Fixation of Intertrochanteric Fractures with Proximal Femoral Nail (PFN) versus Dynamic Hip Screw (DHS) - A Comparative Study

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KEYWORDS

Intertrochanteric fractures, Harris hip score, Dynamic hip screw, Proximal femoral Nail

ABSTRACT

Hip fractures, particularly intertrochanteric fractures, pose significant challenges due to their association with disability, mortality, and economic burden, especially among the elderly population. Trochanteric fractures primarily occur due to low-energy falls, which are more frequent in elder individuals with age-related impairments in vision, hearing, and reflexes.This prospective study aimed to compare the outcomes of Proximal Femoral Nail (PFN) versus Dynamic Hip Screw (DHS) fixation in unstable intertrochanteric fractures.

1. Introduction

Hip fractures impose a major burden on individual and society alike, often resulting in disability or mortality among elderly patients and generating substantial economic costs1,2. It is predicted that as the world's population ages, hip fractures are expected to increase to 6.25 million by 2050 and 2.6 million by 20253. Elderly patients, in particular, are at risk of life-threatening complications including hypostatic pneumonia, catheter sepsis, cardiorespiratory failure, and pressure ulcers. Conservative management almost always leads to failure of union and might result in non union and malunion. Despite the fact the vascular supply to the trochanteric bone is relatively good after fracture, resulting in a higher union rate than in the case of femoral neck fractures, the mortality rates following trochanteric fractures still vary from 12 to 41% in the first six months4.

The main aim of the procedure would be to achieve a stable construct which allows for early rehabilitation, thereby helping in preventing conditions associated with prolonged bed rest and promoting rapid recovery. Both DHS as well as PFN have demonstrated favorable outcomes in managing these complex scenarios. DHS is particularly useful for unstable fractures in patients with osteoporosis because of its fixed-angle locking side plate, which lowers the implant failure's risk 5.

PFN reduces the gap between the hip joint and the implant, providing a biomechanically stable construct. At the point where the lag screw and nail meet intramedullarily, it can withstand bending forces, allowing for early weight bearing in unstable intertrochanteric fractures, and this helps prevent lateral translation of the proximal fragment6-8. However, PFN tends to be relatively more expensive than DHS. According to a review of the literature, PFN has no significant benefits over DHS in terms of complications or functional results. PFN is linked to technical malfunctions despite its many advantages. This study compares the effects of DHS and PFN on unstable intertrochanteric fractures in a prospective, randomized approach.

2. Methodology

This prospective researchhas been carried out in our institution between April 2022 and January 2024. During this period 30 adult patients having intertrochanteric fractures have been admitted in the orthopaedics department. Patients above age of 18 years , of both sexes , presenting within 2weeks have been included in the research after obtaining consent. Pathological fractures, patients having co morbidities, skeletally immature patients and compound fractures were excluded. Patients were assessed pre operatively by carrying out routine lab investigations and plain X-rays of affected femur with traction internal rotation view was taken to assess fracture pattern.Fitness for surgery was obtained. The same orthopaedic surgeon performed each surgery.

The patient has been mounted on a table for traction, and by the assistance of an image intensifier, the fracture was realigned using closed manipulation. Using an Antero-Posterior (AP) view radiograph with magnification correction applied, "the length of the compression screw for the DHS has been measured. The side plate length and neck-shaft angle have been measured employing AP view radiographs of the unaffected side.The femur's diameter at the isthmus level was used to calculate the Proximal Femoral Nail diameter.AP X-ray was used to assess the neck-shaft angle for PFN on the unaffected side". In every instance, a standard length PFN measuring 250mm was employed.

Every patient followed a similar post-operative protocol wherein they were initiated on isometric quadriceps strengthening exercises, knee ROM exercises, high sitting immediately after surgery. IV antibiotics were started and stopped after 2 doses. Patients were started on partial weight bear walking with the aid of walker on POD 3. Regular dressings and wound inspection was done on POD 2, 5. Patients were discharged on POD - 5 and suture removal was done on POD -12. Patients were advised follow up at 6weeks, 3months, 6months, and 1year post-surgery. At each follow-up, assessments were conducted to evaluate fracture union, malunion, and functional ability using tools such as the HHS. Radiologically, osseous healing was noted in both AP and lateral radiographs, while bridging callus formation and crossing trabeculae were detected in at least three of the four cortices. Malunion was referred as varus angulation exceeding 10 degrees. The statistical analyses have all been conducted with a significance level of $p<0.05$. Version 20.0 of the SPSS software was used to conduct the statistical analyses.

