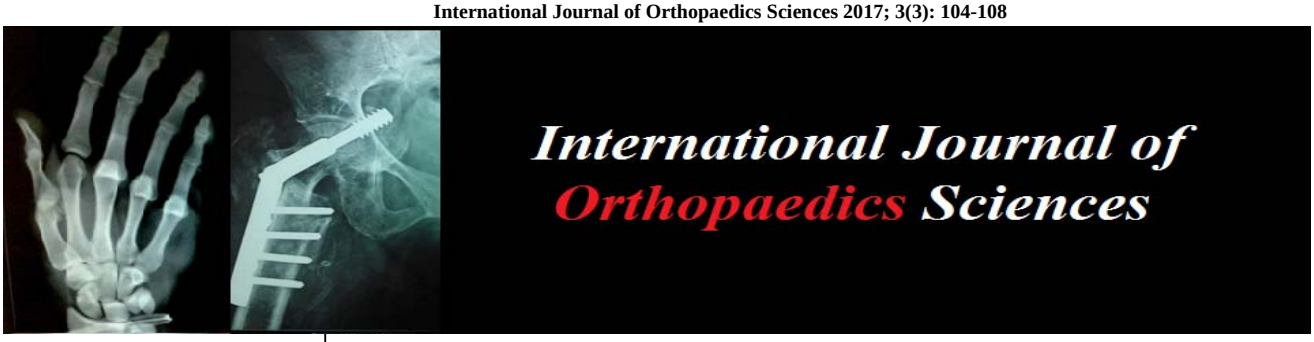

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PFN: A definite advantage over the DHS: A comparative Meta-Analysis

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Abstract
Dynamic Hip Screw fixation is currently considered as a standard treatment for pre-trochanteric fractures; However, due to the long-term hospitalization and other complications, researchers have proposed intramedullary nailing as the alternative surgical treatment. The aim of this study was to compare and examine the consequences of using the intramedullary nailing method versus Dynamic Hip Screw, in terms of functional outcome and duration of the surgery.
Methods: In this study 60 patients with Intertrochanteric fractures, that were surgically managed in Father Muller Medical College and Hospital, Kankanady, Mangalore had been selected for the year 2014-2016. After reduction, fixation surgery with PFN nail (30 patients) and Dynamic Hip Screw (30 patients) had been performed. All patients were screened during surgery and six months after surgery.
Results: In certain parameters like functional outcome, duration of surgery and bleeding there were significant differences between the two groups. In six months follow up period 2 patients from the pfn nail and 8 patients from the DHS group had non-union.
Conclusion: Recorded information of this study, during surgery and after the follow up period showed a comparative advantage of intramedullary nailing method vs. DHS in terms of small incision and lesser bleeding time, shorter duration of the surgery and significantly a better functional outcome.
In addition, with intertrochanteric fractures the PFN has a definite advantage over the DHS in terms of less limb length shortening, earlier restoration of pre-injury walking ability and a better overall functional outcome. Based on these facts, the researchers recommend intramedullary nailing as the first option in treating patients with intertrochanteric fractures.

Keywords: Fracture fixation, intramedullary, bone plates, hip fractures, fractures, bone

1. Introduction
Pertrochanteric fracture is one of the most common cases that orthopedic surgeons interfere during medical treatment.
Trochanteric fractures are one of the most common injuries sustained predominantly in patients over sixty years of age. They are three to four times more common in women who are osteoporotic; trivial fall being the most common mechanism of injury [2].
The goal of treatment of an intertrochanteric fracture is the restoration of the patient to his or her pre-injury status as early as possible. This led to internal fixation of these fractures to increase patient comfort, facilitate nursing care, decrease hospitalization and reduce complications of prolonged recumbency [2].
Intramedullary fixation with PFN when compared to DHS fixation had signicant advantages which included faster insertion, with less operative blood loss and allowed early weight bearing with less resultant shortening on long term follow up.

1.1 Aims of the study
To compare the surgical treatment of intertrochanteric fractures of the femur with the proximal femoral nail and dynamic hip screw device, with respect to:
- Duration of surgery
- Functional outcome

1.2 Biomechanics
The goal of reduction and fixation in any fracture is to achieve union of the fracture with restoration of the normal anatomy and to re-establish the normal force vector acting along the bone.

