

# Comparison of Dynamic Hip Screw and Proximal Femoral Nail in Intertrochanteric Femur Fractures.

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## Authorship and contribution Declaration:

Each author of this article fulfilled ALL 4 Criteria of Authorship:

1. Conception and design or acquisition of data, or analysis & interpretation of data.
2. Drafting the manuscript or revising it critically for important intellectual content.
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## ABSTRACT

**Objective:** To compare the radiological and functional outcome of stable intertrochanteric femur fractures treated with Dynamic Hip Screw(DHS) and Proximal Femoral Nail(PFN).

**Methods:** This randomized controlled trial was conducted in Department of Orthopaedics Pakistan Railway General Hospital Rawalpindi from 20<sup>th</sup> March 2018 and 19<sup>th</sup> March 2020. All patients with stable intertrochanteric fractures fulfilling the inclusion criteria were randomly allocated to group A (DHS) and B (PFN). Patients were reviewed radiologically for healing and functional assessment was done with Harris Hip Score (HHS) and graded as poor (score <70), fair( 70 to 80),good( 80 to 90) and excellent(90 to 100). Comparison of outcomes in both groups were done at 3<sup>rd</sup>, 6<sup>th</sup> and 12<sup>th</sup> month and *P* value was calculated with independent sample t test and Chi-square test. *P*<0.05 was considered significant.

**Results:** The total number of patients were 60.They were equally and randomly divided into group A and B with 30 patients in each. The mean age of group A was 59.20±5.94 years and group B was 58.80±6.67 years. Male patients were 19(63.33%) in group A and 17(56.66%) in group B. Female patients were 11(36.66%) in group A and 13(43.33%) in group B. The mean radiological union time in group A was 13.4±3 weeks while in group B 13.5±5 weeks (*P*>0.05). The Harris Hip Score(HHS) at 3 months follow up was 53.50±3.91(poor) and 34.93±3.98(poor) in group A and B respectively.(*P*< 0.05) At 6 months group A had HHS 89.37±4.03(good) and B 81.87±4.10.( *P*< 0.05)At one year HHS was 93.73±1.99(excellent) and 92.57±2.30(excellent) in group A and B.( *P*>0.05).

**Conclusion:** For stable intertrochanteric fractures both DHS and PFN yielded similar outcome in terms of radiological union. The short term functional outcome of both DHS and PFN at 3<sup>rd</sup> and 6<sup>th</sup> was poor and good but DHS had statistically better score than PFN.At one year follow up both DHS and PFN had similar excellent functional outcome but without any statistically significant difference in the score.

**Keywords:** Dynamic hip screw, Harris hip Score, Intertrochanteric fracture, Proximal femoral nail.

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## INTRODUCTION

Hip fractures are a source of great concern and a significant health problem worldwide.<sup>1,2</sup> It has been estimated that by the year 2050 Asian population would account for more than half of hip fractures owing to rise in life expectancy.<sup>3</sup> Intertrochanteric fractures account for almost half of the elderly hip

fractures.<sup>4</sup> Fracture union with minimum complications and early mobilization is the main aim of treating intertrochanteric fractures.<sup>5</sup> Although Dynamic Hip Screw (DHS) is the most commonly used implant to treat stable intertrochanteric fractures,<sup>6</sup> the proximal femoral nail (PFN) has been increasingly favored in recent times<sup>7</sup> because of biomechanically more stable design.<sup>8</sup> Reports of PFN failures however, have been

reported in literature mainly due to technical errors.<sup>9,10</sup> Many studies had compared the outcome of DHS and PFN in unstable intertrochanteric fractures but comparisons in stable intertrochanteric fractures are lacking.<sup>11</sup>

The objective of our study was to compare the radiological and functional outcome of stable intertrochanteric femur fractures treated with Dynamic Hip Screw (DHS) and Proximal Femoral Nail (PFN). We hypothesized that better radiological and functional outcome would be achieved with DHS rather than with PFN for stable intertrochanteric fractures.

