



E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2020; 6(2): 833-836
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www.orthopaper.com
Received: 04-02-2020
Accepted: 06-03-2020

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Fixation of inter trochanteric fractures by various types of cephalomedullary nails: A tertiary care center review

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DOI: <https://doi.org/10.22271/ortho.2020.v6.i2n.2147>

Abstract

Background: Trochanteric fractures are of intense interest globally, as they are frequently operated. They are fixed commonly either by Dynamic hip screw (DHS) or proximal femoral nail (PFN). The mechanical strength of the nail and less invasive procedure has made the procedure preferable. The different types of nails that are commonly used are, Proximal Femoral Nail (PFN), Proximal Femoral Nail Antirotation2 (PFN A2), Hip fracture nail (HFN) and Halifax nail. The aim of the study was to review intertrochanteric fractures fixation by various types of cephalo medullary nails.

Methods: A retrospective study was conducted at Orthopaedics department of IGIMS, Patna, India. Records of 51 cases operated during 2015 to 2018 which had completed at least one year of follow up and fulfilled the inclusion and exclusion criteria were evaluated. All had been treated using various types of proximal femoral nail for Trochanteric fractures of femur. A radiological assessment was made with serial X-rays.

Results: Most of the patients were between 70-80 years of age. PFN was used in 22, PFNA2 in 24, HFN in 3 and Halifax in only 2 patients. A statistically significant difference ($p < 0.0001$) was noted in the amount of blood loss, duration of surgery and number of C-arm exposures among PFN and PFNA2 groups. However the difference in the functional outcome which was assessed by Harris hip score was not significant, mean score being 81.1 in PFN and 82 in PFNA2 group.

Conclusions: Cephalomedullary nail is a suitable implant for Intertrochanteric femoral fractures. Among them, PFN A2 has slight edge over all others as its instrumentation is easier, operative time is lesser and has lesser c-arm exposure.

Keywords: Intertrochanteric fractures, PFN, PFNA2, Halifax nail, hip fracture nail

Introduction

Intertrochanteric fractures are the most frequently operated fractures and has the highest mortality and morbidity rates. Various modalities of treatment are available for the management of these fractures. Earlier these fractures were used to be treated conservatively with lots of complications. To reduce the complication rate internal fixation was performed¹. In 1990, 26% of all intertrochanteric fractures were reported in Asia, this figure is estimated to rise to 32% in 2025 and 38% in 2050^[2]. Unstable intertrochanteric fractures are difficult to treat³. Intramedullary devices such as PFN are biomechanically stronger and more rigid compared to extramedullary devices such as DHS^[4]. PFN has showed more number of post-operative complications, like implant failures, screws cut out, in case of unstable intertrochanteric fractures^[5]. To improvise it AO/ASIF introduced PFNA (Antirotation system). PFNA claimed better rotation, and angular stability with single screw and better functional outcome in treating un- stable intertrochanteric fractures when compared to PFN⁶. The aim of the study is to compare the various operative aspects and functional outcome of cephalo medullary nail fixation in intertrochanteric femur fractures.

Materials & Methods

This retrospective study was conducted in the department of Orthopedics, IGIMS, Patna, India. 51 cases of intertrochanteric fractures satisfying the inclusion and exclusion criteria

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operated during 2015 to 2018 which had completed at least one year of follow up were enrolled in the study. All fractures were fixed by closed reduction and internal fixation on fracture table under fluoroscopic control. The data was analyzed for type of nail being used, operative time, blood loss, c-arm exposure, post-operative complications and pre and post-surgical ambulatory status. Screw placement was noted. The PFN Antirotaion2 was graded as good if the blade was placed into the lower half of the neck AP view, and centrally on a lateral view and if nail does not protrude outside the greater trochanter. The Halifax was graded as good if the screw was placed into the center of the neck AP view, and centrally on a lateral view. One screw in center along with below integrated screw was graded as good in hip fracture nail. The clinical results were assessed using Harris hip score. The score were categorized as excellent (91-100points) good (81-90points) fair (71-80points) and poor (<70points). A standard post-operative protocol was maintained which included partial weight bearing for 2 months, and assisted weight bearing for another 1 months with calcium and vitamin D supplementation. Post-operative follow up done at 4-6 week intervals for a minimum period of 12 months .Radiograph of the affected hip were obtained in AP and lateral planes to assess the post-operative fracture reduction . AP and lateral view radiographs were also done at each follow up visit. And any change in the position of the