According to Adams and colleagues [9], the shorter lever arm of intramedullary devices provided more load sharing and allowed less collapse hence decreased the tensile strain on the implant and reduced the risk of mechanical failure. Intramedullary devices provide three point fixation and controlled impaction.

From a biomechanical standpoint, Kaufer and associates[1] concluded that intramedullary placement allowed the implant to lie closer to the mechanical axis of the extremity, thereby decreasing the lever arm and bending moment on the implant.

2. Materials and methods

The study was conducted in Father Muller Hospital, Mangalore from 2014 to 2016where 60 patients with intertrochanteric fractures of femur were selected.

No open fractures were encountered in this series. Patients were taken up for surgery as soon as their general condition permitted.

The fractures were fixed with either dynamic hip screw device (DHS) or a proximal femoral nail (PFN). Of the 60 patients in the study, 30 were treated with DHS and 30 with PFN. The duration of surgery and fluoroscopy time was recorded intraoperatively.

All the patients were followed up at monthly intervals for a period of 6 months and check x-rays were taken to assess fracture union and signs of failure of fixation. Walking ability of each patient was recorded at the end of four months and compared with pre-injury walking ability using the Sahlstrand [10] grading. Post operative pain was evaluated using the four-point pain score as also used by Saudan [15].

The outcome was assessed based on the postoperative pain, walking ability, hip joint range of motion, and limb length shortening as follows:

- An excellent result was when there was no postoperative pain, shortening of up to 0.5cm, hip range of motion of more than 80 per cent of normal and ability to walk without support.
- A good result was when there was mild postoperative pain not affecting ambulation, hip range of motion of 60-80 per cent of normal, shortening of 0.5-1.5cm and ability to walk with a cane or minimal support.
- A fair result was when there was moderate postoperative pain affecting ambulation requiring regular analgesics, a hip range of motion of 40-60 per cent of normal, shortening of 1.5-2.5cm and ability to walk with two canes, crutches or any other living support.
- A poor result was when there was severe postoperative pain even at rest requiring stronger analgesics, a hip range of motion of less than 40 per cent of normal, shortening of more than 2.5cm and confined to bed or a wheel chair.

2.1 Inclusion and Exclusion Criteria

Inclusion Criteria

- Posteromedial large fragment fracture;
- Reverse oblique fractures;
- Displaced greater trochanter fracture (Fractures of the lateral wall);
- Basocervical pattern;
- Failure to reduce the fracture before internal fixation.

Exclusion Criteria

- Patients older than 80 and younger than 30 years old,
- multiple trauma patients,
- History of hip fracture or surgery on the same side and
- patients without the ability to walk before the fracture hadbeen excluded from study.

2.2 Materials

In this study Proximal Femoral Nails (PFN) has been used which made by ChM company located in Poland. These intramedullary nails distributed as CHARFIX Femoral Nail brand name.

2.3 Statistical Analysis

After gathering the data, statistical analysis has been performed with SPSS 16 (SPSS Inc. Released 2007. SPSS for Windows, Version 16.0. Chicago, SPSS Inc.). The collective data was analysed by the Z-Test, Student T-test, Chi-square test (X^2), Wilcoxon Signed Rank Sum test and the Mann Whitney-U test using SPSS software to evaluate the results.

3. Results

During this study fixation surgery had been performed on 30 patients with intramedullary nailing with PFN and 30 patients with DHS. The patient was followed up post 6 months of surgery.