## METHODS

We conducted this randomized controlled trial in Department of Orthopaedics Pakistan Railway General Hospital Rawalpindi from 20<sup>th</sup> March 2018 and 19<sup>th</sup> March 2020. All adults patients of either gender and age with stable intertrochanteric fracture femur (AO/OTA type 31-A1)<sup>12</sup> presented to the Accidents and Emergency or OPD of our hospital within one week of sustaining the fractures were included in this study. All patients with pathological fractures, open fractures, segmental fractures, previous hip surgery, bilateral fractures and polytrauma patients were excluded. Complete history, physical examinations and relevant investigations were ordered in all patients. The study protocols were approved by the hospital Ethical Committee. Informed written consent was obtained from all participants of the study. Patients were randomly divided into group A (DHS) and group B (PFN) through lottery method.

### Surgical Techniques

All the surgeries were performed under spinal or general anaesthesia on radiolucent table and image intensifier control. The same surgical team performed all the surgeries following the same standard surgical techniques for DHS and PFN. Fractures were reduced closely. A 5cm linear lateral incision was used distal to the greater trochanter at appropriate place for exposure of DHS (®Esmeco) entry point. We used a 4 hole side plate of 135° angle and appropriate size lag screw and 4.5 mm cortical screws for application of DHS. The lag screw position was maintained posteroinferior in the neck of femur and the tip apex distance (TAD) was maintained <25 mm. For PFN a 5 cm incision just proximal to the tip of greater trochanter was used for entry point. PFN (®Rech) of 135° neck shaft angle and 240mm length with distal locking was used in all cases. At the end of surgery all swabs were weighted and blood loss was determined as per Lee method.<sup>13</sup>

