotation hip screw prevents unwanted rotation of the femoral neck.<sup>[5]</sup>

Past studies have shown that in addition to providing increased stability for unstable fractures, PFN fixation

offers other advantages such as less operative time, minimally invasive, decreased blood loss, earlier rehabilitation and decreased post-operative complications and failures.<sup>[6,7,8]</sup>

PFN fixation had utilized single sliding hip screw systems in which a sliding screw is connected to an intramedullary nail to hold the proximal femoral neck-head region. However, these surgeries resulted in high rates of complications such as cut out of the neck screw, loss of reduction and unwanted rotation of the femoral head.<sup>[9]</sup>

The helical blade system was introduced in PFN to reduce the cut out rates. The helical blade has shown to decrease bone loss, reduce torsional forces whilst introduction, increase rotational stability of the femoral head and reduce cut out rates.<sup>[10]</sup> This is because the blade is not drilled in and it compresses the cancellous bone in the femoral neck upon insertion.<sup>[11]</sup> These improvements

should lead to less post-operative issues, thus decreasing the number of re-operation rates.

Since the production of the helical blade, its advantages over the sliding screw system have not been confirmed. One study showed advantages such as an increase in rotational stability and decrease cut-out rate, while another shows that there is no significant difference between the helical blade and sliding hip screw system.<sup>[11,12]</sup> It is important to determine what method is best suited for what types of patients in order to reduce pain and medical costs, while also ensuring a quick recovery.

Our study aims to compare helical PFN fixation to two screw PFN fixation. Given the limited previous research conducted on this topic, we hope that this study will provide some insight on the advantages and disadvantages of the different nailing systems. We hypothesize that the helical blade will be a more effective treatment method in yielding a better post-surgery outcome for patients.

## MATERIALS AND METHODS

Thirty six patients with intertrochanteric fractures were treated with proximal femoral nailing fixation at our institution from September 2014 to July 2016. All the unstable intertrochanteric fractures were included in the study. Patients with associated distal femoral fractures, other injuries and associated hip or lower limb pathology were excluded from the study. Radiological union, degree of backout of the hip screws on AP radiographs and functional outcomes were taken as end points for comparing the two groups.

The traditional hip scores like the Oxford hip score or Harris hip scores were not utilized as, it was felt that some of the questions did not suit the Indian lifestyle especially in the lower socioeconomic group of patients. All patients were followed up till 4 months, till radiological union was ascertained. The data on final functional outcomes were collected by a telephonic consult by an independent observer, who was not involved in patient care. Enquiry about their mobility, pain, sleep, and complications post discharge if any was made.

Mobility was defined as whether the patient currently uses a cane to walk. Pain was defined as whether they currently experience pain in the fracture site. Sleep was defined as whether they could comfortably sleep on the fracture site. Complications were defined as whether they have had any further surgeries done on the affected hip or whether there is a documented complication in the electronic medical records of our institution.

Results regarding post-surgery condition were gathered from 30 patients. Data was unable to be obtained from

the remaining six due to issues such as death and incorrect phone numbers. 10 patients received helical proximal femoral nailing (mean patients age, 67 years; age range, 52-90 years; male to female ratio, 3:7), while 20 patients received screw proximal femoral nailing (mean patients age, 63.3 years; age range, 32-79 years; male to female ratio; 13:7) Two patients, one from each group, passed away due to alternative reasons post-surgery.

They were not included in the data. Following data collection, comparison of the nailing systems in regards to mobility, pain, sleep and complications was performed using an independent samples t-test for each respective category. Statistical significance was assessed using a P value of .05. Additionally, the senior consultant orthopedic surgeon at our institution evaluated patients' x-rays post-surgery to determine the radiological union and back out of the screw. Ten patients did not have x-rays on their file, therefore they were not included in this part of the data.

### *Ethics Committee Approval*

This study was approved by IEC, Continental Hospitals, Hyderabad.