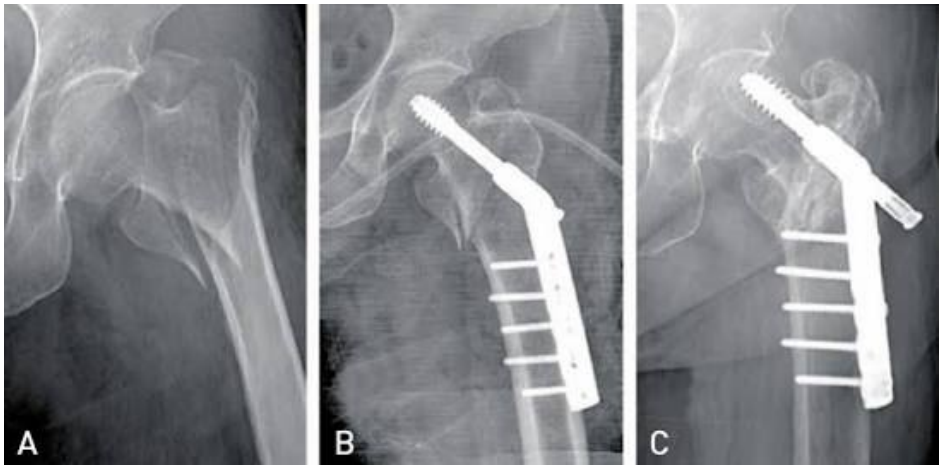


Fig 1: DHS Fixation

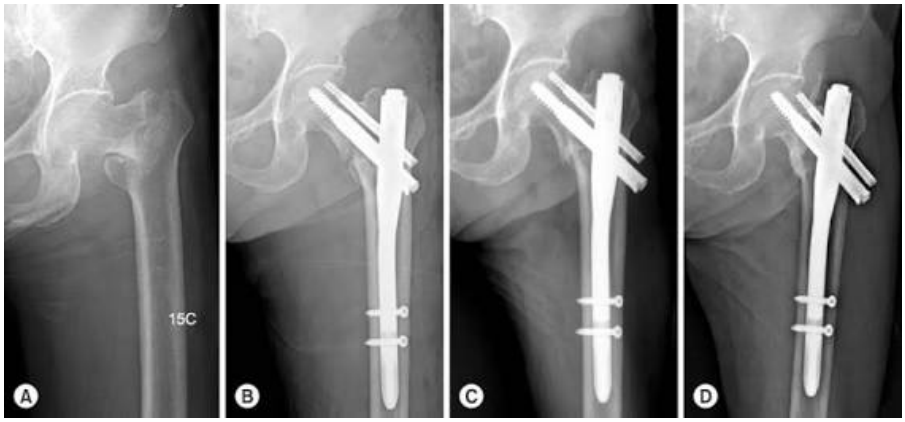


Fig 2: PFN fixation

Finally after radiographic follow up in sixth month two patients has no results of union yet. One patient had relative union and showed more recover during next months. Three patients were experienced treatment failure. One patient had femoral fractures from distal nail and one patient showed neck collapse and screw cut out.

Table 1: Functional Outcome

	Method of Fixation		Total
	DHS	PFN	
Excellent	4 (13.3%)	12 (40.0%)	16 (26.7%)
Good	10 (33.3%)	16 (53.3%)	26 (43.3%)
Fair	8 (26.7%)	2 (6.7%)	10 (16.7%)
Poor	8 (26.7%)	0 (0%)	8 (13.3%)
Total	30 (100.0%)	30 (100.0%)	60 (100.0%)

X2=8.492 p=.037 sig

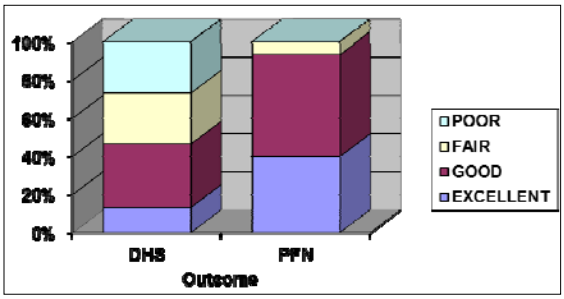
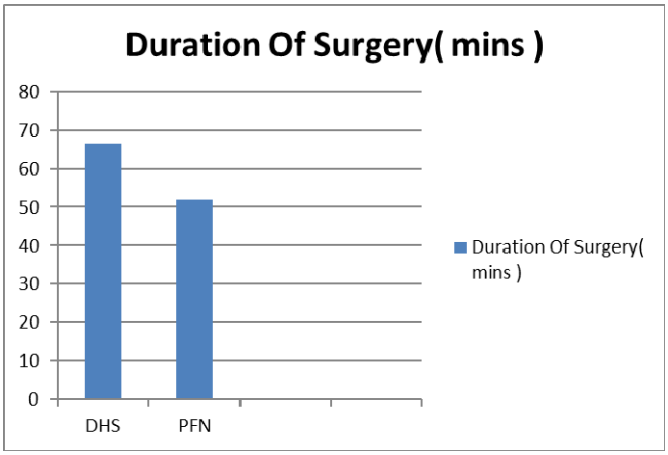


Table 2: Duration of Surgery

Method	N	Mean (min)	Std. Deviation	Z
DHS	30	66.667	13.84437	3.07200
PFN	30	52.0000	8.61892	P = 0.02s

Proximal femoral nailing required 14.67 per cent less operative time as compared to Dynamic hip screw fixation.