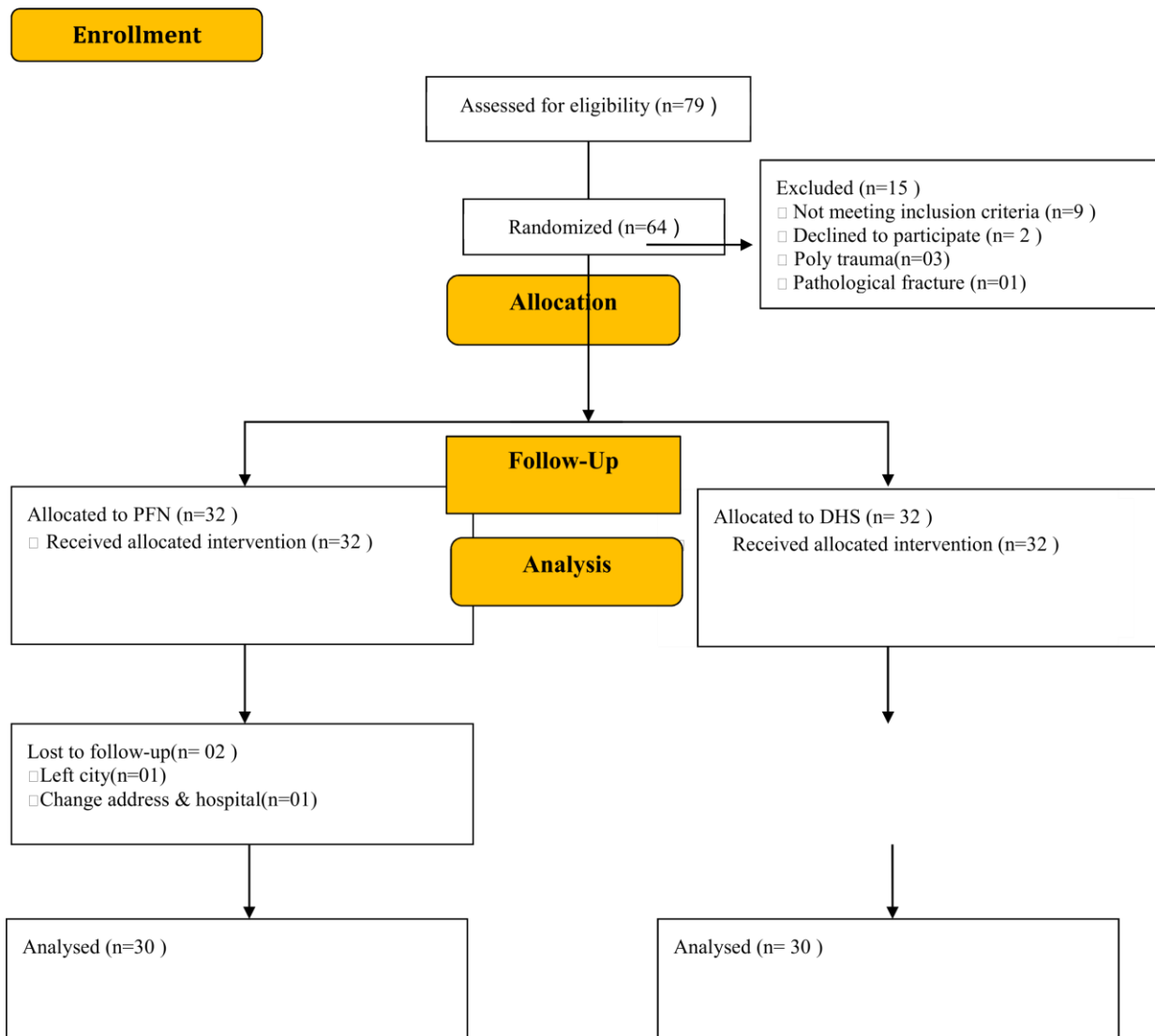
A uniform post operative rehabilitation protocol under the supervision of a qualified physiotherapist was started on the first post operative day. All patients were encouraged to perform frequent Isometric Quadriceps and Abductor exercises. Patients in both groups were allowed non weight bearing with walker or crutches on second post operative day. The post operative follow up visits were scheduled at 2 weeks, 3 months, six months and one year. Radiological assessment of fracture healing was done by noticing callus on AP and lateral radiograph. Functional outcome was assessed with Harris Hip Score (HHS).<sup>14</sup> The HHS was graded as poor (score <70), fair (70 to 80), good (80 to 90) and excellent (90 to 100).

We analysed our data with SPSS version 24. Frequencies and percentages were calculated for qualitative variables while mean and standard deviation for quantitative variables. Comparison of important demographic features and outcomes in both groups were done at 3<sup>rd</sup>, 6<sup>th</sup> and 12<sup>th</sup> month and *P* value was calculated with independent sample t test and Chi-square test. *P*<0.05 was considered significant. CONSORT (Consolidated Standards of Reporting Trials) guidelines by Moher et al<sup>15</sup> have been followed while conducting and reporting this trial. The data was presented in tables where appropriate.

## RESULTS

A total of 79 patients were assessed for eligibility of this study and 64 were enrolled in the study based upon inclusion and exclusion criteria as shown in CONSORT flow chart (Fig I). Final analysis included 30 patients in group A (DHS) and 30 in group B (PFN). The base line demographic variables like age, gender and side of surgery were identical in both groups (Table I). PFN group had smaller incision, less operative time and less amount of intraoperative blood loss than DHS group (*P*<0.05). The mean radiological union time in group A was 13.4±3 weeks while in group B 13.5±5 weeks (*P* 0.06). No non union was reported. The Harris Hip Score (HHS) at 3 months follow up was 53.50±3.91 (poor) and 34.93±3.98 (poor) in group A and B respectively (*P* 0.002). At 6 months group A had HHS 89.37±4.03 (good) and B 81.87±4.10. (*P* 0.001) At one year HHS was 93.73±1.99 (excellent) and 92.57±2.30 (excellent) in group A and B. (*P* 0.30). Superficial skin infection was noted in 2 (6.66%) patients in DHS group and 1 (3.33%) patient in PFN group but all resolved with wound dressing and antibiotics. DHS cut out was documented in 1 (3.33%) patient and PFN breakage in 1 (3.33%) patient. Both

were treated with revision surgery. No mortality was noted in our series.