implant and the extent fracture union were noted. Fracture were judged to be healed radiographically if bridging callus was evident on 3-4 cortices as noted on two views.

Results: Out of 51 cases 33 were male and 18 were female. Most of the patients were between 70-80 years of age. Four types of nails were used in management of these patients with intertrochanteric fractures. PFN was used in 22, PFNA2 in 24, HFN in 3 and Halifax in only 2 patients. We had taken only PFN and PFNA2 group for comparative purpose as only 5 out of 51 fractures were fixed by Halifax nail or hip fracture nail. (Table 1). A statistically significant difference (p<0.0001) was noted in the amount of blood loss, 108.4±6.2ml in PFN and 88.3±7.3ml in PFNA2 groups. The average time to perform the surgery was 49.1minutes in PFN while 36.1minutes in PFNA2 groups (p<0.0001). The number of C-arm exposure was 29.5 and 18.6 in PFN and PFNA2 group respectively (p<0.0001). The outcome was measured by comparing the Harris Hip Score in the two groups and the difference was not statistically significant p0.371). (Table 2). There were no late postoperative complications among patients treated using PFN A2 screws. All patients treated with PFN A2 underwent union whereas non-union was seen in only 1 patient treated with PFN. In PFN group one case each of screw cut out Z effect and broken distal locking screw was noted.

Table 1: comparison of demography, surgical details and functional outcome in the four groups

Variables	PFN	PFNA2	HFN	HALIFAX
No of cases	22	24	3	2
Mean Age (years)±SD	73.5±5.4	74.7±7.1	70.0±3.3	77.0±1.0
Sex				
Male	15	15	02	01
Female	07	09	01	01
Mean Time during surgery (minutes) ±SD	49.1±3.2	36.1±4.7	57.0±2.1	53.5±1.5
Average Blood loss (ml) ±SD	108.4±6.2	88.3±7.3	131.0±6.2	140.0±10.0
Images (No) ±SD	33.5±6.7	24.2±4.1	39.3±2.4	41.2±3.4
Mean Harris hip score±SD	81.1±8.8	82.0±8.4	80.0±4.0	82.0±2.0

Table 2: Comparison of operative details in PFN and PFNA2 groups

	PFN	PFNA2	p-value
Mean Time during surgery (minutes) ±SD	49.1±3.2	36.1±4.7	<0.0001
Average Blood loss(ml) ±SD	108.4±6.2	88.3±7.3	<0.0001
Images(No) ±SD	33.5±6.7	24.2±4.1	<0.0001
Mean Harris hip score±SD	81.1±8.8	82.0±8.4	0.371



Fig 1(A, B): Pre and post- operative images of Intertrochanteric fracture fixed with PFN