3. Result and Discussion

An analysis was conducted on data from thirty patients who underwent surgery between 2022 and 2024 for stable intertrochanteric fractures. Of these patients, fifteen underwent proximal femoral nail treatment and fifteen underwent DHS treatment.The patients were between the ages of 48 and 70, with a mean age of 60.1. There were six females and nine males in the DHS group and seven females and eight males in the PFN group [Figure 1]. Fractures resulted from motor vehicle accidents in twenty cases, slip and fall in eleven cases and fall from height in three cases.

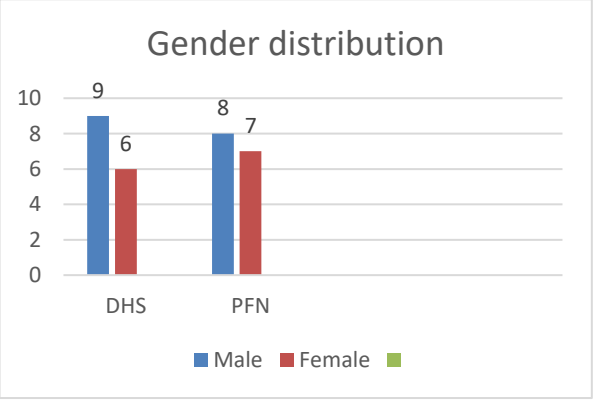

Figure 1: Distribution of gender among participants in both groups

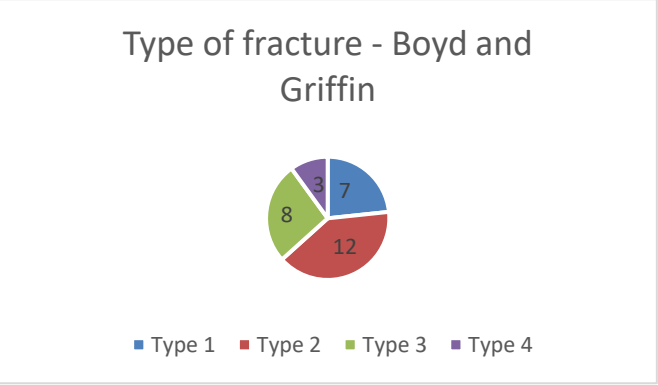

Figure 2: Boyd and Griffin fracture classification

Based on the Boyd and Griffin Classification type, there were twelve fractures classified as type II, eight as type III, seven as type I and three as type IV [Figure 2].It was discovered that "the average blood loss in the DHS group was 336.7ml, whereas it was 136.7 ml in the PFN group [Table 1].The PFN group"experienced a significantly shorter mean surgery duration than the DHS group (p-value < 0.05), with an average of 67.7 minutes for PFN patients and 93.3 minutes for DHS patients.

The patients' follow-up periods ranged from six to twelve months, with an average of nine and a half months. Neither group had any instances of post-operative mortality. Superficial skin infections were noted in 3 patients [Table 2] (2 from DHS group and 1 from PFN group) and they were taken care of by serial dressing and starting the patient on appropriate antibiotics and the fractures healed satisfactorily. Limb shortening was noted in one patient from PFN group. Functional outcomes for all patients were evaluated every month, three months, six months, and once a year. The mean HHS among the patients of the DHS group was found to be 88.5, while in the PFN group, it was 87.3 [Figure 3]. In DHS group. results were found to be excellent in 40 % cases and good in 47 %while in PFN group results were deemed excellent in 53 % and good in 33 % of cases.