**Fig. 1:** Enrollment of our study participants as per CONSORT guidelines.

**Table 1:** Comparison of baseline demographics and outcome variables of both groups.

Demographic/outcome variable	Group A (DHS) (n=30)	Group B (PFN) (n=30)	P value
Age(years)±SD	59.20±5.94	58.80±6.67	
<b>Gender</b>			
Male	19( 63.33%	17( 56.66%)	0.40
Female	11(36.66%)	13(43.33%)	0.52
<b>Surgery side</b>			
Right	20(66.6%)	17(56.66)	0.32
Left	10(33.33%)	13(43.33)	0.75
Incision length(cm)	7.62±0.91	4.71±0.74	0.001
Duration of surgery(min)	70.50±6.86	52.83±5.67	0.02
Intraoperative blood loss(ml)	224.33±43.44	122.33±33.18	0.01
Radiological union(weeks)	13.4±3	13.5±5	0.06

**DISCUSSION**

We treated 30 patients with DHS and 30 with PFN. Our results revealed that the mean radiological union time in DHS group was 13.4±3 weeks while in PFN group 13.5±5 weeks. (P>0.05). The Harris Hip Score (HHS) at 3 months follow up was 53.50±3.91 (poor) and 34.93±3.98 (poor) in group A and B respectively (P 0.002). At 6 months group A had HHS 89.37±4.03 (good) and B 81.87±4.10. (P 0.001) At one year HHS was 93.73±1.99 (excellent) and 92.57±2.30 (excellent) in group A and B. (P 0.30). Kamboj<sup>11</sup> treated 42 patients with DHS and PFN and noted radiological union at 15.84±1.4 weeks in DHS group while in PFN group the average radiological union time was 14.30±1.38 weeks (P > 0.05). The functional outcome as per HHS at 6 months was 77.2 in DHS group and 86.9 in PFN group (P 0.03). These authors concluded that PFN was associated with less per operative blood loss and post operative complications. Patients with PFN were earlier mobilized and had better HHS than DHS. This study however had small sample size and short follow up period of only six months. Sharma<sup>16</sup> treated 60 patients of stable intertrochanteric fractures with DHS and PFN. The HHS was 53.4 in DHS and 47.6 in PFN at 3 months (P < 0.01). At 6 months HHS was 88.7 in DHS and 82.2 in PFN (P < 0.01). At 2 years HHS was 94.2 in DHS and 94.0 in PFN group (P 0.79). Sharma had concluded that although PFN had less complications related to the surgical wound, chances of technical errors were more which could lead to

increased frequency of re operations in PFN group than in DHS group. Similarly Harish<sup>17</sup> treated 30 patients with DHS and PFN and concluded that PFN was better than DHS but technically demanding. Karanam and colleagues<sup>18</sup> compared the outcome of 20 patients treated with DHS and 20 with PFN. Stable intertrochanteric fractures were 23 (57.5%) and unstable 17 (42.5%). They concluded that patients with unstable intertrochanteric fractures had significantly better functional outcome when treated with PFN while for stable intertrochanteric fractures no significant difference in outcome was found when these fractures were fixed with DHS or PFN. Bhakat<sup>19</sup> treated 31% stable intertrochanteric fractures, 58% unstable and 11% reverse oblique type fractures with DHS and PFN. The mean HHS at one month in DHS group was 24.5 while in PFN it was 35.2. (P 0.0001). At 6<sup>th</sup> month HHS 78.8 in DHS group and 82.8 in PFN group (P 0.02). At one year DHS had HSS of 92.1 and PFN 92.5 (P 0.4). These authors concluded that PFN performed well in old osteoporotic and unstable intertrochanteric fractures while DHS had good outcome in younger patients. Similar to Bhakat results, Kumar and Singh<sup>20</sup> treated 50 patients with mean age 62.3 years with DHS and PFN. At 1 month and 3 month PFN had better functional outcome in terms of better HHS than DHS but long term outcome of both implants were the same. These authors concluded that elderly osteoporotic patients with unstable fractures did well with PFN while young patients with stable intertrochanteric fractures were suitable for DHS.