Parameters	Grading of Harris Hip Score
Pain	
Limp	<70 Points - Poor
Distance walked	
Support	70-79 Points - Fair
Sitting	
Enter public transportation	80-89 Points - Good
Stairs	
Put on shoes and socks	90-100 Points - Excellent
Absence of deformity	
Range of motion	

4. Discussion

Our series consisted of 34 stable and 26 unstable intertrochanteric fractures as classified according to Jensen and Michealsen's modification of Evans classification. The distribution of stable and unstable fractures in both groups was similar. Out of the 34 stable fractures, 16 were in the DHS group and 18 in the PFN group. Out of the 26 unstable fractures, 14 were in the DHS group and 12 in the PFN group.

In a study performed by Huat Chua *et al*. in 2013 in Singapore, short-term outcomes doing PFNA vs. DHS compared in patients with intertrochanteric fractures. For mentioned study 63 patients with A2 and A3 fractures were selected with mean age of 60 years old. Based on results patients with PFNA treatment after 6 and 12 months follow up had more independence movement and more score than PMS. Huat Chua *et al*. concluded that using PFNA in intertrochanteric fractures can be regarded as an appropriate treatment option [12].

In another study by Shen *et al*. in 2012 that has been designed to compare the performance and safety of PFNA vs. DHS, some factors like surgery duration, bleeding and complications of surgery has been evaluated. In this study five subjects in nailing group had lower bleeding and complications of surgery in compare with PFNA group [13].

Dousa *et al*. in 2006 performed a study and 41 patients with A2 and A3 fractures fixed with PFN. After six months follow up 95% of patients completely recovered with maintaining the anatomical status [3]. Also in a study by Windolf *et al*. in 2005, 121 cases of patients with nailing fixation has been followed up and resulted 7 cases with local complication after surgery and 21 cases with ease of insertion during surgery and important factor in nailing failure is incomplete reduction and using improper screw [4]. Ming Hui *et al*. in 2014 studied 163 patients with A2 fractures that treated with nailing method, after 15 months follow up Hip scoring showed 25% excellent and 56% good results [14].

The use of intramedullary hip screw in the treatment of pre operatively irreducible fractures was advocated by Garnavos and co-workers [8] to avoid an open reduction and therefore reduced blood loss and allows early mobilization of the patients.

4.1 Functional outcome

The overall functional outcome of patients treated with the PFN was significantly better than those treated with DHS (p=0.037). We also found that patients in our study treated with a PFN regained their pre-injury walking ability at four months significantly more often than those treated with a DHS. In our series, only 10 of the 30 patients (33.33 per cent) in the DHS group regained their pre-injury mobility level as compared to 16 of the 30 patients (53.33 per cent) in the PFN group at the fourth month of follow up. Similar findings were also seen in a series by Pajarinen *et al*. [11] comparing the postoperative rehabilitation of patients treated with DHS and PFN. This suggests that the use of a PFN may favor better restoration of the function in the elderly population compared with the use of a DHS.

4.2 Duration of surgery

The duration of surgery in the DHS group ranged from 40 minutes to 90 minutes with a mean of 66.66 minutes. Baumgaertner *et al*. [5] also found that the surgical times were 10 per cent higher in the DHS group in their series. Baumgaertner and associates [6] concluded that fractures stabilized by an intramedullary hip screw required 10% less operative time and had significantly less blood loss (245cc V/s 340cc) than those stabilized with the sliding hip screw.

5. Conclusion

This study compared a new treatment methodology with an ordinary method. Recorded information of this study during surgery and after follow up period showed a comparative advantage of intramedullary nailing method vs. DHS in terms of small incision and lesser bleeding time, shorter duration of the surgery and significantly better functional outcome.

The smaller incisions, shorter operative times, relatively less blood loss and less postoperative pain with the PFN indicate that the PFN has an advantage over the DHS even in the treatment of stable intertrochanteric fractures where the functional outcomes are similar. In addition, with unstable intertrochanteric the PFN has a definite advantage over the DHS in terms of less limb length shortening, earlier restoration of pre-injury walking ability and a better overall functional outcome.

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