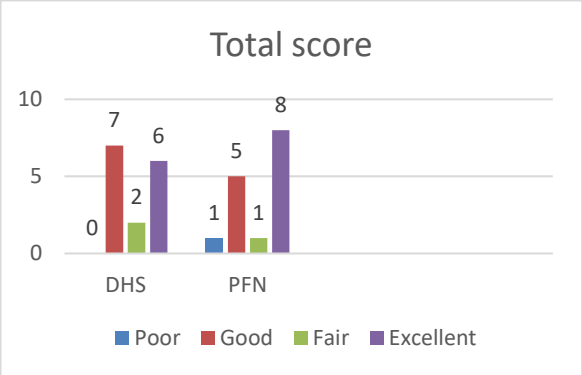

Figure 3: Functional outcome using Harris hip score

This study suggests that the PFN is greater than the "DHS as a technique for managing unstable intertrochanteric fractures in the" older, which is consistent with findings from previous studies. Long-term functional results were similar for both implants; the PFN group had an 87.3 Harris Hip Score, while the DHS group had an 88.5 score.

4. Discussion

Dynamic hip screw was traditionally the ideal treatment for IT fractures until the introduction of proximal femoral nails (PFN) in the last few decades. The PFN and other intramedullary devices have been developed to address the drawbacks and issues related to conventional extramedullary devices, such as non-union, reoperation rates, and malunion, particularly in unstable fractures[9,10]. According to recent data, union rates for intramedullary devices may exceed 100%, which is higher than union rates for extramedullary devices[11]. The age group of the fifth to seventh decade of life comprised the majority of patients in the current study.Gallaghar et al. (1980) found that intertrochanteric fractures in men over 80 years of age and women over 50 years of age increased eight-fold[12].

There was a statistically significant difference (P<0.04) between the mean blood loss of the two groups. The DHS group experiencedgreater mean blood loss as compared PFN group.According to our research, proximal femoral nail insertion surgery took an average of 67.7 minutes, which is less time than dynamic hip screw (DHS) insertion surgery, which took an average of 93.3 minutes. The PFN group required less time to finish the surgery. Comparing this method to the PFN insertion's percutaneous approach, the DHS group required a larger incision and more extensive dissection, which may have contributed to the significantly longer time required for wound closure. On the other hand, both groups' implant fixation times were essentially equal.Additionally, Baumgaertner et al. noted that in their series, the dynamic hip screw group had surgical times that were 10% longer[13]. On the other

hand, Saudan and associates discovered there was no discernible difference in the operating times between the two groups in their series[14].

In the dynamic hip screw group, the majority of patients experienced no complications, while 2 patients (13.3%) developed superficial infections. In the PFN group, 1 patient experienced an infection, and another patient presented with limb shortening. Six millimeters was the mean screw impaction (fracture collapse). In stable patterns, the average fracture settling measured 5.3mm, whereas the average in patterns that were unstable was 15.7mm, as reported by Jacobs et al. More than 15mm of sliding is linked to a higher rate of fixation failure[15]. According to Rha et al., the main cause of fixation failure in unstable fracture patterns was excessive sliding[16].

The PFN has advantages over the DHS even in the treatment of stable intertrochanteric fractures, where functional results are comparable. These benefits include less blood loss, shorter operating times, smaller incisions, and less pain following surgery. Additionally, in instances of unstable intertrochanteric fractures, the proximal femoral nail demonstrates clear advantages over DHS, involving improved overall functional outcomes, early restoration of pre-injury walking ability, and less limb length shortening.

4. Conclusion and future scope

The PFN serves as a load-bearing device, offering stability both proximally at the fracture site and distally along the femoral shaft. Biomechanically, PFN emerges as the preferred implant for fixing peritrochanteric femoral fractures. Compared to the Dynamic Hip Screw (DHS), PFN facilitates biological reduction, providing stability and preventing excessive collapse and limb shortening. Additionally, it results in shorter surgical times, reduced intraoperative blood loss, and shorter hospital stays, particularly in unstable intertrochanteric fractures. Our study suggests that PFN represents a superior alternative to DHS in treating intertrochanteric fractures, offering enhanced stability and better outcomes. However, it's worth noting that PFN is technically demanding and requires a higher level of expertise compared to DHS. While PFN does have challenges, its advantages in terms of stability and patient recovery make it a valuable option in the management of intertrochanteric fractures.

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