## RESULTS

Significant difference was found between the two nailing systems, favoring helical blade fixation, in the mobility and complications category ( $P=.008$ ,  $P=.02$ ). However, there was no statistical difference between the two nailing systems in the pain and sleep categories ( $P=.80$ ,  $P=.10$ ). These results show that in two out of the four categories used to assess the patient's condition, the helical blade fixation yielded a better outcome for the patient. All of the 26 x-rays that were evaluated showed good radiological union.

X-rays for five patients with helical proximal femoral nails did not show screw back out. The remaining patients in the helical PFN group had an average of 6.25mm back out. Additionally, x-rays of five patients with double screw proximal femoral nails did not show screw back out. The remaining patients in the double screw PFN group had an average of 6.44mm back out. This back out was not significant enough to prevent the patient from sleeping on the affected side.

The back out of the screw and healing was good in the helical group even when the fracture reduction was not perfect. In the two screw fixation group it was noticed that the superior of the two proximal screws backed out more than the lower screw.

## DISCUSSION

Our results indicate that in regards to mobility and

complications, the helical blade fixation proves to be a more effective treatment than the sliding hip screw fixation. Since mobility was assessed by the person's ability to walk with or without a walking aids, it can be concluded that the helical blade fixation yielded significantly less patients using a walking aid post-surgery. Improved mobility in with the helical blade can be explained by the fact that this nailing allows for earlier weight bearing when compared to the sliding screw system.

This is due to improvements in the helical blade such as improved purchase of the femoral head through radial compaction of the surrounding cancellous bone around the flanges of the blade upon insertion and increased rotational stability of the femoral head, which prevented cut out.<sup>[13]</sup> The telescoping mechanism in the helical blade system allows for compression at the fracture site of about 5mm, hence allowing for preoperative compression at fracture site and providing a stable bone implant construct. In regards to complications, there was a significant difference between the two nailing systems. A similar finding was concluded in a study done in 2010 that compared helical and screw proximal femoral nails.<sup>[12]</sup>

Our data reveals that the helical blade fixation yielded no complications while the screw fixation yielded four. Two of the patients from the screw fixation group received further surgeries on their hips at alternative institutions, one patient experienced varus collapse and another patient had top screw cut out. Complications like varus collapse occur due to weight bearing forces going across the fracture site.

Additionally, one patient from the group had his implant removed six months after surgery due to his young age. His fracture had healed and he wanted the implant removed in case he needed any other surgeries on his hip in his elder years. Considering that there was no issue with his nailing, this patient was not considered as a "complication" when analyzing the data.

Although no significance difference was found between the two nailing systems with regards to incidence of pain at the final review, three out of the four helical blade fixation patients that have pain received their surgeries within the past year. More specifically, two of these three patients received their surgeries within the last three months. Typically, pain should resolve after a proximal femoral nailing in six months.

This means that at least two of the four patients should still be experiencing pain. Follow up with these patients in about three months is needed to fully assess the effectiveness of the helical blade fixation in regards to

pain. Additionally, there was no significant difference between the two nailing systems when considering whether the patient can sleep on the fractured side.

All x-rays that were evaluated showed good radiological union which means that both nailing systems give good union rates. The average back out of the screw was also similar in both groups. Screw back out is the primary reason for pain post-surgery, however, when the x-rays of the patients who experienced pain were examined, there was little relationship between pain and the amount of screw back out.

One x-ray from the screw PFN group revealed top screw cut out and was documented as a complication. Screw cut out occurs in screw PFN because of a phenomena called the Z-effect. Z-effect occurs during weight-bearing where the inferior lag screw moves laterally and the superior lag screw moves medially.<sup>[14]</sup>

This study contributes information to subject that has not been researched much. There are only two other studies that compare helical proximal femoral nails to screw proximal femoral nails. In a study performed in 2010, the effectiveness of the two nailing systems was examined in forty patients. Effectiveness was measured by mean operation time, amount of bleeding, time to ambulation, average union period, changes in neck shaft angle, complications, mobility and social function.