**Table II:** Results of Zhang *et al*<sup>23</sup> meta analysis comparing DHS and PFN.

S No	Author Name	Year of publication of study	Operation Time (min)		Blood Loss (ml)		Wound Complications				Re operation		Mortality	
			DHS	PFN	DHS	PFN	DHS		PFN		DHS	PF N	DHS	PFN
							Events	Total	Events	Total				
1	Parker M <sup>24</sup>	2012	46±12.3	49±12.7	NA	NA	09	300	06	300	13	05	85	85
2	Huang ZY <sup>25</sup>	2010	52.4±18.3	50.5±20.2	225	202	03	48	04	48	00	00	00	00
3	Liu XW <sup>26</sup>	2009	53.4±8.3	46.5±20.5	152	136	02	65	06	69	00	00	00	00
4	Pajarinen JJ <sup>27</sup>	2005	45 (20–105)	55 (35–200)	357±495	320±3109	05	40	04	40	11	08	11	10
5	Giraud B <sup>28</sup>	2005	42	35	325	410	NA	NA	NA	NA	00	03	01	02
6	Papasimos S <sup>29</sup>	2005	59.2 (40–100)	71.2 (60–240)	282.4	265	00	54	00	54	03	05	01	01
7	Pan X <sup>30</sup>	2004	87.35±21.29	59.16±16.92	489.88±177.90	273.33±120.8	04	34	02	30	00	00	00	00
8	Saudan M <sup>31</sup>	2002	65± 26	64 ±33	NA	NA	10	106	11	100	06	11	17	21
9	<b>Our study</b>	<b>2021</b>	<b>59.20±5.94</b>	<b>58.80±6.67</b>	<b>224.33±43.44</b>	<b>122.33±33.18</b>	<b>02</b>	<b>30</b>	<b>01</b>	<b>30</b>	<b>01</b>	<b>01</b>	<b>00</b>	<b>00</b>

Chandy and Saju<sup>21</sup> treated 35 stable and 13 unstable intertrochanteric fractures with DHS while PFN was used for fixation of 34 stable and 14 unstable intertrochanteric fractures. DHS produced good functional outcome in stable fractures only. Overall PFN had better radiological outcome and better HHS than DHS in all follow up visits. Zaho et al<sup>22</sup> treated 32 A1 fractures with DHS and 12 A1 with PFN and noted the therapeutic effect of both the implants was the same. Zhang *et al*<sup>23</sup> conducted a meta-analysis of 8 studies comparing DHS and PFN in stable and unstable intertrochanteric fractures with mean follow up period of 9.6 months.(table II)This meta analysis indicated a significantly shorter operative time, smaller incision and less intra operative blood loss in PFN than in DHS. This was exactly our findings.According to Zhang *et al* a higher (but not significant) infection rate was noted in DHS group. A higher (but not significant) re surgery rate was documented in PFN than in DHS. No significant difference was found in both groups regarding mortality rates. We had not documented any mortality in our series.

Our study had few limitations. Our sample size was small and our follow up period was only one year. We recommend further studies to address these limitations and to further verify our results.

## CONCLUSION

For stable intertrochanteric fractures both DHS and PFN yielded similar outcome in terms of radiological union. The short term functional outcome of both DHS and PFN at 3<sup>rd</sup> and 6<sup>th</sup> was poor and good but DHS had statistically better score than PFN. At one year follow up both DHS and PFN had similar excellent functional outcome but without any statistically significant difference in the score. The operating surgeon therefore can use any of the two implants for stable intertrochanteric fractures.

**Conflict of Interest:** None

**Grants/Funding:** None

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