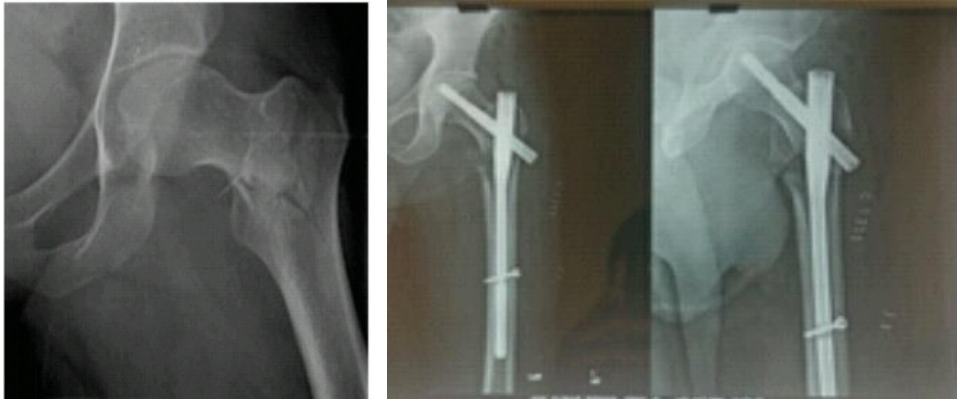


Fig 2(A, B): Pre and post-operative images of Intertrochanteric fracture fixed with PFNA2



Fig 3(A, B): Pre and post-operative images of Intertrochanteric fracture fixed with Halifax nail

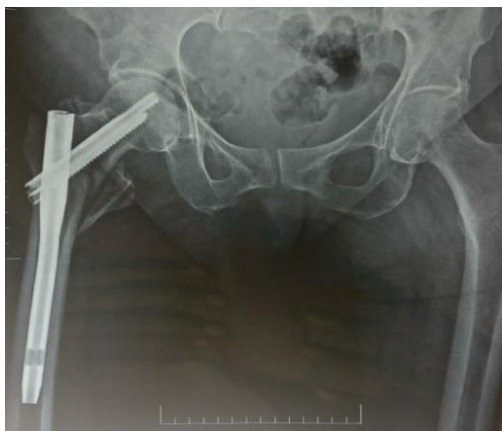


Fig 4: Post-operative image of Intertrochanteric fracture fixed with Hip fracture nail

Discussion

Cephalomedullary nails act as internal splints and helps in indirect healing these devices causes minimal trauma to the vascular supply of the bone [7]. The innovative helical blade design provides better compaction of cancellous bone, there will be increased contact area between implant and the femoral head, better hold on both compact bone and cancellous bone [8]. PFNA2 improves the fixation stability by decreasing reaming of the bone stock which will be done in PFN⁹. There is no need of another derotation screw and it has been biomechanically proven to have better purchase in osteoporotic bones [10]. Biomechanically PFNA2 has greater resistance to cut out better rotational stability achieved with one single element large surface and increased core diameter guarantee the maximum compaction and optimal hold in bone

[11]. It has showed improved resistance to varus collapse resistance to femoral head rotation, longer fatigue life [12]. The 11.0 mm helical blade reduces the amount bone removed in the neck. The tip of the PFNA2 is flexible which reduces the stress on the bone at the tip and therefore, there will be less implant failure (distal nail breakage and distal locking screw breakage) [13].

In PFN, 2 screws are used for the neck the larger screw is the lag screw to take the load. Smaller screw for rotation stability if the length of smaller screw increases vertical force increases and induces the cutout causing effect (Z- effect), or reverse Z effect [14]. Cut out rates of PFN screws is between 0.6-0.8% [15]. In hfn 2 screws are used, helps in better compression at fracture site, while in Halifax, triflange is applied over single screw. This increases operative time and c-arm exposure. In our study, fractures fixed with Halifax nail or HFN were very less, so we mainly compared between PFN and PFNA2

In study done by Bajpai J *et al.* both screw PFN and helical PFN were found equally effective implants in internal fixation of unstable trochanteric fractures. However, helical PFN (PFN A2) group was found better in terms of operative time, blood loss and number of images required [16]. The result was similar to the current study which also proved PFNA2 better than PFN.

Gadhe SS *et al.* studied 50 cases and reported that PFNA2 is better implant in terms of intraoperative complications, blood requirements and union rates [17].

The limitation of the current study is its small sample size, shorter duration of follow up and the surgeries were performed by different surgeons leading to surgical bias.

Conclusion

PFNA2 is superior among various types of cephalomedullary nails in treating unstable intertrochantric fractures in terms of operative time and c-arm exposure and blood loss. However functional outcome is not affected by the type of nails used. Further larger studies are needed to compare these new implants.

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