Results showed that helical PFN yielded higher scores in social function, mobility and lower complication rates, however there was no significant difference between the two nailing systems in regards to operation time, amount of bleeding, time to ambulation, average union period and changes in neck shaft angle. Researchers concluded that that while helical PFN may provide benefits in functionality and complication rates, it cannot be said to be a better alternative to screw PFN.<sup>[12]</sup>

Another study performed in 2015 which examined the effectiveness of blade PFN versus screw PFN yielded a similar conclusion. In this study, 77 patients with unstable IT fractures who received helical or screw PFN fixation were examined to determine which nailing was more effective. Effectiveness was measured by operation time, blood loss, duration of hospital stay, union period, functionality and complications. Across all categories there was no significant difference between the two nailing systems.

The positive results led the researchers to conclude that not only was there no difference in effectiveness between the nails, but also that both nailing systems were adequate in treating IT fractures.<sup>[11]</sup>

There are limitations in this study. First, there is a small

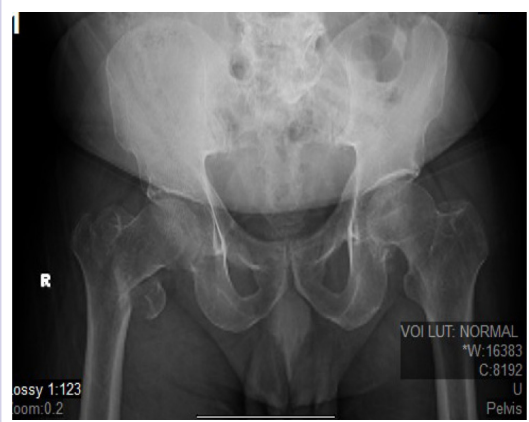


Figure 1 : 1a: Radiograph of patient with unstable intertrochanteric fracture



Figure 2 : 1b immediate post operative radiograph after a two screw fixation PFN

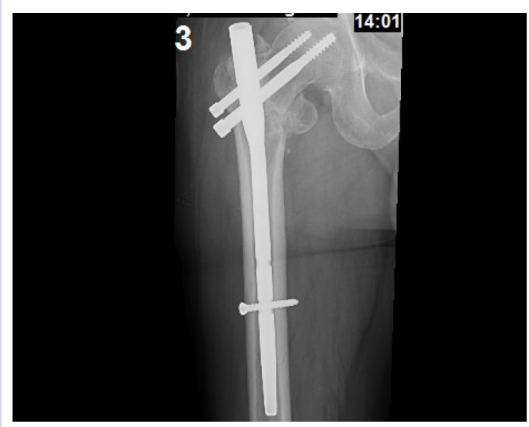


Figure 3 : 1c after radiological union

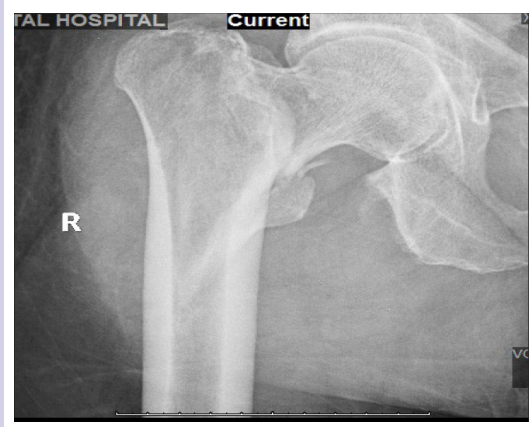


Figure 4 : 2a: Radiograph of patient with unstable intertrochanteric fracture



Figure 5 : 1b immediate post operative radiograph after a Helical blade PFN fixation



Figure 6 : 1c after radiological union

sample size. Further research will need to be conducted with a larger sample size to test which nailing is more effective. Second, the study is a retrospective study so the type of nailing cannot be assigned to each patient.

## CONCLUSION

While our data reveals that helical proximal femoral nails produce better post-surgery outcomes for patients in regards to mobility and complications, it cannot be confirmed that it is overall a more suitable treatment option. This is due to the fact that there was no significant difference in regards to pain and sleep when comparing the two nailing systems.

It can be concluded from our study that both nailing systems provide adequate healing but there is a slight difference in functional outcomes and complications. This finding indicates that more research is needed on this topic to further investigate if there is a superior nailing system in treating intertrochanteric hip fractures.

## CONFLICT OF INTEREST :

The authors declared no conflict of interest

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